REPORT OF THE TRIBUNAL OF INQUIRY ON THE FIRE AT THE STARDUST, ARTANE, DUBLIN

Report

of the

Tribunal of Inquiry on the Fire at the Stardust, Artane, Dublin

on the

14th February, 1981

DUBLIN:
PUBLISHED BY THE STATIONERY OFFICE.

To be purchased from the
GOVERNMENT PUBLICATIONS SALE OFFICE, G.P.O. ARCADE, DUBLIN 1,
or through any Bookseller.

Price £28

(PL 853)

Printed in the Republic of Ireland by Cahill Printers Limited Dublin.

ANARDCHUIRT
(The High Court).
BAILE ATHA CLIATH 7
(Dublin 7).

30th June, 1982.

To: The Minister for ihe Environment,
Dublin.

The Report which follows is the Report of the Tribunal established pursuant to Resolutions passed by Dail Eireann on the 18th February, 1981, and Seanad Eireann on the 19th February, 1981, to inquire inio the fire at the Stardust, Artane, Dublin, on the 14th February, 1981.

The Tribunal

CONTENTS

r

INTRODUCTION

INTRODUCTION

INTRODUCTION

I —INTRODUCTION

1 In the early hours of the morning of Saturday, 14th February, 1981, a disastrous fire swept through a building called the Stardust in the North Dublin suburb of Artane during the course of a St. Valentine's Night "disco" dance. Forty eight people were killed and one hundred and twenty eight seriously injured. The overwhelming majority of the victims were young people.

2 On the 15th February, 1981, the Government announced that a Public Inquiry would be held into the disaster and that this would take the form of a Tribunal to be established under the provisions of the Tribunals of Inquiry (Evidence) Acts, 1921 and 1979.

II — THE RESOLUTIONS OF THE TWO HOUSES OF THE OIREACHTAS

3 Pursuant to the provisions of the Act of 1921, Dail Eireann passed a resolution on the 18th February, 1981, and Seanad Eireann passed a resolution on the 19th February, 1981. The terms of the resolutions were as follows:—

"That it is expedient that a Tribunal be established for—

1. inquiring into the following definite matters of urgent public importance:

   (1) the immediate and other causes of, and the circumstances leading to the fire at the Stardust Club, Artane, on the 14th February, 1981,

   (2) the circumstances of and leading to the loss of life and personal injury at the Stardust Club on the 14th February, 1981,

   (3) the measures, and their adequacy, taken on and before 14th February, 1981, to prevent and detect, and to minimise and otherwise to deal with fire at the Stardust Club,

   (4) the means and systems of emergency escape from the Stardust Club, and their adequacy, on the 14th February, 1981,

   (5) the measures (including the application of the Draft Building Regulations published on 29th November, 1976), and their adequacy, taken on and before 14th February, 1981, at the Stardust Club to prevent and to minimise and otherwise to deal with any other circumstances that led or contributed to the loss of life and personal injury aforesaid or might have led or contributed to loss of life or personal injury,

   (6) the adequacy of the legislation, statutory regulations and bye-laws relevant to fire prevention and safety, so far as material to the granting of planning and bye-law permission for, and the conduct, running, supervision, and official inspection and control of, the Stardust Club, and the adequacy of the application, observance and enforcement of such legislation, statutory regulations and bye-laws in relation to the Stardust Club;
   and,

2. making such recommendations as the Tribunal, having regard to its findings, thinks proper in respect of the statutory and other provisions in relation to fire, fire prevention and means and systems of emergency escape from fire, their adequacy and enforcement and any other matters that the Tribunal considers relevant".

Ill — APPOINTMENT OF THE TRIBUNAL

The Order appointing this Tribunal was made on the 20th February, 1981, by the Minister for the Environment. After reciting the terms of the resolutions passed by the two houses of the Oireachtas, the Order provided as follows:—

" 1. A Tribunal is hereby appointed—

(a) to inquire into the following definite matters of urgent public importance:

(1) the immediate and other causes of, and the circumstances leading to, the fire at the Stardust Club, Artane, Dublin on the 14th February, 1981,

(2) the circumstances of and leading to the loss of life and personal injury at the Stardust Club on the 14th February, 1981,

(3) the measures and their adequacy, taken on and before the 14th February, 1981, to prevent, detect and to minimise and otherwise to deal with fire at the Stardust Club,

(4) the means and systems of emergency escape from the Stardust Club, and their adequacy on the 14th February, 1981,

(5) the measures (including the application of the Draft Building Regulations published on the 29th November, 1976), and their adequacy, taken on and before the 14th February, 1981, at the Stardust Club to prevent and to minimise and otherwise to deal with any other circumstances that may have contributed to the loss of life and personal injury aforesaid or might have led to or contributed to the loss of life or personal injury,

(6) the adequacy of the legislation, statutory regulations and bye-laws relevant to fire prevention and safety, so far as material to the granting of planning and bye-law permission for, and the conduct, running, supervision, and official inspection and control of, the Stardust Club, and the adequacy of the application, observance and enforcement of such legislation, statutory regulations and bye-laws in relation to the Stardust Club;
and

(b) to make such recommendations as the Tribunal, having regard to its findings, thinks proper in respect of the statutory and other provisions in relation to fire, fire prevention and means and systems of emergency escape from fire, their adequacy and enforcement and any other matters that the Tribunal considers relevant.

2. The Honourable Mr Justice Ronan Keane is hereby nominated to be the sole member of the Tribunal.

3. The following persons are hereby appointed to be Assessors to the Tribunal:—

Professor David Rasbash, BSc, PhD, Department of Fire Safety Engineering, School of Engineering, University of Edinburgh,
Mr Gunnar Haurum, Chief Inspector of Fire Services, Denmark,
Mr Pierce Pigott, BE, MSc, C. Eng., F.I.E.I., Head of Construction Division, An Foras Forbartha, Dublin.

4. The Tribunals of Inquiry (Evidence) Act, 1921, as adapted by or under subsequent enactments, shall apply to the Tribunal".

5 The Tribunals of Inquiry (Evidence) Act, 1921, had been amended by the Tribunals of Inquiry (Evidence) (Amendments) Act, 1979. Section 2 of the amending Act provided that a Tribunal might consist of one or more than one person sitting with or without an Assessor or Assessors appointed by the instrument appointing the Tribunal. It also provided that an Assessor so appointed should not be a member of the Tribunal.

IV — PUBLIC SITTINGS

6 The first public sitting of the Tribunal was held on the 2nd March, 1981, notice to the public of the sitting having previously been given by press advertisements. At the first hearing, the Tribunal considered applications for liberty to be legally represented at the hearings and matters of procedure generally. A further public hearing concerned with these matters was held on the 30th March, 1981.

7 The hearing of oral evidence before the Tribunal began on the 6th April, 1981. The hearings continued until the 26th November of the same year. In all (including the two preliminary sittings on the 2nd March and the 30th March) the Tribunal sat for 122 days. All the sittings were held in the premises of the Incorporated Law Society at Blackhall Place, Dublin, with the exception of one of the preliminary sittings, which was held in the Four Courts;

V — REPRESENTATION

8 Under the provisions of the Act of 1921, the Tribunal had power to authorise the representation before it by counsel or solicitor of any person "appearing to be interested".

9 A number of applications for representation were made on the 2nd March, and the 30th March, 1981. The parties who were authorised by the Tribunal to appear were as follows:—

(1) the Attorney General;

(2) Dublin Corporation, the local authority within whose area the disaster had occurred;

(3) the next of kin of the deceased, and persons who suffered injury as a result of the disaster; and

(4) the owners and occupiers of the building in which the disaster occurred, Scotts Foods Limited and Silver Swan Limited.

10 Particulars of the applications for representation and the names of counsel and solititors appearing on behalf of the parties are given in Appendix 5.

11 The procedure used in obtaining and presenting the evidence was the same as that adopted by the Tribunal of Inquiry into the disaster at Whiddy Island, Bantry, Co. Cork on the 8th January, 1979. The Attorney General notified the Tribunal, upon its establishment, that he proposed to assign a solicitor and counsel to the Tribunal who would act as its solicitor and counsel. The reasons which prompted the Whiddy Island Tribunal to agree readily to the adoption of this procedure were also, in the opinion of the Tribunal, applicable in the case of the Artane disaster.

12 The function of a tribunal appointed under the Act of 1921 is to conduct an inquiry, i.e. to establish the truth as to the matters which have been referred to it by the Oireachtas, using every legal resource at its disposal to do so, and (in the case of the Whiddy Island and Artane disasters) to make recommendations in the light of the truth so established. It is not in the same position as a court of law which is required to resolve issues between conflicting parties and to determine their legal rights. The special nature of the functions entrusted to tribunals, such as the Whiddy Island and Artane Tribunals, makes it imperative that the tribunal should be in the position to consider, with its own solicitor and counsel, what evidence should be obtained, and to direct what steps should be taken

to establish the truth as to the matters set out in the terms of reference, including the obtaining of the most informed and expert scientific evidence available.

13 As in the case of the Whiddy Island Tribunal, an additional reason for adopting this procedure was the position of public authorities—such as the Department of the Environment and the Garcia Siochana—whose role and conduct would come under scrutiny by the Tribunal. It was obviously undesirable that the Attorney General, who would represent the Department in question and the Garda authorities, should at the same time be responsible for the presentation of evidence to the Tribunal.

VI —EVIDENCE

14 In the weeks immediately after the fire, over one thousand six hundred statements were taken by the Garda Siochana from persons present in the building on the night of the fire (including patrons, representatives of the owners, and staff), members of the rescue services such as the fire brigade, residents in the neighbourhood and others who witnessed various aspects of the disaster, those concerned with the conversion of the building, whether as designers, suppliers of materials, local authority officials or otherwise, and many others. In order to ensure that the parties represented before the Tribunal had the fullest possible opportunity of cross-examining all witnesses with as much thoroughness as was required, statements of all the witnesses whom counsel for the Tribunal proposed to call were circulated in advance to the solicitors for the parties.

15 Three hundred and sixty three witnesses gave evidence, of whom one hundred and sixty one were present in the building on the night of the fire.

16 The procedure adopted as to the giving of oral evidence was the same as that adopted in the Whiddy Island Inquiry. All witnesses were called by the Tribunal's counsel and first examined by him. They were then available for examination by counsel for the parties to whom the right of representation had been granted. In the case of expert witnesses, reports were obtained and circulated. In most cases, the written statement or report was accepted by the Tribunal as part of the witness's testimony; it was, however, in most cases supplemented by oral evidence.

17 All the oral testimony, as well as counsels' submissions, was taken down in shorthand and transcribed overnight into Books of Evidence.

18 The list of witnesses who gave evidence is given in Appendix 2 of this Report.

19 An alphabetical list of witnesses was prepared by the Tribunal's Registrar and this, together with a reference to the Book of Evidence in which the witness's oral testimony is to be found, is given in Appendix 3.

20 Those witnesses whose statement or report was accepted in evidence are identified in Appendix 2 by the letter "S" or "R", as the case may be, after their names. These statements and reports are forwarded, as are the Books of Evidence, with this Report.

21 A list of exhibits is given in Appendix 4.

22 The scene of the fire was inspected and a detailed investigation undertaken by the Gardai immediately after the fire. They also retained a firm of forensic scientists to assist them with their investigations. In addition, forensic scientists and other technical experts were retained by some of the parties represented before the Tribunal and they also carried out inspections of the building and made reports. These reports were furnished to the Tribunal's solicitor and the solicitors for the other parties; and, in every case where the party requested that the expert who prepared the report be called as a witness, this request was granted.

23 The Tribunal was not, of course, restricted to the technical evidence proposed to be furnished by the parties appearing at the Tribunal. Shortly after the fire, the Tribunal was informed that Dublin Corporation had retained the services of the Fire Research Station of the Department of the Environment in the United Kingdom. The Tribunal's solicitor asked Dublin Corporation, through its Law Agent, to release the Fire Research Station from its commitment to the Corporation so that it could act on behalf of the Tribunal itself. This request was readily complied with by Dublin Corporation and thereafter the Fire Research Station, in consultation with the Assessors to the Tribunal, proceeded to carry out a lengthy series of tests, the major object of which was to ascertain the reasons for the disastrous spread of the fire. The last test in the series which involved the simulation of an area of the ballroom in which the fire was first seen by many of the witnesses, and its ignition, was attended by legal representatives of, and scientific advisors to, the parties appearing before the Tribunal. The conclusions of the Fire Research Station, together with all the data obtained from the wide range of tests, were furnished in the form of a written report to the Tribunal which was circulated to all the parties. This Report also incorporated a substantial amount of video material which was shown at the public sittings of the Tribunal. The scientific officers of the Fire Research Station concerned with the investigation, tests and Report gave evidence before the Tribunal.

24 The Tribunal also retained a firm of consulting engineers, Messrs Varming Mulcahy Reilly Associates, to advise it as to certain electrical aspects of the investigation. Mr Thomas Kelly, of that firm, prepared a written report and gave evidence before the Tribunal.

VII —GLOSSARIES

25 Throughout this Report, references are made to certain physical features of the building in which the fire took place, including in particular an area of seating in the ballroom. In order to avoid confusion as to the meaning of particular terms, a glossary is supplied on p. xxxvii of the meaning attached to certain key expressions, such as "seat" and "seating unit".

26 Chapters 6 and 7, which deal with the cause of the fire and the reasons for its spread, necessarily contain a number of technical expressions, some of which will be unfamiliar to the general reader. A glossary of these technical terms is given on p. 200.

27 A list of abbreviations used in this Report is given on p. xxxv.

VIII — EXPRESSION OF THE TRIBUNAL'S GRATITUDE

28 This record of the Tribunal's work would not be complete without an expression of the Tribunal's deeply felt appreciation of the assistance it received throughout its existence. The Tribunal wishes to place on record, however inadequately, the deep sense of gratitude it feels for the assistance so willingly given.

29 The Tribunal could not have discharged its functions adequately without the assistance of skilled and experienced Assessors. The Tribunal was indeed fortunate in having at its disposal the services of Assessors who were of outstanding eminence in their different spheres.

30 Professor David Rasbash is the head of the Department of Fire Safety Engineering in the University of Edinburgh. This Department, which was the first of its kind in the world, was established by Professor Rasbash himself. He enjoys an international reputation in the field of fire safety engineering and has been responsible for much published work on the subject; and has given expert evidence in many inquiries of this nature, including the inquiry into the Summerland fire disaster in the Isle of Man in 1973. Mr Gunnar Haurum, the Chief Inspector of Fire Services in Denmark, has not merely the detailed knowledge and practical experience of fire prevention and fire-fighting service in his own country that one would expect; he has also a wide range of knowledge of fire prevention and fire-

fighting services in many other countries. Mr Pierce Pigott, as the Head of the Construction Division of An Foras Forbartha, has an unrivalled knowledge of the Irish construction industry and of the problems encountered by builders, designers and local authorities in fields such as fire safety.

31 All three Assessors not only gave assistance to the Tribunal in the course of the public sittings: they also gave considerable advice and assistance during the drafting of this Report. They bore the incursions of the Tribunal's work on their time with unvarying fortitude and good humour; and were constantly available when required, with practical assistance and wise counsel. In addition, Mr Haurum made arrangements for the Tribunal to visit Copenhagen and observe the workings of the Danish Fire Prevention and Fire-fighting Services at first hand. The Tribunal is deeply conscious of the debt of gratitude it owes to its Assessors for the invaluable contribution they have made to its work.

32 In order to ease the burden placed on the Assessors by the unprecedented length of the public sittings, the Tribunal also obtained the services of the late Mr George Moore, Assistant Chief Fire Officer of the Fire Authority for Northern Ireland, as a consultant on fire safety matters. The Tribunal wishes to express its appreciation of the ready co-operation of the Fire Authority for Northern Ireland and, in particular, its then Chief Fire Officer, Mr George Morrison, in so readily making Mr Moore's services available to the Tribunal free of charge. Mr Moore's advice and assistance were constantly available to the Tribunal and were of great assistance in its work. The Tribunal also wishes to express its appreciation of the generous co-operation of Mr Morrison, Mr Moore and the Fire Authority for Northern Ireland in enabling the Tribunal and its Assessors to view the operation of the Northern Ireland Fire Prevention and Fire-fighting Services at first hand.

33 Unhappily, Mr Moore did not live to see the completion of the Report; he died tragically in a motorcar accident a matter of weeks before it was ready for presentation to the Minister for the Environment. The Tribunal wishes to express its deep sympathy to the family of the late Mr Moore and his colleagues in the Northern Ireland Fire Service on their sad loss.

34 A reading of the Report will make obvious the central role played by the UK Fire Research Station in enabling the Tribunal to reach positive conclusions in relation to some of the most important matters referred to in its Terms of Reference. The Tribunal wishes to express its warm appreciation of the high level of expertise and the meticulous attention to detail displayed by the Station and its officers in carrying out the onerous investigation commissioned by the Tribunal.

35 The Tribunal also gratefully acknowledges the ready co-operation of Dublin Corporation in releasing the Station from its commitments to them.

36 The Tribunal also wishes to express its appreciation of the care and thoroughness displayed by Mr Thomas Kelly of Messrs Varming Mulcahy Reilly Associates in carrying out the electrical investigation commissioned by the Tribunal.

37 The Solicitor assigned by the Attorney General to assist the Tribunal in the assembly and presentation of the evidence was Mr Michael Buckley, a Deputy Assistant Chief State Solicitor, who was seconded for that purpose shortly after the Tribunal was appointed and continued to discharge his functions until the sittings of the Tribunal ended. The magnitude of the task which confronted Mr Buckley can hardly be overstated: it involved the careful study and sifting of over sixteen hundred statements, together with a vast amount of other material. He had then to ensure the presence of all the witnesses, three hundred and sixty three in number, whose attendance was thought essential. In addition, he had to conduct correspondence on behalf of the Tribunal and discharge many other functions which inevitably arose during so lengthy an inquiry. Mr Buckley performed these duties with a professional skill, dedication and meticulous attention to detail which was beyond praise and which contributed immeasurably to the Tribunal's work.

38 The Tribunal's Registrar, Mr Gerard Frewen, brought to his task not merely the qualities which he has always displayed as a Court Registrar over many years but, in addition, the vast experience he had gained from having acted as the Registrar to the Whiddy Island Tribunal. In addition to carrying out the duties one would normally associate with such a position in an admirably efficient manner, he also gave invaluable assistance to the Tribunal in the preparation of this Report. In describing the quality of Mr Frewen's contribution one cannot improve on the words used by Mr Justice Declan Costello in the introduction to the Report of the Whiddy Island Tribunal, when he referred to Mr Frewen as bringing to his task "a rare combination of talents—an exceptional organising ability, a meticulous concern for detail, and an inquiring and judicious mind". All of these qualities were readily available to the Tribunal in the present case.

39 Counsel for the Tribunal, who had the extremely responsible and exacting task of ensuring that all the evidence was presented to the Tribunal fully, clearly and in logical sequence, discharged their responsibilities with consistent efficiency and thoroughness. The Tribunal is also deeply indebted to counsel for the parties appearing before the Tribunal: in the course of protecting their clients' interests, they displayed a professional skill which was in the best traditions of the Bar and greatly assisted the Tribunal in its task of establishing the truth. The Tribunal also expresses its gratitude to the solicitors appearing for these parties whose co-operation and industry helped to ensure the efficient conduct of the Tribunal's sittings.

40 Mr Brendan Aherne and a team from the Department of the Environment were responsible for the practical and administrative aspects of the Tribunal's establishment and the organisation of the public sittings. They carried out the many requirements of the Tribunal with a care and attention to detail which reflects the highest credit on them. In addition, a team of typists from the Department of the Environment, led by Miss Mary Doyle, was assigned to the Tribunal by the Department to type this Report and many preliminary drafts. The Tribunal is deeply grateful to them for the skill and speed with which they carried out this work.

41 The enormous task of taking down all the oral evidence in shorthand was undertaken by Mr Padraig O Fearghail and Mrs Sheila Kavanagh. These notes were then transcribed overnight into Books of Evidence by Mr O Fearghail and Mrs Kavanagh, assisted by a team of typists. The difficulty of their task must have been significantly increased by the frequent use of technical terms and concepts. The service provided was nonetheless of the highest order of competence.

42 The Tribunal also acknowledges the co-operation of the Incorporated Law Society of Ireland and their staff in making available their premises at Blackhall Place for the holding of the public sittings and the carrying out of the administrative and secretarial work of the Tribunal.

CHAPTER TITLES

TABLE OF CHAPTERS

CHAPTER 1
The Scene of the Fire

CHAPTER 2
The Fire as Observed by Eye-witnesses

CHAPTER 3
The Evacuation of the Building

CHAPTER 4
The Rescue Operations

CHAPTER 5
Deaths and Injuries

CHAPTER 6
The Cause of the Fire

CHAPTER 7
Why the Fire Spread

CHAPTER 8
The Responsibility for the Disaster of the Owners and their Advisers, Dublin Corporation and the Department of the Environment

CHAPTER 9
Conclusions and Recommendations

CHAPTER 10

Costs

TABLE OF APPENDICES

INDEX TO PHOTOGRAPHS

Acknowledgements

Plates	1,4,21,44,45 and 53: Dublin Corporation.
Plates	2, 3, 10, 11, 12, 13, 14, 17, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 46, 47, 54, 55 and 56: Garda Siochana (Detective Gardai Vincent Flood and Paul Firth).
Plates	5, 6, 7 and 8: Mr Patrick Drennan.
Plate	9: Cremer and Warner, Consulting Engineers and Scientists.
Plates	15, 16, 48 and 49: Vanning Mulcahy Reilly Associates, Consulting Engineers (Mr R. Skelton).
Plate	18: Mr Thomas Blair.
Plates	50, 51 and 52: Dr Keith Gugan and Associates (Mr. D. Tucker).

LIST OF ABBREVIATIONS USED IN REPORT

A	Answer
AC	Alternating current
BBC	British Broadcasting Corporation
BC	Bayonet cap
BS	British Standard
BSDD	British Standard Draft for Development
BSI	British Standards Institute
C	Centigrade
cm	centimetre
cc	cubic centimetre
CIE	Coras Iompair Eireann
DC	Direct current
DD	Draft for Development
DJ	Discjockey
DR	Dressing room
EEC	European Economic Community
ELCB	Earth Leakage Circuit Breaker
ESB	Electricty Supply Board
ETCI	Electro-Technical Council of Ireland
F	Fire extinguisher
FB	Fire Brigade
FIRTO	Fire Insurers Research and Testing Organisation
FRS	Fire Research Station
FS	Fire Station
GLC	Greater London Council
HRC	High rupturing capacity
IIRS	Institute for Industrial Research and Standards
IS	Irish Standard
IS (P)	Irish Standard (Provisional)
1	litre
m	metre
MCB	Miniature circuit breaker
mg	milligrams
MICC	Mineral-insulated copper-cablin
MJ	megajoule
ml	millilitre
mm	millimetre

PVC	Polyvinyl Chloride
Q	Question
T	Toilet
UK	United Kingdom
W	Window
W/cm^2	watts per square centimetre

GLOSSARY NO. 1

TERMS USED IN DESCRIBING THE BUILDING

Seating unit	A self-contained part of a seat with a lifting squab capable of accommodating two persons, as shown in Figure Al and *Plate 4.*
Seat	A combination of two or three seating units arranged end to end accommodating 4 or 6 persons.
Squab	The horizontal cushion of the seating unit.
Back	The vertical cushion of the seating unit.
Tier	A line of seats along the same level.
Row	Groups of seats up the tiers separated for access purposes by aisles.
Aisles	Accesss gangways between the rows and tiers.
Alcoves	Areas of the Stardust with banked seats in an arrangement of rows and tiers.

CHAPTER 1

The Scene of the Fire

CHAPTER 1

The Scene of the Fire

I — INTRODUCTION

1.1 Scott's Food Factory was built in 1948 in the North Dublin suburb of Artane, which was then part of County Dublin. In 1953, as a result of a boundary extension, it became part of the County Borough of Dublin, the local authority for which is Dublin Corporation.

1.2 The building was originally owned by a company called R & W Scott (Ireland) Ltd. The shares in this company were subsequently acquired by members of the Butterly family.

1.3 In 1977/8 a portion of the building, which had previously been used in part for the manufacture of chocolate and subsequently for storage, was converted into what the owners described as "an amenity centre". It consisted of three areas viz:—

(1) a public bar called "The Silver Swan";

(2) a restaurant and functions room called "The Lantern Room"; and

(3) an area originally intended for use for cabarets and concerts called "The Stardust".

1.4 The members of the Butterly family concerned with the conversion and subsequent management of the amenity centre were Mr Eamon Butterly and his father, Mr Patrick Butterly. The relevant drawings were prepared on their behalf by Mr William White and Mr Harold Gardner.

1.5 While the centre as a whole was sometimes referred to as "The Stardust", that description as used in this Report is intended to refer to the third area only. In general terms, this consisted of a stage, dancing area and seating area (referred to collectively as "The Ballroom") together with toilets and cloakroom, bars, and corridors.

1.6 The centre opened to the public on the 6th March, 1978. In February, 1980, the activities in the Stardust were extended to the holding of "disco" dances on Friday and Sunday nights.

1.7 The owners continued to use the remainder of the premises as a food factory.

1.8 In the early hours of the morning of Saturday, the 14th February, 1981, while a St. Valentine's Night Disco Dance was being held in the ballroom, a disastrous fire swept through it, causing the deaths of forty eight people and seriously injuring one hundred and twenty eight others.

Plate 1 — *View of the building taken from the left forecourt. The doors (from left to right) ar emergency exit, Kitchen, main entrance to the Stardust, and Exit 3. The security barrier is at the ex*

II — THE DESIGN, EXECUTION AND SUPERVISION OF THE CONVERSION OF THE BUILDING.

1.9 In 1972 the owners decided to convert the building into an amenity centre. The person first commissioned to prepare drawings for the conversion was Mr William White. While he described himself as an architect, he was not a graduate of any university or a member of any of the generally recognised professional institutions in this country or the United Kingdom. He was a fellow of a body called the Irish Architects' Society and had studied building construction at the College of Technology, Bolton Street, Dublin, from 1948 to 1954. He was then employed as a student draughtsman by Dublin Corporation, being eventually promoted to Grade 2 Draughtsman and then Grade 1 Draughtsman. He worked in various departments in the Corporation, viz. the City Engineer's Department, the Waterworks Department and the City Architect's Department. He worked for the Corporation until 1968 when he joined the Ronald Lyon Group as a job architect designing factories under the supervision of the Chief Architect. He remained with that company for two-and-a-half years and then commenced private practice.

1.10 The decision to employ Mr White was made by Mr Patrick Butterly, a principal shareholder in, and director of, the company which owned the building. His instructions were to obtain permission under the Local Government (Planning and Development) Act, 1963, from Dublin Corporation for a change of use of the premises to a licensed premises, restaurant, bowling alley and warehouse. The approval ultimately granted by the Corporation was for use as a "licensed amenity building" with no mention of use as a bowling alley, but Mr White appears to have thought that the owners were still interested in that as a possible use for the building. He was also instructed that the design should allow for a bar, restaurant and small dance area. All the drawings lodged with the Corporation for the purpose of obtaining permissions and approvals under the Planning Act were prepared by Mr White. He became aware at some stage after the drawings had been lodged that the owners had abandoned the idea of using the building in part as a bowling alley.

1.11 Mr White ceased to act for the owners early in 1977. They then commissioned Mr Harold Gardner to take the necessary steps on their behalf to secure approval of the drawings for the conversion under the provisions of the Building Bye-laws and Bye-laws for Places and Public Resort of Dublin Corporation. Mr Gardner, who was aged sixty three at the time, had spent some twenty years working for a building firm as a draughtsman. He left them in 1964 and worked for a couple of years with another firm who were mainly concerned with installing shop fittings. He then began to work independently, supervising conversions of premises into shops. He ceased doing this type of work after about three or four years and then went into business as a contractor. This latter business consisted of installing a particular type of shop front which he had designed and manufactured. It was this occupation in which he was engaged when he was^ instructed by Mr Patrick Butterly to take over from Mr White. He had no recognised professional qualifications.

1.12 Mr Gardner was furnished with one of Mr White's drawings and prepared revised drawings himself which he lodged with Dublin Corporation, together with a specification, for the purpose of getting bye-law approval.

1.13 Work on the conversion commenced in June, 1977. It was carried out by Mr Eamon Butterly, a son of Mr Patrick Butterly and also one of the directors of the Company which owned the building. He employed the following firms and persons to carry out work in connection with the conversion on his and Mr Patrick Butterly's instructions:—

(1) Mr George Moloney (electrical installation);

(2) Crossflow Air Conditioning Ltd (heating and ventilation);

(3) Mr Brian Spencer (plastering);

(4) Cill Dara Precast Concrete Ltd (precast concrete tiering);

Plate 2 — Aerial view of building and surrounding area viewed from the sou

(5) Mr Christopher Kelly (strengthening of roof steelwork after removal of a stanchion);

(6) Mr Joseph Kidd (stage floor and dancefloor);

(7) Unit Systems Ltd (installation of suspended ceiling);

(8) Andrew Beare and Bernard McGloughlin Ltd (floor coverings and wall tiles);

(9) Mr Michael Fleming (plumbing);

(10) Ideal Tubes Ltd (seating units); and

(11) Kilmore Joinery Ltd (exit doors);

1.14 There was no professional supervision by architects or engineers of any of the work of conversion, other than the strengthening of the roof steelwork, for which Messrs McCabe, Delaney & Associates, Consulting Engineers, were responsible. Mr Eamon Butterly, who was both client and contractor, retained overall control of the work as it proceeded. He had some limited experience of building warehouses and factories.

1.15 Mr Gardner attended at the premises approximately once a week while the work was in progress, but said in evidence that he did not regard himself as supervising the work. He admitted, however, that if he had seen something being done which he thought was wrong, he would have so advised Mr Eamon Butterly. He said that he saw nothing wrong being done which required any such intervention on his part. During the final period of the conversion work (i.e. the early months of 1978) his time appears to have been principally occupied in making and fitting the seating units to be placed against the wall of the Silver Swan, Mr Eamon Butterlyhaving given him the contract for that part of the work.

Ill — GENERAL DESCRIPTION OF THE BUILDING AND ITS LOCATION

(1) Location

1.16 The building is located on Kilmore Road which runs in a westerly direction from the Malahide Road through the North Dublin suburb of Artane *(see Plan 1, Appendix 15 and Plate 2).* The portion which was converted into the amenity centre in 1978 was that fronting on to Kilmore road, from which it is approached by two entrances, referred to in this Report as the east entrance and the west entrance, between which there is a large grass area. Between the grass area and the building there is a concreted area running along the front of the building and on either side of it. There was a security barrier, consisting of a pole which could be raised and lowered, at the south-east corner of the building *(see Plan 2, Appendix 15 and Plate 1).*

1.17 The area was incorporated in the County Borough of Dublin by virtue of the Local Government Provisional Order Confirmation Act, 1953. The building thereafter was in the functional area of Dublin Corporation.

(2) The Building

1.18 The Silver Swan, the Lantern Room and the Stardust, together with the kitchen, toilets, passages and other areas associated with them, occupied 2944 m^2 of the ground floor of the original building and 246 m^2 of office and other accommodation on the first floor. The Stardust section, including toilets and kitchen, occupied about 1853 m^2, the Lantern Room 656 m^2 and the Silver Swan 304 m^2.

1.19 The external walls of the building were of rendered concrete blockwork with some brickwork on the Kilmore Road elevation. It was separated from the remainder of the original building by a concrete block wall. There were offices at the first floor level above the main entrance and these had a flat roof. On either side of this office portion, the roof

Plate 3 — *View from the front of the Stardust as seen from the left forecourt.*

Plate 4 — *Typical seating unit; two or three such units joined together comprised a "seat".*

consisted of A-type corrugated asbestos sheeting incorporating glazing. There was a further portion of flat roof on the west side of the building over the Silver Swan and the Lantern Room toilets. The remainder of the roof contained five bays of northlight roof construction, consisting of corrugated asbestos and wired glass and measuring about 2190 m^2. The floors of the building were concrete. There were two areas of precast concrete tiering in the Stardust.

1.20 The greater part of the area of the Stardust, the Lantern Room and the Silver Swan was covered by a ceiling suspended from the roof structure. The areas to which the ceiling did not extend were the Kitchen, toilets, entrance foyer, the Store Room, the Lamp Room and the area immediately above the stage and dressing rooms in the Stardust, and an area of approximately 15 square metres in the centre of the Stardust. The Bar Store, Switch Room and Battery Room also did not have such a ceiling. This suspended ceiling consisted of mineral fibre tiles about 15 mm thick, which were suspended from a steel grid attached to the steel roof trusses. Each tile was 600 mm square with grooves at the edge to slot into a steel grid to provide a concealed-grid fixing system. At the walls, the edges were supported on steel angles attached to the concrete block walls. The tiling was not imperforate (without openings) throughout: metal grilles were inserted for the heating system, polystyrene grilles were inserted for the ventilation and perforations were also made to facilitate the fixing of downlighter-type metal lighting fittings and the roller blind channels. In the specification submitted by Mr Gardner to the Corporation for bye-law approval, the suspended ceiling was stated to consist of foil-backed plaster-board fitted to metal sections. The change to a ceiling consisting of mineral fibre tiles was made with the approval of the Corporation.

1.21 The internal walls of the ballroom and entrance foyer, with the exception of portions of the passageways and an area at the back of the stage, were covered from the skirting board to the ceiling with carpet tiles, the brand name of which was "Stateroom" and which were manufactured by Messrs Illingworth and Company of Bradford. The tiles were 500 mm square, made of polyester fibre on a PVC backing and attached to the walls by means of a synthetic adhesive. The floor area, including the step risers in the two tiered areas, but excluding the level area, was covered by a non-woven nylon/polyester soft floor covering, the trade name of which was "Nylfloor 2000", which was also supplied by Messrs Illingworth. The level area was covered in part by a nylon polypropylene fibre-bonded carpet the trade name of which was "Villatex Ultra" and which again was supplied by Messrs Illingworth, and in part by a maple floor. A section of the dancing area was covered with a thick linoleum-type material.

1.22 Seats and tables were fixed to the floor in two tiered areas in the Stardust. The larger of these two areas was along the north wall and the smaller along the west wall. They are referred to in this Report as the "North Alcove" and the "West Alcove" respectively.

1.23 The West Alcove was approximately 17.5 m in length and 10 m in depth with blockwork walls on three sides. The seats were stepped from front to rear, each step being about 160 mm high giving five rows separated by aisles 640 mm wide between seats and 680 mm wide at the two ends. There were eight tiers of seats, each tier consisting of fifteen units arranged in threes with a 2.5 m long table in front of each triple seat unit. The seats were constructed from steel angle frames, with 18 mm chipboard base and back. The base and back were padded with 50 mm polyurethane foam and covered in PVC-coated fabric, the base being hinged at the back to allow it to tip up to provide a walking-space in front. The base and the back were separated by a gap nearly 50 mm wide. The table in front of the seats consisted of a steel framework and 30 mm chipboard, covered on top and at the edges with plastics laminate *(see Appendix 14, Jigs. Al andA2 and Plate 4).*

1.24 The North Alcove was approximately 33 m in length and 14 m in depth. Its northern boundary consisted of the concrete block wall separating the Stardust from the factory and its eastern boundary of the external wall of the building, one of the emergency exists and two concrete block walls enclosing toilets. Its western boundary included a flight of four steps leading to a corridor which in turn led to a fire-escape stairs, a glazed partition

which separated it from the Lamp Room and a portion of the concrete block wall which enclosed the Main Bar. The seats in the North Alcove were also stepped from front to rear. There were twelve rows separated by aisles, each of which was between 600 mm and 700 mm wide, except for a dividing aisle in the centre which was 1 m wide, the aisle at the west end which was 1.22 m wide and the aisle at the east end which was 1.14 m wide. There were also two aisles connecting the central aisle respectively to the steps on the west side and the emergency exit on the east side, each aisle being 1 m in width. These measurements are approximate. That which led to the emergency exit did so by means of a flight of six steps. There were eleven tiers of seats, consisting for the most part of double seat units, except for two rows of triple seat units, there being a 1.83 m long table in front of each double unit and a 2.5 m long table in front of each triple unit. The seats and tables were constructed in the same manner as those in the West Alcove.

1.25 The North Alcove and the West Alcove could be isolated from the rest of the ballroom by roller blinds made from PVC-coated polyester fabric. (When the West Alcove was isolated by the blind its depth was reduced to 7.5 m). The blind in the West Alcove consisted of five sections, corresponding to the five rows of seating, each being 3.5 m wide. The vertical edges were guided in aluminium channels fixed through the suspended ceiling to the steelwork overhead and to the floor, the roller mechanism being attached to the steelwork in the roof. When a section of the blind was pulled down, it was secured on either side of the aluminium channels by two barrel bolts on the alcove side of the blind. When fully extended downwards, the lower edge of the blind was at the level of the table in the front row of the alcove, leaving a gap of 0.8 m between it and floor level. In order to return any section to the "up" position, it was necessary to release both barrel bolts. There was a spring-loaded roller at the top which meant that by applying slight pressure with the hand the blind could be returned to the "up" position. When the blind was in the "down" position, there was a gap of approximately 25 mm between the top of the blind and the suspended ceiling. When the blind was in the "up" position, there was no gap. At the top of the blind, there was a pelmet consisting of a timber base running from bracket to bracket with a cloth draped from it. On either side of each of the vertical aluminium channels separating the sections of the roller blind there was a gap of approximately 5 mm between the vertical edge of the blind and the aluminium channel.

1.26 In the West Alcove, the height of the ceiling from floor level at the tier nearest the back wall was 2.36 m. At the row nearest the blind it was 3.48 m, and the distance between the ceiling and the top of the seat at the back wall was 1.26 m.

1.27 In addition to the fixed seating and tables in the two alcoves, there were seats and tables of the same type on the level area (ABC) of the Stardust which were not fixed to the floor. The layout of the seats and tables on the night of the fire is shown in *Plan 2 [Appendix 15).* While these seats and tables were not fixed to the floor, they were not easily movable *(see Plates 5 to 8).*

1.28 At the south-east corner of the ballroom, there was a raised stage which faced diagonally across the floor *(Plate 6).* Behind the stage there were dressing rooms and three toilets. A portable platform, when not in use, was placed between the stage and Exit 4 on the east side of the Stardust *(Plate 22).* This platform was on wheels and could be wheeled into position in front of the stage, at which point it was at the same level as the stage and extending outwards from it to provide a ramp or additional platform for artists. The wheels could be raised and the platform would then rest in position on fixed legs. There was also a "sound box" on the level area *(see Plan 2, Appendix 15).*

1.29 There were three bars in the Stardust: the Main Bar, situated at the north west corner and two smaller semi-circular bars. These were situated respectively on the south and east sides of the ballroom and are referred to in this Report as "Bar 1" and "Bar 2".

1.30 The main entrance to the Stardust was on the south side, roughly half-way between the two entrances from Kilmore Road already referred to. It led into a foyer on the right of which were a cash office and a cloakroom. An open staircase led from the foyer to the offices on the first floor. From the foyer, a pair of swing doors gave access to the ballroom.

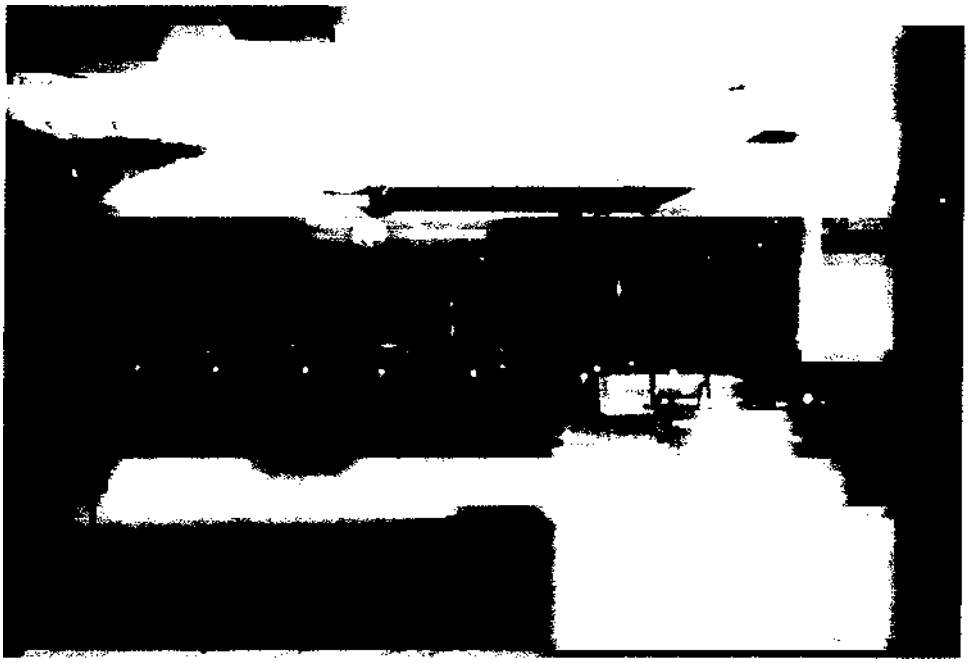


Plate 5 — *View from vicinity of Bar 2 facing the West Alcove with the Main Bar to the right centre and the North Alcove to the right. Note also the void in the ceiling.*

Plate 6 — *View taken from pillar beside Main Bar facing stage; free-standing seats and double tables are visible in foreground.*

Plate 7 — *View from east side of building facing stage and West Alcove; the white door to left centre is Door 15 (leading to Kitchen) and the Main Bar may be seen to the right.*

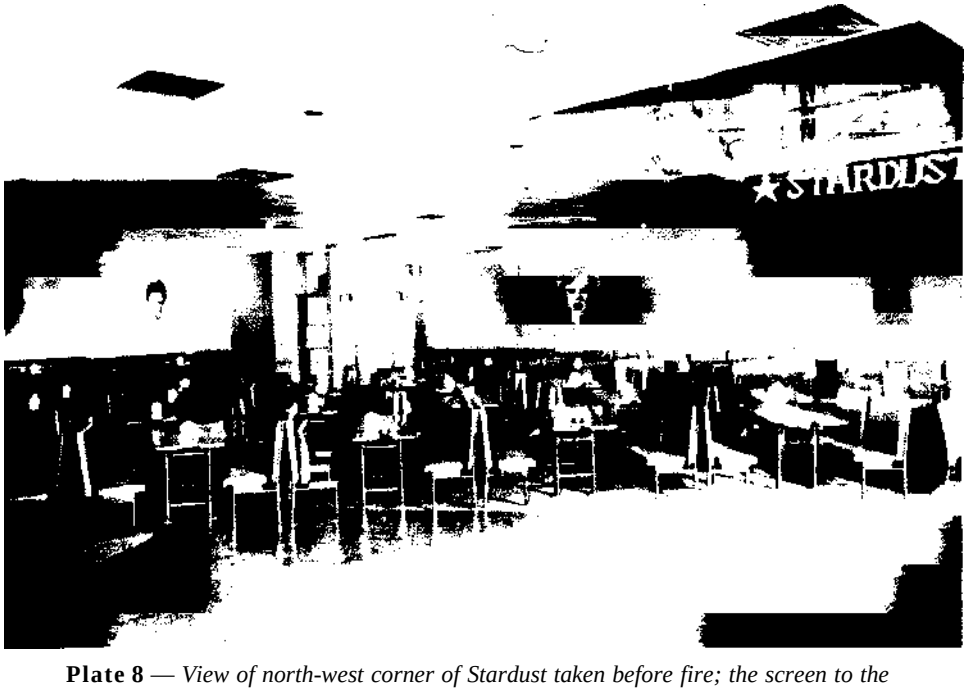


Plate 8 — *View of north-west corner of Stardust taken before fire; the screen to the left covers the West Alcove, and that to the right the North Alcove, the Main Bar being situated between the two.*

1.31 There were five principal emergency exists: one on the south wall, between the stage and the main entrance, three on the east wall, all of which were at ground level and one at a high level in the north-west corner connected with four steps to a corridor which led out on to steel fire-escape stairs descending to the concrete area on the west side. The Stardust was connected to the Lantern Room by a corridor running between the Kitchen and the West Alcove; and to the Silver Swan by a door at the back of the Main Bar.

1.32 The Lantern Room was located at the south-west of the building and consisted of a level area, part of which was available for dancing and the rest of which was covered with tables and chairs and a raised stage. The Silver Swan was located in the north-west corner and consisted of a level area into which a rectangular bar projected from a bar which ran at the back of the Silver Swan into the Lantern Rooms as far as the wall of the corridor connecting the latter to the Stardust. The main entrance to the Silver Swan and the Lantern Rooms was through a pair of double swing doors on the west side of the building through a common foyer. There were also two emergency exits from the Lantern Room, one on the south wall and one beside the toilets on the west side. There was an emergency exit from the Silver Swan at the north-west corner.

1.33 Between the Silver Swan and the North Alcove of the Stardust there were a store room and a projection room (known as the Lamp Room) both on the same level as the corridor leading to the north western emergency exit. Below the high level corridor there was a corridor at ground level which was entered by a door immediately underneath the fire-escape stairs and which led to a small office and cool room under the Store Room and Lamp Room.

IV — MECHANICAL AND ELECTRICAL INSTALLATIONS

(1) Lighting

1.34 There were four systems of lighting in the premises:—

(a) general house lighting

(b) stage and special lighting

(c) primary maintained lighting

(d) secondary maintained lighting

1.35 The **general house lighting** consisted of circular recessed downlighter-type metal lighting fittings mounted in the suspended ceiling tiles and connected to conduit-mounted socket outlets by a three-core, PVC-insulated, PVC-sheathed, flexible cable rated to operate at a maximum ambient temperature of 65°C. This lighting was controlled by a dimmer-unit located in the Lamp Room.

1.36 The **stage and special lighting** consisted of theatre spotlights and floodlights mounted over the stage area and stand-mounted spotlights and lanterns in the Lamp Room. There was also ultra-violet lighting for special effects. The connection of the stage lighting fittings to the lighting-socket system was by three-core, rubber-insulated, rubber-sheathed, flexible cables with a maximum operating temperature of 65°C. The sub-circuit wiring to these sockets was modified considerably during the life of the installation and the method of control re-located. The wiring of the sub-circuits over the stage area was extended, using a system of connectors from the trunking to some dimming equipment and an extensive plug/socket outlet installation. The extension wiring used was PVC-insulated, PVC-sheathed, flexible cables of the heat-resisting type designed to operate at a maximum temperature of 85°C.

1.37 The **primary maintained lighting** system is a system of lighting required by some regulations to be installed in places of public resort to provide permanent minimum illumination, including lighting of exit signs, while the public are on the premises. Regulations normally require the installation of two such systems, the other being referred to as the **secondary maintained lighting system.** Each of these systems is required to

be independent of the other, and of the other lighting systems in the premises. The secondary system must also be capable of being operated by a three-hour battery reserve in the event of the mains supply failing for any reason. The two systems must be so installed that a fault or accident in one system cannot in any circumstances affect the other.

1.38 The **primary maintained lighting system** consisted of conventional 220 volt down-lighter light-fittings mounted in the suspended ceiling tiles and connected to the lighting socket system through PVC-insulated, PVC-sheathed, flexible cable-drops from conduit-mounted sockets outlets overhead. Each fitting was fitted with a 15 watt bayonet-cap incandescent lamp. It appears from the evidence that approximately twenty of these fittings were installed in the ballroom area and internal escape routes.

1.39 Over each of the emergency exits described in Part VI below there was located a 400 mm X 220 mm illuminated "EXIT" sign fitted with three incandescent lamps. One of these lamps was supplied from the primary maintained lighting system. Outside each emergency exit there was a wall-mounted light-fitting also supplied from this system.

1.40 It would appear from the evidence that there was a total of approximately sixty lighting-points supplied from this system. It was arranged in nine final sub-circuits supplied by 2.5 mm^2 PVC cables in the trunking and conduit system already described. The circuits were supplied from a final sub-circuit distribution board located in the Battery Room next to the Switch Room *(see Plate 9)*. The board was of the type known as a "miniature circuit breaker" (generally abbreviated to MCB). MCB boards are frequently used nowadays in place of the traditional fuseboard. They consist of a series of switches which move from an "on" to an "off" position. If the switch persistently moves into the "off" position there is a fault in the system which must be located. The MCB board was rated at 10 amps.

1.41 The **secondary maintained lighting system** (which is sometimes called an emergency lighting system) was supplied at 110 volts AC during normal supply conditions and at 110 volts DC when the normal AC supply failed. The light-fittings consisted of the conventional downlighter-type fittings already described, fitted with similar 15 watt incandescent lamps. It appears from the evidence that there were approximately forty of these fittings installed in the ballroom and in the internal escape routes. The remaining two lamps in the illuminated exit signs were supplied from this system.

1.42 The light-fittings of this system were supplied with PVC cable run in conduit and trunking which was separate from the primary and normal lighting systems. In most cases, the secondary maintained lighting system trunking ran alongside the primary maintained lighting system trunking.

1.43 The system was supplied from a final sub-circuit MCB distribution board located in the Switch Room immediately underneath the MCB board for the primary system.

1.44 The supply unit for the system was a prefabricated control cubicle located in the Battery Room in the south-east corner of the building. It contained lead/acid battery cells and the associated control circuitry. In normal conditions, this system maintains a 110 volt AC supply (from a 220/110 volt transformer) to the lighting fittings, and simultaneously maintains a "trickle" charging supply to the batteries. When the normal AC supply fails, a change-over contactor operates to switch the supply to the batteries. There were fifty five lead/acid battery cells each with a nominal output of 2 volts. The batteries were rated for a continuous output of 17 amps at 110 volts for three hours. It would appear that the total installed load of the secondary maintained lighting system was 8 amps. The system was protected by 20 amp HRC transformer fuses and 20 amp HRC battery fuses. The sub-distribution MCB board was of a type known as the Crabtree 50 type, rated at 10 amps.

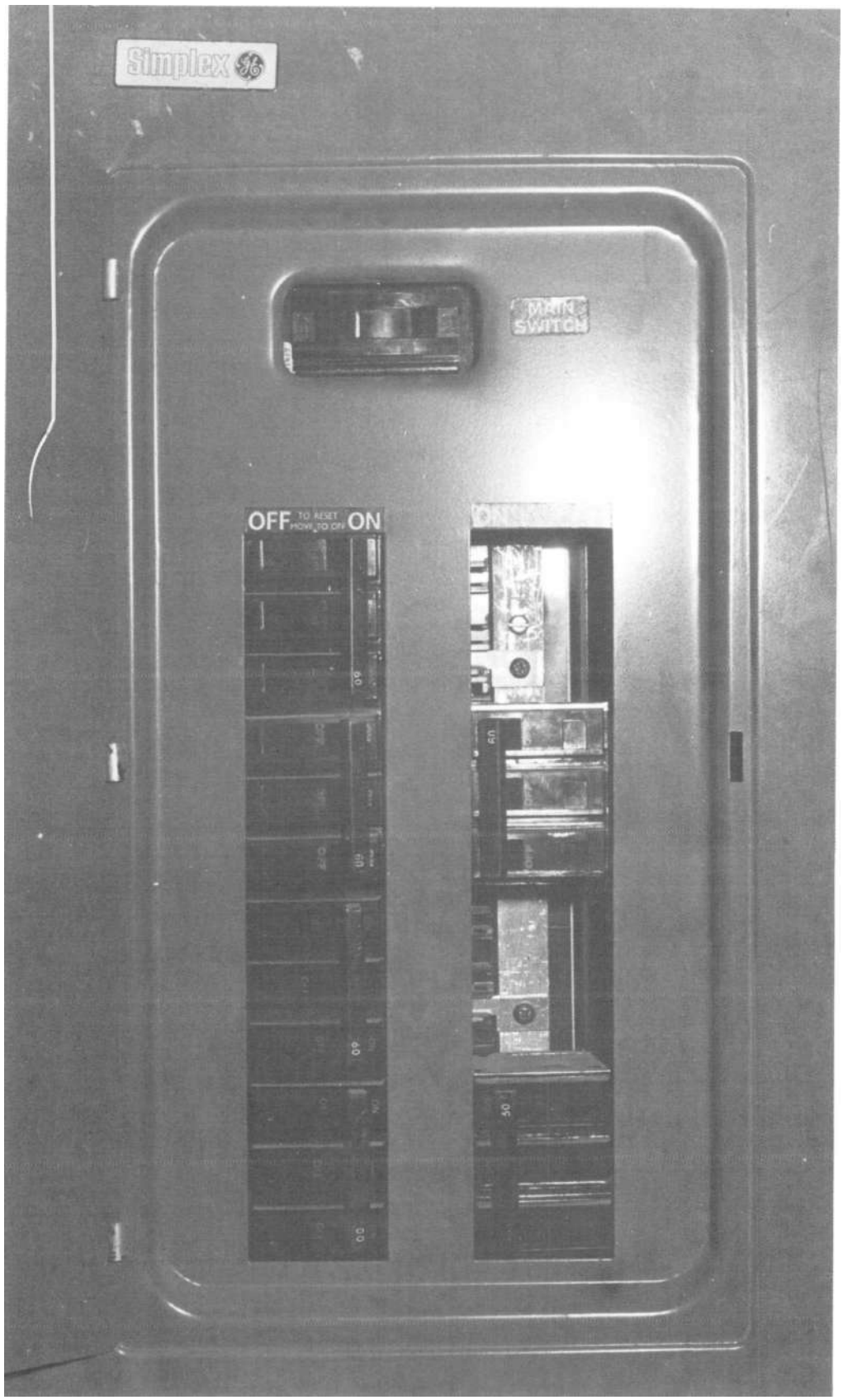


Plate 9 — *Photograph of miniature circuit breakers in Main Control Room.*

1.45 The individual secondary maintained lighting system circuits appeared to have each contained about seven to nine light fittings. Each circuit was protected by an individual Crabtree 50 MCB rated at 10 amps in the distribution board already described. The supply to the battery unit of this system was fitted with a 63 amp/300 milliamp earth-leakage circuit-breaker (ELCB) device. This is a form of earthing intended to avoid the risk of shocks.

(2) Water Heating System

1.46 There was an electrically heated hot-water cylinder in the corner of the Main Bar closest to the West Alcove and the Silver Swan. The cylinder was in a framed plywood cabinet under the suspended ceiling, which provided the top, the base consisting of a steel plate. One half of a ceiling tile above the cylinder had been removed. Immersion heating elements were fitted at the top and bottom of the cylinder. It was insulated by a 100 mm thick, PVC-sheathed, fibreglass, sectional quilt *{see Plate 47).*

(3) Burglar Alarm System

1.47 This system was also located at a high level in the Main Bar, the plywood cabinet already referred to containing the low voltage batteries which operated it. While the installation was so badly damaged by the fire that it is not possible to be certain as to its components, it appears to have included two-core flexible cables of a type normally used in such systems.

(4) Ventilation and Heating System

1.48 The heating and ventilation plant was located in a high-level plant room above the Lantern Room/Silver Swan toilets area. It contained a steam-heated calorifier supplied with steam from a boiler-house in the factory portion of the premises. This heated water which was pumped in steel pipes around the Plant Room to heater batteries in the Plant Room. The heater batteries warmed incoming air, and fans in the air-handling unit distributed this air along rectangular ducts made of galvanised steel suspended at high level in the space over the suspended ceiling. One served the North Alcove and one the rest of the ballroom. This warm air was distributed into the ballroom by metal diffusers in the ceiling. The diffusers were connected to the steel duct work by means of PVC flexible ducting. Air was extracted from the ballroom into the void above the suspended ceiling through plastic extract grilles mounted in the ceiling. The air in the ceiling void itself was extracted by three 700 mm diameter propeller fans mounted in the east gable of the building at high level and extracting the air into the atmosphere outside *(see Plate 26).*

1.49 The total supply air volume was 1,076 cubic metres per minute or approximately 45 cubic metres per minute from each of the diffusers. The volume of air could be controlled by the setting of dampers. The maximum free area of each diffuser was approximately 720 square centimetres. The supply system was designed to provide between nine and fifteen air-changes per hour and the extract system approximately eight air-changes per hour.

There were separate extract systems in the toilets at the front of the building.

(5) Fire Alarm System

1.50 Manual alarm switches, protected by easily breakable glass, were located at eleven positions, seven in the ballroom and four in other areas. These were wired to a six-zone visual indicator plan with a buzzer in the Cloakroom beside the main foyer. The alarm switches were located at the following points:—

Exit 1 (Outer door)

Exit 1 (Inner door)

Exit 2 (Inner door)

Exit 3

Exit 4

Exit 5

Exit 6

Main Exit door from Silver Swan

Exit in Silver Swan

Exit at toilets in Lantern Room

Exit from Lantern Room

(6) Other Electrical Equipment and Fittings

1.51 The electrical fittings in the Kitchen included pumps, fans, ovens, dishwashers, etc. with distribution panels, control panels and local control switches.

1.52 The socket outlets and plugs used throughout the building were of the 13 amp type with a fused plug-top. There was one twin 13 amp socket outlet mounted at a high level in the corner of the West Alcove formed by the Main Bar and the wall of the Lantern Room. There was a special socket installation for the stage to serve the artists' sound equipment There were also three 60 amp fused switches for visiting artists' heavy equipment.

V — ALTERATIONS AND MAINTENANCE

1.53 Certain alterations to the building were made and maintenance work undertaken after the work of conversion had been completed. The most important were as follows:

(1) The Suspended Ceiling

1.54 From time to time, it was necessary to replace ceiling tiles as they became damaged. In particular, a number of tiles were replaced at the centre of the back of the West Alcove. The tiles were of the same manufacture as those used in the original ceiling, but the actual work of replacement was done by the general maintenance man employed by the owners.

(2) The Electrical Installation

1.55 Modifications and alterations were carried out to the electrical system after it was installed. Two fuses on the DC battery supply for the secondary lighting were re-wired due to an earlier fault, using replacement fuse-wire rated at approximately 20 amps.

Additional lights had been installed in the stage area and Lamp Room, and additional wiring used for that purpose.

An emergency diesel generator to provide an independent supply in the event of the failure of the ESB supply was also installed.

(3) The Roller Blinds

1.56 The blinds were replaced in the circumstances described at para. 1.115 below.

VI — MEANS OF ESCAPE FROM THE BUILDING

(1) Means of escape from the Stardust

(i) *Introduction*

1.57 There were eight exits from the Stardust, six of which were specifically intended to be means of escape in an emergency. Of the six, five were emergency exits and one was the main entrance. The six exits were referred to alphabetically by the management but numerically at the hearing and are referred to numerically in this Report.

1.58 The location of the exits is shown in *Plan 2, Appendix 15.* Exit 1 consisted of two doors connected by a passage, the outer door opening on to a steel fire-escape descending to the concreted area. Exit 2 was the main entrance to the Stardust. Exit 3 on the south side consisted of two doors connected by a passage, the outer door opening on to a flight of five steps down to the concreted area. Exits 4, 5 and 6 on the east side opened directly on to the concreted area.

1.59 These exits, other than Exit 2, are referred to collectively in this Report as the "Emergency Exits".

1.60 Some of the exit doors and corridors were badly damaged in the fire. The description of them that follows is derived from the evidence of what survived the fire, and the evidence of the persons concerned with their installation and maintenance before the fire.

(ii) ***Exit 2 and the Emergency Exits***

(a) ***Exit 2***

1.61 The outer exit door *(see Plate 10),* was the main entrance door to the ballroom and led into the main foyer, Cash Desk, and Cloakroom. The outer door was 7 feet 4 inches (2.23 m) in height and consisted of two leaves, each 2 feet 8 inches (813 mm) wide. Each leaf had three double-acting hinges, enabling it to open inwards or outwards more than 90°. When both leaves were fully opened outwards, the width of the opening was 5 feet (1.52 m). When both leaves were opened fully inwards, the width of the opening was 4 feet 10j inches (1.48 m). Each leaf was fitted with fifteen glass panes, 5 inches (127 mm) high by 3 inches (76 mm) wide. As one faced it from the foyer, the right-hand leaf had one knob located at its outer edge approximately 3 feet 8 inches (1.12 m) from ground level. Over this knob was a sign stamped into a small plate with the words "PULL" on it. At the corresponding point on the outer face, there was a similar sign with the word "PUSH" on it. Beneath the knob of this door was the keyhole of a mortice dead-lock. The left-hand leaf was secured by means of two flush bolts, one located at the top and one at the bottom. The receiver for the mortice dead-lock was also located in this door. There was a mat-well in the floor on the inner side of this door, containing a chain-link rubber mat.

1.62 A steel roller shutter could be pulled down to cover the external face of the door and while pulled down could be locked, but could not be locked in the "up" position.

1.63 There were two smaller doors on either side of the main door, of similar height and 2 feet 6 inches (762 mm) wide, each containing fifteen glass panes. Each door had three double-acting hinges, as in the main doors. There were mortice dead-locks on each of these doors, the receiver being located in each case in the door frame. They were also protected by steel shutters. Each shutter could be locked in the "down" position but not in the "up" position.

1.64 There was a cash office on the right hand side of the entrance foyer as one entered it, which was in turn separated by a timber partition from a cloakroom. Two steps led from the Cloakroom into the Cash Office. There were a doorway and a counter from the foyer into the cloakroom area. Immediately above the exit there was a landing approached by stairs situated on the left-hand side of the foyer.

1.65 The floor of the foyer sloped downwards in the direction of the ballroom from a point 2 m in from the outer door. At the ballroom end of the foyer, there was another panelled timber door consisting of two leaves, each 7 feet 2 inches (2.18 m) high and 2 feet 11 inches (0.89 m) wide. This door consisted of a hardwood frame with four hardwood panels in each leaf. It had a "pull" handle on the foyer side and each leaf had three double-acting hinges enabling it to open inwards and outwards through an arc of 180° *(see Plate 11).*

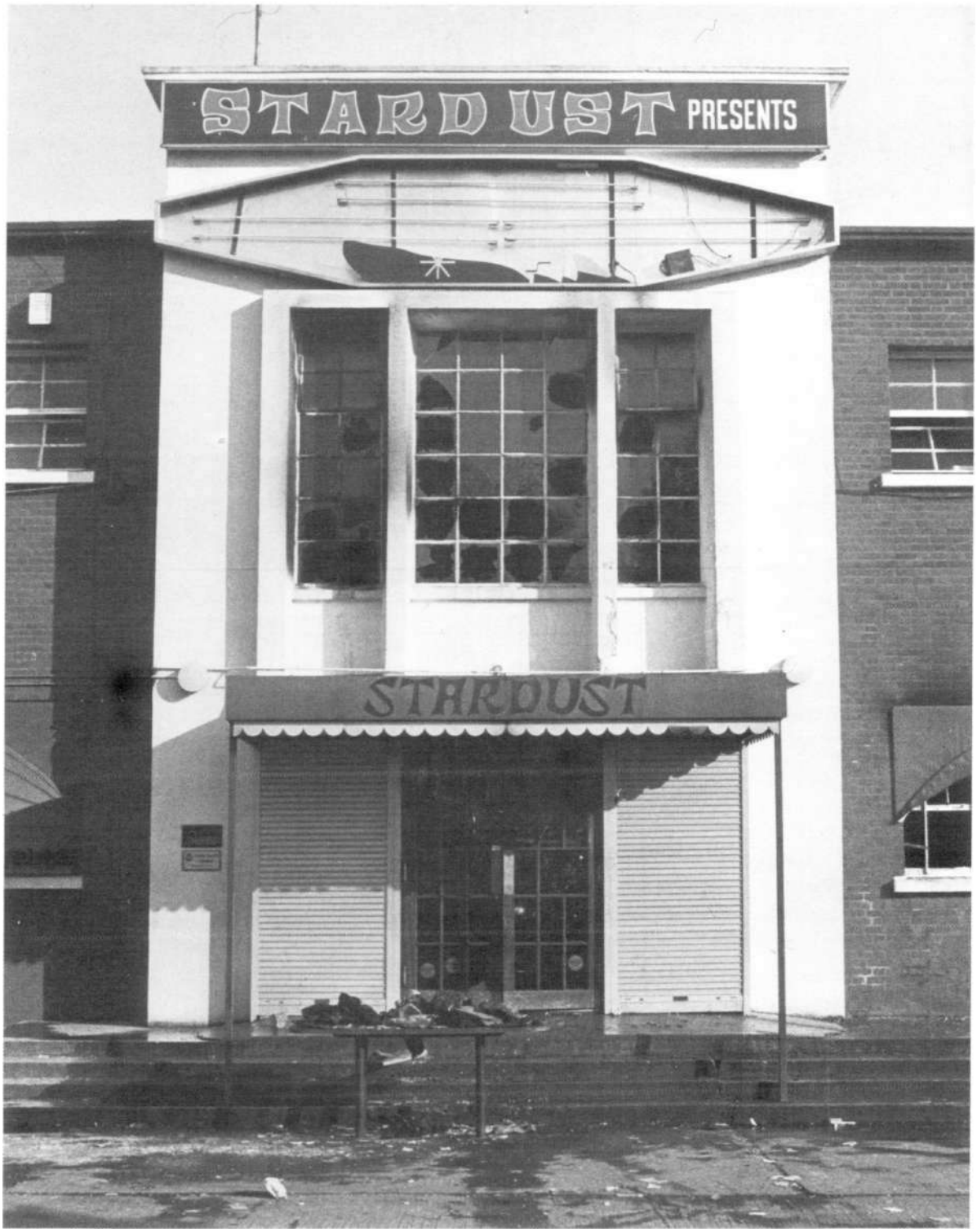


Plate 10 — *Main entrance door.*

Plate 11 — *View of inner door and outer doors (Exit 2) in Main Foyer.*

Plate 12 — *External view of Exit 3.*

(b) *The Emergency Exits*

1.66 The inner and outer doors of Exit 1, the inner and outer doors of Exit 3, and Exits 4, 5 and 6 were of a uniform type of construction. In each case, the door and frame were of softwood *(see Plate 12).* The door was covered on the inside with 6 mm plywood to give a flush panel, and on the outside with tongued and grooved softwood sheeting. The doors were 6 feet 8 inches (2.03 m) in height and each leaf 2 feet 5i inches (0.75 m) wide. Each leaf of Exits 4 and 5 was fitted with special hinges enabling it to open outwards in an arc of 180°. (In the case of Exit 5, the right-hand leaf could only be opened to the extent of 90° because of the presence of a shed on the outside of the building). When both leaves were in the fully open position the width of the opening was 5 feet (1.52 m). Over Exits 4, 5 and 6, the inner door of Exit 2 and the inner and outer doors of Exits 1 and 3, there were exit signs in a central position, consisting in each case of an illuminated plastic box with the word "EXIT" in green.

1.67 Exits 4, 5 and 6, the outer door of Exit 3 and the inner and outer doors of Exit 1 were fitted with panic-bar mechanisms. In the case of the inner and outer doors of Exit 1, Exit 3 and Exit 6, the mechanism was of the "Union" type. In the case of Exits 4 and 5 it was of the "Briton" type. In the case of the inner door of Exit 1, the portion of the mechanism which should have been on the right-hand leaf was missing. In the case of Exit 6, the horizontal portion of the mechanism of the left-hand leaf was in the upside-down position, and to open the door it was necessary to push the bar up instead of down as is usual.

1.68 On each of the doors fitted with a panic-bar mechanism, there was a plastic sign approximately halfway up reading "PUSH BAR TO OPEN".

1.69 The inner door of Exit 1 had four steps ascending to it. Each step had a rise of 6.75 inches (171 mm) and the door was recessed 6 feet (1.83 m) from the edge of the top step which was 6 feet 4i inches (1.93 m) wide. The concrete floor of the passageway into which this door led was carpeted for the first 35 feet 6 inches (10.82 m). At the ballroom end of the passageway at Exit 3 there was a door (Door 11) leading into the passage at the back of the stage.

1.70 As Exit 6 was situated in the North Alcove, access to it was obtained by six steps leading downwards. The steps were 5 feet 2 inches (1.55 m) in width with a rise of 6 inches (152 mm) and had a handrail on each side as one descended them.

(iii) ***Other Exits from the Stardust***

1.71 There were two other exits in the ballroom leading to routes which could be used as means of escape.

(a) *The Kitchen Route*

1.72 From a door (Door 15) beside the inner door of Exit 2, a passage led to the Lantern Room *(see Plate 7).* The Kitchen was located on the left-hand side of this passage. The entrance door had two leaves, one swinging inwards into the passage and the other swinging outwards into the ballroom. There was a door approximately halfway along the passage (Door 17) again with two leaves which swung in an arc of 90° in opposite directions. From this passage two doors (Door 16 and 18) gave access to the Kitchen; from the Kitchen an outer door (Door 21) led on to a flight of five steps on to the concreted area.

(b) *The Lantern Room*

1.73 From Door 15 and Door 17 (already described) there was a route through Door 19 at the end of the passage leading to the Lantern Room, from which escape was possible through three exits leading to the concreted area.

(c) *The Main Bar*

1.74 A door at the back of the Main Bar (Door 23) opened into the bar of the Silver Swan from which escape was possible through three exits leading to the concreted area.

(d) *Windows*

1.75 There were also a number of windows on the front elevation of the building. Four of them (numbers W3 to W6) were in the toilets in the Stardust. They were originally constructed with a 9 inch (229 mm) opening. While their primary purpose was for ventilation it might have been possible for a person to get through them in an emergency. At the time of the fire, steel plates had been welded internally to the frames of the toilet windows (W3 to W6). There were also vertical bars welded to the outside of the windows. The steel plates had been fixed by the management approximately six weeks before the fire in order to prevent persons handing drink, weapons or other unauthorised articles through the toilet windows to friends inside the building *[see Plates 13 and 14).* There were windows (W7 and W8) in the Cash Office and Spirit Store of similar construction to the toilet windows with vertical bars welded to the outside of each window but without steel plates.

1.76 There were also windows at the first floor level in the offices above Exit 2. There was a window which gave access to the roof of the building from a kitchen on the first floor level.

(2) Means of Escape from the Lantern Room and the Silver Swan

(i) ***The Lantern Room***

\.*ll* There were three exits from the Lantern Room. There were two swing doors opening to an arc of 90° into the foyer, which also served as the entrance foyer for the Silver Swan. From the foyer a pair of doors, each containing two leaves opening inwards and outwards, led on to the concreted area. There was an emergency exit beside the stage, fitted with a panic-bar mechanism and leading on to a flight of five steps on to the concreted area. There was also an exit consisting of two doors opening outwards in an arc of 90° beside the toilets into a covered passageway which led directly into the open air.

(ii) *The Silver Swan*

1.78 There were three exits from the Silver Swan. A pair of swing doors opening in an arc of 90° gave access into the foyer shared with the Lantern Room. There was an emergency exit door with a panic-bar mechanism fitted to it immediately to the right of the toilets and leading directly on to the concreted area. There was also a doorway from behind the bar into a passage which led to a door giving access to the concreted area under the fire-escape stairs.

VII — FIRE-EXTINGUISHERS AND HOSE REELS

1.79 There were seven fire-extinguishers in the Stardust located at the points indicated on *Plan 2 {Appendix 15).* Each of them was mounted in brackets on the wall. They were of a standard type manufactured by Messrs Chubb & Co. Six of them were of the liquid type and one of the carbon dioxide type. There were also fire-extinguishers in the Lantern Room and in the Silver Swan. There were no hose reels in the Stardust, the Lantern Room or the Silver Swan.

VIII — OWNERSHIP, MANAGEMENT, STAFFING AND FIRE SAFETY

(1) Ownership

1.80 The building was owned by a company called R & W Scott (Ireland) Ltd. The shares in this company, the name of which was subsequently changed to Scotts Foods Ltd, were ultimately acquired by members of the Butterly family and the Annual Return made under the provisions of the Companies Act, 1963, to the Registrar of Companies on the 29th October, 1972, shows the shareholding as of the 30th November, 1970, to be as follows:—

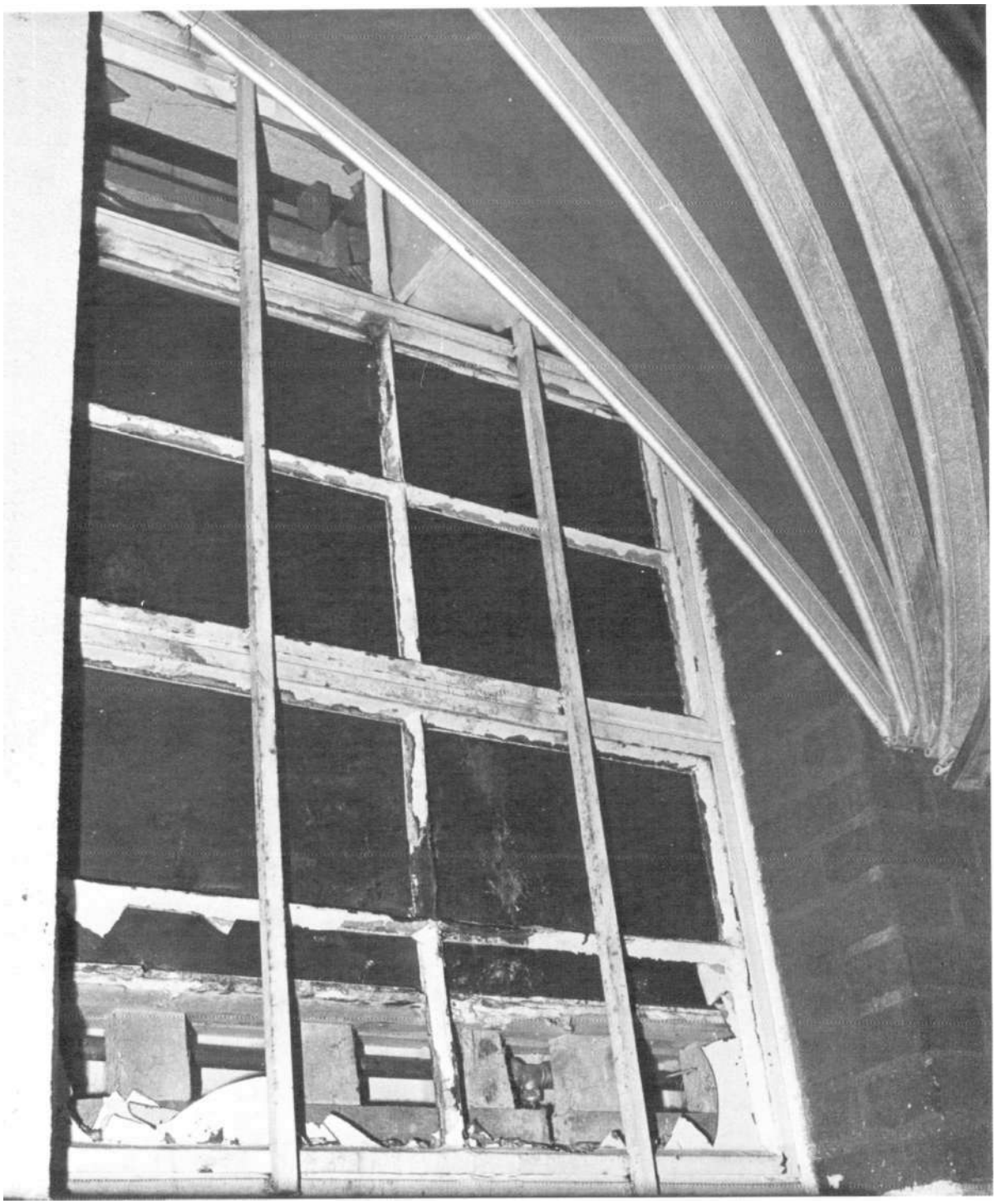


Plate 13 — *External view of window W 3 (Mens' Toilet),*

Plate 14 — *Internal view of window nos. W3 and W4 (Mens' Toilet),*

Patrick Butterly	29,999
Colm Joseph Butterly	1
Patrick Butterly & Sons Ltd	30,000

Some further transfers of shares took place and the Annual Return dated the 31st December, 1978, which was the last return made by the company, shows the shareholding to be as follows:—

Patrick Butterly	30,000
Butterly Enterprises Ltd	30,000

The Directors of the Company are stated in this Return to be Patrick Butterly, Colm Butterly and Eamon Butterly.

The shareholding of Patrick Butterly & Sons Ltd is shown in the Annual Return dated the 31st December, 1974, as follows:—

Colm Butterly	1 B ordinary share
Butterly Enterprises	5 B ordinary shares and 104 ordinary shares

The Directors are shown as Colm Butterly and Eamon Butterly.

In the case of Butterly Enterprises Ltd, a return of allotment dated 31st December, 1973, shows the shareholding of that Company to have been as follows:—

Patrick Butterly	25,499
Eileen Butterly	25,500
Eamon Butterly	9,799
Colm Butterly	9,800
Deirdre Butterly	4,900
Donal Butterly	9,800
Padraig Butterly	9,800
Maeve Butterly	4,900

No Annual Return subsequent to the 31st December, 1973, was made.

Evidence was given by Mr Patrick Butterly and Mr Eamon Butterly that a letting of the Silver Swan, the Lantern Room and the Stardust was made to a company called Silver Swan Ltd sometime in 1978. The rent was stated to be £1,000 per week, but no lease or tenancy agreement was executed until after the fire. The last Annual Return filed for Silver Swan Ltd was dated the 31st December, 1975, and showed the shareholding as follows:—

Patrick Butterly	100 A shares and 7,899 B shares
Colm Butterly	1 B share

(2) Management

The first manager of the premises when it opened on the 6th March, 1978, was a Mr John Fitzsimons (who should not be confused with another person of the same name who was employed as a part-time doorman and who will be referred to elsewhere in the Report). Mr Fitzsimons managed the premises for approximately eight months and was then succeeded by a Mr Frank Berry. Mr Berry in turn was suceeded after a period of not more than two months by Mr Brian Peel. At about this time, i.e. early to mid-1979, Mr Eamon Butterly became the full-time Managing Director and General Manager of the premises and was so acting on the night of the fire. Mr Peel acted as second in command and was in charge of the premises in Mr Butterly's absence. Under Mr Peel there was an Assistant Manager, Mr Jack Walsh. Mr Butterly and Mr Walsh were both present on the night of the fire.

(3) Staffing

1.83 There were ten full-time barmen employed in the premises, all of whom were on duty on the night of the fire. The general maintenance man, Mr P. J. McGrath, was also a full-time employee, as was Mrs Agnes Pearse, the head cleaner. There were three other full-time cleaners. Mr George Moloney, who was responsible for the electrical installation, was employed by the owners as a full-time electrician at the premises until March, 1980, when he obtained another full-time position. He appears to have attended at the premises intermittently thereafter. There were also clerical staff, two porters, a carpenter and a carpenter's mate.

1.84 In addition to these full-time employees, there was a large number of part-time employees. The part-time staff present on the night of the fire appear to have been as follows:—

Mr Phelim Kinahan (Floor Manager)

Mr Thomas Kennan (Head Doorman)

Mrs Teresa Marley (Catering Manageress)

Mrs Maria Brady (Supervisor of lounge-girls)

Mrs Catherine McGrath (Cashier)

Mrs Joan Barrett (Cloakroom Attendant)

Nine doormen

Thirteen barmen

Five washers (assistants to barmen)

Nine kitchen staff

Six waitresses

Fourteen lounge girls

1.85 The lounge-girls were under the supervision of Mrs Maria Brady and the kitchen staff and waitresses under the supervision of Mrs Marley.

1.86 Entertainment at the premises was provided by arrangement with a company called George O'Reilly Promotions Ltd, and persons such as disc jockeys and other performers were employed on a free-lance basis.

1.87 The duties of the doormen included

(a) regulating the entry of patrons to the ballroom so as to ensure that the admission charge was paid and that persons who were not acceptable to the Management for any reason were not admitted,

(b) dealing with disorder in any part of the premises,

(c) preventing unauthorised persons gaining access to the premises, and

(d) locking and unlocking the exit doors (including the emergency exits).

1.88 Mr Thomas Kennan, the head doorman at the time of the fire, is an uncle of Mr Eamon Butterly. At the time of the fire, he had worked as a doorman on the premises for three years and had been head doorman for twelve months. The number of doormen on duty each night varied; the maximum appears to have been twelve and, on the night of the fire, there were ten (including Mr Kennan). Mr Kennan's duties included assigning the doormen to specific posts and supervising them in carrying out their duties. In carrying out his duties, he was answerable solely to Mr Eamon Butterly. He did not attend the premises every night as he had another full-time occupation as a linotype engineer in a newspaper and, on disco nights, he usually left before the function terminated at 02.00. In his absence, his duties were performed by Mr Leo Doyle, who was the deputy head doorman and had been a doorman for five months.

1.89 There was a high turnover of doormen at the premises. A number had been replaced a few weeks before the fire: this occurred because they had been paid without any deduction under the PAYE system being made from their wages. The owners wished to regularise this position and some of the then doormen were not willing to accept the change.

1.90 The following are the names of the eight doormen on duty on the night of the fire in addition to Mr Kennan and Mr Doyle, with their length of service indicated in parentheses:—

Austin Bell (3 weeks)

Frank Downes (6 months)

John Fitzsimons (6 months)

John Furley (3 years)

Michael Griffin (18 months)

Michael Kavanagh (9 months)

Patrick J. Murphy (3 weeks)

Gabriel O'Neill (1 month)

(4) The Staff and Fire Safety

1.91 With two exceptions, none of the staff, including the management, had any training in, or particular knowledge of, fire safety. The first exception was the doorman, Mr John Fitzsimons, whose full-time occupation was fireman in the Dublin Fire Brigade and who was accordingly familiar with fire-fighting techniques and the rescue of people from burning buildings. The second was Mr Phelim Kinahan who had some limited instruction in how to prevent and deal with kitchen fires as part of a course in hotel management. Neither of these employees, however, was given any particular function in relation to fire safety in the building, nor was any other member of the staff assigned any particular function in regard to fire safety.

1.92 No instructions were given by the management or anyone else to any member of the staff as to what procedure was to be followed in the event of a fire. No fire drills of any sort were ever organised on the premises, nor were evacuation procedures ever laid down or even discussed. None of the staff, with the exception of Mr John Fitzsimons and Mr Patrick J. Murphy, another doorman, had ever used a fire-extinguisher. Many of the staff did not know where the fire-extinguishers were located in the premises. None of the doormen knew that the two side doors at outer Exit 2 (see para. 1.63 above) could be opened or even that they were doors and not windows, although this was known to Mr Eamon Butterly.

1.93 Mr Eamon Butterly knew of the existence of the Dublin Corporation Public Resort Bye-laws but had a very limited knowledge of what was required by them. Many members of the staff who were questioned as to their knowledge of the Bye-laws said that they knew nothing about them. This applied in particular to all of the doormen, including Mr Kennan. Mr Kennan and his deputy, Mr Doyle, were aware, however, that exit doors should not be locked while the public were on the premises.

IX — THE RELEVANT LEGISLATION, REGULATIONS AND NON-STATUTORY GUIDELINES

(1) Legislation and Regulations

A number of statutes and bye-laws were relevant to the conversion of the building.

(I) ***Local Government (Planning and Development) Acts, 1963 and 1976***

1.94 The conversion of the building from use as a food factory to use as a bar, restaurant, and an amenity area, constituted a material change in use within the meaning of Section 3(1) of the Act of 1963, and accordingly a development within the meaning of that section for which permission was required. The Acts are referred to in this Report as "the Planning Acts" and the necessary permission as "planning permission".

(ii) ***Building Bye-laws under the Public Health (Ireland) Act, 1878***

1.95 The Corporation, in exercise of its powers under Section 41 of the Act of 1878, made bye-laws on the 27th June, 1949 (referred to in this Report as "building bye-laws") which were applicable in their functional area. The Corporation was advised by Senior Counsel in 1953, following the incorporation of the Artane area in the City, that a resolution would have to be passed by the Corporation to bring these Bye-laws into effect in the added area. No record could be found of any such resolution having been passed, and as a result the Bye-laws were probably not applicable to the building. (The Tribunal's reasons for arriving at this conclusion are set out in Appendix 6). They were, however, treated as applicable by all concerned, viz. the owners, the persons who designed the conversion on their behalf, and Corporation officials concerned with the building.

(iii) ***Dublin Corporation Act, 1890, and Public Resort Bye-laws***

1.96 The Corporation, in exercise of its powers under Section 55 of the Act of 1890, made bye-laws called "Bye-laws relating to Places of Public Resort—Protection from Fire" on the 7th March, 1934 (referred to in this Report as "The Public Resort Bye-laws"), which were applicable to places of public resort as defined in Section 55. The building was a "place of public resort" within the meaning of that bye-law, but, as with the Building Bye-laws, no resolution was passed making them applicable in the added area and, for the same reasons, the Bye-laws were probably not applicable. Again, however, all those concerned with the building treated them as applicable.

(iv) ***The Licensing Acts, 1833 to 1962***

1.97 Since it was proposed to sell, and offer for sale, intoxicating liquor for consumption in the building, a licence was required under the provisions of the Acts.

(v) ***Public Dance Halls Act, 1935***

1.98 Since it was proposed to use the building for public dancing a licence was required under Section 2 of the Act.

(vi) ***Public Health Acts Amendment Act, 1890***

1.99 Since it was proposed to provide entertainment in the form of public singing and music, a licence was required under Part 4 of the Act. Under Section 36 of the Act, ample, safe and convenient means of ingress and egress for the use of the public had to be provided in the premises and kept free and unobstructed to such extent as the Corporation required.

(vii) ***Fire Brigades Act, 1940***

1.100 Under Section 7 of this Act, Dublin Corporation was entitled to serve a notice (called a "Fire Precautions Notice") requiring the proprietor of the building (i.e. Silver Swan Ltd) to refrain from using the building or a specified part of it as a licensed amenity centre unless or until specified precautions were taken to their satisfaction. Silver Swan Ltd would have been entitled to appeal to the District Court within fourteen days of the service of the Notice; but in the event of the District Court confirming the Notice, or no such appeal having been taken, the Notice would take effect upon the making of the District Court Order or at the expiration of the fourteen day period for taking the appeal.

No Fire Precautions Notice was served at any stage in respect of the building.

(2) Non-statutory Guidelines

In addition to the legislation and regulations, there were certain standards, codes of practice, guidelines etc. which had no statutory force but were relevant to the building.

(i) *Fire Protection Standards*

1.101 These were issued in 1967 by the Department of Local Government (now the Department of the Environment) for the guidance of fire officers, architects, builders and others whp were, or should be, concerned with fire safety.

(ii) *Draft Building Regulations*

1.102 Section 86 of the Planning Act, which was enacted by the Oireachtas on the 7th August, 1963, empowered the Minister for the Environment to make building regulations which were intended to be applicable throughout the State and to replace local bye-laws where they existed. A draft of such regulations was circulated to local authorities, including the Corporation, in 1969 for comment. A revised draft was published by the Department on the 29th November, 1976. Parts N, P and Q deal respectively with "Structural Fire Precautions", "Means of Escape from Fire", and "Access for Fire Appliances and Means of Assistance to the Fire Brigade". Parts G, R and S also contained provisions relevant to fire safety.

1.103 Proposed amendments to these Draft Regulations were circulated to local authorities and other bodies on the 27th February, 1981 (i.e. a fortnight after the fire) and in a circular dated 4th March, 1981, the Minister for the Environment requested local authorities and others concerned with fire safety to take the provisions of the Draft Building Regulations, as revised, into account as if they had statutory backing. The revised Draft Regulations were published in April, 1981. At the time of writing, the Draft Regulations have not been given the force of law. (In order for such regulations to be made, Section 86 itself must first be brought into operation by a statutory instrument).

1.104 The Fire Protection Standards and the Draft Building Regulations refer at various points to "Irish Standards" and "British Standards". These are standards prepared by the Institute for Industrial Research and Standards (IIRS) and the British Standards Institute (BSI) respectively, in respect of various materials and constructions. The procedure for ascertaining whether a particular material or construction complies with an Irish Standard or British Standard is laid down in a written specification, indicated by the capital letters "IS" or "BS", as the case may be, and followed by a serial number. A provisional Irish Standard is indicated by the initials 'TS(P)".

(iii) *Codes of Practice*

1.105 Codes of practice represent design and construction recommendations for architects and engineers, and include matters relevant to fire safety.

1.106 In the case of electrical installations, the accepted code of practice in this country is embodied in the National Rules for Electrical Installations issued in 1976 by the Electro Technical Council of Ireland (known as "ETCI Rules"). There are also regulations of the Electricity Supply Board governing the supply of electricity to buildings and the electrical equipment of buildings.

(iv) *Extra-territorial Regulations and Codes*

1.107 Regulations made by authorities in other jurisdictions are also taken into account from time to time by local authorities, architects and engineers and other persons concerned with fire safety. Of these, the most important in practice are the Building Regulations, 1976 (England and Wales); the Places of Public Entertainment Technical Regulations, and the Places of Public Entertainment Management Regulations issued by the Greater London Council; the Building Regulations (Northern Ireland), 1977 and the Building

Standards (Scotland) (Consolidation) Regulations, 1971, since replaced by the Building Standards (Scotland) Regulations, 1981; and the Code of Practice—Means of Escape in Case of Fire issued by the Greater London Council in 1974. (There are, in addition, commentaries published on these regulations which are also taken into account in matters relating to fire safety). There are also Regulations for Electrical Installations issued by the Institution of Electrical Engineers.

X — PERMISSIONS, APPROVALS AND LICENCES

(1) The Planning Acts

1.108 *Outline Permission* was given by the Minister for Local Government on the 19th June, 1973, for use of portion of the existing factory as a licensed premises, restaurant, bowling alley and warehouse. This followed an appeal from a refusal of the application by the Corporation on the 19th January, 1973. The Permission was subject to two conditions, the first of which required detailed plans and particulars to be submitted for approval.

1.109 *Approval* was granted by the Corporation on the 29th October, 1976, in respect of Plan No. 1586/76 providing for the conversion of part of the existing factory to a licensed amenity building. The application was treated by the applicant and the Corporation as one for approval arising out of the Outline Permission already granted by the Minister on appeal. The Approval was subject to ten conditions, of which the first three were as follows:—

"(1) The development to be carried out in accordance with the plans, particulars and specifications lodged with the application, save as may be required by the other conditions attached hereto.

(2) Before commencement of the development, approval under the Building Bye-laws to be obtained and all conditions of the approval to be observed in the development.

(3) Before commencement of the proposed development, the applicant shall consult with the Chief Fire Officer and shall ascertain and comply with his requirements (if any) in regard to the prevention of a fire hazard in the development".

1.110 It should be noted that the *Special Permission* under the earlier town planning legislation, under which the original building was constructed, contained a condition requiring the provision of a tank sufficiently large to store one day's supply of water for the factory.

(2) Building Bye-laws

1.111 The Corporation was regarded by itself and the owners as having granted approval under the Building Bye-laws in respect of Plan Nos. 1492/77, 1492/77A, 1492/77B and 2483/77A on the 6th January, 1978, although the actual Order of the Assistant City and County Manager refers only to an approval under the Public Resort Bye-laws. The approval, which was clearly intended to be given under the Building Bye-laws, was subject to the following eight conditions:—

"(1) The maximum of persons *(sic)* to be admitted to the main cabaret room at any one time being limited to 1458.

(2) All electrical installations both primary and secondary must receive the prior approval of the Corporation Electrical and Public Lighting Department.

(3) Adequate and suitable first-aid fire-fighting equipment to be provided. The number and types of equipment to be agreed with the Chief Fire Officer.

(4) No scenery or properties to be used on the stage platform other than those constructed of non-combustible or inherently non-flammable or durably flame-proofed material.

(5) No hangings or curtains are to be used other than those which are inherently non-flammable or durably flame-proofed. A certificate of flame resistance must be provided for each different material.

(6) All requirements of the Eastern Health Board being strictly complied with.

(7) All areas, rooms etc. not covered by the air-conditioning system to be provided with adequate permanent ventilation to the open air.

(8) Doors between kitchen area and public areas to be fire-resistant and self-closing".

(3) Public Resort Bye-laws

1.112 The grant of approval dated the 6th January, 1978, was, as already noted, expressly made in respect of the Public Resort Bye-laws and was subject to the eight conditions already quoted.

(4) Licensing Acts, 1833 to 1962

1.113 An Ordinary Publican's Seven-day On-licence was issued on the 29th March, 1978, in respect of the Silver Swan, the Lantern Room and the Stardust. A Limited Restaurant Certificate under Section 1 of the Act of 1927 was granted on the 13th September, 1978. A full Restaurant Certificate under Section 12 of the Act of 1927 was granted on the 20th November, 1978.

(5) The Public Dance Halls Act, 1935

1.114 A licence under the Act was granted on the 25th November, 1980, subject to three conditions which were as follows:—

"(1) Permitted hours for use of the said premises for public dancing shall be as follows:— 8.00 p.m. — 2.00 a.m.

(2) The conditions and restrictions contained in the Bye-laws relating to places of public resort prescribed by the local authority are hereby deemed to be incorporated in and form part of the conditions and restrictions upon the uses of the said premises. Any breach or non-observance of the conditions and restrictions of this licence shall constitute grounds for revoking the licence.

(3) Notwithstanding anything contained in paragraph 1 of the foregoing conditions and restrictions, a Justice assigned to said District may, upon the application of the licensee by endorsement hereon extend the permitted hours for the use of the said premises for public dancing on any special occasion. The licensee shall, not less than 48 hours before making such application, serve notice thereof upon the Superintendent of the Garda Siochana for the aforesaid district".

(6) Public Health Acts Amendment Act, 1890

1.115 A licence under the Act was granted on the 25th November, 1980.

The premises, as has been pointed out, opened to the public on the 6th March, 1978. A temporary licence under the Acts of 1935 and 1980 was granted in respect of the premises on the 22nd February, 1978.

The original applications for the licences under the Acts of 1890 and 1935 were adjourned by the District Court following an objection on behalf of the Corporation that the roller-blinds isolating the alcoves were not made of flame-proof material. The objection was withdrawn on the Corporation having been satisfied by the production of a certificate from the IIRS that the replacement roller-blinds complied with the relevant British Standards (BS 3119 and BS 3120).

XI — COMPLIANCE WITH LEGISLATION, REGULATIONS AND NON-STATUTORY GUIDELINES

(1) Legislation and Regulations

(i) *The Planning Acts*

1.116 Planning permission having been granted for the conversion of the relevant part of the existing building to a licensed amenity building, the owners were entitled to use it for that purpose, subject to compliance with the conditions. No use was specified for the Stardust itself other than use as "an amenity area", but the Tribunal is satisfied that its use for public dancing, the provision of entertainment in the form of music and singing, and the sale and consumption of intoxicating liquor were not precluded, provided the necessary licences were obtained.

1.117 The first condition provided that the development should be carried out in accordance with the plans, particulars and specifications lodged with the application. The conversion as completed did not conform in certain respects to the plans lodged, but the Planning Officer of Dublin Corporation, Mr Aliaga Kelly, took the view that these changes, affecting as they did the internal layout of the building only, were not material from a planning point of view, and the Tribunal is satisfied that his view was correct.

1.118 The second condition provided that, before commencement of the development, approval under the Building Bye-laws was to be obtained and all the conditions of the approval observed in the development. The extent to which the Building Bye-laws and any conditions subject to which approval was granted were complied with, is considered below.

1.119 The third condition provided that, before commencement of the proposed development, the applicant should consult with the Chief Fire Officer and should ascertain and comply with his requirements (if any) in regard to the prevention of a fire hazard in the development.

1.120 In connection with an earlier unsuccessful application for permission, Mr White had been informed by the Planning Officer on the 6th July, 1976, of the Chief Fire Officer's requirements. The letter was as follows:—

> "Further to notification of decision to refuse permission for the above proposal, I wish to inform you that prior to this decision your application was referred to the Chief Fire Officer. For your records he requests that plans be submitted showing:—
>
> (1) Stairs to be enclosed in 1 hour fire-resisting construction and to discharge direct to open air at ground floor level.
>
> (2) Alternative means of escape from 1st floor.
>
> (3) No. 5'0" *(sic)* exits from Amenity area.
>
> (4) All internal wall and ceiling linings to have a minimum Class 1 surface spread of flame rating.
>
> (5) Emergency lighting system independent of the mains to Fire Brigade requirement to be installed.
>
> (6) Suitable and adequate first aid fire-fighting equipment".

1.121 The successful application (1586/76) was again referred to the Fire Brigade Department, but their observations were not sent to the Planning Department until the 10th November, 1976, i.e. nearly two weeks after the decision to grant approval had been made. Their observations were in the following form:—

> "Re: Plan Number 1586/76, 38 Kilmore Road, Artane, Dublin 5. Conversion of part of existing factory to licensed amenity building. Mr Patrick Butterly.
>
> With reference to the attached plans for the above mentioned proposal, I recommend additional information to be sought as follows:—

" (1) Five no. fire exits direct to open air from Amenity area.

(2) Exit doors to open outwards.

(3) Internal wall and ceiling linings to possess Class 1 surface spread of flame rating.

(4) Suitable and adequate first aid and fire-fighting equipment.

[signed J Williams)
for Chief Fire Officer

General Fire Department Requirements unless otherwise specified applicable to all buildings and building proposals.

(1) All staircases to be enclosed in 1 hour fire-resisting construction and fitted with fire-resisting self-closing doors on each floor level.

(2) All staircase lobbies to be enclosed in 1 hour fire-resisting construction and fitted with fire-resisting self-closing doors.

(3) All ducts to be separated horizontally and vertically at each floor level in 1-hour fire-resisting construction.

(4) Entrance doors to flat dwellings to be fire-resisting self-closing and fitted with non-automatic locks.

(5) Where fire-resisting glazing is used in fire-resisting construction these are limited to areas and locations, and further details should be obtained from Fire Department.

(6) Wall and ceiling lining in all staircases enclosures and along all escape routes must be non-combustible and have a surface spread of flame classification of not less than Class 1".

1.122 Mr White was not informed of these requirements, but in connection with the application for Building Bye-laws approval, Mr Dermot King, the Senior Building Surveyor of the Corporation, wrote on the 25th August, 1977, to Mr Gardner, who had succeeded Mr White at this stage, as follows:—

> "Further to our recent telephone conversation, I set out hereunder requirements of the various other Corporation Departments:—. . . .".

1.123 There follows a list of requirements by the Eastern Health Board. The letter then goes on:—

> "You have already received the Chief Fire Officer's report. The Senior Engineer in charge of Electricity and Public Lighting Department reports as follows . . . .".

There follows certain requirements, which are not relevant, and the letter concludes:—

> "Before a recommendation can be made under the Building Bye-laws relating to Places of Public Resort, I would require your observations on the above requirements".

1.124 Mr Gardner said that on receiving this letter he took no steps to ascertain from Mr Eamon Butterly or Mr William White what the requirements of the Chief Fire Officer, referred to in Mr King's letter, were. His reason for not making any such enquiries was that he thought the Chief Fire Officer's requirements were in a standard form which was applicable to all buildings. He said that after receiving Mr King's letter, he did have a discussion with Mr Edward Clarke in the Fire Brigade Department of the Corporation, but he did not remember Mr Clarke discussing anything other than the seating and the exits.

1.125 The Chief Fire Officer's requirements as conveyed to Mr White on the 6th July, 1976, and to the Planning Officer on 10th November, 1976, included a requirement which was to be of crucial importance in the light of subsequent events, i.e. that the internal wall and ceiling lining should possess what is described as a "Class 1 surface spread of flame

rating". A person aware of modern fire-protection standards would have understood this to be a requirement that the material in question should come within Class 1 of the relevant British Standard. In the event, the material used for the internal wall lining i.e. the carpet tiling, was of a significantly lower rating under the terms of that Standard, i.e. at worst Class 4 and at best Class 3, and this contributed substantially to the rapid spread of the fire (see Chapter 7).

1.126 Any serious attempt to ascertain the requirements of the Chief Fire Officer would have necessitated Mr Gardner's obtaining from Mr White the letter of 6th July, 1976, and seeking advice from a person more versed in these matters than he was, as to what was meant by a 'Class 1 surface spread of flame rating'. The Tribunal is satisfied that there was a clear failure to comply with this condition and a failure which, in conjunction with other factors, was to have catastrophic effects.

1.127 It must also be said, however, that the condition itself was of doubtful validity. Because of shortage of staff in the Fire Prevention Department, its observations on an application for planning permission are rarely received before the expiration of the statutory period of two months, within which the Corporation must decide to grant or refuse the application. (Under Section 26 (4) (a) of the Act of 1963, where the planning authority do not notify an applicant of their decision within a period of two months from the receipt by them of the application, a decision by them to grant the permission is regarded as having been given on the last day of the period. In cases where notices requiring further information, etc., are served, they have a further period of two months beginning on the day the notices are complied with).

1.128 In these circumstances the practice developed, which the Corporation officials acknowledge to be unsatisfactory, of including conditions of this nature. This means that if the Chief Fire Officer's requirements appear to an applicant or his advisers excessive or unreasonable in the circumstances, he may well be precluded from exercising his right of appeal to An Bord Pleanala in respect of them, since the time limit for appealing runs from the date of notification to him by the planning authority of the decision. The rights of third party objectors are also affected, since the time limit for appeals by them may also have expired before the requirements of the Chief Fire Officer are known.

1.129 Doubts as to the validity of conditions of this general nature have been expressed *obiter* in at least one High Court decision (see the observations of Mr Justice McMahon in *Keleghan and others v. Dublin Corporation and Hilary Mary Corby* (1977) 111 I.L.T.R. 144); and the Tribunal is satisfied that the requirement imposed in the present case was probably not valid. Clearly, however, the validity of conditions of this general nature can only be determined definitively by a judgement of the Superior Courts. It should also be pointed out that neither the applicant nor those acting for him ever sought to question the validity of the condition until after the fire.

(ii) ***Building Bye-laws***

1.130 The Building Bye-law Approval was, as has already been pointed out, subject to eight conditions.

1.131 (1) *"The maximum (number) of persons to be admitted to the main cabaret room at any one time being limited to 1,458".*

Although there had been one occasion prior to the fire when this condition had not been complied with, the number of persons admitted to the Stardust on the night of the fire, i.e. 846, was well below the permitted maximum.

1.132 (2) *"All electrical installations both primary and secondary must receive the prior approval of the Corporation Electrical and Public Lighting Department"*

This condition was complied with.

1.133 (3) *"Adequate and suitable first-aid fire-fighting equipment to be provided. The numbers and types of equipment to be agreed with the Chief Fire Officer".*

The number and types of equipment were discussed by Mr Gardner with an officer in the Chief Fire Officer's Department and the Tribunal is satisfied his Department would not have raised any objection to the equipment actually provided on the premises. To that extent the condition was complied with, but it does not follow that the Tribunal is satisfied that adequate and suitable first-aid and fire-fighting equipment were, in fact, provided and this matter is dealt with later in the Report.

1.134 (4) *"No scenery or property to be used on the stage platform other than those constructed of non-combustible or inherently non-flammable or durably flame-proofed material".*

This condition was complied with.

1.135 (5) *"No hangings or curtains are to be used other than those which are inherently non-flammable or durably flame-proofed. A certificate of flame resistance must be provided for each different material".*

This condition was not complied with initially so far as the blinds isolating the alcoves from the rest of the Stardust were concerned; but, as already pointed out, following an objection in the District Court by the Corporation to the granting of the licences, the blinds in question were replaced by blinds in respect of which a certificate as to their flame-resistant properties was furnished by the owners.

1.136 (6) *"All requirements of the Eastern Health Board being strictly complied with".*

This condition was complied with.

1.137 (7) *"All areas, rooms, etc. not covered by the air-conditioning system to be provided with adequate permanent ventilation to the open air".*

This condition was not complied with in the case of Toilets T3, T4, T5, T6 and T7 and Dressing Rooms DR1, DR2 and DR3.

1.138 (8) *"Doors between kitchen area and public areas to be fire-resistant and self-closing".*

Compliance with this requirement was difficult to assess as no degree of fire-resistance was specified.

1.139 The compliance with the provisions of the Bye-laws themselves, as distinct from the special conditions attached to the Grant of Approval, is next considered.

1.140 Bye-law 32 provides that:—

> "partition walls intended for the purpose of separating one portion of a building from another portion of the same building shall be constructed of brick or concrete or other suitable incombustible material; they shall be of sufficient strength to ensure due stability and shall be carried on suitable and sufficient supports or other proper foundation.
>
> Provided that in any circumstances in which this requirement is not necessary for the prevention of fire, partitions constructed of timber framing, covered with suitable fire-resisting material and of sufficient strength to ensure due stability, may be approved".

The wall separating the upper part of the Store Room in the Stardust from the passage leading to the outer door of Exit 1 was a timber partition. It was on an escape route and, having regard to fire prevention requirements, should have been constructed of incombustible materials.

1.141 Bye-law 107 provides that:—

"(1) Every person who intends to make any addition to a building or to carry out any work to which any of these bye-laws relate shall give notice of such intention to the City Manager and Town Clerk together with a sufficient description in writing (and in duplicate) of the materials intended to be used in the proposed addition, alteration or work.

(2) he shall also deliver or cause to be delivered to the City Manager and Town Clerk complete plans and sections of the proposed addition, alteration or other work, and such plans and sections shall comply with the requirements set out in bye-law No. 106 in respect of drawings for proposed new buildings, so far as the same may be applicable, and shall also indicate so much of the existing building as may be necessary to enable it to be determined whether the proposed addition, alteration or work would, if carried out, cause the resultant building or any part thereof to contravene any of the foregoing bye-laws, and shall distinguish, by colour or in other suitable manner, between existing work and proposed new work".

1.142 Bye-law 108 provides that:—

"no work to which these bye-laws relate shall be commenced unless (i) plans and other documents as prescribed in bye-laws Nos. 106 and 107 shall have been lodged with the City Manager and Town Clerk, (ii) the City Architect shall have, subject to the statutory provision in that behalf, signified in writing his approval of such plans and other documents and (hi) the notice or notices required by bye-law No. 109 shall have been given".

1.143 Bye-law 109 provides that:—

"(1) Every person who shall proceed to erect any building or otherwise execute any work to which any of the foregoing bye-laws apply shall give to the City Architect or Building Surveyor at least two clear days' notice in writing of the date on which the erection of the building or the execution of the work will be commenced, and such person shall also, before proceeding to cover up any drain or to fill in any foundation, give to the City Architect or Building Surveyor at least two clear days' notice in writing of the date on which the covering up of such drain or of the filling in of such foundation will be commenced.

(2) If such person neglects or refuses to give any such notice and if the City Architect or Building Surveyor on inspection of the work finds that the work is so far advanced that he cannot ascertain whether any of the foregoing bye-laws have been complied with and if within a reasonable time thereafter such person shall receive a notice in writing from the City Architect or his Deputy requiring him within a reasonable time specified in such notice to cut into, lay open or pull down so much of the building or work as prevents the City Architect or Building Surveyor from ascertaining as aforesaid such person shall within the time so specified comply with such notice".

1.144 Bye-law 111 provides that:—

"(1) Every person who shall erect a new building or otherwise execute any work to which these bye-laws relate, shall at all times during the erection of the building, or the execution of the work, afford the City Architect and Building Surveyor free access to the building, or work, for the purpose of inspection.

(2) Such person shall, within a reasonable time after the completion of the erection of the building or the execution of the work, and in the case of a building at least fourteen days before it is occupied, give the City Architect notice in writing of the completion, and shall at all reasonable times within a period of fourteen days after such notice, afford the City Architect and the Building Surveyor free access to the building, or work, for the purpose of inspection".

1.145 These bye-laws were not complied with. The work of conversion was commenced, and much of it had been completed, before the approval was actually obtained. It is true that

the Corporation, through its relevant officials, was aware of the completion of the work and carried out inspections from time to time between the 6th March, 1978, and the night of the fire. The Tribunal is satisfied, however, that it was undesirable that so much of the work should have been carried out without bye-law approval having been obtained. In practical terms, it is always more difficult for a local authority to secure compliance with the bye-laws where work has already been done.

(iii) ***Public Resort Bye-laws***

1.146 The approval under the Public Resort Bye-laws was subject to the same eight conditions (see para. 1.111).

On the 11th January, 1978, Mr Gardner was sent a Notice of Approval of the Plans by the Corporation. In this notice it was stated that:—

> "By Order dated 6th January, 1978, the Assistant City Manager waived Building Bye-laws relating to Places of Public Resort *(sic)* subject to following conditions: . . . .".

There followed the eight conditions already referred to.

1.147 It was clear from the terms of the actual order that the form of the notice sent to Mr Gardner contained a typist's error: the Manager's order did not waive compliance with the Public Resort Bye-laws, but granted approval subject to the conditions.

1.148 Bye-law 2 (e) provides that:—

> "On completion of the building, revised drawings in duplicate and on linen shall be forwarded to the City Manager and Town Clerk for record purposes if deviations have been made from the drawings originally submitted".

There were, in fact, deviations from the drawings originally submitted. In the first place the layout of the main entrance was altered. In the second place the seating in the West Alcove, which had originally been shown at a slight angle to the back wall of the alcove, was now arranged parallel to that wall. No revised drawings in duplicate were, in fact, forwarded to the City Manager embodying this change as required by the bye-law.

1.149 Bye-law 4(b) provides that:—

> "partitions intended only for the purpose of separating one portion of the premises from another may be constructed of "brick and stud", or of concrete not less in any case than three inches thick. No timber partitions, whether plastered or not, shall be constructed".

The Lamp Room and the Store Room were partly enclosed by timber partitions contrary to the requirements of this bye-law.

1.150 Bye-law 5 (d) provides that:—

> "the height between the ground floor or the floor of any tier and the ceiling over shall in no part be less than 10 feet".

The height between the floor of the tier at the rear of the West Alcove and the North Alcove and the ceiling was in fact 7 feet 9 inches (2.36 m), but Mr King took the view that compliance with this requirement was not necessary as only a small floor area was involved.

1.151 Bye-law 7 provides as follows:—

> "(a) premises shall not be used for a seated audience, except in accordance with plans previously submitted to and approved by the Corporation in writing . . . .
>
> (c) The seating shall be fixed firmly to the floor".

This bye-law applied to the premises at the time the application was made for approval, since the principal use envisaged for the Stardust was concerts and cabarets at which

there would obviously be a seated audience. The seating originally installed was, in fact, fixed to the floor, but when the owners began to hold discos in February, 1980, they decided to have non-fixed seating and a larger dancing area. This bye-law continued to be applicable to the premises, since cabarets and concerts continued to be held on nights other than disco nights and there was, accordingly, a failure to comply with Paragraph (c).

1.152 Bye-law 9 (a) provides that:—

> "gangways not less than 3 feet 6 inches in width shall be formed in the auditorium (i) leading direct to exit doors and (ii) intersecting the rows of seating in such a manner that no seat shall be more than 10 feet from a gangway measured in the line of seating".

This was not complied with, since a number of seats in the North Alcove were more than 10 feet (3 m) from a gangway of the required width measured in the line of seating. Gangways of sufficient width were not provided in the West Alcove (see para. 1.23).

1.153 Bye-law 10 (j) provides that:—

> "the aggregate unobstructed width of all the exit doorways or passageways that lead from a vestibule towards a street or thoroughfare shall be at least one-fourth greater than the aggregate width of all the exits that lead into such vestibule".

On the 21st December, 1977, Mr Gardner wrote to Mr King enclosing a proposed plan of the main entrance doors in a new position to give a 5 feet (1.52 m) clear opening. Mr King replied on the 12th January, 1978, as follows:—

> "I refer to yours of 21st December, 1977, and attached details of front entrance doors.
>
> The detail is acceptable provided a clear opening of 5'0" is obtained between the leaves of the main doorway and the adjoining screens are converted to single-leaf pass doors as discussed".

The adjoining screens were converted to single-leaf pass doors as stipulated by the Corporation. These doors were, however, invariably kept locked and none of the doormen was aware of the fact that they could be unlocked, although Mr Eamon Butterly was.

1.154 Bye-law 11 (c) provides that:—

> "temporary barriers, other than rope barriers, shall not be provided . . . .".

The evidence established that, during the period when patrons were entering the premises (which in the case of disco nights was from the hour of 22.00 approximately until shortly after midnight) two tables were placed at the entrance doors to facilitate the search of women patrons' handbags and body searches of male patrons, as a security precaution. Behind these tables a large screen was placed at right angles in order to channel the patrons past the cash desk. The evidence established that the normal procedure in relation to the table and the screen was that when the last patrons were admitted, the tables were placed in the alcove under the staircase and the screen was placed against the wall between the staircase and the inner doors. This procedure was in contravention of Bye-law 11 (c).

1.155 Bye-law 11 (d) provides that:—

> "any barriers in exitways which may be provided with the approval of the Corporation for checking or controlling admission shall be arranged so that the portions immediately in the line of the exit will open automatically upon pressure being applied in the direction of exit and so as not to reduce the width of the exitway. Any such barrier shall be opened as soon as is reasonably possible after the public are admitted".

The barriers in the foyer already described were not approved by the Corporation and could not have been, since they did not meet the requirements of this bye-law.

1.156 Bye-law 11 (e) provides that:—

> ". . . . doors fitted with automatic bolts shall have the words "PUSH BAR TO OPEN" or other appropriate notice painted upon them in block letters at least 4 inches high".

This requirement was not complied with. The height of the letters at Exit 6 was 3 inches (76 mm).

1.157 Bye-law 11 (f) provides that:—

> "exit doors, if fastened during the time that the public are on the premises, shall, during such time be secured only by automatic fastenings which will operate when the doors or the cross bars of the fastenings are pressed in the direction of exit. Locking bars, hasps, staples, screw-eyes, locks, monkey-tail, flush or barrel bolts or any fastenings other than automatic fastenings shall not be fitted on exit doors, barriers or gates".

There were persistent and deliberate breaches of this bye-law which are dealt with elsewhere in this Report.

1.158 Bye-law 11 (i) provides that:—

> "if chains and padlocks be used for securing exit doors when the public are not on the premises, a keyboard shall be provided in a position approved by the Corporation and before the admission of the public the chains and padlocks shall be hung upon such board, each in an allotted position and shall remain upon the board during the whole of the time that the public are on the premises. The chains and padlocks when in use shall be attached to the bars of the automatic fastenings".

Chains and padlocks were used for securing the exit doors when the public were not on the premises, and also on occasions when the public were on the premises. A key-board was not provided upon which the chains and padlocks were hung in an approved position. Accordingly Bye-law 11 (i) was not complied with.

1.159 Bye-law 11 (j) provides that:—

> "collapsible gates or rolling shutters shall not be installed in entrances or exits without the consent of the Corporation in writing, and any such gates or shutters which may be installed shall be open to allow full width and necessary height of exitway before the admission of the public and shall be kept locked in that position during the whole of the time that the public are on the premises".

The consent of the Corporation in writing was not received for the steel roller shutters over the external face of outer Exit 2. They could not be locked in the "up" position. Accordingly Bye-law 11 (j) was not complied with.

1.160 Bye-law 12 (a) provides that:—

> "every staircase, passage, lobby, corridor and landing intended for the use of the public shall be formed of fire-resisting materials, and so placed that they shall be easy of access from every part of the building. They shall be constructed without winders, each flight not to have more than twelve steps or less than three steps".

As already stated, the carpet tiling used on the walls of the premises came within Class 4—or, at best, Class 3—of the surface spread of flame rating as determined by the relevant British Standard. Mr King, however, was of the opinion that the reference to passages being formed of "fire-resistant material" in this paragraph was not a reference to wall linings. The Tribunal is satisfied that, on a strict construction of the paragraph, Mr King's approach was arguably correct: the Places of Public Entertainment Technical Regulations of the Greater London Council (on which the Public Resort Bye-laws were

modelled) contain an express provision (Clause 301 (6)) requiring materials used as wall linings to be to the Council's satisfaction, and a note to the relevant clause states that, for the purpose of the Regulation, the Council normally requires such material to be non-combustible or to be rated Class 1 for the classification of surface spread of flame in accordance with the British Standard. It is at least arguable that the absence of a corresponding provision in the Public Resort Bye-laws supports Mr King's opinion that the Bye-laws did not deal with the fire-resisting properties of wall linings.

1.161 It is clear, however, that Mr King should not have applied so strict and literal a construction of the bye-law. It should have been borne in mind in applying the Bye-laws that they were over forty years old, and modern requirements should have been insisted upon where appropriate. There would not have been any difficulty in securing compliance with the Fire Brigade requirements, having regard to the obligation on the owners to secure various licences for the uses intended by them, and the powers of the Corporation under the Fire Brigades Act, 1940, including the power to serve a Fire Prevention Notice.

The escape stair from Exit 1 did not comply with this bye-law as it had fifteen steps.

1.162 Bye-law 23 (f) provides that:—

> "a sufficient number of employees shall have allotted to them specified duties to be performed in the event of fire or panic, and they, or other persons definitely appointed to act as deputies, must be available during the whole of the time that the premises are open to the public. Particulars of such duties shall be posted in positions approved by the Corporation and such particulars shall be revised from time to time according as changes in staff or other circumstances require. Dry fire drill shall be held at least once a week".

Bye-law 23 (f) was not complied with. No employees were allotted specified duties to be performed in the event of a fire or panic. No particulars of such duties were posted anywhere. No form of fire drill was ever held on the premises.

1.163 Bye-law 23 (g) provides that:—

> "fire appliances and equipment as approved by the Corporation shall be efficiently maintained. They shall be in charge of some suitable person specially nominated for the purpose, who shall see that they are always available for use. Fire hose shall be subjected to a water test once a year".

While there was no evidence that there was any person specially nominated for the purpose of this Bye-law Mr P. J. McGrath said in evidence that the fire extinguishers were regularly checked and serviced by the manufacturers and that he was personally satisfied that they were in working order on the night of the fire. There was, accordingly, an effective compliance with this Bye-law.

1.164 Bye-law 29 provides that:—

> "the Licensee shall take all due precautions for the safety of the public, the performers, and the employees, and shall retain control over all portions of the premises".

The "Licensee" within the meaning of this bye-law was Scotts Food Ltd. (See para. 1.80). From mid-1979 onwards, when Mr Eamon Butterly became responsible for the day-to-day management of the premises, Mr Patrick Butterly contented himself with visiting the premises approximately once a week. The Tribunal is satisfied that from that time onwards the person in effective control of the premises was Mr Eamon Butterly. The extent to which precautions for the safety of the public and employees on the premises were taken by either Mr Patrick Butterly or Mr Eamon Butterly is considered elsewhere in various parts in this Report.

1.165 Bye-law 30 provides that:—

> "the Licensee or some responsible person nominated by him in writing for the purpose shall be in charge of and upon the premises during the whole of the

time that they are open to the public and there shall also be during that time a sufficient staff of competent attendants on duty on the premises. The person in charge shall not be engaged in any duties which will prevent him from exercising general supervision".

There was no evidence that Scotts Foods Ltd ever nominated any person in writing for the purpose of this bye-law. The competence of the staff of attendants on duty on the premises is dealt with elsewhere in this Report.

1.166 Bye-law 31 provides that:—

"authorised officers of the Corporation shall be admitted immediately at all reasonable times to all portions of the premises".

This bye-law was generally complied with. Mr Kennan, however, on one occasion instructed another member of the staff that, in the event of an Inspector from the Corporation arriving, he should be detained in conversation at the door while locked exits (which should have been unlocked) were unlocked.

1.167 Bye-law 32 (a) provides that:—

"premises which are for the time being in regular use for a particular form of entertainment shall not be used for any other form of entertainment, unless notice of intention so to use the premises shall have been given to the Corporation five days at least before such change of user".

There was no evidence that the Corporation was ever given any formal notice of the intention of the owners to use the premises for disco dances, but this technical non-compliance with the bye-laws was not significant since, by regular inspection, the Corporation was aware that it was being so used.

1.168 Bye-law 33 provides that:—

"overcrowding shall not be permitted in any part of the premises".

This bye-law was generally complied with, except on one occasion when more than the maximum number of persons permitted by Condition 1 of the conditions attached to the Bye-law Approval were present during a concert on the 15th January, 1981. The owners explained that this was due to the fact that a number of tickets had been forged on that occasion; they themselves had not sold tickets in excess of the stipulated maximum.

1.169 Bye-law 34 (b) provides that:—

"alterations or additions, whether permanent or temporary, to the structure, the lighting, electrical heating, ventilating, mechanical or other installations or to the seating, gangways or other arrangements at the premises, as approved by the Corporation from time to time in accordance with these bye-laws shall not be made except with the consent of the Corporation in writing, and in accordance with the conditions of such consent. Notice in writing shall be given to the City Manager and Town Clerk of any alteration or addition proposed to be made and such notice shall be accompanied by full details, and if necessary, by drawings (in duplicate and on linen). The work shall not be commenced until the consent of the Corporation in writing has been obtained.

"Provided that this bye-law shall not require notice to be given to the Corporation of any work which is necessary for the efficient maintenance of the premises and of the electrical and other installations as approved by the Corporation in accordance with these bye-laws and which it may be proposed to carry out in accordance with these bye-laws".

The conversion of the building as completed did not comply entirely with the plans as lodged for bye-law approval. There had been alterations in the seating in the West Alcove and (when it was decided to hold disco dances on the premises) there was an enlargement of the dance area and a substitution of new seating for the seating shown in the lodged plan. (A seating plan was furnished by Mr Gardner to the Corporation prior to the

completion of the conversion, which showed the seating as installed, but this plan appears to have been mislaid). No notice was given to, or approval sought from, the Corporation for the enlargement of the dance floor and the substitution of the non-fixed seating for the fixed seating. The Corporation was, however, aware through inspections of this change and raised no objections.

1.170 No notice was given to the Corporation of, or consent obtained from them to the changes in the lighting and electrical installations described at para. 1.55 above.

1.171 Bye-law 38 provides that:—

> "special care shall be taken to ensure that the means of escape provided for all persons on the premises are at all times maintained unobstructed and immediately available.
>
> Except necessary *(sic)* for the protection of the public and required by the Corporation in writing, bars, wire guards or the like shall not be fitted to windows, nor shall the windows be otherwise obstructed in a manner likely to render them unavailable as means of escape in case of emergency".

There were persistent and deliberate breaches of this bye-law which are dealt with elsewhere in this Report.

1.172 Bye-law 40 provides that:—

"(a) All gangways, corridors, staircases and external passageways intended for exit shall be kept entirely free from obstruction whether permanent or temporary, and shall not be used as cloakrooms.

(b) Pay boxes, check boxes and attendants' seats shall be fixed in such positions that they will not obstruct means of exit, and any mirrors, pictures, notices or advertisements which may be provided shall be attached to or hung upon the walls in positions in which they will not be likely to cause obstructions to exit, and shall be fixed flat against the wall or kept clear of the headline, i.e. 6 feet 9 inches above the floor. (See bye-law 12 (f) and (i)).

(c) Advertisement boards, easels or other articles shall not be placed in positions in which they are likely to obstruct means of exit or to be overturned. Notice in writing of any proposal to rail off a portion of the vestibule for the accommodation of such boards or easels shall be given to the City Manager and Town Clerk and the Corporation's written consent obtained. (See bye-law 10 (k))".

There were persistent and deliberate breaches of Paragraph (a) which are dealt with elsewhere in this Report.

The desk at the Cash Office was in such a position that, in the event of a fire or other emergency occurring while the public were still coming into the premises, a serious obstruction could have been caused to the means of exit provided by Exit 2.

Paragraph (c) was contravened in relation to obstructions in the foyer (See para. 1.154).

1.173 Bye-law 41 provides that:—

> "all exit doors shall be available for exit during the whole of the time that the public are on the premises and shall be opened at the end of the performance or exhibition for the use of the persons present at such performance or exhibition . . . .".

There were persistent and deliberate breaches of this bye-law, which are dealt with elsewhere in this Report.

1.174 Bye-law 45 provides that:—

"seven days' notice in writing shall be given to the Corporation of any entertainment involving special risks and of any special entertainment for children. In connection with any such entertainment any conditions imposed by the Corporation shall be complied with".

There was evidence that film shows for children were, from time to time, held in the Stardust to which this bye-law was clearly applicable. No notice was given to the Corporation of these film shows and, accordingly, this bye-law was not complied with.

1.175 Bye-law 66 provides that:—

"(i) any secondary battery which may, with the approval of the Corporation, be provided for supplying either of the lighting systems required by bye-law 51 shall either (a) be capable of carrying the full load on that system for at least twelve consecutive hours when the battery is connected so as to maintain the load before admission of the public to the premises, or (b) be capable of maintaining the load for three consecutive hours if the battery is floated across the generator of an independent motor generator set and so connected that in the event of the motor generator shutting down the battery automatically picks up the load, in which event an indicator fixed in a position approved by the Corporation must operate so that the Manager or other responsible person may be made aware that the safety plant is functioning . . . .".

No indicator was ever fixed in a position approved by the Corporation to indicate to the Manager or other responsible person that the safety plant was functioning; and to that extent the bye-law was not complied with.

1.176 Bye-law 85 (a) provides that:—

"the electrical installation shall be in the charge of a competent person during the whole of the time that the public are on the premises".

If this bye-law is to be construed as requiring the presence of an electrician during the time the public are on the premises, it is clear that it was not complied with. Mr Eamon Butterly said in evidence that he regarded himself as being the "competent person" referred to; and it is at least doubtful whether, even on a generous interpretation of the bye-law, he could be so described. Mr George Moloney (para. 1.83), when asked who the competent person was, referred to Mr Frank O'Doherty and Mr John Green who looked after the sound and lights.

1.177 Bye-law 86 (b) provides that:—

"all temporary installations shall be disconnected from the permanent installations immediately after each occasion on which they are used and shall be entirely removed immediately the need therefor has ceased".

There was evidence that temporary wiring had not been removed from the roof space prior to the fire and, accordingly, this bye-law was not complied with.

1.178 Bye-law 90 provides that:—

"a diagram and schedule indicating clearly the arrangement of the circuits and sub-circuits, the position of the distribution boards and the sizes of the cables shall be kept in an accessible position on the premises and shall be open to inspection by the Corporation at any time. (See bye-law 51 (a)). A copy of such diagram and schedule shall be supplied to the Corporation if required".

This bye-law was not complied with. No such diagram or schedule was kept in an accessible, or any, position on the premises. It should also be pointed out that, notwithstanding the size and complexity of the electrical installation, the Corporation never sought a copy of the diagram and schedule.

1.179 Bye-law 91 provides that:—

"at least one bucket filled with dry sand, or a chemical extinguisher of a type approved by the Corporation for the purpose, shall be provided and kept readily accessible in the following positions, viz. intake rooms, main distribution room, motor generator rooms, near stage switchboards and in such other positions as the Corporation may consider necessary".

This bye-law was not complied with. Fire appliances as required were not provided in the Battery and Switch Rooms or in the shed housing the generator.

1.180 Bye-law 93 provides that:—

"the electrical installation at the premises shall at all times be maintained in good condition and safe working order".

This bye-law was generally complied with save in some instances which are referred to subsequently (see paras. 1.214 and 1.215).

(2) Non-statutory guidelines

(i) *Fire Protection Standards*

1.181 In the part headed "Structural Requirements", Clause 7 provides that:—

"in general, all interior walls, partitions, ceiling surfaces and wall linings should have a Class One surface spread of flame rating in accordance with the classification in British Standard Specification No. 476: Part 1: 1953".

As has already been stated, this requirement was not complied with.

1.182 Clause 14 provides that:—

"corridors and passageways should be of fire-resisting construction of not less than \ hour grade .... All corridors and passageways leading to exits should be kept free from obstruction".

The building did not comply with this standard. The passage leading to the outer door of Exit 1 was not constructed entirely of fire-resisting materials of half hour grade. The corridors and passageways leading to the exits were not kept free from obstruction, a matter which is dealt with elsewhere in this Report.

1.183 In the section dealing with "Fire-fighting Equipment", Clause 29 provides that:—

"fire-fighting equipment as set out in Clauses 34 and 35 should be provided at suitable points throughout all buildings. This equipment should be located in prominent positions at central points such as stair landings, so that it is readily available for use in a number of directions. It should be concentrated at such points, rather than scattered haphazardly throughout a building".

While a number of fire-extinguishers were provided in the premises, this standard was not entirely met. One fire-extinguisher was placed at the rear of the West Alcove, which was not a prominent position at a central point and it was not, in fact, used at all in the fire.

1.184 Clause 34(1) provides that:—

"hydraulic hose reels, also referred to as first-aid hose reels, which are permanently connected to a water supply, are a most useful form of light internal protection. In addition, where special risks are present, suitable types of portable extinguisher will be necessary".

There were no hydraulic hose reels on the premises.

1.185 Clause 37 provides that:—

"sprinkler installations provide an efficient form of automatic first-aid fire protection, and are particularly advisable in buildings with a fire risk above

normal, such as large undivided premises, or buildings with an increased life risk due to age, combustible construction, contents, or any special risk".

No sprinkler installation was provided at the premises, but it should be pointed out that it was probably not a type of building which was envisaged by the framers of this particular recommendation as appropriate for sprinkler installation. The question as to whether sprinkler installations are a suitable form of fire protection in premises such as this is dealt with elsewhere (see para. 9.151).

1.186 Under the heading "General Fire Precaution", Clause 38 (ix) and (xi) provide that:—

"(ix) accumulations of dust, rubbish or other litter should be avoided, and metal receptacles with lids should be provided in which to deposit wastepaper, oily rags, cotton waste or other rubbish.

(xi) Where smoking is allowed, an adequate supply of suitable ashtrays should be provided. When ashtrays are being cleaned, the contents should be emptied into metal bins".

The evidence established that at the end of an evening in the Stardust, the lounge-girls normally emptied the contents of ashtrays, together with other discarded material such as serviettes, cigarette packets, etc. into bags which were then left outside the Main Bar and remained in that position until the following morning when they were put out with the waste refuse.

This procedure would indicate that the requirements of these two clauses were not met.

1.187 Clause 43 provides that:—

"all exits, corridors, passageways, stairways and landings should be kept clear and unobstructed to their full effective width. Frequent inspections should be made to ensure that emergency exits which are not in normal use are fully maintained".

There were numerous serious incidents of failure to comply with this requirement which are dealt with elsewhere in this Report.

1.188 In the part headed "Administrative Arrangements", Clause 44 provides that:—

"the officer in charge of a building or building group is ultimately responsible for the organisation and supervision of the fire-fighting and fire-prevention arrangements, but may delegate such organisation and supervision to an officer who should be a permanent and responsible member of the staff of the building or building group in a position to ensure:

(a) that recommendations to superiors will receive adequate consideration, and

(b) that instructions to the staff and occupants will be carried out.

The officer should arrange for a deputy or deputies to take charge of the fire-fighting and fire-prevention arrangements in his/her absence, the number of deputies necessary being dependent on the size of the building or building group and the fire and life risk involved. The officer appointed should be responsible for ensuring that:—

(i) all necessary inspections of equipment are made in accordance with the instructions given in the relevant clauses of these standards dealing with fire-fighting equipment.

(ii) equipment is installed, maintained and kept in good condition as specified in those clauses.

(iii) the measures and precautions specified in the clause dealing with general fire precautions, which are to be taken to prevent an outbreak of fire arising from the use of the building are strictly observed.

"(iv) evacuation schemes and practices for the building or building group are carried out in accordance with the instructions contained in Clauses 47 to 50.

(v) regular fire drills are carried out by fire crews or squads.

(vi) a record of fire and evacuation drills is entered in a book especially kept for this purpose.

(vii) specific arrangements are made for summoning the fire service and that the staff are acquainted with those arrangements. In this connection, it should be understood that all information of any outbreak of fire, however slight, or suspected outbreak, should be at once communicated to the fire service. The officer appointed should not be made responsible for the structural requirements set out in Clauses 1 to 28.

Fire-fighting and fire-prevention arrangements should be considered for the building or building group as a whole".

None of these requirements was complied with.

1.189 Clause 45 provides that:—

"where practicable, it may be advisable to form a trained and properly equipped fire-fighting squad chosen from suitable able-bodied personnel who can be collected together at any time to cope with a fire until the fire service arrives. The local fire authority should be consulted on the equipping and training of such squads. Such an arrangement is particularly desirable in buildings remote from the fire brigade stations".

These requirements were not complied with.

1.190 Clause 46 provides that:—

"the standard types of portable fire-extinguishers recommended for general use have already been outlined in Clause 30. No standard drills for these are necessary, as each is designed for efficient operation by one person. Personnel of fire squads, however, should be trained in the proper utilisation of each particular type in accordance with the manufacturer's instructions, and opportunity should be taken for practical demonstrations with extinguishers when they are being periodically discharged. Fire-fighting schemes should provide that fire squads in buildings or building groups, equipped primarily with fire-extinguishers should be trained in mobilising rapidly all available extinguishers at the scene of a fire outbreak and it should be noted that the quick use of a number of extinguishers in succession will often be effective in dealing with a fire, even if of some magnitude. There should be no haphazard and aimless use of extinguishers. The squads should be so trained that one, or at the most, two members take post at the scene of the fire and have extinguishers passed to them in succession by other members of squads. The officer in charge of the fire-fighting arrangements of the building or building group should ensure that certain portions of the fire squad personnel are trained in recharging extinguishers in accordance with the instructions of the makers. These instructions are usually clear and concise and no great technical knowledge is needed to follow them. Fire squad personnel should also be made aware of the precautions to be taken in connection with the use of certain types of extinguishers *(see Clause 30)".*

These requirements were not complied with.

1.191 Clause 48 dealing with evacuation schemes for non-dormitory buildings provides as follows:—

"typical buildings of this type are administrative buildings, e.g. office or storage blocks and dayschools. The success of this type, *or indeed any other type* [Tribunal's emphasis] of evacuation scheme depends on the cool-headedness and resource

of the persons in charge. Responsible individuals .... should be thoroughly instructed in their duties as leaders and should, on the sounding of an alarm, take charge of and direct the evacuation operations .... A general notice as to the action to be taken by the occupants in the case of fire is essential. The notice, which should be posted at a number of prominent places in the building, should be brief, as in the following examples .... (There follow two specimens which are followed by the comment "The word 'Fire' should be boldly printed in 'red' block capitals . . . .").

"Practices are most important and should be held often enough to ensure that all occupants are kept familiar with the procedure to be adopted .... half yearly practices should be sufficient, if care is taken that in the preliminary training all become familiar with the routine. The practice should not alone consist of effecting the complete evacuation of a particular building in an orderly manner, but should also include reporting to the place of assembly and checking that all occupants, except those detailed for fire-fighting duties, the summoning of the local fire brigade etc., are present . . . .".

None of these requirements was met.

1.192 Clause 51 provides that:—

"it is advisable that every large building should be provided with a fire plan. The plan, specially drawn up for the purpose, should be located as near as possible to the principal entrance and the following information, *inter alia*, should be clearly marked on it:

(1) Positions of all exits

(2) Stairways from ground floor

(3) Internal firemains and valves, hydrants outlets and first-aid hose reels

(4) Points of high fire risk, e.g. boiler houses

(5) Gas and electricity as well as any other service intakes

(6) Location of nearest external fire hydrants or static water supplies

Such a plan familiarises all personnel with the internal layout of the building, and it is also invaluable to fire service officers at the time of inspection. A copy of such plan should be furnished to the local fire authority".

No fire plan was provided on the premises.

1.193 Clause 52 provides that:—

"all staff in the building should receive instruction in the elementary principles of fire-fighting, with particular reference to the first-aid appliances available in the premises".

This requirement was not complied with.

(ii) ***Draft Building Regulations***

1.194 The relevant Draft Building Regulations from the time the building opened on the 6th March, 1978, until the night of the fire, were those published on the 22nd November, 1976.

1.195 In Part N, under the heading "Structural Fire Precautions", Regulation N 13 (3) provides that:—

"the surface of a wall or ceiling in a room, circulation space or protected shaft shall be of a class not lower than that specified as relevant in the Table to this regulation, with the exception that—

"(a) a wall may have a surface of any class not lower than Class 3 to the extent permitted by paragraph (4) . . . .".

The relevant purpose group under Regulation A 19, applicable to the Stardust, was Group VII "Places of Assembly", and, accordingly rooms (other than small rooms, circulation spaces and protected shafts) needed a Class 1 surface. Regulation N3 (6) makes it clear that the relevant criteria for determining the Class are those prescribed in Section 1 of BS 476: Part I: 1953. As already stated, the carpet tiles on the walls were generally of Class 4 or, at best, Class 3.

1.196 The foyer at Exit 2 was a circulation space as defined by Regulation N13 (1), i.e. a space "which is solely or predominantly used as a means of access between a room . . . . and an exit from the building . . . .". The requirement under N13 (3) for the wall lining was accordingly Class O (the most rigorous standard for surfaces of walls and ceilings). An authoritative commentary* on the corresponding Building Regulations, 1976, (England and Wales), however, suggests that this requirement may be unduly restrictive.

1.197 Regulation N13 (4) provides that:—

"any part of the surface of a wall in a room may be of any class not lower than Class 3 if the area of that part (or, if there are two or more such parts, the total area of those parts) does not exceed the lesser of the following—

(a) half the floor area of the room, or

(b) (in the case of a building or compartment of Purpose Group I, II, or III) 20 m^2 or (in any other case) 60 m^2".

The area of the walls in the Stardust covered by the carpet tiles greatly exceeded the area permitted to be covered by Paragraph (4).

1.198 In Part P, "Means of Escape", Regulation P 3 (1) provides that the number of escape routes available from any room of a building shall be not less than the number specified for the particular "occupant capacity" specified for that room. The "occupant capacity" of the Stardust, excluding bars, stage, dressing rooms and entrance foyer, as determined in accordance with Regulation P4 (4) was about 1,750. Accordingly, six escape routes were required under Regulation P (3) (1).

1.199 An escape route is defined in Regulation P2 as meaning a route which complies with Regulation P6 by which a person in a building may reach a place of safety, and means, in relation to any room, a route from the doorway of the room. A "place of safety" under the same regulation means a place in the open air at ground level in which persons are in no danger from fire.

1.200 Regulation P7 requires that the unobstructed width of every escape route from a room with the occupant capacity of the Stardust, having six escape routes, was to be 1590 mm throughout its length. The minimum widths of the escape routes in the Stardust were 1524 mm. The Regulation was, accordingly, not complied with; but the extent of the non-compliance was minimal and it should be noted that they, in fact, complied with the precise requirements of the Fire Brigade as to the width of exit doors.

1.201 Regulation P5 (1) provides that the escape routes available from any storey shall be of such number and so situated that the "travel distance" from any point on the storey does not exceed (in the case of a building such as the Stardust) 18 m. "Travel distance" is defined in P2 (1) as, in relation to any point in a storey, "the distance between that point and the nearest protected doorway".

1.202 It is accordingly clear that the "travel distance" in the case of the Stardust must be measured to the *outer* doors of Exits 1, 2 and 3. This is because "protected doorway" is defined as "a doorway leading directly to a place of safety", i.e. the open air, or

*Guide to the Building Regulations, 1976 A J. Elder, ARIBA, — Architectural Press, London.

"a doorway containing a self-closing, fire-resisting door which is located on an escape route and across an opening in a compartment wall, separating wall or protecting structure enclosing a protected shaft . . . .".

1.203 Under Regulation P2 (2), references to a "self-closing fire-resisting door" mean a door which, with its frames and surrounds, has a fire-resistance for a period not less than that required by Regulation N5. This requires a minimum period of fire-resistance of half an hour; and the evidence did not establish that any of the inner doors of Exits 1, 2 and 3 satisfied this requirement. Nor in the case of Exits 1 and 3 was there any evidence to suggest that the inner doors were self-closing.

1.204 The travel distance permitted by the Regulations accordingly appears to have been exceeded in the case of much of the West Alcove, portion of area D in the North Alcove and much of areas A and B *(see Plan 3, Appendix 15).* It should be noted however, that this requirement was extremely rigorous: the travel distance was altered in the amendments circulated on the 27th February, 1981, to 31 m. This would have substantially reduced the extent of the non-compliance.

1.205 There were openings near the ceiling level in the wall dividing Exit 2 and the Cloakroom from the ballroom. These openings, which were on either side of the inner doors, are indicated on Plan 2. Regulation N8 (1) requires every "compartment wall" to be imperforate (i.e. without openings) with certain exceptions, and, if this wall were regarded as a compartment wall, the regulation would not have been complied with. However, it is probable that this wall was not a "compartment wall" within the meaning of Regulation A2 under which the expression means a wall "provided for the purpose of dividing a building into compartments".

1.206 Regulation P9 (1) provides that:—

"every stairway forming part of an escape route (being neither a stairway wholly within a dwelling nor a stairway to which regulation P5 (4) applies) shall be enclosed by a protecting structure and no other part of the building containing that stairway shall be enclosed within that protected shaft, other than a wash-room or watercloset or floor space giving access to the stairway if such floor space is intended for use solely as a means of passage or, where two or more escape stairways serve a building, a ticket office or porter's lodge".

1.207 The stairway leading to the offices on the first floor from the foyer at Exit 2 was clearly part of an escape route for any persons on the first floor. As such, it was required to be enclosed by a "protecting structure", defined in Regulation N9 as a wall or floor or other structure enclosing a "protected shaft". "Protected shaft" is, in turn, defined in Regulation A2 as "a stairway . . . . which enables persons, things or air to pass between different compartments and which complies with the requirements of Regulation N9".

1.208 The "protecting structure" enclosing the stairway in this case also contained the Cloak-room and the Cash Office. (The wall between the foyer, the Cloakroom and the Cash Office contained openings contrary to Regulation N9 (5) and therefore could not be considered as part of a "protecting structure"). It, accordingly, failed to comply with Regulation P9. Moreover, as a "protecting structure", it should have had no openings except those permitted by Regulation N9 (5).

1.209 Regulation PI 2 (1) (b) requires every door across an escape route, if constructed to open both ways, to have a transparent upper panel. The inner door of Exit 2 did not comply with this requirement.

1.210 Regulation P13 provides that:—

"where fixed seating is provided the following provisions shall apply, that is to say—

(a) all seating shall be firmly fixed to the floor . . . .

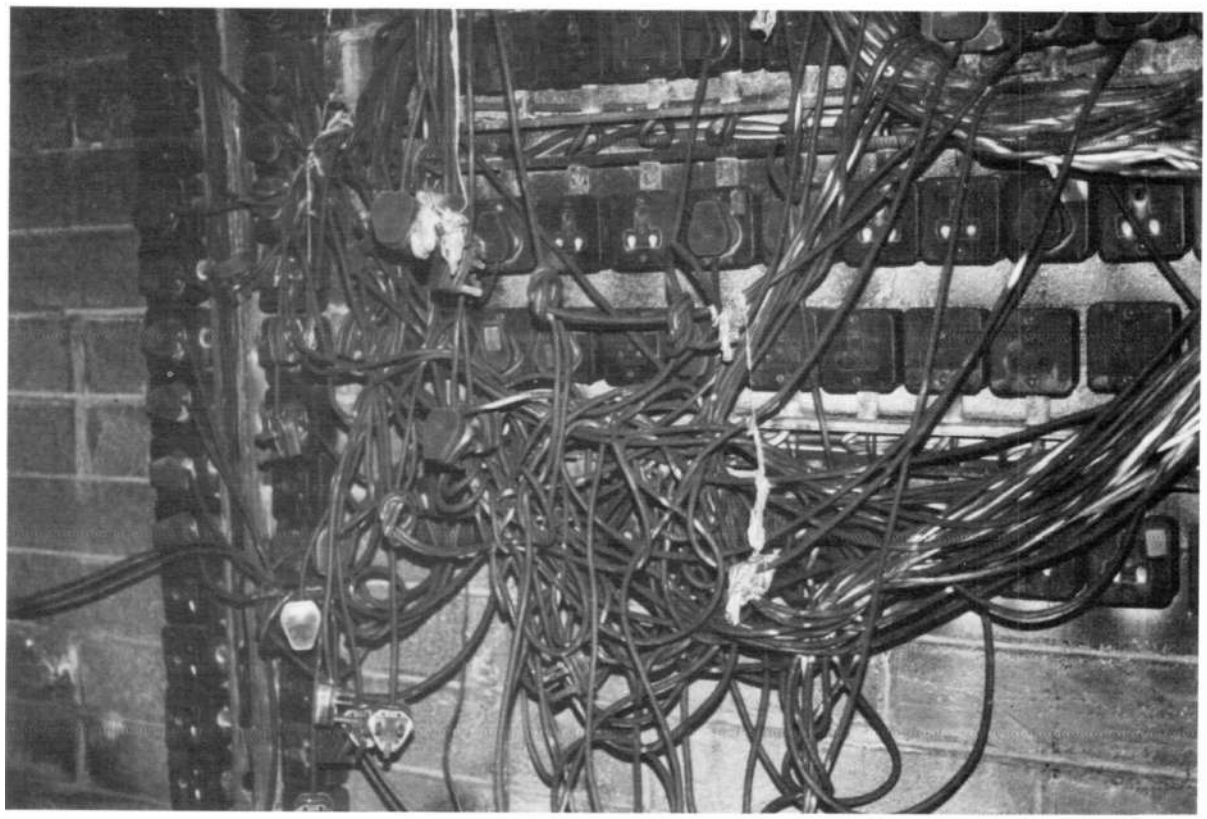


Plate 15 — *View of electrical patch-panel over stage.*

Plate 16 — *Photograph showing typical electrical trunking installation-with covers removed; ceiling void over Lantern Room.*

"(c) there shall be an unobstructed space, in this regulation referred to as a seatway, of at least 300 mm measured between perpendiculars between the back of one seat and the front of the seat immediately behind, the front of such a seat being taken, in cases where the seat tips up automatically, as its maximum forward projection when in the 'up' position . . . .".

1.211 Fixed seating was provided and accordingly this Regulation was applicable. There was a large quantity of seating in the ABC area which was not firmly fixed to the floor. The requirement as to the unobstructed space in sub-paragraph (c) was not complied with. This Regulation, however, probably did not envisage the type of seating provided in the Stardust, i.e. with tables in front of the seats.

1.212 Regulation L8 (1) provides that:—

"every bathroom, washroom or watercloset compartment shall be ventilated either—

(a) directly to the external air by a ventilator having an opening area of not less than one twentieth of the floor area of the room or compartment or 0.1 m^2 whichever area is the greater, or

(b) by a system of mechanical ventilation providing a minimum of—

(i) two air changes per hour in the case of a bathroom or washroom, or

(ii) three air changes per hour in the case of a watercloset compartment".

The toilets T3, T4, T5, T6 and T7 did not comply with this regulation.

1.213 Regulation B1 (1) provides that:—

"any materials used—

(a) in the erection of a building

(b) in the structural alteration or extension of the building

(c) in the execution of works for the installation of fittings, being works or fittings to which any provision of these regulations applies .... shall be

(i) of a suitable nature and quality in relation to the purposes for and conditions in which they are used ....

(ii) applied used or fixed so as adequately to perform the functions for which they are designed . . . .".

The materials used on the walls in the ballroom and main entrance foyer and on the walls surrounding the Lamp Room and Store Room did not comply with this regulation.

(iii) ***Electrical Standards***

1.214 Some unsatisfactory features of the original installation were not remedied. Some PVC armoured cables were not fitted with the correct type of termination glands; the recommended trunking capacity was exceeded in certain areas (especially over the stage area); earth continuity bonding links were not fitted at all joints in the trunking; and the trunking lids were not fitted in several areas *(see Plates 15 and 16).*

1.215 In the case of sub-circuit wiring, containment within trunking and conduits was incomplete and, in some cases, absent.

In some instances, conduit fittings such as box covers and glands were missing.

XII — SUMMARY OF NON-COMPLIANCE

1.216 The following is a summary of the principal areas in which there was a failure to comply with the legislation, regulations and guidelines.

(1) Planning Acts

1.217 The representatives of the owners concerned with the conversion of the building, Mr Patrick Butterly and Mr Eamon Butterly, and the person acting as architect on their behalf at the relevant time, Mr Gardner, failed to ascertain the requirements of the Chief Fire Officer and to take the necessary steps to ensure that they were complied with. The specific requirement that the wall linings should have a surface spread of flame rating not lower than Class 1 was not met.

(2) Building Bye-laws

1.218 Work was commenced on the conversion before approval had been obtained from the Corporation.

(3) Public Resort Bye-laws

1.219

(i The seating in the A, B and C areas was not fixed firmly to the floor.

(ii Timber partitions were used to enclose the Store Room and Lamp Room.

(iii Chains and padlocks used for securing the exit doors were not on a proper key-board while the public were on the premises.

(iv The walls of Exit 2 could not be regarded as being of fire-resistant material, unless an unduly narrow interpretation is given to Bye-law 12.

(v Employees were not allocated specified duties to be performed in the event of fire, and fire drills were never held.

(vi No person was nominated to be in charge of the fire appliances and equipment.

(vii The licensee, did not take due precautions for the safety of the public, the performers or the employees.

(viii There was not a sufficient staff of competent attendants on duty at the premises.

(ix Special care was not taken to ensure that the means of escape provided for persons in the premises at all times were maintained unobstructed and immediately available.

(x The corridors intended for exits were not kept entirely free from obstruction.

(xi The exit doors were not available for exit during the whole of the time when the public were on the premises.

(xii There was no diagram indicating the arrangements of the electrical circuits.

(4) Fire Protection Standards

1.220

The requirement as to internal finishes having a Class 1 surface spread of flame was not complied with.

The corridor to Exit 1 was not entirely of fire-resistant construction.

(iii The corridors were not kept free from obstruction at all times.

(iv One fire-extinguisher was not located in a prominent position.

(v There were no hydraulic hose reels in the premises.

(vi There was no record book containing details of fire-fighting equipment.

(vii The contents of ashtrays were not emptied into metal bins.

(viii) Exits were not kept clear and unobstructed to their full effective width.

(ix) There was no officer responsible for the organisation and supervision of fire-fighting or fire-prevention.

(x) There were no arrangements for fire squads and fire drills, or training in the use of fire-extinguishers.

(xi) There was no scheme provided for the evacuation of the building in the case of fire or other emergencies.

(xii) There was no fire-plan provided at the premises and no arrangements were made to give the staff of the building instruction in the elementary principles of fire-fighting.

Draft Building Regulations

Some materials used in the alteration of the building were not of a suitable nature and quality in relation to the purposes for and conditions in which they were used.

The ventilation provided in some toilets was not adequate.

The structural fire precautions were inadequate in respect of Exit 2.

The area of the walls covered with carpet tiles having a surface spread of flame rating lower than Class 1 significantly exceeded the permitted area.

The surface spread of flame rating lower than Class 0 of the carpet tiles used on the walls of the main entrance foyer seriously contravened the Regulations.

The travel distance in relation to several escape routes in the ballroom exceeded those permitted by the Regulations.

CHAPTER 2

The Fire as Observed by Eye-witnesses

CHAPTER 2

The Fire as Observed by Eye-witnesses

I —INTRODUCTION

An attempt is made in this chapter to reconstruct the events of the night from the evidence of eye-witnesses. The Tribunal heard evidence from two hundred and ninety one people who were either present in the building or were in its vicinity on the night; and it is obvious that it has an enormous amount of data to assist in attempting such a reconstruction. Some cautionary notes must be sounded, however, at the outset.

In the first place, there are serious, and in some instances inexplicable, discrepancies between the versions given by different witnesses of the same events. In a limited number of instances, this can be accounted for by the fact that the witnesses were simply not telling the truth. In the overwhelming majority of cases, however, the witnesses were honestly endeavouring to recall to the best of their ability what had happened. In such cases the discrepancies simply illustrate the fact, with which the Courts have long been familiar, that two or more witnesses, genuinely concerned to tell the truth, can give radically different versions of the same event even where their opportunities for observation were the same.

In the second place, there were frequent material discrepancies between the statements furnished to the Gardai by witnesses in the period immediately after the fire, and their evidence given weeks or months later on oath to the Tribunal. The significance that should be attached to such discrepancies, however, should not be exaggerated. The contents of the statement are very often determined in part by the form of the questions put to the witness by the interrogating Garda officer. Moreover, in many cases, at the time when the statements were given, the witnesses were still suffering from the effects of the experiences through which they had been.

In the third place, estimates of **time** must be treated with caution. This applies both to the **point of time** at which an event is said to have occurred and the **length of time** over which it is said to have occurred. A witness who says that a particular incident occurred, for example, "about 1.30" might well, in ordinary speech, be allowing himself an interval of five minutes either way. In the same way, a witness who says that he was waiting at a particular place for "two or three minutes" may in fact have over-estimated or under-estimated the time by a number of minutes. These variations are of considerable significance in the context of the major events of the evening, which occurred in a relatively short space of time. On one view of the evidence, the time which elapsed between the first telephone call being made to the fire brigade and the arrival of the fire brigade was eight minutes: but, during that period, again on one view of the evidence, a small and apparently controllable fire on one or two seats had become a major conflagration enveloping the entire premises and causing the deaths of many people. Obviously, greater weight must be attached to those estimates of points of time which were checked by reference to a watch or clock; and still greater weight attached when the point of time is recorded, either manually, as in the case of the fire brigade calls, or automatically by machines, as in the case of the calls to the Gardai. Moreover, it is obviously safer to rely on the period of time

within which a particular activity should have taken place (e.g. walking or running from point A to point B) rather than a person's recollection of the time he thinks it took him.

2.5 In the fourth place, the distressing and agonising nature of the experiences undergone by many of the eye-witnesses must, in some instances, have seriously blurred or distorted their recollection. In particular, estimates of time must again be treated with caution: clearly, a person in a dangerous or physically and mentally distressing situation will frequently think the time he was in such a situation to be significantly longer than, in fact, it was.

2.6 In the fifth place, the recollection of a number of witnesses was clearly affected by the amount they had to drink. The fire was first observed not more than forty minutes after the bars closed (at the latest) and a number of patrons had been drinking, either in the Silver Swan or in bars elsewhere in the City, before coming to the Stardust.

2.7 The Chapter begins with an account of the condition of the mechanical and electrical installations in the building on the night of the fire. There follows a narrative description of the events of the night as seen by eye-witnesses, from the opening of the Stardust until the extinguishment of the fire.

Reference should be made in reading the Chapter to *Plan 2 [Appendix 15),* and it should be borne in mind that the higher-numbered tiers of seats (i.e. 8 and 9) were nearer the back of the West Alcove. Row A was the row of seats nearest the Main Bar and Row E the row nearest the Kitchen.

II — THE CONDITION OF THE MECHANICAL AND ELECTRICAL INSTALLATIONS

(1) Lighting

2.8 Much of the wiring was destroyed in the fire and this made it difficult for the experts to establish by inspection the operational state of the primary and secondary lighting systems at the time of the outbreak of fire. However, the evidence establishes to the satisfaction of the Tribunal that immediately prior to the fire both systems were operating normally.

(2) Heating and Ventilation

2.9 Mr Kinahan, the floor manager, said in evidence that at approximately 09.00 he went into the Main Bar of the Stardust to turn on the heating system. He said that the switch which controlled the supply to the back portion of the North Alcove was out of order, but that he switched on the supply to the remainder of the Stardust.

2.10 Mr Kinahan also gave evidence that at approximately 09.35 he went behind the blind in the West Alcove. He said that he was satisfied at this stage that the heating was in operation. He paid a subsequent visit later in the evening, at a time in relation to which he could not be precise: it was at either approximately 00.50 or between 01.20 and 01.30. He did not check the heating on this occasion.

2.11 An examination of the control gear confirmed that one of the heating batteries was in operation immediately prior to the fire, but that the other, serving the North Alcove, was not. This examination also established that the three extract fans of the ventilation system were not in operation immediately prior to the fire. There was no evidence to show whether the extract systems in the toilet area were in operation immediately prior to the fire. There was evidence which established that the heating battery serving the North Alcove had been out of operation for several weeks.

III — SEQUENCE OF EVENTS FROM THE OPENING OF THE STARDUST UNTIL 01.00 HOURS

2.12 On the evening of the 13th February, 1981, the Silver Swan was open in the normal way until 23.00. There was a function in the Lantern Room which began at approximately

21.00 i.e. a dinner-dance under the auspices of the Marine, Port and General Workers' Union.

2.13 A "St. Valentine's Night Disco" had been advertised for the Stardust and a bar extension until 01.00 had been obtained. The promoters intended a feature of the evening to be a disco dancing competition. Because of the numbers expected, the management decided to close off the West Alcove by means of the roller blind (see para. 1.25), but to leave the North Alcove available for patrons with the blind in the "up" position. This was the reverse of the normal procedure on "disco" nights.

2.14 The centre doors at Exit 2 were unlocked by Mr Kavanagh at approximately 21.40. The first patrons started arriving for the disco at this entrance at approximately 22.00. Thereafter they began to arrive in increasing numbers and by 23.00 there was a queue stretching along the front of the building as far as the south-west corner. The normal procedure was followed for disco nights in the main entrance foyer i.e. the two tables were placed across the front, with the screen at right-angles, as patrons were searched before being admitted (see para. 1.154). The evidence varied as to the time at which the outer Exit 2 doors were eventually locked, but it appears to have been at some stage after midnight and before 00.30. At that stage Mr Frank Downes, the doorman on duty, locked the centre leaves and put the key in his pocket. (The side-leaves were always locked—see para. 1.153). He retained the key for the rest of the evening, except for a period of approximately ten minutes beginning at 01.10 when he went into the Stardust and Mr John Fitzsimons relieved him at the outer doors. Shortly before 00.30, Mr Patrick J. Murphy removed the two tables and the screen, placing the longer table under the staircase inside the other door of Exit 2, and the smaller table and screen against the wall on the left-hand side of the foyer facing the ballroom and on the ballroom side of the staircase.

2.15 It appears that eight hundred and forty six patrons were admitted to the Stardust on that evening, of whom twenty eight had been furnished with complimentary tickets. The management had a policy of not admitting patrons under the age of eighteen, but the evidence established that a number of boys and girls under that age were, in fact, admitted to the Stardust on that evening. (It was clearly not easy, particularly in the case of the girls, for the doorman readily to ascertain whether, in fact, they were telling the truth about their ages if challenged). For the rest, the overwhelming majority of the patrons were in the age group from eighteen to twenty-five approximately.

2.16 The music for the evening was provided by a disc jockey, Mr Danny Hughes. He had five other disc jockeys to assist him.

2.17 The evening passed uneventfully in the Stardust until the end of the disco dancing competition. (There was an incident involving trespassers on the roof at some time between 23.45 and 00.15 of which most of the patrons in the Stardust would have been unaware. It is dealt with in detail in Chapter 6, paras. 6.158 and 6.159).

2.18 Shortly before midnight, two of the boys helping with the washing-up in the bars, Declan Burnett and Joseph McGrane, took a break behind the blind in the West Alcove. They brought chips with them in a plastic carton, and glasses containing minerals. They sat at the table in Tier 3 in either Row D or the row nearest the Kitchen. They stayed for approximately fifteen or twenty minutes. They noticed nothing unusual while they were there. Joseph McGrane left first and Declan Burnett, following him, encountered two of the lounge-girls who were also coming into the alcove to have their break.

2.19 These two were joined almost immediately by two others and the quartette (Michelle Murray, Elaine Stapleton, Patricia Gaynor and Marian Mulvaney) sat in approximately the middle of the area, in either Row C or Row D. The girls were anxious to ensure that they got their full break and one of them asked Marian Mulvaney, who was wearing a digital watch, what the time was. She said it was 00.27. These girls each had a bottle of mineral and chips during their break, and while they were there one of the doormen,

Mr Patrick J. Murphy, came into the alcove and spoke to them briefly. Neither Mr Murphy nor any of the girls noticed anything unusual at that stage in the alcove. The girls left at approximately 00.45

2.20 Shortly afterwards, two more lounge-girls, Phyllis Cobbe and Paula Foy, took their break behind the blind in the West Alcove. They also brought in minerals and chips to the area. Miss Foy estimated the time of their visit as 01.05: Miss Cobbe said it was after the bar closed and might have been as late as 01.15. They said that they spent at the most five minutes there—Miss Foy thought it was less than five minutes—and they left the cartons with the uneaten chips in them in the alcove, as they thought that the chips were not very nice that evening.

2.21 As has already been pointed out, Mr Kinahan also went into the West Alcove at some time between 00.50 at the earliest and 01.30 at the latest. He noticed nothing unusual on this visit.

2.22 A meal consisting of sausages and chips was served to all the patrons in the Stardust who wanted it. The meal was served for a period of something over an hour, beginning around midnight and ending at approximately 01.10.

IV — THE DISCO DANCING COMPETITION

2.23 The disco dancing competition began shortly after the bar was closed, which the evidence establishes as having happened at about 01.00. There was a divergence of view, however, as to precisely when it started and finished. Most of the witnesses thought that it ended at 01.30 (at the latest) or 01.20 (at the earliest). Mr Danny Hughes, the disc jockey, who was on stage during the competition but did not actually judge it, thought that it began at either 01.20 or 01.25 and was over at 01.30. Mr Colm O Briain, one of the assistant DJ's, who was also on the stage, thought that it began at 01.15 and finished at approximately 01.30. '

2.24 The competitors—who were thirty six in number—danced to one record only, "Born to be Alive", sung by an artist named Patrick Hernandez. The exact length of this recording has been established by the Tribunal as 6 minutes 4 seconds. The competition lasted, at the most, ten minutes. The evidence, accordingly, indicates that the competition probably began at approximately 01.15 and finished at about 01.25. It is also clear that, while the disco competition was in progress, a large number of patrons and some of the staff clustered around the edges of the dance floor to watch it. Some people stood on tables or seats in order to get a better view; and some girls stood on the ledge provided by the edges of the tables on which the blind in front of the West Alcove was resting, so that their backs were actually in contact with the blind.

2.25 There was no evidence of anything unusual being observed in the Stardust while the competition was in progress.

V — THE EARLIEST OBSERVATION OF THE FIRE

2.26 When the record "Born to be Alive" came to an end, Mr Hughes immediately announced the names of the two winners. (They had been selected during the progress of the competition by two of the assistant DJ's, who were acting as judges and conveyed their decision to Mr Hughes a minute or two before the competition ended). The winners came up on the stage and shook hands with Mr Hughes who brought them down to one of the dressing rooms behind the stage to present them with their prizes. While they were being introduced to Mr Hughes, Mr O Briain took over as disc jockey.

2.27 The first record played after the announcement of the winners was a repeat of "Born to be Alive". The winners returned to the stage, having been presented with their prizes and, at the request of the disc jockeys, began to give a demonstration dance on the stage. Either Mr O Briain or one of the assistant disc jockeys then invited the patrons to dance on the floor at the same time, and a number of people responded to this invitation.

2.28 The evidence establishes that, in contrast to the time of the competition itself when the attention of most people in the Stardust was focussed on the dance floor area, there was a considerable amount of movement in different directions immediately after the competition. Some, as has been pointed out, went on to the dance floor to dance at the same time as the winners. Some went to the various toilets. Some went to Exit 2, either with a view to going home immediately or to fetching their belongings from the Cloakroom preparatory to going home. Some went back to the tables at which they had been sitting, to finish drinks or talk to friends.

2.29 An analysis of the statements by patrons furnished to the Tribunal indicates that of the eight hundred and forty six who had been admitted to the Stardust during the course of the evening, thirty five left early. Thus the great majority were still in the building when the disco competition ended (see para. 3.66).

2.30 Some of them spent the period following the end of the disco competition in the area immediately in front of the West Alcove; and, since the fire was first seen inside the building at that point, their evidence is of importance.

2.31 Linda Bishop, a patron, was sitting at the first table in front of the blind next to the Main Bar. She said that at about 01.30 she began to feel warm, having felt the Stardust to be cold during the evening. She said to Sandra Hatton, a girl who was also sitting at the table, that she was beginning to feel warm and that someone had turned the central heating on. They then got up to dance and she looked at her digital watch and noticed that it was 01.33. Sandra Hatton also remembered the central heating coming on "about half one". Some minutes later—Miss Bishop thought approximately four to five minutes —both girls were dancing to a record called "Lorraine" when Miss Hatton saw a fire in the West Alcove and said to Miss Bishop "look, a fire".

2.32 A group of patrons (Frances Winston, Valerie Walsh, Sharon O'Hanlon, Pamela McGuinness, Sandra Hyland and Gerard Quinn) were sitting at the same table as Linda Bishop and Sandra Hatton. At a time which she thought was about 01.35, Frances Winston smelt smoke. She asked Pamela McGuinness, Sharon O'Hanlon and Gerard Quinn whether they could smell it. She then looked under the blind and saw a small fire in the area of Tiers 7, 8 and 9 of Row A.

2.33 Sharon O'Hanlon said that after the disco competition was over, she went back to the table. She remembered Frances Winston asking her whether she could smell burning. She then saw that the blind appeared to be very bright and she looked underneath it. She saw what appeared to her to be the three seats in Tiers 7, 8 and 9 of Row A on fire, with flames nearly reaching the ceiling. Valerie Walsh also remembered Frances Winston asking her if she smelt smoke or something burning. She said "no" and then Sharon O'Hanlon asked her the same question. She then smelt the burning and looked under the blind with the other two girls and saw some seats near the back wall burning.

2.34 Pamela McGuinness said that she remembered that, after there had been a couple of dances subsequent to the disco final, Frances Winston asked her if she could smell smoke. She then looked under the blind and saw what seemed to her to be all the seats in Tier 9 from the Main Bar to the Kitchen on fire. The glow was apparent through the blind.

2.35 Gerard Quinn said that he also remembered Frances Winston asking him if he smelt something burning. He also looked under the blind with the girls and saw what seemed to him to be the seat in Tier 8 of Row B on fire. He thought there was something in the shape of a coat on fire on the seat and he also saw the fire in three different places, on the seat, on the back wall and on the ceiling.

2.36 Sandra Hyland watched the demonstration dance after the competition from the floor. When the demonstration was over, she went back to her seat. She then got up and danced again and returned to her seat. She said that she remembered smelling something burning, and then someone, whom she could not identify, pulling up the section of the blind nearest

to the Main Bar. She then saw for the first time that the two or three seats in the area of Tier 3 in Row A were on fire.

2.37 Anthony Bannon, who was sitting at the second table from the Main Bar, said that he had gone back to his seat at the end of the competition. He said that he remembered seeing smoke coming from the blind at about 01.30. He went to a doorman standing at the inner door of Exit 2 and told him about the smoke. He then went back to the table, got his jacket and went almost as far as the inner door of Exit 2. He returned to his seat to see if any of his friends were still there and saw a section of the blind nearest the Main Bar up and a fire on the seat in Tier 9 of Row B. The whole seat was on fire.

2.38 Yvonne Keogh, who was sitting at the same table, said she remembered seeing one section of the blind going up, and a small fire at the back of the alcove. Patrick Burke, who was also sitting at this table, saw what he described as a "glitter" beneath the blind. Someone then raised the section nearest the Main Bar and he saw a fire on the seat in Tier 9 of Row A. Robert Duffy, who was also sitting at this table, said that he became aware of some disturbance in the immediate vicinity and then looked under the blind. He saw what appeared to him to be the seat in Tier 8 of Row B on fire.

2.39 Carmel Richardson was also among the patrons sitting at the second table from the Main Bar. She said that she did not get up to dance at any stage after the disco competition. Some time after it ended, as she was sitting at the table, she smelt smoke and looked under the blind. She said that she saw all the seats in Tier 9 from the Main Bar down to the Kitchen on fire.

2.40 Linda Higgins and Margaret Courtney said that some time after the end of the disco competition they were standing near the inner door of Exit 2 and Door 15. Miss Higgins saw smoke coming from under the blind at Row E and then saw the section of the blind nearest the Main Bar being pulled up. She saw a fire on the seat in Tier 9 of Row A. Miss Courtney also saw the section nearest the Main Bar being raised and said that she remembered seeing the seat in Tier 9 of Row A on fire.

2.41 Another of the patrons at the second table, Deirdre Brady, said that she remembered some disturbance in her immediate vicinity which prompted her to look through one of the gaps in the blind. She saw what seemed to her to be a very small fire on the seat in Tier 9 of Row B. It seemed to her to be a fire which was easily controllable. Another, Deirdre Ryan, was one of those who responded to the invitation to dance while the winners were giving their demonstration. She only stayed on the floor for part of one dance and had been sitting at her table in front of the blind "for a while" when she smelt burning. She said that she then looked up, and saw smoke, grey-black in colour, coming out at the top right-hand corner of the blind nearest the Main Bar. She said that she told Carmel Richardson that there was a fire and left.

2.42 Two of the girls, who had been sitting on stools in front of the blind between Rows B and C, Kathleen Manning and Jacqueline McCarthy, were dancing for what Miss Manning thought was "a couple of minutes" during the demonstration dance. They then both went to the ladies toilet (Tl) and went back to where they had been sitting. Miss McCarthy asked Miss Manning if she could smell burning and Miss Manning said that she could, and that it smelt like tyres burning. Miss McCarthy said that she then looked under the blind and saw the entire of four seats on fire, in Tiers 8 and 9 of Rows A and B. Miss Manning said she looked under the blind after Miss McCarthy and saw what appeared to her to be the seat in Tier 8 of Row B on fire.

2.43 Ruth Comiskey, another of the patrons sitting at this table, remembered having a meal as the disco competition ended and, about five minutes subsequently, smelling smoke. She mentioned it to Patrick Bride, who was sitting beside her, but he could not smell it. Three or four minutes later, the section of the blind nearest the Main Bar went up and she saw a fire on the seats in the area of Tiers 7 and 8 of Row A.

2.44 Elizabeth Marley, one of the waitresses, had been serving meals in the Stardust since about 00.10. She had finished serving the bulk of the meals by 01.10, but a small number of customers presented her with tickets after that time. She said that she was serving meals in the North Alcove and was asked by a patron sitting in the very back row in that area whether he could have a meal, even though it was late. She thought this was at approximately 01.20. She then went to the Kitchen and asked her mother, Teresa Marley (who was the catering manageress) whether this was alright and her mother said that she could serve the patron in question with a meal. She said that this was at approximately 01.25. Mrs Marley confirmed that the time her daughter asked her this was 01.25 because she remembered looking at her watch and thinking that it was somewhat late to be still serving a meal. She thought that she had probably checked her watch that morning.

2.45 Miss Marley, having got the meal, went back to the North Alcove and served the last patron. She then proceeded to collect plates from that area, put them on a tray and carried the tray back to the Kitchen. She said that as she came along the aisle immediately in front of the West Alcove, she got a very heavy smell of smoke. She thought this was at a point approximately opposite Row C in the West Alcove. She had not been conscious of any smell of smoke at any earlier stage. Her recollection was that, at this stage, the disco competition was over and the winners were giving the demonstration dance. She did not recall seeing any people sitting in front of the blind. She said that she moved straight on to the Kitchen, walking at a smart pace, went in and saw her mother standing at the door. She said that she told her mother that she could get a very bad smell of smoke, that she then put down the plates and that they both went into the Stardust, approximately as far as the cigarette machine.

2.46 Miss Marley then looked up at the blind and saw, through the gap between the second and third sections of the blind from the Kitchen, what appeared to be the two seats in Tiers 6 and 7 of Row D on fire. She looked at the fire for a period which she thought could not have been more than a minute and then ran or walked briskly along the aisle towards the Main Bar. She said that as she went along the aisle, none of the sections of the blind was up. At this stage, she thought there were some people standing in front of the alcove. She thought that it took her a minute or less to get from the Kitchen to the Main Bar.

2.47 Belinda Pearse, a waitress, was also serving meals in the North Alcove during the disco competition. While the demonstration dance was still on, she became aware of a smell of burning and then noticed smoke at the level of the ceiling. She went to Exit 6 and attempted, without success, to open it (see para. 3.49). She then ran along the aisle from Exit 6 to the centre aisle of the North Alcove, down the steps and towards the Main Bar. As she came to the floor in front of the centre of the North Alcove she saw the section of the blind nearest the Main Bar in the West Alcove partially raised, and the seats in Rows A and B on fire from Tier 4 up to the back wall.

2.48 Mrs Maria Brady, the supervisor of the lounge girls, was collecting empty bottles and glasses from tables in the North Alcove immediately after the disco competition and at the time when the winners were giving the demonstration dance on the stage. She brought a number of trays of glasses into the Main Bar and then returned to the sound box *(see Plan 2, Appendix 15),* picked up another tray of glasses and went back towards the Main Bar. As she approached the Main Bar, she saw a glow behind the blind, all the sections of which were in the "down" position. The glow appeared to her to be coming from the back of the alcove. She then went immediately into the Main Bar with a view to getting somebody with a fire-extinguisher.

2.49 John Andrews was working in the Main Bar, and helped to make up the cash after it closed. He finished this job about 01.20 and then went to the toilet, returning to the Main Bar after about five minutes. He was standing in front of the hatch at the Main Bar when he heard somebody remark on a smell of burning. He then saw a waitress, whose first name he thought was Liz, looking under the section of blind beside the Main Bar, which was still down. After she had looked under the curtain he (the witness) looked under it and saw a fire on the centre seating unit of Tier 8 in Row A. While he could not see it properly, he formed the impression that the flame on the seat was coming from the squab.

Plate 17 — *View looking up the aisle of the West Alcove showing the party wall to the M*

He watched it for a second or two only, and then somebody shouted to him to get a fire-extinguisher and he ran up the steps between the Main Bar and the North Alcove.

VI — RAISING THE ALARM

2.50 The activity in the vicinity of the table and seats nearest the Main Bar where some patrons were crouching down and peering under the blind, together, perhaps, with some indications of fire—such as smoke and a glow behind the blind—attracted a growing group of patrons. This group stood in the aisle immediately beside the table at a corner of the Main Bar *(see Plate 17)* in sufficient numbers for Miss Marley to be conscious of them as she made her way into the Main Bar. The music continued to play, however, and the dance floor was still crowded with dancers at this stage. It is clear that the group of people standing immediately in front of the blind grew rapidly as people drifted over from the dance floor or other parts of the Stardust to see what was happening, some of them being under the impression that a fight had started.

2.51 Jacqueline McCarthy, who was among the group of patrons sitting or standing in front of the blind and who saw early indications of fire (see para. 2.42) said that, on seeing the fire in the position which she described, she went to a doorman who was standing on the ballroom side of the inner door of Exit 2. While she was under the impression that the doorman in question was Michael Kavanagh, it is clear from other evidence that it was, in fact, Patrick J. Murphy that she spoke to. She said that she went up to him and said "the place is on fire" pointing to the area at which she had seen the fire.

2.52 Mr Murphy said that he recalled Miss McCarthy coming towards him in a stream of people who were moving along the aisle in front of the blind in the direction of Exit 2. He said that she detached herself from the stream of people and said to him "they have started a fire up in the corner". Miss McCarthy said that she then saw the doorman to whom she had spoken run in the direction of the blind, after which she recalled seeing a section of the blind being pushed up. Mr Murphy, for his part, said that as soon as Miss McCarthy told him of the fire, he turned, ran to the inner door of Exit 2 and shouted to Leo Doyle (who was in the foyer) to ring for the fire brigade. He then turned and ran to the blind, crawled under the section nearest the Kitchen, and, from a position immediately behind the blind saw a flame on the top of the seat in Tier 9 of Row A. The flame was along the entire length of the seat, and was approximately 3 to 4 inches in height.

2.53 Miss McCarthy's companion, Miss Manning, on seeing the fire, said to a waitress, Elizabeth Prizeman, who was standing at the third table in front of the blind, "look, there is a fire." Miss Prizeman said she then looked underneath the blind, all the sections of which were still down, and saw what appeared to her to be a small fire on two units of the seat in Tier 2 immediately behind the blind in Row C. She said that she then ran towards the inner doors of Exit 2 and shouted to Leo Doyle, whom she thought was speaking on the public pay telephone on the right-hand side of the foyer as she faced it, that there was a fire. She then went through Door 15 into the corridor from the Stardust to the Lantern Room, where she met Michael Kavanagh and told him "there is a fire".

2.54 At the time that Mr Murphy and Miss Prizeman said they gave their warning to Mr Doyle, there were, in addition to Mr Doyle, the following persons in the foyer: Frank Downes, who was still at his station at the outer doors (see para. 2.14), the cloakroom attendant who was also still at her station, Ann Roe, a patron who had lost her handbag, and her boy-friend, Peter O'Toole, who was reporting the loss of the handbag to the Gardai and for that purpose was speaking into one of the telephones in the foyer. There was also an intermittent stream of patrons who were leaving the Stardust, some of whom were collecting their coats from the Cloakroom.

2.55 The call made by Mr O'Toole was, in common with all 999 calls to the Gardai, automatically tape-recorded in the Garda Communications Centre at Dublin Castle, the time being recorded as 01.42. The Tribunal heard the tape-recording of this call, the transcript of which reads as follows:—

". . . . Hello, yes, hello.
I'm at the Stardust disco (01.42) Can you hear me?
. . . . yes.
And my girl-friend's handbag was robbed
. . . . Your girl-friend's handbag was robbed?
She's the Manageress in the Shoe Shop in Northside Shopping Centre.
. . . . Wait now would you . . . . Stardust
Yes, I'm in the Stardust disco, discotheque, and my girl-friend's bag went missing, someone's after taking it.
Can you hear me?
. . . . yes.
Can you hear me?
. . . . And where were you . . . . where were . . . . the Guards, where will you meet the Guards?
Pardon?
What's your name . . . what is your name?
Hello.
. . . What is your name? (Screams in background, caller hung up)".

It is clear that the call was terminated by Mr O'Toole hanging up as the noise in the background began; and that the noise was, in fact, the first alarm of fire being given to the people in the foyer.

2.56 Mr O'Toole said that before he hung up and at the time when people started shouting that there was a fire, Mr Doyle grabbed a fire-extinguisher from the wall near the telephone and went into the ballroom through the inner doors. Mr O'Toole said that Mr Doyle returned very shortly afterwards and began to use the phone.

2.57 Miss Roe said that someone, a boy whom she could not identify, came into the foyer while Mr O'Toole was on the telephone and told Mr Doyle that there was "a bit of a fire in there". She said that Mr Doyle then went to the inner door, looked in, came back and took the fire-extinguisher off the wall. He then went into the ballroom but only went in a few feet and returned to the foyer. She said he then put the extinguisher back on the wall and began to make a telephone call. She then went into the ballroom herself.

2.58 Mr Doyle gave a different version of this incident. He said that Mrs Prizeman called to him from the inner door "Leo, there is a fire inside", and that a matter of seconds afterwards Mr Murphy ran to him from inside the ballroom and told him to call the fire brigade. He said that he thereupon dialled 999, called down the hall to Mr Downes to summon the fire brigade, handed him the receiver, grabbed an extinguisher from the wall, went into the ballroom and did not return.

2.59 Mr Downes said that at approximately 01.40 Mr Patrick J. Murphy was standing in the foyer somewhere near the inner doors, when 'a girl shouted that there was a fire inside, and Mr Murphy went into the Stardust "like a flash". He said that he then saw Mr Doyle with his hand on a telephone receiver and that Mr Doyle then called down to him

"Frank, ring the fire brigade, there is a slight fire under the screen on the left"

or words to that effect. He said that Mr Doyle then handed the phone to him (witness), grabbed the fire-extinguisher and went into the ballroom. He (witness) dialled 999 and at the same time saw a very hazy grey smoke coming through the inner door of Exit 2. He then shoved the phone back on the receiver and went to the front door where he attempted to secure the two centre leaves in an open position.

2.60 There are divergences of detail between the various accounts of what transpired in the foyer at this time, but on the most important matters the witnesses are in agreement. Mr O'Toole was making his phone call (timed at 01.42) when Miss Prizeman called into the hall that there was a fire. Mr Murphy may well, as he says, also have shouted into the foyer at Leo Doyle to ring the fire brigade, but, if he did, it was probably after Miss Prizeman had already given the alarm. This is not to say that Mr Downes is necessarily

correct in placing Mr Murphy inside the foyer at the time Miss Prizeman raised the alarm: it is more likely that Mr Murphy was standing where he said in evidence he was, i.e. just inside the inner doors of Exit 2 in the Stardust itself, when Miss McCarthy approached him. This is consistent with Miss McCarthy's own evidence and that of Mr Doyle. It is also clear that almost immediately after Mr Murphy had given the alarm, Mr Doyle took the extinguisher from the wall and went into the Stardust.

2.61 Mr Noel Quigley who had previously been employed in the Stardust as a doorman, was present as a patron on the night of the fire. He said that at about 01.30, he decided to go home and went to the outer doors of Exit 2, which he found to be locked. He said that there were two doormen there, Mr Downes and Mr Fitzsimons, and he turned towards them to get the key, which he assumed one of them would have in his pocket. He saw another doorman, Mr Doyle, on the phone. As he walked towards the two doormen, a girl came into the foyer shouting that there was a fire. He (the witness) then went into the ballroom through the inner doors with Mr Fitzsimons and Mr Downes. Mr Doyle was still on the phone at this stage.

2.62 Mrs Maria Brady, having seen the glow behind the blind (para. 2.48), went into the Main Bar and shouted to Laurence Neville, a charge-hand barman, "Larry, come out, there is a fire". She then went on through Door 23 into the Lantern Room via the Silver Swan.

2.63 Mr Neville said that Mrs Brady shouted to him at some time between 01.30 and 01.35 that there was a fire. He said he then ran out through the Main Bar and stood immediately in front of the blind beside the wall of the Main Bar. At that stage, the section of the blind nearest the Main Bar was up, but the other sections were down. He said that he could see the seat in Tier 8 in Row A on fire; of that seat the two seating units nearest the bar were on fire. He did not think the seat in Tier 9 was on fire. He said that the flame was about three feet high from the squab, but the back of the seat itself was not on fire. He said that he watched the fire for a matter of seconds only, perhaps as few as five seconds, and then ran into the Main Bar and through it to the Silver Swan. At that stage, he remembered Mr Eamon Butterly, Mr Jack Walsh and a couple of other people being in the Silver Swan. He shouted from the door (Door 23) "there is a fire in the Stardust" and, accompanied by the other people in the Silver Swan, ran back to where he had been standing.

2.64 The section of the blind nearest the main Bar was still up and the other four sections still down. Mr Neville said the fire at this stage was "jumping" from row to row; he also described the fire as "shooting like a fireball" across the row of seats. There were four or five members of the staff actually in the alcove at this stage, two of whom he thought were doormen and the others barmen, but none of whom he could identify by name. One o; two of them had fire-extinguishers and were playing them on the base of the fire, and there seemed to him to be a lot of chemical coming out of one extinguisher. They were standing at about the area of Tiers 4, 5, 6 and 7 either in the aisle between Rows A and B or among the seats in Row A.

2.65 Mr Neville said that on this second view of the fire it seemed to him that it was getting out of control, and he did not spend more than a few seconds—he thought at the most fifteen or twenty—before deciding to leave and telephone the fire brigade. He then ran through the Main Bar and into the Silver Swan through Door 23, followed by Danny Hughes and another barman, Cormac Rose. He picked up an extension phone which was at the back of the bar in the Silver Swan, but was unable to make any call as it was not switched over to the public phone, and it was not possible to dial out on it.

2.66 Mr Neville said that he then went out into the Silver Swan from behind the counter and Mr Hughes joined him. He asked Mr Hughes to switch over to the public phone to dial 999, but Mr Hughes could not find the switch. Mr Rose came in a second or two later and switched it over. He (Mr Neville) then dialled 999. He said the phone was ringing for a second or two only when it was answered and he was asked which service he required. He said "fire brigade" and "in the matter of a second" the fire brigade responded. He said that he then said: "Would you come down to the Stardust Club in Artane as fast as you

can. There is a large fire. There is over 800 people in the place. For God's sake come quick, it is getting out of control".

He said that the fire brigade officer then asked him for his telephone number, he (the witness) said "317827", and the officer said "we are on our way".

2.67 Mr Neville said that he then went back into the Stardust, but that at this stage smoke was filling up the whole ballroom. He described the fire in the West Alcove at this stage as "completely out of control" with about a quarter of the area on fire. He did not notice whether the wall at the back of the area was on fire. The flames were "tipping" the ceiling at this stage. He said that the seating which was in flames was the seats in Tiers 7, 8 and 9 from the wall of the Main Bar down to the end of Row B. The smoke was very thick and choking and was going "like a tornado" across the whole area of the Stardust. He then heard Jack Walsh saying "come on, everybody out". He himself then ran back into the Main Bar through Door 23. As he came running in, he saw John Fitzsimons, the doorman, on the phone and assuming that he was phoning or attempting to phone the fire brigade, said to him "it's okay, John, I have already phoned them". He said that Mr Fitzsimons in response said "Okay, everybody out", and then put the phone down. He said that he (the witness) then went out the exit door of the Silver Swan into the concreted area.

2.68 The 999 call, which Mr Neville said he made, was not automatically recorded in the Central Telephone Exchange on a tape-recorder, as happened in the Garda Communications Centre with Mr O'Toole's call. Its receipt was, however, recorded in a log book by the officer on duty and timed at 01.43. Similarly, the call was not recorded automatically on a tape-recorder in the Central Fire Station at Tara Street to which the 999 call was routed: there was no apparatus for tape-recording calls in the Control Room at Tara Street, although there had been one in the past. (The reasons for its removal are dealt with in para. 4.6). Mr Neville's call was received by Fireman Glover who was on duty in the Control Room at the time and, in accordance with the normal procedure, wrote the details of the call on a docket, including the time at which it had been received. He then passed the docket to Sub-officer Hughes, the senior fire officer on duty in the Control Room at the time. Both the docket and the Occurrence Book kept in the Control Room record the time of the call at 01.43. Fireman Glover's account of the conversation was similar to that given by Mr Neville. There was no written record of a call from Mr Fitzsimons, but Fireman Glover, Sub-officer Hughes and Fireman Mooney all gave evidence of having received such a call from Mr Fitzsimons at 01.45.

2.69 Elizabeth Marley (para. 2.46) having arrived at the Main Bar went through Door 22 into the bar and shouted that there was a fire. She was making her way towards the far counter when she saw Mr Eamon Butterly, Mr Hughes and Mr Kennan running into the Main Bar through Door 23 from the Silver Swan. She went through the Door 23 herself and saw Gerard Guilfoyle, one of the barmen who had been on duty in the Main Bar, taking the pin out of one of the extinguishers inside the door in the Silver Swan. She then went on herself into the Lantern Room where she spoke to two barmen, David Rynne and John Dignam. She told them that there was a fire in the Stardust, and thereupon Mr Dignam went into the Silver Swan and Mr Rynne came out from behind the bar with her. She told Mr Rynne that there was a fire-extinguisher at the exit into the foyer of the Lantern Room and then made her way towards the stage where she knew there was another fire-extinguisher.

2.70 Miss Marley said that she took this fire-extinguisher from the wall and gave it to Mr Fitzsimons who had just run up to her. She saw Mr Fitzsimons go to Door 19 into the kitchen corridor leading to the Stardust. She then spoke to one of the people in the band in the Lantern Room and heard Jack Walsh telling the band leader to stop playing and get people moving. She then attempted to follow Mr Fitzsimons through Door 19 into the kitchen corridor, but when she pushed one of the swing doors there was very heavy smoke inside which drove her back. Mr Bridgeman then joined her and told her to leave the Lantern Room by the emergency exit, which she did, using the exit immediately beside the stage.

2.71 Assuming that the versions of the sequence of events given by Mrs Brady and Miss Marley after giving the alarm are both correct, it follows that Mrs Brady gave the alarm in the Main Bar first. By the time Miss Marley arrived in the Main Bar, Mr Eamon Butterly, Mr Hughes and Mr Kennan had already been alerted to the fire, and there is no evidence to indicate that this alarm had been given by anybody other than Mr Neville, who in turn had been alerted by Mrs Brady.

VII — ATTEMPTS TO EXTINGUISH THE FIRE

2.72 Mr Patrick J Murphy, having seen the extent of the fire (para. 2.52) took a fire-extinguisher (F5) from its position on the wall between the inner doors of Exit 2 and Bar 1. He knew that there was a fire-extinguisher in this position and he described it as being silver in colour. There was a static grip on the top of it extending out three inches (76 mm) and underneath that a handle like a brake on a push-bike. As soon as one pulled up the trigger at the head of the extinguisher, the extinguisher operated by means of a small hose which was held in one hand while the trigger was released with the other hand. He carried this extinguisher under his arm and went back under the first section of the blind next to the Kitchen. He said he went by this route because the aisle immediately in front of the blind was crowded with people. He said that at this stage the fire was on the seats in Tier 9 in Rows A, B and C. The fire he described as being still not very big, with flames three to four inches high. As far as he could see, the carpet tiling on the back wall was not on fire. He did not see any smoke.

2.73 Mr Murphy said that he then moved diagonally through the seats up to the corner formed by the wall of the Main Bar and the back wall of the alcove. He stopped at Step 8 in the aisle between Rows A and B, and operated the fire-extinguisher. He said that he directed water along the back of the seat closest to the Main Bar, which he thought was the source of the fire, since it was confined to that seat when he saw it first. He said that the jet of water had no effect whatever on the fire and he then turned it on the corresponding seat in Row B. He said that at this stage the carpet tiles were definitely not on fire. He was at this point conscious of intense heat which appeared to be coming from behind the suspended ceiling. The heat was sufficiently severe to singe his hair and burn his face and the backs of his hands. He said that because of the intensity of the heat he moved back down two steps and continued to play the extinguisher on the seat in Row B. He was afraid that the ceiling might collapse, and was looking around the alcove at this point and saw Mr Doyle about six or seven feet away from him on his left-hand side, also using an extinguisher. He also saw Mr Austin Bell, another doorman, in the aisle beside the Main Bar but said that the latter did not have an extinguisher.

2.74 Mr Murphy said that at this stage "the ceiling started to drip, melt". Particles, some of which were flaming, fell from the ceiling, landing on the tables and seats. The particles that were not flaming seemed to be of a jelly-like substance and some fell on the cuff of his shirt, leaving a stain of a strawberry-red colour. The flaming particles continued to flame after they landed on the seats and tables, but did not appear to him actually to set fire to either. A matter of seconds later, a larger portion of the ceiling in the corner area fell. Mr Murphy said he continued to move backwards down the aisle until he was level with the blind, the first section of which was up at this stage, although he had not seen it being lifted. As he came level with the blind, a much larger section of ceiling collapsed, which he described as roughly covering a rectangular area from the blind up to Step 7 over Rows A and B.

2.75 As soon as the ceiling collapsed in this manner, a large volume of thick black smoke, which appeared to be coming from the ceiling, came out into the area of the ballroom itself, followed immediately by a flash of light. Mr Murphy said that the lights in the Stardust then went out. He thought that from the time he entered the alcove with the extinguisher until this series of events, not more than forty five seconds elapsed. The next events—the collapse of the ceiling, the cloud of black smoke and the flash of light—all happened in two seconds or less. At no stage while he was in the alcove with the

extinguisher did the height of the flames change, nor at any stage was the back wall on fire.

2.76 Mr Leo Doyle said that, having grabbed the extinguisher, he ran through the inner door of Exit 2. He then saw that all the sections of the blind were up, except the one nearest the Kitchen. As he came through the door, he could see a fire up in the corner of the alcove beside the Main Bar, but at this point the section in the "down" position was obscuring his view. He ran along the aisle in front of the blind without any difficulty, but he was also conscious of a crowd of onlookers beginning to assemble in the aisle. He ran into the alcove below the section that was down and went up the steps of either the second or third aisle from the kitchen wall. He went as far as about Step 7 and could see fire on each of the seats in Tier 9 of Rows A, B and C. The flame seemed to be about three feet high and was coming about a foot above the back of the seat in each case. He said that the flame did not appear to be touching the wall and that the wall was not on fire, although he had said in one of his statements to the Gardai that

> "the fire was spreading along the back wall and a number of the seats were on fire".

The only other person whom he could remember with certainty as being in the alcove fighting the fire at the same time was Mr Murphy, whom he thought was already there when he himself arrived and was up to his right in about Tier 6 or 7 of Row B. There was somebody else on Mr Murphy's right, whom he thought was Mr Bell, standing on about Step 3 or 4 of the aisle nearest the Main Bar.

2.77 Mr Doyle said that he had pulled the pin out of the extinguisher that he was carrying as he ran towards the alcove. As he came to Step 5 or 6, he pressed the grip on the extinguisher and directed water on the seat in Tier 9 of Row C. He played the water on the fire for not more than a minute. He thought that the fire was coming from the squab of the seat to a point about a foot above the back of the seat, but that the seat itself was not on fire. The jet of water had little or no effect on the flame and, as he was directing it, he became conscious of intense heat coming from the ceiling and causing a burning sensation, similar to sunburn, on his hands, his forehead and the back of his neck. This heat was so intense that it drove him back the aisle to Step 4, where he stayed for a few seconds only. As he moved down, he was looking up at the ceiling, which he was afraid was going to collapse, and his extinguisher was now directed towards the ceiling. As he was on Step 4, he heard someone shout "it's out of control"; while he could not identify the person with any certainty, he was sure it was a doorman, and thought it was probably Mr Fitzsimons. He then started moving back again and heard a crash from the other end of the alcove near the Main Bar, "a big gush of black smoke" came from the ceiling and the lights went out. He then ran down on to the dance floor in the direction of Exit 2.

2.78 Mr Austin Bell said that between 01.30 and 01.35, he was standing in the middle row of seats from the stage in the A/B area when he heard what seemed to him to be the noise of a section of the blind going up in the West Alcove. He said that at this point the demonstration dance which followed the disco competition was over and people were dancing in the ordinary way. He looked over in the direction of the noise and saw that the section of blind nearest the Main Bar was up. He also saw a person whom he thought was Mr Doyle standing at the table nearest the Main Bar in front of the alcove. He (Mr Doyle) was looking around and Mr Bell, under the impression that there was a fight going on and that Mr Doyle might need his assistance, went in this direction via the aisle which led from the Main Bar to Exit 5. As he reached the junction of this aisle and the aisle in front of the West Alcove and the Main Bar, there were not many people in the area. He saw a fire on the seat in Tier 8 of Row A. He said that the flame extended right across the seat and appeared to be on the narrow ledge, which formed the top of the seat, and the table behind it. He said it was about two and a half to three feet in height above the top of the seat. He said that from his view-point there could have been a fire on the seat behind it. It was not spreading at that stage and the flames were not reaching the ceiling.

2.79 Mr Bell remembered that there was an extinguisher (F4) in the West Alcove, and went into the alcove with a view to getting it. He went rapidly up the steps in the second aisle

from the Main Bar and got as far as Steps 6 and 7, when the heat which seemed to be coming from the fire got too much for him and he turned around to go down to the blind again. He said that the sensation of heat was confined to his face and did not seem to him to be coming from the ceiling. He did not see Mr Murphy in the alcove at this or any other stage.He went down to the blind at Row D and released each of the bolts which were holding that section in position. He then pushed the blind with his hand and it flew into the "up" position. He said that as he was releasing the first bolt, he saw Mr Doyle running in with the extinguisher and knocking against him.

2.80 Mr Bell then turned round in the direction of the Main Bar and saw that a crowd was gathering around the section of the blind nearest the Main Bar. He said he immediately went in that direction himself, clambering over the seats in a hurry, in order to get the crowd to move. He said that he did not notice at this stage whether the remaining sections of the blind were up or down but said that he did not lift them. He had, however, said in his first statement to the Gardai that he had opened "more shutters". As he moved towards the Main Bar, the fire seemed to have got bigger and to have spread to the corresponding seat in Row B. The flames on the seat in Row A were reaching the ceiling at this stage but the flames in Row B were smaller. He did not see any flame on the back seats, nor did he see Mr Doyle at any stage after he ran in past him with the fire-extinguisher.

2.81 Mr Bell said that, at a point in time which he thought was after he had entered the alcove but before he had raised the section of blind, he heard the disc jockey, Colm O Briain saying something, which he thought was "keep calm". The music had stopped playing at this stage, but the lights were still on. He said that there was black smoke coming from the fire on the seats. As he reached the section of blind nearest the Main Bar which was in the "up" position, he heard a crash which he thought was part of the ceiling collapsing and "with that, a gush of black smoke came through". It seemed to spread very quickly and, as Mr Bell turned towards the dance floor he said that "people started panicking all over the place". He then moved out of the alcove with a view to going to the disc jockey and asking him to make another appeal for calm.

2.82 Mr Michael Kavanagh said that, after being given the alarm by Mrs Prizeman, he ran through the kitchen corridor into the Stardust. He ran to the cigarette machine and saw that the three sections of the blind nearest the Main Bar were up and that there was a fire on the seat in Tier 9 of Row A. He said that at this point the fire was confined to the two seating units nearest the wall and seemed to have started on the squab and gone on to the back of the seat. He said that he then turned round and saw Elizabeth Marley holding a fire-extinguisher a few feet away from him, and that he grabbed the fire-extinguisher from her. He then turned back towards the fire and moved in the direction of the alcove. He said that as he turned back towards the fire, he saw that it had spread. At this stage it was starting to run up the carpet tiles on the back wall. He ran towards the alcove and the fire continued to spread to the remaining seating unit in Row A. As he ran towards the fire, past the two sections of blind nearest the Kitchen, there were people standing in the aisle looking at the fire who were in his way.

2.83 Mr Kavanagh went into the alcove at the aisle between Rows C and D. Mr Murphy (whom he had seen before he took the fire-extinguisher from Miss Marley) was standing at about Tier 8 in the second aisle from the Main Bar using an extinguisher; and Mr Doyle was standing parallel to him but in the aisle third from the bar, also using an extinguisher. As he came up this aisle, the fire was coming up towards the ceiling along the carpet tiles on the wall at the back and was travelling simultaneously along the back wall towards the Kitchen. At this point, he saw that as the flames reached the ceiling, thick black smoke was developing. He said that he then stood on the centre seating unit of the seat in Tier 7 of Row C, and proceeded to play his extinguisher in the direction of the fire.

2.84 Mr Kavanagh said that he did not spend more than about half a minute using the extinguisher. The pin had already been removed when he took it from Miss Marley and he had the impression that it had already been partially used. He said that he was

conscious of a heat so intense that he could not get near the fire and that the extinguisher he was using was having no effect on it. He turned around to leave the alcove and, as he did so, saw portions of the ceiling appearing to melt and fall in the area where Mr Murphy was standing. He did not see any of them flaming: they appeared to him to be pieces of melting material. As he turned to leave the alcove, he also saw that people were standing in front of the alcove looking at him and the other doormen fighting the fire and he shouted to them to "get the hell out of there". He then came down out of the alcove in the direction of Exit 2, followed, as he thought, by Mr Doyle and Mr Murphy. He recalled that, as he (the witness) reached the area of the cigarette machine, Mr Doyle was spraying the ceiling with his extinguisher. Neither Mr Murphy nor Mr Doyle remembered seeing Mr Kavanagh in the alcove at any stage.

2.85 Mr John Fitzsimons said that he had entered the Lantern Rooms from the kitchen corridor shortly after 01.40 when he heard Mrs Prizeman shouting to him that there was a fire in the Stardust. He said that he ran back into the Stardust through Door 15 and went under the blind. He got under the blind at Row D and stood inside the alcove. He saw a fire on the two seats in Tier 9 of Rows A and B. The fire appeared to be on the back of the seats and to extend about one foot above them. He could see black smoke accumulating in the corner of the ceiling next to the Main Bar. He went back under the blind and through Door 15 into the kitchen corridor where a barman, whose name he thought was Dave, handed him a fire-extinguisher. He then returned through Door 15 and went towards the blind again. He said that at this stage at least one section of the blind had been raised, although he could not remember which or how many.

2.86 Mr Fitzsimons saw Mr Murphy and Mr Doyle up near the fire and also saw Mr Bell and another person in the area whom he could not identify. The fire at this stage had spread considerably, and in at least three of the rows of seats all the seats from the back wall down as far as Tier 6 were on fire. The carpet tiles on the back wall were also on fire and the fire was moving from right to left diagonally across the alcove from the Main Bar towards the Kitchen. Particles were falling from the ceiling and Mr Murphy and Mr Doyle were beginning to move out of the area. Mr Fitzsimons said that he knew from the appearance of the fire that the extinguisher he was carrying, which was a gas one, would be of no effect and he discarded it. He then went into the Silver Swan and made a 999 call for the fire brigade (see para. 2.67).

2.87 Mr Robert Duffy (see para. 2.38) went into the Main Bar, where he saw a young barman going through Door 23 into the Silver Swan and returning with a fire-extinguisher. Mr Duffy said that he took it from him and came out of the Main Bar. When he returned to the alcove, the section of the blind nearest the Main Bar was up and he went up the steps beside the wall. He said that the fire at this stage was spreading from the seat in Tier 8 of Row B to Row A. He operated the extinguisher—which was blue in colour—directing the liquid towards the base of the fire. He had not been there more than about twenty seconds before the heat became so intense that it drove him back down from the fire. He did not remember seeing any doormen in the alcove, although they could have been there. He said that the extinguisher did not appear to have any effect on the fire.

2.88 Mr John Andrews (para. 2.49) having got to the back wall of the North Alcove took the fire-extinguisher off the wall at F3 and ran back down the stairs. He met Colm O'Toole—another barman—about halfway down the stairs and the latter helped him to carry the extinguisher down to the West Alcove. When they got there, the section of the blind nearest the Main Bar had been raised and there was a doorman, whom he could not identify, standing there. He and Mr O'Toole went about halfway up the aisle nearest the Main Bar. First Mr Andrews and then Mr O'Toole tried to work the extinguisher but without success. The fire at this stage had spread to the two outer seating units and was also a little higher. There was also some smoke at this stage and he (the witness) was beginning to feel extremely hot and to feel scorching on his face.

2.89 Mr Andrews retreated back down the steps and ran into the Main Bar. As he went in Door 22, Eamon Butterly and Jack Walsh came out of the Main Bar into the Stardust. He

(the witness) then returned to look at the fire. At this stage, he said, there were about three people fighting the fire. One was standing at Step 6 beside the Main Bar, another one in the middle of Row A about four seats back from the wall and the third at about Step 7 in the next aisle beside Row B. There were also some people standing in Tier 3. About half a minute after he had been standing there watching the fire and the process of fighting it, the lights went out and he (the witness) ran back into the Main Bar and from there into the Silver Swan.

2.90 Mr Colm O'Toole, the barman referred to by Mr Andrews, said that he was standing outside the shutters of the Main Bar sometime after the bar had closed, when Caroline Maher, a waitress, told him there was a fire "just around the corner". He said that he then went into the Silver Swan through the Main Bar and saw Mr Eamon Butterly, Danny Hughes, Jack Walsh, Gerry Guilfoyle and some other people. When Mr O'Toole got there, Mr Guilfoyle was already telling the people there about the fire, and he (the witness) went back through the Main Bar into the Stardust. When he got back to the West Alcove, the section of the blind nearest the Main Bar was half up and he could see a fire on the middle of the seat in Tier 9 of Row B. He told people sitting at the tables to move to the exits; some of them did so. He then saw Alfred Reilly, a patron, making his way up the steps nearest the Main Bar with a fire-extinguisher.

2.91 Mr O'Toole said that he had seen Mr Reilly earlier in the evening and thought that he was somewhat the worse for drink. He said that at this stage Mr Reilly was dragging the fire-extinguisher along the ground and that he, (the witness) went up the steps beside the Main Bar to about Step 4, grabbed him around the chest and brought him back down again. Mr O'Toole said that Mr Reilly then dropped the fire-extinguisher, and then he (the witness) picked it up and went back up the aisle towards the fire to about Step 7 and crossed over the seating to the middle of Row A beside Step 7. He then played the fire-extinguisher, directing it at the middle of the seat in Tier 9 of Row B, where he said the fire was. As he did so, he saw someone else approaching from the other side of the fire with a fire-extinguisher. He played the fire-extinguisher himself on the fire for about a minute and a half, during which time the fire on the seat grew and eventually reached the ceiling.

2.92 The other person with a fire-extinguisher in the alcove whom Mr O'Toole saw had walked over the top of the seats from Row D. He could see powder coming from the other person's extinguisher, but it did not appear to be having any effect on the fire. His own extinguisher had no effect on the fire and he left the alcove and walked to the doorway of the Main Bar. As Mr O'Toole arrived at the doorway, he met Mr Eamon Butterly coming out of the doorway. He (the witness) then changed direction and went back along the aisle in the direction of Exit 5, telling people who were "running all round the place" that there was an exit through the Main Bar. He stopped somewhere in the area of the sound box, at which stage there was a lot of smoke beginning to fill the hall, making it more difficult to breathe. He then went back in the direction of the Main Bar and saw that the fire had grown since he first saw it, and that it now extended to the seats nearest the blind. He saw a table on fire in front of the alcove and turned the extinguisher on it. He said that he dropped the fire-extinguisher at this stage and, as it was getting too difficult to breathe, he left the Stardust and went out via the Silver Swan. He said that he never at any stage helped Mr Andrews down the steps in the North Alcove with a fire-extinguisher or went into the alcove with him.

2.93 Mr Peter Dolan, another barman, was working in the Main Bar and was standing outside it with a couple of other barmen at approximately 01.25. He thought he had been standing in this position for approximately ten to fifteen minutes when he heard a girl shouting "there is a fire". He then moved around the corner to the first section of the blind, which had been raised at this stage. He saw the seat in Tier 9 of Row A on fire: the entire seat was not on fire and the flame was about a foot above the back and about two and a half fdet in length. The wall did not seem to him to be on fire and he did not see any smoke. He said he then ran up the steps beside the Main Bar in the North Alcove to get a fire-extinguisher, and returned with one to the West Alcove. He did not remember whether

he took it off the wall or was given it by some one, but he did try to work it without success when he got back to the West Alcove.

2.94 The fire by this time had spread from right to left and the seat in Tier 9 of Row B was now on fire. At this stage, Mr Dolan thought at least two, and possibly three, additional sections of the blind had been raised. He said that when he came back someone grabbed the extinguisher from him. He also remembered about four or five people in the alcove at this stage, although he could not remember whether they had fire-extinguishers or not. At the time he made a statement to the Gardai, however, he referred to about four or five men with fire-extinguishers fighting the fire. As the fire-extinguisher was taken from him, either Mr Butterly or Mr Walsh, both of whom were now standing in his vicinity, shouted to him to ring the fire brigade. He then ran into the Silver Swan through the Main Bar and saw Mr Neville on the phone to whom he shouted "will you ring the fire brigade". He said Mr Neville nodded his head. He (the witness) then went back to the Stardust and either Mr Butterly or Mr Walsh said "get out". At this stage the whole of the West Alcove, except Tiers 2 and 3, was on fire. The back wall was now also on fire.

2.95 Mr Gerard Guilfoyle, who was the charge-hand barman in the Main Bar, started counting the cash and putting away the spirits after the bar had closed. He finished this work at between 01.20 and 01.30 and then went into the Silver Swan to talk to Jack Walsh. Mr Butterly and Mr Hughes were also in the Silver Swan at this stage. After about five or ten minutes, he went back to the Main Bar, which he proceeded to clean up. While he was cleaning, somebody shouted at the door "there is'a fire" and he then went into the Silver Swan, followed, he thought, by Mr Neville. He said to Mr Walsh and Mr Butterly that there was a fire outside and they went through the Main Bar into the Stardust, followed by the witness and, he thought, Mr Neville.

2.96 When Mr Guilfoyle reached the West Alcove, he stopped at the first section of the blind which had been raised, and saw a fire on Tiers 8 and 9 of Row A. In each case it was on the seating unit nearest the wall and was not more than 5 inches in width and the same height. He also saw some black smoke rising up to the ceiling. He then went into the Silver Swan and got a fire-extinguisher which was hanging on the wall in the Silver Swan opposite the door into the Main Bar (Door 23). Cormac Rose, another barman, grabbed another fire-extinguisher off the wall in the Silver Swan at the same time and he and the witness both returned immediately to the Stardust. He said that at this stage the fire had spread and that there was "terrible heat" coming from it. Other seats in the same row were on fire and the flames were higher. He started to use the fire-extinguisher by pressing the handle down three or four times and some white foam came out of it.

2.97 At approximately this time, Mr Guilfoyle heard the disc jockey making an announcement "not to panic". The extinguisher was then grabbed from him by Noel Quigley (para. 2.61). Mr Quigley told him (the witness) "to get out for my life" and moved back to the Main Bar with the extinguisher, but did not appear to use it. At this point, the witness said that people in the area "were beginning to panic, to scream". He then turned back towards the Main Bar and went through it into the Silver Swan, at which stage the lights went out.

2.98 Mr Eamon Butterly said that he was in the Silver Swan at about 01.30 with Mr Phelim Kinahan, Mr Danny Hughes, Mr Dermot O'Neill and Mr Tom Kennan when Mr Larry Neville came in Door 23 and shouted "there is a fire in the Stardust". He (the witness) said to him "ring the fire brigade" and then went into the Main Bar through Door 23 and through Door 22 into the Stardust. He came as far as the section of blind nearest the Main Bar which was in the "up" position. He saw a fire on the seat in Tier 9 of Row A. The fire was running across the seat and into the seat in Tier 9 of Row B, but only as far as the centre seating unit of that seat. He saw two doormen whose names he did not know, and a barman, using fire-extinguishers. It was obvious to him (the witness) that they were not having any success in putting out the fire and he went up two or three steps into the alcove and shouted to them to drop the extinguishers and concentrate on getting the people out.

2.99 Mr Phelim Kinahan said that at about 01.40 he was leaving the Silver Swan where he had been having a conversation with Mr Butterly when Mr Neville rushed by him saying that there was a fire. At this stage Mr Butterly was talking to Mr O'Neill and Mr Hughes was also there, as was Mr Jack Walsh. He said he ran out the door of the Main Bar (Door 22) and saw that the section of blind nearest the Main Bar was up, although not all the way. There were a number of people standing in the area. He saw a fire on the seat in Tier 9 of Row A, and as he watched he saw the fire "jump" from the top of that seat to the seat in Tier 9 of Row B. The flame was about 18 inches high and was on the narrow horizontal portion of the top of the back-rest of the seat. The carpet tiling on the back wall appeared to be slightly on fire.

2.100 Mr Thomas Kennan said that he was in the Silver Swan at about 01.30. Mr Butterly was also there, as was Mr O'Neill. Mr Hughes came in shortly afterwards. Mr Hughes began talking to Mr Butterly and, at that stage, a barman whom the witness thought was called 'Gerry' came in and said "there is a fire". He said that Mr Butterly moved straight away and he (the witness) followed him. They both went to the Main Bar, through Door 23 and as far as the section of blind nearest the Main Bar. The section was in the "up" position and the witness saw a fire on the seats in Tier 9 or Tier 8 of Rows A and B. The flame was about 1| or 2 feet high and was long and narrow. The back wall did not appear to be on fire. He thought it was a serious fire and that people should be moved out. He did not see anyone fighting the fire.

2.101 Mr Danny Hughes (para. 2.26) having given the winners of the competition their prize went across the ballroom through Area C and into the Main Bar through Door 22. From there he went into the Silver Swan with a view to getting his cheque for the evening from Mr Butterly. He had been talking to Mr Butterly for about half a minute to a minute when somebody ran in and said there was "a bit of a fire". Everyone then ran out from the Silver Swan through Door 22 into the ballroom. He stood in front of the section of blind nearest the Main Bar and saw a fire on the seat in Tier 9 of Row A. The flames were about 2 to 2i feet in height and more than one seating unit and possibly as many as three of the seating units were on fire.

2.102 There was smoke billowing around the area which seemed to be black at the back and 'whiteish' at the front. There was somebody up near the fire with what seemed to be a fire-extinguisher. He (the witness) looked at the fire for a few seconds only and then ran in through Door 22 into the Main Bar. As he did so, a barman passed him going in the direction of the fire with an extinguisher which he was testing.

2.103 Mr Cormac Rose, one of the barmen in the Main Bar, had finished his work and was sitting with another barman, Joe Maguire, at the second table from the Main Bar in front of the North Alcove. They were watching the disco competition from this table and at a time which he thought was about 01.40, he saw a semi-circle of people standing in front of the West Alcove from the table nearest the Main Bar to the second table from the Main Bar. The section of the blind nearest the Main Bar was up and the people seemed to be looking up towards the back of the alcove, but he (the witness) could not see what they were looking at. He thought there might be a fight going on and they went over to see what was happening. He then saw the seat in either Tier 7 or 8 of Row A alight. There seemed to be a large flame coming from the seating.

2.104 Mr Rose saw two of the doormen standing in the aisles with fire-extinguishers in their hands, although he could not see whether the extinguishers were working. One of the doormen, whom he thought was Mr Doyle, was standing in the second aisle from the Main Bar, approximately three tiers down from the back wall; and the other doorman, whom he could not identify, was standing in the aisle nearest the Main Bar at about Step 7 or 8. He (the witness) knew that there was an extinguisher in the Silver Swan and he ran there through the Main Bar. As he did so, he saw Mr Neville on the phone in the Silver Swan. Mr Neville asked him to switch over the phone from behind the bar so that he could ring the fire brigade, which the witness did. He then got the fire-extinguisher and came back into the Main Bar through Door 23 where he met Joe Maguire who told him to "forget it", that it (the fire) was "out of control". He dropped the extinguisher and the

lights went out. He then went back through Door 23 into the Silver Swan where he thought two of the emergency lights were still on.

2.105 Mr Noel Quigley (para. 2.97) having entered the Stardust with Mr Downes and Mr Fitzsimons, ran up the aisle in front of the West Alcove and up the stairs in the North Alcove with the intention of getting the fire-extinguisher which he knew to be on the back wall. He said that as he passed the West Alcove, the two sections of the blind nearest the Main Bar were up and he saw a small fire on the seats in Tiers 8 and 9 of Row A. The fire was not spreading at this stage. He then ran up the steps to the back wall and found that the fire-extinguisher was gone, and he returned to the West Alcove. At this stage the fire had spread considerably and the entire of the three rows nearest the Main Bar were on fire. He remembered grabbing an extinguisher from a barman, who was going into the Main Bar in what the witness described as "a state of panic". There were two people in the alcove trying to put the fire out at this time, but they were not doormen. He (the witness) used the extinguisher for a couple of minutes, but he said that at this stage the fire was "shooting out" from the alcove as though there was some kind of draught behind it. There was also a lot of grey smoke coming from the alcove and the lights then went out. The witness then made his way up towards Exit 1 in the dark.

2.106 Mr David Rynne, a barman in the Lantern Room, had finished work at about 01.20 or 01.25. He then stood outside the bar and had a drink and sometime shortly afterwards, which he estimated at 01.30 at the earliest and 01.40 at the latest, Elizabeth Marley came in and said

> "Dave, there is a fire in the Stardust, get everybody out".

He then ran to the cloakroom beside the exit in the Lantern Room and took an extinguisher from the wall. He ran into the kitchen corridor through Door 19, along it through Door 17 and into the Stardust through Door 15, going through each door without difficulty. When he came into the Stardust, he came to a halt in front of the West Alcove at Row D. While he was not entirely clear in his recollection, he thought that the section of blind nearest the Kitchen was still in the "down" position, but that the two sections in front of Row D and Row C were up. He saw what he described as a very big fire on the seats in Rows C and D. He thought it possible that the fire at that stage was also in Rows A and B, but had not a proper view of that area. The fire certainly extended down as far as Tiers 4 or 5 and could have extended as far as the back wall. The flames were reaching the ceiling, but the ceiling itself was not alight. He directed the fire-extinguisher on the flames for about thirty or forty seconds and a white liquid came out, but had no effect on the fire. Heavy black smoke was reaching him at this stage and affecting his breathing; it was slightly sweetish in taste and was affecting his lungs.

2.107 Mr Rynne dropped the extinguisher and ran back through Doors 15, 17 and 19 into the bar of the Lantern Room. He held his head over one of the wash basins and had a fit of retching, brought on, he thought, by the fumes. As he was retching, he noticed the lights flickering in the bar. He then went up to the band leader, Mick Morrissey, and said "It is very serious, get everybody out". The exit beside the stage in the Lantern Room was open at this point and some people were filing out. He said that people who were sitting at tables in the Lantern Room were now beginning to realise that there was an emergency of some sort and were standing up, gathering into small groups. He (the witness) helped to clear people from the Lantern Room and then remembered that he had left his overcoat in the Main Bar. He returned to it via Door 23 and found his coat on top of the ice-machine underneath the immersion heater (see para. 1.46). He noticed no smoke in the Main Bar, which was empty. He then went back into the Silver Swan and left by the exit beside the toilets.

VIII — THE SPREAD OF THE FIRE

2.108 During the early stages of the fire, people continued to leave the Stardust. Some patrons, such as Pamela McGuinness (para. 2.34) and Sharon O'Hanlon (para. 2.33) who had been in front of the West Alcove, left through Exit 2 without any difficulty. During this

period, a growing number of people, looking for their coats, began to assemble at the cloakroom at Exit 2. Some patrons also left without difficulty at this stage through Exit 6 (para. 3.49).

2.109 Mrs Teresa Marley, after seeing the fire (para. 2.45) went back to the Kitchen. There she was joined by Belinda Pearse (para. 2.47) and, together with other members of the kitchen staff, they went out through Door 21 to the forecourt. Other members of the kitchen staff had already left through this door. (Mrs Marley had instructed the staff under her control that in the event of any emergency occurring in the ballroom, such as a fight, they were to go straight to the Kitchen). Mrs Brady (para. 2.62), Elizabeth Marley and at least one other waitress left via the Lantern Room. Some of the bar staff also left during this period through either the Lantern Room or the Silver Swan.

2.110 There remained in the Stardust a large number of patrons whose number it is impossible to estimate with anything approaching accuracy. Many of them were in the growing group of people who had assembled in front of the West Alcove to see what was going on. David Rynne (para. 2.106) thought that the crowd numbered about four hundred or five hundred. The music was still playing and a number of people were dancing, although their numbers were being rapidly depleted as individual patrons either joined the watching crowd in front of the West Alcove or left by Exit 2. Some patrons, perhaps no more than six in number, were still asleep at tables in the North Alcove.

2.111 As the attempts to extinguish the fire were being made, or shortly before then, the blind was raised. Nearly all the witnesses agreed that all five sections were not raised at once. Most witnesses, including those who were in a better position to see or whose evidence could for other reasons be relied on, thought that the section immediately beside the Main Bar was raised first, although some thought not to its full extent. It also seems probable, although there is less agreement on this, that the remaining four sections were raised together at almost the same time. Some thought that the section nearest the Kitchen remained in the "down" position while the centre sections were raised.

2.112 It is also clear that, during the period when one section only of the blind was raised, most of the people watching the fire thought it was relatively small, not dangerous and would be brought under control rapidly. It was not until the remaining sections were raised that what many of the witnesses described as widespread "panic" developed. So strong an impression did this leave in the minds of many onlookers that they formed the impression that the raising of the remaining sections in some way contributed to the spread of the fire.

2.113 Three distinct phenomena were associated in the minds of many of the onlookers with the development of "panic":

(1) the collapse of part of the ceiling in the West Alcove;

(2) the rapid spread of flame through the West Alcove and into the ballroom; and

(3) the filling of the ballroom with clouds of dense black smoke.

2.114 The first and second phenomena appear to have happened almost simultaneously, followed immediately by the third. It was also as the flames appeared to spread that most people recalled hearing the disc jockey make an announcement, urging people to remain calm and walk to the nearest exits. The lights in the Stardust failed almost immediately after this announcement: the evidence of most of the witnesses suggests that not more than a minute can have elapsed and the period may have been less.

2.115 Valerie Walsh and Sharon O'Hanlon, who were among the group in front of the West Alcove, were gathering up their coats from the table having seen the fire (para. 2.33), when part of the ceiling collapsed on to the table. They were so frightened that they ran immediately to the inner door of Exit 2 and, as Miss Walsh looked back, she saw flames shooting at ceiling level from the West Alcove into the ballroom. Sandra Hyland, who also picked up some coats and ran to the door as soon as she saw the fire, looked back

from the inner door of Exit 2 and saw it "rolling across" the ceiling. Adrienne Rahaman, who was dancing when she first saw what seemed to her to be a small fire in the West Alcove, climbed over the tables on the floor (in Area B) and saw doormen fighting the fire with extinguishers. She then saw the fire "cutting across the ceiling" very quickly above her head.

2.116 Patrick Burke was moving back towards the cigarette machine as the remaining sections of the blind were being raised and said that, as soon as they were raised, the flames spread very quickly to all the other seats. While the ceiling did not seem to him to be on fire, the flames were shooting out along it. "Panic" then broke out and people started running in all directions. Yvonne Keogh (para. 2.38), who was kneeling on a seat in front of the alcove to get a better view of what was going on, saw the section nearest the Main Bar go up and then saw a fire about 2 or 3 feet high on the back of a seat in Tier 9 of either Row B or C. She said that

> "Suddenly it just seemed to explode on to the wall and up to the ceiling".

2.117 Veronica McCormack, who was standing in front of one of the tables on the floor in Area B saw smoke in the area of the Main Bar at ceiling level and then saw that the seat in Tier 9 of Row A was on fire. In a few seconds, the flames touched the ceiling and then travelled at ceiling level towards the blind. Paul Doyle, who was dancing in front of the stage when he first saw the fire in the West Alcove, also described the fire as going up the ceiling and then coming across the ceiling very quickly "like a ball of fire". Jacqueline McCarthy (para. 2.42), said that as soon as the first section was raised, she saw the fire spreading to the ceiling and thought that the whole of the back wall was on fire. The flame at this stage was shooting out beyond the West Alcove to the ballroom.

2.118 To Michael Nolan, who was on the dance floor at the corner of the stage in Area C and saw a relatively small fire in the West Alcove, it seemed as though the fire changed its character fairly suddenly, spreading through the alcove and towards the dance floor, as though a breeze had caught it. Deirdre Dames, who had danced to one record after the demonstration dance and had come off the floor, saw a crowd in front of the West Alcove and the glow of the fire through the blind. The section of blind nearest the Main Bar was then lifted and she saw flames shooting out.

2.119 Ruth Comiskey (para. 2.43) saw a doorman with a fire-extinguisher near the seats on fire and another doorman who ran down towards her and told her to get out. She moved as far as the cigarette machine and looked back and at this stage saw that the flames had travelled out from the alcove to the area in front of the blind and were up at the ceiling. Patrick Bride remembered Ruth Comiskey saying something to him about a smell of smoke, and thought the time of this was 01.40. He then saw one of the doormen move a section of the blind nearest the Main Bar. He saw about three to four seats in Tiers 6, 7 and 8 of Row A on fire. He could see a doorman running up the steps towards the flames and operating a fire-extinguisher as he (the witness) approached the cigarette machine and looked back. He then started to make his way towards the inner doors of Exit 2 and felt a sensation of heat from the alcove. At this point, the fire seemed to be spreading down further and the ceiling was on fire. A portion of it over Row D seemed to be collapsing and he could hear a cracking noise as of burning wood.

2.120 James Feery saw two doormen fighting what seemed to him to be a small fire in the West Alcove. The flames seemed to be coming from Row D and he remembered hearing the disc jockey asking people not to panic. He was in an aisle in the North Alcove at this stage and continued walking down between the tables on the dance floor to go out the main entrance. As he walked past the West Alcove, he said that the fire "spread quickly on out, like a flame-thrower, up towards the ceiling". The flames spread from Row D towards the Kitchen and across towards the main exit.

2.121 David Mulligan saw a fire on a seat in Tier 7 in either Row A or Row B. He could see this through the blind before it was lifted. He saw two doormen lift the section of blind nearest the Main Bar and then start to lift the remaining sections.

His evidence continued (*Volume 16, questions 65—77):—*

"Q. What happened to the flame you already said was on the seat at Step 7?

A. As soon as they raised the curtains the fire seemed to spread across

Q. Across to where?

A. From here down

Q. Towards the Kitchen?

A. Yes

Q. Along what did the fire spread. Was it along the seats?

A. Along the seats as soon as it hit the ceiling

Q. What?

A. It spread outwards

Q. When you say "it hit the ceiling" did the ceiling catch fire?

A. Yes

Q. What about the wall of the partitioned-off area, did that catch fire?

A. On the back here

Q. Yes?

A. I am not sure about that

Q. Did the wall catch fire as soon as the flame spread as you have said in the direction of the Kitchen?

A. Yes

Q. . . . .How soon after all the shutters were up did the ceiling itself go on flame?

A. Seconds . . . .

Q. Did you notice in relation to the ceiling which was alight how it burned?

A. Like plastic, just dissolved

Q. When you say it dissolved did anything come down from the ceiling?

A. Yes, there were pieces falling off the ceiling".

2.122 The pieces which he saw falling he described as being about the size of his hand. Some of them were flaming and some of them were ashen in appearance, as though they had already burnt. Bernadette Fullard also saw pieces of the ceiling falling after the five sections of the blind had been raised.

2.123 Eilish Carlyle was sitting in the North Alcove when she saw a fire on the seat in Tier 9 of Row A which was not very high and which two or three doormen seemed to be trying to extinguish. She was sitting at somebody else's table at this point and moved back to her own seat (which was also in the North Alcove) and got her bag. There was a lot of movement of people at this stage and she was pushed around a lot. She then went on to the dancefloor and from there could see the flames coming out from the West Alcove towards the dancefloor at ceiling level: the ceiling itself appeared to be falling in the area immediately in front of the West Alcove in small flaming drops. At the same time the flames in the alcove appeared to be covering the whole of the back wall. Alfred Reilly, who said that he took an extinguisher from one of the doormen (he thought Mr Bell), went into the alcove as far as about Step.7 in the aisle nearest the Main Bar, at which stage the fire began to spread very rapidly and he was dragged out by someone. He remembered the portion of the ceiling collapsing in the alcove at that stage.

2.124 Doreen Desmond was one of those who was dancing on the floor when a friend of hers, Margaret Lynch, pointed out a fire to her on the seat in Tier 9 of Row A. The section of

the blind nearest the Main Bar was up at that stage. She thought the fire would be controlled and went on dancing for about a minute. She then heard the DJ saying "don't panic", looked back in the direction of the fire and saw that it had gone about ten feet up the wall. It had also widened out a lot.

2.125 Nicholas Prior was also dancing when his friend, Patrick O'Keeffe, saw the fire and told him. He ran to his seat at Area C on the dance floor to get his coat, turned around and saw the ceiling falling in the area immediately in front of the West Alcove. He described it as being like balls of fire falling, while at the same time broken tiles also fell. At this point, the fire seemed to be spreading out at ceiling level towards the dancefloor. David Carroll, who was sitting in the North Alcove, saw smoke coming through holes in the ceiling and then saw flame coming from the direction of the Main Bar, giving the impression that the tiles on the ceiling were on fire and that the flames were approaching him rapidly.

2.126 Brian Baitson, who was with Patrick O'Keeffe and Nicholas Prior, remembered Mr O'Keeffe pointing to where there was a glow in the aisle between Rows A and B, a glow which was apparent through the blind, all the sections of which were down. He ran towards Exit 4, but as this appeared to be locked, he ran back in the direction of Exit 2 and as he did so saw that the sections of the blind in front of Rows A and B were up and that the whole of that area was on fire. He then met Nicholas Prior and a girl they knew who was looking for her sister. They had about half a minute's conversation, by which time all the seating in the West Alcove seemed to be ablaze. The three of them ran down the aisle from the Main Bar and towards Exit 4, at which stage the flame was shooting right across the ceiling over the dancefloor in a path five feet wide. It then retreated to about the centre of the dancefloor (at Area B) and continued to burn. Melting pieces of what appeared to be plastic were falling from the ceiling at this stage.

2.127 John Crowe, the charge-hand barman in Bar 2, was standing inside the bar when he saw two doormen running towards the West Alcove. He then saw flames on the back wall of the alcove and it seemed to him that the carpet tiles were on fire. He could not see any seats or tables on fire. At this stage, the section of the blind nearest the Main Bar was up. Black smoke then began to curl all round the dancefloor. Mrs Elizabeth Hunter, who was working in the same bar, also saw a doorman, whose attention had been attracted by a girl, going towards the West Alcove. She then saw a sheet of flame in the alcove reaching up as far as the ceiling and covering about a third of the area. Black smoke then began to come quickly across the dancefloor in the direction of the bar.

2.128 Peter McMahon, was standing in the North Alcove (at Area E) when he heard screaming. He turned round and looked towards the West Alcove, where he saw flame at the back wall shooting up towards the ceiling. He then went down to the dancefloor to get three girls whose coats he had been watching and succeeded in bringing one of them as far as Exit 5. The flames were affecting about a third of the back wall of the West Alcove at this stage, roughly in the centre of the alcove. He also saw part of the ceiling falling. Paula O'Connor was dancing on the floor when she thought she smelt smoke and then heard somebody saying that the place was on fire. She turned and saw a fire on the seat in Tier 9 of Row A, the flames from which were rising up to the ceiling. She ran first to Exit 5, and saw crates of bottles stacked against it, which made her think that she would not get out that way. She then turned in the direction of Exit 2 and at this stage saw "flames all over the place". She then went to Exit 6, where there were people banging and pushing the door, and this decided her to go back to Exit 5, through which she escaped. During this period, there were still people dancing on the floor.

2.129 Pauline Gaynor was dancing with Doreen Desmond (para. 2.124) when she noticed smoke all over the ballroom, which she assumed was some special disco effect. She then saw fire in the West Alcove giving her the impression that the whole blind was aflame. The fire seemed to be very near the ceiling and she ran towards it and saw that it was getting bigger. She then went to Exit 5, where there was a delay of about two minutes before the door opened. At this time she saw the ceiling in the Main Bar area on fire: pieces of

material were falling from it in the North Alcove (Area D). A line of flame was spreading across the ceiling at this stage towards where the witness was standing.

2.130 John Furley, a doorman, was standing at Bar 2 when he saw people looking towards the West Alcove and saw a fire on the seat in Tier 9 of Row A. The fire appeared to be on the two seating units nearest to the Main Bar. He walked towards it along the aisle from Exit 5 to the Main Bar, when suddenly black smoke came from the ceiling and he turned and went back in the direction of Exit 5. Gabriel O'Neill, another doorman, was with Mr Furley at the bar when he heard a girl saying "look at the fire". He thought that the back wall of the West Alcove and some of the seats were on fire and he then saw thick black smoke spreading through the hall.

2.131 Maeve Naughton, a waitress, was in the North Alcove when she smelt burning, looked over at the West Alcove and saw what she thought was the second section of the blind from the Main Bar up. The flames were about halfway down the alcove and "going very fast through rows of the seats". She said that she knew it was serious and was going to warn the patrons in the North Alcove when "a bang went over the ceiling".

2.132 Joseph McGrane, the washer-up in Bar 2 (para. 2.18), remembered John Crowe telling him there was a fire. He continued working for a short time and then saw smoke travelling across the hall at ceiling level towards him.

2.133 Colm O Briain, the disc jockey, said that as the winners of the competition were dancing on the stage, "Born to be Alive" and some other record were played. After that, he played approximately five or six records, but cut from one to the other so that no record was actually playing for more than a couple of minutes. He remembered looking at his watch, noticing that the time was approximately 01.40 and then seeing the fire. The second section of the blind nearest the Main Bar was up and he saw what seemed to him to be a very small fire in the area of the seats in either Tier 8 or 9 of Row B. He played another record and less than half a minute later looked over and saw that the fire had grown. The flames had got very high and he thought that the ceiling itself had gone on fire. The flames also seemed to be spreading in the direction of the Main Bar and there was smoke coming across the room. His account went on as follows:—

> "At that stage people were beginning to panic. I started into another record and they were beginning to move off the floor so I asked them not to panic. Just after that, I stayed on the stage for a while and some people sat down and when they noticed the fire getting bigger they just started to panic and move out and some people moved up on to the stage from the floor".

He said that what prompted him to make the announcement was that people were beginning to panic already. So far as he could recall the words he used were

> "don't panic, everything is under control. Move quietly to the exits".

2.134 He remained on the stage for about a further fifteen seconds and saw that the smoke was spreading down very far and that there were now flames over the entire of Rows B, C and D. Mr O Briain said that, while the dancefloor had been full at the beginning of the last sequence of records played by him, some people did begin to move off the floor at the time when he first noticed the fire. After he had finished his announcement, people began to move off the floor in large numbers, most of them in the direction of Exit 2. When he first made the announcement, some patrons went on dancing or sat down again at tables. He said that at the stage he made the announcement people were "panicking slightly" and that he made it because he was apprehensive that "panic" might develop.

2.135 The dense black smoke described in the evidence of many of the witnesses already referred to, filled the whole area; and the witnesses are agreed that it was at this time that the lights went out in the Stardust.

2.136 Mr Kinahan said that, having watched the fire for about two to three minutes, he pushed his way through the crowd, and went up the steps in the North Alcove and into the Lamp

Room, where he turned all the lights in the Stardust up full. He then came down the steps again to the Main Bar and at this stage saw a thick black cloud of smoke rolling across the ceiling in front of the North Alcove. At the same time he heard a loud bang and the lights went out.

2.137 Some patrons in the ballroom noticed a momentary increase in light before the lights failed. But the spread of thick black smoke through the Stardust immediately prior to the failure of the lights rapidly obscured what light there was. At the same time, as the flames spread, there was increased light from them. These factors for some people lessened the impact of the failure of the lights inside the Stardust proper: by contrast, in the main foyer and the corridor leading to outer Exit 3, the lights failed before black smoke had filled the area and the impact of their failure was correspondingly greater in those areas.

IX — ATTEMPTS AT ESCAPE

2.138 Mr Thomas Kennan said that, having decided that the fire was not going to be controlled, he ran up the steps in the North Alcove beside the Lamp Room, shouting at patrons in that area to leave. He then left by Exit 1 (see para. 3.4). Some other patrons and staff members also gave evidence of leaving by this exit. A small number of people also left by Exit 6 at this stage.

2.139 In the early stages of the fire, a steady trickle of people continued to leave via Exit 2. At the same time a group of people formed in front of Exit 4 and a larger group in front of Exit 5. The group in front of Exit 4 swelled to approximately thirty or forty before the doors eventually opened. This appears to have happened not much more than a minute after all the sections of the blind had been raised and the fire became apparent to most people in the ballroom. There was a longer delay and a larger crowd at Exit 5, which at one point stretched as far as half way along the aisle from Exit 5 to the Main Bar. The black smoke had, however, filled the ballroom and the lights had failed before the doors opened. Another crowd of people had made their way into the corridor leading to the outer door of Exit 3 and approximately half-filled this corridor while again the doors remained closed. Smoke had filled a portion of the corridor and the lights had failed by the time the doors were opened, which appears to have been at least two minutes after all the sections of the blind had been raised, and possibly as much as three minutes after that.

2.140 At the time the disc jockey's announcement was made, the steady movement of people in the direction of Exit 2 turned into a rush of large numbers of people. Within a very short time, the foyer was crowded from the outer doors to the inner doors and a further crowd of people attempting to get out built up in an area between Bar 1 and the West Alcove. The flames were now sweeping across the ballroom, which was filled with thick black smoke, and the lights had failed, while the ceiling continued to collapse. People's movements inside the ballroom became increasingly confused and random as they ran from one exit to another.

2.141 A number of witnesses described the crowd at Exit 5 as pushing and struggling in an effort to get out, many of them becoming hysterical and screaming while some were knocked to the ground. As the black smoke filled the ballroom, some passed out and had no recollection of anything further until they were outside. Similar but less extreme conditions prevailed at Exits 4 and 3. It was at Exit 2, however, that the worst conditions appeared to have been experienced. (For a detailed description of conditions in the foyer at Exit 2, see paras. 3.5 to 3.8).

2.142 A number of people found their way into the toilets in the Stardust. They did so in some cases because they mistook them for exits, in some cases as a refuge from the conditions of smoke and heat in the ballroom, and in some cases because they were brought or dragged in by other people.

2.143 Deirdre Dames (para. 2.118) was running towards the main door when the lights went out and she fell. When she got up, she could not see where she was going and went into

the ladies' toilet (Door 13). Smoke was coming into the toilet which made her sick. There were two other people in the toilet, a man and a woman, and all three of them were screaming and banging on the walls. She could not go out through Door 13 because, when she tried to open it, she could see flames coming in. She and the other two persons remained in the toilet until they were rescued by a fireman.

2.144 Jean Hogan was also running in the Direction of Exit 2, but her path was obstructed by the crowd of people which had formed between the West Alcove and Bar 1. At this point that crowd was backing up as far as the corner of the stage opposite the seats at A. A girl pulled her through the crowd and into a door which she thought was the door of Exit 2 but turned out to be the door of the men's toilet (Door 12). Apart from herself and the other girl, there were about eight or ten people in the toilet, all of whom were coughing and one or two of whom were vomiting. Very thick smoke was coming into the toilet and some of those inside were screaming. She and others hammered and beat on the windows and eventually someone opened the door in the hope that they might get to Exit 2. She could see at that stage the actual door frame aflame and everything outside in flames. More smoke came in and the witness, who was now very frightened, lay on the floor. She and the others were eventually rescued by firemen. A number of people also found themselves in the toilets on the east side of the building (T6 and T7) and remained there until rescued by the firemen. The disc jockey, Mr O Briain, after leaving the stage, took refuge in a toilet behind the stage (T4). He eventually left this and got to the corridor of Exit 3 via the passage behind the stage.

X — THE FIRE AS OBSERVED FROM OUTSIDE THE BUILDING

2.145 Mr Christopher Holt, an employee of the security firm, Apollo Securities Ltd, retained by the owners, was in a hut near the front of the building, from which he had been conducting regular patrols during the course of the evening. He said that he left the hut at approximately 01.15 and went around the building for a period of approximately ten to fifteen minutes. During the course of this patrol, he saw and heard nothing unusual. He said that he next left the hut, according to his watch, at 01.45, but said that the watch was approximately two minutes fast and that the time was probably more accurately 01.43. As he did so, he heard from the building a voice over a loud-speaker saying "don't panic, don't panic". He looked in the direction of the building and saw first black smoke and then a red glow over an area which he estimated was approximately the centre of the dancefloor. After a period of time, which he estimated to be at least a minute and possibly as long as two to three minutes, he saw Exit 4 open and people come out. At the same time, he heard some banging on the door of Exit 3 and after approximately a minute people came out of that exit also.

2.146 Mr. Robert O'Callaghan, a taxi driver said that he picked up a fare at the Adelphi Cinema in Abbey Street at approximately 01.20 on the night of the fire, and brought him to the area of Beaumont Road near the Stardust. He said that as he was waiting for the fare to get money from his house to pay him, he looked at the clock in the taxi and saw that it was 01.30. He then went towards the Stardust with a view to collecting fares from there, and drove towards it via Skelly's Lane. As he came to the junction with Skelly's Lane, he saw a red glow in the sky. Driving towards the Stardust itself, he saw flames above the building itself, about "the size of a house". At this stage, he was approximately 100 yards from the building. He drove into the concreted area and parked his car on the west side of the building. He said that at that side of the building—in the area of the Lantern Room—he could see the lights as of a disco from the windows and could hear music. He then went towards the front of the building in the direction of the main entrance and saw people, whom he described as elderly or middle-aged, coming out the door with drinks in their hands. He told them that there was a fire and they said that they knew this. One of them told him that he should get his taxi out of the way and he reversed it to nearer the west entrance from Kilmore Road. Some girls then asked him if he was a taxi man and, on learning that he was, asked him to take them to their destinations, which he did.

2.147 It is clear that the door from which Mr O'Callaghan saw people coming out with drinks in their hands was the emergency exit beside the stage in the Lantern Room and not Exit

Plate 18 — *Photograph taken by a local resident during the fire. Flames may be seen to right of centre rising above the roof of the building.*

2. While he remembered seeing at least one girl coming out screaming, he said that she seemed to be more over-excited than anything else, and he did not recall seeing any panic-stricken crowds in the area.

2.148 A number of residents in the area heard or saw the fire from their homes. In most cases what first attracted their attention was a noise as of crackling or banging, which in some instances they likened to shots being fired. At this stage, they could see from their houses smoke and flames rising from the roof of the Stardust. (The nearest house on Maryfield Drive is approximately 52 m from the building). The times at which these witnesses recalled having first heard or seen the fire varied widely from 01.21 to 01.40. Some of them said they remembered looking at clocks or watches and some recalled having watched television and then gone to bed before they were awoken by the noise. In two cases, the witnesses said that they watched a film on television which did not end until at least 01.20. The television stations whose programmes are normally received in the Dublin area had closed down well before that time, with one exception. According to information supplied by the BBC to the Tribunal, a film was, in fact, being transmitted by BBC Wales on that evening which did not finish until 01.33.

2.149 A more precise timing was given by Mr Alan Buffini. He lives at 8 Maryfield Drive *(see Plan 1, Appendix 15)* and is a post-graduate music student. He was listening, during the course of the night, to music on tape on a stereo machine. The pieces he was listening to were examination pieces and he was concerned to time them; and for that purpose, as he removed the ear-phones, he looked at the clock and saw that it was 01.38. As he took them off, he heard a crackling noise, left the room and went out the back door. He then saw some of his neighbours, including Mr Anthony Pasquetti, standing at the garage next door. At this stage, he could see sparks and dense black smoke from the top of the Stardust building *(Plate 56).* He then got up on the garage and saw a large flame where the sparks had been *(Plate 55).*

2.150 Mr Pasquetti, who lives at 10 Maryfield Drive, left his girl friend's house in Coolock at approximately 01.30. He said it took him about five minutes to go home and he was about to put his car into the garage when he heard shouting and screaming from, as he thought, the back lane. He turned off the engine and heard more screaming. He then ran into the garden from where he could see people running down the fire escape from Exit 1. He could hear a crackling noise coming from the building at this stage and could see black smoke, but he could not see any flames. He then ran up to his parents' bedroom, and told them there was a fire; from there he could see a glow coming up through the roof. He then went downstairs into the garden with the intention of getting up on the garage to get a better view of the fire and at that stage flames were coming through the roof. As he got up on the garage (where he was joined by Mr Buffini) the flames were getting larger.

2.151 Maria Blair, who lives at 6 Maryfield Drive, (two houses away from Mr Pasquetti) remembered hearing a noise at about 01.40. She went out into the garden and looked in the direction of the Stardust. She could see flames above the roof of the building. She got up on the garden wall to get a better view and could see people running down the fire-escape stairs from Exit 1. Her father, Thomas Blair, heard a noise at a time which he could not estimate with accuracy other than that it was between 01.30 and 01.45; he went up to his bedroom, from which he could see flames coming from the building. He was interested in photography and, not realising there were people in the building at the time, he went out on the road and took a photograph of the fire *(Plate 18).* He then went back into the house and, finding his wife dressed, left with her for the Stardust. On the way out they had a conversation with their neighbour Mrs Kelly which she placed at 01.35.

2.152 A number of patrons who left through Exit 2 in the early stages of the fire without difficulty, such as Pamela McGuinness and Sharon O'Hanlon (para. 2.108) said that after a relatively short period, which Miss McGuinness thought was not more than a minute or two, a large number of people started to pour out of the outer doors of Exit 2. The doors were open but then closed for a relatively short period which may have been only a matter of seconds. When the doors re-opened there was a further large exodus of people. In the case of both groups, there were a number of people whose faces were blackened by smoke

and who were giving other indications of distress. At the same time, banging and screaming could be heard from the windows of the toilets (Tl and T2). People still inside the building could also be seen at this stage breaking the glass over the front of Exit 2 and climbing out on to the canopy. From this period onwards, the scene outside the building, as described by the eye-witnesses, was one of increasing disorder and confusion.

2.153 The noise of crackling which was heard by the residents (para. 2.148) was also heard by some of the patrons who made their escape at an early stage. They, too, observed the flames shooting through the roof at this point. David Murray said he was outside the building for two minutes at the most when he heard the noise, looked up and saw flames coming out of the roof. Lorraine Brady, who escaped at a slightly later stage, said that some time after she got out she saw fire coming from the roof which had not been there before.

2.154 James Shortall left the Stardust at a time which appears to have been 01.40. Mr Downes was still at the outer door and there were no indications of any sort of fire as Mr Shortall made his way to his car which was parked near Exit 1. As he came round the corner of the building on the west side, he noticed smoke coming from the roof which he assumed to be from the Kitchen. He then went on to his car, removed frost from the windscreen, sat in it and started the engine. As the car started, he saw the door of Exit 1 being pushed open "fairly sharply". Black smoke then poured out followed almost immediately by a crowd of people, one of whom shouted for light. He then shone his car head lights on the fire escape stairs. He had to move his car out of the way of other cars on to Kilmore Road and, having parked it, went back towards the building. As he did so, he could see the roof on fire.

2.155 Those who were at the front of the building saw the outer doors of Exit 3 opening and a crowd of people pouring out and jumping or scrambling over the small wall and rail at the head of the flight of steps, their passage being obstructed by a white van parked at the foot of the steps (see para. 3.104). This appears to have happened not less than two minutes and not more than four minutes after the first patrons had left by Exit 2 without any difficulty. Exits 4 and 5 appear to have been opened shortly before Exit 3 (see para. 3.63). Exit 6 appears to have been opened as the fire increased in intensity in the West Alcove, probably at about the same time as or shortly before Exits 4 and 5. More congestion was experienced at Exit 5 than at exits 1, 3, 4 or 6 (see para. 2.139).

2.156 A number of the patrons and staff who escaped went to their homes or the houses of friends or elsewhere. There remained outside the building, however, a crowd of several hundred which was swelled by residents and others in the neighbourhood who hastened to the scene. The confusion and disorder already referred to increased as many of the crowd, physically and mentally shocked by what had occurred, milled aimlessly around the building, many of them screaming and hysterical. Some of the crowd were endeavouring with some degree of success to force their way back into the building to help out injured people. Some of those who had already emerged from the building were clearly seriously affected by their injuries, and were laid on the grass by their friends or other helpers while the arrival of the ambulances was awaited.

2.157 Some of the patrons who made their escape from the exits on the eastern side gave accounts of what they could see happening inside the building at this stage. Some of them, at considerable personal risk to themselves, went back into the building to help people out.

2.158 Damien Fallon (para. 3.30) saw people whose clothing was burnt leaving Exit 5 and said that he could see a girl about five to ten feet inside the exit running in circles as a ball of flame fell on her from the ceiling. David Carroll (para. 3.38) who escaped through Exit 5, said that as he looked back into the building through that exit, he could see seats on fire in the east section of the North Alcove. The ceiling was aflame over this area and particles of fire were falling on people. He remembered one girl in particular lying on the floor as material fell from the ceiling on her, and her dress went on fire. He could also see people crawling on top of each other in the seats at the east section of the North Alcove. He at

one stage went a few feet inside the door and helped people out, but ultimately the heat became too intense.

2.159 Raymond English who escaped without difficulty through Exit 5 (see para. 3.38) said that he then went round to the Silver Swan to see if anyone had called the fire brigade. He came straight back to the area of Exits 4 and 5 and was standing there for a few seconds when the lights went out. His account continued:

> "there was a few fellows standing in front of the door. There was a girl inside crawling out. Her clothes were on fire. They were trying to figure out some way of getting her out. She was a few feet from the door .... I stopped to see if I could help. They couldn't get near. The heat drove them back".

2.160 Martin Quinn escaped through Exit 5 while the lights were still on (see para. 3.41). Having got out, he looked for his sister and could not find her. He then went back in through Exit 5 and managed to get in a few feet. He helped a girl out whose skirt was in flames, putting his jacket round her. He then went back in, but the heat was too intense and he had to leave. There were people lying on the ground burning between the eastern section of the North Alcove and the stage in Area C.

2.161 Harry Mahood also went out through Exit 5 behind about thirty or forty other people. Having got out, he helped to pull other people out of the exit and in order to do so went about 10 or 15 feet inside the door. He went on—

> "there was one girl coming towards us and she just went up in flames and hit the ground and when she stopped moving I went away".

He said that this girl was about 15 or 20 feet inside the door, but the heat was so intense that he could not get near her.

2.162 Similar attempts were made by some of the patrons to get their friends out from the corridor leading to Exit 3 after the doors had opened. There was a greater concentration of activity, however, at the windows of the toilets (Tl and T2) where screaming and banging could still be heard from inside, and members of the public with various implements were attempting to remove, or make an opening in, the steel plates welded to the windows.

2.163 This was the scene that met the first unit of the Fire Brigade to arrive. The first appliance actually on the scene (from Kilbarrack FS) sent a message to Tara Street FS by radio on their arrival which was recorded as having been received at 01.51. It was followed almost immediately by another unit from North Strand FS and over the course of the next three to four minutes four more appliances, including an emergency tender, arrived. The first appliances to arrive found difficulty in getting through the crowd, and, in the case of that from Kilbarrack FS, it was further impeded by the security barrier on the east side of the building. This was forced open by a number of people and that appliance then went to area of Exit 5.

2.164 The fire-fighting and rescue operations are described in detail in Chapter 4. At this point, it is sufficient to say that they were initially concentrated on the east side of the building and at the front. The first units had seen the flames above the building as they arrived; and as they commenced rescue operations the outer doors of Exit 2 appeared to be on fire, according to Station Officer Parkes, and flames were coming right up to the door of Exit 5 according to Station Officer Mooney.

2.165 At this stage, the fire had reached its peak of intensity. The first firemen to enter the building came from the second appliance and did so as soon as they arrived. It took them at least three or four minutes to get the injured people out, and during this process the first dead bodies were discovered inside the building. Thereafter rescue operations and the playing of water on the building went on as the fire continued to subside. The first ambulance arrived at between 01.53 and 01.55, and the process of taking the injured to

various hospitals in the city began. The first Garda car arrived immediately after the first units of the Fire Brigade.

2.166 The first phase of the Major Accident Plan which was designed to co-ordinate the actions of the various emergency services (see para. 4.88) was activated at 02.06 and the second phase at 02.12. Approximately ten minutes later a systematic search of the building was conducted by the fire brigade officers and the remaining dead bodies removed from the building. The firemen moving through the building continued to find occasional small pockets of fire which they extinguished, but it is clear that the fire had been completely put out by 02.54 at the latest.

XI —CONCLUSIONS

(1) The Earliest Observation of the Fire

2.167 The earliest indication to persons inside the Stardust of the fire appears to have been a feeling of heat on the part of some of the patrons sitting in front of the West Alcove. No one gave evidence of having noticed this—or indeed any other sign of fire—during the disco dancing competition, although some patrons were standing on the ledge in front of the West Alcove with their backs in physical contact with the blind during the competition. As the competition probably ended not later than 01.30, Linda Bishop's evidence that she looked at her digital watch shortly after becoming aware of the heat and noted the time as being 01.33, may be taken as giving a reasonably accurate indication of when this feeling of heat first became apparent.

2.168 The next indication of the fire was a smell of smoke or burning, which was particularly noticeable in front of the West Alcove and the Main Bar, but was also detected in the North Alcove. The first appearance of smoke in the area of the blind appears to have been at approximately the same time, although it was not observed by all those who noticed the smell of smoke or burning.

2.169 The next indication of the fire was its visual appearance behind the blind, either in the form of a glow observed through the material or the actual flame itself seen through the gaps between the sections. This happened almost immediately after the detection of the smell of smoke or burning and the appearance of smoke.

(2) The Location and Extent of the Fire when First Observed

2.170 The fire when first seen in the Stardust was in the section of the West Alcove closer to the Main Bar than to the Kitchen. Within that area, most witnesses agreed in placing it in the corner of the alcove formed by the back wall and the wall of the Main Bar. There were different versions as to where within that area it was located when first seen: to some, it appeared to be on the hack seat in Row A, to some on the back seat in Row B, to some on the second or third seat in either of those rows and to some on the back seats in both rows, even extending to the back seat in Row C and, in some cases, as far as Row E. There are also those who thought it was occupying the first two seats from the back in both rows. In choosing between these different versions, it has been necessary to bear in mind the opportunities of observation of the eye-witnesses concerned and their reliability as witnesses. Viewed in this light, the evidence indicates that the fire when first seen appeared to be located on the back seat in Row A. The evidence also indicates clearly, however, that it was spreading with great rapidity to other seats in the immediate area; and may have been present simultaneously on one or more of the other seats, although at a point or points where it could not be seen by the witnesses who thought it was confined to one seat.

2.171 The extent of the fire observed by the witnesses on its first appearance is considered in more detail in Chapter 6. At this stage, it is sufficient to say that most witnesses agreed in describing it as "small" and apparently capable of being easily extinguished. Virtually without exception, however, they were agreed that it occupied at least one seating unit and extended a distance of anything from six inches to two feet (150 mm to 600 mm)

above the back of the seat. The flames, as observed by the witnesses, did not appear to be reaching the ceiling at this point; nor did the carpet tiling on the back wall appear to be ablaze. There was little visual indication of smoke in the alcove at this stage, although smoke, of course, had already been observed by witnesses at the ceiling level in front of the alcove and in the North Alcove.

(3) The Attempts to Extinguish the Fire

2.172 The alarm of fire was given in the foyer at 01.42, this time being fixed by the telephone call made by Mr O'Toole. The first person to shout to those in the foyer that there was a fire was probably Mrs Prizeman, followed almost immediately by Mr Murphy. This was within a few seconds of the appearance of the fire behind the blind, detected by the patrons either in the form of a glow or the actual appearance of flame through the gap in the blinds. It was accompanied virtually simultaneously by the giving of the alarm by Mrs Brady to the staff in the Main Bar.

2.173 The first doormen to arrive on the scene were Mr Murphy, Mr Doyle and Mr Bell, followed fairly closely by Mr Kavanagh. Within a matter of seconds of their arrival, a section of the blind was lifted and it seems most likely to have been the section nearest the Main Bar. Over the immediately following period of from one minute to two minutes, attempts were made by three of the doormen, Messrs Murphy, Doyle and Kavanagh, to put out the blaze with extinguishers. At the beginning of the period, Mr Neville, having seen the first section of the blind up and the extent of the fire, went into the Silver Swan and telephoned the Fire Brigade, at a time which is recorded as 01.43.

2.174 During the period of one minute to two minutes while the attempts at fire-fighting were going on, the remaining sections of the blind were lifted. This brought the fire to the attention of a substantially larger number of people in the Stardust and the small crowd of perhaps twenty to thirty people who had gathered in front of the first section of the blind rapidly swelled to a large crowd. At the same time, a large number of patrons were still dancing.

(4) The Spread of the Fire

2.175 The doormen were joined at one stage in their attempts to extinguish the fire by at least one patron and one or two of the barmen. Inside the alcove, however, the temperature rose rapidly, forcing the fire-fighters to retreat. As they did so, the flames spread suddenly and rapidly to other parts of the alcove and at ceiling level into the ballroom itself. At the same time, portions of the ceiling in the alcove began to collapse and clouds of black smoke poured into the ballroom from the alcove.

2.176 Immediately before the dramatic spread of fire just referred to, some of the patrons had moved rapidly in the direction of the exits, most of them going to Exit 2, but some, following Mr Kennan, going to Exit 1 and some to Exit 6. The disc jockey, Mr O Briain, observing this, lowered the volume of music which was still playing and, over the public address system, said

> "We have a slight problem, don't panic. Walk to the nearest exits"

or words to a substantially similar effect.

His announcement, however, virtually coincided with the dramatic increase of the fire and "panic" immediately followed. (It does not necessarily follow, of course, that the announcement caused the "panic".) This took the form of a rush of people towards Exits 2, 5 and 4, with a particular concentration of people moving in the direction of Exit 2.

2.177 Within the period of the next two or three minutes, the smoke and flames already observed sweeping through the alcove and at ceiling level into the ballroom, swept through the whole of the ballroom. The ceiling began to dissolve all over the area of the ballroom in the form of particles, some of which appeared to be flaming as they reached the floor or furniture.

2.178 During this period and almost immediately after the spreading of black smoke through the ballroom, the lights failed. This sharply accentuated the already existing state of "panic": many of the patrons did not know what part of the ballroom they were in, and found themselves moving into toilets in the belief that they were moving through exit doors. Acute congestion was now being experienced at the inner doors of Exit 2 and the foyer itself was packed to capacity with people who were unable to move out through the outer doors.

(5) Sequence of Events and Time-Table

2.179 It is possible at this stage to construct the following time-table of events in the Stardust on the night of the fire. For the reasons already given, many of the times are extremely problematical and conjectural; the greatest reliance can obviously be placed on the interrupted call about the handbag at 01.42, the 999 call for the fire brigade at 01.43 and the reporting by the first fire appliance to arrive of its arrival at 01.51.

Time	Indications of fire	Events in Ballroom	Music and Announcements	Telephone calls	Activity of Staff and Patrons
01.15		Disco Competition begins			
01.16					Staff have final break in West Alcove
01.17					
01.18			"Born to be Alive"		
01.19					
01.20					
01.21					
01.22					
01.23					
01.24					
01.25		Last meals served Disco competition ends			Mr Kinahan in West Alcove
01.26		Announcement of winners			
01.27					
01.28					
01.29			"Born to be Alive"		
01.30					
01.31	Increase in heat felt by Linda Bishop and Sandra Hatton				
01.32					
01.33					
01.34					
01.35					
01.36					
01.37					
01.38			"Lorraine"		

Time	Indications of fire	Events in Ballroom	Music and Announcements	Telephone calls	Activity of Staff and Patrons
01.39					
01.40	Smell of smoke Smoke visible at ceiling level				
01.41	Flames visible behind blind. Fire appears to be on one seat only		"Adam and the Ants"		
01.42	Fire spreading to adjoining seats			999 call to police about lost handbag	First section of blind raised, Mrs Prizeman gives alarm in foyer
01.43		Exit 2 opened by Mr Downes Exit 1 open Exit 6 open		999 call to Fire Brigade	Attempts at extinguish-ment All sections of blind raised
01.44	Flames at ceiling level Ceiling collapsing in West Alcove. Black smoke appears	Exit 2 closed	Announcement by Disc Jockey		Abandonment of attempts at extinguish-ment. "Panic" in ballroom
01.45	Flames all over Alcove. Black smoke filling ballroom. Flames at ceiling level in ballroom Ceiling collapsing in ballroom	Exits 4 and 5 open Lights fail Exits 1 and 6 clear of people Exit 2 open Exit 4 clear of people			
01.46	Fire venting through roof of building.	Exit 3 open Exit 5 clear of people Exit 3 clear of people			
01.47	Seats and tables in North Alcove on fire				
01.48					
01.49	All of ballroom on fire				
01.50					
01.51	Flames at outer doors of Exits 2, 4 and 5 Fire diminishing	Fire Brigade arrives.			

2.180 Making allowances for the tentative nature of this time-table, it seems reasonably clear that the development of the fire as observed by the witnesses can be divided into five distinct phases.

(i) ***From the earliest observation of fire to the raising of the first section of the blind***

2.181 During this period, the fire appeared to be confined to one or possibly two seats and seemed to the onlookers to be small and easily controllable. It was not, of course, actually seen until towards the very end of this period and could have been considerably smaller when first detected by a feeling of increased heat, smell or the appearance of smoke. If the first indication of the fire was the sensation of increased heat, this period could have been as long as ten minutes.

(ii) ***From the raising of the first section of the blind to the abandonment of the efforts at extinguishment***

2.182 During this period, which cannot have lasted more than two minutes, the fire spread to at least two or three more seats and appeared to the onlookers to change from a small and controllable fire to one which was not controllable and was accompanied by intense heat. At the very end of this period, the flames reached the ceiling itself and began to travel out into the ballroom, portions of the ceiling in the West Alcove collapsed and thick black smoke began to appear in the ballroom for the first time.

(iii) ***From the abandonment of the efforts at extinguishment to the failure of the lights***

2.183 This period which was shorter than Period (ii) did not last for more than a minute and a half and was possibly only a minute in duration. During it, a number of events happened either simultaneously or in extremely rapid sequence. People began to move in an increasingly rapid and confused manner towards the exits (the "panic" referred to by many witnesses), the disc jockey made his announcement, the fire spread to the greater part of the West Alcove, the black smoke filled the entire ballroom and began to penetrate the main foyer and corridor at Exit 3, and the lights failed. During this period also, the flames were travelling across the ceiling of the ballroom itself, and that portion of the ceiling also was beginning to collapse.

(iv) ***From the failure of the lights to the beginning of the rescue operations***

2.184 At the beginning of this period, which probably lasted about five to six minutes, the fire broke through the roof of the building. During the course of it the fire reached its peak of intensity, and most of the furniture in the Stardust went on fire, including the seating and tables in the North Alcove and on the dancefloor. Towards the end of the period the fire inside the building began to subside.

(v) ***From the beginning of the rescue operations until the extinguishment of the fire***

2.185 During this period, the fire continued to diminish until it was completely extinguished not later than 02.54.

CHAPTER 3

The Evacuation of the Building

CHAPTER 3

The Evacuation of the Building

I — INTRODUCTION

The legally permitted maximum occupation of the Stardust was 1,458 persons. The evidence established (see para. 3.66) that at the time the fire was first observed there were more than 800 people in the ballroom. It was of crucial importance, accordingly, that the conditions existed for the prompt and orderly evacuation of the premises in the event of fire.

Such arrangements in a premises of this kind should take three forms. In the first place, there should be proper precautions to prevent the spread of the fire. In the second place, there should be proper provision for means of escape such as passages, doors and staircases so arranged, protected and indicated as to ensure, as far as possible, safe escape; and appropriate lighting arrangements including proper provision for emergency lighting. In the third place, there should be proper organisational precautions, such as the provision and training of staff and the establishment and maintenance of evacuation procedures and fire routines, drills and practices.

This Chapter considers the extent to which the second and third form of arrangements were in existence in the premises on the night of the fire. (The spread of the fire is dealt with in Chapter 7). It begins with a reconstruction from the evidence of the manner in which the building was evacuated.

The various factors which might have affected the evacuation are then considered in turn viz.:—

(1) the suitability of the means of escape;

(2) the condition of the means of escape;

(3) the failure of the lighting;

(4) the behaviour of the staff; and

(5) the behaviour of the patrons.

II — THE EVACUATION AS OBSERVED BY EYE-WITNESSES

(1) Inside the building

Exit 1

Mr Thomas Kennan said that, when he first saw the fire, he ran up the steps between the North Alcove and the Lamp Room shouting at patrons in that area to leave. He said that he went through the inner door of Exit 1, along the passageway, and arrived at the outer door. He pushed it open without any difficulty and a number of patrons who had followed him went out on to the fire-escape steps. He said that he tried to go back along the corridor to the inner door, but that the smoke was too thick. Some other patrons and staffmembers

Plate 19 — *Main entrance as seen from inside the Main Foyer.*

gave evidence of leaving by this exit. None of them said that the exit was locked, chained or otherwise obstructed.

Exit 2

3.5 Mr Frank Downes, the doorman on duty at the outer door of Exit 2 (para. 2.14) said that when he saw grey smoke coming from the inner door into the foyer, he immediately unlocked the outer door. (The steel shutter which covered the outer face (para. 1.62) had been put by him, he said, into the "up" position at about 01.30. Immediately prior to that it had been in the half-way down position). He said that, with the intention of keeping the door open, he folded both leaves back in the ballroom direction. He secured the right-hand leaf (as one faces the door from the foyer) by lifting up the edge of the mat in the well, and the left-hand leaf by putting the bolt down into the gap between the lip of the well and the mat. People then started to move through the door *(see Plate 19).*

3.6 Mr Downes said that a few seconds later he heard a scream from the ballroom followed by a sudden rush of people into the foyer. The lights then went out and what he described as "complete panic" ensued. The evidence established that for some time after this, which may have been from two to three minutes, the foyer was completely jammed with people who were not succeeding in getting out. Thick black smoke rapidly filled the foyer, the lights failed and the struggles of people to get out increased in vigour and desperation as apprehension grew.

3.7 Many people were knocked to the floor at this stage and found others walking over them. Some found themselves pushed up the staircase and being pushed back down into the hall again. One of them, Anthony Preston, said that he broke the windows over the main entrance and escaped that way. Kathleen Fennell said that she was knocked to the ground and climbed over the bodies of semi-conscious people into the Cloakroom, where there were seven other people. She managed to climb back into the foyer and eventually found herself out in the open air. A number of people described themselves as having been carried out in the crowd and finding themselves in the open air. Some people said they found it easier to breathe when lying on the floor: the smoke appeared to remain at an upper level.

3.8 Some people gave evidence that the outer doors were shut for at least some of the time while they were in the foyer. Some patrons could also hear people banging and kicking on what they assumed to be the front door. Mr Downes said that he himself was wedged into the corner of the wall and the door at the outer doors by the pressure of the crowd. He said that when he eventually did get out he went back up the steps and tried to pull people out from inside the foyer. He also tried to stop people going back in. He then spent a minute or so wrestling with Alfred Reilly (para. 2.91) at the grass verge opposite Exit 2 in an effort to prevent him from going back into the building. When he looked back he saw that the doors were closed. He said that he did not know how this happened, but that after a short time they opened again and more people came out. Bernadette Fullard, a patron, said that when she got to the front door the steel shutter in front of the centre leaves was half-way down. A doorman, whom she knew as Mick, said that he could not let people out because of the danger of letting in a draught. She said that she got out by crawling under the shutter; (but see para. 3.5).

Exit 3

3.9 Mrs Joan Flanagan, Mrs Maureen Brazil and Mrs Christina Fullam said in evidence that, having seen the fire while they were outside the ladies' toilet (T1), they went at once to Exit 3. When they were in the corridor leading to the outer doors, the lights were still on. They said that there was no one else in the corridor when they reached the outer doors. Mrs Flanagan said that she remembered Mrs Fullam fumbling with a chain and lock and saying "the bloody door is locked". Mrs Fullam remembered seeing a padlock on the door, but could not remember any chain. Mrs Brazil did not remember the lock or chain. Mrs Flanagan and Mrs Fullam, however, remembered that after they had been standing at or near the outer door for a relatively short time, three young men came

running down the passage shouting "no panic, no panic". The young men then proceeded to kick the doors for the space of about a minute, at which point the doors opened, but not more than a foot. After they had kicked them for a further minute, the doors burst open completely.

3.10 Anthony McDonald, one of the disc jockey's assistants, said that he was on the stage when he saw the fire in the West Alcove. He went down to one of the dressing-rooms behind the stage (DR3) and told the people there—three in number—that there was a fire "out there". He then returned to the stage and saw that the ballroom was full of black smoke. He went down the passage behind the stage to the corridor of Exit 3 through Door 11. He saw two girls in the corridor who said "it is locked"—referring to the outer door. When he got to the outer door, he found that a chain was wrapped around the bars on both leaves and joined by a lock. He tried to open the door by pushing down the bars, but failed. He then pulled at the chain and started kicking the door. Some other people joined him in kicking the door, which opened "a little bit" after about two minutes, and then opened fully.

3.11 Yvonne Keogh (para. 2.38) said that on hearing the disc jockey's warning, she went to Exit 3 and encountered thick smoke in the corridor. She saw two men trying to kick the doors open, at which point the lights failed. The doors then opened and she got out. Linda Higgins (para. 2.40), was pushed out of the main foyer back into the ballroom, and then went to Exit 3. She saw a crowd of people gathered at the outer doors, which were being kicked by two men. She decided that she was not going to get out by that exit and went back to Exit 2 through which she was carried to safety by the crowd who were at that stage in what she described as a state of "panic".

3.12 Paul Keogh saw a crowd moving towards Exit 2 and then, having seen the fire, went to Exit 3 and saw a man trying to open the outer door. He joined him and kicked the left-hand door above the bar. It opened a few inches on the left and then, after approximately a minute, during which he, the other person and a third man who had joined them continued to kick it, it opened fully.

3.13 Gerard Donohoe said that, having seen the fire in the West Alcove and heard an announcement by the disc jockey, he watched the fire for about two minutes. He then went to Exit 3 and saw six men kicking the outer doors, both leaves of which flew open after approximately half a minute. He said that approximately ten to fifteen people were in the corridors in front of him and that there was no great rush for Exit 3; most people were heading for Exit 2.

3.14 David Weldridge, who admitted to being drunk at the end of the evening, said that he was the first person to arrive at Exit 3. He could not open the door and he kicked it and got out in about two to three minutes. He said that there was no chain on the left-hand leaf. Paul Foley, having seen the fire spreading to ceiling level from the West Alcove initially, went to the door of one of the toilets (Door 12) and then felt weak. He was pulled into the corridor leading to Exit 3 and recalled seeing a big lock and chain across the exit door. The person with him handled the lock and tried to open the door without success; they then both kicked the door, and were joined by a third man who also proceeded to kick the door, and then by one or two others who did the same. The door opened "a bit" and then, after about twenty seconds, opened fully.

3.15 Trevor King, having seen the fire in the West Alcove, went to Exit 3. There were about ten to fifteen in the passage ahead of him. He did not see a lock or chain on the door. He kicked the doors once or twice and they then broke open and he was carried out by the crowd. Joseph Heapes also saw the fire in the West Alcove. A crowd of people who were looking at it watched it for about half a minute and then began to move. At that stage, he went towards Exit 3 and the lights failed. He went to Exit 2 and was pushed by the crowd there into the Cloakroom and then went back to the ballroom. At this stage, he was in a state of panic and went first to the ladies' toilet and then the men's toilet. He eventually found himself in the corridor of Exit 3, where he heard somebody shouting "the door is locked" and was conscious of heavy smoke. When he got to the door a number of men

were kicking it and he formed the impression that it was slightly open since he felt cold air coming in.

3.16 Jean Fitzsimons, having seen the fire ran to Exit 3, at which stage the lights failed. She waited for approximately a minute at the door of the men's toilet (Door 12). She could hear kicking or banging from where she stood at the inner door of the passage, and the passage was filled with smoke. She was pushed into the passage and eventually got out.

3.17 Paul Powell heard the disc jockey's announcement and saw a small fire. Some people were pushing their way to Exit 3 and he went with them. The light was on in the passage and he could see someone kicking the outer doors at the end.

3.18 Kenneth Coleman, having seen the fire and heard the disc jockey's announcement, moved to Exit 3. He got into the passage and saw the outer door closed and heard people kicking it. He estimated that approximately eight men were kicking the door. He also joined in kicking it and it opened approximately five to six inches. At that stage, he could see the chain looped in a taut position across the gap which had been opened. After they had given the door three or four more kicks, both leaves burst open and he got out.

3.19 Eilish Carlyle (para. 2.123) said that, as the lights failed, she succeeded in getting into the passage at Exit 3, where there was a large crowd and much shouting. She did not, however, see the doors being kicked. She eventually got out this exit.

3.20 Harriet Kearney saw people running, stood on a seat and saw the fire. She then headed for Exit 2 but the lights failed. She was then carried along by a crowd in the darkness to Exit 3, where she recalled seeing smoke in the passage and where the crowd seemed to come to a halt for a second or two. She heard banging in front of her and then the crowd surged through the outer doors.

3.21 Mark Swaine, having seen the fire, went with his girl friend to Exit 3, at which stage people were running in all directions off the dancefloor. About five or six people were ahead of him in the passage of Exit 3 and he could hear somebody shouting "get that chain off the door". He also heard screaming from behind, but when he got to the outer doors, they were open.

3.22 Derek Farrelly was dancing with his girl friend when she pointed out the smoke. He was moving in the direction of Exit 2 when he saw the "Exit" sign of Exit 3 and went into the passage. There were about ten people in the passage when he went into it and he could see four men kicking the outer door. It seemed to open slightly on both sides and then fully, in the space of about thirty seconds.

3.23 Joseph McCabe heard the disc jockey's announcement and went at once to Exit 3. There were not many people in the passage but he could see men kicking the outer doors, and could hear them cursing and shouting "it's locked". He began kicking the doors himself, but did not see a lock and chain. The lights were still on at this stage. The doors opened about a foot and he went back up the corridor r short distance to find a friend of his. He was then carried out with the rush of the crowd through the open doors.

3.24 A number of these witnesses gave evidence that the white van parked by Mr O Briain outside Exit 3 (see para 3.104) was still in position at the foot of the steps, as a result of which they had to jump or scramble over the wall or rail on the left-hand or right-hand side of the top step *(see Plates 12, 20 and 24).*

Exit 4

3.25 The evidence established that, on the night of the fire, a portable platform was placed near this exit in the location shown in Plan 2, Appendix 15 *(see, also, Plate 21).* This platform, which was on wheels and could be raised or lowered, was used during cabaret performances as an extension to the stage and, on such occasions, projected at right angles

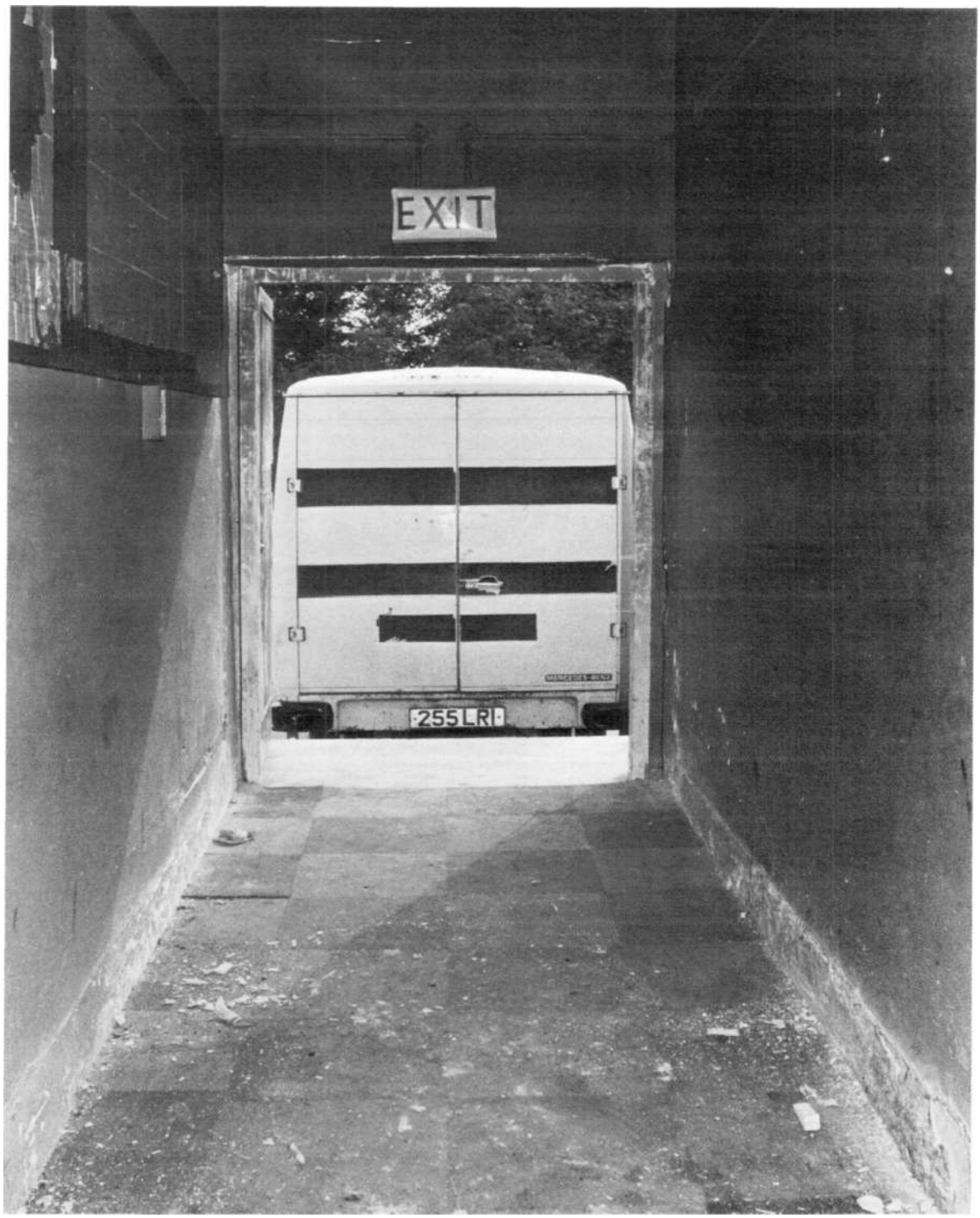


Plate 20 — *View from corridor leading to Exit 3, with white van at steps.*

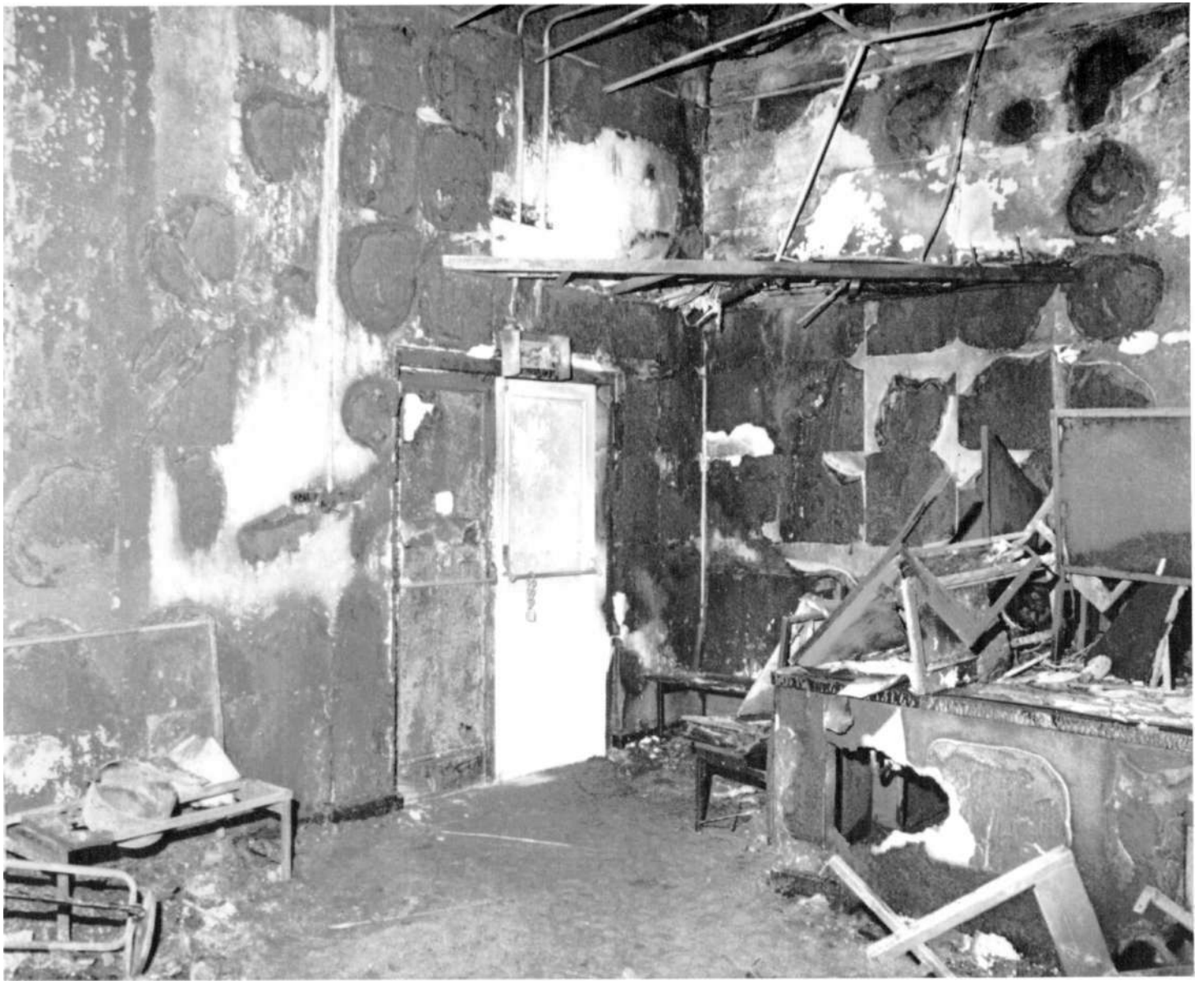


Plate 21 — *Photograph of Exit 4. The portable platform is to be seen at the right of the p*

from the front of the stage in front of the seating in the A/B Area. When not in use it was normally kept between the stage and Exit 4. There was also evidence that some tables, of the same type as those used throughout the Stardust, were stacked on the floor between the portable platform and the stage as shown in Plan 2, Appendix 15. There were also some seats, again of the type used throughout the Stardust, stacked against the ballroom side of the wall of Dressing Room No. 3 and between Exit 4 and Bar 2. (The location of these seats is also shown in Plan 2).

3.26 David Bridgemen, one of the barmen in Bar 2, said that, after the bar had closed at approximately 01.05 he was watching the disco competition, when he saw a fire in the West Alcove. He said that he then went over to Exit 4 where there was a doorman named Mick. He was able to open the door by moving the chain from where it was resting behind the bar on the left-hand leaf and pushing the horizontal bars. He said that he had no difficulty in doing so, and that both leaves opened. With the assistance of the other doorman, he then moved two seats out of the way and got up on the portable platform, from which he proceeded to shout and gesture in the direction of Exits 4 and 5. He remembered a few people going out through Exit 4. He remained there for less than a minute and then, as thick black smoke came down and interfered with his breathing, he jumped down from the portable platform through the door. Later on he returned to Exit 4 and saw someone holding the door closed at a stage when "the place was up in flames".

3.27 Michael Griffin was originally on duty in the Lantern Room but was told at about 23.45 by Mr Kennan that he needed someone to go on duty in the ballroom. He then went to Exit 4 and remained there from about 00.30 until the fire. He recalled seeing five or six loose seats between the exit and Bar 2. When he saw the fire in the West Alcove, he moved immediately to the door, both leaves of which he said he opened. He did not recall seeing David Bridgeman in the vicinity. He said that he called on the patrons to leave but that the majority of them would not leave. He estimated that approximately thirty to forty people did, in fact, go out through the exit. A dense cloud of smoke then descended making it difficult for him to see and breathe. He stood by Exit 4 and helped people out, some of whom were in a state of collapse.

3.28 Sandra Hatton (para 2.31) said that, on seeing the fire, she ran to Exit 4 where there were already a few people standing. She saw a chain wrapped around the horizontal bar and said that people had started shouting and kicking at the door and banging it. She could not see any member of the staff at the door, and thought that she might have been standing waiting for it to be opened for a minute or two. It eventually opened and she went out without difficulty. Mark O'Hanlon saw the fire from the dance floor and went in the direction of Exit 4. He said there was a crowd of people going out of the exit at this stage, but that they were moving without difficulty.

3.29 Susan Darling said that she was dancing on the floor when she saw the fire, heard the disc jockey's announcement and ran immediately in the direction of Exit 4 and out the door which was open. Evidence to the same effect was given by Karen Dunne. Michael Nolan (para. 2.118) said that he was aware of Exit 4 and, on seeing the fire from the dancefloor, proceeded to usher people in its direction. After about two minutes the lights failed and "panic" ensued. He remembered falling over a seat and crawling to Exit 4, out of which he was pulled by a doorman whom he could not identify.

3.30 Ann Tuck said that, when the fire began, she and the people she was with, who numbered about fifteen, moved in single file to Exit 4, holding hands. She thought that only the right-hand leaf of the door was open, through which she said that she and the rest of her party got out without difficulty. Harriet Reilly said that she ran first to Exit 4, where a doorman was trying to unlock a chain but failed to do so. She said that she then ran round to Exit 5 with the same doorman, who succeeded in opening it after pushing at it. Damien Fallon (para. 2.158) said that he saw a number of people kicking at Exit 4 and failing to open it. They then went to Exit 5 and appeared to him to go out through it without any delay.

3.31 Tony Bartley said that a few seconds after he noticed the fire, he heard the disc jockey's announcement. He then saw two doormen go to Exit 4 and bang on it. A large crowd ran from the dancefloor to the door and he moved to Bar 2 as he was afraid of being trampled by them. He said that the door opened after about a minute, during which time the crowd were halted. He also noticed tables and seats between the door and the portable platform. After about two minutes he got out himself, at which stage only the left-hand leaf was open. The right-hand leaf was eventually opened by the crush.

3.32 Liam Gallagher said that his brother Kieran grabbed him and they both headed for Exit 4. It was closed and he could hear people kicking it, but at that stage he lost consciousness because of the smoke. He was eventually dragged out by his brother. His brother, Kieran, also gave evidence of having got half-way from the centre of the dancefloor to Exit 4 when the lights went out. He said that he could hear people kicking at the door and he thought he had to wait at least half a minute before he got out. He was badly affected by smoke at this stage. He was aware of other people going out the exit and eventually pulled his brother out.

3.33 Doreen Desmond (para. 2.124) said that she ran towards Exit 4 on hearing the disc jockey's announcement. The lights failed when she was a few feet from the door. There were "a few dozen people" ahead of her and the door was still closed. After she had been waiting for a few seconds, the doors opened and she was pushed out. Margaret Lynch (para. 2.124) also decided to run just as the disc jockey made the announcement. She said that she could see about twenty people at Exit 4, but the lights failed before she got to it. She remembered tripping over someone and other people falling on top of her. The smoke was very bad at this stage. She remembered hearing somebody shout "please open the door" and hearing a sound as though somebody was banging the door with their shoulders. She said that she was at the exit for about twenty or thirty seconds when she felt a breeze coming through it and was able to crawl out.

3.34 Nicholas Prior walked quickly to.the exit when he saw the fire and was close to it when the lights failed. There were approximately thirty or forty people ahead of him and the crowd seemed to be getting bigger, but not moving out the exit. The door then burst open and everybody went out, including himself.

3.35 Brian Baitson (para. 2.126) said that on seeing the fire he ran to the exit and saw about six or eight people at the door trying to open it by pushing and shoving it. He said that the door opened only an inch or two and he could see a chain wrapped round the centre bar. He said that he kicked the door in anger and then ran in the direction of Exit 2. On the way he met two of his friends, and the three of them then started to run in the direction of Exit 5 when the lights went out. He said fire had shot right across the ceiling at this stage and that thick black smoke had also descended. They ran in the direction of Exit 4 and were held up by a crowd in front of it. The door then opened and he and his friends got out without difficulty. He thought that a period of not more than about two minutes had elapsed from the time he first saw the fire until he got out.

3.36 Frederick Phelan heard someone shouting "the door is shut" at Exit 4, following which a number of people, including himself, went to Exit 5 where he got out. Gerard Patje heard the disc jockey's announcement and remembered the lights failing. He could still see Exit 4 and left by it with a crowd of about forty to fifty people. He had no difficulty in getting out.

Exit 5

3.37 Gabriel O'Neill, a doorman, (para. 2.130) said that on seeing the fire he went immediately to Exit 5 and saw a padlock and chain dangling from the horizontal bar on the right-hand side of the door. He said that he pulled at the chain for about five or six seconds, but that it never occurred to him to push the bars.down and open the door. He then went to Exit 4. He saw no one else at Exit 5.

3.38 John Furley, a doorman, (para 2.130), having seen the fire, returned to Exit 5 and pushed down the horizontal bar on the left-hand side. There were five or six youths kicking the other leaf of the door, and he said that as the door opened almost immediately, he assumed that they had pushed down the right-hand bar. He did not see Mr O'Neill at the door. Raymond English said that, on noticing light smoke beginning to thicken at the level of the ceiling, he went to Exit 5. He shook the bars of the door in an attempt to open them, but did not realise that there was any serious emergency. When he heard a girl in a group of people behind him shouting "let me out, mister" he used greater force on the bars and the doors opened. David Carroll arrived at Exit 5 as thick black smoke was filling the ballroom. He said that he could see a chain which appeared to be wound around the horizontal bars on both sides of the door. He pulled and pushed the bars and then collapsed in a semi-conscious condition caused by inhaling the smoke. He said that he could hear other people banging at the door and that after about a minute the door opened.

3.39 Linda Farrelly said that she saw smoke in the ballroom and heard the disc jockey's announcement. "Panic" immediately ensued and she headed for Exit 5 which was near her. She recalled seeing a chain hanging from the door and a man trying to open it. He kicked it two or three times. At this stage, there were about ten or twelve people in front of her. She said that almost immediately the doors opened and the crowd went out.

3.40 Derek Brown said he reached Exit 5 after the lights had failed and at a stage when there was a crowd already at it. He saw a chain on the right-hand door and, together with others, kicked the doors which then opened. Patricia O'Hare, after seeing the fire, went to Exit 5 and saw one of the doormen kick the doors. She recalled seeing a chain looped on a horizontal bar and remembered the lock falling back against the door as the doorman kicked it. She said that the doorman then pushed the bars and the doors opened wide. She went out the door and did not remember any rush of people behind her.

3.41 Harriet Reilly (para. 3.30) said that the doorman, who had unsuccessfully tried to unlock the chain on Exit 4, succeeded in opening Exit 5 after pushing at it. Damien Fallon, (para. 3.30) having seen people get out Exit 5 without any delay, went out the same exit himself without any difficulty when the smoke and flames increased in intensity. Martin Quinn said that he saw the doors at Exit 5 being kicked open at a stage when the lights were still on and went out then himself.

3.42 Frederick Phelan (para. 3.36) said that, just after noticing the fire, he saw Harriet Reilly run to the doormen near Exit 5, one of whom appeared to check the doors. He then went towards Exit 5 himself but said that the crowd trying to get out was so big that he headed instead in the direction of Exit 4. Having heard people crying "the door is shut" he returned to Exit 5 and was eventually pushed out that exit by the pressure of the crowd. He said that his passage through the exit was badly hindered by people outside who were fighting to get back in.

3.43 John Crowe, a barman, (para. 2.127) who was talking to his girl friend when he saw the fire, pulled her inside Bar 2 because of the pressure of people who were moving in the direction of Exit 5. He told her to leave by Exit 5. She went in that direction, but returned a few seconds later and told him to get out. He then went out through Exit 5 with a number of people. At this stage the lights were still on. Elizabeth Hunter (para. 2.127) after seeing the fire left the bar immediately and ran out Exit 5 which was open. She had no difficulty in getting out, and said she was among the first fifty to leave by that exit.

3.44 Pamela Farrell said that she saw doormen running in the direction of the fire, grabbed her handbag and ran for Exit 5. The lights were still on at this stage. When she came to the exit, it was shut but was being kicked by three or four young men. She said that after about two minutes, the doors burst open and she went out. Adrienne Evans also saw a girl drawing the attention of a doorman near Exit 5 to the fire. She then saw the fire herself and went towards Exit 5. She remembered seeing a doorman, whose name was John, ahead of her, who was pushing and kicking at the horizontal bar on the door. When she

got to it, the door was open and she went through it. She did not remember seeing any lock or chain on the door.

3.45 Harry Mahood (para. 2.161) said that when he arrived at Exit 5 there was already a crowd of some thirty or forty people around it and the doors were closed. He could not see any lock or chain on the door and did not hear any noise of kicking or banging. He said that, within seconds of his arriving at the door, the lights failed and the doors opened. He then went through the exit with the rest of the crowd. Peter McMahon also said that when he came to Exit 5 there was a crowd of approximately forty people at it who seemed to be stationary. He said that almost immediately the doors opened, the lights failed and he went out.

3.46 Peter Griffin, who was sitting at a table facing Exit 5, saw a doorman run to it and kick the doors open. He said that a number of people were running across the hall in the direction of the exit, but he himself did not appreciate the seriousness of the fire. A friend pulled him out Exit 5 and the lights failed just as he went through the exit. David Brady also saw a doorman run to Exit 5 and open the doors. He described the doorman as having opened the doors with a backward kick. He said that between thirty and forty people went out Exit 5 ahead of him (the witness) without any difficulty.

3.47 The evidence established that there were two plastic skips or bins *(see Plate 22)* used as receptacles for empty bottles for Bar 2, which were normally outside that bar in the vicinity of Exit 5. Each skip was on wheels, the larger being 1015 mm in length, 685 mm in width and 760 mm in depth and the smaller 915 mm in length, 360 mm in width and 570 mm in depth. The washer-up at this bar, Joseph McGrane, gave evidence that at the beginning of the evening he placed the smaller skip in front of the left-hand leaf of Exit 5 and the larger one at right angles to it close to the wall of the ballroom which adjoins the store at the ladies' toilet (T6), this being where they were usually located *(see Plan 2, Appendix 15).* He also said that during the course of the evening there were trays of glasses stacked up on top of the smaller skip. Mr Bridgeman and Mr Crowe remembered the larger skip being there on the night of the fire but did not recall the smaller one.

3.48 A number of patrons gave evidence of either falling over these skips as they were going out or being held up as they were pushed out of the way. The evidence indicated that some of the patrons who were the first to go out by this exit pulled one of the skips out through the exit and threw it to one side. As a result, bottles were scattered on the ground immediately outside the exit. A number of patrons gave evidence that they fell on these bottles, some actually sustaining cuts in the process.

Exit 6

3.49 Belinda Pearse (para. 2.47) said that, on noticing smoke coming from the West Alcove, she went to Exit 6 with the intention of opening the door and allowing the smoke to escape. She said that although she pulled and pushed first at the horizontal and then at the vertical member of the panic-bar mechanism she was unable to open the door. There was a chain looped over the bar on the right-hand leaf but the door was not locked.

Gary Sullivan, a patron, who was sitting in the area of the North Alcove, saw the fire in the West Alcove and within a matter of seconds walked to Exit 6 with his girl friend. He said that the doors were closed and that he pressed the horizontal bars while at the same time applying pressure to the doors with his thigh and that the doors opened immediately. He did not see any padlock or chain. Other patrons gave evidence of having left by this exit without any difficulty.

(2) Outside the Building

Exit 1

3.50 Laurence Neville (para. 2.63) ran out on to the concreted area from the Silver Swan. He ran up the fire escape stairs to Exit 1 with Cormac Rose (para. 2.103) and saw the outer

Plate 22 — *View of plastic skips which had been positioned at Exit*

door bursting open and Mr Kennan "bursting out the door himself. He also saw a number of people coming out and smoke coming from the passageway. Gerard Guilfoyle (para. 2.95) also went out on to the concreted area from the Silver Swan. This was at the time that the lights failed and was just after he heard the disc jockey make the announcement. He saw about thirty people coming down the steps from Exit 1 *(see Plate 23)* and smoke pouring out. Evidence to the same effect was given by James Shortall, a patron who left the Stardust just before the fire was observed (para. 2.154) and two of the residents in neighbouring houses, Anthony Pasquetti (para. 2.150) and Maria Blair (para. 2.151).

Exit 2

3.51 Sharon O'Hanlon (para. 2.115) said that, during the period that the outer doors of Exit 2 were closed, she saw a person, whom she thought was one of the doormen, close the doors and stand with his back to them facing the people trying to get in, apparently in order to dissuade them from so doing.

3.52 David Mulligan (para. 2.121), having seen the fire, followed a doorman through the kitchen corridor and into the Lantern Room. He did this because there was a crowd standing in the ballroom at the inner doors of Exit 2 which did not seem to be moving. He said that he then went out of the Lantern Room (where the lights were still on). When he got outside, he saw the outer doors of Exit 2 bursting open and a crowd pouring out. He said that people continued to pour out the exit for about fifteen minutes.

3.53 David Rynne (para. 2.106) left the building by the Silver Swan and went round to Exit 2. At this stage, the outer doors were closed, so far as he could remember, and he could see people smashing one or two of the windows in those doors. Lorraine Brady, who went out through Exit 2, saw the outer doors closed shortly afterwards, at a stage when she thought there were people in the foyer.

3.54 John Reilly (a brother of Alfred and Harriet Reilly) had arrived with them earlier in the evening but had been refused admission as he had been barred from the Stardust. He remained outside the Stardust in the vicinity of Exit 2 in the hope that he might ultimately secure admission. He said Mr Downes had locked the right-hand leaf of the door, as seen from the outside, but that the left was open for the purpose of letting people in and that Mr Downes was standing inside the door, opening and closing it to let people in. After the alarm of fire had been given in the foyer, he saw Mr Downes come to the outer door and unlatch the right-hand leaf in order to let people out, while he (the witness) held the left-hand leaf for the same purpose.

3.55 At this stage, crowds of people began to come through the hall and John Reilly then saw black smoke coming into the hall. The lights then went out and the crowd in the hall started pushing towards the outer doors and pushed him (the witness) out. At that stage, he thought that the right-hand leaf slipped and locked back into the closed position, but that the left-hand leaf continued to swing in and out. At this time there were still a few people in the hall. He (the witness) went into the hallway in the direction of the inner doors, but at this stage those doors were on fire and the carpet in the hall was also on fire. He said that by now there were only a few people left in the foyer. A number of people appeared to be caught at the counter in the Cash Office. They were pulled out of the window (W8) of the Cash Office.

3.56 The evidence of this witness was at variance with that of Mr Downes, who said that when he had opened the doors and secured them in order to let people out, Mr Reilly ran past him into the foyer.

3.57 Michael Kavanagh (para. 2.82), who left via the Lantern Room at a stage when the fire seemed to him to be out of control, saw Alfred Reilly creating some sort of disturbance outside Exit 2, at which time he said there was no one coming out of that exit. Mrs Prizeman (para. 2.85) opened the Lantern Room doors and helped to get the patrons to leave. She tried to return to the ballroom via the kitchen corridor, but failed to get past

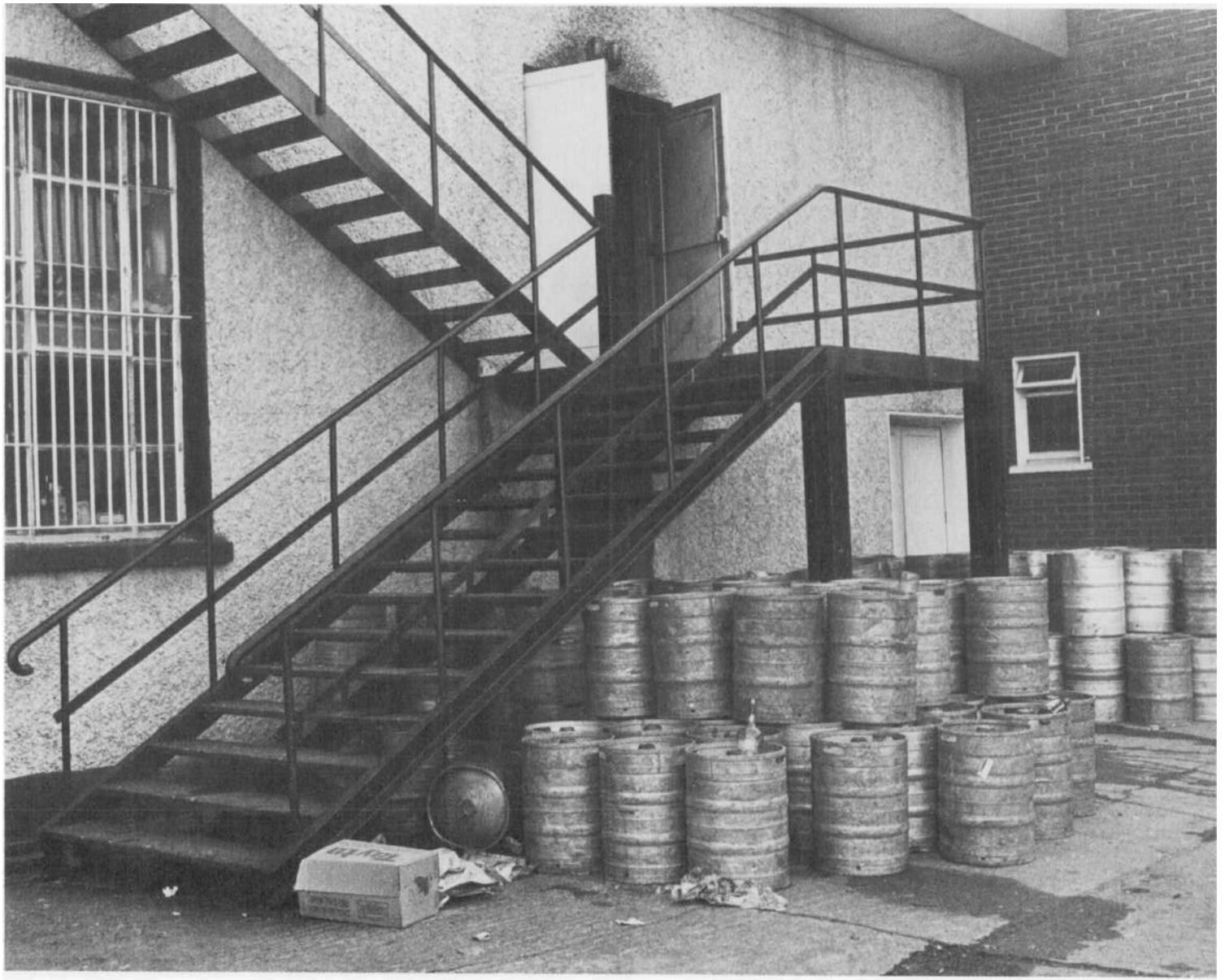


Plate 23 — *View of Exit No. 1 and fire-escape.*

Door 17. She then left the premises through the Silver Swan exit and went round to Exit 2. She said that the outer doors were now closed and that there were people banging on the doors from the inside; the centre roller shutter was in the half-way-down position. While she did not actually see this shutter go up and the doors open, she did see people pouring out of the exit at some stage, some of them with their clothing on fire.

3.58 Jack Walsh (para. 2.70) made his way to the front of the building and helped to push the disc jockey's van away from Exit 3. At this stage, he remembered looking into the foyer at Exit 2. He said that both doors were open and that the right-hand frame of the inner door was "aglow".

3.59 Mr James O'Toole who lives at 44, Kilmore Road, Artane, had gone to bed, but remembered hearing noises at 01.40, looking out the window and seeing a big flame on the roof of the building. He got dressed and ran towards it and could see thick black smoke across the top of the building and could hear a very loud crackling noise. After speaking to Mrs Marley (para. 2.44), he went on up to the front of the Stardust, where he saw the outer doors of Exit 2 closed and what appeared to be a red light behind it. The metal shutter was in the "up" position and he could see no one inside.

3.60 Ann Hoare, a member of the kitchen staff, was among the staff who came out the kitchen exit (Door 21—and see para. 2.109). Hearing the sound of a fire alarm from the direction of Exit 2, she looked towards it and saw crowds of people on the steps, some of them coughing and some falling as they came down the steps because the crowd coming after them were pushing them. She could not see the doors of the exit.

3.61 Adrienne Evans who left by Exit 5 without any difficulty, while the lights were still on, saw the doors of Exit 2 closed at a time which she estimated was about ten minutes after she had got out. At this time, she said, the centre shutter was half-way down.

Exit 3

3.62 A number of persons who were outside the building gave evidence of seeing the outer doors of Exit 3 opening and a crowd of people pouring out and jumping or scrambling over the small wall or rail at the head of the flight of steps, their passage being obstructed by the white van parked at the foot of the steps, (see para. 3.104 and *Plate 24).* The van was removed, but this appears to have happened after most of the people who left by Exit 3 had made good their escape.

Exits 4,5 and 6

3.63 Most of those who escaped from the building in the early stages, or who arrived at the scene of the fire from elsewhere, gathered in front of the building. The security officer, Christopher Holt, however, saw Exit 4 being opened about a minute before Exit 3 was opened (see para. 2.145). Damien Fallon (para 3.41) who went out through Exit 5 without any delay, went on to Exit 4, which was still closed. He said that it opened approximately thirty seconds later. It would also appear that Exit 6 was open prior to Exits 5 and 4.

(3) Analysis of the use made of different escape routes

3.64 In considering the factors which affected the evacuation, it is obviously of considerable importance to establish, so far as is practicable, the precise numbers who left by each of the escape routes. One cannot, however, safely extrapolate from the evidence of the witnesses in order to arrive at the true figures. The summoning of witnesses to give evidence before the Tribunal was not done on a random basis and, accordingly, does not provide the sort of sample from which conclusions could safely be drawn.

3.65 Statements were made to the Gardai by 798 patrons who were present in the Stardust on the night of the fire. Of these, only 131 gave evidence to the Tribunal. It would have been wholly impracticable for all these patrons to attend before the Tribunal and give evidence on oath as to the escape route used by them. An analysis was accordingly conducted of all

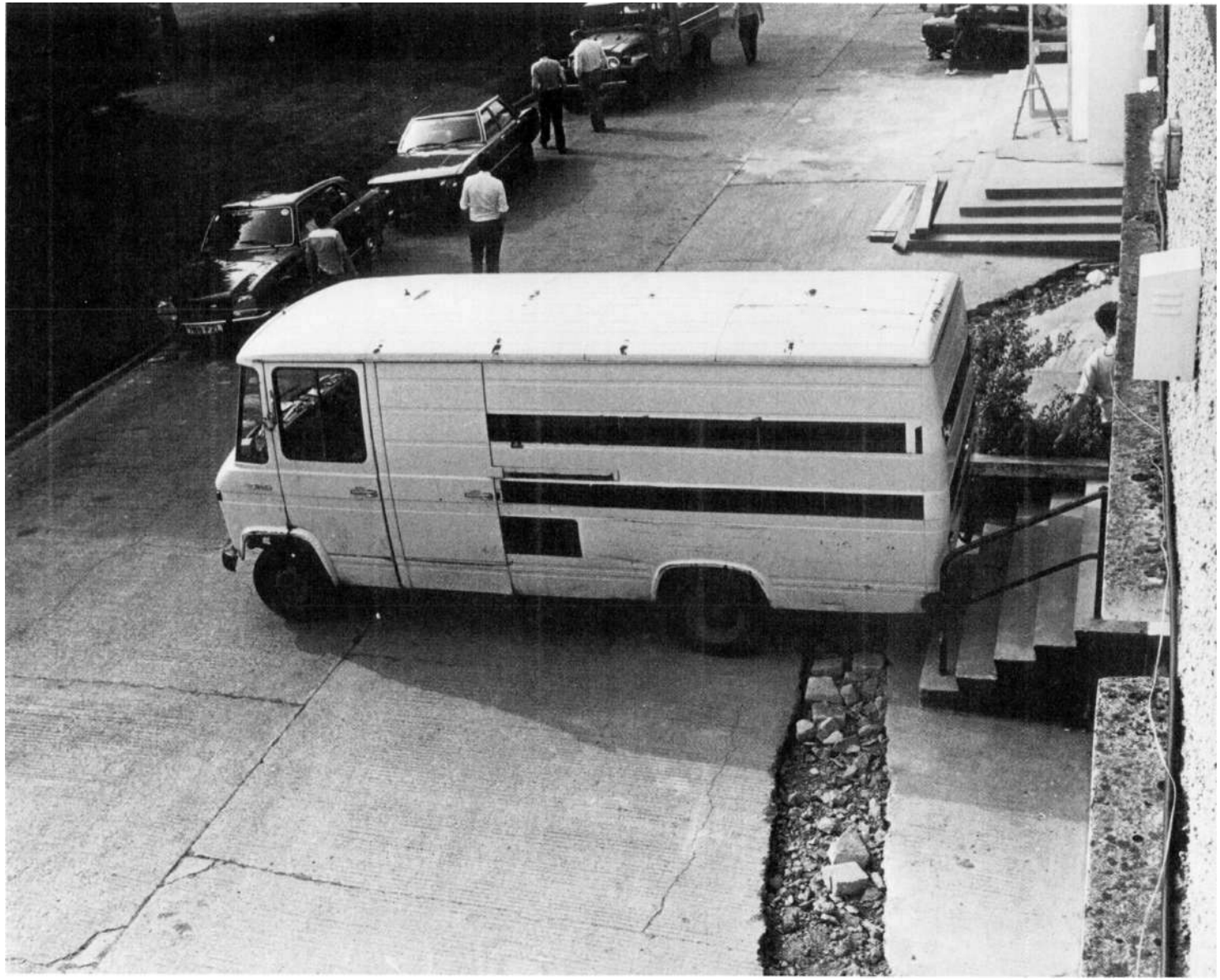


Plate 24 — *View of white Mercedes van, registration no. 255 LRI, parked at steps of Exit 3 in on night of fire.*

their statements in order to establish which escape routes they appear to have used. It should be emphasised that, while most of the statements in question were circulated to all the parties who were represented before the Tribunal, and all of them were available to the parties, their evidential value is greatly reduced by the fact that so many of the persons who made them did not give evidence on oath and were not cross-examined. While giving full weight to this consideration, the Tribunal is none the less satisfied that the statements provide a safer basis for reaching a reasonably precise quantitative conclusion as to the actual use made of the escape routes than the *viva voce* evidence.

3.66 One peculiar feature of the figures that emerged from the statements should be observed. They indicate a total attendance on the night of the fire of 846 patrons (including eight young people who were either acting as disc jockeys or assisting the disc jockeys). The evidence of Mr Dermot O'Neill, the Assistant Cashier, was that there were 775 paying customers, 12 non-paying competitors in the disco dance competition and 16 complimentary tickets. This gives a total of 803 patrons only or — if the disc jockeys are included — 811. The figure of 775 paying customers is confirmed by the evidence of Mrs Marley, who said that she served 775 dinners. Mr O'Neill said that the cash balanced correctly on the night with 775 people paying £3 each. The Tribunal has not found it possible to reconcile the discrepancy — amounting to 35 people — between the number of patrons recorded in the statements as having been present and the number recorded by the management as having been admitted.

3.67 It should also be pointed out that, of the 846 patrons referred to, 35 left before the fire. Some of those who made statements were among those rescued by the fire brigade from the toilets and other areas. Some were unable to identify the exits by which they left and some were in doubt as to the exits. The break-down is as follows:—

3.68

No. able to identify exit by which they left	676	(80%)
No. unable to identify exit by which they left	32	(4%)
No. who left early	35	(4%)
No. rescued by firemen	15	(2%)
No. who identified exit but with some doubt	40	(4.5%)
Fatal casualties	48	(5.5%)
Total	846*	

3.69 The following was the use of the exits as indicated by the statements:

Exit	Positive		Doubtful	Total	
1	52	(8%)	—	52	(7%)
2	271	(40%)	4	275	(38%)
3	47	(7%)	5	52	(7%)
4	104	(15%)	14	118	(17%)
5	145	(21%)	12	157	(22%)
6	40	(6%)	3	43	(6%)
Lantern Room	3	(3%)	—	3	(3%)
Silver Swan	3		1	4	
Kitchen	2		1	3	
Cash-office window	3		—	3	
Window over Exit 2	3		—	3	
Other Window (not identified)	3		—	3	
Totals	676		40	716	

*This figure includes eight young people who were discjockeys or were assisting disc jockeys.

3.70 The following was the use of the escape routes by the staff

Left by Kitchen Door at front	14
Lantern Room	10
Silver Swan	15
Exit 1	4
Exit 2	4
Exit 3	1
Exit 4	3
Exit 5	5
Exit 6	2
Left early (before fire broke out)	5
TOTAL	63

III — FACTORS AFFECTING THE EVACUATION

(1) The Suitability of the Means of Escape

3.71 Exits number 1, 3, 4, 5 and 6 were suitable for use as emergency exits, were properly equipped with panic-bar mechanisms and illuminated by EXIT signs. They were also, in the main, appropriately located. Some criticism was advanced as to the locations of Exits 1 and 6, which were availed of by relatively few people during the fire. While the Tribunal is satisfied that the relatively small number of people using these exits reflected the small number of people who were in the North Alcove when the fire was first observed, the length of the passage-way at Exit 1 did create a problem. The passage-way did not comply with the Draft Building Regulations (see para. 1.202); and in fact became smoke-logged at an early stage of the fire.

3.72 The fact that well over a third of the patrons attempted to leave by Exit 2 was of crucial importance in the evacuation. It was due in, part to the well-established tendency of persons in fires and other emergencies to leave a building by the route by which they entered. It was also due, however, to the fact that delay was being experienced in opening the other exits most accessible to the great bulk of the patrons, viz. Exits 3, 4 and 5: and that many people were carried involuntarily into the entrance foyer when the main rush towards it occurred.

3.73 Exit 2 suffered from serious defects. The inner doors were not sufficiently fire-resistant; the high-level openings on either side of the inner doors permitted smoke to penetrate the foyer; and the carpet tiling on the walls had not the required surface spread of flame rating. (On one view, it should have been Class O and on any view should not have been less than Class 1). In addition, the stairway did not comply with the Regulations. These shortcomings all constituted breaches of the Draft Building Regulations (see paras. 1.194 to 1.213). Moreover, the location of the Cloakroom was such that congestion was likely to be worsened if patrons gathered round it in an attempt to recover their belongings, which is what in fact happened.

3.74 So far as its width was concerned, Exit 2 complied with the relevant regulations and guidelines provided the side leaves of the outer door were opened. Had no other factors intervened, there would probably have been a continuous stream of people moving at a reasonable pace through it from the time the fire first became apparent, although injuries would almost certainly have occurred because of the rapid penetration of the area with smoke and flame due, in part, to the shortcomings in the foyer already mentioned.

3.75 Unfortunately, however, other circumstances did intervene. In the first place, the centre leaves of the outer door were initially wedged by Mr Downes in such a position as to reduce the effective width of the opening to 3 ft 9 ins (1.143 m). This meant that the width of the outer opening was significantly less than that of the inner doors, thus creating conditions for the back-up of people in the foyer and ballroom.

3.76 It is also clear that the pressure of people in the foyer ultimately forced the doors into a closed position. It is probable that the bolt on the right-hand leaf as one faced the door from outside became wedged against the lip of the well for the doormat. (This is consistent with the damage to the bottom of the door: see para. 3.112 and *Plate 28).* At the same time, the left-hand leaf could not clear the mat which had been folded over by Mr Downes to hold the door in position. This condition—with the doors in the closed position—appears to have lasted for a relatively short time, perhaps not more than two minutes, before the pressure of the people forced the doors into the outward open position: but during this period there was no movement at all out of the foyer and an ever-increasing crowd was trying to get into it from the ballroom.

3.77 In the second place, the fact that two side-leaves of the outer door *{see Plate 25)* remained locked throughout the fire undoubtedly increased the congestion, particularly up to the stage at which the two centre leaves were forced open by the pressure of the crowd.

3.78 In the third place, the filling of the foyer with black smoke and the failure of the lights, greatly increased the "panic"; and, at that point, the staircase became a particular hazard. People who were confused and disorientated by the smoke and darkness went up the stairs instead of out the exit doors and in some cases were pushed up the stairs by the press of people. Two of the patrons who died were found on the landing of this staircase *{see Plan 4, Appendix 15).*

(2) The Condition of the Means of Escape

(i) *The procedure adopted as to locking and unlocking exit doors prior to the fire*

3.79 The panic-bar units which were fitted to the doors at Exits 4, 5 and 6 and the outer doors of Exits 1 and 3 (see para. 1.67) ensured that, while the doors could not be opened from the outside, they could be opened from the inside by exertion on the bar. It was also possible to lock the doors from the inside by securing both sides of the panic-bar unit with a padlock and chain. In the case of Exit 6 the bar was upside down.

3.80 Prior to January, 1981, the practice normally adopted in the Stardust as to the locking of the exit doors was as follows. During the hours the premises were not open to the public the outer door of Exit 2 was locked in the ordinary way and the outer doors of Exits 1 and 3 and the doors of Exits 4, 5 and 6 were secured on the inside by a padlock and chain in the manner already described. The keys were normally kept in the office attached to the Silver Swan. If there was a function in the Stardust,- whether it was a concert, cabaret or a disco, the first doorman to arrive on duty collected the keys from this office and opened each of the exits before the public were admitted. After the public had left at the end of the evening, each of the exits was locked again. If the North Alcove was not in use and curtained off (which was usually the case on disco nights) Exit 6 and the outer door of Exit 1 were left locked throughout the evening.

3.81 The practice had also developed, at least six months before the fire, of draping the chain across the horizontal bar of the panic-bar unit when the public were on the premises in order to give people the impression that the doors were, in fact, locked when they were not locked. This practice began because it was discovered that patrons inside the ballroom were letting in their friends, who either had not paid an admission fee or were barred from the premises, through these exit doors. The evidence did not establish who initiated the practice, but it was known to and approved by Mr Eamon Butterly, Mr Phelim Kinahan, Mr Thomas Kennan and Mr Leo Doyle, and known to the other doormen who were at the Stardust from that time onwards. Its object was to make patrons inside the Stardust think that the doors were locked and thereby discourage unauthorised entry.

Plate 25 — *Internal view of main entrance doors (Exit 2); the locked side-leaves are to be see*

3.82 Exit 3 was the exit through which the disc jockeys and their assistants brought their equipment at the beginning of the evening. It was used for this purpose because it was situated conveniently close to the stage. On disco nights they normally arrived at approximately 20.30, at which time, of course, the outer door of Exit 3 would normally be locked. They would be admitted by a barman or other member of the staff, who would unlock the door with the keys obtained from the Silver Swan office. The keys would then be returned by the barman or member of staff to that office.

3.83 Exit 4 was availed of by the barman on duty at Bar 2 for the purpose of going out to the shed which was located outside the building between Exits 4 and 5, for the purpose of either connecting up or replacing kegs *(see Plan 2, Appendix 15).*

3.84 Because the problem of unauthorised entry into the ballroom was increasing Mr Eamon Butterly decided, shortly after Christmas, 1980, to introduce a new procedure. He gave orders that the emergency exits were to remain locked until midnight or 00.30 on disco nights. On disco nights, most of the paying customers were normally inside the Stardust by midnight or 00.30 at the latest; and at midnight or shortly afterwards, it was normally possible to release the doormen on duty at the outer door of Exit 2 for duty inside the Stardust.

3.85 Mr Butterly claimed in evidence that this instruction was confined to Exits 1, 5 and 6. He said that it did not apply to Exits 3 and 4, because Exit 3 was opened at 20.30 or thereabouts to admit the disc jockey and his assistants, and Exit 4 was opened at a relatively early stage in the evening to permit the barmen access to the shed already referred to. Mr Kennan, Mr Kinahan, Mr Doyle and some of the other doormen were aware of this instruction but none of them in evidence said that they understood it to be confined in its application to Exits 1, 5 and 6. Mr Butterly did not claim in his evidence that he had given any express instruction to Mr Kennan or any of the doormen that his directive was to be interpreted in this limited sense; and it is difficult to understand why he thought Mr Kennan, Mr Doyle or any of the doormen should so have understood it. No doubt, it was logical (though not, in any sense, defensible) to lock Exits 1 and 6 and leave Exits 3, 4 and 5 open on disco nights prior to the fire, when the North Alcove was normally isolated from the rest of the area by the blind. But whether the North Alcove was isolated or not, there was no logic whatever in keeping Exits 1, 5 and 6 locked and Exits 3 and 4 unlocked. The Tribunal is satisfied that Mr Butterly did not, either expressly or by implication, limit his directive in the manner suggested by him in his evidence, and that it was not understood by any of the members of his staff to be so limited.

3.86 Mr Michael Kavanagh said in evidence that, on one occasion during the period when this practice was in operation, he unlocked the doors but found later on the same evening that they had been relocked. Mr Doyle said in evidence that on an evening about four weeks before the fire Mr Michael Kavanagh had already opened all the exits when Mr Kennan asked him (Mr Doyle) whether they had been opened and Mr Doyle confirmed that they were. He said that Mr Kennan then told him to tell Mr Kavanagh to go around and lock them up until midnight or 00.30. He said that, at a later stage he (Mr Doyle) told Mr Kavanagh that he was to go and lock them again. Mr Kavanagh in his evidence confirmed having got such an instruction from Mr Doyle on some occasion prior to the fire.

3.87 While the evidence, accordingly, established clearly that the doormen had instructions from Mr Butterly, transmitted by either Mr Kennan or Mr Doyle, that the emergency exits were to remain locked until midnight at the earliest, it also established that no member of the staff had the responsibility of unlocking the exits after that time. Mr Butterly, Mr Kennan and Mr Doyle each said in evidence that it was not his specific responsibility; and, accordingly, the possibility remains that on a number of occasions prior to the fire, all the emergency exits, with one exception, remained locked during the whole of the time that the public were on the premises.

3.88 The exception was Exit 4. In the case of that exit the evidence established that a duplicate key was given to the barmen on duty in Bar 2 to enable them to gain access to the shed.

In normal circumstances, they would usually have to do this within about an hour of the public being on the premises; and the barmen would not normally relock the door thereafter. Mr Doyle gave evidence that, when the doors were locked, the chains were tightly secured with the padlock hanging from the third-last link of the chain.

3.89 In the case of Exit 2, the two side-leaves of the outer door were kept permanently locked, with the metal shutter in the "down" position and locked. The first doorman on duty unlocked the two centre leaves and pulled up the metal shutter which covered them so that it was in the "up" position, but not locked or otherwise secured. The outer doors were normally locked at midnight or shortly afterwards and the key retained by the doorman on duty on that entrance, who would then open the door for persons leaving the Stardust before the end of the evening's entertainment and relock them after they had left.

(ii) ***The locking of the doors on the night of the fire: the evidence of the staff***

3.90 Mr. Michael Kavanagh gave evidence that on the night of the fire he arrived at the premises at 21.00. He went into the Silver Swan office and collected the keys of Exit 2 and the emergency exits from Mr Patrick Lennon, the cellarman. At about 21.40, he unlocked the two centre leaves of the outer door of Exit 2 and pulled up the shutter in front of the door leaving it unlocked. (It could not be locked in the "up" position: see para. 1.63). The two side leaves remained locked, with the metal shutter down in front of each of them, this again being the usual position. He then met Mr Doyle and said to him "Leo, I am going to open up the exits" Mr Doyle said "No, leave them for a while". Mr Kavanagh said he then put the keys in a desk in the Cash Office in a drawer which was just inside the door and was unlocked. He retained the keys of Exit 2 and gave them later in the evening to Mr Downes.

3.91 Later in the evening, at a time which he estimated was somewhere between midnight and 00.15, but was probably nearer to 00.15, Mr Kavanagh said that he checked each of the emergency exits. He said that at the time each of them was locked with a chain and padlock. They could be opened out so as to create a gap of 9 inches but not more. He went to Exits 5, 4, 3, 6 and 1 in that order. In the case of Exit 3 he did not go as far as the outer door to check it but went within about 3 feet of it. He said that he was satisfied that at that time it was locked with chain and padlock. This was the last occasion prior to the fire on which he saw the exits.

3.92 Mr Kennan said that he came on duty at about 21.55. He said that there were six doormen on duty at Exit 2 (Mr Doyle, Mr Kavanagh, Mr Downes, Mr Fitzsimons, Mr Murphy and Mr O'Neill), one on duty in the ballroom watching the exits (Mr Bell) and two in the Lantern Room (Mr Furley and Mr Griffin). At about 22.20 he had a conversation with Mr Eamon Butterly during which the latter again expressed his concern about the security position, and said that he was considering employing an outside security firm to deal with security inside the premises. He said that at approximately 23.00 he checked each of the emergency exits by kicking the lower portion and said that, as far as he could recall, each of them was locked at that stage.

3.93 Mr Kennan said that some time between 23.30 and midnight Mr Butterly told him that there was somebody on the roof or at the exits and that the two of them went to the outer door of Exit 1. He said that the door was locked at that time by the chain and padlock, but that it was possible to open it slightly to the extent that the length of the chain permitted. He said that Mr Butterly then said to him "you had better open all the exits". He thought that he got the keys from the cash desk in the office in the main foyer, but did not actually recall getting the keys from there. He said that he then went to Exit 1, unlocked it and draped the chain and padlock across the panic bar in the manner already described. He said that while he could not specifically recall opening any individual exit other than Exit 1, he had in fact opened all the other doors. His evidence on this matter was as follows (Volume 34, questions 391/393):—

"Q. Are you in fact quite sure you opened any of the exits?

"A. I am quite sure.

Q. You only remember No. 1?

A. I opened the exits.

Q. The only one you remember opening is No. 1?

A. The reason I remember opening No. 1 is because when I was going in that night there was talk that there was some people going to attack John Furley that night. I remember walking up the passageway because I was nervous. That is how I remember".

3.94 Mr Kennan said that he then went to the Lantern Room where he met Mr Michael Griffin and Mr John Furley. He told them he was looking for a volunteer and that the exits were open. He then sent Mr Griffin to cover the exits in the ballroom with Mr Austin Bell. He kept the keys in his pocket until approximately 01.30. He had decided to go home at that time and had gone into the Lantern Room with the intention of going to his car in the adjoining car park. On the way out, he discovered that he still had the keys and was about to give them to Mr Furley, who was in charge of the entrance to the Silver Swan and Lantern Room, but decided instead to bring them back to the doorman on duty at the main entrance to the ballroom, i.e. Mr Downes. (Mr Furley recalled Mr Kennan taking the keys out of his pocket as if he was about to give them to him (the witness) but thought that this happened at about 01.00). Mr Kennan said that he then returned to the main foyer and threw the keys to Mr Downes saying "the exits are all open".

3.95 Mr Kennan's account of the latter incident was confirmed in evidence by Mr Downes and by two other doormen, Mr Patrick J. Murphy and Mr Doyle, who said that they were present in the foyer at the time. Mr Downes, however, thought that the words Mr Kennan used were: "Frank, here are the keys, close all the exits when it is finished". Mr Downes said that he then gave the keys to Mr Doyle and asked him to lock all the exit doors when the dance had finished, as he would be very busy at the front. Mr Doyle confirmed that Mr Downes said this to him. Mr. Doyle said that he put the keys in his pocket but did not remember that he had, in fact, done so, until he came across them on the Tuesday after the fire, when he found them in the suit he had been wearing on the night of the fire. He then gave them to Mr Jack Walsh. Mr Doyle denied that he had told Mr Kavanagh to leave the doors locked earlier on in the evening.

3.96 Mr Austin Bell said that on the night of the fire he arrived for work at approximately 20.30 or 21.00. He went into the hallway of the Silver Swan and the Lantern Room where he met Mr Griffin and Mr Furley. Mr Kavanagh joined the three of them shortly afterwards and then went off. He then returned with the keys to the exits and handed them to Mr Bell, but then took them back again and said "I will go". Shortly after that, Mr Kennan assigned the doormen to their various duties and told him (the witness) to go and cover Exit 6. A few seconds later, Mr Kennan gave him the keys of the exits and he went to Exit 6. This was at about 22.30. He said that at this time Exit 6 was locked and Exit 4 was unlocked. He could not see whether Exit 5 was locked, because there were a trolley and glasses obscuring his view. He agreed that he had told the owners' solicitor that it was "locked solid" but said that this was not correct. He said that in the case of Exit 4 the chain was looped hanging loosely from the bar. He then looped it over the bar.

3.97 Mr Bell said that at some stage before 23.00, Mr Kennan came to him and said he wanted the keys, because he was "opening up". (Mr Bell's and Mr. Kennan's evidence was at variance on this point, Mr Kennan insisting that he did not get the keys from Austin Bell, but got them from the office). He said that at approximately 00.20, he saw Mr Kennan going up the steps towards Exit 1 and then towards Exit 6. He then saw Mr Kennan unlocking Exit 6, although he was not certain whether he then looped the chain over to the other side of the door. Earlier in the evening, at a time he could not place, he had gone to Exit 1, because he could see light coming through the door. When he got to it, it was locked but the light was coming through. He said that he went down to ask Mr Kennan if the door was okay and that Mr Kennan came back up with him to check the exit. They

Plate 26 — *View oj the eastern elevation looking towards the front of the building.*

pulled the exit door back tight and Mr Kennan said that it was okay: it was just where the door was warped.

3.98 Mr Michael Griffin and Mr John Furley said that at about 23.45, Mr Kennan came into the Lantern Room and told Mr Griffin to go into the ballroom. Mr Griffin said that he then followed Mr Kennan into the ballroom, where they both went to Exit 5 and met Mr Bell. Mr Kennan then instructed Mr Bell and himself to watch the exits. He was standing between Exits 5 and 6 for about thirty five minutes thereafter when Mr Bell came up to him and he (witness) went to Exit 4. He said that he put his hands on the door to make sure that the panic-bolt was secured, and that at that stage the door, while properly closed, was not locked. He did not notice the chain at that stage. He thought this was between 00.25 and 00.30.

3.99 Mr Kinahan said that he checked the exit doors at approximately 00.40. The outer door of Exit 1 was closed but unlocked, with the chain and padlock draped over the bars. The position was the same at Exit 6. He said that Exit door 5 was unlocked, but could not remember whether the chain was draped across the bar or not. He then went to Exit 4 where again the door was unlocked with the lock and chain draped across the bar. He went to Exit 3, but did not go any further than Door 11 as he stopped to talk to a girl he knew. He agreed that he did not check the outer door of Exit 3 to see if it was locked.

3.100 Mr Eamon Butterly said that he arrived at the premises about 22.00. At approximately midnight he told Mr Kennan to open the doors. He said that his conversation took place somewhere near the inner door of Exit 2, in the vicinity of the cigarette machine; and that it was about ten to fifteen minutes before Exit 2 was locked. He said that at approximately 00.30 he was informed by Mr Jack Walsh that there were intruders on the roof and went to the bar of the Silver Swan and out into the forecourt where he saw at least one and possibly more male figures running away. There was no other incident involving persons on the roof during the course of the night and his recollection was that this incident took place some time after he had told Mr Kennan to open the doors. He had no recollection of going with Mr Kennan to Exit 1 and then telling Mr Kennan to open the doors. Shortly after the incident on the roof, at approximately 00.45 he (the witness) checked Exits 1 and 6 by pushing the bars and opening them.

3.101 Mr David Bridgeman, one of the barmen in Bar 2, said that at some stage during the evening, which he thought was probably between 23.00 and midnight, he had occasion to go out to the small shed abutting the outside wall of the ballroom between Exits 4 and 5 *(see Plate 26),* in order to replace an empty keg. He said that he went out, as the barmen usually did, through Exit 4, and at that stage the door was not locked, although the chain was draped across the bar on the left-hand leaf of the door. John Crowe, the chargehand barman at the same bar, also gave evidence of having gone out through Exit 4 on two occasions during the night to replace kegs, around 23.00 and shortly after midnight. On each occasion, the door was unlocked and the chain and lock were hanging from the bar on the right-hand leaf.

3.102 Mr. Anthony McDonald, said that he arrived at the premises at approximately 20.30 went to the Silver Swan Bar and asked one of the barmen to open Exit 3 so that the disco equipment could be brought through the corridor and put on the stage, as was the normal practice. He said that he then returned to the outer door of Exit 3 and that shortly afterwards it was opened by one of the barmen. This was confirmed by Mr Gerard Guilfoyle, the barman in question , who said that he got the keys from Mr Lennon and went out into the ballroom, opened the lock and chain on the outer door of Exit 3 and left it hanging on one of the bars. He then left back the keys on a nail in the office of the Silver Swan.

3.103 Mr Colm O Briain, one of the disc jockeys, gave evidence of having arrived with Mr McDonald and of Exit 3 being opened for them by a barman. While he could not remember what was done on this evening, he said that the normal procedure was for the barmen to open the door and to leave the chain and lock hanging on one of the bars, in

the position described by Mr Guilfoyle; and he said that it was also usual for the lock to be hanging from the end links of the chain.

3.104 Mr McDonald and Mr O Briain also gave evidence that on arriving at the premises, they parked a white Mercedes van, in which the disco equipment was contained, with its back up against the bottom of the steps leading from Exit 3 down on to the forecourt. They did this in order to bring the equipment from the van down the corridor of Exit 3 and on to the stage. The width of the van was 6ft 8ins (2.03m) and its location, as established by the evidence of these and other witnesses, is shown in Plate 24.

(iii) ***The locking of the doors on the night of the fire: the evidence of patrons***

3.105 Noel Quigley, who had formerly worked as a doorman at the club, went as a patron to the disco on the night of the fire. He had agreed to let a friend of his in through one of the exit doors, and said that with that in mind he went to Exit 3. This was shortly after he had himself paid to get in at approximately 23.30. He said that the exit door was locked and secured by a padlock and chain. He then went to Exit 6 and found that the position was the same. He was satisfied that each of these exits was locked, as he endeavoured to open them, and he thought, from looking in their direction that Exits 5 and 4 were also locked, but did not test them, as there were a number of people in the vicinity.

3.106 Seamus Caffrey said that he was in the vicinity of Exit 4 for about fifteen minutes at some time before midnight and saw the door chained and locked, with furniture stacked against the wall between Bar 2 and the exit about 4 to 6 feet deep.

3.107 Bernadette Daly said that at some time, which she thought was between midnight and 01.00, she was dancing near Exit 4 and saw a chain and padlock wrapped around the bar of the door. She thought from its appearance that the door was locked.

3.108 Alfred Reilly said that, having paid to go into the ballroom at 23.20 with his sister Harriet, he went at some stage to Exit 6 in order to let his brother John into the disco. He had agreed to do this, as John was barred from the premises. He said that he recalled at some stage looking at Exit 6, which appeared to be locked. He said that at about 00.15 or 00.20 he tried to open Exit 4 but found that it was locked. His evidence as to the time of this incident was, however, at variance with that of his sister Harriet, who said that she kept watch for her brother while he tried to open Exit 4, as soon as they entered the ballroom. Ann Hyland said that at approximately 23.45 she was near Exit 5 and saw a chain and padlock on the left-hand side of the door, which appeared to be wrapped around the left-hand bar.

(iv) ***The Physical Condition of the Exits after the Fire: the Evidence of the Gardai***

3.109 Detective Garda Seamus Quinn of the Garda Technical Bureau arrived at the scene at 02.23 on the morning of the fire. At 05.00 he informed senior Garda Officers that he was leaving the scene and would return at 08.30 with a full team to commence an examination of the premises. He asked Inspector Curran to get everybody out of the building as soon as practicable and to preserve the scene. He returned to the scene at 08.35 on the same morning and carried out an inspection of the entire premises.

3.110 Mr Michael Norton, of the Forensic Science Laboratory of the Department of Justice, visited the scene later on the same day. He carried out a detailed examination of the premises on the 16th and 17th February, 1981. Similar examinations were carried out by scientific experts retained by the various parties who were represented before the Tribunal. The evidence established to the satisfaction of the Tribunal that the physical condition of each of the exit doors was as set out below.

Exit 1

3.111 The external door was intact with the panic-bars in position. An iron chain, with a locked Chubb lock attached, was hanging from the right-hand panic-bar. There was no indication of force having been applied to open the door *(See Plate 27).*

Exit 2

3.112 Twelve of the fifteen glass panes in the left-hand centre leaf of the door (as one looks at the door from the foyer) were broken. Ten of the panes in the right-hand leaf were broken. The two bolts located at the top and bottom of the left-hand door were in the closed position. The mortice joint at the bottom of the door had opened and split the timber for a distance of approximately 8 inches (200 mm), leaving a gap in the joint of almost 3 inches (75 mm) *(Plate 28).* There were also footwear impressions on the door. The metal roller shutter protecting the exterior of the door was in the "up" position. The two smaller doors on either side of the centre door were locked. The metal shutters in front of them were both pulled down and locked.

Exit 3

3.113 The paintwork on the external door was undamaged by fire. The panic-bar was missing from the left-hand leaf as one faces the door from the ballroom *(Plate 29).* The panic-bar and upright were present on the right-hand leaf. The retaining clip for the upright was broken at the bottom *(Plate 30),* and the overhead door frame was damaged and broken in the area where the retaining upright was inserted *(Plate 31).* The lower perpendicular bar was severely bent inwards *(Plate 32).* There was a crack in the right-hand door panel underneath the panic-bar *(Plate 33).* There were traces of blood on the internal and external sides of the right-hand leaf. A chain with a Chubb lock attached was suspended from the panic-bar on the right-hand leaf. The Garda photograph taken on the Tuesday after the fire showed that the lock was hanging from the fourth link from the bottom on the chain *(Plate 33).*

3.114 The remains of a panic-bar of the "Union" make were found by Garda Quinn lying on the ground under the "PUSH BAR TO OPEN" sign. The locking mechanism had been subjected to great force and had yielded and bent under the force *(Plate 34).*

Exit 4

3.115 The left-hand leaf (as one faces it from the ballroom) was badly fire-damaged, the veneer panelling being burnt through in places. The retaining screws for the instruction sign ("PUSH BAR TO OPEN") were still visible in the timber. The panic-bar was still in place and a chain with a Chubb lock attached was suspended from it on the right-hand side. The tip of the crash-bar was missing on the left-hand side *(Plate 35).*

3.116 The paintwork on the inner edge of the left-hand door and frame was undamaged, apart from smoke blackening at the top corner *(Plate 36).* The right-hand door was undamaged apart from some blistering of the paintwork near the top inner edge. The paint on the inner edge and frame had blistered and was smoke-damaged to the same degree on both surfaces. No sign of physical damage was visible on the preserved right-hand door, or on the surrounding frame, or on the exterior of the two doors.

Detective Garda Quinn had some difficulty in opening these doors due to the timber sticking firmly against the ground.

Exit 5

3.117 The left-hand door as one faces the door from the ballroom was badly damaged and the veneer panelling completely burned through, although the remaining screws for the instruction sign were still visible in the timber. The panic-bar was completely missing from the door: there were four metal screws on the outer edge and three on the inner edge where the bars should have been retained. The bar itself and catch mechanism were found

on the ground beside the door. The paintwork on the inner edge of the door and frame was undamaged *[Plates 37 and38).*

3.118 The right-hand door was fire damaged at the inner edge and in places the panelling was burnt through. The panic-bar was still affixed to this door *[Plate 39).* The inner support of the panic-bar was removed on the 5th April, 1981, by Detective Garda Quinn and examined by Mr Norton. He observed that portion of the panic-bar system was hollow and had walls about \ inch (3.18 mm) thick. The portion at the support nearest the door edge, and accordingly nearest the fire, showed signs of melting. On examination, he found that the piece was manufactured from aluminium. He also examined a retaining screw from the left-hand door.

Exit 6

3.119 The doors were undamaged by fire. The instruction sign was intact on the left-hand doc *[Plate 40).* The complete panic-bar system was intact and there was a chain, to which a lock was attached, hanging from the panic-bar on the right-hand side. The top of the upright portion of the panic-bar was slightly bent. On the exterior of the door at the joining edge there were signs of damage where the timber had been freshly broken. This was particularly apparent on the top left-hand door where a piece of timber was actually missing.

3.120 Mr Norton carried out a test on Exit 6 with a view to determining what might happen if the lock and chain were draped across the panic-bar. He closed Exit 6 and hooked the lock and chain on the right-hand panic-bar across the left-hand panic-bar with the lock behind the retaining portion of the panic-bar. He then pushed the panic-bar on the right hand side ten times and found that on two occasions out often the doors would partially open and then jam when the chain tightened. He then repeated the experiment with the two sides of the door pushed simultaneously. On each occasion the doors jammed when the chain had tightened, giving the impression of the doors having been locked.

3.121 Detective Garda Quinn also gave evidence of having carried out tests on the outer doors of Exits 1 and 3 and Exits 4 and 6. Two people pushed on the left-hand side and one on the right-hand side, all with their hands on the bars, while the lock and chain were draped across the door with the lock jammed between the horizontal bar and the door itself. In each case, the lock was hanging on the last link. He said that it took several attempts with all three people pushing, to get the chain to release itself from the horizontal bar of the door and for the door to open. He said that the vertical beading on the door was a critical factor in causing the lock to jam. He also said that if the lock were hanging from the fourth-last link of the chain (see para. 3.113) it was not possible to jam the lock properly. If the lock and chain were simply draped across the bar without the lock being jammed behind the bar, the door could be opened without any great pressure.

(v) ***Conclusions***

(a) ***The evidence of Mr E anion Butterly and the doormen***

3.122 Mr Michael Kavanagh made a statement to the Gardai on Monday the 16th February, 1981, i.e. the Monday after the fire, in which he said that he had unlocked each of the emergency exits at 21.00 on the night of the fire. He made the same claim in an interview which was transmitted by Radio Telefis Eireann in the "Today Tonight" programme on the same evening.

3.123 Mr Kavanagh made a further statement to the Gardai on Thursday, the 19th February, 1981, in which he said that the version of the unlocking of the doors given by him in his earlier statement was untrue. In this further statement, he gave a version of events which corresponded in all material particulars with the evidence given by him in answer to Counsel for the Tribunal. In the course of the statement, he said that

> "Yesterday, the 18th February, 1981, Leo Doyle and P.J., another doorman, came to my house and asked my mother to tell me to go on television or to tell

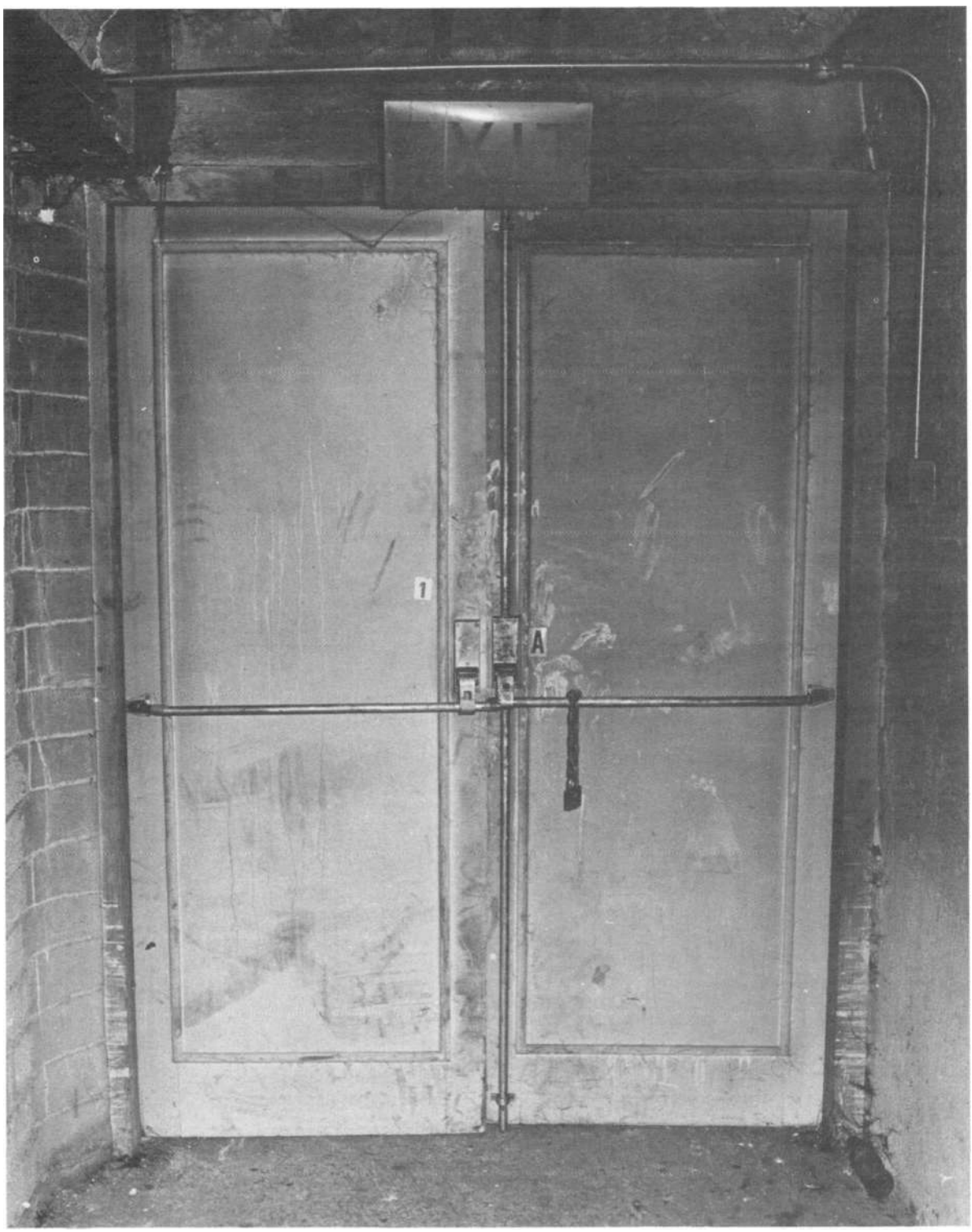


Plate 27 — *Internal view of Exit 1 (outer door) as seen from inside the passage.*

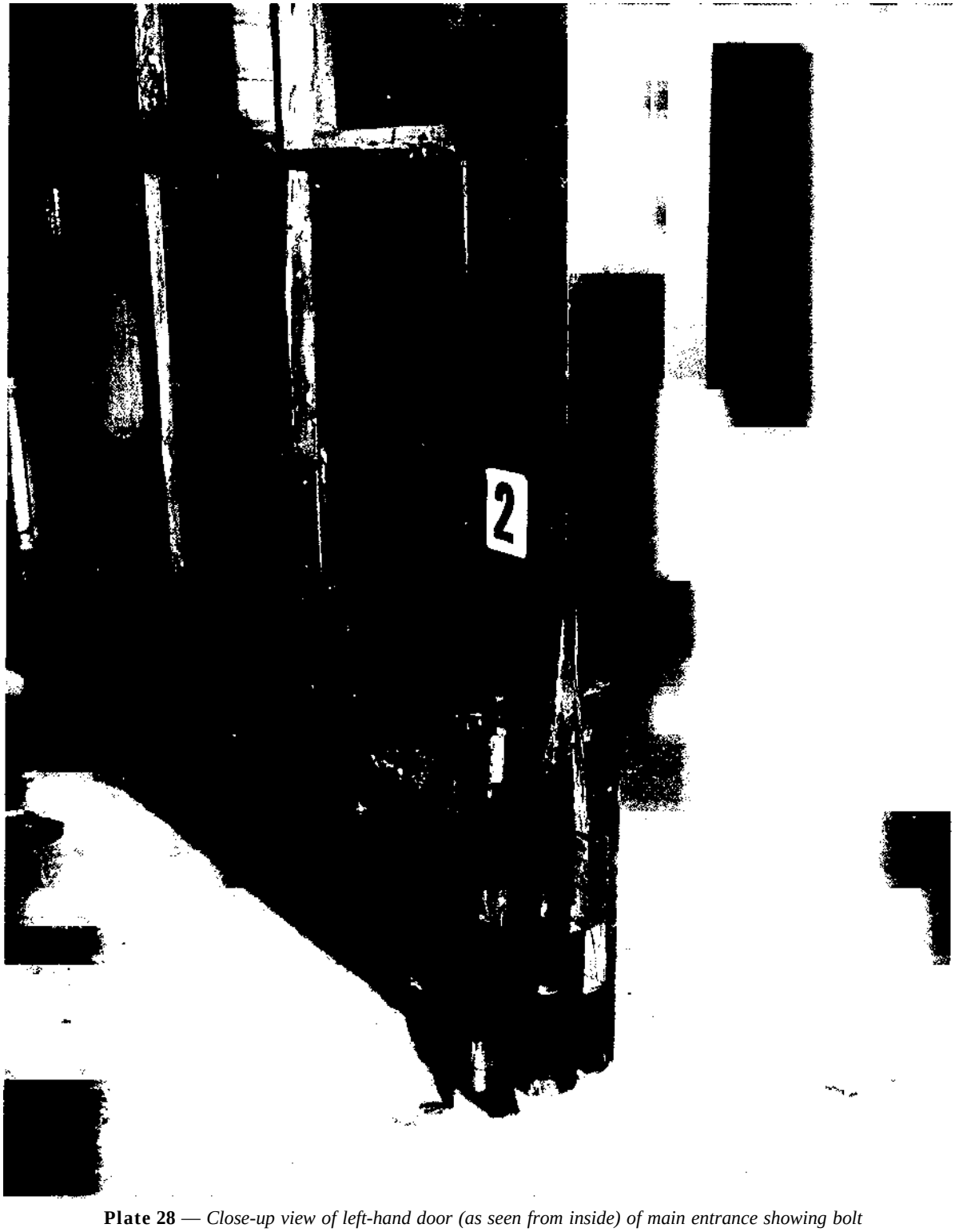


Plate 28 — *Close-up view of left-hand door (as seen from inside) of main entrance showing bolt and damage to door.*

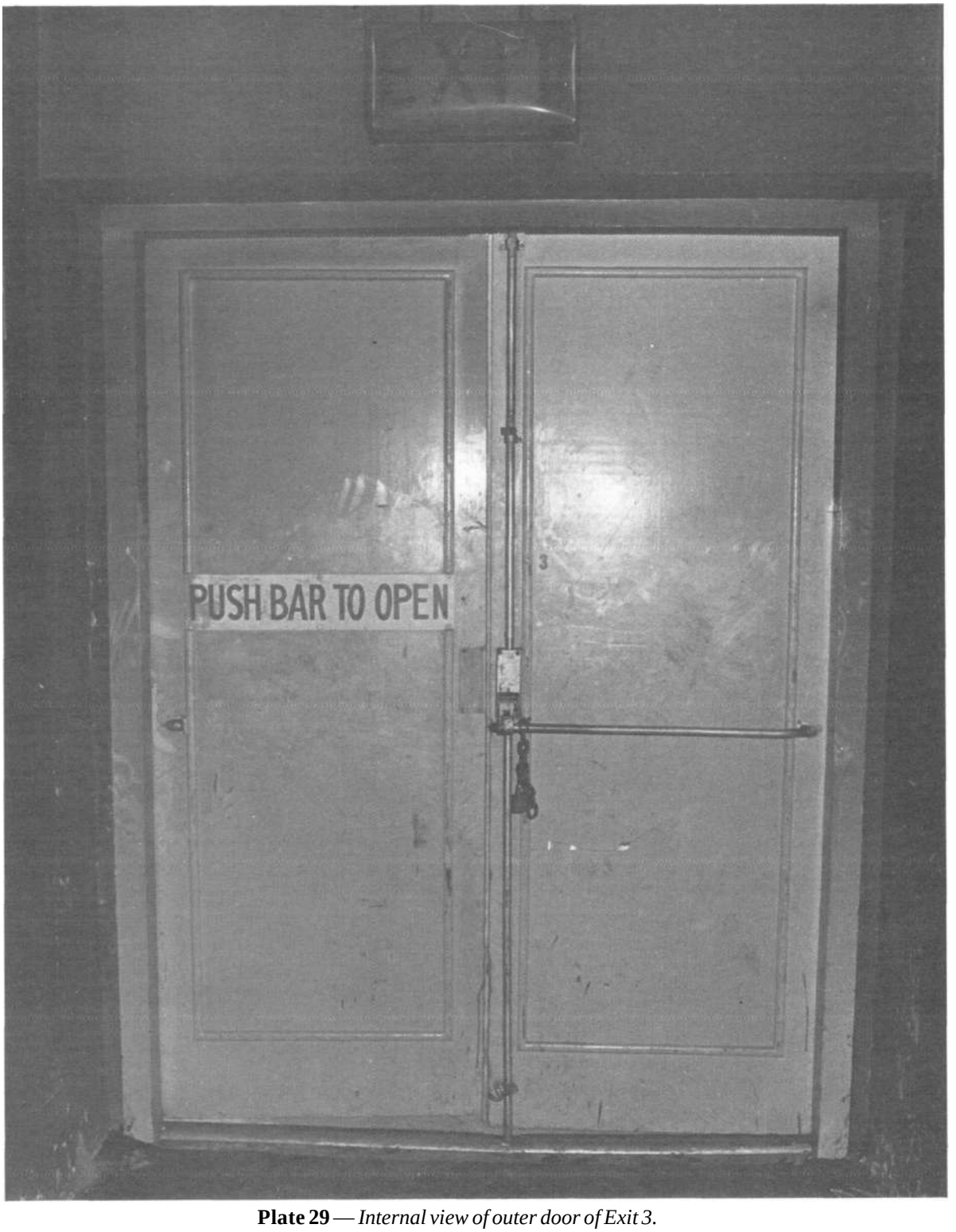


Plate 29 — *Internal view of outer door of Exit 3.*

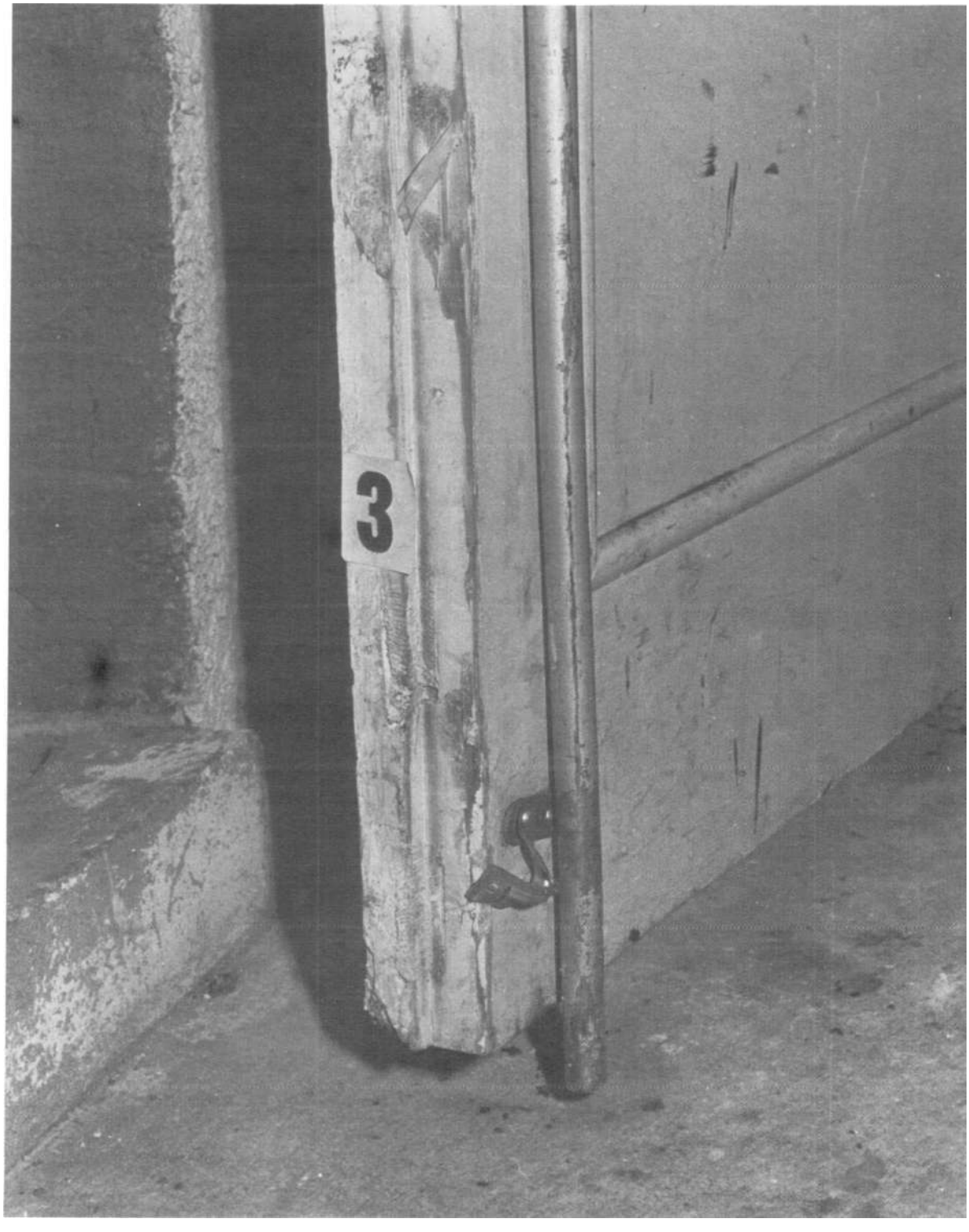


Plate 30 — *View of bottom of outer door of Exit 3 showing vertical bar displaced from retaining clip.*

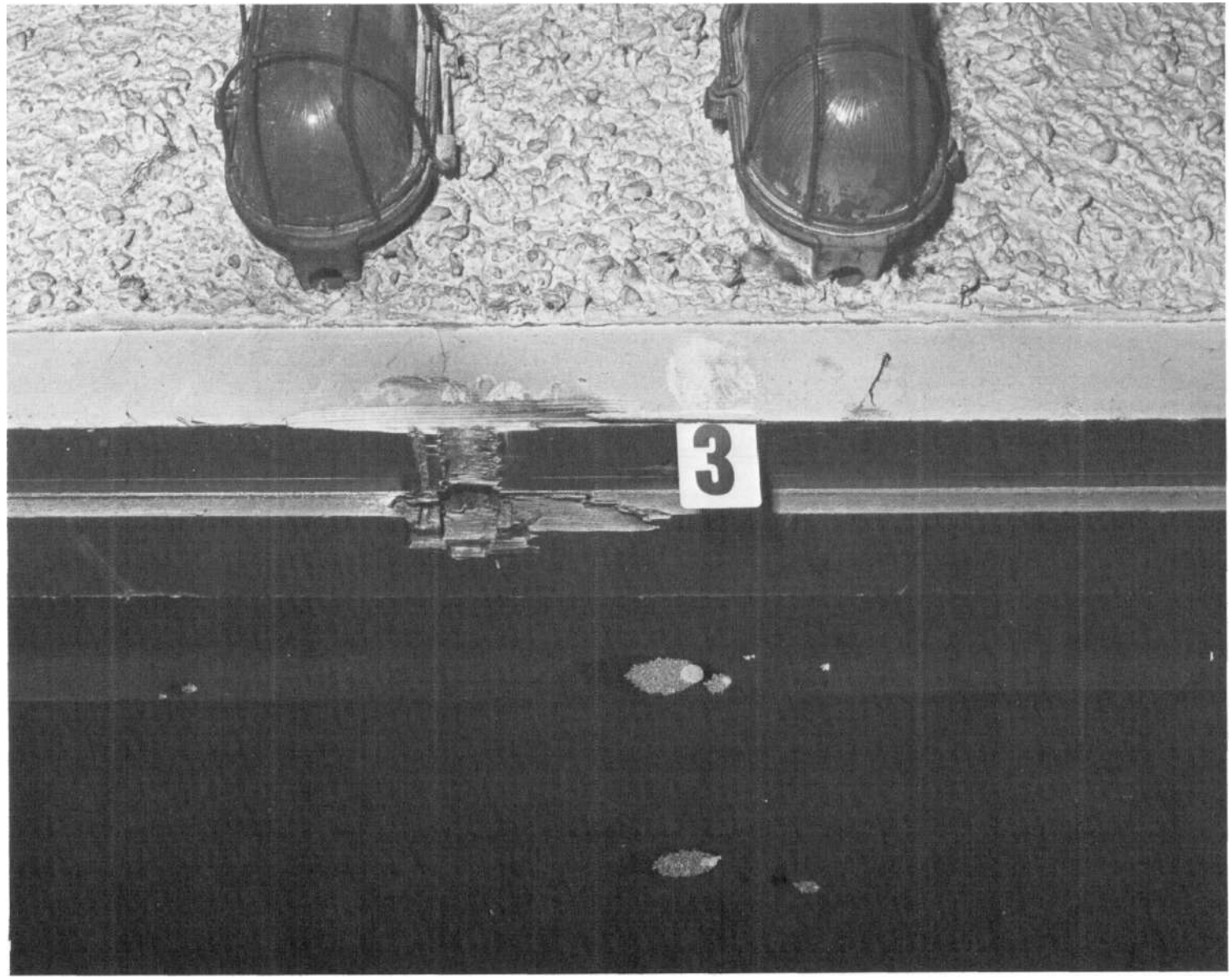


Plate 31 — *View showing damage to top of doorframe of outer Exit 3.*

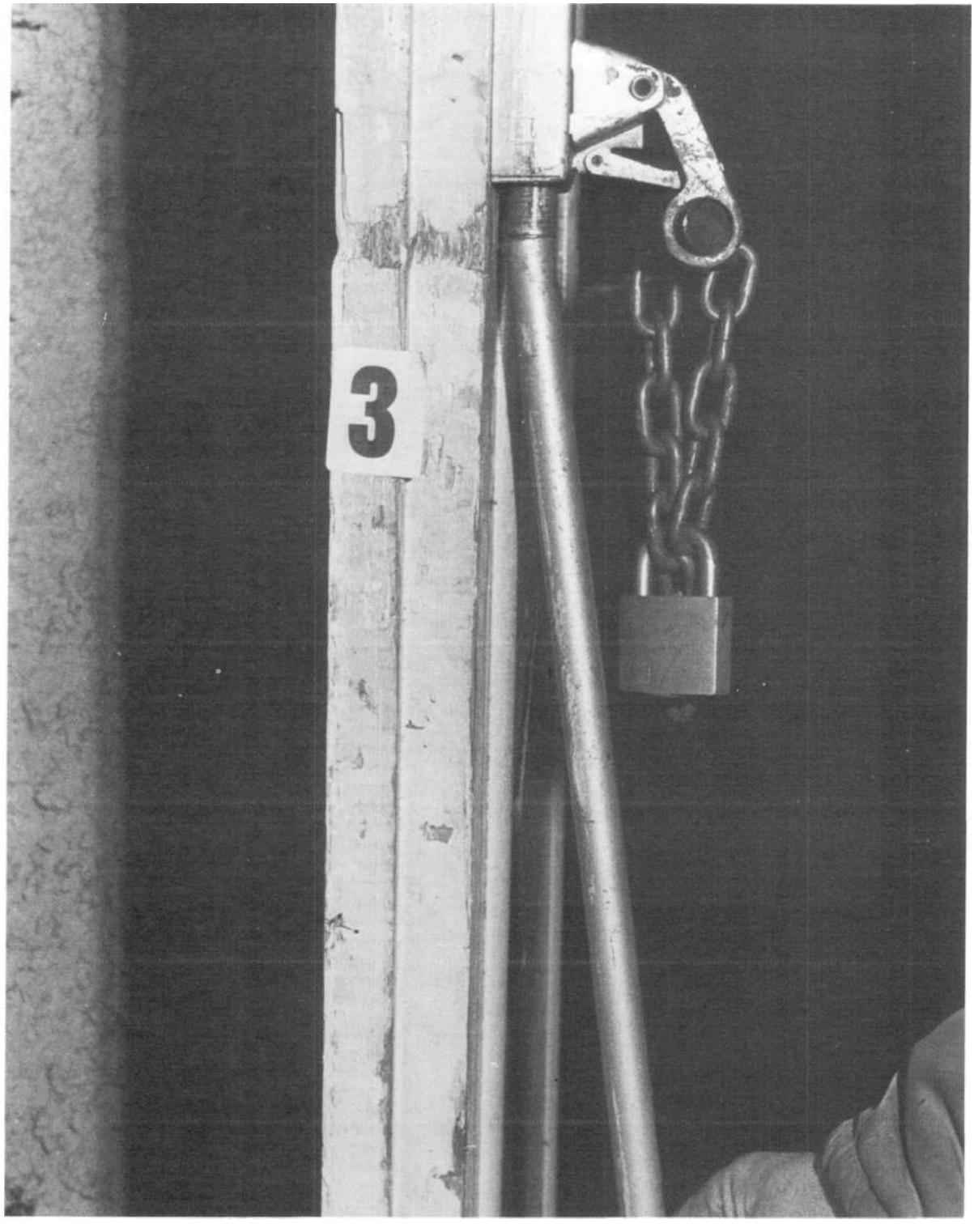


Plate 32 — *View of the right-hand door of outer Exit 3, showing vertical bar bent inwards and lock and chain hanging from horizontal bar.*

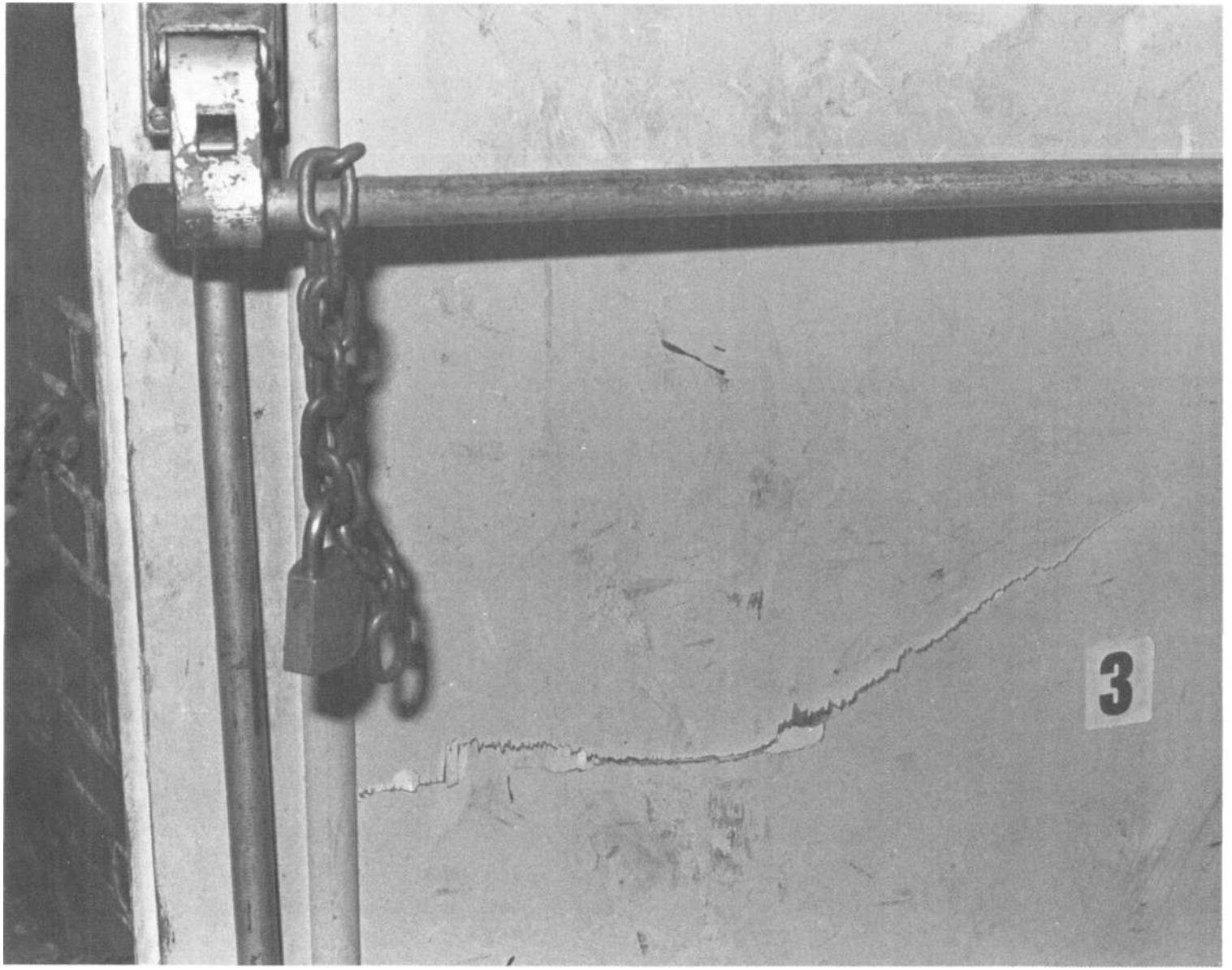


Plate 33 — *View of outer Exit 3 showing horizontal bar and damaged plywood. See also chain secured*

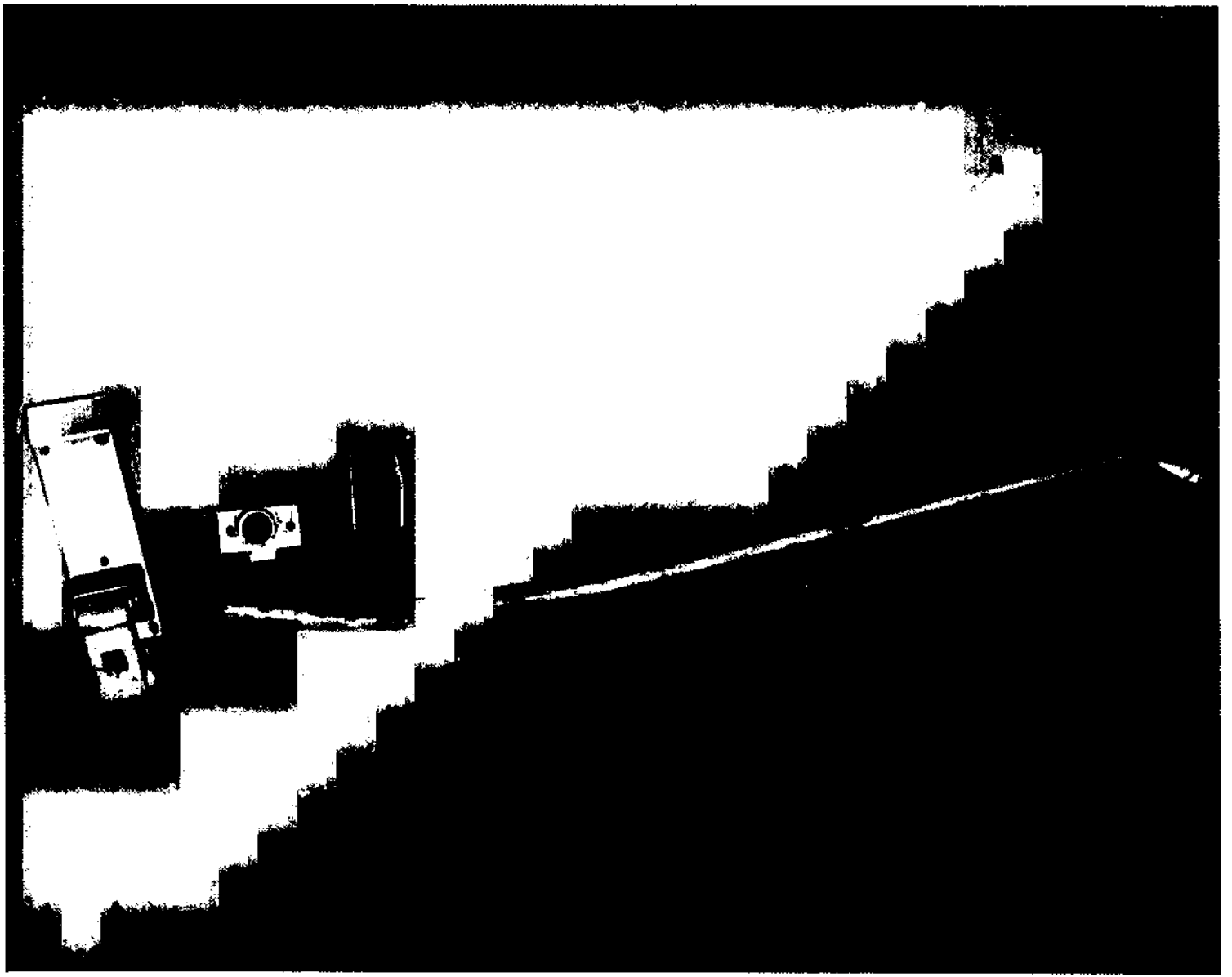


Plate 34 — *View of horizontal bar and fittings from left-hand door of outer Exit*

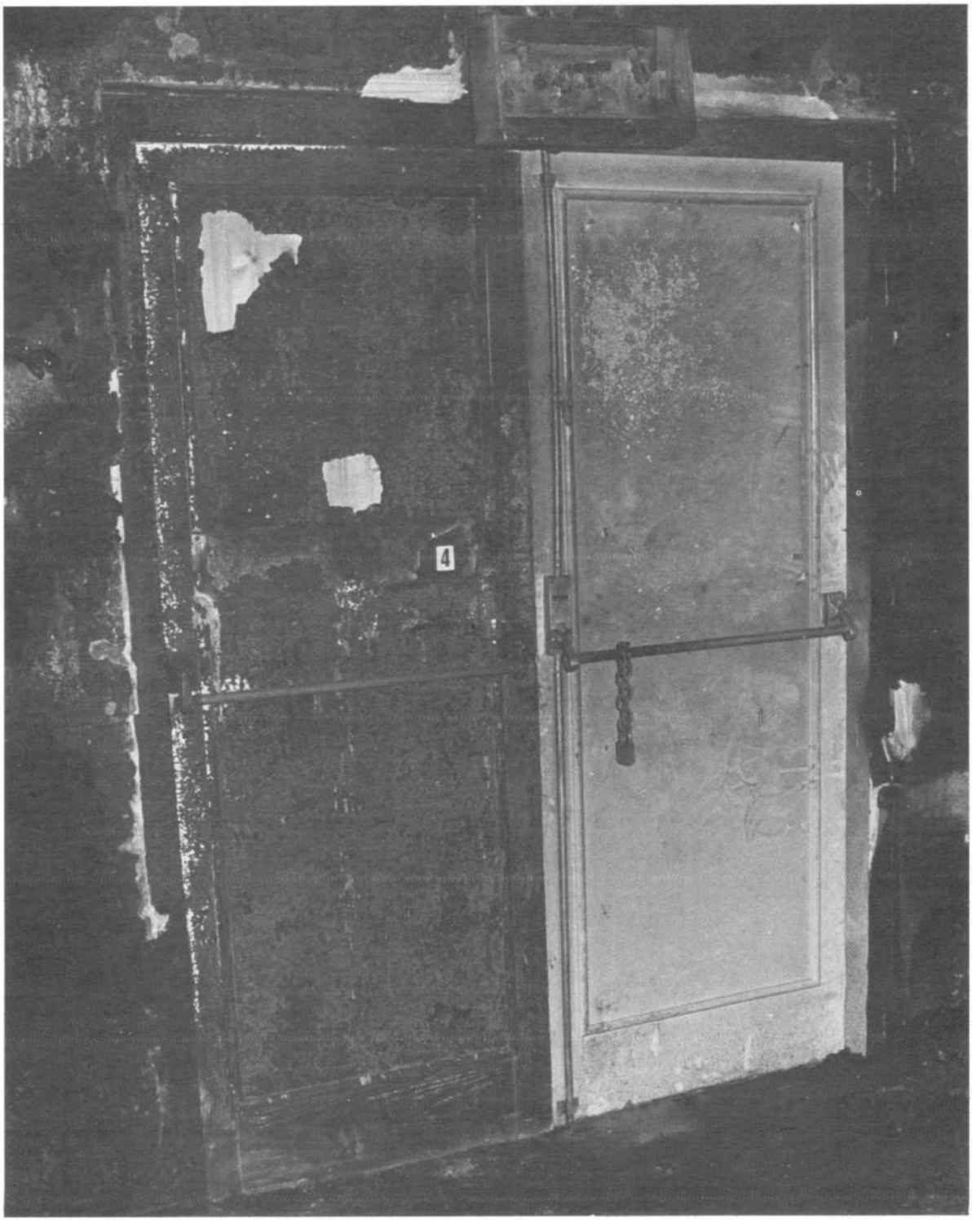


Plate 35 — *Internal view of Exit 4, showing left-hand leaf badly fire-damaged.*

Plate 36 — *View of left-hand door and frame of Exit 4; note edges of door and frame undamaged.*

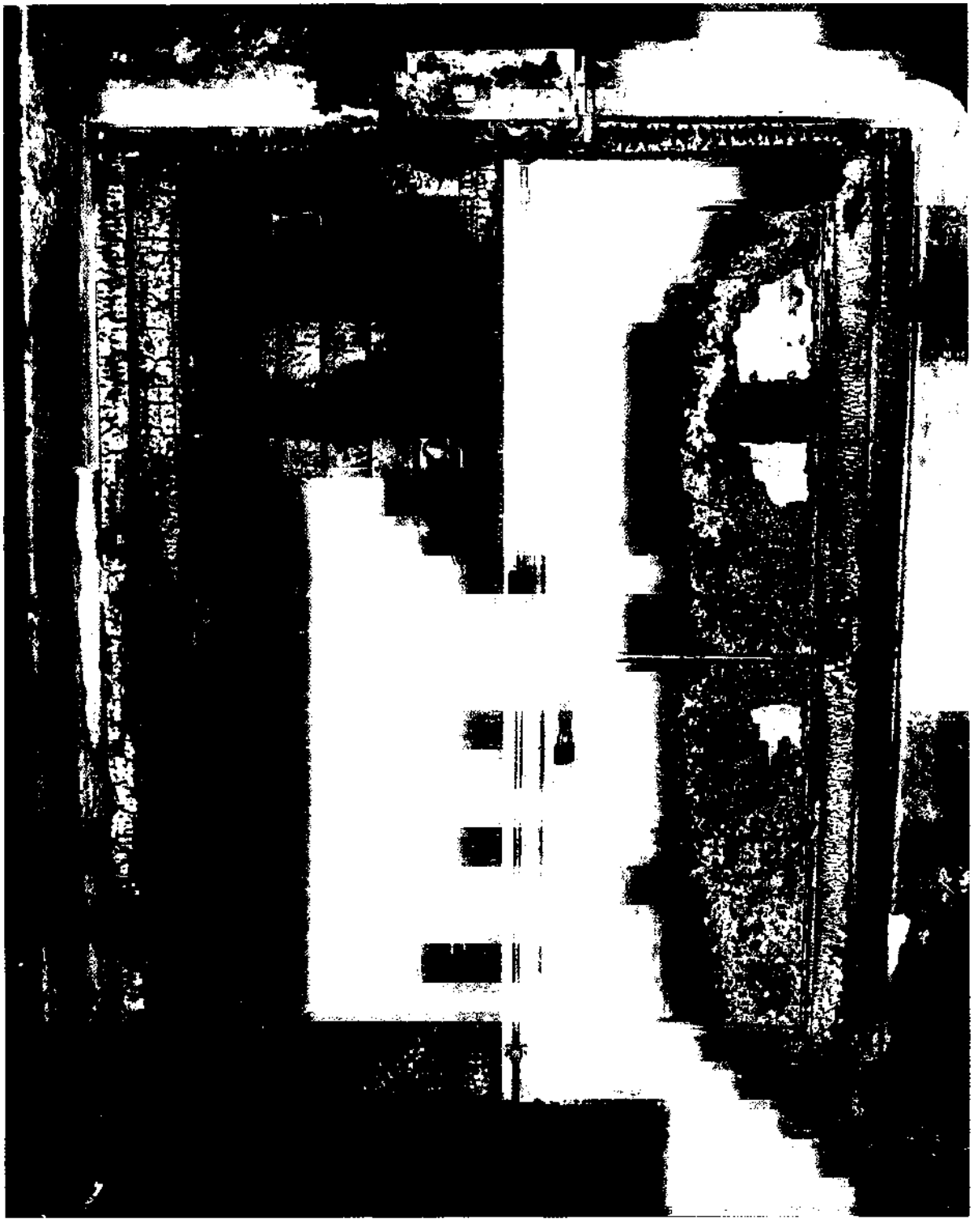


Plate 37 — *Internal view of doors of Exit 5; note plywood covering on left leaf burnt away.*

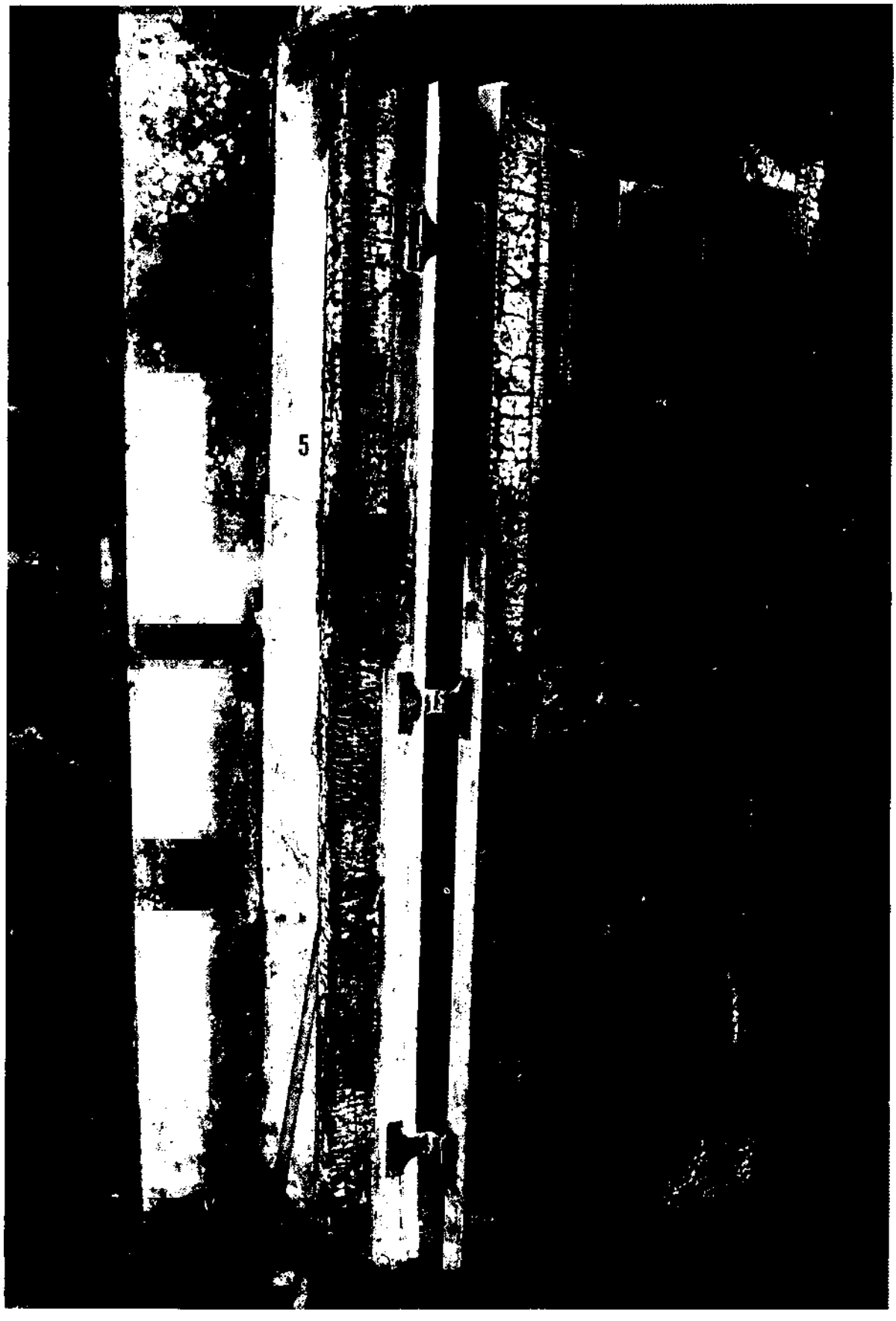


Plate 38 — *View of left-hand door and frame of Exit 5.*

Plate 39 — *View of right-hand door and frame of Exit 5; note edges of door and frame fire-damaged; the wall of the store used by the barmen of Bar 2 is visible to left of picture.*

Plate 40 — *View of doors of Exit 6 in North Alcove.*

the papers that I got the keys and that I was responsible for opening the fire exit doors of the Stardust Club on the night of the fire".

In his evidence to the Tribunal, however, Mr Kavanagh said that he was not at his house when Mr Doyle and Mr Murphy called, but that his mother had told him that they had left a message for him that he was to go up and tell the Gardai that he (Mr Kavanagh) had nothing to do with the opening of the exits.

3.124 Mr Kavanagh said in evidence that he had told lies to the Gardai and on television because he was in a state of grief and shock following the death of his girl friend in the fire, and because he was angered by the criticism in his neighbourhood of the conduct of the doormen during the fire, and what he considered to be the bogus claims of some of the patrons to have behaved heroically on the evening.

3.125 Mr Kennan made a statement to the Gardai on the Saturday of the fire. He made no reference in the statement to his having unlocked the exit doors during the course of the evening. The owners' solicitors also furnished to the Tribunal a written memorandum by them of a statement made to them by Mr Kennan on the same evening which again did not refer to his having unlocked the exits. Nearly a week later, on Friday, the 20th February, he made a statement to the Gardai in which he said that he had unlocked the exits at the time and in the circumstances of which he gave evidence to the.Tribunal. That statement was, of course, made after Mr Kavanagh had made his second statement to the Gardai. Mr Kennan did not go to the Garda Station of his own volition to make this second statement: the Gardai called to his house at 07.30 and requested him to accompany them to the Garda Station to assist them further in their enquiries.

3.126 Mr Doyle, Mr Murphy and Mr Downes also made statements to the Gardai on the Saturday of the fire. None of them made any reference to the incident in the foyer when Mr Kennan was alleged to have thrown the keys to Mr Downes and told him that the exits were open. Nor did any of them make any attempt to get in touch with the Gardai on this matter; and it was not until they were each invited to make further statements on the following Friday that they each gave a version of the incident. Each of them was also interviewed by the owners' Solicitor on the Saturday of the fire and, according to the written memorandum of the interview, made no mention of the incident. Mr Downes, in the course of his statement on the Saturday said that "prior to the disco starting one of the door staff opened all exits leading from the Stardust Club". In his second statement, he said that "when I said in my original statement that a doorman had unlocked the doors I assumed that it would have been done because it was normal practice".

3.127 The Tribunal is satisfied beyond doubt that Mr Kavanagh's statement to the Gardai on the 16th, that he had unlocked each of the five emergency exits when he arrived for work at 21.00 on the night of the fire, was untrue. It is also clear that this statement was made by him when he was in a state of acute and understandable emotional distress following the death in the fire of his girl friend, to whom he had been talking during the course of the evening. The fact remains that he told a brazen falsehood to the Gardai and, through the medium of television, to the public at large, on a matter which he knew to be of the utmost gravity. In these circumstances, his sworn evidence to the Tribunal as to his actions on the night in question must be treated with great caution.

3.128 Mr Kennan was unable to give any satisfactory explanation to the Tribunal as to why he chose to withhold the crucial information which he alleged to have in his possession, as to the opening of the doors, until nearly a week after the fire. The Tribunal accepts that his failure to mention it in his first statement on the Saturday of the fire may have been due, in part, to the form of the questions put to him by the Gardai, and in part to the fact that he was still somewhat shaken by his experience. The same reasons may explain his failure to refer to the matter in his interview with the owners' solicitors. The Tribunal is satisfied, however, that early in the following week Mr Kennan was well aware that Mr Kavanagh was falsely asserting to the world at large that he had opened the doors.

3.129 There can be only two explanations of Mr Kennan's failure at that stage to go to the Gardai. The first is that the version of the unlocking of the doors given by him on oath before the Tribunal was untrue. The second is that the version was true in whole or in part, but was withheld by Mr Kennan from the Gardai in the hope that they, and the public at large, would remain under the impression that the doors were open at 21.00. Irrespective of which of these explanations is the correct one, the Tribunal is satisfied that Mr Kennan's motive in misleading the Gardai, whether by telling falsehoods or remaining silent when he had a clear duty to speak out, was his fear as to the consequences for himself and his nephew Mr Eamon Butterly, if it transpired that the emergency exits were not merely chained and locked until midnight on the night of the fire, but on other disco nights as well. In these circumstances, the Tribunal has also treated this witness's sworn evidence with great reserve.

3.130 The Tribunal is satisfied that at the time when Mr Doyle and Mr Murphy went to Mr Kavanagh's house and left a message with his parents that Michael Kavanagh should go back to the Gardai, both of them were aware not merely that Mr Kavanagh had been claiming to have opened the doors, but that Mr Kennan was also asserting at that stage that he had, in fact, opened them. They both claimed in evidence to have been aware of a fact which lent at least some support to Mr Kennan's claim to have opened the doors, i.e. the throwing of the keys to Mr Downes in the foyer at 01.30. Their clear duty in these circumstances was to inform the Gardai, as soon as possible, of this additional information, and they were unable to furnish the Tribunal with any satisfactory explanation of why they did not do so. This, again, has compelled the Tribunal to treat their evidence with great reserve.

3.131 The same considerations apply to Mr Downes's failure to tell the Gardai of the throwing of the keys to him until the following Friday. Mr Downes was also unable to give any satisfactory explanation as to why, in his statement on the Saturday, he elected to inform the Gardai that, prior to the disco on the night of the fire, one of the door staff opened all the exits, when he did not, in fact, know that to be the case. It would have been a simple matter for Mr Downes to have told the Gardai on the Saturday that, while he had not actually witnessed the unlocking of the doors, he presumed that normal practice had been followed. This has compelled the Tribunal to treat this witness's evidence with great reserve also.

3.132 Mr Austin Bell suffered injuries during the fire as a result of which he was detained in hospital for approximately a week. On the Saturday of the fire he made a statement in hospital in which he made no reference to any of the doors having been locked. He made a further statement on the 20th February, 1981, in which he referred to Exit 6 as having been locked and subsequently unlocked by Mr Kennan. The Tribunal is satisfied that Mr Bell's failure to refer to the locking of the doors in his first statement may have been due to the form of questions put to him and to his physical and mental condition in the immediate aftermath of the fire. It does not, in the opinion of the Tribunal, affect his credibility as a witness.

3.133 Mr Gabriel O'Neill made a statement to the Gardai on the 24th February, 1981. In the early part of the statement, he said that he had opened Exit 5 without any difficulty and Mr Griffin had opened Exit 4. In a later part of the statement, he retracted this and gave a version of events which corresponded with the evidence given by him, on oath, to the Tribunal. Mr O'Neill's initial attempt to mislead the Gardai cannot be in any way due to the form of the questions put to him, nor was it due to his being physically or emotionally distressed in the immediate aftermath of the fire. In these circumstances, the Tribunal has also had to treat Mr O'Neill's evidence with great reserve.

3.134 Mr Phelim Kinahan did not tell the Gardai in his first statement on the 14th February, 1981, that he was aware of the practice of keeping the doors locked for portion of the night, or of his tour of inspection of the doors. He must have appreciated the importance of this matter, since he told a newspaper reporter on the 14th February that all the fire

regulations were adhered to. In the circumstances the Tribunal has also had to treat his evidence with great reserve.

3.135 Mr Eamon Butterly made a statement in the presence of his solicitor on the 14th February, 1981. At the end of the statement he said:—

> "I would like to add that in accordance with normal procedures I asked Tom Kennan, the Head Doorman, if all the fire exits were unlocked and he answered me that they were and he had men stationed at each exit in accordance with standard procedure. I personally saw that ten of the exits were open and Tom Kennan then went over to the other exits himself and came back to me and said everything was okay. This occurred between 11.00 p.m. and 11.30 p.m."

(The reference to "ten" is clearly an error in the transcription for "two").

3.136 Mr Butterly did not tell the Gardai that, in accordance with the procedure that had been in operation for at least four weeks prior to the fire, Exits 1, 5 and 6 were, to his knowledge, locked and chained until at least midnight. Nor did he tell the Gardai that the statement which he alleged Mr Kennan to have made was, to his knowledge, untrue since there was no point in the evening at which there were men stationed at each of the emergency exits. The Tribunal is satisfied that Mr Butterly must have known that his failure to disclose his full knowledge as to the state of the exits on that night could only have been seriously misleading.

3.137 Mr Butterly was aware, following transmission of the "Today Tonight" programme by Radio Telefis Eireann on the following Monday, that Mr Kavanagh was giving an untrue version to the public at large as to the unlocking of the exit door. Mr Butterly made no further statement to the Gardai until the 26th October, 1981, i.e. towards the end of the public sittings of the Tribunal. He had, however, been furnished by Detective Inspector Ronayne on the 8th March, 1981, with a written questionnaire containing 127 questions. A number of the questions related to the locking of the exit doors, which the Gardai wished to have answered in order to assist them with their investigation into the fire. Mr Butterly decided to avail of legal advice in relation to the questions and they remained unanswered until the 26th October, 1981.

3.138 The Tribunal is satisfied that Mr Butterly was under a clear duty to tell the Gardai all he knew in relation to the locking of the exit doors on the night of he fire and, in particular, to tell them at the earliest possible opportunity that Mr Kavanagh's version was wholly untrue.

In these circumstances the Tribunal has been compelled to treat Mr Eamon Butterly's evidence with great reserve.

3.139 The conduct of these witnesses (Mr Kavanagh, Mr Kennan, Mr Doyle, Mr Murphy, Mr Downes, Mr O'Neill, Mr Kinahan and Mr Butterly) in failing to co-operate fully with the Gardai in an investigation of this magnitude and gravity, amounting in the case of Mr Kavanagh and, to a lesser extent, Mr O'Neill, to an attempt to mislead them, was deplorable and indefensible. While it is clear, however, that some of the witnesses discussed the question of the unlocking of the exits with each other after they had made their first statement and before they made further statements, the suggestion made on behalf of some of the next-of-kin that some of these witnesses participated in a form of organised conspiracy to conceal the truth from the Gardai, was not, in the opinion of the Tribunal, borne out by the evidence. The suggestion that two of the doormen, Mr Leo Doyle and Mr John Fitzsimons, played a major role in such a conspiracy was also, in the opinion of the Tribunal, not borne out by the evidence.

3.140 Questions were also asked on behalf of some of the next-of-kin, which appeared to suggest that some of these witnesses had been bribed with a view to their withholding information from, or actively misleading, the Gardai. It was, by implication, suggested that this was being done either directly by, or at the instigation of Mr Eamon Butterly. This suggestion was never put to Mr Eamon Butterly when he was in the witness box and, in the opinion

of the Tribunal, there is no substance in the allegation that any attempt had been made by Mr Butterly or any other person connected with the premises to bribe any of the witnesses concerned.

3.141 It should also be pointed out that, while the evidence of these witnesses on the question of the locking of the exit doors must be treated with reserve, the same does not necessarily apply to the evidence given by them as to the fire itself.

3.142 There are serious discrepancies between the evidence of Mr Kennan and Mr Butterly as to the instruction allegedly given by the latter to the former to unlock the doors. Mr Kennan said that it was given following a report that there were people on the roof and the visit by him and Mr Butterly to Exit 1. Mr Butterly said that the instruction was unrelated to any such incident and was given by him to Mr Kennan at the cigarette machine. Mr Butterly's reasons for giving the instruction to Mr Kennan at that stage, moreover, are not clear: his instructions to the staff envisaged that the doors should not be opened until the main entrance door was locked, which had not happened at the time he claims he gave the instruction to Mr Kennan. In addition, this instruction was not normally given by Mr Butterly himself and there seemed no obvious reason why he should have departed from the normal procedure.

3.143 Mr Butterly said that the incident on the roof was reported to him at approximately 00.30 by Mr Jack Walsh. However, the evidence of a number of witnesses gives a somewhat earlier time for this incident: it would appear to have been over at 00.15 at the latest (see para. 6.158).

3.144 It may be that the conversation between Mr Butterly and Mr Kennan did take place after the incident on the roof had been reported to the former. This might explain why Mr Butterly ordered the doors to be opened at that stage: the incident had been reported to the Gardai and he might have been apprehensive at their presence on the premises at a stage when some or all the emergency exits were chained and locked. If the instruction to Mr Kennan was given after the incident on the roof, and possibly as late as 00.15, it would explain why Mr Kavanagh on his tour of inspection at some time between midnight and 00.20 at the latest, found the exit doors still locked. Allowing that it would have taken some time for Mr Kennan to go to each of the exits and that Mr Kavanagh's timing may not be entirely reliable, this would reconcile the various versions given.

3.145 The Tribunal is of the opinion that it is unsafe to arrive at any conclusion as to the locking or unlocking of the exit doors which is based solely, or even principally, on the evidence of these witnesses. It is of that opinion for three reasons:—

(a) the lack of credibility of the principal witness;

(b) the discrepancies between the different versions of events given by the witnesses; and

(c) the fact that no member of the staff appears to have been responsible for seeing that the exit doors were unlocked at midnight, or thereabouts, on disco nights.

3.146 There is, fortunately, a volume of eye-witness evidence which does not suffer from the same imperfections. This, coupled with the physical condition of the doors as found by the Gardai after the fire, has enabled the Tribunal to reach a definite conclusion as to the condition of each of the exit doors immediately before the fire. It is proposed to deal with the exits in turn, beginning with Exit 6 and moving in a clockwise direction around the building.

(b) ***The condition of the exits***

Exit 6

3.147 There were indications that force had been used to open this door. These were, however, consistent with somebody having tried to force the door open from the outside. The fact that the chain and padlock were found hanging from the undamaged panic-bar was

consistent only with the door having been unlocked during the fire; and the evidence of Gary Sullivan, the first patron to leave by this door, confirmed that this was so. As to its condition for the remainder of the evening the Tribunal accepts the evidence of Mr Bell that he tested it at some stage and found it secured by a lock and chain and that he observed Mr Kennan unlocking it at 00.20. The Tribunal is also satisfied that this exit door was locked and chained from the time the public were admitted to the premises at 22.00 approximately until Mr Kennan unlocked it at 00.20. The panic-bolt mechanism on this door was upside down.

Exit 5

3.148 The Tribunal accepts the opinion of Mr Michael Norton that the extent of the damage to the left-hand and right-hand leaves of this door (as one faced it from the ballroom) indicates that the left-hand leaf was closed for the duration of the severe fire in this area, but that the right-hand leaf was open during that time. The evidence of some of the witnesses suggested that, while both leaves opened initially after the application of some degree of force, the left-hand leaf was pushed back into the closed position. The Tribunal also accepts the opinion of Mr Norton that the lightweight aluminium supports for the panic-bar had melted, leaving the retaining screws in position on the left-hand leaf. It followed that the fact that the panic-bar was missing from the left-hand leaf did not, of itself, mean that unusual force had been used to open the doors.

3.149 The evidence of the patrons and the staff who went out by this door suggests that, while there was a significant degree of obstruction of the door, it was not such as to lead to the inference that the door was locked and chained. In particular the evidence of Mr David Carroll that he could see a chain that appeared to be tied around the horizontal bar on both sides of the doors may be explained by its having been wrapped around both sides of the bar in order to give people the impression that it was locked. This may also have accounted, in part, for the undoubted confusion at this door, creating the impression in some patrons' minds that the exit door was, in fact, locked and chained, and causing them to seek another route of escape. In addition, the skips full of bottles clearly constituted a significant obstruction, adding to the delay and confusion.

3.150 The Tribunal is satisfied that Mr Kennan unlocked this door at approximately 00.20. It is true that there is no evidence of this—other than the evidence of Mr Kinahan that he found the door unlocked at approximately 00.40—but, in the view of the Tribunal, it is improbable that Mr Kennan would have unlocked Exit 6 and not Exit 5. The Tribunal is also satisfied that this exit had been chained and locked since the public came into the premises at 22.00.

Exit 4

3.151 The Tribunal accepts the opinion of Mr Norton that the physical condition of this door suggests that the left-hand leaf (as one faced it from the ballroom) was closed for the duration of the severe fire in the area, but that the right-hand leaf had been opened during that time. This would indicate that the left-hand leaf was closed very shortly after the door was opened by Mr Bridgeman or Mr Griffin, although it is not clear by whom. The fact that the panic-bars were in position, and that a chain with a lock attached was suspended from the panic-bar on the right-hand side, indicates that no significant degree of force was applied to the door.

3.152 The Tribunal accepts the evidence of Mr Griffin that he tested this door at some time in the region of 00.25 or 00.30 and found it to be unlocked. The Tribunal also accepts the evidence of Mr Bridgeman and Mr Crowe that the door was unlocked at around 23.00 when they went out to replace the kegs. There is no evidence to indicate whether the door was locked or unlocked prior to that time.

Exit 3

3.153 The Tribunal is satisfied that the condition of the outer door was consistent with considerable force having been used to open it. The Tribunal rejects the suggestion that this was due to the panic-bars not having been pushed downwards and the vertical member of the unit being caught in the receiver at the top of the door. It accepts the evidence of the patrons who said that the door, when kicked violently, opened approximately an inch and then, after further kicking, burst open completely. This points clearly, in the view of the Tribunal, to the door having been secured by a lock and chain. The lock was found on the Tuesday after the fire to be hanging from the fourth link of the chain, close to the position in which, according to Mr Doyle, the lock was attached when the doors were locked. It is also clear that, if the chain were draped across the bar so as to give the impression that the door was locked, it would have been difficult to jam the lock behind the bar while it was attached to the fourth link. It would follow that if the lock was, in fact, hanging from the fourth link and the chain was draped across the bar without actually locking the door, it should have been comparitively easy to open it by the exertion of some pressure.

The Tribunal is, accordingly, satisfied that this exit was, in fact, locked with a lock and chain when the fire began.

3.154 The Tribunal is also satisfied that, while this door was unlocked when the disc jockey came in with his equipment at 20.30, it was relocked subsequently by a member of the staff who was aware of Mr Butterly's direction that the exits should remain locked until midnight at the earliest.

Exit 2

3.155 The evidence establishes that the outer door of Exit 2 was locked from some time between midnight and 00.30 until the first alarm of fire was raised in the foyer. The Tribunal is satisfied that at that stage it was unlocked by Mr Downes, and that he attempted to secure the door in the manner described in his evidence. The Tribunal is also satisfied that, at the stage that the alarm was raised in the foyer, Mr Downes had already put the metal shutter outside the door into the "up" position.

3.156 Of the many people who either escaped through Exit 2 or were in front of it during the fire, only three recalled seeing the metal shutter half-way down in front of the outer door, and the Tribunal is satisfied that their recollection must have been mistaken. There is no evidence to suggest that the doors were subsequently re-locked, although it is clear that they were in the closed position for a time.

Exit 1

3.157 The condition of the outer door indicates that no unusual degree offeree was used to open it. The possibility exists that Mr Kennan may have unlocked the door himself after the fire began, but in the view of the Tribunal this is unlikely. There seems no reason why he would have unlocked Exits 6 and 5 and left Exit 1 locked. No doubt the same could be said of Exit 3; but in the case of Exit 1 he was seen moving in its direction and it seems more probable than not that he did, in fact, unlock it at that stage. He was also seen by one of the patrons who escaped by that route pushing it open without unlocking it.

(c) **Summary**

3.158 The Tribunal has, accordingly, come to the conclusions that, immediately before the fire, Exit 2 was locked and had been locked since between midnight and 00.30 and that Exit 3 was locked with a chain and padlock and had been locked since the public were admitted to the premises at 22.00. The remaining exit doors were unlocked before the fire, but in each case the lock and chain had been draped across the bars so as to give the impression that the doors were, in fact, locked. In the case of Exit 5, the exit was seriously obstructed by two plastic skips. In the case of Exit 4, there was some degree of obstruction, but not so great as that existing at Exit 5, in the form of loose chairs. In the case of Exit 3 the free

passage of patrons out of the building was impeded by the white van at the foot of the steps.

(3) The Failure of the Lighting

3.159 The evidence established that all the lighting in the Stardust—the house lighting, the stage lighting, the primary maintained system and the secondary maintained system —failed not later than four minutes from the visual observation of fire in the ballroom. One witness, Robert Duffy (para. 2.87) said that he went into the ladies' toilet (T6) near Exit 5 at a stage when the lights had gone out and saw that there was still a light on in that toilet. That might suggest that the secondary system remained operative for some relatively short time after the failure of the rest of the lights; but too much weight cannot be attached to this evidence, since the general burden of the evidence was that all the lights failed together.

3.160 Mr Maurice Lowe, the Senior Engineer in the Electricity and Public Lighting Section of Dublin Corporation, visited the premises on the 16th February, 1981, and inspected the Battery Room. He said that the main switches for both the primary and secondary lighting MCB boards were in the "ON" position.

(The Garda photograph showed them to be in the "OFF" position, but this was because Mr P. J. McGrath, the maintenance man, turned them off, according to his account, at some time on the 16th February.)

3.161 On both the boards some of the MCB's were in the "OFF" position: three in the case of the secondary maintained lighting board and seven in the case of the primary maintained lighting board. When Mr Kelly of Varming Mulcahy Reilly Associates, the consulting engineers retained by the Tribunal, inspected the boards at a later date, only one of the MCB's on the primary board was in the "OFF" position. When Mr Tennyson, the consulting engineer retained by the owners, inspected the boards, two of the MCB's on the primary board were in the "ON" position while the remaining ones were in the "OFF" position. In the case of the secondary system, four were in the "OFF" position and the remaining five were in the "ON" position. (Mr Tennyson's inspection was on the 19th February, 1981, and Mr Kelly's inspection was on the 7th April, 1981.)

3.162 The ESB electrician who was on emergency stand-by duty in the area on that evening, arrived at the Stardust at approximately 01.55. He made his way through the crowds with difficulty to the ESB sub-station and withdrew the low-tension fuses, thereby cutting off the mains electricity supply to the Stardust. When he left the sub-station and came closer to the building, he heard the noise of the emergency generator running. He had not noticed it running before.

3.163 Both the main fuses protecting the 110 volt AC normal supply and the 110 volt DC battery supply in the secondary lighting control cabinet were found to be "blown". Mr Kelly and Mr Tennyson agreed that they must have blown prematurely, since not all the MCB's were in the "OFF" position. Had the system operated properly, each of the sub-circuits should have failed, tripping each of the MCB's into the "OFF" position before the protecting fuses blew. In technical terms, it followed that there was inadequate "discrimination". Both experts agreed that a 20-amp rating for the main fuse upstream of the 10-amp MCB's could not ensure discrimination, and did not in the present instance. This appears to be confirmed by the fact that the batteries, which should have come into operation to supply the secondary system when the AC supply failed, had been used hardly at all; and that the main switches on both systems had not tripped into the "OFF" position.

3.164 Had proper discrimination been ensured, the secondary lighting system might have remained in operation for a short time longer than it actually did. It is, however, clear that at some stage during the fire most of the wiring inside the building, including the wiring to the secondary maintained system, was destroyed, and this would have eliminated the secondary system also. In any event, the level of illumination provided by the

secondary system was such that it would probably have been rapidly obscured by the black smoke which filled the ballroom. (It is possible that the EXIT signs might have remained visible for a marginally longer time.)

3.165 It also appears unlikely that the absence of lids from some of the trunking (para. 1.214) would have significantly accelerated the destruction of the wiring: it appears probable that the increase in temperature caused by the fire would have been sufficient to achieve this without direct exposure of the wiring to flame. Had discrimination been ensured in the secondary system, it is possible that it might have lasted for at least some time longer than it actually did, thereby assisting the evacuation. For the reasons indicated, this would have been a rather marginal contribution, since all the secondary lighting would have been rapidly obscured by the black smoke. A significantly greater contribution, however, could have been made by the use of mineral-insulated copper cabling (MICC) rather than PVC-insulated cables. The experts agreed that the latter is significantly more vulnerable to fire attack and early failure; and this was illustrated in the present case, as Mr Tennyson pointed out, by the fact that redundant MICC cabling remained intact in the vicinity of Exit 1, although all PVC cabling in the vicinity had failed, and there was evidence that some timbers in the vicinity were deeply charred.

3.166 The desirability and the practicability of using MICC cabling for emergency services, such as secondary maintained lighting and fire alarms in public assembly buildings, is considered in para. 9.154.

(4) The Behaviour of the Staff

3.167 As no one person was responsible for directing the actions of the staff in the case of an emergency such as fire, the individual members of the staff had to use their own judgement and initiative when the fire actually occurred. Since none of them, with the exception of Mr Fitzsimons, had ever received any training or instruction in fire-fighting, and none of them—including Mr Fitzsimons—had participated in any form of fire drill or evacuation rehearsal at the Stardust, it is not surprising that their reaction to the emergency left a lot to be desired.

3.168 The action of Mr Downes in wedging the centre leaves of outer Exit 2 in the mat-well has been already referred to. In order to perform this unnecessary and, in the event, dangerous operation, he abandoned an attempt to ring the Fire Brigade; although alerting them at the first sign of fire should have been an urgent priority.

3.169 In a properly organised evacuation, either Mr Doyle or Mr Downes would have ensured that the brigade was telephoned, and Mr Downes should then have assisted in the evacuation. He is not, of course, to be blamed for failing to open the side leaves of outer Exit 2, since he did not have the keys and had never even been told that they were, in fact, doors capable of being opened.

3.170 It would have assisted considerably in the prompt and orderly evacuation of the premises if a member of the staff had been stationed at each of the emergency exits, as well as Exit 2, when the fire began. Mr Bell was keeping Exits 5 and 6 under observation until immediately before the fire was first seen. He then went, however, to the area of the West Alcove because he thought Mr Doyle was having some difficulties with the patrons in that area. There was, accordingly, no doorman in the vicinity of Exit 6 when the emergency arose; and the only reason that two of the doormen happened to be near Exit 5 at the time was because the bar was beside it and they were having a drink. Exits 1 and 3 were not covered by any members of the staff.

3.171 Although some attempt was made by the disc jockey and by Mr Fitzsimons to encourage patrons to leave by exits other than Exit 2, the greatest concentration of people continued to make their way out of that exit. The congested conditions which rapidly developed in that exit on the ballroom side of it might have been mitigated to some degree by a prompt and organised reaction on the part of the staff. In particular, those members of the staff (Mr Fitzsimons and Mr Kavanagh) who had just left the Lantern Room knew that, apart

from the appearance of some smoke, the fire had not reached that area to any significant degree and that there was no difficulty in leaving by exits in the Lantern Room. It would not normally be a good idea to divert people from the recognised escape routes in this manner, but a sensible decision in the crisis that arose would have been to get as many people as possible to avail of what was known to be a safe escape route.

3.172 Mr Kavanagh seems to have appreciated this and to have made some attempts to get people to leave by Door 15 along the kitchen corridor, but his attempts were short-lived and ineffectual. Mr Fitzsimons (para. 2.67) after returning to the Stardust from telephoning the Fire Brigade, said that he shouted to people "to go to the exits on the far side, use the far exits", meaning Exits 4, 5 and 6. The difficulties, of course, were increased by the fact that of these three exits, two were seriously obstructed (see paras. 3.25 and 3.47). As doormen who regularly patrolled the ballroom, Mr Kavanagh and Mr Fitzsimons should have been well aware of these conditions. In any event, it was apparent to all the patrons in the ballroom who gave evidence that congestion was developing, not merely at Exit 2 but at Exits 3, 4 and 5. This made it all the more imperative for those members of the staff who attempted to organise the evacuation, to try to divert as many people as possible through the kitchen corridor or the Main Bar.

3.173 In the circumstances in which they actually found themselves at the time, Mr Kennan, Mr Furley and Mr Griffin probably took the only action available, i.e. of getting people out the nearest exit. (Mr Furley assisted in opening Exit 5, Mr Griffin in opening Exit 4 and Mr Kennan persuaded patrons in the North Alcove to leave by Exit 1.)

3.174 Mr Downes's action in jamming the two centre leaves of outer Exit 2 in the manner already described was ill-judged and undoubtedly resulted in the narrowing of the width of this exit and its ultimate blockage for a significant period of time.

3.175 The attempts at extinguishing the fire were short-lived and unsuccessful. When Mr Murphy first saw the fire, it was confined to the back of a seat in Tier 9 of Row A. He admitted that if he had known that there was a fire-extinguisher (F4) at the back of the alcove he would have gone straight on and collected it and proceeded to use it on the fire *(see Plate 41).* Not knowing that it was there, he wasted precious seconds in returning to the area of Bar 1 and taking a fire-extinguisher (F5) from the wall. The fact that he did not know of the existence of the fire-extinguisher at F4 reflected the general lack of knowledge of the staff as to the location of the extinguishers, and the lack of any fire drills or evacuation rehearsals.

3.176 Mr Murphy had some experience in the use of fire-extinguishers and it may be that the nature of the fire with which he was attempting to deal was such that even an experienced operator could not have extinguished it. If the fire was confined to the top of the seats, it should have been possible to extinguish it; but it may be that the fire had begun under, or behind, one or more of the seats, in which case even efforts by a trained operative to extinguish it might have been futile.

3.177 What is certain, however, is that the use of hose reels at this stage would have had a much more significant impact on a fire of these dimensions and might have succeeded in arresting its progress to a significant extent. It is the case that the effective use of hose reels—which are recommended by the Fire Protection Standards (see para. 1.184) depends on there being an adequate water supply. (The question of the use of hose reels is considered further in Chapter 9.)

(5) The Behaviour of the Patrons

3.178 The use of the word "panic" in quotation marks in this Report has been deliberate. Recent research, particularly in the United Kingdom, the United States and Canada, has indicated that the pejorative associations of the word make its use to describe the reactions of persons to a fire seriously misleading. As one English psychologist has put it:

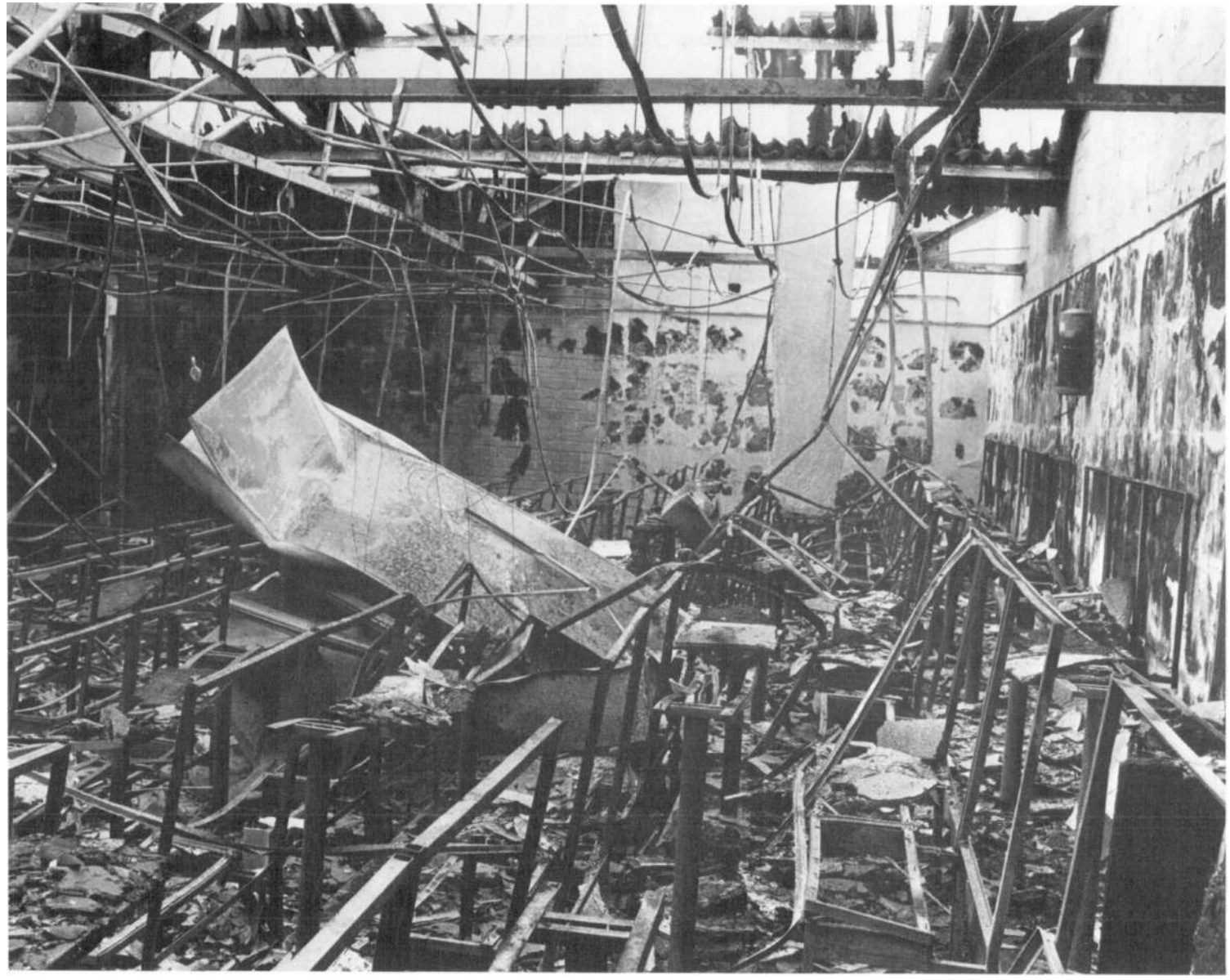


Plate 41 — *View of the West Alcove looking across the back wall, showing fire-extinguisher sti*

"behaviour in a fire can only be properly judged against the individual's awareness of the options available at different stages of the fire, his familiarity with the building and general constraints of the fire situation. Unfortunately, the primary criterion adopted for panic or irrationality is the inappropriateness of behaviour as judged from someone else's perspective".*

3.179 Specifically, the flight of a person from what he sees as a danger to him, such as fire, is frequently described as "panic", particularly when a crowd of people, as distinct from an individual, flee. The use of the word automatically suggests that the behaviour of the people concerned is, in some sense, foolish and even irrational. It is, however, frequently the case that the rational course for a crowd to adopt when confronted with a dangerous fire is, in fact, flight.

3.180 The validity of this approach to the concept of "panic" is vividly illustrated in the case of this fire. Not merely was there a general use of the word "panic" to describe the sudden movement of people, particularly in the direction of Exit 2, at the time when it was obvious that the fire was a great deal more serious than had at first been realised: that word was used by individual patrons to describe their own reactions. No doubt, many of those who used the word "panic" had in mind not merely the fact that people were moving rapidly towards the exits, but that they were doing so in a disorderly fashion, pushing each other and in some cases screaming.

3.181 The fact remains that the course adopted by those patrons who moved rapidly in the direction of the nearest exits was entirely rational: the confusion and disorder which ensued was the almost inevitable consequence of the inadequate or obstructed nature of the exits, the filling of the ballroom with black smoke and the failure of the lights, and not of the "panic" referred to by so many of the witnesses.

3.182 The evidence established (see para. 2.50) that, in contrast to those who moved rapidly to the exits when it became obvious that a serious fire was developing, a large number of people, possibly between two and three hundred, stood in front of the West Alcove and watched the fire for an appreciable period of time. At the same time, many people who were dancing in front of the stage took no steps to leave the building when they saw the fire: they either joined the crowd in the front of the West Alcove or went on dancing. There can be no doubt that many of the dead and injured were members of this group. (There were approximately six patrons asleep in the North Alcove and they may also have perished in the fire.) Some of them, at least, might have been saved from death or serious injury, if they had walked rapidly or even run to the nearest available exit, although such behaviour might normally have been described as "panicking".

3.183 The rapid movement of people towards the exits, accompanied by pushing and jostling, was not, in itself, a cause of any of the deaths or of any significant amount of serious injury. The deaths and the greater number of the injuries were caused by the effects of smoke inhalation or exposure to flame (see Chapter 5).

3.184 The action of the disc jockey must be considered in this context (see para. 2.133). In first deciding that the fire was small and would be easily brought under control by the members of the staff going to it, and secondly making the announcement that he did when he thought people were about to "panic", he probably did what most people would have done under the circumstances and, in the opinion of the Tribunal, is not to be blamed for adopting the course of action that he did. Until the researches just referred to began to raise serious doubts as to its validity, it had been part of the conventional wisdom accepted by those concerned with fire safety that, in the event of a fire occurring, a major objective should be the avoidance of "panic". It is clear from what happened at the Stardust that, had more individual members of the crowd "panicked" in the sense of running or walking rapidly towards the exits, lives might have been saved and injuries avoided. Had the

**The Concept of 'Panic'* by Jonathan D Sime: *Fires and Human Behaviour* Ed. David Canter (London: 1980: John Wiley and Sons Ltd).

management and staff of the building injected a note of urgency into the evacuation as soon as the fire was observed, specifically by the broadcasting from the stage of an urgent appeal to people to leave the building immediately, that result might have been achieved.

IV —CONCLUSIONS

(1) Factors Affecting the Evacuation

3.185 The following factors all contributed to the failure to ensure a prompt and efficient evacuation of the premises:

(1) the inadequacy of Exit 2 as an escape route on the night of the fire, coupled with the large number of people using it;

(2) the locking of Exit 3 with a chain and padlock;

(3) the draping of a padlock and chain across the panic bars of both Exit 4 and 5 in such a manner as to give people the impression that they were locked;

(4) the obstruction caused by seats in the vicinity of Exit 4;

(5) the obstruction of Exit 5 by the skips containing bottles;

(6) the absence of any evacuation procedures or any organisation to deal with an emergency of this nature;

(7) the lack of knowledge of the staff as to the location of the fire-extinguishers;

(8) the absence of hose reels;

(9) the ineffectual nature of the attempts at extinguishing the fire; and

(10) the failure of the lights.

3.186 It is also possible that the inexperience and lack of training of the staff in the use of fire-extinguishers was a factor. However, Mr Murphy had some experience and it may be that the extent of the fire was such that even an experienced operator would have been unable to deal with it.

3.187 While it is not strictly relevant to the efficiency of the evacuation, it should be pointed out that the lack of adequate ventilation in some of the toilets (see para. 1.212) clearly increased the hazard for those who took refuge, or were trapped, in the toilets (see para. 2.142).

3.188 While all the factors mentioned above played some part it is clear that the most important were the unsuitable nature of Exit 2, the locked and obstructed condition of the other exits, the organisational shortcomings and the rapid spread of the fire.

3.189 The width of the exits was sufficient to permit the discharge of the total occupant capacity of the Stardust (about 1,750 persons) in two and a half minutes, using the standards employed in the Draft Building Regulations (see para. 1.198). Recent studies have queried the validity of some of the assumptions on which this rate of discharge is based, as not making sufficient allowance for such factors as the actual behaviour patterns of people moving along the escape routes, the nature of the clothing worn by them, the nature of the wall surfaces, etc. But whatever allowance is to be made for those factors as increasing the time within which the occupant capacity should have discharged through the exits, it is more than counter-balanced by the fact that the *actual* occupant capacity of the ballroom was at about only 50% of the *total* occupant capacity.

3.190 The prompt and efficient evacuation of the premises should have begun as soon as Mrs Prizeman gave the alarm in the foyer, thus alerting Mr Doyle and Mr Downes. Had the evacuation then gone ahead in an orderly manner through unlocked and unobstructed exits with the crowd properly marshalled by trained attendants, the patrons should have passed through all the exits in less than two and a half minutes. If one now refers to the suggested time-table of events in'Chapter 2 (see para. 2.179), it would follow that all

persons should have been brought to safety out of the building at a stage when the flames and black smoke had not spread to the rest of the ballroom. This would also have been before the lights failed. This would suggest that, had such an evacuation taken place, all of the deaths and most of the injuries might have been avoided, notwithstanding the rapid spread of fire.

3.191 The Tribunal is satisfied, however, that such a conclusion would be too sweeping, based as it is on a necessarily theoretical exercise which ignores some of the realities that even the most efficient evacuation would have had to contend with. It is clear that a number of patrons were actually asleep and therefore might not have responded in sufficient time to save themselves under any circumstances. Nor could there be any guarantee that all the patrons who behaved irrationally in staying at a dangerous scene would necessarily have had a greater regard for their own safety if the evacuation had been properly organised.

3.192 The Tribunal is satisfied that, if the appropriate precautions to ensure an efficient evacuation had existed on the night of the fire, the injuries sustained would have been unquestionably less and the death toll would almost certainly have been reduced. It cannot be said, however, that even with such precautions all the deaths which actually resulted would have been avoided.

(2) Responsibility for the Evacuation

3.193 The unsuitable nature of Exit 2 should have been appreciated by those responsible for preparing the drawings on which the various permissions and approvals were obtained, viz. Mr Gardner and Mr White. It should also have been appreciated by the owners, and in particular Mr Eamon Butterly, who retained a direct control over all stages of the conversion. It should also have been appreciated by the Corporation officials who recommended the granting of Planning Permission and approval under the Bye-laws.

3.194 The action of Mr Downes in wedging the centre leaf of the outer door might have been avoided, if Mr Downes and the other doormen had received any proper training in evacuation procedures or if regular fire-drills had been held on the premises. The failure to hold such regular fire-drills was a breach of Bye-law 23(f) of the Public Resort Bye-laws and a breach of Clause 44 of the Fire Protection Standards.

3.195 The fact that the outer leaves of this door were kept permanently locked contributed to the congested conditions and was a breach of the spirit, if not the letter, of the conditions imposed by the Corporation on the approval under the Public Resort Bye-laws. Mr Eamon Butterly was the only member of the staff who appears to have been aware that the Corporation's intentions were being disregarded. The condition of the outer doors represented a non-compliance with Bye-law 38 of the Public Resort Bye-laws, which required special care to be taken to ensure that the means of escape provided for all persons on the premises were, at all times, maintained unobstructed and immediately available.

3.196 The use of carpet tiling on the walls of the foyer and the fact that the inner doors had limited fire-resistant qualities probably contributed to the spread of flame and smoke into the foyer. iThe use of the carpet tiles was in breach of the express requirements of the Fire Brigade Department of the Corporation and was also contrary to the Draft Building Regulations and the Fire Protection Standards. The circumstances in which the carpet tiles came to be used are considered further in Chapters 7 and 8.

3.197 The locking of Exit 3 and the obstructing of Exits 4 and 5 were a breach of Bye-law 38 and of Bye-law 11 of the Public Resort Bye-laws. The latter bye-law required chains and padlocks to be hung upon a board in a position approved by the Corporation while the public were on the premises.

3.198 The siting of Bar 2 between Exits 4 and 5 was likely to cause an obstruction by the placing of crates or skips in its vicinity, a matter which should have been foreseen by the owners, and specifically by Mr Eamon Butterly.

3.199 The failure of the management, and specifically of Mr Eamon Butterly, to ensure the regular holding of fire-drills at the premises or to establish any form of evacuation procedures, contributed to the inadequacy of the attempts to extinguish the fire and to the ineffective nature of the evacuation. Having regard to the high turnover of doormen, it was not merely essential that fire-drills should be held, but that they should be held at more frequent intervals than would be necessary in a building where the turnover of staff was not so high. The failure to arrange for fire-drills and evacuation procedures was in breach of Bye-law 23 (f) of the Public Resort Bye-laws, and represented a failure to comply with the Fire Protection Standards. The failure of the management to ensure that fire safety was the responsibility of one or more responsible staff members nominated for that purpose, was a breach of Clause 44 of the Fire Protection Standards.

(3) The Locking of the Doors: Inspection by the Corporation

3.200 The premises were visited on a number of occasions before the fire by Mr Martin Donohoe, an Inspector of Places of Public Resort in Dublin Corporation with special responsibility for electrical matters. On the 4th July, 1979, he found that one leaf of the exit door on the west side of the Lantern Room was not opening fully. He brought this to the attention of Mr Eamon Butterly on that occasion. He visited the premises again on the 10th August, 1979, and the position had not been rectified. He again drew it to the attention of Mr Butterly. On the occasion of this visit, he also found loose tables obstructing the passageway leading from the Main Bar to Exit 5. He pointed out this condition to Mr P.J. McGrath. On the 7th August, 1980, he found that the portable platform close to Exit 4 was causing an obstruction; and that there were also a number of loose seats obstructing the passageway on the east side of the building. He drew the attention of Mr Butterly and Mr McGrath to these matters. He was satisfied that, when the portable platform was moved into the position at which it was on the night of the fire, it was not causing any serious obstruction.

3.201 He visited the premises again on 22nd August, 1980, and found the plastic skip in front of Exit 5 full of empty bottles and so placed that it could cause an obstruction. He said that he drew the attention of some members of the staff, whose identity he could not remember, to this obstruction. On the 4th September, 1980, as a result of a complaint from a member of the Gardai, he inspected the Silver Swan and found an exit door which was chained and locked. He drew this to the attention of Mr Butterly, who said that he was not aware that the door should be kept open and that he would have it opened immediately. (The chaining and locking of this exit door was not in breach of the Public Resort Bye-laws, since the Silver Swan was not a place of public resort, according to the interpretation of the Public Resort Bye-laws adopted by the Corporation: see para. 8.82).

3.202 On 24th November, 1980, he inspected the Stardust again and found that Exit 5 was chained and locked, and that the bolt on the panic-bar mechanism was broken and the upright piece hanging loose. He brought this to the attention of Mr Kennan, who explained that the vertical member had been broken during the evening and that the door was locked and chained for security reasons. He (the witness) insisted on the lock and chain being removed from the door. He said that if he (Mr Kennan) was worried about security he should put a man on the door, but the door must be left unlocked. Mr Kennan then unlocked the door.

3.203 He inspected the Stardust again on the 15th January, 1981, and found that the passage leading to Exit 3 was obstructed by a large box. He spoke to Mr Butterly and the promoter of the concert for that evening, Mr McCann. He told them the box would have to be removed, and continued with his inspection. When he returned, he found that it had been placed between the toilet doors (Tl and T2) in the ballroom. He again remonstrated with Mr Butterly and said that it would have to be removed. It was then put in a truck and taken away.

3.204 Following this last visit, the Planning Officer of the Corporation wrote to Mr Patrick J. Butterly as follows:—

> "Dear Sir,
>
> The Inspector for Places of Public Resort (Electrical) visited the above premises on 15th January, 1981, at 9.00 p.m. and noted the following:—
>
> (1) Exit passageway at side of stage obstructed with cases, boxes, etc.
>
> (2) Overcrowding—the number of persons present in the Cabaret Room was greatly in excess of the permitted number (of 1,400) for which exiting is provided. This constitutes a very serious infringement of this bye-law.
>
> Your attention is drawn to the requirements of Bye-law 38 of the Bye-laws relating to Places of Public Resort which require that special care shall be taken to ensure that the means of escape provided for all persons on the premises are at all times maintained unobstructed and immediately available.
>
> Unless I receive your immediate assurances that the Exit ways will in future be maintained unobstructed at all times the public are on the premises and immediately available it will be necessary to institute proceedings against you for contravention of the above bye-law and also to raise the matter during the hearing of your application for renewal of your annual licence".

3.205 This letter was answered as follows by Mr Eamon Butterly on 27th January, 1981:—

> "Dear Sir,
>
> I have received your letter of 23rd January, 1981, and note contents.
>
> The back Exit in question was cleared immediately it was brought to my attention and I assure you that it will not happen again. I personally take great care to make sure all exits are clear.
>
> Re overcrowding, I had discovered that tickets were forged for the show on that particular night and I have forged tickets if you wish to see them. This would account for the number of people who were on the premises. I have also decided not to stage concerts of this type again.
>
> Again, I assure you that all Exits will be kept clear when the public are on the premises.
>
> Yours faithfully,
>
> (Signed)
> Eamon Butterly".

3.206 The policy of locking and chaining the exits during the time the public were on the premises until midnight at the earliest, had been initiated by Mr Butterly, despite the reminders he had been given by Mr Donohoe as to the importance of having all the exits available in an unobstructed condition for use by the public while the public were on the premises. It was pursued by him up to and including the night of the fire. The letter of the 27th January, 1981, was a deliberate attempt by Mr Butterly to mislead the Corporation into thinking that all the exits would be kept in an unlocked and unobstructed condition while the public were on the premises.

The adequacy of the inspections carried out on behalf of the Corporation is considered further in Chapter 8.

(4) The Locking of the Doors: the Attitude of the Management and Staff

3.207 The Tribunal is satisfied that the policy of keeping the exit doors chained and locked until at least midnight led to one exit being actually locked and chained while the fire was in progress; and that this policy was pursued by Mr Butterly with a reckless disregard for

the safety of people in the premises. Mr Butterly's legitimate objective of preventing unauthorised persons from gaining access to the Stardust could have been readily achieved by the stationing of doormen at each of the exits, but he deliberately elected to pursue a policy which was more economical in the use of doormen and was manifestly dangerous.

3.208 Mr Kennan and his deputy, Mr Doyle, implemented this policy which they knew to be extremely dangerous, as did a number of other doormen. Mr Kinahan and Mr Jack Walsh were also aware of the policy and raised no objection to it.

CHAPTER 4

The Rescue Operations

CHAPTER 4

The Rescue Operations

I —INTRODUCTION

4.1 The bodies concerned in the rescue operations were the Dublin Fire Brigade, a number of ambulance services and hospitals, and the Gardai.

4.2 The Dublin Fire Brigade is maintained by Dublin Corporation under the provisions of the Fire Services Act, 1981 (which replaces the Fire Brigades Act, 1940, in force at the time of the fire). By agreement with Dublin County Council, the area of operation of the Fire Brigade extends to the administrative area of that authority.

4.3 The Dublin Fire Brigade consists of two departments, one concerned with fire-fighting and the other with fire prevention. At the time of the fire, the number of personnel concerned with fire-fighting was 550. The overwhelming majority of these were full-time firemen and fire officers, but there was a limited number of "retained" or part-time personnel.

4.4 The command structure of the Brigade at the time was as follows. The Chief Fire Officer, Mr Thomas O'Brien, who has since died, was in command of the Brigade. Under him, there was a Second Fire Officer who was next in command. Beneath him, there were five Third Officers, who were normally engaged on administrative duties and recruit training. While all these officers were largely engaged in administrative work, they also from time to time undertook operational duties, including, in particular, attendance at large fires. The fire stations themselves were operated by district officers, station officers and sub-officers. The district officers and station officers were in charge of the stations and operated the "watches" or periods of duty. (Contrary to what his title might suggest, a district officer did not have control over a particular area: he appears, in effect, to have been a higher grade of station officer). District officers, station officers, sub-officers and firemen conducted fire-fighting operations, with either a district officer or station officer normally in charge at a fire. Sub-officers, in addition, manned the control rooms together with firemen and relieved the station officers where required.

4.5 The central fire station of the Fire Brigade is at Tara Street. It has a central control room from which fire-fighting appliances in that and other fire stations in the area are mobilised to respond to alarm calls. Six other stations are maintained on a full-time basis. In addition, four stations are maintained by "retained" personnel in the North County area. The location of the three stations in the City area actively concerned in the rescue operations, and their respective distances by road from the scene of the fire, as they appear from the relevant ordnance survey maps, are shown on *Plan 6, Appendix 15.* Each fire station has one or more pumping appliances. An appliance is normally manned by a district officer, station officer or sub-officer and a crew of five men. Each full time station also has an ambulance operated by a crew of two firemen.

4.6 The Central Control Room in Tara Street FS contains three desks, one with a switchboard and a special 999 telephone, one with a 999 telephone, radio equipment and a telephone

for dialling out, and one with a 999 telephone. The Control Room is normally manned by a sub-officer and two firemen. A 999 call reporting a fire is received first in the Post Office Telephone Exchange and then routed to the Central Control Room, where it is normally received via the switchboard or the special 999 telephone. The fireman receiving the call writes down the details on a docket and hands it to the sub-officer, who thereupon dials the telephone number of whichever fire station he considers appropriate, and mobilises such appliances as he thinks necessary. The docket is passed to the second fireman in the room, who records the details of the call in the "Occurrence Book" *(see Appendix 12).* There was at one time a system in operation of recording all calls automatically on a tape-recorder, but this system was discontinued, because, according to Captain O'Brien, personnel had been interfering with the equipment and it was damaged as a result. 999 calls are not automatically recorded in the Post Office Telephone Exchange.

The officer who receives the call in the local fire station alerts the crew of the appliance to be mobilised by sounding the alarm bell and switching on the lights. The time of the call from the Central Control Room is also recorded in the local fire station in an occurrence book. Under the procedure actually in existence at the time of the fire, the officer in charge of an appliance leaving the station did not send back any radio call to the Central Control Room to confirm that the appliance was mobile. The appliance was automatically recorded as being mobile one minute after the call having been made to the local fire station.

The normal response to an alarm of fire was to send two appliances. If the officer in charge on arriving at the scene of the fire was satisfied that there was danger to life, he made what was known as a "district call" to Tara Street FS, which thereupon responded by sending two additional appliances, the ambulance and an emergency tender which carried additional items of equipment. If the officer in charge at the scene of the fire was satisfied that the fire was sufficiently serious to warrant the presence of additional appliances, he made a call known as a "brigade call". If it was anticipated that more than twenty-five casualties were likely, the Major Accident Plan (Stage 1) was implemented, involving the co-ordinated use of a number of Dublin hospitals. If the responsible officer was satisfied that the scale of the fire justified it, Stage 2 of the Major Accident Plan was implemented, which involved the notification of other organisations such as the Defence Forces.

The second part of this chapter consists of a narrative account of the rescue operation. The remaining parts of the chapter are devoted to various aspects of rescue operations.

II — THE SEQUENCE OF EVENTS DURING THE RESCUE OPERATIONS

(1) The Fire Brigade

There were four members of the Brigade in the Central Control Room in Tara Street FS when the first alarm was received. They were Sub-officer Hughes, and Firemen Glover, (Rory) Mooney and Dowdall. Fireman Glover was at the desk where there was a switchboard and a special 999 telephone. Sub-officer Hughes was at the desk where there was a 999 telephone, radio equipment and a telephone for dialling out. Fireman Mooney was at the third desk where there was also a 999 telephone. As alarm calls came in to his switchboard or on the 999 telephone, Fireman Glover wrote out a docket which he handed to Sub-officer Hughes who then mobilised such appliances as he considered appropriate. The docket was then passed to Fireman Mooney who made the appropriate entry in the Occurrence Book. (The relevant extracts from the Occurrence Book for the evening in question are contained in *Appendix 12).*

Fireman Glover said that at 01.43, the 999 telephone rang. His account continued as follows:

> "I said, 'Dublin Fire Brigade'. This chap rang in and he said 'there is a fire in the Stardust'. I said 'where is the Stardust?' He said 'it is in Artane'. I said 'what is on fire?' He said 'the whole place is on fire'. I said 'what is your 'phone number?' He gave me the 'phone number and hung up".

4.12 He then wrote on a docket the words 'pub (Stardust)', followed by the telephone number given to him, and he also recorded the time on this docket at 01.43, this being the time shown by the digital clock in the Control Room. This docket, the original of which was destroyed but the carbon retained, was used by Fireman Mooney as the basis for the record of the call in the Occurrence Book which was as follows:—

"Fire	01.43	Phone 317287 Fire at Stardust Club, Kilmore Road, Artane".

4.13 Fireman Glover told Sub-officer Hughes, immediately upon receipt of the telephone call, that there was a fire in the Stardust "pub". Sub-officer Hughes thereupon dialled Kilbarrack FS and told them to turn out their appliance. He then dialled the North Strand FS and told them to turn out their first appliance.

4.14 Within a period of approximately one to two minutes after the receipt of the first call, at least two further telephone calls giving the alarm, one by a resident in the area, were received, but not recorded. Mr Fitzsimons's telephone call (para. 2.67) was received during the same period by Fireman Dowdall. Sub-officer Hughes said that he was told by Fireman Dowdall that Mr Fitzsimons—who was known to both of them—had rung to say that there was a major fire at the Stardust.

4.15 Sub-officer Hughes said that, on receipt of that information, he turned out from North Strand FS a second appliance and an ambulance; and from Tara Street FS, the emergency tender and a turn-table ladder appliance. (Sub-officer Hughes said that the ambulance was from North Strand FS, but this appears to have been an error: the first ambulance mobilised appears to have been from Tara Street FS (see para. 4.46)). He also told North Strand FS to have their third appliance on stand-by, i.e. ready in the engine room to respond if it was required. The calls from other members of the public and Mr Fitzsimons were not recorded in the Occurrence Book. The personnel in the Control Room said that the call from Mr Fitzsimons, coming as it did from an off-duty fireman, would not be treated as an official "district call", even though there was evidence that he used that form of words; and that for that reason, together with the pressure of calls coming in, it was not recorded. They were satisfied, however, that it was a genuine call and hence Sub-officer Hughes's response to it.

4.16 At 01.51, the Occurrence Book records a district call as having been received from Station Officer Noel Mooney who was the officer in charge of the Kilbarrack fire appliance which was the first appliance to arrive at the fire-ground. The evidence established that this was received by Sub-officer Hughes on the radio telephone and that he thereupon turned out the appliance which was on stand-by at North Strand FS, together with a further ambulance. The Chief Officer, Mr O'Brien, and the appropriate Third Officer, Mr Kiernan, were also notified of the fire at this stage by telephone to their respective homes. The ESB, the Gardai and the Waterworks Department had been notified by Fireman Rory Mooney, in accordance with standard procedures, after he had received the first two alarm calls.

4.17 The Occurrence Book kept in Kilbarrack FS recorded the call from the Central Control Room in Tara Street FS as having been received at 01.45. An entry in the Occurrence Book at Tara Street FS records the appliance (FB61) as having been mobile at 01.44. As has been pointed out, however, the procedure was to record the appliance as being mobile one minute after the call being made to the relevant station from Tara Street FS: it was not recorded as the result of a radio call from the vehicle in question to the effect that it was, in fact, mobile.

4.18 The call at Kilbarrack FS was received by Fireman Murphy who switched on the bells and a red light to alert the personnel on duty. Station Officer Mooney said that he thought roughly thirty to forty seconds would have elapsed from the time the alarm was switched

on until appliance FB61 was mobile, this being the normal time for turn-out in a night-time call. The route taken by the appliance was along Tonlegee Road and then via the Malahide Road, the Artane Roundabout and along Kilmore Road, a road distance of 2.5 miles (4 kms). Station Officer Mooney estimated the time taken to complete the journey as between five and six minutes.

4.19 When they had been about two minutes on the road, the crew could see smoke above the building; and, as they approached the entrance, Station Officer Mooney said that he saw many people in hysterical condition, some of whom were obviously suffering from burns. He then made the district call (para. 4.16) and the appliance went towards the east side of the building. The security barrier was still in position obstructing their further progress: and a number of people forced the barrier open by moving it in a horizantal direction towards the front of the appliance. The driver (Fireman Keane) said that he had to reverse his vehicle a few feet in order to avoid the barrier coming in contact with it: then, the passage being clear, the vehicle went along the side of the building and halted between Exits 5 and 6. (The positions of the various appliances as they were stationary at the fire is shown in *Plan 4, Appendix 15).*

4.20 The evidence of the officers in charge of the various appliances was that the normal procedure when an appliance arrived at the fire-ground, in the absence of express instructions to the contrary from the officer in charge, was for two designated members (Nos. 3 and 5) to "make down" to the nearest available water-hydrant, by connecting a line of hose from the hydrant to the appliance. Two other designated members (Nos. 2 and 4) had the task of attacking the fire immediately by "making down" a line of hose from the pump on the appliance to the appropriate point at the building, these hoses being fed initially by the 400-gallon (1800 1) tank carried on the vehicle itself. The driver remained at the pump to control the pressure and flow of water, while the officer in charge supervised and, where necessary, participated in the fire-fighting or rescue operations himself.

4.21 Each of the appliances carried twenty lengths of hose and three branch pipes which were fitted to the hose in order to direct the jet. They also carried reels of first-aid hose, which were of smaller diameter and easier to handle. Some of the appliances, including FB 61, carried a portable pump which was intended to enable the appliance to avail, where necessary, of a source of water other than the mains supply, e.g. a river or water tank. Each of the appliances normally carried four sets of breathing-apparatus of the compressed air type. In the case of FB 61, however, there were only two sets of breathing-apparatus. The vehicle in question was not the one normally in use at Kilbarrack FS; that was out of commission at the time for repairs, and a replacement vehicle had been supplied by Tara Street FS.

4.22 Station Officer Mooney said that as soon as he arrived he learned from those who were on the scene that there were still people inside the building, and he accordingly decided that the priority of the personnel present should be the rescuing of the people concerned. He said that FB 42 under Sub-officer Parkes arrived almost immediately after FB 61, and that he went to the front of the building to tell the officer in charge to remain there and concentrate on rescuing people at the front of the premises. In the meantime, Firemen Magee and Stephen McDonald (from FB 61) made down one line of hose to Exit 6, which was open at this stage. At the same time, Firemen Matthews and McLoughlin from the same appliance went back to the roadway to make down to a hydrant.

4.23 Fireman Magee said that the heat at Exit 6 was such that it was impossible to go in without first cooling down the area. He had been engaged in this process for about three or four minutes when Station Officer Mooney ordered him to help with the connection of a supply from a static water tank near the premises by means of the portable pump on the appliance. During this period, Fireman Magee was the only fireman at Exit 6: Fireman McDonald said that as soon as the hose was made down, he went back to the appliance and got another line of hose to Exit 5.

4.24 The hose into Exit 6 was initially fed by the 400-gallon (1800 1) tank on the appliance. The evidence established that, while the pump was capable, in theory, of delivering this volume of water at a maximum rate of 700 gallons (3200 1) per minute, thereby emptying the tank in less than half a minute, this was not the rate at which the water was discharged in practice. With branch pipes being used in the normal manner, the tank would take from four to five minutes to empty. The driver, Fireman Keane, said that after a period of some minutes—which he said at a guess was about seven minutes—his tank was emptied. At this stage there was no supply of water, but Fireman Keane said that just as it ran out, he was told by somebody, whom he thought was associated with the management of the Stardust, of the existence of the static tank. His evidence on this matter was as follows (*Volume 88, questions 609/611)*:—

> "Q. You exhausted your own 400 gallons and then there was an interval when you were without any water whatever?
>
> A. Yes.
>
> Q. Until you discovered the 30,000 gallon (140 000 1) tank?
>
> A. Yes.
>
> Q. Can you say what that interval was before you were re-supplied with water?
>
> A. To my memory it was simultaneous, as it was running out I was being informed. There was no stage I was starting to panic or get worried about water. As I ran out I was informed of the adequate source nearby . . . .".

4.25 Mr Eamon Butterly said in evidence that he informed a member of the crew of the first appliance to arrive, of the existence of the underground static water tank. The tank was one required by the terms of the special permission under which the factory was originally built (see para. 1.110).

4.26 Station Officer Mooney and Fireman Matthews, who had returned to FB 61 at this stage, together with Firemen Keane and Magee brought the portable pump to the tank and effected the connection. The mechanics of getting the supply restored by setting in the portable pump to the static tank took approximately four minutes.

4.27 Fireman Magee said that, when he returned to Exit 6, he was told by somebody that there were people in the toilets and that he should get breathing-apparatus on. He thought the person who told him this was Mr John Fitzsimons. He then went back to the appliance, got a breathing-apparatus and returned. He had been told by Mr Fitzsimons that he should by-pass the men's toilet (T7) as the people were in the ladies' toilet (T6). He saw a number of people in a collapsed condition in the toilets and helped to carry out four of them to Exit 5. As he came through Exit 5, he stumbled over a dead body, which was removed almost immediately. There was another body lying against the wall in the same area. (The location of the dead bodies as found by the firemen is shown on *Plan 4, Appendix 15).*

4'.28 Fireman Stephen McDonald, who went to Exit 6 with Fireman Magee initially and then made down another line to Exit 5, said he could see two bodies about ten to fifteen feet inside the door and was satisfied that they were dead, because they were very badly burnt. There was immense heat coming out through the door and he could not go in. After he had been using the hose for a matter of minutes, a fireman came from the front of the building and told him that there were people trapped in that area and he went with him to assist in the rescue operation. It is not clear who used the second breathing-apparatus on FB 61, or if it was used at all; but it is clear from the evidence that the firemen carrying out the rescue operations at these toilets (T6 and T7) needed breathing-apparatus because of the heavily smoked-logged conditions.

4.29 At the front of the building attempts to rescue people still inside were being made at Exit 3 before the arrival of the Fire Brigade. Michael Kelly, a resident, having heard the noise of crackling at approximately 01.45 from his house at 140 Ardmore Drive, went into

the back garden and saw smoke coming from the direction of the Stardust. He drove in through the west entrance and ran in the door of the Lantern Room where there did not appear to be anybody. He then went through Door 19 into the kitchen corridor and as far as Door 15 which was on fire. He then went back into the Lantern Room, out of the building and towards Exit 2, where people were breaking the windows of the outer door.

4.30 Mr. Kelly went on to Exit 3, the outer doors of which were open, and went in the corridor. He then went along the corridor and through the inner doors. Inside the ballroom, the tables and chairs on the dance floor area (AB) were aflame and the ballroom was filled with thick black smoke. He shone a torch he was carrying with him around and saw people lying on the ground in front of the men's toilet (T2). He managed to bring one of them out of the building and made two further journeys into the ballroom, clearly at considerable risk to himself, and brought others out. When he was returning the third time, about half-way along the corridor he met a person with a white hat whom he thought to be a fireman.

4.31 The second appliance to arrive at the fire was FB 42 from North Strand FS under the command of Sub-officer Parkes. It came to a halt between Exits 2 and 3 and Sub-officer Parkes ordered Firemen O'Rourke and O'Dowd to make down and Firemen Thornby and Haslam to carry out rescue operations. Fireman Hempenstall was the driver. Firemen Thornby and Haslam donned breathing-apparatus and went in with Sub-officer Parkes through the corridor of Exit 3. They had the first-aid hose with them and used it on the inner doors of Exit 3 which were on fire. They then went through Door 11 into the area behind the stage and effected the rescue of some people who were in that area. As they came out of the corridor the 2i inch diameter (63 mm) hose was being brought in through Exit 3 from FB 41 which had arrived immediately behind them and gone to the east side of the building. Fireman Hempenstall at this stage was rolling out a length of hose in the direction of Exit 2 and Sub-officer Parkes attached the branch pipe to it and hosed the outer doors of Exit 2 which appeared to be on fire. He also hosed the whole of the foyer as far as the staircase, which was on fire, and succeeded in extinguishing it. He was then told that there were people trapped in the toilets to the right of Exit 2. He, Fireman O'Rourke and Fireman Hosback, a member of the crew of the emergency tender, FB 105 from Tara Street FS, which had arrived at this stage, then went into the Spirit Store at the rear of Bar 1, through window W7.

4.32 Fireman O'Rourke had a hose from FB 42, which was still being supplied from the 400-gallon tank on the appliance which failed at around this stage. Fireman Hosback succeeded in getting as far as the men's toilet (T2) where there was intense heat. He kicked open the door of the toilet and ascertained that there were still people in there. He then went back to the Spirit Store and called for breathing-apparatus, which was handed to Fireman O'Rourke from outside the building and then to Fireman Hosback. He then succeeded in getting people out of the toilet and into the Spirit Store, where they were helped out the window by Fireman O'Rourke and Sub-officer Parkes. While he was in the toilets, Fireman Hosback tried to assist three of the people there by allowing them to breathe through his breathing set. This was with a view to giving them sufficient strength to come out of the building.

4.33 One of the members of the crew of FB 42, Fireman O'Dowd, said that he spent about four to five minutes searching for a hydrant and remained at the hydrant for a further period in order to ensure that the public did not interfere with the hydrant and the hose connected to it.

4.34 The third appliance at the scene was FB 41 from North Strand FS under the command of Station Officer Rowan, who on that evening had the rank of Acting District Officer. His appliance responded to the same call as FB 42 under Sub-officer Parkes and arrived almost immediately after that appliance. It went to the east side of the building and stopped between Exits 4 and 5. He said that he initially used up the 400-gallon tank in his appliance at Exit 5, and then, on being told that there were people trapped at the front, went round to Exit 3 where a hose was being made down from his appliance. This appliance was supplied from a hydrant and the connection was effected by Fireman Flood,

who said that he took between five to ten minutes to find the hydrant. Station Officer Rowan said that the pressure of the water from this hydrant was poor, but adequate for the amount of fire-fighting required at that stage. There was, however, an interval of time between the emptying of the 400-gallon tank and the supply from the hydrant becoming available.

4.35 The next appliance to arrive was the emergency tender from Tara Street, FB 105, under the command of Sub-officer Hobbs. This appliance was equipped with four sets of breathing-apparatus, approximately twelve spare replacement cylinders for the breathing-apparatus, a portable generator and portable lighting, steel hawsers, sledge-hammers, pickaxes, a hacksaw, a number of jemmies, four lengths of hose, stand pipes and branch pipes. The vehicle parked in front of Exit 3, and Sub-officer Hobbs went first to Exit 4, where he met Station Officer Rowan. He said that the heat was so intense at this exit that it was not possible to effect an entry; and that there was no line available at that point to effect the necessary cooling down of the exit area. Having ascertained that there were still people trapped in the toilets at the front, he directed some of his crew, including Fireman Hosback, to assist in the rescue. He himself went in through Exit 2 and was able to go through the inner doors of Exit 2, which had been alight but had now "disintegrated". He then went to one of the toilets (either Tl or T2) and assisted in helping people out from that area.

4.36 At this stage, the steel hawsers were attached from FB 105 to the bars on the toilet windows and the engine on the tender then started up in an unsuccessful attempt to remove the bars. The attempt was abandoned when Sub-officer Hobbs told the crew that all the people had been removed from the toilets.

4.37 The next appliance to arrive was FB 106 from Tara Street FS commanded by Sub-officer Kavanagh. This was a turntable ladder appliance which Sub-officer Kavanagh decided was not necessary to use when he arrived. He parked his vehicle just below Exit 4 and, having heard that there were people trapped in the toilets at the front, went in through Exit 3 and into the men's toilet (T2). Fireman Hosback and Sub-officer Hobbs were already wearing breathing-apparatus. He had no breathing-apparatus, there being none on his appliance. Having seen the people being moved from the toilets, he went through Door 11 into the area at the back of the stage. When he returned the fire in the area of the toilets was largely extinguished and he and the other firemen then proceeded to search the area of the ballroom where they found a number of bodies and assisted in their removal. He also went into the main foyer and up the stairs where he found two dead bodies on the landing. He said that he found conditions in the toilet area, when he first went there, uncomfortable without a breathing-apparatus.

4.38 The last appliance to participate to any extent in the rescue and fire-fighting operations was FB 32, the third appliance from North Strand FS which had been on stand-by and was sent to the scene after the district call had been received. It was under the command of Station Officer John McMahon. About three hundred yards (274 m) before the east entrance to the building, it was flagged down by fireman McLoughlin, one of the crew on FB 61 j who asked for some assistance in making down. He said that the crowd were creating difficulties for firemen who were attempting to leave the scene of the fire in order to make down hoses to hydrants. He (the witness) dropped off two men with eight lengths of hose and told them to finish making down with Fireman McLoughlin.

4.39 Station Officer McMahon said that at this stage the area in front of the building was crowded with police cars, ambulances, fire appliances, private cars and hundreds of people. He could not get through them and went on to the west entrance, where he saw two firemen making down to another hydrant. He dropped off two further members of his crew and then went down the building to the area of Exit 1. A person whom he thought was the Assistant Manager showed him an entrance into the building, i.e. the corridor at ground level under Exit 1. He went in through that corridor into the Silver Swan bar and could see the fire through Door 23. He then went back to the appliance and brought a hose in through the Main Bar with Fireman Messitt and Fireman Murphy. They

proceeded to hose down the ceiling in the Main Bar, but the heat from the ballroom was still of such intensity that they could not get in.

4.40 Station Officer McMahon then went outside again, asked his driver for another line of hose and laid a hose up the fire-escape stairs and in through Exit 1. The Store Room and Lamp Room were burning fiercely at this stage and, leaving Fireman Redmond to deal with that area, he (the witness) returned to the area of the Main Bar. While he was there, he was told by his driver that the Assistant Manager wanted to speak to him again. He (the witness) went out to him and was told by the Assistant Manager that he had left a large sum of money unattended in the building. He asked the witness to assist him in locking it up or retrieving it. He then brought the witness down the corridor at ground level to the Silver Swan office and established that the money was safe. The witness advised him to lock the door of the office. He said that the Assistant Manager then said to him that there were still people in the ballroom; and that he (the witness) went back to Firemen Murphy and Messitt and told them that they would have to make an attempt to go into the ballroom. They did so and started to find bodies in front of the North Alcove. One body was found in the Main Bar close to Door 23. They continued to work at pockets of fire in the building until Third Officer Kiernan ordered them to take part in a systematic search.

4.41 It should be pointed out that the Assistant Manager on duty on the night, Mr Jack Walsh, gave evidence to the Tribunal. It was not suggested to him in the course of his evidence that he had asked a fireman to assist him in retrieving money before telling the fireman that he thought that there were still people in the ballroom.

4.42 Third Officer Kiernan was notified by telephone at his home of the receipt of the district call. When he arrived, there were already a number of fire appliances in operation on the east side of the building and he also saw that the emergency tender was outside Exit 3. He saw people endeavouring to break windows at the front and this indicated to him that there was a possibility of people being trapped in that area. He then went down the corridor of Exit 3 and through the inner doors. He said that at this stage the floor area was on fire with flames to a height of about 2 feet. He said that, from about 6 feet in, the whole area of the floor was on fire, the roof had "vented itself and part of the roof had "disappeared in the fire". He then entered the toilets to the left of Exit 3, (Tl and T2) and satisfied himself that there were no people left in them. He came out through Exit 3 and saw the emergency tender FB 105 making an attempt to pull the bars off the window. He told the driver to stop, as all the people had been taken from the toilets. He then made a Brigade Call to the Central Control Room (see para. 4.8) and went back into the ballroom through Exit 3. He saw that people had been or were being assisted from the area at the back of the stage and decided that the circumstances justified the implementation of the Major Accident Plan, Stage 1. He said that he met a Garda outside who was in possession of a walkie-talkie. He requested him to "send back Stage 1 of the Major Accident Plan" which the Garda did in his presence.

4.43 Officer Kiernan, having seen a number of bodies on the east side of the building, realised that there was a possibility of a large loss of life and, meeting another Garda, requested him to "send back Stage 2 of the Major Accident Plan", which the Garda did in his presence. He then went back in through Exit 5 and saw members of the Fire Brigade taking people from the toilet on the right of Exit 5. He said that he assisted in this operation and that approximately eight to ten people were removed. Shortly afterwards he met Inspector Ronayne, Inspector Curran and Superintendent McGrath (who has since died) of the Gardai. He (the witness) requested that the City Morgue be opened, as it was clear that there would be a considerable number of fatalities. He then returned to Exit 5, at which stage the fire was "blackened out" except for isolated pockets. He ordered the crews under their officers to carry out a systematic search of the entire building. Shortly afterwards, Chief Fire Officer O'Brien arrived, and after a discussion the Chief Officer said that he proposed to stand down Stage 2 of the Major Accident Plan. At this time there were, in the opinion of both officers, sufficient fire brigade appliances and ambulances at the scene.

4.44 Third Officer Kiernan said that he thought he arrived at the scene at approximately 01.56 or 01.57. He thought that it would have been about six minutes afterwards that he sent the message that Stage 1 of the Major Accident Plan should be implemented. The first record in the Communications Centre, Dublin Castle, of the request for the implementation of the plan, as recorded by the master tape (see para. 4.93) is however, 02.06, and is as follows:

> "I've been talking to the Fire Chief and he says that there is a major accident, Stage 1, over".

The same record indicates that the request for Stage 2 of the Major Accident Plan to be implemented was at 02.12.

4.45 The officers and firemen who expressed an opinion said that they thought that the fire had passed its peak at the time the first appliance arrived.

(2) The Ambulance Services

4.46 The first ambulance to arrive at the scene was the Fire Brigade ambulance from Tara Street FS. The driver was Fireman Daly, who said he received a call to go to the Stardust at approximately 01.45. He was accompanied by Fireman Earley. It took him approximately eight to ten minutes to get to the scene. He was stopped on the main road by a crowd of injured people, whom he assisted into the ambulance. He then drove them to the Mater Misericordiae Hospital and informed the control Room in Tara Street FS by radio that he was on his way there with approximately ten to fifteen injured people. When he arrived at the hospital, he found that a number of injured people had already been brought there in private cars and Garda cars. Having left the injured in the care of the staff at the hospital, he then returned to the scene of the fire and entered the building on the west side through the Silver Swan. He was looking for Station Officer McMahon who, he had been told, required an ambulance (see para. 4.40). Just inside the Main Bar, beside Door 23, he found a body which he brought out to the ambulance. A further body was brought to the ambulance by Fireman Hosback and he brought both bodies to St Vincent's Hospital.

4.47 Sub-Officer Hughes (para. 4.16) on receiving the district call from Station Officer Mooney, dispatched a further fire brigade ambulance. At 01.52, he asked the Eastern Health Board and Waverley Ambulance Service for ambulances. The latter had none available at that stage, but the Eastern Health Board did send an ambulance. More ambulances became available over the course of the next five or six minutes and were also sent to the fireground.

4.48 Mr Peadar Sheridan, one of the Waverley drivers, said that he was in St James's Hospital on other duties in the early morning of the 14th February, 1981, when casualties suffering from burns arrived at the hospital. He then received a call on the radio to go to the Stardust and arrived there at approximately 02.35. At that stage, bodies were being removed from the building on the east side and he assisted in the removal of two of them to the City Morgue.

4.49 Thomas Brady, the Chief Ambulance Officer attached to the Eastern Health Board, was telephoned at his home at 02.25 by the radio telephone operator, Mr Foley, in the Central Control Room of the Board at St James's Street. Mr Foley informed him that Stage 2 of the Major Accident Plan was in operation and that the scene of the fire was at the Stardust. He then left immediately in his car for St James's Street, and while on his way received a message requesting him to go to the Stardust. He asked the operator to get in touch with his Deputy Supervisor and asked him to call in ambulances from Naas, Maynooth and Loughlinstown. He (the witness) arrived at the Stardust at 02.35. When he got there, he was satisfied that there were few remaining casualties. The further ambulances that arrived were used to bring the remains of those who had died to the City Morgue.

(3) The Gardai

4.50 The first Garda to arrive on the scene was Garda Bartholemew Doherty attached to Coolock Garda Station, who was on patrol-car duty in the area on the night. At 01.47, he received a call from Garda Control that there was a fire at the Stardust and he was to go there immediately. He went in his car (Romeo 1) to the Stardust and on the way passed out the squad-car from Coolock (Romeo 2). As his car approached the junction of Malahide Road and Kilmore Road, he saw a fire appliance turning to the right and he stayed behind it until both vehicles arrived at the fire. He said that he arrived at the scene at approximately 01.50. The fire appliance pulled into the grounds of the building. He stopped his car and people told him that there were people injured on the road and he immediately got in touch with Garda Control requesting ambulances to be sent. Garda Doherty then went in the west entrance in the direction of the building, where he said there was a scene of considerable confusion. The outer doors of Exit 2 appeared to him to be on fire and he could hear people screaming from the toilets. (Sub-officer Parkes (para. 4.31) also said that the outer doors of Exit 2 were on fire and that he used the hose on them. The outer doors were, however, found to be relatively intact after the fire, although much of the glass was broken. What both witnesses probably saw was flames and smoke coming through the door from the foyer). Some civilians were hammering on the windows of the toilets with a sledge hammer (which they had got from the fire appliance) and iron bars. He (the witness) succeeded in breaking the glass in the window, but could not dislodge the steel plate.

4.51 By now the firemen were connecting up the hoses on the appliance, but had not yet directed any water into the building. One of the firemen told Garda Doherty that they needed Garda assistance and he (the witness) went out on the road. He found that another patrol car had arrived and he radioed for more assistance. He was told by Control that as much assistance as possible was on the way. Garda Doherty returned to the premises and found that the firemen had hosed Exit 2 and that the fire at the outer door and in the foyer had been extinguished, but that there were some small fires burning. He thought a period of approximately four minutes elapsed between the time he arrived and the time he came back from making the call for further assistance and saw that the fire at Exit 2 had been extinguished.

4.52 Garda Doherty followed a fireman into Exit 2 and went as far as the Cloakroom where he was handed bodies which he brought out and helped to put in the ambulance. Other firemen took out other bodies as well, and after a time he was told that there were no more people in that part of the building. Having been told that more injured people were being brought out of Exits 4, 5 and 6 he went round to that side of the building. At Exits 4 and 5 the doors were open, but no people were coming out. There was black smoke coming out of both exits. Bodies were being carried out of Exit 6, but he could not say whether they were dead or not. They were put in ambulances and brought away immediately. He said it became clear to him between 02.15 and 02.20 that there were no more people alive in the building. He said that at this stage it was decided by the Garda Officers present that enough Garda assistance was present, and they began to clear the area in front of the building in order to make way for the ambulances. The first ambulance had arrived approximately ten minutes after he did. Garda Doherty said that there was great difficulty in controlling the crowds at the fire, some of whom wanted to go back in and some of whom, who were not badly injured, wanted to travel on the ambulances.

4.53 The second Garda car to arrive on the scene (Romeo 2) came in response to the same call. There were two Gardai in plain clothes in the car, Detective Garda Staunton and Detective Garda Hoban. Detective Garda Staunton said that when he arrived, the whole roof of the building was on fire. There was a scene of extreme confusion in front of the building, with approximately five hundred people milling around, many of them hysterical and some of them clearly injured. He decided immediately that more Garda assistance was needed to control the crowds and got in touch with Coolock Garda Station on his pocket radio requesting more brigades, ambulances and Garda personnel. He said that the first ambulance arrived in about three or four minutes. He said that within about fifteen minutes, there was a full quota of approximately twenty Gardai present.

4.54 Garda Doherty's first call was recorded in the Garda Communications Centre on the master tape as having been received at 01.52. The transcript is as follows:—

> "R.l to control, could you get an ambulance to the Stardust
> . . . . . .Roger, all the units are on the'way, what's the scene like there?
> R. 1. It's a fairly bad fire at the moment
> Yes do you want a number of ambulances?
> R.l to control. . . . . .".

4.55 The call appears to have been interrupted at this point by another incoming call from another patrol car in relation to the fire, calling for ambulances. At 02.00, the transcript of another call from Romeo 1 reads:—

> "The Fire Officer here requests more Garda people present to clear the people from around the Stardust (02.00). There aren't enough Guards here at the moment, so could you send a few more cars from outside districts to the scene, please.
> . . . . . .Roger, will do.
> Ah yes, R.l, we have a lot of help on the way up there at the moment".

Ill — THE TRAINING OF FIREMEN

4.56 Newly recruited firemen in the Dublin Fire Brigade are given eleven weeks' training on entry. Six weeks are allotted to fire brigade training and five weeks to ambulance training. The ambulance training syllabus is laid down and the training provided by the Eastern Health Board and the Department of Health. The fire brigade training includes instruction in the proper methods of rescuing people from burning buildings and the use of breathing-apparatus. While there is a practice of giving refresher training in ambulance work in the light of new developments, there is no such provision in the case of fire brigade training. There had been training courses, however, in the use of breathing-apparatus during the two years prior to October, 1981. These courses were optional.

4.57 The training of firemen is the responsibility of one of the Third Officers. The Chief Fire Officer, Mr O'Brien, said in evidence (on October 8th, 1981) that the Corporation was in the process of acquiring premises for use as a fire brigade training centre and that it was hoped that the premises would be available in about six months time from then, to commence some training courses.

4.58 It was obvious from the evidence of many of the firemen that they regarded their principal training as being derived from their experience in fighting fires. It was also clear, however, that such experience, in the case of many of the men and some of the officers, was of a limited nature. Although the initial training course was limited to only six weeks' fire brigade training, firemen were promoted to officer rank without any additional training; and promotion seemed largely to depend on seniority of service. A fireman can be promoted up to the grade of Third Officer in Dublin.

4.59 In the case of the Chief Fire Officer, a degree in engineering or its equivalent, is required. This, in practice, means that the Chief Fire Officer may enter the service at a level above that at which he would have practical experience of fire-fighting, although he does attend from time to time at fire-fighting operations.

4.60 A drill book is used in the Fire Brigade for instruction purposes. It was prepared in 1957 and the Chief Fire Officer accepted that it was, in some respects, out of date. He said that, however, from time to time Brigade Orders were issued by him, which included directions as to new procedures and equipment. These Brigade Orders were collected in a book which was produced to the Tribunal. While some of them did relate to new procedures and equipment, the book also contained a vast number of orders which related simply to administrative matters, disciplining of personnel, etc. The evidence indicated that it was not used as a drill book or instruction manual in any real sense. Manuals produced by the Home Office in the UK on fire-fighting techniques were used for instruction purposes.

IV —EQUIPMENT

4.61 The evidence established that on a pump appliance — as distinct from an emergency tender or a turntable ladder appliance — there was the following principal equipment:—

(1) a 400-gallon (1800 1) tank with a 700-gallon (3200 1) per minute pump;

(2) twenty lengths of hose of 2i" (63 mm) diameter;

(3) two first-aid reels;

(4) three branch pipes;

(5) a portable pump;

(6) one search light;

(7) jemmies;

(8) stand pipe and key (for connecting to hydrants);

(9) sledge-hammer and pickaxe; and

(10) four sets of breathing-apparatus.

4.62 No cutting equipment — in the sense of oxy-acetylene or compressed-air cutters — was carried by any of the appliances, except the emergency tender, when going to a fire. The cutting equipment carried by the emergency tender was an air-operated hacksaw. Diffusers and fog nozzles — which can direct a fine spray on flame — were carried on some of the appliances but not used at the fire.

4.63 Portable lighting and a portable generator were carried on the emergency tender and there was a swivel spot-light fixed to the appliance itself, but these do not appear to have been sufficient to provide the sort of illumination required for the systematic search of the building carried out in the later stages of the operations. A lighting plant was supplied at that stage from Dublin Airport.

4.64 Although there was evidence that routine checks were carried out during each watch to ensure that all the appropriate equipment was on a particular appliance, it seemed doubtful whether in the case of each station a check-list in writing actually existed, and none was produced to the Tribunal.

V — KNOWLEDGE OF THE SCENE

4.65 Some of the firemen had visited the building as patrons. This apart, none of them had any knowledge of the building.

4.66 No systematic inspection of buildings in their area was carried out by members of any of the fire stations in the Dublin area. Their training did not include any requirement to familiarise themselves with buildings in their area which were of special risk or where fire could have specially serious consequences. Nor did it include any requirement that they should familiarise themselves with the geography of the area so as to ensure that they were not handicapped in responding to a call by lack of knowledge of where the building was situated. The firemen were expected to rely on whatever local knowledge they might have.

4.67 There were no plans in Tara Street FS or in any of the stations in the Dublin area of buildings of special risk or where fire could have specially serious consequences.

4.68 There were no plans in either Tara Street FS or any of the fire stations or any of the appliances themselves in the Dublin area, showing the location of hydrants. It was normal practice to denote the location of a hydrant by fixing a plate with the letter "H" to a wall, railing or post in the ground in its immediate vicinity, but in the case of the hydrants closest to the building, there were no such plates. The training of the firemen did not

include a requirement that they should familiarise themselves with the location of hydrants and other water sources in their area.

4.69 Routine inspections of hydrants to ensure that they were in working order were carried out by the Waterworks Department, and not by the Fire Brigade. As a result, the only guide that members of the Fire Brigade arriving at the fire-ground had as to the location of hydrants was the rule of thumb that they were normally located at a road intersection and intervals of 100 m approximately. Since there were no plans, either in Tara Street FS or the other stations, of buildings at special risk or where fire could have specially serious consequences, they were not aware of the location of hydrants in the grounds of the building itself.

VI – THE RESPONSE TO THE ALARM

4.70 The Occurrence Book in Tara Street FS recorded the first alarm call as having been received at 01.43. The Occurrence Book kept in Kilbarrack FS recorded the call from Tara Street FS to them as having been received at 01.45. It was suggested that the apparent delay of two minutes could be explained by the fact that the clocks in the two stations did not record in seconds and that the call in Tara Street FS might have been received a second or two short of 01.44 and that in Kilbarrack FS a second or two after 01.45, thereby reducing the time to a minute. It is equally the case, of course, that the call at Tara Street FS might have been received a second or two after 01.43, and that in Kilbarrack FS a second or two before 01.46, thereby giving a delay of closer to three minutes. It is safer, in the view of the Tribunal, to assume that there was a delay in the median range of approximately two minutes.

4.71 The Chief Fire Officer said in evidence that a new control room was contemplated for Tara Street FS with more sophisticated equipment than was at present available. He said that in the new control room, there would be four consoles for receiving emergency calls and that the operators receiving the calls would have headphones on, so that they would not have to use their hands to pick up any instrument to answer a call. Visual display units would be employed to show an incident sheet and the operators, who would be trained to touch-type would be able to type in the address of the fire, the strength of the turnout and any other relevant particulars. The crew in the local station—e.g. Kilbarrack—would be alerted directly from Tara Street FS by a bell rather than by a telephone call to a fireman in the Control Room of the local station. This would mean that as soon as a 999 call was received, the operator would alert the appropriate station before or during the time that he was taking the particulars from the caller. The Chief Fire Officer said that he thought that, had such a system been in operation on the night of the fire, it might have saved up to a minute of time.

4.72 There was no system in the Fire Brigade under which there was a special pre-determined response to alarm calls in respect of places of public resort. (There was a pre-determined response in respect of the Port Area of Dublin, which was regarded as an area of high risk, and in respect of institutions such as hospitals).

4.73 The officer responsible for mobilising appliances in response to a call in the Central Control Room used his own judgement as to what station or stations should be mobilised. He did not have available to him a detailed street by street register of the area indicating in the case of an alarm call from any point:

(a) the first station to be mobilised;

(b) the extent of the first attendance required;

(c) the back-up stations in the event of no appliance being available from the first station or more appliances being required because of the extent of the fire or the nature of the building; or

(d) any special features of the building, including its use, presence of dangerous materials, access for the Fire Brigade, location of hydrants or other water sources etc.

4.74 So far as the actual response from the local fire stations is concerned, the Tribunal accepts the evidence of Station Officer Mooney that—in the case of night-calls—a turnout of between thirty and forty seconds was normally achieved at the Kilbarrack station and was probably achieved on the night of the fire. It also accepts the evidence of the other station officers that this was the approximate length of turnout in the case of the appliances under their command.

VII — COMMAND STRUCTURE, CONTROL AND CO-OPERATION AT THE FIRE-GROUND

4.75 Under the system in operation, whoever was the senior officer present at any particular time was the officer in charge. Thus, Station Officer Mooney was in charge until the arrival of Station Officer Rowan, who had the rank of acting District Officer on that evening. He remained in charge until the arrival of Third-officer Kiernan and the latter remained in charge until the arrival of the Chief Fire Officer. Some of the officers said that they did not know at any particular time, during the course of the fire, who the senior officer present was.

4.76 While the senior officer present at any particular time was, in theory, in charge of the fire-fighting operations, there appears in fact to have been little or no command structure. The evidence established that, as each appliance arrived at the scene, the members of the crew either "made down" to the nearest hydrant or commenced fire-fighting or rescue activities. Their adoption of any of these courses was because of the position they occupied on the appliance and was not in compliance with any express order from the officer in charge. In many instances the firemen were left entirely to their own initiative: thus, as has been noted, Fireman Stephen McDonald left Exit 5, where he had been using a hose for three or four minutes, and went to the front of the building, simply because a fireman who had come from that direction had told him that there were people trapped in that area. He did not receive any order to that effect from Station Officer Mooney, who was not only the officer in charge of his appliance, but was also the senior officer at that stage at the fire-ground.

4.77 There was no incident control point at the fire: it was not the practice of the Fire Brigade, even at a major disaster, to utilise a particular vehicle with a unique flashing light as a control point to which officers or firemen could report if they wanted directions or information.

4.78 None of the officers carried personal radios. If an officer wished to communicate with another officer at another part of the fire-ground, he would go to the other area accompanied by a fireman and would then send back the fireman with the appropriate message.

4.79 No officer at the scene of the fire had the responsibility of ascertaining whether any member of the management was available to give information which might be of assistance in the fire-fighting operations.

VIII — THE SUPPLY OF WATER

4.80 Mr James Hill, the Senior Engineer of the Waterworks Department of the Corporation, said in evidence that the water-main on the road in front of the building was a 9" (229 mm) main. The evidence established that there were three hydrants on this main within 170 m of the building. The location of these hydrants is shown on *Plan 5, Appendix 15.* One of them was in a grass margin on the other side of the road from the building. Mr Hill said that the records in his Department showed that it was proposed to have a hydrant near the west entrance to the building (at the location indicated on *Plan 5).* He did not know, however, whether that hydrant had, in fact, been installed: he said that a new pavement had been laid in 1976 and he could not say whether the hydrant had

actually been installed and subsequently covered with concrete. The two hydrants used by the Fire Brigade on the night of the fire are also indicated on *Plan 5*.

4.81 Mr Hill tested the water-supply from the hydrants on Monday the 16th February, 1981, i.e. three days after the fire, and carried out the test at night-time. Mr Hubert Mooney, the Corporation turncock who attended the scene of the fire, said in evidence that he operated the valve (the location of which is also shown on *Plan 5)* so as to increase the supply of water to the Fire Brigade. Mr Hill, when carrying out his tests, asked Mr Mooney to set the valve in the same position on the Monday evening, which he did. Mr Hill said that before the valve was opened the flow of water through the two hydrants used by the Fire Brigade on the night of the fire was approximately 465 gallons (2100 1) per minute. With the valve opened, there was what he described as a marginal improvement to 475 gallons (2150 1) per minute. (This improvement was so marginal, indeed, that in the view of the Tribunal it can for practical purposes be disregarded). He said that the pressure was in the order of 22-25 lbs per square inch (1.5 to 1.7 bars) with the two hydrants working. He said that there was no standard pressure in respect of hydrants, but that an accepted authority said that he recommended 10 lbs per square inch (0.69 bars) as the minimum residual pressure at fire-flows. The flows were recorded with both hydrants running simultaneously. The co-efficient of friction of the actual hoses used by the Brigade on the night of the fire was 0.0032; and this would mean that, given the length of the actual hoses employed, there would have been a maximum loss of pressure of approximately 13 lbs. per square inch (0.9 bars).

4.82 Mr Noel Byrne, the Yard Turncock from the Waterwoks Department of the Corporation at Marrowbone Lane, said that he was notified at 01.50 of the fire in the Stardust and logged it in the book kept for that purpose. At 01.55, the log book recorded the Yard as having been notified of the district call and Mr Hubert Mooney thereupon left for the scene of the fire. He said that he arrived at approximately 02.00 at the fire-ground where he said there was a lot of confusion. He could not see any fire officer, but he met a firemen at the junction of Skelly's Lane *(Plan 1, Appendix 15)* and enquired whether the water was alright. The fireman told him that it was. He checked the pressure himself by standing on the hose, which he said was the normal thing to do; and, although satisfied that the pressure was adequate, he then opened the valve. He eventually located Mr Kiernan, the Third Officer, and asked him if everything was 'okay'. Mr Kiernan said "yes".

4.83 Mr Mooney said that he did not locate the hydrant in the grass margin on the roadway opposite the building on the night of the fire *(see Plan 5, Appendix 15).*

4.84 The evidence established that hydrants in the city area were normally located at distances of approximately 100 metres apart and were, in addition, usually to be found at road intersections.

4.85 The evidence established that there were three fire hydrants in the grounds of the building itself *(see Plan 5, Appendix 15).* None was marked as a hydrant, however, and one was incorrectly marked as a "Sluice Valve". None of them was used during the fire, their existence being unknown to the Fire Brigade.

4.86 The evidence established that the pressure of the water from the mains supply on the fire-ground itself on the night of the fire was, for a time, inadequate. Station Officer Rowan said that when his crew made down to the hydrant, the pressure was poor; and Mr Michael Kelly (para. 4.30) said that he saw one of the hoses from one of the appliances "kinking".

4.87 The flow in the mains was checked on the Monday after the fire at night time and found to be adequate. It is most improbable, in the view of the Tribunal, that the situation on the night of the fire was any different. The inadequate water-pressure on the fire-ground can probably be explained by the length and nature of the hose from the appliance to the hydrant (218 yards (200 m) in the case of FB 41). Had one of the portable pumps been used to boost the pressure at the hydrant, or had one of the three hydrants in the grounds been used, this problem would not have arisen.

IX — THE MAJOR ACCIDENT PLAN

4.88 Before it commenced its hearings the Tribunal was furnished by Dublin Corporation with a copy of the Major Accident Plan for the Dublin Area. This document defined a "major accident" as "any serious incident involving twenty five or more seriously injured casualties". The plan was to be in two stages, the first of which was to be implemented by the Senior Fire Officer in Dublin Fire Brigade in consultation with the Senior Garda Officer of Dublin Castle. Stage 1 involved the dispatch by the Fire Brigade of all available fire brigade ambulances, and the notification of the "first line hospitals", of the Eastern Health Board's Ambulance Control Centre, of the private ambulance services and the Civil Defence Officer. There was also then provision for action by the Ambulance Control Centre, and for the making available by each of the hospitals of at least ten beds. The "first line hospitals" were stated to be (on the north side of the city), the Mater Misericordiae, Jervis Street and St Laurence's, and (on the south side) St James's, the Meath, Dr Steeven's and St Vincent's.

4.89 The decision to put Stage 2 into operation was the responsibility of the Senior Garda Officer at Dublin Castle. Once this decision had been made, an Accident Control Centre was to be established in Dublin Castle and a radio-car dispatched to the scene of the accident which would form a Field Accident Control Centre under the Senior Garda Officer present. The accident control centre would then notify the Fire Brigade head-quarters and the Eastern Health Board's Ambulance Control Centre that Stage 2 was in operation; it would also alert Dublin Airport, the Eastern Command of the Army and the Air Corps at Baldonnell (the last-named in hours of daylight only). The Red Cross, the St John's Ambulance Brigade and the Order of Malta ambulances were to be alerted by the Civil Defence Officer.

4.90 This version of the Major Accident Plan appears to have emanated from the Department of Health. At the hearing, however, it transpired that the Fire Brigade had a different version of the Accident Plan in the form of Order No. 1/1976. This did not state who was to be responsible for implementing Stage 1 of the Major Accident Plan, but said that the decision to put Stage 2 into operation "is the responsibility of the Senior Garda Officer at Dublin Castle after consultation between the Senior Garda Officer and Senior Fire Officer at the incident".

4.91 In the present case, Third Officer Kiernan implemented both stages of the plan without consultation, with any senior Garda Officer.

4.92 Although the Gardai had their own version of the Major Accident Plan, which again differed in some respects from that furnished by the Corporation and the Fire Brigade Order, it appears that the officer on duty in the Communications Centre at Dublin Castle was not aware initially of the existence of the plan.

4.93 The following is the transcript of the relevant exchanges:—

> "(0206) . . .K4
> I have been talking to the Fire Chief and he says that there is a major accident, Stage 1, over.
>
> . . . . Roger.
>
> . . . . 190, Guards here again, one of our units came in to say that one of your chiefs said that this is a major something, phase 1. Major Accident Plan.
>
> . . . . Major Accident . . . .?
>
> Plan.
>
> _____Phase 1.
>
> Yes.
>
> . . . . What does that mean in our language?
>
> Hang on just a second will you, hello.

". . . . Yes the Guards here, we have word back through our car from one of your chiefs that this is a major accident, Phase 1.

What?

That's correct you .... what does that mean in our language?

It means that you will have a list there, you are in control aren't you?

.... Yes.

You have a list there who to notify, all the hospitals, dangerous buildings. We'll do most of it anyway.

.... All hospitals?

Yes, now the only thing/way you can help us out is if you get CIE with the single-deck buses for the non-urgent cases up there or any of your cars that are available to shunt them into some of the hospitals.

Yes, we have all our mobiles on the way out there to (02.12) get them in.

Yes we've had ten ambulances, that's the best we can do.

.... we have our cars taking them in also.

Yes.

.... But all we have to do is . . . you have notified the hospitals is it?

We are looking after that end of it.

. . . and you've got to contact CIE to see if they can produce any single deck buses?

Yes, and if you can .... have you got a direct line to any of the army barracks there?

.... to where?

To see if they can help with any ambulances, any of the army barracks.

.... What's stage 2. Now he says Major Accident Phase,^

That's it the shit has hit the fan so.

What?

The shit has hit the fan.

.... Is that right, what does that mean?

It means everything is notified, army, the whole lot.

That's everyone notified, right.

.... You want everyone notified?

Yes.

Right you are, thanks. (02.13)."

4.94 In view of the fact that there appeared to be different versions of the Major Accident Plan in the case of the Department of Health, Dublin Fire Brigade and the Garda Siochana, the Tribunal requested the following bodies to furnish the versions of the Major Accident Plan in their possession:—

Civil Defence

Coras Iompair Eireann

Department of Defence

St John's Ambulance

Aer Rianta

The Blood Transfusion Service Board

Irish Red Cross Society

Order of Malta

ESB

4.95 In the case of Civil Defence, the Department of Defence, the Blood Transfusion Board, the Irish Red Cross Society and the Order of Malta, the form of the plan was identical to that which was issued from the Department of Health, although in some cases the organisation concerned had added an annex containing details of its own internal requirements in relation to any major accident. The plan furnished by CIE related principally to the transportation of dangerous substances by rail. The St John's Ambulance Brigade had certain emergency telephone numbers, but no full text of the plan. Aer Rianta had extracts from the plan, but not the full text. The ESB had no documentation in relation to the plan.

4.96 It appeared that in the case of one of the hospitals, St Laurence's, the telephone number as it appeared in the Fire Brigade version of the plan was not the actual telephone number of the hospital at the time of the hearings.

X —CONCLUSIONS

4.97 The members of the Fire Brigade carried out their duties on the night of the fire in a dedicated manner and, in the case of those firemen and fire officers who took part in the actual evacuation of people from the building, at considerable risk to themselves. The evidence clearly established, however, that the management (including the general organisation), the training, and the equipment of the Dublin Fire Brigade had not been modernised so as to enable it to cope with a disaster of these proportions in a satisfactory manner.

4.98 In the first place, the evidence revealed serious shortcomings in the training of officers and firemen. The fact that neither firemen nor officers receive any training beyond their initial recruitment training, other than certain *ad hoc* courses attended on a voluntary basis, such as that in the use of breathing-apparatus, and that attendance by officers at courses of instruction in modern fire-fighting and rescue methods is on a purely voluntary basis, is not satisfactory. The recruitment system operated in the case of some senior officers, including the Chief Fire Officer, means in practice that such officers may have no practical experience of fire-fighting before they are appointed; and this again is not satisfactory.

4.99 Apart from the advantages to the officers and firemen of getting such additional training, such courses also have the advantage of bringing to light deficiencies in equipment and fire-fighting procedures in the individual fire stations. The absence of any organised compulsory training, other than the brief initial period of training, necessarily means that there is a unique dependence on experience gained from actual fire-fighting operations.

4.100 The Tribunal is of the opinion that the lack of training at every level, from senior management to firemen, in the Dublin Fire Brigade, coupled with the fact that many of the officers and men had no experience of dealing with a disaster of these proportions, contributed significantly to the shortcomings in the rescue operations by the Fire Brigade.

4.101 The lack of training was reflected in the actual conduct of the fire-fighting operations themselves. Firemen were expected to go and look for fire hydrants or take part in rescue operations depending on the place they were occupying on the appliance. A proper system of command would have ensured that the first officer to arrive made an immediate assessment of the situation and then gave express directions to the other officers as they arrived so as to ensure the optimum use of the equipment and manpower available. That officer should thereafter have remained in recognised command of the fire-fighting

operations until the arrival of the appropriate senior officer. The officers who arrived subsequently should have taken their orders from the officer in command and transmitted them to their individual crews.

4.102 Station Officer Mooney on his arrival had correctly determined that the rescue of people still inside the building was the priority of the Fire Brigade. All available manpower should then have been concentrated on effecting an entry to the building and getting people out. However, after the first hose had been made down to Exit 6—the first exit in the building to be tackled—only one fireman stayed at the hose and he left after three or four minutes to help with the portable pump. Another fireman, having commenced to use the hose at Exit 5, left, without any direction from his officer, to help at the front of the building. The only fireman from the first appliance who put on breathing-apparatus did so in response to a suggestion from Mr Fitzsimons, an off-duty fireman, and not because he was ordered to do so. The other breathing-apparatus does not appear to have been used at all.

4.103 The lack of any command procedure was also reflected in the pointless attempts at the front of the building to remove the bars from the toilet windows by means of a hawser attached to the emergency tender. This was clearly serving no useful purpose, since there were steel plates welded to the windows, but the crew again appeared to have acted on their own initiative without any orders from any officer in charge.

4.104 The fire officers and firemen were also seriously hampered by their lack of knowledge of the scene. The fact that they were unaware of the existence of the static water tank led to an interruption in the water supply, for however brief a period, at a critical stage in the rescue operations. A more detailed knowledge of the interior of the building and, in particular, of the location of the toilets, might have expedited the rescue of people from those areas. The fact that the firemen were unaware of the location of any of the hydrants, including the three hydrants in the grounds of the building itself, led to the wasteful use of manpower in a time-consuming search for hydrants, when the personnel concerned could have been far more usefully engaged in rescue work. At least six and possibly eight or even ten firemen were engaged in this search, although ultimately only two hydrants were used. This also reflected the inadequate training and lack of a proper command procedure.

4.105 This lack of knowledge was also the consequence of inadequate training of both officers and men and, in particular, of the absence of any system of pre-fire planning in the fire stations. Such a system would have ensured that fire-fighting personnel familiarised themselves with their area and, in particular, with buildings at high risk or where serious consequences might be expected in the event of fire, and had available to them, both in the stations and on the appliances in readily accessible form, simple outline plans of, and relevant information relating to, such buildings. Pre-fire planning of this nature has been standard in brigades in other countries for many years and, while the Chief Fire Officer said that he thought staff difficulties would make its use impracticable in this country and he was, in any event, doubtful as to its utility, the Tribunal is satisfied that such a system should have been in operation at the time of the fire.

4.106 The lack of knowledge as to the location of hydrants could have been significantly reduced if the Fire Brigade had been supplied with up-to-date maps by the Waterworks Department, indicating the location of hydrants. Moreover, had the Fire Brigade established a system of inspecting all the hydrants in their areas, and reporting any defects to the Waterworks Department, it would have meant that the personnel would have been familiar with the location of hydrants.

4.107 The absence of a satisfactory system of ensuring that all hydrants were clearly marked also contributed to the delay in locating them on the night of the fire. The question as to how hydrants can be most effectively located and marked is dealt with in Chapter 9 at para. 9.237.

4.108 The fire-fighting operations were also hampered by the absence of an "incident control point" at the fire, in the form of a particular, clearly identified vehicle to which officers or firemen could have reported for directions or information. The officers were also hampered by the absence of personal radios.

4.109 The equipment used was not entirely adequate. The first appliance to arrive carried only two sets of breathing-apparatus. The evidence as to the existence of a check-list, to which reference was made at the beginning of each watch to ensure that all appliances carried the required equipment, was vague and unsatisfactory. It is clear that, if a check list existed in Kilbarrack FS, against which the equipment was checked at the beginning of each watch, the sets of breathing-apparatus on the appliance would have been brought up to the proper number i.e. four.

4.110 Although the first alarm call was received at 01.43, the first appliance did not arrive until 01.51. This seems unduly lengthy, having regard to the distance to be travelled from Kilbarrack FS to the fire-ground, i.e. 2.5 miles (4 km) and the fact that the appliance was travelling in the early hours of the morning in light traffic conditions.

4.111 The Tribunal is satisfied that the unduly long period can only be explained by the out-of-date nature of the Control Room in Tara Street FS. It is not acceptable that a system should still be followed under which one fireman receives a call, writes out details of it on a piece of paper and passes it to another fireman who then dials the local fire station. This system probably led to a delay of two minutes in notifying the Kilbarrack Station, and it is possible that the delay might even have been of the order of three minutes.

4.112 The out-of-date nature of the Control Room was also reflected in the absence of the data that should have been immediately available to the operators responding to the alarm call. There should have been available in the Control Room in easily accessible form, a detailed street-by-street register of the Dublin area, giving the information already referred to (see para. 4.73). The presence of such data would have enabled the operator to radio to the appliances vital information as to the building itself, including the existence of the static water tank and the location of the nearest hydrants.

4.113 The out-of-date nature of the Control Room was also reflected in the absence of a tape-recorder to ensure the automatic recording of all alarm calls. Such a system is obviously essential as part of the machinery enabling the Fire Brigade, in the wake of a serious fire, to conduct its own investigations, take any necessary disciplinary measures and ascertain what lessons have been learned from the incident. It may also, however, be of practical significance at the time of the rescue operations themselves, since the Control Room, in the event of any uncertainty as to the location of the building, the nature of the fire, etc., can always check the details of the actual call made.

4.114 The use in the Central Control Room—and in Kilbarrack FS—of a clock recording in minutes only, was also unsatisfactory. A clock should have been provided recording in seconds as well as minutes.

4.115 The shortcomings referred to in the preceding paragraph emerged clearly from the oral evidence given at the Tribunal. The Tribunal visited the Central Control Room after the hearings; and the conclusions already drawn from the oral evidence were significantly re-inforced by that visit. The shabby and makeshift appearance of the room made it difficult to believe that it was the nerve centre of all the fire-fighting operations for the capital city and the largest concentration of population in Ireland. Such surroundings can only have a demoralising effect on the personnel who are required to operate the Control Room; and the fact that they have been tolerated for so long reflects a most disturbing absence of concern on the part of the senior management of the Corporation.

4.116 In the case of the rescue operations themselves, the Tribunal is satisfied that the decision taken to concentrate the rescue efforts on the south and east sides of the building was the correct one. Mr George Eastham, a fire safety consultant retained on behalf of the next-of-kin, said that in his opinion there should have been a greater concentration on fighting

the fire from the west side of the building, but the evidence clearly established that the people trapped inside the building who could be rescued were concentrated in the areas of the toilets and stage on the south and east sides of the building: an attack on the west side might have needlessly diverted rescue attempts from where they could be most effective.

4.117 The pressure of the water at the fire-ground was lower than it should have been for a period during the fire-fighting operations. This was probably due to the length and nature of the hose from the appliance (FB 41) to the hydrant, and should have been avoided by the use of one of the hydrants in the grounds or nearer the building on the road or, at worst, by boosting the pressure at the hydrant actually used with one of the portable pumps. This did not, however, materially affect the fire-fighting operation.

4.118 The evidence did not establish that the use of the cutting equipment available on the emergency tender would have resulted in a more rapid rescue of the persons in the toilets at the front of the building.

4.119 The Tribunal was seriously concerned by the fact that, although the first appliance arrived at 01.51, people were still being rescued from the toilets on the east side of the building as late as 02.15 (after Third Officer Kiernan had requested the implementation of Stage 2 of the Major Accident Plan). The conclusion is inescapable that this delay must have been contributed to by the various shortcomings in the rescue operations, many of them stemming from inadequate training, which have been detailed in this Chapter. The Tribunal accepts the evidence of a number of officers and firemen that conditions were such that most of the persons who died in the fire perished in the period of two minutes from the time the fire travelled from the West Alcove into the rest of the ballroom. It must also be said that the evidence did not establish that any of those trapped in the building who died after being removed from the building would have survived if the rescue operation had been mounted with greater efficiency. The Tribunal is, however, satisfied, that much discomfort and distress and possibly some injury would have been alleviated by a more efficiently mounted operation.

4.120 The Tribunal has, accordingly, come to the conclusions that, although injury and discomfort to a number of the survivors would probably have been avoided by a more efficiently mounted rescue operation, no avoidable deaths were shown to have resulted. It must be emphasised, however, that had the course of events been different, the consequences in terms of human lives lost as a result of the deficiencies in the Dublin Fire Brigade revealed at the Tribunal's hearings might have been calamitous indeed.

4.121 The Tribunal accepts that the Fire Brigade were seriously hampered in their rescue operations by a factor which was wholly outside their control, i.e. the hysterical behaviour of many members of the public outside the building, which made it more difficult for the appliances to get close to the exits and for the individual officers and firemen to get into the building. Before arriving at its conclusions as to the shortcomings of the rescue operations, the Tribunal has given full weight to this factor; and has also been conscious of the caution which should be exercised before judgements are passed, with the benefit of hindsight, on decisions which had to be taken by fire officers in dangerous and difficult circumstances.

4.122 The Fire Brigade were also hampered by the fact that they were not alerted by a telephone call from the building until 01.43. The first smoke had been seen in the ballroom at least as early as 01.40; and a fire on one or more seats was plainly visible to staff and patrons alike at 01.41. No one member of the staff was charged with the duty of ensuring that the Fire Brigade was alerted at the first sign of fire; the management had never laid stress upon the importance of ringing the Fire Brigade immediately; and there were no notices bringing the point home to staff and patrons alike. Mr Downes, indeed, actually abandoned an attempt at ringing the Fire Brigade from the main foyer at Exit 2; and it was left to one of the barmen, Mr Neville, to use his own initiative at 01.43 and telephone from the Silver Swan. None of the management—Mr Butterly, Mr Walsh, Mr Kennan or Mr Kinahan

—made any attempt to ring the brigade from the Silver Swan as soon as the alarm of fire was given. Mr Butterly said in evidence that he told Mr Neville to ring the Fire Brigade as soon as the latter came into the Silver Swan; but this was not confirmed by any other evidence.

4.123 The first Gardai to arrive at the scene found themselves handicapped by lack of numbers in dealing with a large hysterical crowd. However, the first Gardai to arrive re-acted promptly and correctly by sending for more personnel. The actual provision of ambulances was adequate in the circumstances, but again they were hampered in the early stages by the behaviour of the crowd.

4.124 Some serious deficiencies emerged in the operation of the Major Accident Plan. It is not satisfactory that some of the bodies who are furnished with the Plan, and who are expected to assist in its implementation, have differing versions of it. The Gardai should have ensured that all officers manning the Central Control Room in Dublin Castle had an adequate working knowledge of the Plan: the transcript discloses that, in fact, the officer who responded to the fire brigade call had never even heard of the Plan. The procedure should not have been followed under which Third Officer Kiernan requested a Garda to transmit the message implementing Stage 1 of the Plan; the appropriate procedure would have been for Third Officer Kiernan to radio himself to the Central Control Room and request the senior Garda Officer present to implement Stage 1 of the Plan.

CHAPTER 5

Deaths and Injuries

CHAPTER 5

Deaths and Injuries

I —INTRODUCTION

5.1 Forty eight people lost their lives as a result of the fire. The bodies of forty, who appeared to the rescue services to have died in the fire, were brought directly to the Dublin City Morgue at Store Street. Four victims were brought to hospital for resuscitation, but were found to be dead on arrival. Four more victims died subsequently in hospital, four days, five days, eleven days and twenty five days after the fire respectively.

5.2 The bodies of all the victims taken to the City Morgue were submitted to full post-mortem examinations by a team of five pathologists, working under the direction of the City Coroner. Blood samples and, where available, urine samples were taken from each body. A microscopic examination of tissues was carried out in certain cases, notably the late survivors.

5.3 Two hundred and fourteen people were treated for injuries resulting from the fire in the following Hospitals:—

Dr Steevens' Hospital

Jervis Street Hospital

Mater Misericordiae Hospital

St James's Hospital

St Laurence's Hospital

St Vincent's Hospital

Of these one hundred and twenty eight patients were treated as in-patients and eighty six as out-patients.

5.4 Evidence as to the results of the post-mortem examinations was given by Dr J.F.A. Harbison, the State Pathologist. Evidence as to the nature of the injuries suffered by the persons admitted to hospital was given by Surgeon Brendan Prendiville of Dr Steevens' Hospital.

II — THE CAUSE OF THE DEATHS

5.5 Dr Harbison's conclusions as to the cause of the deaths were based on his own examination of some of the victims, on the post-mortem reports supplied by the other pathologists and on the results of analysis of the blood and urine samples taken from the bodies which were supplied to him by Dr James Donovan, the head of the Forensic Science Laboratory of the Department of Justice. These tests determined the level of carbon monoxide and cyanide in the blood and also the level of alcohol in the blood. The results are set out in Appendix 7.

5.6 Thirty two of the bodies were charred in varying degrees with loss of portions of limbs in many cases. Of the forty four victims who died immediately, all but one were observed to

have soot or carbon in their air passages indicating inhalation of smoke. The exception was shown by means of gas analysis to have inhaled smoke and fumes. None of the victims, including the sixteen whose bodies were not severely charred, escaped without burns to some part of their bodies. Three bodies, still fully clothed, were superficially burned on the hands, face or neck only.

5.7 In only three of the bodies was there any evidence of injury accompanied by bleeding, i.e. an injury sustained in life. One bore a bruise behind the right ear, another on the forehead and a third in the deep muscles in the left chest wall not accompanied by any rib fractures. A fourth case bore scratches on one shin.

5.8 All these injuries were minor, and with the exception of the chest bruising, were noted in bodies which had not become charred. Dr Harbison said that superficial injuries in the charred bodies could not be ruled out. However, all the skull bases, many skull vaults, all the spines and pelves, and virtually all the rib-cages were preserved and none of these showed any evidence of pre-death injuries. Dr Harbison said that he and the other pathologists were all agreed that it was reasonable to conclude from the findings that no major crush injuries had occurred. He though that crush asphyxia could not be excluded in the more severely burned, since there was heat blackening of the chest organs in some, and it is the finding in the heart and lungs of asphyxial haemorrhages that provides the main internal evidence of asphyxia. He said that he found evidence of asphyxia in one of his own post-mortem examinations, but that this was in a minimally burned victim with no evidence of crushing.

5.9 In Dr Harbison's opinion, the accurate causes of death in the victims could really only be stated in the four victims who subsequently died in hospital. These consisted of three cases of bronchopneumonia, two of them with lung abscesses, and one case of irreversible brain and heart-muscle damage as a result of shock sustained in the fire. Examination of lung tissue under the microscope from three of these four cases showed a change in the lining membrane of the air passages, suggestive of severe irritation.

5.10 Dr Harbison said that the remaining forty four victims died directly from shock due to extensive burns or from inhalation of smoke and fumes in the fire. Death was attributed by the pathologists to the fumes where lethal blood levels of carbon monoxide or hydrogen cyanide were found in the blood; and directly to burns where the blood gas levels were below the lethal level. Both causes—i.e. fumes and burns—were given where gas levels were raised but were not lethal.

5.11 Dr Harbison said that where death was due to either of the two toxic gases—carbon monoxide or hydrogen cyanide—alone, the lethal levels tended to be higher, especially where they were not associated with fire, e.g. 60% in the case of carbon monoxide and 200 micrograms of cyanide per 100 ml of blood, in the case of hydrogen cyanide. Dr Harbison considered that the lethal level for fire victims who inhaled both gases was bound to be lower than if only one had been inhaled.*

5.12 The FRS tests showed the presence of other toxic or irritant gases and vapours. It appeared, however, from those experiments that the levels of such gases or vapours were so low that they would not have added significantly to toxicity or irritancy (see para. 7.78).

5.13 Dr Harbison said that the victims could be divided into three groups, those with levels of carbon monoxide in the 40% and upwards bracket, which he regarded as potentially lethal, those with levels of carbon monoxide of less than 20% which could have been

*It should be pointed out, however, that since the public sittings concluded, a paper has been published in the UK embodying the results of research by R.A. Anderson and W.A. Harland of the Department of Forensic Medicine and Science in Glasgow University on the role of hydrogen cyanide in fire deaths. They reported that no additive or synergistic effects were observed in fatalities between cyanide and other factors, including carbon monoxide and alcohol. (Fire Deaths in the Glasgow area: III The Role of Hydrogen Cyanide: by R.A. Anderson and W.A. Harland; Med. Sci. Law (1982) Vol. 22, No. 1).

derived from smoking cigarettes or exposure to a high level of petrol exhaust fumes in the street, and a third intermediate group with significantly raised levels of carbon monoxide. The hydrogen cyanide results tended to mirror the carbon monoxide results, in that the levels of over 100 micrograms per 100 ml of blood were found in the 40% plus group of carbon monoxide. Dr Harbison said in evidence, however, that work by Professor Harland in Glasgow had indicated a different figure for lethal levels of hydrogen cyanide, in the area of 260 micrograms per 100 ml of blood.

5.14 Seventeen of the victims fell into the 40% plus (or potentially lethal) group of carbon monoxide levels, eight into the 20% carbon monoxide and under group, while the remaining nineteen were in the intermediate group. Dr Harbison said that he attempted to classify the victims into those who were either charred or at least quite severely burned and those who were not, and to relate these to blood gas levels. Of the forty four immediate victims, ten were in the less burned category, but seven of them had potentially lethal carbon monoxide levels, while the remaining three were in the intermediate group. There were none in the 20% or under group. Dr Harbison thought it was probable that the less severely burned individuals were in areas where smoke was severe, but flames only arrived in the late stages, if at all. Of the thirty four bodies in the severely burned or charred group, ten had carbon monoxide blood levels of 40% or over, eight had 20% or under and sixteen were in the intermediate group.

5.15 Potentially lethal levels of cyanide were found in only four of the victims.

5.16 The blood alcohol levels, in the opinion of Dr Harbison, were not such as to have contributed directly to any of the deaths.

Ill — THE NATURE OF THE INJURIES

5.17 Mr Prendiville produced in evidence a joint medical report signed by himself and five other surgeons who treated the victims in the various hospitals.

5.18 The eighty six persons treated as outpatients were described as having small areas of superficial burning or were distressed as a result of the disaster.

5.19 Of the one hundred and twenty eight patients admitted to hospital and treated as in-patients, the majority were suffering from shock, distress, relatively moderate superficial burns and minor respiratory irritations. Thirteen patients were regarded as having significant respiratory complications, of whom nine required intensive therapy. Four patients died of respiratory complications. All the other patients admitted to hospital survived and were eventually discharged, although a few required subsequent admission for further surgery.

5.20 The patients who survived the respiratory complications had settled down satisfactorily. Mr Prendiville, however, said that he considered that in the future they could be more susceptible to respiratory diseases. Two cases, in fact, were subsequently re-admitted to hospital, having developed pneumonia as a result of the respiratory injuries.

5.21 In the case of eleven patients who were described as having deep burns, the full depth of the skin had been destroyed over a significant area. These were re-surfaced by grafting operations. All those who required grafting would have scarring of significance as a permanent disfigurement. They would require continuing treatment, including surgery. The ultimate results, however, would depend largely on their future progress, which Mr Prendiville said was difficult to predict at this stage. He had no doubt, however, that some would be permanently disabled from doing work which required power and dexterity in their hands.

5.22 There was no evidence of any crush injuries or of trampling, "panic" injuries or significant exit accidents. All the injuries found were consistent with those which would be sustained from heat and smoke. There was no positive evidence of injuries from poisonous or noxious materials.

5.23 Mr Prendiville said that, in some cases, there was a series of burns across the backs of the shoulders just below the neck. He said that this was not a usual finding in injuries due to fire and that he thought it was possibly due to a liquid or molten substance falling on the patient from above his head.

5.24 Evidence as to the general psychological after-effects of the fire on a number of survivors was given by Professor J McKenna. Professor McKenna had interviewed twenty four persons, equally divided between the sexes. For obvious reasons, their names were not given in evidence.

5.25 Professor McKenna found a wide range of symptoms among the survivors, including mild anxiety, general nervous tension, sleep disturbances, nightmares relating to the fire, phobic reactions, conversion neuroses and hysterical symptomology, mild and severe depressive reactions, disorientation and increased alcohol intake.

5.26 A common reaction to the fire shared by all the survivors, he said, was "personality decompensation". In the case of some, this was a transient phenomenon from which they have made a satisfactory recovery. With others, it was of a relatively long term nature. The form it took depended in part on the vulnerability and/or predisposing factors in their personalities; and in part on the severity of the experience. So far as the latter was concerned, those who lost immediate family members were more severely depressed, obsessional or tense than those who had lost close friends.

5.27 Similarly, those who had lost friends were more severely affected by such symptoms than those who had lost no friends or family. The circumstances of the fire, already referred to in detail in Chapters 2 and 3, including in particular its rapid spread and the plunging of the building into darkness, had psychological consequences, in the view of Professor McKenna, for those who survived. Some, at the height of the emergency, had thoughts only of getting out of the building while others had tried to find their friends in the darkness. These circumstances led, in the case of some of the survivors, to poorly concealed guilt reactions resulting from their escape when their friends had died. In addition, there were immediate shock reactions in most of the injured who made their escape.

5.28 Professor McKenna said that most of the persons he had interviewed would be able, from their own resources, to overcome their particular neurotic reaction. Some had already surmounted it and had integrated the event into their general life experience. There was, however, the possibility of a post-traumatic neurosis with some, where there might be a vulnerable personality with an already existing incipient neurosis. He was satisfied, however, that in the majority of cases the fire would become an unhappy memory and would not lead to any radical changes in their life style. In the same way, grief reactions to the deaths of close friends or members of a family should run their course, as the victim adjusted to the new state of affairs. Where such grief reactions continued, they would, in his view, be generally attributable to already existing personality weaknesses rather than the circumstances of the fire.

IV — THE EFFECTS OF ALCOHOL

5.29 The tests showed that three of the victims had blood alcohol levels greater than 200 mg per cent. Dr Harbison said that, in the case of these three persons, the level of alcohol might have made them somewhat unsteady on their feet, but that they nonetheless would have been well able to walk. None of the deceased had levels of alcohol in their blood which would have incapacitated them in his view, but he did think it possible that, in the case of those with the relatively higher levels of alcohol in their blood, the manner in which they re-acted to the fire might have been affected.

V — IDENTIFICATION AND LOCATION OF VICTIMS

5.30 **In** the case of most of the victims, identification was effected reasonably rapidly. In at least four cases, however, identification presented difficulties. The problems arose partic-

ular-ly from the youthfulness of the victims, which meant that age changes and the effects of surgery and dental fillings were not prominent in the bodies. Dr Harbison thought that one of the contributory factors to the absence of dentistry was the effect on dental hygiene of the fluoridation of the municipal water supplies. He considered it desirable for people to wear, either around their necks or their wrists, some metallic disc for purposes of identity. He also said that, in his view, doctors, dentists, hospitals and health centres should keep accurate and detailed records which should not be destroyed for a period of at least twenty years and that this applied with particular emphasis to x-ray films.

5.31 While a plan was prepared by the Fire Brigade showing the location of bodies as they were found during the rescue operations *{Appendix 15, Plan 4)* the removal of the bodies to the morgue meant that it was not possible to identify the locations at which the bodies of individual victims had been found. Dr Harbison said that, to derive useful conclusions from differing blood gas levels and degrees of burning of bodies, it would have been informative to have known these locations. He was of the view, with which the Chief Fire Officer agreed, that in such cases, while giving priority to the removal of bodies where any possibility of life remains, attempts should be made, so far as practicable, to number bodies where found in the building before they are removed.

VI — CONCLUSIONS

5.32 Forty eight people died as a result of the fire. Of these, forty four died immediately, either directly from burns or from inhalation of toxic fumes, principally carbon monoxide.

5.33 Four victims died during a period of between four to twenty five days after the fire, from respiratory complications resulting from the injuries suffered by them during the fire.

5.34 None of the victims suffered any serious crush injuries.

5.35 Twenty eight of the victims had consumed alcohol. It did not, however, contribute directly to any of the deaths. In a relatively small number of cases, amounting probably to three, the consumption of alcohol may have been such as to affect the reaction of the victims to the fire, but even in those cases the levels of alcohol were not such as to have physically incapacitated the victims and thereby hindered their escape.

5.36 Two hundred and fourteen persons suffered injuries as a result of the fire. Of these, eighty six suffered minor injuries. One hundred and twenty eight required in-patient treatment and, of those, thirteen had significant respiratory complications, of whom nine required intensive therapy. Eleven had seriously disfiguring or disabling burns which would be permanent in their effect.

5.37 A number of the persons who escaped from the fire suffered, and may continue to suffer in the future, from psychiatric problems caused by the experience and, in particular, from guilt feelings associated with their survival when so many suffered death or serious injury.

CHAPTER 6

The Cause of the Fire

GLOSSARY 2

Terms and Units used in describing fire behaviour

Burning rate: The rate at which a combustible material decomposes; this may be derived indirectly by measuring weight loss.

Crib: A carefully designed arrangement of wood sticks which, when ignited, can provide a known rate of heat release.

Fire load and Fire load density: The amount of combustible material available for burning. This is usually expressed in units of heat energy (joules, kilojoules or megajoules) per unit of floor area of the room.

Flame spread: A measure of the spread of flame over exposed surfaces of walls or ceilings, usually measured by BS 476: Part 7.

Flammability: A measure of the continuous burning of materials such as fabric sheets, films etc, measured by standard tests.

Heat flux: The transfer of convection plus radiation heat energy.

Heat output: The total heat emitted when a fully or partially combustible item is burned: this is expressed in terms of kilojoules (kj) or megajoules (MJ).

Heat release rate: The rate at which a combustible material releases heat; this is usually expressed in terms of kilowatts (kW) or megawatts (MW).

Heat transfer: Passage of heat from one article or medium to another at a lower temperature. Heat transfer can be conductive, convection or radiation or a combination of these. Heat transfer from flames is by convection as well as radiation but is by radiation alone if the object is not in the path of convection currents. It is usually expressed as watts/cm^2.

Ignitibility: The ease with which a combustible material can be ignited.

Ignition: The initiation of combustion in combustible material, usually evidenced by flaming.

Spontaneous ignition: Ignition of a heated combustible material without the application of a localised small flame or spark to the combustible decomposition gases accumulating above its surface.

Pilot ignition: Ignition of a heated combustible material by application of a localised small flame or spark to the combustible decomposition gases accumulating above its surface.

Ignition source: A known, and usually controllable, heat source used to cause the ignition of a material or product under test.

Optical density: A measure of the opacity of the smoke. The greater the optical density the lower is the visibility in smoke but not in direct proportion. An optical density of 0.6 is roughly equivalent to a visibility of 2 m.

Oxygen depletion: Reduction in the oxygen content from the normal 21% because of oxygen being consumed during the combustion process.

Radiation: The transfer of heat energy by electromagnetic waves other than by heating the medium through which they pass.

CHAPTER 6

The Cause of the Fire

I —INTRODUCTION

6.1 This Chapter considers the possible causes of the fire.

Part 2 consists of a more detailed examination of the evidence of the eye-witnesses as to the nature of the fire actually observed by them in the West Alcove. It should be read in conjunction with the assessment of the evidence of these witnesses contained in Chapter 2.

Part 3 describes the condition of the building and its contents after the fire, as established by the evidence of members of the Gardai and the technical experts.

Part 4 considers the ignitibility of the contents of the West Alcove as they existed immediately prior to the fire, in the light of the data derived from a range of scientific tests.

Parts 5 and 6 examine the possibilities respectively of the fire having been started accidentally or deliberately.

Part 7 consists of the Tribunal's conclusions as to the probable cause of the fire.

II — THE LOCATION, NATURE AND EXTENT OF THE FIRE SEEN BY EYE-WITNESSES

6.2 The evidence of the eye-witnesses who appeared to have been in the best position to observe the fire in the West Alcove in its initial stages has already been considered in Chapter 2. The evidence of the eye-witnesses varied considerably, not merely as to the actual location of the fire within the alcove but also as to its size. Both of these factors can, of course be explained to some extent by the fact that the eye-witnesses may have been seeing the same fire at different stages of its development.

6.3 A number of the eye-witnesses were shown yideo films of tests carried out by the Fire Research Station on behalf of the Tribunal (see para. 7.28). In the first of these, a section of wall tiling was ignited by setting fire to a crib. In the second, a seating unit of the same design and manufacture as those in the Stardust was ignited, again using a crib. In the course of this test, the fire spread to adjoining seating units. In the third, which was the first of two large-scale tests, a seating unit forming part of a tier of seats against a rear wall covered with carpet tiles similar to those used in the Stardust was ignited. In this test, the fire spread to adjoining seating units, the wall tiles, the carpet and other seating units and tables in the experimental rigs, ultimately all the contents of the rig being consumed by fire.

6.4 The witnesses who were shown the video films were asked to indicate any points of similarity between the fire as recorded by film and what they saw in the Stardust and, in addition, any points of dissimilarity.

6.5 Sharon O'Hanlon said that when she looked under the blind (see para. 2.115) she saw the fire in the "three last seats nearest the Main Bar and nearest the back wall". When shown

the video film, she said, at the stage when the flame in the test occupied no more than at most a third of one seating unit, that the flame she had seen was much wider and that it involved the whole of the three units of the seat. She also said that it was spreading "much quicker" than was recorded by the film. (The film showed the progress of the flame in a generally upwards direction at what most people would probably consider a relatively slow and unalarming rate, at least in its initial stages).

Gerard Quinn said that when he saw the fire "it was spreading over all the seat. It was like the shape of a coat on fire", had spread to the back wall and was going up the ceiling, and the flame was blue and fast. He said he thought there were three different fires. Later in his evidence, he said that having thought about it, he did not think that it was a coat at the back of the seat. After considerable questioning on this topic, he eventually gave the following series of replies (Volume 6, questions 567/572):

Q. "You said in your answer to . . . . the first Counsel who questioned you that the impression you got was that it was a coat on fire on the back of the seat?

A. Yes.

Q. You say now you don't think, in fact, that it was a coat on fire?

A. Yes.

Q. Did you get the impression or did you think there was an object on the back of the seat, some material of some sort?

A. Yes, it looked like a coat.

Q. It looked like the shape of a coat?

A. Yes.

Q. You don't think that there was any separate object?

A. Yes.

Q. Roughly in the same shape as a coat?

A. Yes".

Mark O'Hanlon (see para. 3.28) said that the fire he saw was only a small one, but that it was about three feet in width. Anthony Bannon (see para. 2.37) said that when he saw the fire on Tier 9 in Row B, it seemed to him that the whole seat was burning and that the flame was going up the wall. Shown the video film, he said, at a stage when the fire on the seat in the test was still confined to part only of one seating unit, that the fire he had seen was across the back of the seat rather than in one spot and that it was across the whole of the three units of the seat. Yvonne Keogh (see para. 2.116) said that the fire she saw was on the back of the seat, about two or three feet high, and that she could not tell whether it was one or two seats which were involved. Robert Duffy (see para. 2.38) said that when he saw it first, an entire seat was on fire.

Kathleen Manning, who looked under the blind with Jacqueline McCarthy (see para. 2.42) said that she saw the seat in Tier 9 of Row B burning and that it seemed as if the whole seat and the back of the seat were on fire. Flames seemed to be coming from both the squab and the back of the seat. Jacqueline McCarthy (see para. 2.117) said that there were four seats on fire: Tiers 8 and 9 of Row A and the corresponding tiers in Row B. Shown the video film, she said that the flame was wider than shown in the film at the stage where it was confined to part of one unit of the seat. She also said that there did not appear to her to be a continuous fire between the seats in the two rows. The fire was spreading straight up to the ceiling.

David Mulligan (see para. 2.121), when shown the video film, said that the fire was much quicker than shown in the film. He also said that it was no wider than the fire in the film when the latter was confined to part of one seating unit only. Gerard Donohoe (see para. 3.13) said that he could see the fire from the dancefloor on the seat in Tier 9 of

Row A. He said the flame was crawling up the back of the seat towards the wall. Shown the video film, he also said that it was no wider than as shown in the film when confined to part only of one unit. He said that, unlike the flame in the video film, it kept spreading to the side.

6.10 Mr Thomas Kennan (see para. 2.100) described the flame he saw as a "long narrow flame" on either Tier 8 or Tier 9 of Row A and extending to the corresponding tier in Row B. He did not see it spreading. It was a long, dense flame.

6.11 Michael Kavanagh (see para. 2.82) said that he saw the fire on the seat in Tier 9 of Row A. The two seating units closest to the Main Bar were on fire. He was not able to see the squab, but could see the fire on the back of the seats. The carpet tiling on the wall above the seat was on fire and the flames were spreading towards him. Shown the film of the first test (of carpet tiling on fire), where again the flame spread at what would probably seem to most observers a relatively slow pace and in an unalarming fashion, he said that the flame he had seen was spreading "an awful lot quicker" and sideways rather than upwards. Shown a film of a seat on fire, again with the fire confined to portion only of a seating unit, he said that the flame he had seen was much wider and extended to two units of the seat. He said that it was burning along the top of the seat and at the same time was travelling across the carpet tiling on the wall but at a slower pace. When it reached the ceiling, however, the fire seemed really to take hold. There was nothing else on fire in the alcove: just the seating and wall tiles initially, and then the ceiling.

6.12 Patrick J Murphy (see para. 2.72) said that when he first saw the fire it consisted of a flame along the entire length of the seat in Tier 9 of Row A. It was on the top of the back of the seat and not on the seat itself. The flame did not appear to be on the wall: it was very small, not more than three to four inches high. When he returned with the fire-extinguisher, the height of the fire was still about the same, but the seats in Tier 9 of Rows B and C were also on fire at this stage. He did not see any fire on the wall itself and there was no line of fire connecting the fire on the three seats. The fire appeared to him to be orange in colour.

6.13 Leo Doyle (see para. 2.76) said that when he came into the alcove with the fire extinguisher, he saw the seats in Tier 9 in each of the Rows A, B and C on fire. He thought that the flame was about three feet high in all, extending about a foot in height above the top of the seats. He thought it was coming from the squab portion. It seemed to him, however, that the material itself was not burning, either at the back or on the squab. The flame seemed to have a number of colours, orange, yellow and blue. He did not see any smoke at all. He then described the flame as follows (Volume 40, questions 658/662):

Q. "It struck you as an unusual flame or fire at that stage?

A. The way she was burning, flaming, it appeared it was running on that seat, you know.

Q. When you say running, the flame did not change in extent when you were watching it, playing your extinguisher on it?

A. No.

Q. What do you mean by running?

A. It was in one area, on one side of the seat and probably moved down the other area as if there was a liquid there.

Q. I don't want to put words into your mouth, but would dance be a good description?

A. Yes.

Q. You know the effect. Don't agree unless it bears some relation to what you saw, but if you pour whiskey on the Christmas pudding, something like that, that dancing effect from one part of the seat to the other?

A. Yes".

6.14 During the time that he had the fire under observation, he said that he did not see the carpet tiling on the back of the wall catch fire at any stage. He agreed that in one of his statements to the Guards he had said

> "The fire was spreading along the back wall and a number of the seats were on fire".

6.15 Austin Bell said that he saw the fire on the seat in Tier 8 of Row A. He said that it seemed "like a dancing flame on top, three feet high". The flame was two and a half to three feet high and extended over the full length of the seat. After he had raised the blind, he saw the flame spreading very rapidly to the corresponding seat in Row B. The flame, when he first saw it, seemed to be bright orange with a blue tinge. There was no smoke at all. The material at the back of the seat seemed to be burning. There was a distance between the fire in Row A and Row B. He said that from his viewpoint he did not see any seats in Tier 9 or the back wall on fire, although they could have been.

6.16 Phelim Kinahan (see para. 2.99) said that he saw the fire on the seat in Tier 9 of Row A on the two units further away from the Main Bar. He then saw the fire jumping from that row into the corresponding seat in Row B. The fire was very small, and he had the impression that the carpet tiling on the back wall was on fire between the two sections of seating. He thought that in appearance it resembled "some kind of spirits on fire". He agreed that he had not given such a description of the fire to the Gardai in the eight statements he made. Shown the video of the seat on fire, he said that the fire seemed "far too slow".

6.17 John Fitzsimons (see para. 2.85) said that, on his first visit to the West Alcove, he saw the fire on the two seats in Tier 9 of Rows A and B. The whole of the seat nearest the Main Bar was on fire, but he could see flames only at the top of the seat. The flames were about two feet in height, but varied in height along the top. The flames appeared to be "travelling" and were higher at the Main Bar end. In the corresponding seat in Row B, the flame was not as high, but nearly the whole of the top of the seat was on fire.

6.18 Laurence Neville (see para. 2.63) said that when he first saw the fire it was on the seat in Tier 8 of Row A. The two seating units nearer the Main Bar were on fire, with flames approximately three feet high, but the back of the seat did not seem to be on fire. He also said that there was one area of flame on the two units "as if something was sprinkled over it".

Ill — THE CONDITION OF THE BUILDING AND ITS CONTENTS AFTER THE FIRE

6.19 The first detailed examination of the building and its contents after the fire was carried out by Detective Garda Seamus Quinn, of the Ballistics Section of the Garda Technical Bureau. He began his investigation, assisted by other Gardai, in the West Alcove at 08.35 on the morning of the 14th February, 1981.

6.20 The section nearest the Main Bar was investigated first, since it appeared to Detective Garda Quinn, from such eye-witness accounts as had been furnished to the Gardai at that stage, that this was where the fire had been first seen. The examination of this area was extremely detailed and intensive, and five hours alone were occupied in an examination of Row A and the aisle on either side of it.

6.21 In this area, one spent match was found on the floor in front of the seat in Tier 9 of Row A. The location of the match was in front of the right front leg of the seat unit nearest to the aisle beside the Main Bar. This spent match was in a blackened condition and its head had been knocked off, but the remainder of it was in good condition. It was preserved by Detective Garda Quinn and produced to the Tribunal. He said that it was lying near the top of debris, which was in a charred condition, on the carpet. The debris consisted of carpet tiling, with a portion of ceiling tile above that, and above that again part of the

PVC covering of the seat. The match was resting on the ceiling tile with some more ceiling tile above it.

6.22 The detailed examination of the West Alcove was resumed on the 15th February, 1981. A portion of an "Afton Major" cigarette packet, with three burnt out cigarettes in it, was found on the floor in Tier 2 of Row B at the seating unit nearest the aisle, between Rows A and B. The box was lying under the table and the pack was almost totally burnt away. It was possible to see the three columns of ash where the cigarettes had been, and there was also some silver paper on top of it. There was also some green coloured material or debris under the area of the blind. Both the cigarette packet and the green debris were preserved by Detective Garda Quinn.

6.23 On the 16th February, 1981, the investigation of the West Alcove was completed with an examination of the front tier of seats. In the course of this, some molten metal was found under the area where the blind had been. This material was also preserved by Detective Garda Quinn.

6.24 A number of samples of material were removed by Detective Garda Quinn from the north-west corner of the West Alcove, and handed to Mr Norton of the Forensic Science Laboratory of the Department of Justice. A number of samples of materials from other parts of the building were also removed by him and handed to Mr Norton.

6.25 Detective Garda Quinn said that he was satisfied beyond all doubt that no part or portion of an explosive or incendiary device was overlooked during the intensive examination of this area.

6.26 Mr Norton was present briefly at the scene of the fire on the 14th February, 1981. He returned on the 16th February, and on that day and the following day carried out a detailed examination of the entire building. The description of the building which follows is derived from his evidence and that of Detective Garda Quinn.

6.27 The greater part of the Stardust had been gutted by the fire. Nothing of the suspended ceiling in the ballroom remained except for some tiles above the dance floor area and near Exit 2. The greatest intensity of fire appeared to have been in the West and North Alcoves *(see Plate 42)* where not merely had the suspended ceiling been destroyed, but the asbestos roof had also largely disappeared and some of the glass panels were missing. Other glass panels showed signs of melting. The steel roof-trusses in these areas showed signs of buckling. All the seating and tables in these two areas, apart from the seats in Tiers 8 and 9 of Row A, were burned out and the frames which were bolted to the floor had buckled. (For the condition of the two seats referred to, see *Plate 43* and para. 6.31).

6.28 The floor in the dance area was not badly damaged, nor was the maple floor in the area immediately surrounding the dance area and in the vicinity of Exit 2. Most of the floor covering on the rest of the floor had been destroyed in the fire.

6.29 The blind in the West Alcove was almost entirely destroyed: the iron T-piece supports remained in position and underneath there were the pieces of re-solidified metal and green-coloured materials already referred to, and spring-loaded iron tubes. The remains of two systems of drainage pipes were also visible, running from north to south across the centre portion of the ballroom just above the suspended ceiling. The remnants of the ducted heating system and timber planking of the cat-walk were also visible above the ceiling level.

6.30 A detailed description follows of the condition of the various parts of the building, again principally derived from the evidence of Detective Garda Quinn and Mr Norton.

The West Alcove

6.31 As has already been pointed out, all the seats and tables in this area were completely burnt, with the exception of the two seats in Tiers 8 and 9 of Row A. In these two seats,

o

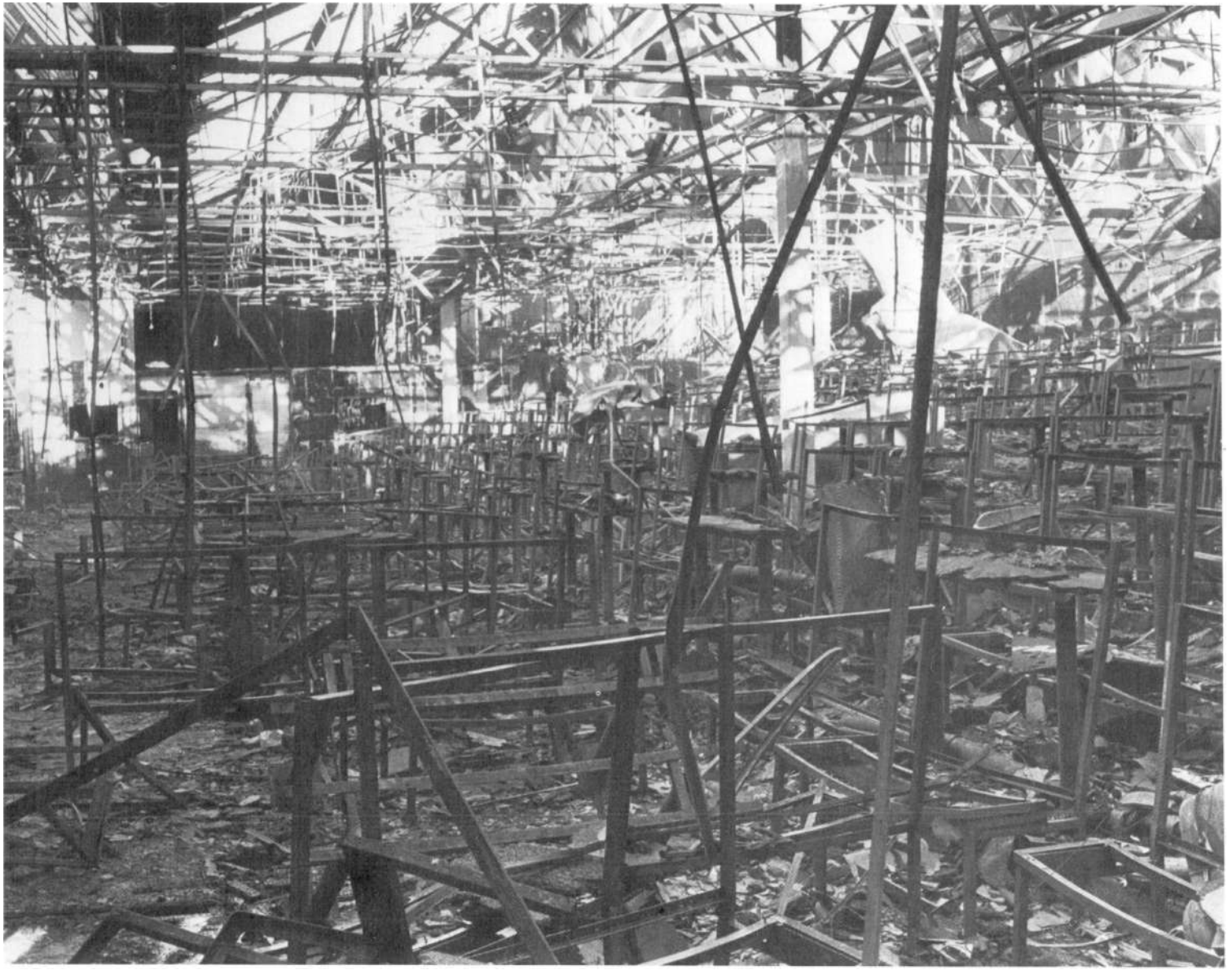


Plate 42 — *View looking towards Main Bar with North Alcove to the right.*

Plate 43 — FZVIX> *of seats and table frame in north-west corner of the West Alcove.*

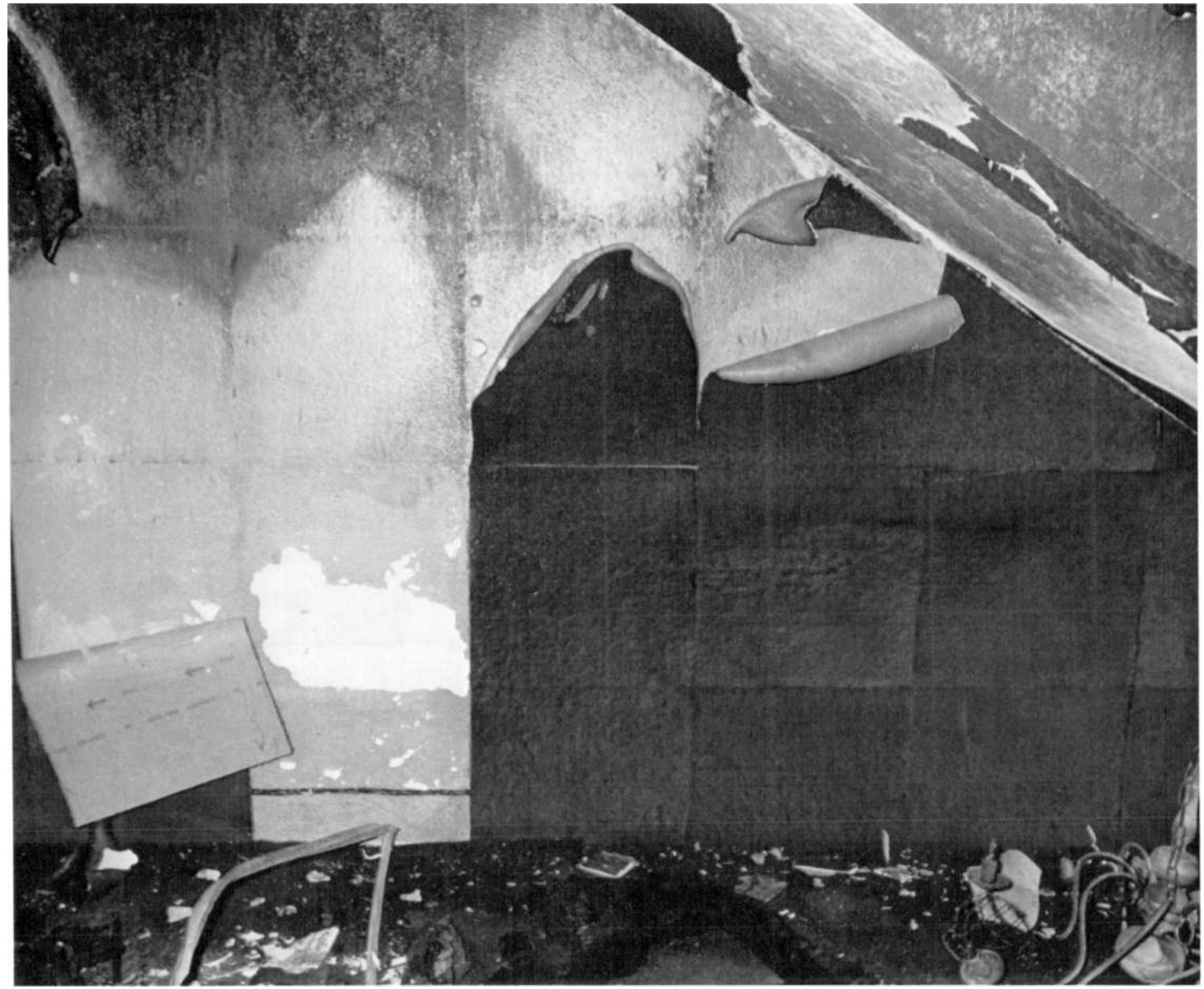


Plate 44 — *Photograph showing damaged wall-tiles peeling from wall; also showing inta*

the PVC covering had been consumed by fire, but some of the polyurethane foam and chipboard remained, although badly fire-damaged. The carpet tiles on the wall behind the seat in Tier 9 next to the Main Bar were also relatively undamaged by fire. When Detective Garda Quinn inspected the area on the afternoon of 14th February, 1981, water was cascading upon it from a pipe in the area of the end wall of the Main Bar.

6.32 Mr Norton said that the seating unit in Tier 9 closest to the Main Bar had foam preserved on the leading edge of the seat extending almost to the back edge. It also had foam preserved on the bottom edge of the back portion. The centre unit had foam preserved on the leading edge of the seat portion. The unit on the left-hand edge of the row had a small piece of foam preserved on the leading edge of the seat portion beside the centre unit.

6.33 The skirting boards along the back wall were intact. Residues from some of the carpet tiles on the wall were present on the steps along the wall beside the Main Bar. Below where the ventilation grid had been, there was a patch of re-solidified plastic material. Mr Norton said that there was no trace of the water-pipe leading from the cold-water valve in the direction of the West Alcove, even though the other pipes leading to and from this valve were intact but perished.

6.34 In the presence of Mr Norton, Detective Garda Quinn removed the cover from the plug socket on the wall next to the Main Bar. Mr Norton said that the plug socket showed no signs of electrical failure. He was also present when the cover from the socket on the left-hand wall was removed. He said that this cover showed signs of corrosion. The wiring of the socket was intact.

The Store Room and Lamp Room

6.35 The Store Room was totally destroyed by fire, as were its contents, i.e. roller towels, detergents, washing-up liquids, toilet paper etc. The door and timber partition were totally destroyed. The timber partitions in the Lamp Room, together with the spot-lamps and chairs which had been there, were also totally destroyed.

Main Bar

6.36 The damage in this area was mainly due to heat and smoke. The heating control box was badly heat-damaged. Much of the timber and plywood cabinet containing the hot-water cylinder and the quilted PVC jacket which formed the lagging (see para. 1.46) had been destroyed in the fire. A detailed description of the hot-water cylinder and the immediately surrounding area, as it was found after the fire, is contained in para. 6.130 below.

The Foyer at Exit 2

6.37 The carpet tiles on the wall and floor tiles in this area were all badly damaged by fire, except for those which were protected by the stairway. The Cash Office was fire-damaged, although saved to some extent by its partition and door. The door is adjacent to the Cloakroom and was badly damaged, though the framework was still in position.

Spirit Store and Toilets (Tl, T2, T6 and T7)

6.38 The damage to the Spirit Store was smoke-damage only. All the toilets suffered damage from heat and smoke which was severe in the case of toilets T6 and T7. The entrance doors to all the toilets were totally destroyed by fire.

South-east Corner

6.39 The stage was badly damaged by fire and the portable platform was badly charred. The damage to the dressing rooms and toilets was confined to smoke-damage. The Battery Room and Switch Room were undamaged by smoke or fire.

Corridors

6.40 The corridor leading from the Stardust to the Lantern Room was smoke-damaged. The door leading into it from the Stardust (Door 15) was destroyed by fire, and only the charred jamb remained. The corridor from inner to outer Exit 3 was damaged by heat and smoke, and the inner door was almost totally destroyed by fire.

Areas Undamaged by Fire

6.41 Apart from the area in the West Alcove already referred to, there were three other small areas in the Stardust partially unaffected by fire.

(1) Behind the back tier in the north east corner of the North Alcove, some carpet wall tiles were still stuck to the wall and were relatively intact.

(2) Carpet wall tiles were firmly affixed to the wall at each side of Exit 6. Some had a relatively small amount of smoke-damage to them.

(3) There were twelve relatively undamaged carpet tiles still in place on the wall near Exit 4.

The Lantern Room

6.42 The Lantern Room was largely undamaged by the fire. Some of the seats and tables were the same as those used in the Stardust, and Mr Norton examined about thirty of the seats. Three of them were damaged with the covering material cut along the edge. In the case of two of the seating units the seats were detachable: their retaining screws had been removed so that the squab could be pushed back against the seat back. Nearly all the seats showed signs of cigarette burns on the squab. In no case, however, had the fabric disintegrated as a result of the burn so as to expose the foam filling.

Samples from the Stardust and the Lantern Room

6.43 Reference has already been made to a number of samples removed by Detective Garda Quinn from the Stardust and other parts of the building and handed by him to Mr Norton at various times subsequent to the fire. In the case of a number of samples of various materials from the West Alcove which were received by Mr Norton on the 14th February, 1981, tests were carried out by him immediately to determine whether there were traces of a hydrocarbon fire accelerant, such as petrol, white spirit or paraffin oil. The items analysed by Mr Norton are listed in *Appendix 8*.

6.44 It should be noted that the samples for analysis came to Mr Norton in both nylon and plastic bags. He agreed that there would be a much greater tendency for vapours to diffuse through the high density polythene of which the plastic bags were made. There would also have been some loss of vapours in transferring the samples from the plastic bags to the nylon bags. He estimated that about 10% of the vapours were transferred into the gas chromatograph i.e. the instrument used to detect the presence of hydrocarbons. This instrument detects one part per million of hydrocarbons and, accordingly, with a 10% sample should have been able to detect one part in 100,000. It would also detect the presence of other volatiles, e.g. organic ones such as alcohol, although it would not have identified alcohol as such.

6.45 Detective Garda Quinn agreed that the best material to test for the existence of volatiles would have been the floor covering or the debris from the floor covering in the area closest to the supposed seat of the fire. It is clear, however, from his evidence that none of the samples given to Mr Norton for analysis contained samples which could be clearly identified as samples of the debris from the floor or the remains of floor covering.

6.46 There were also no tests carried out for hydrocarbons or other volatiles on the remains of ceiling tiles found in the West Alcove.

6.47 A number of other samples or items of material from the Stardust and other parts of the building were also given by Detective Garda Quinn to Mr Norton in the days following the fire and in some cases were subjected by him to certain analyses and tests.

They were as follows:—

(1) *Ceiling tiles from the Lantern Room*

6.48 Samples of ceiling tiles were removed from the Lantern Room and subjected- by Mr Norton to a test which is described in Appendix 14 M.

(2) *Ventilation Grid*

6.49 This also came from the Lantern Room and measured 62.8 cm X 62.8 cm with holes measuring 1.2 cm X 1.2 cm in it. The holes were almost completely blocked with dust which was on the downward-facing side. The grids were manufactured from polystyrene, which has a melting point of 120°C and is combustible. There were a number of these grids in the ceiling of the Stardust.

(3) *Orange "Wavin"Piping*

6.50 This was portion of a 6-inch (150 mm) diameter orange "Wavin" drainage pipe. It was one of a number in the roof space above the suspended ceiling, one of which (over the Lantern Room) survived the fire. They were manufactured from unplasticised PVC. When subjected to heat from a bunsen burner, the material burned and tumesced heavily. When the flame was removed, the plastic was quickly self-extinguishing.

(4) *Plastics Air Duct*

6.51 This was manufactured from PVC tape wound on an iron spring-like coil to produce a flexible tube. These tubes varied in diameter depending on their position in the building. The tape consisted of plasticised PVC coated on to a fibre-glass woven mesh. The proportions by weight of the various components in the tape were

(i) PVC 41%

(ii) Plasticiser27%

(hi) Fibre-glass 32%

The plasticiser was composed of a mixture of an organic ester and a phosphate plasticiser. There were a number of these heating ducts in the Stardust, all of which burned and fell from the roof on to the area beneath. Mr Norton said that he exposed a piece of one of the ducts to a flame from a bunsen burner. The piece burnt, but as soon as the bunsen was removed, the flame went out.

(5) *Sample of Re-solidified Metal and Green Material from the Area of the Blind*

6.52 Mr Norton found the molten metal to be aluminium. It could have been from either of two sources, the channels for the blind or the roof.

6.53 The green material was found to be a mixture of inorganic oxides, mainly chromium and lead. Mr Norton said that he considered these to have originated from the pigment material in the blind. A sample of the blind-material ashed in a furnace at 900°C, gave an ash which was green in colour and contained the same elements.

(6) *Metal Plug Top*

6.54 This was found to be a nickel-plated brass plug top. In the damaged area the nickel had been etched away exposing the brass underneath. There were pock-marks in the brass in this exposed area indicating heavy corrosion. Mr Norton said that this damage would have been caused by hydrochloric acid released from the PVC.

(7) *Glass from the roof*

6.55 This was found to have a melting point of between 600°C and 700°C.

(8) *Nut and Ferrule from the Water Valve above the Cylinder in the Main Bar*

6.56 Mr Norton examined these items and, in particular, the ferrule, to see if traces of the water-pipe remained on it. The ferrule came from a T-junction. The other two pipes were still in position. The pipe which appeared to have gone across the West Alcove, had completely disappeared and the subject of Mr Norton's examination was the actual nut and ferrule inside the T-piece. There was a very thin smear of plastic on the outer edge of the ferrule.

(9) *Plastic from the Water-pipe*

6.57 These samples were taken from the other two pipes leading into the junction mentioned in the preceding paragraph. Mr Norton found them to be polyethylene, which he said, has a softening point of 60°C and a melting point of approximately 110°C.

6.58 One of the scientists from the Fire Research Station, Dr W.D. Woolley, however, expressed a different view: he said that he thought that temperatures in excess of 100°C would be required to produce softening. The Tribunal is satisfied that Dr Woolley's estimate is preferable.

(10) *Material from the PVC Quilt of the Cylinder in the Main Bar*

6.59 Mr Norton examined this material and found it to be manufactured from PVC with a phthalic ester plasticiser added. This material constituted the cover of the fibre-glass forming the lagging on the cylinder. It was described by Mr Norton as being paper-thin, by which he meant not more than 0.5 mm. He ignited it with a match and the fire spread across the portion of material.

(11) *Corrugated Asbestos from the Roof*

6.60 So far as Mr Norton knew, this came from the area above the stage. He examined it microscopically and took a scraping off the surface on which he did an infra-red spectrum test to see if there was any organic material. He found no such traces. The mixture consisted of a mixture of asbestos fibres and Portland cement in the proportions of approximately 1 to 9 respectively. The external surface was very fibrous where the cement had been corroded by the action of the weather. He said that under the fire conditions, stress in this material sufficient to have broken it would have been created in three ways:

(i) Moisture trapped in the cement being converted to vapour would create conditions similar to that in plaster which produces an effect called "spalling".

(ii) Uneven expansion of the material due to one face being hot and the other cold, could have taken place.

(iii) The corrugated sheets were held rigidly in place with bolts, allowing no leeway for thermal expansion.

6.61 Mr Norton subjected a small piece of the material to the heat of a bunsen burner and this caused minor fracturing, but not enough to crack the piece of the material completely.

(12) *Other Materials*

6.62 The following materials were also given by Detective Garda Quinn to Mr Norton and subjected by the latter to various analyses and tests:

(1) material from blind,

(2) seat from the Stardust,

(3) sample of material from table-top in the Stardust,

(4) sample of carpet tile, and

(5) sample of floor-covering material.

Details of the analysis and tests carried out by Mr Norton on these items are contained in Appendix 14 M.

6.63 Mr Norton said that on the 23rd February, 1981, he received two blue shirts, the property of Mr Patrick J. Murphy. It will be recalled that Mr Murphy gave evidence that, while he was in the alcove attempting to extinguish the fire, drops of a reddish liquid fell on his shirt (see para. 2.74). He examined one of the shirts and observed on the left-hand cuff microscopic traces of a red material together with a yellowish staining of the shirt in the area of the red material. He said that there was not sufficient red material present to carry out a chemical analysis. He agreed that, had certain equipment been at his disposal, such as a mass spectrometer, he could have carried out such an analysis, which had in fact been requested by the Tribunal. He said that the shirt was no longer available.

(13) *Investigation by Mr Green*

6.64 Mr Green of Messrs Cremer & Warner Ireland Limited, forensic scientists, who were commissioned by the Gardai to carry out an investigation, said that in the course of an examination of the premises on the 8th and 9th April, 1981, he found a number of pieces of glass, apparently from tumblers or glasses, and one piece of bottle-glass, in the West Alcove. He found the pieces around the legs of the seating units in Tier 7 of Row B.

6.65 Mr Green also gave evidence that the steel frame of the table in Tier 7 of Row B was "blued", but that he was unable to find any other signs of "blueing" in the Stardust. He said that he would infer from this that at the time the firemen's hoses were directed on the steelwork, it was hotter than at any other point in the building. He said he would further infer from this that the heat had been applied to the steel for a longer period than elsewhere, and that this suggested that the fire might well have started at that point.

IV — THE IGNITIBILITY OF THE CONTENTS OF THE WEST ALCOVE: THE EVIDENCE OF THE TESTS

(1) The Nature of the Tests

6.66 The tests carried out on the various materials for the purposes of the Inquiry fell into two broad categories.

First, there were *standard tests.* The object of these was to ascertain whether a particular material or construction complied with certain defined standards. It should be emphasised that these tests did not necessarily reproduce conditions in the building as at the time of the fire. Thus, the standard test for the surface spread of flame on wall and ceiling linings which has already been referred to (para. 1.125), is that contained in BS 476: Part 7: 1971. In this test, six specimens are tested to determine the surface spread of flame classification. Two such tests were undertaken in which the carpet tiles used as wall linings were fixed to asbestos millboard. A further test on one specimen only was undertaken with the carpet tile fixed to a concrete substrate. The carpet tiles in the Stardust itself were fixed to plastered walls.

6.67 Second, there were *non-standard tests.* These tests are procedures devised specifically to examine particular behaviour patterns. Some of them, intended to reproduce the early stages of the fire, do not comply with any standard specification for apparatus or procedure, and are more properly described as *ad hoc* tests.

6.68 Evidence was given of standard and non-standard tests carried out by the following persons or bodies:

An Garda Siochana and Department of Justice (Old Technical Bureau, St John's Road, Dublin 8);

Cremer and Warner Ireland Ltd (commissioned by An Garda Siochana);

Yarsley Technical Centre, a non-governmental agency, at Redhill, Surrey, England (commissioned by An Garda Siochana);

Fire Insurance Research and Testing Organisation (FIRTO), a non-governmental agency at Borehamwood, Herts, England (commissioned by An Garda Siochana);

Fire Research Station (FRS), Borehamwood (commissioned by the Tribunal); and

Dr J. H. Burgoyne & Partners (commissioned by the owners).

6.69 Some of the tests were specifically relevant to the cause of the fire, some to the spread of the fire and some to both. As already pointed out (see introduction) the tests carried out by the Fire Research Station were primarily intended to produce information on the possible factors which lead to the spread of the fire. Some of them, however, also produced important data which are relevant to the cause of the fire.

(2) **The Results of the Standard Tests**

(i) ***Standard Test for Ignitibility of Upholstered Furniture (BS 5852: Parti: 1979)***

6.70 This test is designed to ascertain the ignitibility by smokers' materials of upholstered composites for seating. The complete finished item of furniture is tested, rather than the individual materials of which it is made. Since it is thought that the position at which accidentally dropped cigarettes or lighted matches are most likely to cause ignition is at the angle between vertical and horizontal surfaces, this situation is reproduced as far.as possible in the test.

6.71 In the first test, a smouldering cigarette source is used. The precise dimensions, mass and smouldering rate of the cigarettes are specified—approximating to a "Senior Service Virginia" cigarette as sold in May, 1979—the method of lighting is specified and the specification then requires the smouldering cigarette to be placed in position along the junction between the vertical and horizontal test pieces. The progress of combustion is then recorded and, depending on whether progressive smouldering or flaming is observed, the item passes or fails.

6.72 The second test employs a butane flame. The actual flame used is referred to as "ignition source 1" and has been designed to give a calorific output roughly approximating to that of a burning match. Larger flaming sources are specified in BS DD 58: 1978 and they are referred to as "ignition sources Nos. 1—7". In the case of ignition source 2, a gas flame of a specified calorific output is adjusted according to the specification, the burner tube being positioned axially along the junction between the seat and the back. (The specified calorific output is approximately equivalent to a normal cigarette-lighter flame). Observations are then made to ascertain if progressive combustion of the materials exists for specified times, and a "pass" or "fail" is recorded accordingly.

6.73 Two tests were carried out on combinations of foam and PVC covering used in the seating units in the Stardust. They were formed into an assembly, in accordance with BS 5852: Part 1, representing the junction between the seat and the back (or arm) of an upholstered chair. The two sources referred to in BS 5852: Part 1 were then employed with the results set out in Appendix 14, Table C5. The first test was carried out by FIRTO and the second by the FRS. In the case of the FRS test, it was also subjected to ignition source 2 of BS DD 58. The FIRTO test was carried out on materials from one of the seats in the building and the FRS test on new materials of the same composition. The results of the tests may be summarised as follows. In the case of the FIRTO test, the materials passed the smouldering cigarette test, but failed the butane flame test. In the case of the FRS, they passed both tests.

6.74 The FIRTO test was criticised by Dr Watt, of Dr J. H. Burgoyne & Partners, as not having complied with the terms of the specification: he claimed that the operator had pressed the bunsen tube against the material, whereas the specification requires it to be positioned as indicated. Detective Garda Quinn and Mr Norton were present at the same test, and said that they were satisfied that it was carried out in accordance with the specification.

6.75 It should be noted that the specification requires that there be a join between the horizontal and vertical components. In the case of the actual seating used in the Stardust, there was no such join. Detective Garda Quinn and Mr Norton said, however, that in the case of two seating units found by them in the Lantern Room, which had the retaining screws removed, it was possible to push the squab against the seat back so as to provide ajoin.

6.76 After the standard tests had been carried out at FIRTO, a further test was carried out in which a butane flame equivalent to a burning match was applied to the surfaces both vertical and horizontal for twenty seconds. It was observed that these surfaces were caused to flame slightly using this source. When the source was removed, no sustained ignition was observed. A heavy char mark was evident on the surfaces. Ignition source 2 of BS DD 58—roughly equivalent to a cigarette-lighter flame—was then applied to the vertical and horizontal surfaces for forty seconds. This was sufficient to cause both the vertical and horizontal surfaces to ignite and produce sustained ignition when the source of the flame was removed.

6.77 Further tests of a similar nature were also carried out by the FRS. Ignition sources 1, 2 and 3 as specified in BS DD 58 were used. The flames were applied to the squab in a horizontal orientation as well as positioned at different angles to the back. In order to ascertain the effect of damage to the PVC covering, the cover was cut with a knife and a lighted cigarette placed on the cut. In addition, a match flame was used at a different location in the cut.

6.78 The results of the tests referred to in the preceding paragraph are set out in Appendix 14, Table D5. In all but three cases, there was no sustained ignition of the seat. The first exception was when ignition source 3 was applied to the squab and the face of the back, with the squab in the "down" position. The second was when the squab was varied in angle from 90° to 5° and ignition source 1 applied to the angle; in six tests the flame went out but persisted in one. The third was when a match was placed on the exposed foam with the squab down and cut. In the first and third cases, the flames extinguished after periods varying from 70 seconds to 120 seconds.

(ii) ***Other Standard Tests for Ignitibility of Contents of West Alcove***

6.79 The standards which were the basis for the tests described in the previous section, were designed for testing the ignitibility of upholstered furniture using self-contained sources of ignition. They are directly relevant to the ignitibility of the upholstered parts of the seats. However, a degree of comparison between the various combustible items that were present in the West Alcove may be made by comparing results obtained under another test, viz. BS DD 70: 1981. In this test the time to achieve pilot ignition (i.e. ignition by a small flame placed momentarily near the surface) and spontaneous ignition is measured for different levels of radiation falling on the surface. A small sample of the composite lining assembly lying flat with the surface uppermost, is exposed to radiation from a conical furnace (Appendix 14, Plate 1), the intensity of the irradiation on the surface being adjusted to give 1 to 5 W/cm^2. The time to ignition, on application of a pilot flame at each intensity, is then recorded.

(a) *Upholstered Seats (BS DD 70)*

6.80 Ignition of polyurethane foam covered with PVC, as was present in the seats, was obtained at a low level of radiation, viz. in less than one minute at a radiation flux of 1 W/cm^2 *(Appendix 14, Table C6).*

(b) *Rear of Seat (BSDD 70)*

6.81 The rear of the seat-back consisted of chipboard covered with PVC. The ignitibility of this part of the seat was broadly the same as that of the polyurethane foam covered with the PVC material. The chipboard covered with polypropylene scrim as used for the base of the seating units, however, was more difficult to ignite *[Appendix 14, Table C6).*

(c) *Tables (BS DD 70)*

6.82 The chipboard was easier to ignite when the top layer of the melamine was in place than when it was not in place. In the latter case, the performance expected would be similar to timber *[Appendix 14, Table C6).*

(d) *Wall Tiles (BSDD 70)*

6.83 The results of this test on the wall tiles showed that the tiles were about as difficult to ignite as chipboard and substantially more difficult to ignite than the PVC-covered polyurethane foam *[Appendix 14, Tables CI and C6).*

(e) *Floor Covering (BS DD 70 and BS 4790)*

6.84 The ignitibilities of the floor coverings, "Nylfloor" as used on the tiers and "Ultra" as used on the main floor, were determined using the BS DD 70 method (Appendix 14, Table CI 1). The "Ultra" carpet ignited in a slightly shorter time than the wall tiles and the "Nylfloor" in a much shorter time still.

6.85 Another important test is used to determine the extent to which fire spreads from a small but persistent ignition source on the surface of the floor covering. Known as the "Hot Metal Nut Method" (BS 4790: 1972) it involves the supporting in a horizontal position in an enclosure of a small sample of the covering. A metal nut heated to 800°C* is placed centrally on its surface and the extent of spread of the burning zone measured. The results are also given in Appendix 14, Table C11.

(3) The Results of the Non-standard Tests

(i) ***Garda Old Technical Bureau***

6.86 In the presence of Mr Norton, Detective Garda Quinn burned one of the seating units which he had removed from the Lantern Room. The centre of the squab portion of the seat was ripped with a pen-knife so that the foam was exposed. The foam was then ignited with a cigarette-lighter. The squab portion caught fire easily and burnt with a bright flame about 18 inches high producing a large quantity of black smoke. The seating unit appeared to burn like a pool of liquid gradually expanding outwards. After approximately two minutes, the back portion of the seat showed signs of melting and then caught fire. The flames increased immediately reaching a height of 9 feet, approximately, above ground level, with a generation of a large quantity of black smoke. The flames spread across the complete back quickly, and more slowly across the complete squab portion. The seating unit was burnt out after seven minutes. On examination, the covering and foam had burnt completely, while the chipboard base and back were charred. The polypropylene underneath the seat was undamaged. Slight damage occurred to the covering at the rear of the back of the seat.

6.87 A further test was carried out by Mr Norton in Detective Garda Quinn's presence. He ignited two separate seating units also from the Lantern Room, having first exposed the foam at the seat edges by tearing the PVC covering. Mr Norton ignited the foam by using a match. The seating units ignited very easily and burned very slowly initially until after *5i* and 6i minutes respectively, when the backs of the seating units caught fire. The second

*This is what was stated in evidence but the standard requires a temperature of 900°C.

seating unit was burnt in more draught-free conditions than the first. Mr Norton said that in draught-free conditions it would take even longer for a fire to reach the back of the seating unit and produce a large flame. The fire on the second seating unit was easily extinguished when half-burnt, by throwing approximately two gallons of water on it. Mr Norton also attempted to ignite a seating unit by burning a carpet tile and allowing the material falling from the tile to land on the squab of the seat. The tile was ignited by holding a piece of rolled up newspaper to the edge. The tile was then held in place above the seating unit and allowed to burn. Burning debris then fell from the carpet tile and caused the seating unit to ignite.

(ii) ***Crenter & Warner Ireland Limited***

6.88 Tests were carried out by Mr Green with smouldering cigarettes and lighted matches which gave the same results as those achieved in the FIRTO and FRS tests. The tests were then repeated with whiskey spilt on the seat but the results were no different.

6.89 The PVC covering was then slit and a cigarette-end placed on the foam. It smouldered to ash, but without igniting the foam. A lighted match was then used and ignited the foam fairly readily, but only when the PVC was folded back.

(iii) ***Fire Research Station***

6.90 A series of tests was carried out in an attempt to reproduce the early stages of the fire as described by the eye-witnesses. In these tests, different arrangements of seating units were used, some against a section of wall tiling and some at a distance from it, resting on "Nylfloor" floor covering. Various methods of ignition were attempted, some of them involving the spilling of various volatile liquids on the tops of the seating units, in order to reproduce the appearance of the flames, as described particularly by Mr Murphy, Mr Doyle and Mr Kinahan (see paras. 2.72, 2.76 and 2.99).

6.91 The details of this series of tests are contained in Appendix 14E. The results, so far as the ignitibility of the seating units is concerned, can be summarised as follows.

When about 200 cc of white spirit were poured over the top edge of the back seat, no ignition occurred on the application of a lighted match. About 200 cc of a mixture of alcohol and water were then spilled over the top edge of the seating unit, of which some fell on the carpet tile on the wall and on the back of the seat. Ignition was effected with a match and there were dancing blue flames over the whole length of the back rest, which were quickly reduced to localised flaming in one or two spots. There was no ignition of the PVC covering material or the wall carpeting. Other tests were carried out with the same mixture allowed to fall in a small gap between the unit top and the wall lining and with the squab of the seating unit lifted up, but no sustained flaming of the seating unit occurred. 200 cc of a mixture of alcohol and water in equal parts were then spread over the squab, some of it spilling on to the floor carpet and some splashing on to the back. When the mixture was ignited by a match, it burnt readily over the whole seating unit surface and the fuel on the carpet was also ignited. The flames were light blue in colour and 150-200 mm in height. The flaming on the seating unit was confined to one or two isolated areas and it burnt at one place near the front edge for nearly a minute, after which it died down. Similarly flaming on the carpet and floors continued for a short period and died down.

6.92 200 cc of the same mixture were then spilled over the whole top horizontal edge of the seating unit and some of it allowed to fall on the wall carpet and to drip down. It was ignited by a match, and flaming occurred over the whole length of the seating unit top with light blue dancing flames 150 mm in height. The flaming gradually reduced in severity but persisted in two areas where there was sufficient fuel for it to continue. There was some flaming on the carpet tiling on the wall, but the floor carpet did not ignite. No flame spread was seen behind the seating unit. Flaming at one point at the top of the backrest persisted and damaged the PVC cover allowing the foam to become ignited. The

flame was now yellowish in colour and it was easily extinguished. It was thought that had it been allowed to burn, it was quite probable that in approximately four to five minutes it would have involved the whole back seating unit and the carpet tiles on the wall.

6.93 Four to five sheets of small-sized newspaper were crumpled and placed below the front of the seating unit on the floor carpeting, and about 200 cc of an alcohol/water mixture poured over the paper and a match used to ignite it. The whole length of the paper was quickly burning with flames over the front edge of the unit. Flames also spread back towards the rear of the unit and through the gap between the seat squab and the back. The upper part of the unit was ignited with the whole unit burning rapidly. The back rest was also involved and the whole unit was burning furiously at about one and a half minutes from ignition.

6.94 The largest of the non-standard tests consisted of the simulation of an entire section of the West Alcove and the starting of a fire in it. The details of this test are contained in Appendix 14 I but its results, so far as ignitibility is concerned, can be summarised as follows. Three double sheets of newspaper were placed under one of the seats and ignited with a match. The newspaper itself burned out fairly quickly but ignited part of the floor covering and the wall tiling behind the seat. As it was clear that the fire was not developing, five additional double sheets of newspaper were ignited in a slightly more forward position. This was 13 minutes 40 seconds after the original ignition. This time a sustained ignition of the seat was achieved.

(iv) *Dr J. H. Burgoyne and Partners*

6.95 Dr R. Watt said that he carried out a large number of tests with smouldering cigarettes. These were done directly on the PVC covers and at the junction of the seat-back and raised squab. He also said that the tests were conducted in, or in front of, a fume cupboard with a forced draught, which, in his opinion, simulated air movement similar to, or even greater than that in the West Alcove. In addition, he carried out tests with cigarettes in direct contact with the foam inside the damaged seat. He said that in no case did ignition occur.

6.96 Dr Watt said that, in order to test a theory as to the possible cause of the fire which had been suggested during the course of the Inquiry, he attempted to ignite a seat, taken from the Lantern Room, with a piece of screwed up paper-napkin. He lit various sizes of screwed-up napkin, from about a quarter of a napkin to a whole napkin. He lit each of them with a match, but in no case was he able to obtain ignition of the seat.

V—THE POSSIBILITY OF AN ACCIDENTAL ORIGIN

(1) A Careless Smoker

6.97 The first possibility to be considered is of a smoker in the West Alcove having carelessly discarded a lighting match or smouldering cigarette in such a manner as to start a fire. It is evident from the tests described in the preceding part that the only items of furnishing in the alcove which need to be considered in this context are the seats.

(i) *The Evidence of the Tests*

6.98 The tests indicated that, while the possibility of a lighting match causing a seat to ignite could not be ruled out completely, it was an unlikely source of the fire. A lighting match resting on the exposed foam, however, could have created sustained ignition. A smouldering cigarette resting either on the seat squab or the exposed foam would not have created sustained ignition.

6.99 An ignition source 2 flame (roughly equivalent to the flame of a cigarette-lighter) applied to the back of the seat could have caused sustained ignition, but is not indicative of an accidental origin from a carelessly discarded cigarette or match. A cigarette extinguished

by pressing it on the PVC covering or the exposed foam would not have caused sustained ignition.

6.100 It also appears from the evidence of Dr Woolley and Mr Malhotra, the officers of the FRS who gave evidence on this aspect, that it is improbable that either the ageing of the seats or their being damaged by cigarette burns would have created conditions sufficient for a lighting match to have ignited the seat. Such conditions would be present if the seat was actually cut with a knife or other sharp instrument.

(ii) ***The Condition of the Seats***

6.101 In determining whether the fire was caused by a careless smoker, the actual condition of the seats in the West Alcove on the night of the fire is, accordingly, of fundamental importance.

6.102 Evidence as to their condition was given by Mr P.J. McGrath, the general maintenance man, Mrs Agnes Pearse, the head cleaner, and two of the other cleaners, Mrs Mary McPartlin and Mrs Alice Finn.

6.103 Mr McGrath said that from time to time over the period of three years when he was acting as general maintenance man, he found some of the seat cushions in the Stardust to have been ripped. He had some spare seats and, when this happened, he replaced the seat in its entirety. He said that the last time he had replaced a seat was a long time before the fire. That seat was not slashed, but broken by somebody having jumped on it. He was in the alcove on the 13th February, 1981, prior to the disco dance and he said that he believed that on that occasion he went round and inspected the seating. This was his normal practice.

6.104 Mrs Agnes Pearse, the head cleaner, said that the Stardust was vacuum-cleaned and swept on the Monday, Wednesday and Friday of the week of the fire. The furniture was also sprayed with polish. She recalled having seen one seat in the West Alcove slashed at some stage, but could not recall whether she had seen it in that state on the 13th February, 1981. Mrs McPartlin said that she saw torn seats from time to time in the Stardust, but could not recall seeing one in the West Alcove. She saw torn seats approximately once a week.

6.105 Mrs Alice Finn said that on Wednesday, the 11th February, 1981, she and Mrs Delahunty were vacuum-cleaning in the Stardust. She (the witness) was cleaning in front of the West Alcove. On the afternoon of the following Friday, she was vacuum-cleaning on the first two or three steps behind the blind in the West Alcove. She recalled seeing one loose seat in the row nearest the Kitchen. She did not recall ever seeing seats damaged, except in that manner.

6.106 There is, accordingly, no positive evidence as to the existence of a seat in the West Alcove with a cut or torn cover on the night of the fire; and the probabilities are that, had there been such a seat in the alcove in the week preceding the fire, it would have been replaced by Mr McGrath in the normal way.

(iii) ***The Presence of a Smoker***

6.107 While some of the staff who took their break in the West Alcove on the night of the fire admitted to being smokers, no one admitted to smoking in the alcove on the night.

6.108 Neither the existence of the match nor the partially destroyed packet of cigarettes points to the presence of a careless smoker in the alcove on the night of the fire. The relatively undamaged condition of the match and its location near the top of the debris suggests that it is more probable that it was not there during the fire. The presence of the cigarette box with the evidence of some unsmoked cigarettes in it indicates no more than that someone left such a packet somewhere in the vicinity of the alcove. Even if it could be assumed that it had been left in the alcove itself, this would do no more than indicate that some person

had been smoking in the alcove and had left the unfinished packet there by mistake. In fact, however, the inevitable disturbance of the area during the fire-fighting operations and the search for bodies by the firemen, made it by no means improbable that the cigarette packet was originally left on one of the tables or seats on the ballroom side of the alcove.

6.109 The respective locations of the cigarette packet and the spent match made it unlikely that they were related in any way.

(iv) ***The Possibility of the Fire being Unobserved***

6.110 If, contrary to what the evidence has appeared to suggest, the fire was started by a carelessly discarded lit match falling on the exposed foam of a damaged seat, a further difficulty remains. The tests indicated that such a fire would commence immediately with an obvious flame; and even assuming the co-incidence of the careless smoker having immediately left the West Alcove, it seems more probable that he would have observed the fire before he left.

(2) Smouldering Material brought into the Alcove

6.111 There was evidence that at the end of disco evenings in the Stardust, the waitresses and floor girls would collect the contents of ashtrays from the tables in brown paper or black plastic bags. These bags were left at the entrance to the Main Bar and were taken out with the rest of the refuse the following morning. The bags were supplied to the girls by the barmen in the Silver Swan.

6.112 This practice, coupled with the evidence of Gerard Quinn (para. 2.35) that he thought that the fire seen by him resembled a coat on fire, drew attention to the possibility that a bag containing smouldering material had been left in the West Alcove and had initially set one of the seating units on fire. He thought he had seen the object resembling a coat on the seat in Tier 8 of Row B. The possibility considered was that the object seen by him was, in fact, such a smouldering bag, burning fragments from which were carried by air currents to other seats in the alcove.

6.113 It was accepted by the scientific witnesses that a seating unit could have been ignited in this manner. There was much discussion, however, as to the possibility of the fire having then spread to other seats. As already noted, Dr Watt carried out an *ad hoc* test to determine whether pieces of paper napkin folded in different sizes and shapes and then lit could ignite a seat, in order to ascertain whether it was possible for a burning fragment of some such material to have travelled from a smouldering bag and ignited another seat. He failed to achieve sustained ignition in any of the tests, but it is clear, and indeed was accepted by Dr Watt, that one cannot readily draw conclusions from such a test. There is a great range of possibilities so far as the contents of such a bag of rubbish are concerned and as to the possible size of the fragment which, as suggested, might have been carried by the currents of air in the alcove to another seat. So great are the uncertainties that, in the view of the Tribunal, one cannot say more than that the possibility exists, given a number of conditions, that a fragment of burning material from such a bag might have been carried by air currents to another seat, thereby causing the fire to spread in the manner observed by so many of the eye-witnesses.

6.114 There are, however, serious difficulties in the way of this theory. In the first place, there is no evidence that such a bag of rubbish was placed in the West Alcove on that night or any other night. The evidence of those waitresses and lounge girls who were questioned about this matter was that the operation was carried out at the end of an evening only; and, accordingly, was not carried out at all on the evening of the fire. It should be said, however, that, as this possibility was canvassed extensively only in the later stage of the Inquiry, none of the patrons who were sitting in front of the West Alcove was asked whether he observed any" person going behind the blind with such a bag. It is also the case, of course, that if anyone did place such a bag in the West Alcove on the night of the fire, his or her anxiety at the thought that it had led to the fire might have caused the

person concerned to lie about it. The fact remains that there is no evidence of its having been done, not merely on that night, but on any night.

6.115 In the second place, apart from the evidence of Gerard Quinn, there is nothing in any of the eye-witness accounts to suggest that anyone saw an *object* on fire as distinct from the seats themselves. It is true, of course, that some of the eye-witnesses would have had a restricted view and, depending on whether the bag was on the floor or not, might not have been able to see it. This could not apply, however, to those who actually went into the alcove and got closer to the fire, none of whom saw anything remotely resembling an object of any sort on the seats. In the view of the Tribunal, the evidence of Gerard Quinn forms far too tenuous a basis for the theory: he admitted to having been drinking, to having fallen asleep and to having got sick shortly before the smell of burning was drawn to his attention.

6.116 In the third place, no traces of any of the contents of such a bag were found in the West Alcove. It is possible, for example, that had the bag contained empty cigarette packets and ashtrays, traces of aluminium foil or paper might have been found. Very limited weight, however, should be attached to this factor: the planting of evidence in the final large scale test (see para. 6.168) included aluminium ashtrays and cigarette packets, but no traces were found by Detective Garda Quinn after the test.

6.117 Another theory advanced during the Inquiry was that the fire was started by a coat containing smouldering material and left on one of the seats. This was first suggested by Mr Green and was also prompted in part by the evidence of Mr Quinn. In addition to the lack of evidence to support it, it also suffers from the additional improbability that the only conceivable source of such smouldering material was an unextinguished pipe, an unlikely object in these particular circumstances.

6.118 Another possibility, which was also dependent on the presence of a careless smoker, was the extinguishing of a cigarette by stubbing it out in, or the throwing of a flaming match into, a plastic food-container or some object of similar nature. As already noted, a number of members of the staff when taking a break in the West Alcove, brought chips with them in plastic containers. While some of them admitted to being smokers, they all denied having been smoking while in the alcove. In addition, they all confirmed that they were sitting at a point far removed from the probable location of the fire.

(3) A Fire Accidentally Started in the Roof-Space

6.119 The evidence established that there was very little in the nature of combustible materials in the roof-space. According to the evidence of the contractor who erected it, however, the suspended ceiling did not extend to the Store Room. The contents of the Store Room included toilet rolls, kitchen towels, paper napkins, plastic cutlery, drums of cooking oil, and aerosols such as cleaning agents and polishes. There was also evidence that members of the kitchen and bar staff were accustomed to going to this room in order to replenish various items that they might need in the course of their work and for that purpose obtained a key from the cellarman, Mr Lennon. Mrs Pearse, the head cleaner who was helping in the Kitchen on the night of the fire went with Mrs Marley, the catering manageress, to the room for that purpose on the evening of the fire. She said that they locked the door when they left. There was no evidence of anyone else having visited the room that evening.

6.120 It is, of course, clear that, with so much combustible material available, a carelessly discarded cigarette or match could easily have started a fire in the Store Room. The theory that this was the cause of the fire, however, necessitates not merely the start of the fire in this manner, but its transference in some way across the roof-space and into the alcove where it was first seen in the ballroom. Again, there are serious difficulties inherent in this theory.

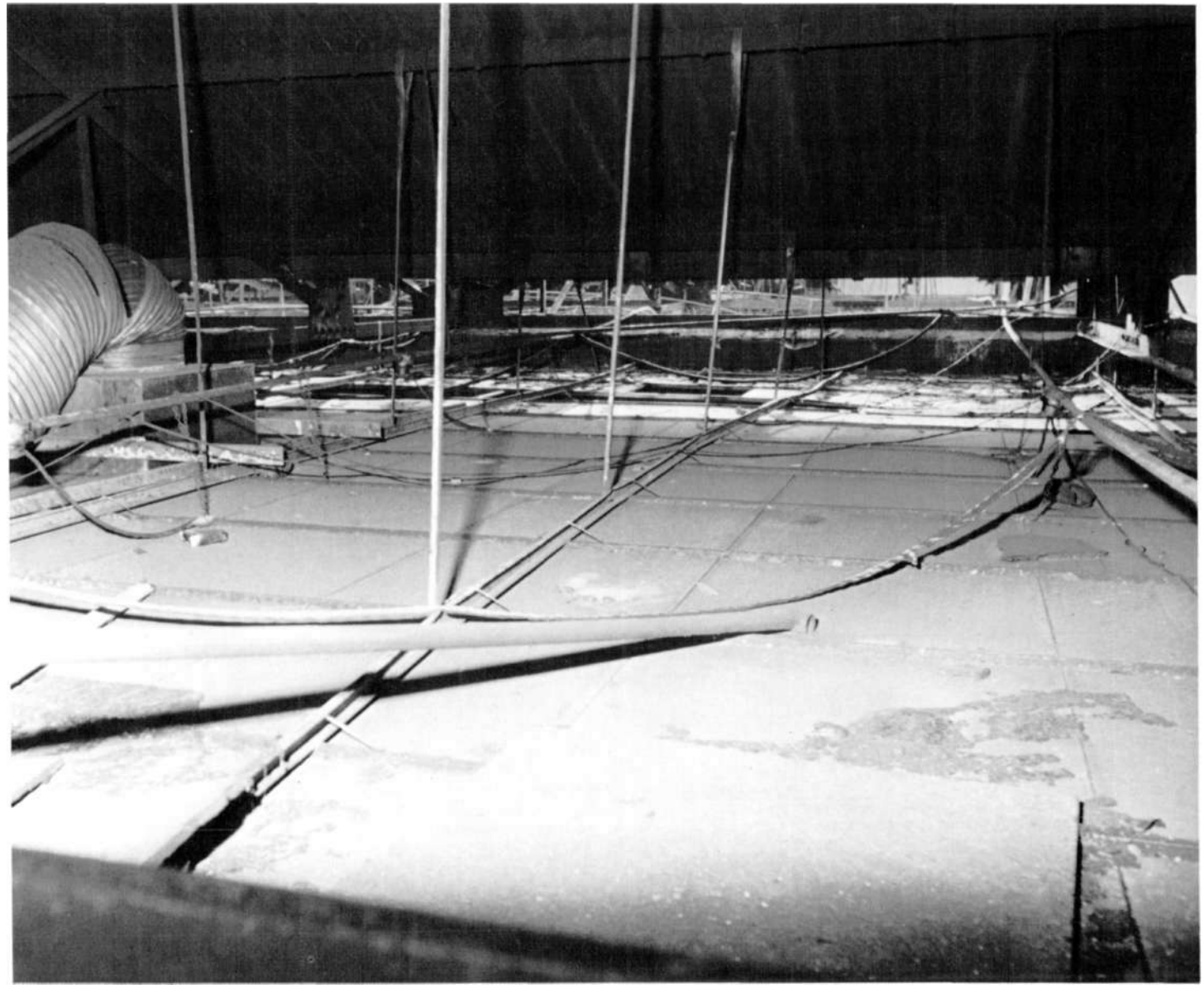


Plate 45 — *Photograph taken in roof space facing towards the Stardust. The vertical suspended ceiling are clearly visible while to the left a damaged air-circulatio*

6.121 In the first place, while it might be possible in theory for flaming material in such a fire to be brought by currents of air as far as the suspended ceiling over the West Alcove, it seems improbable that this could have happened. While there was no direct evidence as to the currents of air which might have existed in the roof-space (see *Plate 45)* on the night of the fire, the indications are that neither their velocity nor orientation would have been such as to effect the necessary transference of flaming material. The most obvious source of an air current—the air extraction system—was not in operation, and the most likely orientation of such currents as there may have been would have been from east to west following the line of the roof apexes, rather than from north to south, the direction required to support the theory.

6.122 In the second place, even given air currents of the appropriate velocity and orientation, it is not easy to understand how a fragment of flaming debris sufficient to ignite one of the seats in the West Alcove could still be in a flaming condition sufficient to ignite one of the seats after being wafted across the intervening space.

6.123 As has already been pointed out, there was very little in the nature of combustible materials in the roof-space, with the exception of the Store Room. A possibility that merited consideration was one of the plastics ventilation ducts which ran above the suspended ceiling. Given the existence of a fragment of flaming debris in the roof space, the possibility arises that this suceeded in igniting the plastic duct, a burning portion of which might have been carried in the duct itself by the current of hot air through the grilles in the suspended ceiling and on to the seating units. This presented the immediate difficulty that the position of the duct—running in an east-west direction across the top of the West Alcove an appreciable distance south of the wall of the Main Bar—made it an unlikely source of fire penetrating the suspended ceiling at the point where the fire was first seen in the alcove. Moreover, the test carried out by Mr Norton (para. 6.51) indicated that the source necessary to ignite the duct would have to be of such a size and sustained for such a period as to make it unlikely that it could have been carried by air currents from the area of the Store Room.

6.124 Consideration was also given to the possibility that materials might have been stored in the roof-space which had been overlooked in the evidence. However, the most probable location of any such materials would have been at the point in the Main Bar where the roof-space was accessible by means of a ladder. Again, this would indicate a location too far removed from where the fire was actually observed.

6.125 In the third place, the theory demands that the flaming debris, during its progress from the Store Room to the West Alcove, should have travelled upwards and downwards again at two points in its journey in order to surmount the obstacle presented by the top portions of the internal walls as they rose clear of the suspended ceiling.

6.126 In the fourth place, unless the plastic duct was ignited in the manner suggested above, the theory requires the penetration by the flaming debris of the suspended ceiling over the West Alcove. Mr McGrath's evidence established that the replacement of ceiling tiles at the back of the West Alcove did not result in the new tiles fitting tightly against each other or against the existing tiles. Any crevice, however, that remained was so narrow as to be measured in millimetres and it seems extremely improbable that flaming debris could have penetrated it, let alone any of sufficient size to ignite a seating unit.

6.127 One possible machinery suggested was the melting of the water-pipe above the suspended ceiling in this area (see para. 6.57). Mr Norton carried out an *ad hoc* test which demonstrated that the pouring of quantities of water on the ceiling tiles could have resulted in the tiles breaking up and collapsing. If this is correct, however, it is not easy to understand why none of the witnesses who saw the fire from nearby in its early stages saw any water cascading through the roof in the manner suggested.

6.128 In the fifth place, the evidence as to the nature of the damage in the Lamp Room and the Store Room suggests that the fire in this area spread from the Lamp Room to the Store Room and not *vice versa.* Dr Watt's evidence, which was not contradicted on this matter,

Plate 46 — *View of copper cylinder in the south-west corner of the Main Bar as seen from Door 23.*

was that the timber partition between the two rooms was more severely damaged by fire on the Lamp Room side than the Store Room side.

(4) An Electrical Fault

(i) *General*

6.129 The evidence of the electrical engineers, Mr Kelly and Mr Tennyson, was that the electrical installation throughout the building was generally of good standard and proper workmanship. The deficiencies which their examination revealed, such as the absence of lids on the trunking boxes and the inadequate discrimination in the secondary lighting system, might have affected the performance of the secondary lighting system during the fire, but would have had no relevance to any electrical fault that could have been the source of ignition. The two sockets examined by Mr Norton in the West Alcove gave no indication of having been the source of an electrical fault giving rise to any possibility of ignition.

(ii) *The Immersion Heater*

6.130 The location and nature of the immersion heater in the Main Bar is described in para. 1.46 *(Plate 46).* After the fire, it was found that much of the timber and plywood cabinet in which it was contained, together with the quilted PVC jacket which provided the lagging for the hot-water cylinder, had been destroyed in the fire. Detective Garda Quinn and Mr Norton both examined the remains of the door of the cabinet which was found on the floor a few feet from the cylinder. Their evidence was to the effect that the burning on the door was more severe on the outer side than on the inner side and consisted of a crescent-shaped area extending approximately three or four inches from the top of the door. The fire-damage to the timber uprights on either side of the door which remained in position was more severe at the top than at the bottom. Detective Garda Quinn and Mr Norton inferred from this that the fire had burned from the top downwards. Garda Quinn said that the outer side of the door appeared to him to be more severely burned than the inside and he inferred from this that the fire had originated outside the cylinder.

6.131 The immersion group itself consisted of two units, one at the top and one at the side near the bottom of the cylinder. These units were normally covered by bakelite caps held in place by a brass screw. Much confusion developed during the Inquiry as to what had happened to the two caps in question before, during and after the fire.

6.132 The first photographs taken of this area after the fire (by Mr Mooney on behalf of Dublin Corporation) showed the lower cap to be in position, but did not indicate whether the upper cap was in position or not. The Garda photograph *(Plate 47)* showed the lower cap to be in position and apparently damaged. It was not possible to ascertain from the photograph whether the upper cap was in position. There were also what appeared to be two additional caps lying on the base of the cabinet. When Mr Kelly photographed the heater in April, however the upper cap was missing and the unit filled with debris. The retaining screw was still in position. He also found the two additional caps lying on the base of the cabinet.

6.133 Detective Garda Quinn said first in evidence that on his examination after the fire he removed the top cover but said that he could not recall whether he replaced it or not. When he was recalled by the Tribunal to deal with this matter again, he said that he had, in fact, replaced it. He could not say, however, what had happened to the fourth cap: only three were available for inspection by Mr Kelly on behalf of the Tribunal. Of the three caps, one was severely damaged by fire. The remaining two showed some sign of smoke discolouration on the outside. The retaining screw was missing from one of these two *(Plates 48 and 49).*

6.134 The hot-water cylinder had been removed by the Gardai to their headquarters after me commencement of the Inquiry. The two immersion heaters were removed on the

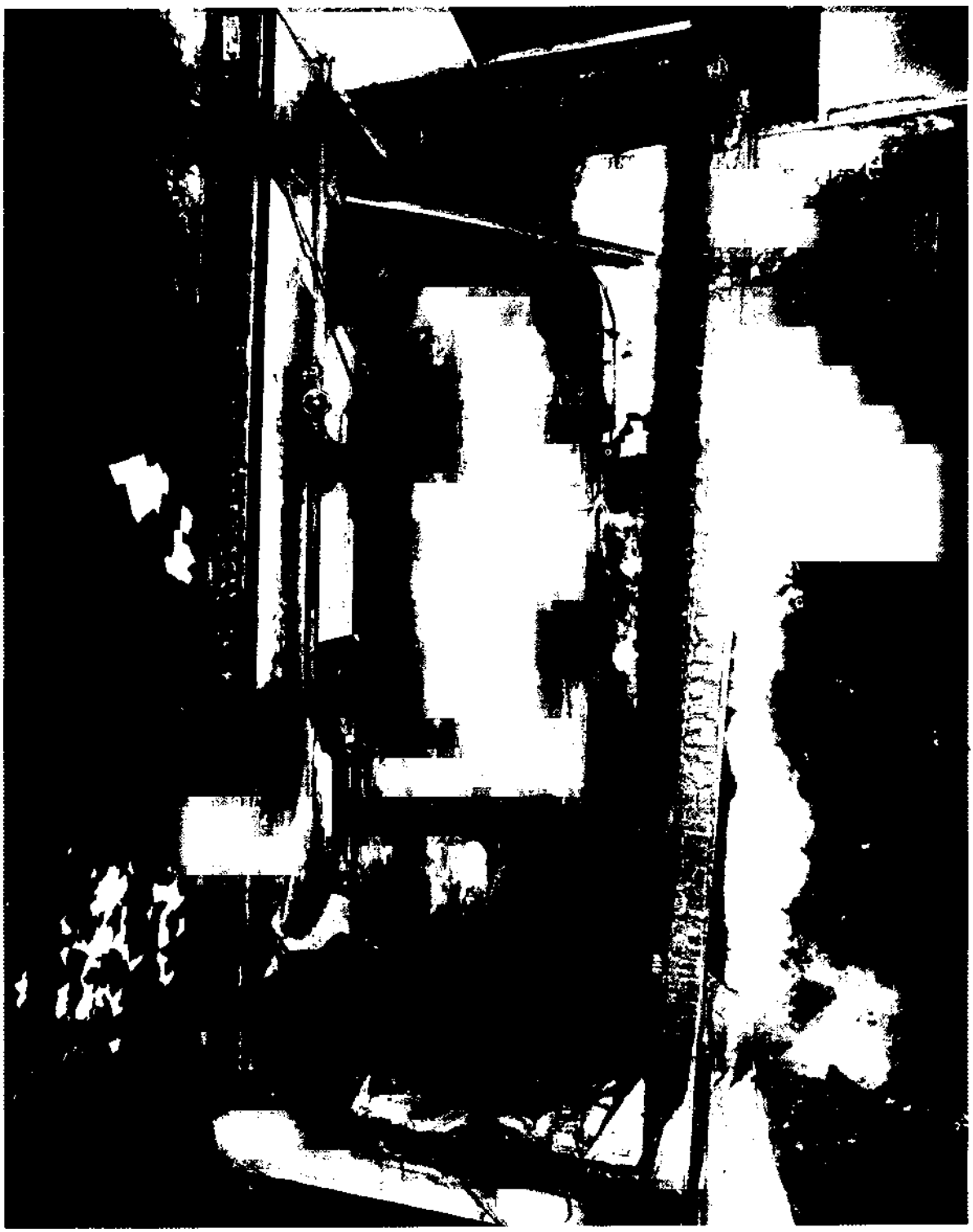


Plate 47 — *Close-up view of copper cylinder in Main Bar. Note bakelite caps lying on base of cabinet.*

Plate 48 — *Photograph of immersion heater terminal covers—interior.*

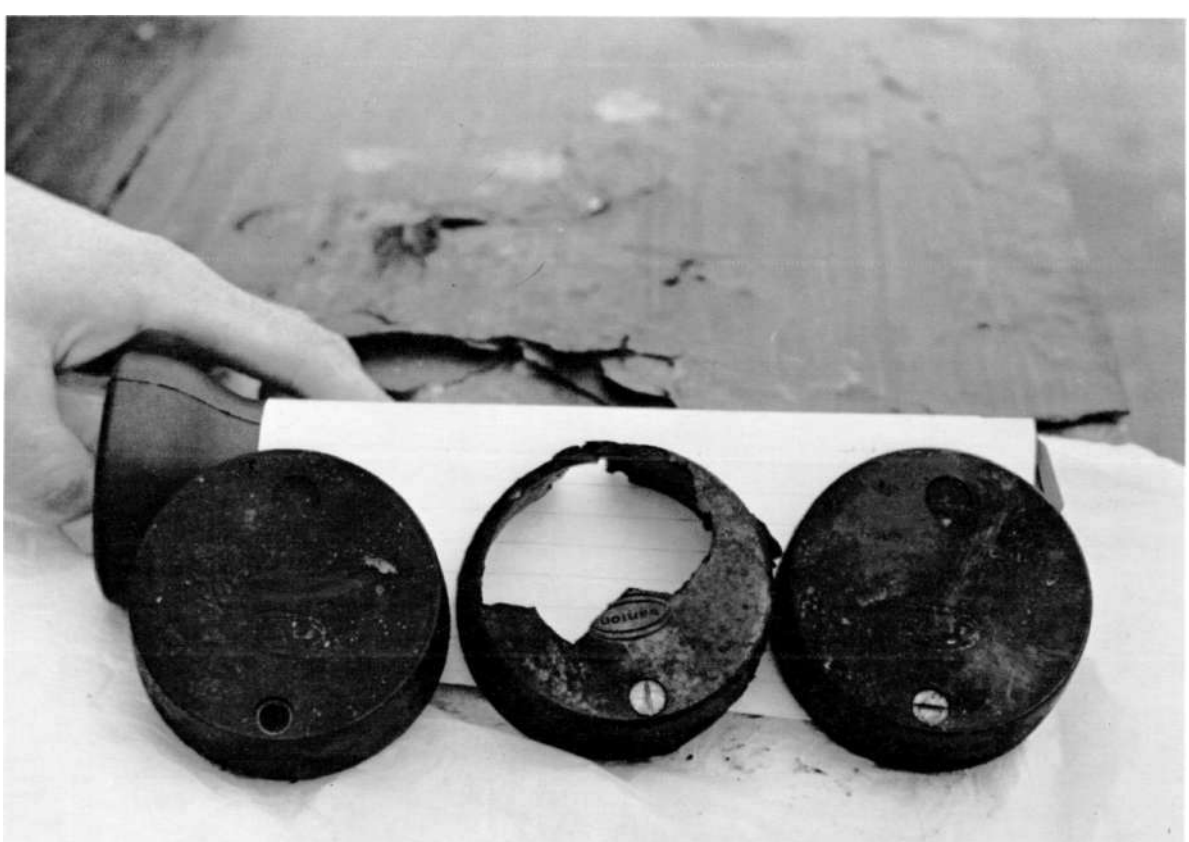


Plate 49 — *Same covers—exterior.*

30th September, 1981, in the presence of Mr Green and Mr Kelly. Each expert carried out a careful examination of the two heaters.

6.135 Mr Green said that a thorough inspection of the retaining screw in the upper heater established that only the slotted top of the screw was blackened, the thread being quite clean. He inferred from this that the screw was in place during the fire. He said that the grub screw from the neutral connection was removed and appeared to be considerably corroded. It was also apparent that the end of the cable had not been properly inserted into the terminal and this also showed evidence of corrosion. Mr Green said that he considered that this could have resulted in some overheating at this point. The screw and retaining square washer were also removed from the "line" connection; and again it appeared that not all of the strands of the cable had been secured under the washer. In this instance, there was no appreciable corrosion to the end of the cable. Again, he thought that there must have been a real possibility of overheating. He did not, however, think that it was sufficient to initiate a fire. He was also satisfied from an inspection of the thermostats that they had functioned normally.

6.136 There was a considerable amount of black material in among the connections to the upper immersion heater, which appeared to him very probably to have been bakelite, although it was not possible to identify it with certainty.

6.137 The lower heater had suffered very little damage. The appearance of the exposed end suggested to Mr Green that burning material, falling from above, landed on the plate underneath the cylinder and ignited the insulation around the cable entry and the cover. He thought that this, in turn, might have burnt the cap locally and blackened the plastic end of the heater. In the case of this heater, the conductors appeared to be much more securely fixed in the terminals than in the case of the upper heater. In the case of both the "line" and neutral cables, only a very few strands of the 50-strand cable had not been secured by the terminal screw.

6.138 Both heating elements were then tested and performed perfectly normally.

6.139 Mr Green was satisfied from the appearance of the three timbers forming the framework of the enclosure that the fire had burnt from the top downwards. Charring decreased progressively from top to bottom. The base of the enclosure showed slight charring of the upper surfaces of the timber framework and scorching over part of the surface of the rectangular piece of chipboard fixed to the timbers. This suggested to him that objects which had been resting on the board at the time of the fire had left their imprint on the surface of the board.

6.140 A close examination of the timber framework of the cabinet and such portions of the panel as remained, indicated to Mr Green that the fire started inside the cabinet rather than outside. He thought that had it started from outside the enclosure, the outer edge of the timbers would have been more charred than they were.

6.141 Mr Green was unable to find any evidence of "arcing"—one of the usual sources of ignition in the case of an electrical fault—at any point.

6.142 Notwithstanding the indications of poor workmanship in the connections *(see Plates 50* and *51)* and signs of local overheating, Mr Green was of the view that the amount of overheating generated would probably not have been enough to cause a fire. The existence of these faulty connections, however, and the evidence of overheating, he thought, meant that the question was not entirely free from doubt.

6.143 Mr Kelly confirmed Mr Green's view, that the wiring in the top heater was badly connected to the terminals and that this would cause severe local heating. He agreed that there was no evidence of "arcing" or short circuiting at the terminals or any evidence of arcing or welding of the thermostat contacts. The testing of the elements and thermostats showed that no faults were present that would have caused short-circuits.

Plate 50 — *Photograph showing the electrical connections at the top of the immersion heater on the cylinder in the Main Bar, taken before dismantling.*

Plate 51 — *Close-up photograph of same, showing poor electrical connection at the live terminal.*

Plate 52 — *View of upper terminal block on immersion heater.*

6.144 Mr Kelly said that, in the case of the lower heater, there was no positive evidence of electrical tracking, arcing or short-circuiting.

6.145 He said that, in his view, the extent of overheating was such that it was practically impossible to determine whether the overheating was due to a fault while the immersion heater was in use, or was the result of the high temperatures created by the fire itself.

6.146 It was not possible to analyse the burnt material in the top immersion heater, shown in Mr Tucker's photograph *(Plate 52)* as it had been dislodged by the careless removal of the cylinder from the Stardust to Garda Headquarters.

6.147 Mr Kelly concluded that the damage to the lower immersion heater was probably caused by the external source of heat and flame: and that it was unlikely that it caused or contributed to the fire in any way.

6.148 Mr Tennyson also attended the examination and testing of the immersion heater at Garda Headquarters. He confirmed that the workmanship of the final electrical connections to one of the units was extremely poor, but said that the strands which did make the connection were quite clean and free from arcing or burning. His view was that, despite the poor workmanship, these connections did not in any way cause or contribute to the fire.

6.149 While it is not clear what happened to the cap at the top of the cylinder, it seems unlikely that it was removed either before or after the fire, since it is more probable that somebody removing it would have also removed the retaining screw. The most probable explanation, in the view of the Tribunal, is that the cap was in position during the fire, but was destroyed by it. This would be consistent with the damage to the upper unit, which was more extensive than that to the lower unit, and with the position of the retaining screw. It remains unclear why there should have been two additional caps in the cabinet: but, on any view, there was at least one cap more than was required and no theory advanced as to what happened in the area of the immersion heater could account for the presence of more than the required number.

6.150 It was agreed by the experts who examined the cylinder that there was no evidence of arcing or tracking such as is normally associated with the existence of an electrical fault. On any view, the evidence of some local overheating was ambiguous and uncertain. A theory was explored, however, based on the assumption that some material might have lodged between the two terminals in the upper unit of such a nature as to act as a conductor and thereby cause overheating in this area, thus providing a source of ignition. This theory plainly presented a number of difficulties.

6.151 In the first place, as has already been suggested, the most probable conclusion on the evidence is that the cap was in position on the upper unit, but was destroyed during the fire. If this is correct, the postulated material could not lodge between the two terminals in the manner suggested.

6.152 In the second place, as has already been indicated, the evidence of local overheating was much too tenuous to justify the inference that there had been any fault of the nature suggested at this point.

6.153 In the third place, the theory depends on a piece of burning material having travelled in an upwards direction from the cylinder into the roof-space through the hole left by the missing tile and then having ignited some combustible material in the roof-space. The most likely source of such burning material would be the quilted PVC jacket. Mr Norton said this could be ignited by a match, and that the fire spread across the material (para. 6.59). It did not appear that sufficient conditions of turbulence would be generated by such a fire to enable a burning piece of material to float upwards into the roof-space. Even if it did, the only combustible material present in any quantity in the vicinity of such a piece of floating, flaming material was a wooden door which covered the water-tank

Plate 53 — *Photograph of Main Bar; the hot-water cylinder in the south-west corner of the Bar is visible in the centre of the picture.*

which rested on the trusses in the roof-space above the Main Bar. The wooden door apparently projected a distance of about six inches (150 mm) over the wall dividing the Main Bar from the West Alcove. It is clear, however, that this door became involved in the fire and fell into the tank and not on to the suspended ceiling on the alcove side. The difficulties involved in treating the plastic ventilation duct as having possibly provided combustible material have already been considered, as has the possibility of other materials having been stored in the roof-space (see paras. 6.119 and 6.123).

6.154 In the fourth place, there was no machinery for transferring flaming debris to the area of the West Alcove, as has been pointed out in relation to the possibility of an accidental fire in the Store Room. The difficulties are, of course, somewhat less in relation to the fire starting in the immersion heater, but it would still require the flaming debris to travel up, across and then down the parapet of the wall dividing the Main Bar from the West Alcove. The difficulties of penetrating the suspended ceiling are, of course, the same insofar as this theory is concerned.

6.155 In the fifth place, there was no evidence of anyone having observed a fire anywhere in the area of the immersion heater at the relevant time. It should be remembered that there were a number of members of the staff, either in the Main Bar itself or standing in front of it, at the time the fire was first observed in the West Alcove. One of them (Declan Burnett) actually smelt smoke, it would seem, at the same time as patrons in front of the West Alcove also smelt smoke (see para. 2.33). It would appear to be straining credulity very far to suppose that a fire sufficient to destroy most of the PVC lagging jacket and sufficient of the door of the cabinet to cause it to fall off, could have passed undetected by all the people in the Main Bar, including a person who was actually conscious of an unusual smell of smoke somewhere in his immediate vicinity. It will also be recalled that one of the barmen in the Lantern Room, David Rynne, having attempted unsuccessfully to extinguish the fire in the West Alcove went back to the Main Bar to recover his coat which he had placed directly under the immersion heater (see para. 2.107 and *Plate 53).* Again it seems strange that he could have avoided noticing any sign of fire in the immediate area where he was recovering his coat. There is a possibility that a fire inside the cabinet could have been drawn up into the roof void and thus escaped attention, but again a further assumption must be made that this, in fact, happened.

6.156 The evidence of the first fire officer and fireman to fight the fire in the area of the Main Bar would also appear to be more consistent with the fire having spread from the roof-space into the immersion heater cabinet rather than *vice versa.* Station Officer McMahon (para. 4.39) and Fireman Messitt both recalled that, having attempted to fight the fire in the main ballroom area, they returned through the Main Bar, and at that stage saw a fire below the area of the immersion heater. This would be entirely consistent with the fire in the roof space in its latter stages having penetrated, in the form of falling debris, the area of the cabinet, and set fire to it, destroying most of the lagging jacket and part of the door, and flaming fragments having continued to set fire to the material immediately below it. By contrast it does not seem consistent with a fire having started in that area and then penetrated the roof-space in an upwards direction.

6.157 Some members of the staff gave evidence of an incident some three or four weeks before the fire, when they saw what appeared to be smoke coming from one of the openings in the suspended ceiling. They went up to the Lamp Room and checked under the tiles. They were satisfied that what they had seen was not smoke and was probably dust.

VI — THE POSSIBILITY OF A FIRE STARTED DELIBERATELY

(1) The Presence of Persons on the Roof during the Night

6.158 The evidence establishes that at some time prior to the fire on the night of the 13th/14th February, 1981, four youths succeeded in getting on to the roof of the building by climbing the drain pipes on the east-side in the vicinity of Exit 5 *(see Plate 54).* The four in question—Harry Wade, John Finnegan, John Hartnett and Desmond Byrne—had previously that evening made an unsuccessful attempt to force open Exit 6 from the outside

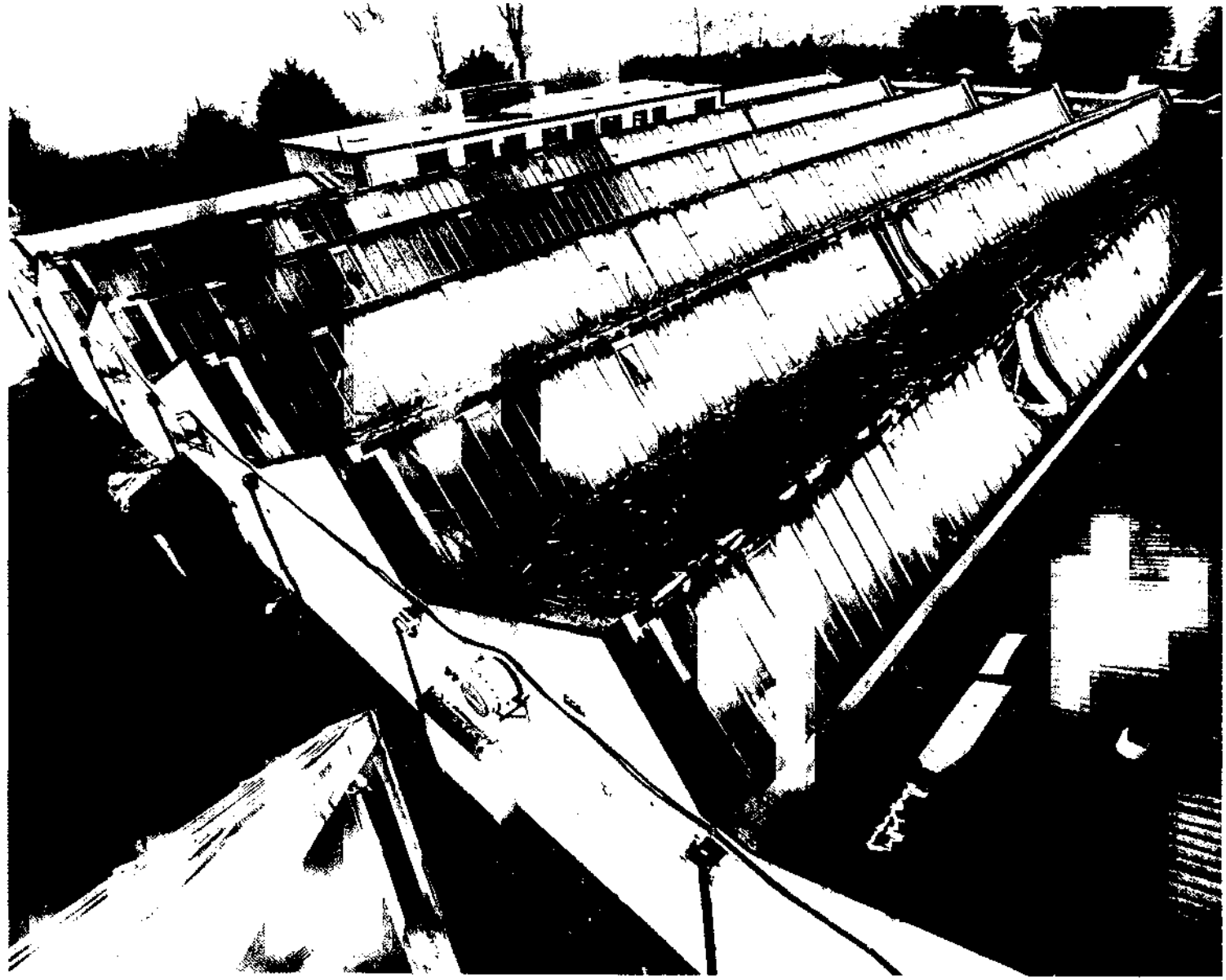


Plate 54 — *Close-up view of the roof taken from the north-east. The drainpipes by which the tr the roof are to be seen in the foreground.*

in an effort to get into the Stardust. They were defeated in this object by the presence of the lock and chain on the ballroom side of the door (see para. 3.93). Hoping to gain access from the roof, they then got on to it in the manner already described. While they were on the roof, Harry Wade endeavoured to open one of the glass skylights by lifting the metal flashing, but was unsuccessful *(Plate 54)*. John Finnegan tried to crack one of the pieces of asbestos but was also unsuccessful. While they were on the roof, they became aware of the presence of a Garda car and lay down in the valley between the apexes to hide. They then moved towards the west side of the building and jumped down on to the concreted area in the vicinity of the fire-escape stairs. They knocked over some metal beer kegs in their descent and this noise was heard by members of the bar staff in the Silver Swan who rushed out. The four made their escape and said that they did not return to the Stardust that night.

6.159 Laurence Neville, one of the barmen, was checking the cash in the Silver Swan at approximately 23.45, when he heard a noise outside the fire exit and a commotion which sounded like barrels rattling. He grabbed a leg of a chair from nearby to protect himself, if necessary, and then went out. He saw one youth banging on the door with a beer-keg and two others on the roof. He challenged the youth who was actually banging on the door and he ran off, as didthe other two, who dropped down from the roof.

(2) The Presence of Persons in the West Alcove during the Night

6.160 The evidence established that a number of members of the staff went into the alcove during the course of the night for their breaks (see paras. 2.18, 2.19 and 2.20). In addition, Mr Phelim Kinahan and Mr Patrick J. Murphy were also in the alcove at different stages. None of the staff members concerned saw or heard anything which excited their suspicion on any of these visits.

6.161 The evidence also established that one of the patrons, Mrs Joan Flanagan, went under the blind some time after midnight and left three drinks on the table in Tier 2 of Row A so that they would be out of sight, while she and a friend went off to look for other friends. She returned at approximately 00.30, went underneath the blind again and recovered the drinks.

6.162 Another patron, Caroline Jolley, said that she was sitting in the area of seating on the dance floor (Area B) nearer to the West Alcove when the disco dancing competition finished. She then went to the toilet and when she returned sat at the same table with her back to Exit 2. She said that she then saw three men coming down the steps beside the Main Bar in the West Alcove. One of them was wearing a Shetland jumper. She then looked back up and saw the fire in the alcove on Tier 8 of Row B. Four or five sections of the blind were up at that stage. She thought that the section nearest the Main Bar was up at the time she saw the three men. She described the men as "youths" and said they were walking down "just walking ordinary". She agreed that she had told the Gardai in earlier statements that she had seen the three men running down the steps "as if they were running away from the fire".

6.163 Another patron, Elizabeth Kavanagh, said that she saw two men coming down the steps in the West Alcove between Rows A and B one of whom was either coughing or had his hands to his face. In her statement to the Gardai, she said that she thought the men were acting suspiciously, but in her evidence said that she did not really think that this was so. She said that they were just walking normally.

(3) Motives and Opportunities

6.164 The evidence established that there was, from time to time, some disorder in the Stardust on disco nights. There were also frequent attempts by people to get in without paying and those who did so, when detected, were ejected without much ceremony by the doormen. This undoubtedly led to some animosity between some of the patrons and the doormen. There was also some evidence to suggest that gangs of youths from the Artane and

Donnycarney areas, known as "The Dragon Gang", "The Animal Gang" and "The Soap Gang", were in the habit of frequenting the premises. It should, however, be emphasised that the troublemakers constituted only a small minority of the large attendances of young people at the Stardust on disco nights.

6.165 While there had been at least one serious assault on one of the doormen and frequent threats by individual patrons or groups of patrons to cause trouble at the Stardust, the evidence of a motive for a deliberate act of arson on the premises remains tenuous. It was suggested on behalf of the owners that the fire might have been started in the West Alcove with the object of diverting the doormen's attention while a robbery—of cash, spirits or cigarettes from other parts of the premises—was carried out. Again, however, there was no evidence to support this theory.

6.166 The opportunities for starting a fire, either in the alcove or in the roof-space, are clear beyond argument. The admitted presence of trespassers on the roof during the night shows that there was no great difficulty, particularly for agile youngsters, in scaling the roof. Thereafter, it would have been possible to make an opening in the roof, pour petrol or some other volatile substance on top of the suspended ceiling and then drop a lighted match on it. Equally, there was no problem in one or more persons slipping behind the blind in the West Alcove while the disco competition was in progress and the attention of most staff and patrons was occupied by it. The fire could then have been started in a number of ways e.g.

(i) the slashing of a number of the seats with a pen-knife or other sharp object and the lighting of the exposed foam with a match or cigarette lighter;

(ii) the pouring of petrol or some other volatile over one or more of the seats and the setting fire to it with a lighted match;

(iii) the ignition with a match of newspapers either underneath or on one or more of the seats, either in the pristine state or soaked in petrol or some other volatile; or

(iv) the placing of a series of simple but effective incendiary devices at selected points in the alcove.

(4) The Possibility of a Fire Started Deliberately in the West Alcove

6.167 As in the case of the various possibilities of an accidental fire already considered, there is no evidence to indicate that the fire was, in fact, started deliberately in the West Alcove. The evidence of anyone having been seen acting suspiciously in the area of the alcove is so thin that it must, in the opinion of the Tribunal, be disregarded in arriving at any conclusion as to the origin of the fire (see paras. 6.162 and 6.163).

6.168 No traces were found of any accelerants or incendiary devices. In order to test the possibility that such traces might have existed and not come to light in the post-fire investigation, a number of samples of various accelerants were placed in the test rig at selected points prior to the final large-scale FRS test. This was done at the request of the Assessors without the Garda who also attended the test having been notified. Detective Garda Quinn was then asked to take samples from the burnt-out debris in the test rig and give them to Mr Norton for analysis. Mr Norton's analysis revealed traces of accelerant —kerosene—at one point only. It will also be recalled that there was no evidence of Detective Garda Quinn having given Mr Norton samples of the debris from the floor which would have been the likeliest location for traces of accelerants. It is clear, in these circumstances, that the absence of any traces of accelerants or incendiary devices cannot in any sense be regarded as conclusive.

6.169 Some weight can be attached to the fact that no can or other metal object, which might have been expected to be used for bringing a volatile accelerant into the West Alcove, was found; but there is the possibility that it was carried in some form of plastic container which was destroyed in the fire.

6.170 A more substantial difficulty is that, although some witnesses noticed burning smells in the area of the West Alcove before observing the fire itself, no one appears to have noticed a smell of petrol or paraffin in that area at the time of the fire. Such smells as were detected were likened to burning plastic, tyres or rubber. (One of the waitresses said she remembered noticing what seemed to be a smell of petrol in the vicinity of the cigarette machine, but this was early in the evening, at approximately 21.20. Another waitress said she noticed a smell of paraffin at about 01.00, but this was in the vicinity of the toilets in the Lantern Room). Moreover, it is unlikely that the container necessary for bringing in the accelerant would have escaped detection by the doormen at the main entrance; and a person going into the West Alcove with such a container concealed under a pullover or jacket would still have been relatively conspicuous having regard to the number of people who were immediately in front of the West Alcove at the relevant time.

(5) The Possibility of a Fire Started Deliberately in the Roof-space

6.171 None of the pieces of ceiling tile which remained after the fire was analysed for the presence of accelerants. No container in which such an accelerant might have been carried on to the roof-space was found there after the fire.

6.172 The results of one of the non-standard tests carried out at the Fire Research Station are material in this context. Burning liquid fuel was spread on the upper surface of ceiling tiles suspended in a standard grid section, similar to that used in the Stardust, which were fixed with an edge channel section 1.4 m above the ground to a 2.4 m high non-combustible wall *(see Appendix 14, Fig. E4 and Plates 30 and 31).* The test results are given in Table El in Appendix 14. They show that when diesel fuel was ignited on the upper surface of the ceiling, it caused a fire on that surface only. When, however, paraffin was ignited in the same manner, the volatiles on the underneath portion of the tiles ignited.

6.173 The presence of the four trespassers on the roof at the earlier stage of the evening does no more than establish that there was relatively little difficulty in getting on to the roof. The Tribunal accepts the evidence of the four youths in question that, following their unsuccessful attempt to get into the premises and their discovery by the staff, they fled and did not return.

6.174 The principal difficulty presented by the theory that the fire was started deliberately in the roof-space is again the absence of any evidence to support it. In particular, none of the eye-witnesses who saw the fire in the earlier stages of its development in the West Alcove saw any indication that the ceiling itself was on fire. It would be necessary to postulate a fire on the upper surface of the suspended ceiling which penetrated the crevices already referred to and landed in the form of flaming drops on the seats, thereby causing a fire. The tests already referred to, however, appear to indicate that it was more likely that the fire would either have burned on the upper surface of the ceiling or, if it did penetrate the ceiling, would have led to a fire on the underneath surface of the ceiling, which could hardly have escaped observation by the eye-witnesses.

VII —CONCLUSIONS

(1) The Location of the Fire

6.175 There were two possible points of origin for the fire: the West Alcove and the roof-space (which latter term includes the Store Room).

6.176 The evidence of those witnesses who saw the fire from outside the building is of importance in determining whether the fire began in the roof-space of the West Alcove. However, while some of these witnesses recalled hearing or seeing the fire at times which were significantly earlier than the time at which it was first seen in the ballroom—in one case as early as 01.21—the Tribunal is satisfied that it would not be safe to draw any inference as to the possible point of origin of the fire from such evidence. In the first place, a significant number of the witnesses placed the fire at around 01.40, i.e. approximately the same point of time as the first observation in the ballroom. In the second place, as has

cc

Plate 55 — *View of west side of the Stardust taken from the roof of the shed in the back garden of 10 Mary field Drive (the residence of Anthony Pasquetti).*

already been pointed out, where these estimates of time were given without reference to a watch or clock they must obviously be treated with caution.

6.177 The evidence of Mr O'Callaghan, the taxi driver who saw a red glow in the sky above the building as he turned into the junction of Skelly's Lane shortly after 01.30 (see para. 2.146), undoubtedly lends support to the proposition that the fire began in the roof-space. The fact that he saw flames reaching as high into the sky as thirty or forty feet above the roof when he was a hundred yards from the building, and yet found no obvious signs of panic when he reached the front of the building, would point clearly to such a conclusion. It is difficult, however, to accept Mr O'Callaghan's recollection as being completely reliable, although the Tribunal accepts that he was entirely honest in his account of what he remembered. In the first place, there is a substantial volume of evidence which establishes that, at the time the patrons were being shepherded out of the Lantern Room, the alarm had already been raised in the ballroom and people were already coming out Exit 2. The doors of Exit 2 were, of course, closed for a short time, but all the evidence indicates that during that time hysteria was already developing among the growing crowd outside Exit 2. Mr O'Callaghan, however, seems to have seen none of this. In the second place, he recalled seeing through the window of the Lantern Room flashing lights of the disco type, although there was no evidence to suggest that any form of disco lighting was used in that part of the premises.

6.178 The evidence of a group of residents in Maryfield Drive—Mr Pasquetti, Mr Buffini, Mr Thomas Blair and Mrs Ann Kelly—requires careful consideration. If Mr Pasquetti's evidence, which does not depend on any time estimate, is correct, then it seems extremely unlikely that the fire started in the roof-space. His evidence was to the effect that he first heard, and then saw, people running down the fire-escape from Exit 1 *before* he saw a glow above the roof *{see Plate 55).* If one relates this account to Mr Kennan's evidence of the state of the fire when he left for Exit 1, and if one further relates it to the evidence of the witnesses as to the stage at which the ceiling in the West Alcove began to collapse, it is clear that the glow above the roof seen by Mr Pasquetti was the fire in the West Alcove which had broken through the suspended ceiling, and not an independent source of fire in the roof-space.

6.179 It should, however, be pointed out that, while Mr Pasquetti said that he saw the people from a point in his back garden, running down the fire-escape, a photograph taken by direction of the Tribunal at the point in question *{Plate 56)* would appear to indicate that no part of the fire-escape is visible at that point. When this was drawn to his attention, Mr Pasquetti said that "there is a hill in the garden .... as you go in further up you can see over".

6.180 The evidence of Mr Buffini that he heard the crackling noise at 01.38, if correct, is plainly at odds with the approximate estimate of time given by some residents who said that they saw a fire above the roof at "about 01.35 or 01.30". If regarded as precise, it does not entirely dispose of the possibility of an independent fire in the roof-space, since it is at least four minutes *before* the alarm given by Mrs Prizeman, and the fire observed by eye-witnesses prior to that alarm had not penetrated the suspended ceiling, still less caused the glass in the roof or the asbestos to fracture.

6.181 The photograph taken by Mr Blair *{Plate 18)* indicates a fire above the building; and if Mrs Kelly's evidence that he spoke to her at 01.35, immediately before he took the photograph, is correct, it is clear that the fire must have started in the roof space. Mrs Kelly said that she had checked her estimate of the time by reference to a clock.

6.182 Mr Pasquetti's evidence and Mrs Kelly's evidence are clearly not consistent if Mrs Kelly's estimate of the time is correct. Mr Buffini's estimate of the time is inconsistent with both the evidence of Mr Pasquetti and Mrs Kelly, but the degree of leeway one has to allow for in his estimate of time, if one is accepting either version, is significantly greater in the case of Mrs Kelly's version.

o

Plate 56 — *View of west side of the Stardust taken from the back garden of 10 Maryfie*

6.183 In addition to the evidence of these residents and of Mr O'Callaghan, regard must also be had to the evidence of those of the patrons who escaped in the early stages of the fire and saw flames coming out of the roof (see paras. 2.153 and 2.154) which they had not seen before.

6.184 There are undoubtedly inconsistencies in the eye-witness evidence which are difficult to reconcile. The Tribunal is nonetheless satisfied that the evidence as a whole points clearly to the fire having originated in the West Alcove rather than the roof-space. No one detected any sign of trespassers on the roof after 00.15 at the latest, although the outdoor security officer and some of the management and indoor security staff were alert to the possibility following the earlier incursion. By contrast, there was a considerable amount of innocent traffic in and out of the West Alcove, including members of the staff and at least one patron, Mrs Joan Flanagan (para. 6.161). It would have been very easy for a person, without attracting notice, to have slipped behind the blind unobserved. The unlikelihood of an accidental fire having started in the roof space has already been discussed (see para. 6.174).

6.185 The location of the fire within the West Alcove must next be considered. Mr Norton inferred from the condition of the two seats in Tiers 8 and 9 of Row A that the fire probably commenced on the centre unit of the back seat. He took the view that if it had commenced on the forward seat and spread backwards, one would have expected to find that the foam at the leading edge of the seats in the rear would not have been preserved.

6.186 One feature might at first sight seem to be inconsistent with the view that the fire started in this area of the alcove, i.e. the fact that these seats and the carpet tiling on the wall in their immediate vicinity suffered less fire-damage than the remainder of the seating units in the West Alcove. Whatever else may be the explanation for the difference in fire-damage, however, it cannot have been their distance from the source of the fire, since they were the only two seats in the entire of the West Alcove which were found in this condition; and there must have been other seating units at least equidistant or even further from the source of the fire.

6.187 A number of possible explanations for this phenomenon were advanced during the hearing. They were as follows:

(i) Mr Green suggested that the actual geometry of the corner could have had a bearing on the relatively lesser amount of damage. He pointed out that the corresponding corner in the North Alcove had also suffered less than the rest of the North Alcove (para. 6.41).

(ii) The plastics water-pipe leading from the water-tank immediately above the Main Bar softened and ultimately dissolved at some stage during the fire; and when Detective Garda Quinn first inspected the alcove some hours after the fire on the 14th February, 1981, water was still pouring on to the area of the two seating units. Depending obviously on when it occurred, this could have contributed significantly to the reduction of fire-damage in this area.

(iii) While the attempts at extinguishing the fire were unsuccessful, some of the contents of the fire-extinguishers were emptied on the fire and this could have had the result of reducing the fire-damage.

6.188 The Tribunal is satisfied that the first theory, while at first sight attractive, is not correct. If the geometry of the corner was the explanation, one would have expected to find a similar phenomenon in the south-west corner in the West Alcove. The fact that the north-east corner in the North Alcove also showed less signs of fire-damage may well be explained by the fact that conditions in that area were entirely different: the corner was close to Exit 6 which was opened at a relatively early stage in the fire (see para. 2.179) and the air currents might well have had an effect on the behaviour of the fire in this area.

6.189 While it is not possible or even necessary to come to any firm conclusions in this matter, the Tribunal is satisfied that the more probable explanation is to be found in the attempts

at extinguishing the fire, or the melting of the plastics water-pipe, or a combination of these factors.

6.190 The Tribunal is also satisfied that the pieces of broken glass found by Mr Green in Tier 6 do not have any particular significance in relation to the cause of the fire. As they were not observed by the Gardai or the other witnesses who conducted earlier investigations of the West Alcove, there is a substantial possibility that they were originally in some other part of the building and were moved into the West Alcove by accident between the fire and their being found by Mr Green. The Tribunal is also satisfied that the "blueing" of the steelwork at this point does not necessarily support an inference that this was where the fire began: there are too many variable factors affecting the intensity of heat in different areas of the ballroom to enable such a conclusion to be drawn and "blueing" of this nature cannot be regarded as a reliable indicator.

6.191 The evidence of the eye-witnesses as already assessed (see para. 2.170) points to the fire as having first been seen in the north west corner of the West Alcove. The evidence also indicates that, while some witnesses thought the fire was confined to the seat in Tier 9 in Row A and others thought it was confined to one seat in the immediate area of that seat, the probability is that it was either on more than one seat or spreading with great rapidity from one seat to another.

6.192 The condition of the seats in Tiers 8 and 9 does not necessarily lead to the conclusion, as Detective Garda Quinn and Mr Norton suggested, that the fire originated on the centre unit of the seat in Tier 9. (It should be noted that, at the time they reached that conclusion, they had not the advantage of considering the great volume of eye-witness evidence subsequently available to the Tribunal). The fact that some of the foam was preserved on that seat might well have been due either to the attempt by Mr Patrick J. Murphy to extinguish the fire (see para. 2.73) or to the water observed by Garda Quinn to be falling from the ceiling area, (see para. 6.31) or a combination of both.

(2) The Cause of the Fire: Accidental or Deliberate

6.193 The cause of fire is not known and may never be known. There is no evidence of an accidental origin: and equally no evidence that the fire was started deliberately. In these circumstances, the Tribunal has found it necessary to examine in detail all the possible hypotheses of an accidental or a deliberate origin.

6.194 Six possibilities in all have been explored in detail. In considering which of these is the most likely, the Tribunal, in addition to the various factors which have already been analysed, has had regard to the actual evidence of the eye-witnesses as to the fire which they observed in the West Alcove. This evidence, on the whole, suggests clearly that the fire, when first seen, was significantly larger than would have been expected had it commenced with a small ignition source, such as a match or small particle of burning debris. It may be, of course, that the fire did commence in this fashion, i.e. from a small ignition source, and burned steadily and unobserved for a relatively lengthy period of time before it was first seen. While this possibility cannot be excluded, it is also significant that a number of the eye-witnesses thought that the fires shown in the video films—which were ignited by sources representing even larger sources of ignition than a lighted match or burning particle of debris—did not burn as rapidly and were appreciably smaller than the fire they observed.

6.195 Another feature of great importance is that a number of the eye-witnesses of the fire in its early stages saw it on more than one seat; and this suggests strongly that the fire either began simultaneously on more than one seat or spread with great rapidity from one seat to another, both across the aisles and in a forward direction. This is particularly significant in view of the data derived from the FRS tests considered in detail in the next chapter (see para. 7.58). These tests established clearly the difficulty of creating a fire, even by relatively large sources of ignition, which spread to adjoining seats in the manner observed by the eye-witnesses. The most likely mechanism for such a spread was the presence of the carpet tiling on the back wall.

6.196 The carpet tiles on the back wall, however, while they contributed to the rapid spread of the fire in the West Alcove (see para. 7.118) do not provide a sufficient explanation on their own of the rapid spread of the fire in its earliest stage. Very few of the witnesses, including those with a good opportunity of seeing the back wall, said that the fire was, in fact, on the wall. Of those who did, Mr Michael Kavanagh probably had the best opportunity of observing the spread of the fire; and his evidence was clearly to the effect that the fire was spreading more rapidly along the seats than it was along the back wall. The conclusion is inescapable that, whatever else was providing the rapid spread mechanism in the earliest stage of the fire, it was not the carpet tiles.

6.197 Of the hypotheses considered, the Tribunal is satisfied that the lowest degree of probability must be attached to a fire caused by an accidental smoker. Not merely is it negatived by the evidence as to the condition of the seats in the alcove on the night of the fire taken in conjunction with the tests for ignitibility; it also provides no explanation for the rapid spread from seat to seat.

6.198 There remain five other possibilities, three of an accidental origin and two of a deliberate origin. The difficulties of the hypotheses based on a smouldering bag of rubbish or a smouldering coat or other object have already been considered in detail. They are not supported by the evidence; and in each case, with the possible exception of the smouldering bag of rubbish, they provide no satisfactory explanation for the rapid spread of fire from seat to seat.

6.199 The same difficulty—the rapid spread of fire—also arises if the fire is postulated as having started either because of a fault in the immersion heater or an accidental fire in the roof space. In addition, both of these hypotheses present many other difficulties which have been considered in detail.

6.200 This leaves two possibilities: a fire started deliberately either in the roof-space or in the West Alcove. Both of these could explain the rapid spread from seat to seat. A fire started deliberately in the West Alcove could have been started in one of the ways already indicated, which would then have presented the appearance of a fire spreading rapidly in the manner described by the eye-witnesses. Alternatively, burning droplets from volatiles ignited in the roof-space might have dropped on to more than one seat, thus again giving the appearance of a rapid spread of fire.

6.201 Of these two possibilities, the Tribunal has no doubt that the first is the more likely. It accords with the view as to the point of origin of the fire which is the more probable (see para. 6.184). It also accords with the evidence of the eye-witnesses who do not recall seeing the ceiling itself on fire in the early stages. Finally, a fire started in the West Alcove does not necessarily require the presence of volatiles, which were not smelt by any of the people in the vicinity of the West Alcove on the night of the fire.

6.202 Of the various expert witnesses who gave evidence before the Tribunal, Mr Norton, Mr Eastham (who was retained by some of the next-of-kin) and Dr Watt, all thought that the fire was more probably caused deliberately. Mr Green and Mr Tucker, however, were inclined not to rule out the possibility of a fire caused by some electrical fault.

6.203 The examination conducted by the Tribunal of each of the hypotheses based on an accidental origin has produced serious and, it may be, insurmountable objections to every hypothesis, including the two based on the smouldering bag of rubbish and the smouldering coat.

6.204 In these circumstances, the Tribunal has come to the conclusion that the more probable explanation of the fire is that it was caused deliberately. It is also satisfied that it was probably started in the West Alcove and not in the roof space. Of the various methods that might have been employed, the most probable was either the slashing of a number of seats with a pen-knife or other sharp object, followed by their ignition by a match or cigarette-lighter, or the lighting of newspapers on or under a seat. One of the seats so

ignited was in Tier 9 of Row A. The evidence of some of those who fought the fire in its early stages, together with the evidence derived from the tests that it would be relatively easy to ignite seating units by pouring volatiles over them, obviously lends significant support to the view that such volatiles were used to start the fire. However, the fact that no smell of volatiles such as petrol, diesel or paraffin was noticed by any of the witnesses points to an ignition without liquid accelerants as a more likely mechanism.

6.205 The motive, the number of persons involved, their sex and age, the degree of premeditation, and the precise time at which the fire was started must remain matters for conjecture. The fact that the attention of the great majority of the staff and patrons was absorbed by the disco competition, during the period immediately before the fire was generally observed, may be no more than a co-incidence. It would seem more probable, however, that there is a more sinister explanation; and that it was while the West Alcove was not under observation, particularly from members of the staff, that the fire was started. It may be, and this again must remain no more than conjecture, that the object of the arsonists was to do no more than cause a fire in the alcove itself, for whatever motives; and that, in carrying out this reckless criminal enterprise, they had not intended to cause any injury or death, still less on the appalling scale that, in fact, resulted.

CHAPTER 7

Why the Fire Spread

CHAPTER 7

Why the Fire Spread

I — INTRODUCTION

While a significant saving, certainly of injuries and probably of lives as well, could have been achieved by a prompt and efficient evacuation of the building, it is certain that serious injuries and it may be, some deaths would in any event have resulted from the rapid and disastrous spread of flame and smoke through the Stardust. This Chapter considers the various factors which contributed to the rapid spread of the fire.

Before proceeding to consider the scientific evidence on this matter, it is necessary to recapitulate the principal relevant findings of fact already made by the Tribunal, viz.:—

(1) The fire started in the north west corner of the West Alcove.

(2) The fire was probably started deliberately.

(3) The fire when first seen appeared to be confined to one seat in the back row of the alcove nearest the Main Bar. It was also seen, however, in its early stages on a number of seats, although visible to some of the onlookers on one seat only. Whether present or not on more than one seat when first seen, it spread with great rapidity to other seats.

(4) Within a period of not more than two minutes from the first observation, the fire spread to at least two or three more seats and changed in appearance from a small and controllable fire to an uncontrollable fire accompanied by intense heat.

(5) Within a period of three to four minutes from the first observation the flames reached the ceiling itself, portions of the ceiling collapsed and thick black smoke appeared in the alcove.

(6) In the period which followed and which did not last more than ninety seconds, the fire spread to the greater part of the West Alcove and black smoke filled the entire ballroom and began to penetrate the main foyer at Exit 2 and the corridor of Exit 3. During this period, the flames were travelling across the ceiling, over the ballroom where the ceiling was beginning to collapse.

(7) At the end of the period just referred to, the fire which was not in the roof space broke through the roof in the form of flame, sparks and smoke. For a period of approximately four to five minutes, the fire inside the building was at its peak and thereafter began to subside.

Shortly after the disaster, the Fire Research Station of the Department of the Environment in the United Kingdom (the FRS) were asked by Dublin Corporation to investigate the fire on its behalf. When the Tribunal was established, it sought and obtained from the Corporation the release of the FRS so that they could act on behalf of the Tribunal itself.

The primary objective of the investigation undertaken by the FRS on behalf of the Tribunal was to establish the reasons for the spread of the fire. This in turn, however,

made it necessary for them to consider various ways in which the fire might have started, in order to determine the effects these might have had on the subsequent development of the fire. The data produced by this part of the investigation has already been considered in part in the preceding chapter dealing with the cause of the fire. In order to enable the fullest possible investigation to be undertaken by them, the FRS were kept fully informed of the evidence given by eye-witnesses as to the nature of the fire as the Inquiry proceeded. They were also furnished by the Gardai with any materials or furnishings from the building that might be relevant to their investigation.

During the course of the investigation, a wide range of tests was carried out by the FRS at their headquarters at Borehamwood near London. Tests on a larger scale were carried out in an experimental facility at Cardington, also near London, one of which took the form of a test in a rig intended to provide a complete enclosure with tiers of seats and wall, floor and ceiling finishes as in the West Alcove.

The report of the investigation was presented by the FRS to the Tribunal in September, 1981. Mr George Nice, the head of the FRS, Mr H. L. Malhotra, the head of the Building and Structures Division, Mr P. L. Hinkley, the head of the Materials, Components and Structures Section and Dr W. D. Woolley, the head of the Combustion Products Section, gave evidence before the Tribunal and were cross-examined by the various parties represented.

II — THE INVESTIGATION BY THE FIRE RESEARCH STATION

(1) The Scope of the Investigation

The FRS Officers said that, in carrying out their primary task of investigating the reasons for the spread of the fire, they considered it was essential to do the following:—

(1) to establish

(a) the burning characteristics of different materials present in the West Alcove either as contents or construction at the time of the fire;

(b) the burning behaviour of individual items in isolation as well as in conjunction with each other; and

(c) the conditions under which fire-spread was likely from one item to another;

(2) to develop plausible mechanisms of fire-growth in the early stages of the fire;

(3) to explain the rapid fire spread leading to the engulfment of the entire alcove and the subsequent involvement of the entire Stardust;

(4) to examine the production of smoke and toxic products; and

(5) to consider other features of construction which influenced the fire-growth and development.

(2) Materials and Contents used in the Tests

For the purpose of the investigation, the FRS indicated that they would require the following materials and components:—

(1) seats

(2) tables

(3) wall carpet tiles

(4) floor carpeting

(5) suspended ceiling tiles

(6) roller blinds.

The details of the materials and contents used in the tests are contained in Appendix 14.

7.9 In the case of the seats and tables, the FRS were supplied with the items from the Lantern Room which the evidence established were the same in design and construction as those in the Stardust on the night of the fire. It was also necessary to reconstruct seats and tables by using the appropriate filling and PVC covering material.

7.10 The carpet tiles used on the walls and the floor carpeting material were made in the United Kingdom by Messrs Illingworth of Bradford. Mr Graham Whitehead, the Secretary of the Company, gave evidence that the production of these tiles had been discontinued and the FRS were unable to find any other tiles of the same specification. They obtained details of the tiles from Messrs Illingworth and simulated tiles were produced with the assistance of the Kidderminster Technical College and the Plastics Division of ICI Ltd. Samples of the tiles actually used in the Stardust were supplied by the Tribunal to the FRS, and tests were carried out to establish the similarity of the characteristics of the simulated tiles and the actual tiles.

7.11 Both the floor carpeting—Nylfloor 2000—and the mineral fibre tiles of which the suspended ceiling was constructed were still commercially available and they were supplied by the relevant firms.

(3) The Nature of the Tests

7.12 The tests undertaken by the FRS consisted of both standard and non-standard (or *ad hoc)* tests. The distinction between the two types of test is explained at para. 6.66. The tests fell into the following categories:

(i) standard tests for measuring the following:—

(a) ignitibility,

(b) combustibility,

(c) flame-spread (the spread of flame over exposed surface of walls and ceilings),

(d) flammability (the continuous burning of material such as fabric),

(e) heat-release rate (the rate at which a combustible material releases heat),

(f) smoke-producing properties;

7.13 (ii) non-standard tests on individual materials and components, consisting of procedures to establish the ignitibility of the carpet tiles and the seats, as well as the behaviour of the suspended ceiling with burning liquid fuel on top;

7.14 (iii) non-standard tests to determine the burning characteristics of individual components such as a complete seating unit or wall carpet tiles when fixed to a substrate;

7.15 (iv) *ad hoc* tests to examine the interaction between two components such as seating units and wall carpet tiles;

7.16 (v) *ad hoc* tests to examine the interaction between seats, wall carpet tiles and the floor covering;

7.17 (vi) *ad hoc* tests to study fire growth in various arrangements of seats with wall carpet tiles, carpet flooring and a simulated ceiling, but without a complete enclosure; and

7.18 (vii) a large scale *ad hoc* test in a rig intended to provide a complete enclosure with tiers of seats and wall, floor and ceiling finishes as in the West Alcove.

7.19 The tests conducted are listed in Appendix 14; they include the standard tests undertaken by FIRTO and the Yarsley Technical Centre to which reference was made in the preceding chapter.

7.20 Of the non-standard tests on individual materials and components, those concerned with the ignitibility of the seats and the behaviour of the ceiling with burning liquid fuel on top have already been considered in the preceding chapter. So far as the wall carpet tiles are concerned, the relevant standard test provides for the examination of the tiles in a horizontal orientation under a range of radiant heat exposure conditions. In the non-standard test, their ignitibility was examined in a vertical orientation—the position in which they were fixed to the walls of the West Alcove—in front of gas-fired radiant panels. Additional measurements were made of the weight loss of the sample and observations recorded of the molten drop formation on the softening of the polyester fibres. This test was also used to compare the behaviour of simulated wall carpet tiles. The details of the non-standard fire tests of individual items are contained in Appendix 14 D.

7.21 The next series of tests consisted of *ad hoc* ignition experiments on individual assemblies, i.e. a seat/wall lining assembly and a suspended ceiling assembly (Appendix 14 E). These tests, which have already been discussed in the preceding chapter at para. 6.90, represented in part an attempt to reproduce the early stages of the fire as described by witnesses, and involved the ignition of seats by means of paper and flammable liquids.

7.22 The next series of tests (Appendix 14 F) was designed to provide precise measurements of certain burning characteristics of the seats and the wall tiles. In the first two tests, the object was to ascertain the rate of burning and heat-transfer from a seating unit when ignition had occurred. In the second two tests the object was to assess the ignition, flame-spread and rate of burning (in terms of heat output) of wall carpet tiles when exposed to a fire equivalent in severity to that generated by a burning seating unit in close proximity to it. In both cases, a rig consisting of a room with a corridor leading to it was used, with the sample in the room.

7.23 The seating unit was ignited in two different ways, first with a crib, the heat output of which corresponded to the burning of two double sheets of full-sized newspaper, and secondly with a strip of fibre insulating board soaked in paraffin. Similar measurements were made by burning six of the original wall tiles attached to a wall and exposed to a fire represented by a specially designed crib whose heat output was intended to correspond with that of the burning seating unit measured in the previous test. The experiment was repeated by burning the crib, without any carpet tiles on the non-combustible wall.

7.24 The next series of tests (Appendix 14 G) was intended to examine the interaction between the seats and the wall tiles and, in particular, to investigate the possibility of igniting wall tiles from burning seating units and the subsequent rate and pattern of fire-spread.

7.25 A special balcony type of rig was used in these tests representing a corner in the angle between two walls with an insulated ceiling fixed at a height to allow three rows of tiles to be fixed above a seating unit. The other two sides of the rig were open to the laboratory. The fire source was a timber crib corresponding in heat output to a seating unit. Both the original and the simulated wall carpet tiles were tested and a crib was burned on its own to distinguish between its heat output and the heat output from other components. Visual and recorded observations were made of the fire spread on the wall and to seating units separated from each other by a gap of 500 mm. A special test was also carried out in the same rig in which cones of sawdust impregnated with paraffin were placed on the back of a seating unit.

7.26 Large scale *ad hoc* experiments were then undertaken in the experimental facility at Cardington. The first two tests (Appendix 14 H) were in a rig with two walls, a simulated insulating ceiling and tiered seats. In the first, the fire was started by using a small crib on the squab of a seating unit in front of the rear tier. In the second, three seats, each of three seating units, were placed against the wall with a carpet tile finish and the fire started in an end unit, in order to study the spread of fire from seating unit to seating unit across the aisle and to the seating unit in front. The purpose of this latter test was to

investigate the possibility of a fire which was started on one seating unit spreading both laterally to seating units across the aisle and in a forward direction.

7.27 The final test (Appendix 14 I) was the one which sought most closely to simulate the actual conditions in the West Alcove. In addition to casting light on the possibilities of a lateral and forward spread of the fire from one seat, this was also intended to provide data as to the effect of the downward radiation of heat from the suspended ceiling. The rig was accordingly specially modified to support a mineral-fibre suspended ceiling made of the same tiles as were used in the Stardust and erected by the manufacturers, Messrs Armstrong Cork Company Limited. Five tiers of seats were used and, in addition to wall tiles and floor carpet, the test chamber had two sections of roller blind in front which could be raised or lowered during the test. The test arrangement included all the relevant materials and systems which had been previously examined in the smaller scale test. The test was extensively instrumented for measuring temperature, heat flux, smoke density, flame velocity, oxygen depletion and toxic gases.

7.28 Video records were made of many of the tests and still photographs taken (Plates 1 to 48 in Appendix 14). In all, there were twenty-two hours of video recordings and 6,500 feet (2000 m) of film. All of this material was available to the scientific experts representing the different parties, and portions of it, including a special video film intended to record the major aspects of the investigation, were shown at the Tribunal sittings.

Ill — THE RESULTS OF THE TESTS

7.29 The detailed results of all the tests are given in Appendix 14 C to M inclusive. The summary of the main findings of the tests are given in Appendix 14 A in tabular form.

(1) The Ignitibility and Surface Spread of Flame Characteristics of the Contents of the West Alcove

7.30 In the case of the seats, the ignitibility tests showed that "pilot" ignition could be obtained at intensities at least as low as 1 watt per square cm (1 W/cm^2), while at higher intensities ignition occurred in only a few seconds. (See Appendix 14, Table C6. The relevant figures for radiation intensities and different materials are shown graphically in Appendix 14, Figure 3). "Pilot ignition" in this context means the ignition of a heated combustible material by the application of a localised flame or spark of the gases accumulating above its surface produced by radiation falling on the surface. In the case of spontaneous ignition—i.e. the ignition of the material without a spark or flame—the ignition took over a minute at 5 W/cm^2. At intensities of radiation in excess of 6 W/cm^2, however, spontaneous ignition occurred in only a few seconds (Appendix 14, Table D6). It should be noted that this test was carried out on vertically supported samples of upholstery, although the radiation in the fire would have been falling on the horizontal surfaces of the seating units. The standard test (BS DD 70) is carried out on horizontal surfaces, but can produce misleading results: see para. 7.137 below.

7.31 The results of the ignitibility test on the wall carpet tiles showed that they were not as easy to ignite as the seats. (Appendix 14, Table CI). These tests were also for pilot ignition and established that intensities of 4 W/cm^2 were needed with pilot ignition for ignition to occur in less than one minute.

7.32 The carpet tiles used as wall linings were tested under the relevant standard (BS 476: Part 7) to determine their surface spread of flame characteristics. This gave a surface spread of flame performance of between Class 3 and Class 4. (Table C3).

7.33 The ignitibility of the other furnishings, i.e. the tables and floor covering, has been considered at paras. 6.80 to 6.84. These finding are of importance in considering the possible causes of the lateral and forward spread of the fire from seat to seat as described by the witnesses.

(2) Heat Output of the Wall Tiles and Seating Units

7.34 It was thought by the FRS officers, in agreement with the other experts who gave an opinion on this matter, that, in determining the extent to which the furnishings in the alcove might have contributed to the spread of fire, the rate of heat production by the different items was of considerable importance. In the case of the wall carpet tiles, a small-scale test demonstrated that, at intensities of 4 or 5 W/cm^2, the theoretical heat output rose to over 400 W/m^2 about half a minute after ignition. However, this high rate was not sustained and fell to half its value in just over a minute. (In practice, the actual heat output was probably less than 400 kW/m^2 due to incomplete combustion).

7.35 A test carried out in the compartment/corridor test facility (Appendix 14, Test F2), indicated that the contribution of the tiles in this respect was much less than half of what would have been anticipated from the results of the small scale test. Mr Hinkley, however, considered that this was due to the nature of the experimental rig. The considerations involved are of a complex technical nature and are discussed further in para. 7.136 below. Because of this, the burning rate measured in the small-scale tests are used in the subsequent calculations: this was described as the "theoretical heat output" of the wall tiles.

7.36 The measurements of the heat output of burning seating units are described in Appendix 14, Test F2. The difficulty experienced in measuring the heat output of the wall tiles was not experienced in this case. The heat output depended on the method of ignition and two situations were investigated.

7.37 In the first, ignition was by a crib placed at the centre point of the length of the seating unit in the angle between the squab and the back. The fire spread slowly sideways taking over four minutes to reach the edges, by which time the polyurethane foam had burned out at the point of ignition. The peak heat output of the fire was 190 kW at about four and a half minutes (Appendix 14, Fig. F16). A heat output of 180 kW was sustained for over a one minute period and of 120 kW over a two-minute period.

7.38 In the second, ignition was by a paraffin-soaked strip of fibre board placed near the back of the squab. This did not result in the entire area of the squab and back being ignited simultaneously, but the squab and back were eventually burning over their entire area at the same time. The peak heat output was about 300 kW at two and a half minutes. 260 kW was exceeded for one minute and 150 kW for two minutes. It was thought that if the seating unit, squab and back were ignited simultaneously by radiation, the peak heat output would have been obtained sooner and might have been higher: under those circumstances, the peak heat output was assumed to be 300 kW.

7.39 In the case of the tables, the burning rate of the top and under surfaces was taken to be the same as the "standard" burning rate of timber, giving a theoretical heat output of 65 kW/m^2.

(3) The Conclusions of the Fire Research Station Investigation:

(i) *Fire-spread from Seat to Seat without Involvement of the Wall Tiles*

7.40 The FRS Report concluded that, having regard to the records of intensity of radiation from individual seating units Appendix 14, Fig. F9 to F13 taken in conjunction with the intensities required for ignition of the seating units (Appendix 14, Tables C5, C6 and D6) the likelihood was that, even if a seat was ignited in such a way that all the polyurethane foam was burning at the same time, fire spread by spontaneous ignition from seat to seat (unless they were touching) was unlikely. Pilot ignition of seating units in front of and behind the original one was possible, but even pilot ignition would be difficult across an aisle.

7.41 This, the FRS said, was confirmed by Test HI in which a seat, consisting of three seating units assumed to be in Tier 8, was ignited by a crib. A single seating unit and a table were provided on the rear tier, there was a table in front of the three seating units and a single

seating unit on the tier in front (Appendix 14, Fig H2). A few carpet tiles were provided on the rear wall and there were carpet tiles (Ultra) on the floor. The fire took over six minutes to spread to lm from the source of ignition, by which time the polyurethane foam in the vicinity of the source had burned out. Although both tables ignited and flames spread over the rear of the backs of the three seating units, there was no ignition of the rear seating unit or the front seating unit or of the carpet tiles on the wall. Given suitably positioned pilot flames, both the rear and front seating units would have ignited.

7.42 The FRS Report concluded that if a seating unit away from the back wall were ignited, then fire would spread to involve a whole seat comprising three seating units. The heat transfer to seats behind and in front was insufficient for spontaneous ignition, although more than adequate for pilot ignition of the upholstery composite. A possible source of a pilot flame, i.e. a fire spreading over a carpet which had been ignited by falling debris, was discounted, since extensive spread over the carpet was not obtained in any experiments simulating the early stages of the fire.

7.43 The FRS Report also found that the tables in front of and behind the burning seats were likely to ignite, but that there was no evidence of any mechanism by which they could provide a source of pilot ignition of the gases given off by the heated upholstery. It was, however, suggested on behalf of the owners that in the case of a fire started by newspapers under the seat, such as was simulated in the E series of tests and in the final large-scale test, pilot ignition of the seat in front could be achieved and was, in fact, achieved in one of the E series of tests. This suggestion is examined in greater detail at para. 7.113 below.

7.44 The FRS Report went on to say that other sources of pilot ignition pre-supposed the presence of other materials. Thus a more easily ignitable material on the seat might ignite itself and so cause pilot ignition of the seating material. Another possible mechanism was a piece of burning material, such as paper, carried in the convection currents from the fire.

7.45 The spread of fire across the gangway appeared to be even less likely than the spread of fire from one tier to another, the rates of heat-transfer across the gangway being lower than the rate of heat-transfer to the seats in front and behind.

7.46 Similar considerations applied to the spread of fire if a seat in the back row were ignited, up to the time when the carpet tiles became ignited.

7.47 No mechanism, except the presence of other materials introduced into the alcove, was found which would account for the ignition of one seat by another before involvement of the carpet tiles on the wall. The likelihood of the presence of such materials has been considered by the Tribunal in para. 6.111.

(ii) ***Mechanism of Fire-spread***

7AS The FRS Report considered that the crucial matter was to determine the mechanism by which a fire confined to a relatively small number of seating units spread very rapidly to involve the greater part of the alcove. They considered that the mechanism which most probably accounted for this final rapid fire-spread was the presence of long flames beneath the suspended ceiling radiating heat downwards on to the combustibles beneath, at an intensity sufficient to cause spontaneous ignition in a few seconds.

7.49 Such flames could originate in two ways. In the first place, they could originate from a combustible ceiling which was burning over a substantial area. In the second place, they could be the result of the vertical flames moving upwards from the burning seats, tables and wall linings and meeting the ceiling where they became horizontal.

7.50 Although the ceiling tiles were, in theory, combustible and ignited when heated strongly, their heat output was very low (Appendix 14, Table C 10). In addition, Mr Hinkley gave evidence of previous experimental work which he had carried out involving a line of flame underneath a combustible ceiling which, in his view, reinforced the conclusion that the

contribution of the heat output from the ceiling tiles to the growth of the fire and its ultimate size was negligible.

7.51 It followed that the fuel for the horizontal flames must have been provided by the burning furniture, carpets and wall lining, unless other materials were present in quantity. A minimum heat output was required to produce the necessary intensity of radiation and the investigation showed how such a fire would have occurred by involving carpet tiles on the back wall above a burning seat.

7.52 The FRS Report considered that, in the early stages of the fire, long before the flames reached the ceiling, the smoke and hot gases rising from the fire would have been confined to an outward spreading layer beneath the ceiling. The gases at ceiling level at this stage would have consisted mainly of air brought up by the rising gases. The quantity of air brought up would have been more than was necessary for the combustion of the gases emitted by the burning material. As a result, the layer would have floated on the cool air beneath and would not have mixed very much with it, except to the extent that the flow of air through the ventilation grilles may have provided some mixing. The smoke at this stage would not have been very dense and would have been greatly diluted; and this, combined with the lighting conditions actually existing in the Stardust, would have explained why it does not seem to have been seen by a number of the eye-witnesses.

7.53 In the view of the FRS, had the wall tiles not become involved, the burning of a seat comprising three seating units would not, of itself, have produced sufficient heat to bring about the rapid fire spread already referred to. Even were several seats to be ignited simultaneously on the same tier, the involvement of the wall tiles would still have been necessary for the rapid spread of flame; and the same probably applied to a situation where two seats, one behind the other on adjacent tiers, were ignited simultaneously. Mr Hinkley said in evidence that unless two complete tiers were on fire, making thirty seating units in all, it would have been unlikely that the radiation downwards would have been sufficient to cause the rapid spread of fire, without the involvement of the wall tiles.

7.54 The FRS Report concluded that ignition of the carpet tiles on the wall above the seats would have led to a considerable increase in the rate of heat output. The heat peak output of a burning seating unit ignited along the length of the seat was 300 kW (Appendix 14 F) with 150 kW sustained over a two-minute period. The six carpet tiles above the seating unit would produce enough fuel gases to give an initial heat output of nearly 500 kW if they were completely involved in the fire (Appendix 14, Fig. D 3). This heat output would be halved in about one and a half minutes and, in practice, would probably not be realised because the mass of air brought up by the hot gases and flames rising from the burning seating unit would probably not be greatly affected by the presence of the burning carpet tiles on the wall. There would have been a decrease in the oxygen content of the layer of hot gases, leading to incomplete combustion and an increase in the production of smoke and other toxic products (Appendix 14 F).

7.55 The upper parts of the wall lining would be within the layer of hot gases and flames travelling horizontally beneath the ceiling and the heat transfer to the wall tiles near the vertical flames would be sufficient to cause them to ignite. The result would be fire spreading for some distance along the top of the wall lining. At the same time it would spread downwards to some extent by runnels of burning polyester material (Appendix 14 G).

7.56 The FRS Report stated that at this stage of the fire the intensity of radiation falling on the seat beneath would be sufficient for pilot, but not spontaneous, ignition. This would mean that fire would spread across a seat, comprising three seating units. The fire would not, however, spread across the aisle to the next seat without a pilot flame. In Tests Gl and G2, the pilot flame was provided by molten burning material falling from the carpet tiles with the fire ultimately spreading along the next seat (Appendix 14 G). At about this stage in Test H2, the intensity of radiation was found to be sufficient to cause spontaneous ignition of the seat on the tier immediately in front of the one ignited first, thus causing

the fire to spread forwards as well as sideways. (Appendix 14 H). It was found in Test H2 —where there were three seats in the rig against the back wall—that the rate of production of burning molten material by the carpet tiles decreased somewhat so that ignition of the third seat at the rear was delayed until fire spread to it across the floor carpet (Appendix 14 H).

7.57 The Report stated that, as the mass of flammable gases produced by the burning material increased disproportionately to the mass of air brought up by the rising vertical flames, the oxygen content of the layer decreased to zero. Shortly afterwards, the intensity of radiation downwards from the flames beneath the ceiling exceeded that necessary for spontaneous ignition of the seats over the whole distance for which measurements were made. This was equivalent to five tiers in one experiment (Appendix 14 H) and an even greater distance in another test (Appendix 14 I, the final large-scale simulated test). In the first case, they found that very rapid fire spread would have occurred approximately one and three quarter minutes after the ignition of the wall tiles. In the second case, it would have occurred within about one minute.

7.58 The results of the tests—particularly the latter two—demonstrated, in the view of the FRS, that intensities of radiation on the seats exceeding $6W/cm^2$ could be achieved over a wide area (at least one-quarter of the alcove) within one and three quarter minutes of ignition of the wall tiles by about half a seating unit. The same result would be achieved in less than one minute if the tiles were ignited by a larger source (slightly more than one seating unit). They thought that, if for some reason, a greater length of wall tiling were ignited by one or more seats burning simultaneously over their entire area, the time taken to reach this intensity of radiation might be even less and would be unlikely to be longer. The tests referred to earlier (see para. 7.40) demonstrated that at intensities above $6W/cm^2$ the seats ignited in less than eight seconds. This, in turn, would lead to an extension of the area over which the intensity exceeded $6W/cm^2$ so that fire would spread both forwards and sideways to all the seating units in the alcove.

7.59 It was thought that spread over the carpet tiles may have been less rapid because their ignition times at given rates of heat transfer are longer but that it was probable that the wall would be fully involved well within thirty seconds after the involvement of adjacent seats.

7.60 At this stage of the fire—the period within which the flames began to spread to the rest of the alcove—the collapse of the ceiling and the consequent venting of the fire introduced a complication. No such collapse took place in the final large scale test where a ceiling of the same materials had been supplied and erected by the same manufacturers. It was, however, clear from the evidence that such a collapse did take place at the end of the second period of the fire, i.e. when it had changed from a small and controllable fire to one which was not controllable, and was accompanied by intense heat. It also appears from the evidence that, at the end of the period when the fire had spread through the rest of the alcove, the flames broke through the roof of the building.

7.61 The FRS Report stated that, had the ceiling and roof remained intact, the rate of burning and fire-spread in the ballroom would not have been determined by the amount of available fuel but by the air available within the building and the way in which this mixed with the fuel gases. Thus, if all the material in the alcove was burning at once at the maximum measured rate, sufficient fuel gases would have been produced for a heat output of 100 MW. If all this fuel had been burnt, it would have reduced the oxygen content of the air in the Stardust to 14% (when flaming combustion becomes problematical) in about eight seconds. Had the ceiling remained intact conditions in the Stardust, in their view, would probably have deteriorated to the extent that life would have been impossible within a period of less than thirty seconds after the stage in the fire when the intensity of radiation downwards exceeded $6W/cm^2$. This, of course, would have been at the stage during which the fire was spreading to the remainder of the West Alcove, i.e. at a time when the overwhelming majority of patrons had still not escaped. It necessarily follows that if the FRS findings are correct, casualties would have been substantially greater had the ceiling not collapsed.

7.62 Dealing first with the collapse of the ceiling itself, the FRS Report considered that this would have had a number of effects. First, the ceiling tiles in the act of falling would have had the effect of causing transient local mixing between the layer of smoke and hot gases under the ceiling and the air beneath. If there were flames in the layer, this would have the effect of deepening them near the points where the tiles fell and could give the illusion that the tiles themselves were burning. Secondly, some of the hot gases in the layer would flow through the hole into the space above the ceiling. Unless a large hole appeared immediately over the fire, only part of the layer would flow into the hole and thus, although the layer might become shallower, it would still be present. Thirdly, where the layer went over the edge of the hole it would mix with the air in the roof space, and if it contained flames the burning of which was reduced by lack of oxygen, they would burn more brightly as they passed into the roof space.

7.63 The overall effect of the collapse of the ceiling, in the view of the FRS, was accordingly likely to have been beneficial, because smoke and toxic combustion products were released into the roof space and the lengths of horizontal flame under the ceiling might have been reduced, although there would have been a localised increase in burning rate and hence radiation.

7.64 As for the roof itself, the conclusion was that, if it had remained intact, the roof space would eventually have filled with smoke and hot gases and although some respite would have been obtained the building would have eventually been filled entirely with smoke and hot gases. During the stage when the fire was spreading rapidly, there would have been a positive pressure in the building which would probably have resulted in combustion products flowing out through all the exits and other openings.

7.65 In fact, however, the roof did shatter; and once the area of shattered roof and of fallen tiles had become comparable to the area of the open exits, fresh air would have flowed into the building through the exits to replace the smoke and hot gases flowing out through the openings in the roof. At this stage, it was possible for a situation to exist where the smoke, hot gases and flames were confined to a layer above peoples' heads while the air beneath was relatively cool and clear. The FRS Report consider however, that it was probable that the fire was too large for that to occur. The shattering of further roof covering would not increase the amount of fresh air flowing in through the exits, but when a large area of roof covering shattered it was likely that the hot gases would flow out through some of the resulting openings, while fresh air would flow in through others. They thought that it was possible that local cooling by the fresh air flowing in accounted for the presence in the south east corner of the building of a number of items of furniture which had not ignited. (It should be pointed out that there was, in fact, no evidence of furniture in this area not having ignited, but some carpet tiles on the wall remained intact. See para. 6.41).

7.66 The FRS Report concluded that the venting of the fire through the roof might have slowed down the fire-spread to some extent and could well have accounted for the survival of a number of people in the ballroom, but was too late to affect the main course of the fire.

7.67 The Report also concluded that because of the high rate of burning and the low amount of combustible material available for burning, only a proportion of which was capable of rapid burning, the maximum rate of burning of the fire could not have been sustained for long, probably for less than five minutes. Subsequent burning involved the timber and chipboard; at that stage most of the asbestos roof covering had shattered allowing the hot gases produced to be dissipated and fresh air to flow in to ensure complete combustion.

(iii) ***The Raising of the Roller Blind***

7.68 The Report concluded that, before the blind was raised, it could have confined the layer of hot gases in the alcove thereby causing it to deepen more rapidly. This would have meant that the tops of the flames came into the vitiated atmosphere in the layer with a reduction in the heat output. Had this happened, however, they considered that smoke production would probably have increased and the alcove would have been obviously

smoke logged when the blind was raised. In fact, the evidence was that, at the time the blind was raised, very little smoke was evident in the alcove. They also considered that the air within the alcove was sufficient to sustain a 1 MW fire (more than a complete seat burning at its maximum rate) for ten minutes without taking into account leakage of air from the space below the lower edge of the blind and the flow of air into the alcove from the ventilation system.

7.69 Although the blind material would burn when exposed to high intensities of radiation or flames in a fire, experiments with similar materials showed a satisfactory behaviour in fire. When flames from a fire impinge on such a material, it may burn locally but once a hole has formed the flaming does not occur beyond the area affected by the original fire. However, when contained within a layer of hot flaming gases the material will burn and fall to the floor where it will probably continue to burn because of the high intensity of radiation falling on it.

7.70 The Report concluded that the blind was raised before it had affected the fire in the early spread stage and that, although the material involved would have contributed some heat in the later stages, it played no significant part in the rapid spread of fire.

(iv) ***Production of Smoke and Toxic Products***

(a) *General*

7.71 In order to determine the potential toxicity and irritancy of the fire atmosphere, gas analyses were carried out during the various tests. Preliminary analyses were carried out during the small and medium scale tests and more elaborate analyses at two of the large scale tests, including the final test. The particular measurements chosen were as follows:—

(1) Continuous measurements of carbon monoxide, carbon dioxide and oxygen: carbon monoxide measurement was deemed essential, because this is usually the main toxic species present in fires.

(2) Specific estimations of hydrogen chloride: this was analysed because it is known to be a highly irritant and toxic gas produced during the decomposition and burning of PVC.

(3) Specific estimation of hydrogen cyanide: this is a known product from the decomposition of nitrogen-containing polymers (both synthetic and natural) such as polyurethane foam, and is highly toxic.

7.72 In addition, a new technique was used to ascertain the existence of minor constituents in the fire atmosphere.

(b) *Ad hoc Fire Test H2*

7.73 This was the test carried out in a rig with two walls, a simulated insulated ceiling and tiered seats, with carpet tiles on the rear wall and on the floor.

7.74 At five and a half minutes after the ignition time there was a light and temporary increase in the carbon dioxide reading (Appendix 14, Fig. K7) without any observed increase in carbon monoxide (Appendix 14, Fig. K6) or reduction of oxygen (Appendix 14, Fig. K8). At about six to six and a half minutes after ignition there was a sudden and very rapid increase in the concentrations of carbon monoxide and carbon dioxide to about 4% and 16% respectively, and a reduction of oxygen to about 1% within about one minute, corresponding to a sudden increase in the development of flaming. This concentration of the oxides of carbon and oxygen at the relevant monitoring point returned to "ambient" level i.e. the levels obtaining before the spread of the fire, within a further two to three minutes following extinction of the fire.

7.75 Over a period of between about six and seven minutes after ignition, the average hydrogen chloride reached a maximum of nearly 10,000 ppm (1%) but the decline was less rapid

than with the oxides of carbon; hydrogen chloride persisted at a few hundred ppm for some time (probably from hot residual PVC). (Appendix 14, Fig. Kl 1.)

7.76 The Report concluded that the maximum concentration of carbon monoxide and hydrogen chloride (about 4% and 1 % respectively) and low oxygen concentration would be expected to be immediately fatal whether considered individually or in combination. In spreading away from the fire zone, dilution would have taken place resulting in cooling. However, in the view of the FRS, even if diluted ten times (and hence likely to give an atmosphere of a more breathable temperature with oxygen restored) the atmosphere would still be dangerous to life in a short exposure to the carbon monoxide (0.4%) and very irritant because of the hydrogen chloride (0.1%) at concentrations approaching dangerous levels. Dilution by a further ten times would give a non-lethal atmosphere provided there was a short exposure to it, but the atmosphere would still be very irritant (with hydrogen chloride at a concentration of 100 ppm). Some hydrogen chloride, however, could be lost during the dilution processes by surface absorption or reaction.

7.77 By contrast, very small concentrations of hydrogen cyanide were detected and even the highest concentration measured by any technique (about 50 ppm in the undiluted smoke) would not have resulted in an immediate threat to life in comparison with the dominant carbon monoxide and hydrogen chloride.

7.78 The new techniques already referred to detected about forty additional products, but with the very low concentrations involved even during the period of developed burning, it was thought most unlikely that they would have added significantly to toxicity or irritancy.

(c) *Ad hoc Fire Test I*

7.79 This was the final large-scale test. Two positions were selected for monitoring the smoke and combustion products, one at nose level within the tiers of seats and one near ceiling level and the opening of the rig, which was more remote from the PVC seating.

(1) Nose-height Measurements in Tiers

7.80 In this test, a second ignition of the source was effected (see para. 6.94). After re-ignition, there was a period of about one and a half minutes with only marginal increases in the oxides of carbon and little observed reduction of oxygen. (Appendix 14, Fig. K10.) However, after this time the carbon monoxide and carbon dioxide increased rapidly to 3% and 17% respectively, with oxygen reduction to a few per cent within about one minute, followed by a gradual restoration towards ambient levels.

7.81 Hydrogen chloride development at the 'nose' point (Appendix 14, Fig. K12) was slightly delayed compared to the oxides of carbon but increased to about 9,000 ppm at about three and a half minutes after re-ignition.

7.82 The hydrogen cyanide measurements (Appendix 14, Fig. K13) indicated that there might have been a sudden increase in the production of hydrogen cyanide at about one and a half minutes after re-ignition (corresponding to the time of increase of the oxides of carbon) to a few hundred ppm.

7.83 The conclusion reached was that there was a time of about one and a half minutes after re-ignition when the atmosphere would have been tolerable. (This conclusion, of course, related solely to the gas analysis test and not to the effect, for example, of exposure to severe heat.) After this time and with the sudden development of fire, the atmosphere would have been immediately hazardous to life, primarily from carbon monoxide with increasing and rapid contribution (particularly regarding irritancy) from the hydrogen chloride.

7.84 Again, the new technique showed a very complex pattern of products at low concentrations which were unlikely to have contributed to toxicity or irritancy.

(2) Ceiling Level Near Opening of the Rig

7.85 The concentrations of oxides of carbon increased significantly (with a corresponding reduction in oxygen) at about one and a half minutes from re-ignition, and within a further minute maximum concentrations of carbon monoxide (li%), carbon dioxide (8i%) and minimum oxygen (about 3%) were recorded (Appendix 14, Fig. K9). This rapid change in combustion products co-incided, as the Report expected, with rapid changes in the fire atmosphere at the 'nose' position in the tiers.

7.86 At the same time that these concentrations were reached, the hydrogen chloride also reached a maximum of about 1,000 ppm (Appendix 14, Fig. K12). This is much less than was observed in the 'nose' position in the tiers (about 1%), but it was thought that this was not unexpected, the testing position being much more remote from the PVC-covered seating.

7.87 Again, very complex products were tested by the new techniques, but these results were not significant.

7.88 In this test, about one and a half minutes after re-ignition, there was a marked and sudden increase in the combustion products released. After two and a half minutes at the latest, it was thought, the combustion products would have presented an immediate threat to life from toxicity (particularly from carbon monoxide, with high irritancy from hydrogen chloride). A dilution of these gases, during the possible spreading out from the fire zone, by ten times (which would bring the atmosphere to a more breathable temperature and tend to restore the oxygen) would still have given an atmosphere potentially dangerous to life from carbon monoxide (1,500 ppm), with high irritancy (100 ppm) from hydrogen chloride.

(v) *The conclusions of the FRS Report*

7.89 The principal conclusions of the FRS Report may be summarised as follows:—

(a) *Seats*

7.90 The seats were of good design, without corners in which smouldering materials would become lodged, and with smooth surfaces on which liquids could not be retained in a substantial quantity. The covering material was border-line in resisting ignition from a small flaming source, and ignited easily with larger sources. The rate of involvement depended on the size of the igniting source and the position of application. The time for full involvement varied between two and six minutes, and when fully burning a single seating unit evolved 300 kW of heat energy, which is comparable to that likely to be produced by a burning domestic armchair.

(b) *Wall Lining*

7.91 The carpet tiles used as a wall covering were not intended for that purpose. They were not within the spread of flame performance criteria normally applied to wall coverings in most buildings. Under the relevant standard (BS 476:Part 7) they gave a surface spread of flame performance of between Class 3 and Class 4. The material was not easily ignitible from a match-type flame; but in the presence of a radiant heat source produced by flames from the seats, it not only ignited easily, but generated considerable heat. Tiles above a burning seating unit were capable of evolving heat at over 500 kW (i.e. nearly twice the amount of heat given off by the seating unit). Accordingly, the carpet tiles used as wall linings in conjunction with the seating unit were thought to have made a significant contribution to the spread of fire.

7.92 Another characteristic of the tiles which made a significant contribution to fire development was the formation of molten burning droplets which either ran down the surface, forming runnels, or fell free of the surface on to contents below, and under suitable conditions caused their ignition.

7.93 The carpet tiles on the wall provided an important link in the early spread of fire along the wall and, because of their heat output, in a forward direction.

(c) *Floor Covering*

7.94 The floor carpeting material was of a reasonable standard qualifying as a medium radius of effective ignition under the relevant British Standard, BS 4790.

7.95 Although the floor carpeting was thought to play a secondary role in the growth of the fire, at some critical point it did assist spread from one seat to another, thereby accelerating the spread and growth.

(d) *Suspended Ceiling*

7.96 The suspended ceiling materials were of a good standard and with a suitable construction system would have provided adequate fire resistance. Its low height at the top of the banked seating area and its insulating nature were thought to have influenced the rate of growth of fire. On the other hand, a higher ceiling with the type of wall covering used could have resulted in greater heat output, due to an increased amount of combustible material present on the walls in the form of the carpet tiles.

7.97 It was thought that the collapse of the ceiling at an early stage in the fire itself might have been due to the presence of the openings for lights and to the methods of replacement of damaged tiles. The suspended ceiling in the final large-scale test withstood the severity of heating to which it was exposed.

7.98 The collapse of the ceiling in the fire exposed the roof to high temperatures and led to its shattering, thereby ventilating the smoke and hot gases. It was thought that this would have led to the rapid clearance of the toxic products and made the conditions safer for those who were still in the building, thus assisting their survival.

(e) *Roller Blind*

7.99 The blinds in front of the alcove were of a reasonable standard and played only a minor part in the development and spread of the fire. They did not completely seal the area, did not remain down for long and were thought to have added only a little fuel to the fire. They might have hindered, to a limited extent, the direct flow of smoke during the early growth phases. They might also have prevented the flames from being seen clearly.

(f) *Smoke*

7.100 Dark smoke was produced by the burning of the seats and, to a lesser extent, by the wall covering. The smoke would have stratified, forming a layer, and spread laterally as well as in the forward direction. The rate of production and the density of the smoke were such that visibility would have been reduced rapidly as shown by test data (Appendix 14J and Fig. I 21).

7.101 In some of the experiments, video records were made when the lighting was red in colour. This had a significant effect on the visibility of the smoke making it more difficult to see. It was deduced that the actual lighting conditions in the ballroom may have made the identification of the smoke in the West Alcove more difficult.

(g) *Toxic Products*

7.102 The toxic products produced were primarily of carbon monoxide, hydrogen chloride (from the burning PVC) and small quantities of hydrogen cyanide (from the burning polyurethane foam). The most lethal results would have been produced by the rapidly achieved high levels of carbon monoxide. The high levels of hydrogen chloride, also rapidly

achieved, would have resulted in a high degree of irritance. No other combustion products of abnormal toxicity were found in any test.

IV — CRITICISMS ADVANCED OF THE INVESTIGATION

(1) The Heat Output of the Wall Tiles

7.103 It was suggested on behalf of the owners that the Report might have over-estimated the heat output from the wall tiles. The basis of this criticism is discussed above at para. 7.35. Mr Hinkley was of the view that, notwithstanding certain experimental difficulties which are dealt with in greater detail at para. 7.136, it was possible to arrive at a figure for the heat output of the wall tiles, using as a basis the theoretical heat output ascertained as indicated in Appendix 14, Fig. D3.

(2) The Suspended Ceiling

7.104 A number of the parties suggested that the validity of the large scale experiments might have been affected to some degree by the fact that the ceiling, while of the same composition as that in the Stardust, stayed in place during the experiments. Mr Tucker (for Dublin Corporation) doubted whether the ceiling was similar thermally to the one in the Stardust. It was, however, agreed by both the FRS experts and the other experts that, in drawing conclusions, it was necessary to bear carefully in mind the fact that the ceiling in the fire itself did collapse.

(3) The Re-ignition in the Final Test

7.105 Three double sheets of newspaper which were placed under a seating unit at the rear of the test rig were used to start the fire in the final large-scale simulation test. The newspapers burnt out and the resulting ignition of both the floor covering and of the wall covering material was not very extensive. Although there was still some degree of flaming, the FRS officials, after consulting with the Assessors who were present at the tests, decided to re-start the fire. Accordingly, 13 minutes 40 seconds after the first ignition, another ignition was effected by lighting five double sheets of newspaper. This time the resulting fire did set fire to the seating unit and the experiment proceeded to its conclusion. Mr Tucker said that, in his opinion, the test should have been allowed to continue without interference, or should have been re-started from the beginning. There was general agreement, however, among the scientific experts that the re-ignition did not affect any conclusions that might be drawn as to the manner in which the fire actually spread.

(4) The Simulating of Conditions in the West Alcove in the Final Test

7.106 Two discrepancies emerged during the course of the evidence between the construction used in the final test and the conditions actually prevailing in the Stardust which had not been appreciated previously.

7.107 In the first place, it appeared that the height of the seats at the back wall in the test rig was 5.5 inches (140 mm) less than the height of the seats in the Stardust. This would obviously have meant that the amount of carpet tiling exposed would have been different in each case. Mr Malhotra, having been given an opportunity of considering this matter, returned to give evidence and said that, in his view, this would not have made any significant difference to the test in question, a view which was not dissented from by any of the other scientific experts. (Mr Malhotra submitted in evidence an addendum to the Report which will be found at Appendix 14 L).

7.108 In the second place, it emerged that the height of the table-tops in the final test was 1 inch (25.4 mm) higher than in the Stardust. It was suggested on behalf of the owners that this could have made a difference to the forward spread of flame in the case of the seating units since it meant that, in the Stardust, the table-top was at a slightly lower level than the seat in front of it, whereas in the test rig it rose slightly above it. The significance of this discrepancy is considered further in Parts V and VI below.

7.109 It was also suggested that, in some of the earlier tests, three carpet tiles were exposed above the seating, whereas in the Stardust two and a half tiles only, on average, were exposed. Mr Hinkley agreed that this might be so, but said that this was in places where the performance of the carpet tiles themselves was being assessed, rather than their actual performance in a rig in conjunction with the seating.

V — OPINIONS OF THE SCIENTIFIC EXPERTS CALLED BY THE PARTIES

7.110 With two exceptions, none of the scientific witnesses called by the parties expressed any dissent from the conclusions arrived at by the FRS report, confirmed in the evidence of the FRS officers before the Tribunal and set out in detail in Part III.

7.111 The first, and more important, reservation was expressed by Dr Watt, on behalf of the owners, as to the contribution made by the wall tiling to the rapid spread of fire. Dr Watt accepted that, if the fire originated in Tier 9 (next the back wall) the wall tiles were likely to have been a major factor. If, however, the fire started on a seat away from the back wall and spread to seats on the back wall he thought that the contribution of the carpet tiles might have been less. He also thought that, if the fire was started deliberately on several seats not against the back wall, then fire-spread might have occurred as rapidly with, or without, the presence of the carpet tiles. He said that he thought that if six seats had been ignited at approximately the same time, the spread of fire would have been as rapid whether the tiles were on the wall or not.

7.112 Dr Watt had presented a preliminary report before the FRS investigation was completed and their Report presented. In that report, he said that it was unlikely the wall tiles made a major contribution to fire spread. In his final report, however, presented after the FRS Report had been presented, he acknowledged that, if all the evidence were taken into. account, it seemed likely that the wall tiles were involved early in the proceedings and did make a more significant contribution to the rapid spread of fire than had been envisaged in his preliminary report.

7.113 It was suggested on behalf of the owners that one of the earlier tests (E 3) indicated that it would have been possible for pilot ignition of a seat in front of a seat away from a back wall to have taken place by the direct impingement of flame on the back of the forward seat. It was urged that this created a possibility that the forward spread of flame might have taken place without the downward radiation of heat contributed by the wall tiles in addition to the burning seat units. It was suggested that this was another pattern of spread which might have emerged in the final test, particularly if the height of the table-top corresponded more exactly to actual conditions in the Stardust (see para. 7.108).

7.114 The second reservation was as to the part played by the raising of the blind and the spread of fire. Mr Norton in his report said that, if the blind had remained in position, the fire would have spread less quickly. He added, however, that it would not have been contained, as the hot gases spreading out along the ceiling would very rapidly have caused it to melt at ceiling level, because it was combustible, and that this would have been followed by the collapse of the curtain. It should be said, however, that this conclusion was reached by Mr Norton before the investigation by the FRS had been commissioned and the results of their experiments had become available.

VI — CONCLUSIONS OF THE TRIBUNAL

(1) Factors which affected the Spread of the Fire

7.115 The only matter which remained in serious dispute as between the scientific experts was the contribution of the wall tiling to the spread of fire. If the fire started in Tier 9 (next to the back wall) the unanimous view of the experts was that the wall tiles were a significant factor. The Tribunal has already stated its conclusion that the fire was first observed on Tier 9 but, in view of the importance of the matter, it is necessary to consider the possibility that the fire started in a tier away from the back wall.

7.116 Dr Watt accepted that, for the wall tiles not to have been involved, it would have been necessary for the fire to have started away from the back wall and to have involved at least six seats, i.e. eighteen seating units. Mr Hinkley, on the other hand, thought that it would have been necessary for the fire to extend to at least two entire tiers, i.e. thirty seating units. It is obviously difficult to reach a precise and reliable conclusion as to the number of seating units which might have been required. It is, however, clear that, if one assumes that the fire did not start in the back tier, a greater degree of downward radiation would have been required, since the distance between the top of the seats and the suspended ceiling would have been correspondingly greater.

7.117 On any view, one has to assume the initial involvement of at least eighteen seating units in the fire at a point away from the back wall, if the conclusion that the wall tiling did not play any significant part is to be justified. The number of seating units required might well, in the light of the scientific evidence, be significantly higher even than that figure. In these circumstances, it seems clear that far more seats would need to have been involved at the outset of the fire than the evidence of the eye-witnesses suggested. The Tribunal is also satisfied that the criticisms advanced of the final large-scale Test I (see paras. 7.107 and 7.108) do not affect the validity of the conclusions reached in the FRS Report.

7.118 The Tribunal has come to the conclusion that the rapid spread of fire through the alcove and ultimately throughout the Stardust was due to a combination of the following factors:—

(1) the presence of a tier of seats containing quantities of combustible material abutting a wall lined with combustible carpet.tiles;

(2) the presence of a low ceiling; and

(3) the presence of a large area of combustible seating to which the fire could, and did eventually, spread.

7.119 The tables and the carpet on the floor also probably played a secondary role in providing surfaces for flame spread during the transitional phase of the fire.

7.120 The collapse of portions of the ceiling in the West Alcove at a relatively early stage of the fire's development probably slowed down the flow of smoke and combustion products throughout the ballroom to a significant extent, and probably resulted in a substantial mitigation in the number of casualties.

7.121 The venting of the fire through the roof probably slowed down the fire-spread and may have accounted for the survival of a number of people in the ballroom.

7.122 The raising of the blind did not have any significant effect on the spread of the fire.

7.123 The combustion of the furnishing in the alcove produced quantities of carbon monoxide sufficient to cause or contribute to many of the deaths. The combustion of the PVC covering produced quantities of hydrogen chloride sufficient to cause high levels of irritancy. The combustion of the polyurethane foam produced quantities of hydrogen cyanide, but it was unlikely that the quantities were sufficient to contribute substantially to the total lethal effects of the combustion gases. (See, also, Chapter 5, Part II).

(2) Compliance of the Wall Linings and Seats with the Relevant Legislation, Regulations and Guidelines

7.124 The use of wall linings having a surface spread of flame rating of Class 3 at the highest, was in breach of the requirements of the Dublin Fire Brigade and of the Draft Building Regulations.

7.125 The evidence established that the seating used in the Stardust is widely used in places of assembly throughout Ireland and that two of its components—polyurethane foam and

PVC covering—are used in furniture in many private dwellings as well. There are no statutory or other controls on the use of furnishings of this type in places of assembly.

(3) Control of furnishings

7.126 The evidence established that the use of synthetic materials of the type used in the seating in the Stardust in place of such traditional materials as animal hair, flock, wire springing, etc. had widely increased over the past two to three decades. Some disastrous fires, such as the Woolworth fire in Manchester in 1979, had drawn attention, prior to the disaster, to the possible dangers arising from the fact that such materials appear to be easily ignited and to produce fires which are relatively intense, usually of short duration, and accompanied by large quantities of smoke.

7.127 Dr Woolley's evidence to the Tribunal established that there are widespread misunderstandings as to the nature of the hazards from such materials. They would appear to be, if anything, less vulnerable than the traditional materials to ignition from small smouldering sources such as a lighted cigarette. (See the results of the tests in Appendix 14C). The danger of such materials, so far as ignitibility is concerned, is that when exposed to flame they will burn rapidly with the fabric "melting" to expose the flammable filling. By contrast, natural fabrics such as wool tend to form a char when exposed to flame, which can act as an effective barrier to the penetration of fire.

7.128 Dr Woolley's evidence also established that while at certain temperatures the components of the upholstery will generate toxic products, including hydrogenchloride and hydrogen cyanide, other traditional materials can also produce irritant and toxic products. The specific dangers associated with such synthetic materials as polyurethane foam—and PVC fabric—are, in addition to their ease of ignitibility when exposed to even small sources of flame, their rate of burning and their production of smoke.

7.129 The question as to whether the safety of such furnishings might be improved by the use of flame-retardant additives was also the subject of discussion during the course of the evidence. Dr Woolley said that, while the use of such additives undoubtedly reduced ignitibility, they would also tend to generate increased amounts of smoke and toxic gases if the fire, in fact, developed. The use of such additives, in other words, might arrest the fire completely; but if, notwithstanding their use, a fire developed, there could be undesirable by-products in the form of increased smoke and toxicity. He did not see the making of their use compulsory as an answer to the problem.

7.130 Dr Woolley said that, in his opinion, the answer to the problem of control was not to be found in treating individual components of furniture, such as polyurethane foam or PVC fabric, in isolation. He was strongly in favour of an approach based on the performance of an entire seating unit, rather than its individual components. It was clear from his evidence that much scientific work remains to be done both in the British Standards Institute and corresponding bodies in other countries, and in the International Organisation for Standardisation in Geneva, before an acceptable standard can be evolved which will take account of all these difficulties. In the meantime, he considered that the best approach was to seek the improvement of the ignitibility properties of such furniture by the imposition of the relevant British Standards. He said that in the United Kingdom a beginning had been made in the public sector by imposing on certain purchases of furniture by Government Agencies a requirement that it comply with BS 5852: Part 1.

7.131 The Tribunal accepts the opinion of Dr Woolley that the problem of controlling furniture of this nature should not be resolved by treating its components in isolation but that control should be based, if possible, on the performance of the entire seating unit. The question as to the controls which might properly be imposed on the use of such furnishings in Places of Assembly is considered further in Chapter 9.

(4) Adequacy of the tests

7.132 The most important combustible materials involved in the rapid spread of the fire were the wall linings and the seats. The fire properties of wall linings were tested according to BS 476:Part 7:1971, (the surface spread of flame test covering performances in Classes 1, 2, 3 and 4), and BS 476:Part 6:1968, (the fire propagation test which covers Class 0). In the surface spread of flame test, the rate and extent of horizontal spread of flame are measured on a sample of the material exposed to radiation which decreases from 3.7 W/cm^2 to 0.75 W/cm^2 along its length. In the fire propagation test, an index is obtained representing the rate of heat release of a sample of material exposed to a heat transfer which increases from about 2 W/cm^2 to 5 W/cm^2 in twenty minutes. There is also an upper limit on the capability of the fire propagation test to measure the rate of heat release because of possible oxygen deficiency; however, this limit does not affect materials which are classified as Class 0. (See Appendix 14 C).

7.133 The tests for the assessment of burning rates of seats and wall tiles (Appendix 14, Tests F3 and F4) showed that the wall linings in the actual fire were probably exposed to a heat transfer from a burning seat of up to 10 $WVcm^2$. This rate is significantly greater than the heat transfer rates used in either the standard surface spread of flame test or the standard fire propagation test. Moreover, the dominant factor in bringing about the ultimate rapid spread of fire may well have been the rate of heat release from the ignited wall linings. The performance in the surface spread of flame test, although partly dependent on the rate of heat release at the appropriate radiation, cannot be used as a measure of this rate.

7.134 For these reasons, it is possible to visualise situations similar to that which arose in the Stardust where a wall lining which is Class 1 or even Class 0 may be dangerous. On the other hand, it is also probable that thee are a significant number of wall linings which may be classified as Class 2 or 3 but which would produce a substantially smaller rate of heat release than the wall tiles and accordingly might have been regarded as safe even under the conditions in the Stardust.

7.135 The Tribunal is satisfied that there is, accordingly, room for improvement in the test methods used to classify wall linings so that they can give a direct measure of the rate of heat release. In particular, a test which measures the rate of heat release which wall linings are capable of giving when exposed to radiation of up to 10 W/cm^2 in a free supply of air is needed.

7.136 In the case of Tests F3 and F4, the results of which are set out in Appendix 14, Table Fl 1, it was beyond the capability of the room/corridor test apparatus to measure the rate of heat release from the burning wall tiles under the conditions that would have obtained in the ballroom where they would have been ignited by a burning seat. This was because insufficient air was being supplied to the tiles. For this reason, resort was had to information on the rate of loss of weight of a small sample of material exposed to radiation to obtain the maximum theoretical rate of heat release (Appendix 14, Fig. D3). This would normally over-estimate the actual rate of heat release. As against this, however, the maximum radiation flux used in Test D3 was only 5 W/cm^2, whereas in fact the radiation may have been as high as 10 W/cm^2. It follows that the value of the rate of heat release of 400 kW/m^2 indicated in Figure D3 (Appendix 14) was probably reasonable. The Tribunal is nonetheless satisfied that the availability of a standard kit capable of measuring heat output in excess of 400 kW/m^2 under conditions of high radiation at the burning surface would have avoided the difficulty.

7.137 The standard test for the ignitibility of the surfaces of the seats (BS DD 70:1981) gives a far shorter time for spontaneous ignition at a given radiant intensity for a horizontal surface than did the non-standard test for a vertical surface (Appendix 14, Tables C6 and D6). This probably reflects the results of vapours being ignited prematurely by the radiant heater in the BS DD 70 test rather than the difference between a horizontal and a vertical surface. This factor needs to be taken into account in developing a test for spontaneous ignition.

7.138 The major factors in determining the contribution of the seats to the spread of fire were the ignitibility and, again, the rate at which an ignited seat produced heat. The ignitibility of the furniture can be satisfactorily determined in accordance with BS 5852:Part 1:1979 and Part 2:1982. (Part 2, which replaces BS DD 58:1978, has been circulated since the public sittings of the Tribunal ended). It is, however, desirable that a test be devised to measure the rate of heat release of items of furniture once they are ignited.

7.139 In a number of the FRS tests it was observed that after wall tiles became ignited, and subsequent to the spread of flame along wall tiles, flaming droplets produced within the burning area of wall tiles were capable of spreading fire to neighbouring seats which were against the wall. The mechanism was by the production of flaming droplets which fell on to the seat. In fact there is no evidence from the observations made by eye-witnesses during the actual fire that fire did actually spread in this way, but the capacity of a wall lining to behave in this way can be a potentially dangerous property. The British Standard test for Surface Spread of Flame BS 476: Part 7, does require observations to be made for the production of flaming droplets. However, there is no indication in the classification of the wall linings which will give information as to whether the lining has this property or not. The classification of wall linings, according to BS 476: Part 7, should include a reference to the capability of the lining to produce flaming droplets. Such an indication may be useful in choosing materials which will comprise those small areas of Class 2 or Class 3 wall lining which may be allowed by the Building Regulations (see para. 9.130).

CHAPTER 8

The Responsibility for the Disaster of the Owners and their Advisers, Dublin Corporation and the Department of the Environment

CHAPTER 8

The Responsibility for the Disaster of the Owners and their Advisers, Dublin Corporation and the Department of the Environment

I— THE RESPONSIBILITY OF THE OWNERS AND THEIR ADVISERS

(1) The Design, Supervision and Execution of the Conversion

1 The owners of the building, Scotts Food Ltd., carried out the conversion of the building with the intention of using it as an entertainment centre for which they expected, and obtained, attendances of well in excess of one thousand people. They were, in these circumstances, under a high degree of responsibility to ensure that all the appropriate precautions were taken to ensure the fire safety of the building. This responsibility rested particularly on the two executive directors who were active in initiating and managing the project, Mr Patrick Butterly and Mr Eamon Butterly. As neither of them had any specialist qualifications or skills, other than such as might have been derived by Mr Eamon Butterly from his limited experience as a builder, the only manner in which they could have fulfilled this responsibility was by employing professional advisers who possessed the necessary skills and experience. Mr White and Mr Gardner, who were commissioned to prepare the drawings on which the various planning and bye-law applications were based, did not have the necessary skills or qualifications to undertake a project on this scale. Some degree of responsibility must also be attributed to them for undertaking work of this nature in the knowledge that they were not equipped to deal with it.

2 Professional skills were not required at the design stage only. It was essential that the entire work of conversion, including the supplying and installation of finishings and furniture, should be supervised by competent and responsible persons. The only person who appeared to supervise any of the work was Mr Eamon Butterly, who was manifestly not such a person. Again the responsibility for this must be attributed to Mr Patrick Butterly and Mr Eamon Butterly.

3 The low level of professional expertise availed of by the owners contributed specifically in two respects to the scale of the disaster. In the first place, it led to the carpet tiles being used as wall linings. In the second place, it meant that inadequate consideration was given to the suitability of Exit 2 and the extent to which it failed to comply with the requirements of the Draft Building Regulations. In addition, it led to other breaches of the relevant regulations and standards, details of which are given in Chapter 1, paras. 1.116 to 1.215, and some of which were also relevant to the events of the fire. They included

(1) the use of loose seating on the level area;

(2) the unsatisfactory location of Exits 1 and 3, having regard to the distances which had to be travelled to reach the outer doors in each case; -

(3) the use of timber partitions to enclose the Store Room and Lamp Room; and

(4) the inadequate ventilation of some of the toilets.

8.4 The dangerous consequences that could flow from having the suspended ceiling so close to the back seating in the West Alcove would also have been apparent to a person aware of recent developments in fire science (see para. 7.118).

8.5 The failure to appreciate that special care should be taken in relation to Exit 2 was not surprising, in view of the lack of expert knowledge and professional qualifications of both Mr White and Mr Gardner. Mr White said that he had considered the problem created by the staircase in the main foyer, but thought that it was too expensive to remove it. He accepted that his drawings did not make any provision for a cash office and that consequently the only way of collecting cash or tickets would have been to have some form of table inside the door, thereby creating an obstruction. He said that there was no discussion of this at the relevant time.

8.6 It is also clear that Mr White's commission was essentially to obtain planning permission. The extent to which he was consulted about the internal finishes and furnishings of the building appears to have been minimal.

8.7 Mr Gardner, for his part, rightly regarded himself as not being an expert on fire safety matters. He said he had consulted with his clients as to the proper number of exits. It wa° quite clear, however, that he had no appreciation of the particular problems presented b) Exit 2.

8.8 The evidence established that the carpet tiles came to be used as wall linings in the following circumstances. The plans lodged by Mr Gardner for bye-law approval included a section showing a wall in the stage area as having a tirolean finish. This was a plaster finish which would have attracted a surface spread of flame rating of Class 1 i.e. sufficient for use in the ballroom. The same drawing, however, showed a wall-covering in the area of the stage which appeared to consist of vertical strips of timber. The specification lodged by Mr Gardner with the application for bye-law approval on the 2nd May, 1977, contained the following:—

> "Curtains: All curtains for the stage and wall coverings must be treated with the approved method of fire resistance".

8.9 The internal walls of the building were plastered by Mr Brian Spencer in the late summer of 1977. Some time later, before Christmas of that year, Mr Eamon Butterly considered using some form of covering on the walls and discussed this with Mr Gardner. Initially Mr Butterly indicated to Mr Gardner that the form of covering he would prefer was some form of textile draping. Mr Gardner said that, while he was not enthusiastic about this form of covering, he made enquiries on Mr Butterly's behalf as to how its "flame proof qualities might be ascertained. He said that he rang a firm called Goodbody's in Dublin and ascertained from them that they would be in a position to test such textiles, when supplied to them by the witness, for their "flame proof qualities.

8.10 During a period prior to Christmas, 1977, and which may have been as early as August or September of that year, Mr Butterly received a visit from Mr Declan Conway, a sales representative employed by Messrs Bernard McGloughlin Ltd. This firm was interested in quoting for the use of floor coverings in the building and, having ascertained that Mr Butterly would like to get a quotation, Mr Conway returned within a week with samples of different materials. At that meeting, the discussion appears to have been confined to floor coverings, but at a later stage, probably about the month of November, 1977, Mr Conway learned that it was Mr Butterly's intention to put drapes on the walls.

8.11 Mr Butterly was satisfied, after discussing the matter with Mr Conway, that drapes would represent an unsatisfactory form of covering, since they would be both expensive and a nuisance in the ballroom, as patrons would pull at them and swing out of them. Mr Conway said that at this time he met Mr Ian Dewar, the area sales representative for

Ireland of Messrs Illingworth Ltd of Bradford, the carpet manufacturers. Again in November, 1977, he went with Mr Dewar to a trade show in England and to the Illingworth factory. He said that he saw various photographs depicting carpet tiles on walls, and that he mentioned the possibility of using them to Mr Dewar. He said that Mr Dewar told him that it was his experience that people in England used carpet tiles on walls, in buildings such as the Stardust, particularly because of the acoustic effect.

8.12 On his return to Ireland, Mr Conway said that he again saw Mr Eamon Butterly and discussed the possibility of using such carpet tiling on the walls of the Stardust. He said that he then got a sample from Messrs Illingworth of red tiles (the colour Mr Butterly required) which, he claimed, that firm were well aware were going to be used on walls. He said—and his evidence was confirmed by Mr Butterly—that he nailed some of the tiles to the wall at the back of the West Alcove in order to show Mr Butterly the effect. Both Mr Butterly and Mr Conway said in evidence that shortly after this demonstration, Mr Butterly told Mr Conway that he would use the tiles in question on the walls, provided he was satisfied on three matters:—

(1) that the manufacturers did, in fact, recommend their use on the walls;

(2) that the manufacturers recommended an adhesive suitable for securing the tiles to the walls; and

(3) that the manufacturers supplied what Mr Conway described as a "fire specification" for the tiles.

8.13 Mr Conway said that having had this conversation with Mr Butterly he then spoke to Mr Dewar on the telephone, and Mr Dewar told him there would be no problem in relation to these three matters and that the fire specification would be furnished within a week or ten days.

8.14 The file of Mr Dermot King, the Senior Building Surveyor of Dublin Corporation, produced to the Tribunal, contained a document with the following heading:—

"E. ILLINGWORTH AND COMPANY (BRADFORD) LIMITED
RESULTS OF FLAMMABILITY TESTS ON STANDARD PRODUCTION QUALITIES".

There follows a list of products which are stated as having been tested in accordance with BS 4790:1972 (the "hot metal nut method", of which details are given in Appendix 14 C).

Of these products, one is "Stateroom" the trade name of the carpet tiles used on the walls in the Stardust, but the list also includes "Villatex Ultra" and "Nylfloor 2000" two of the floor coverings used in the Stardust. Each of th° products is stated to have a char radius of less than 35 mm, i.e. a low radius for effects of ignition.

8.15 This document—the full text of which is contained in Appendix 16—was accompanied in Mr King's file by a covering letter dated 26th January, 1978, and addressed to Mr D Conway, Bernard McGloughlin Ltd, 22 Anglesea Street, Dublin. The letter was as follows:—

"Dear Sir,

At the request of our Technical Services Department, we have pleasure in enclosing herewith the results of flammability tests on standard production qualities as recently requested.

Assuring you of our best attention at all times, we are,

Yours faithfully,

E. ILLINGWORTH AND COMPANY (BRADFORD) LIMITED.

(Signed) Mrs E. M. Kenningham,
Home Sales Domestic Co-ordinator'\

Mr Conway said that on receiving it he handed this document and the covering letter to Mr Eamon Butterly.

8.16 The documentation produced in evidence by Mr Graham Whitehead, the Secretary and Financial Controller of Messrs Illingworth, established that the initial order for the tiles went through the Credit Control Section of the Company on the 24th January, 1978, with a subsequent order on the 17th February, 1978. The evidence indicated that the first supplies were dispatched on the 31st January, 1978—and it would appear from the evidence that the work of fixing the tiles to the walls began almost immediately and was fully completed by the time the premises opened officially on the 6th March, 1978.

8.17 Mr Conway said that two representatives of Messrs Illingworth, Mr Whitehead and Mr Scott, their Northern Ireland representative, came to Dublin at the time of the opening and took photographs of the tiles in position on the walls for use as publicity material.

8.18 Mr Whitehead said that his company had never manufactured any carpet tiles for use on walls and that he himself was unaware that it was intended to use them on the walls of the Stardust. He said that they were never advertised for use as wall-linings, although it was a common practice to put carpets on walls in show-rooms in order to display them to the best effect. He denied that he was in Dublin at the time of the opening or that he took photographs of the tiles in position.

8.19 Mr Dewar, the sales representative for Ireland at the relevant time, did not give evidence to the Tribunal, having emigrated to Canada some time ago.

8.20 Mr Gardner said that the first he knew of the use of the carpet tiles on the walls was when he saw them being actually fixed in position by a workman under Mr Butterly's supervision. He said that he asked Mr Butterly whether the tiles were fire-proof and that Mr Butterly told him that they were. He did not ask Mr Butterly whether the carpet tiles satisfied the local authority's requirements.

8.21 Mr Butterly said that he gave the document obtained by Mr Conway from Messrs Illingworth, together with the covering letter, to Mr Martin Donohoe, the Inspector for Places of Public Resort with a special responsibility for electrical matters (see para. 3.200) on the eve of the successful application for a Temporary Music and Singing Licence on the 22nd February, 1978. He said that he placed it in an envelope with three other documents, a specification for the fire protection system used for the steel stanchions, the specification for the suspended ceilings provided by Messrs Armstrong, the manufacturers, and a certificate as to the flame resistance qualities of the stage curtain provided by Messrs Bourke, Strand Electric Ltd. The last of these three documents was dated the 21st February, 1978. These latter three documents were also in Mr King's file with the document from Messrs Illingworth.

8.22 Mr Butterly said that all four documents were provided by him at the express request of either Mr King or Mr Donohoe. He thought that Mr Donohoe had asked for the certificate in relation to the carpet tiles at some period between mid-December, 1977 and mid-January, 1978.

8.23 Mr King agreed that he had asked for the material in relation to both the suspended ceiling and the protection for the steel stanchions, since in both cases they represented a deviation from the plans and specification lodged for bye-law approval. He said that he thought the furnishing of the certificate from Messrs Bourke, Strand Electric Ltd, would have been in response to the relevant condition (No. 5) in the conditions attached to the Grant of Bye-law Approval (para. 1.111). He said that he was not aware at any stage prior to the opening of the premises on the 6th March, 1978, of Mr Butterly's intention to use the carpet tiling on the walls and had consequently never asked Mr Butterly for a document of the type which emanated from Messrs Illingworth. Mr Donohoe denied having asked Mr Butterly for any certificates; he said that Mr Butterly handed him an

envelope on the eve of the application for the temporary licences and that he, in turn, gave the envelope to Mr King.

8.24 The Tribunal is satisfied that the decision to use the carpet tiles as wall lining was made by Mr Butterly. He did not seek advice from Mr Gardner in relation to their use and, had he done so, Mr Gardner would not have been in a position to give him any informed or expert opinion as to their fire safety qualities. The Tribunal is also satisfied that the Illingworth document relating to the carpet tiles was not obtained by Mr Butterly in response to any request from Mr King or Mr Donohoe. The terms of Condition 5 attached to the Building Bye-law Approval, which were notified to Mr Butterly by a document dated the 11th January, 1978—"a certificate of flame resistance must be provided for each different material"—probably alerted Mr Butterly's mind to the necessity for obtaining certificates for the different finishes used in the building, including the wall lining; and this, in the view of the Tribunal, probably led to his obtaining, through Mr Conway, the Illingworth document. He was clearly concerned to ensure that there should be no objection by the Corporation at the application for the temporary Public Dance Hall and Music and Singing Licences on the 22nd February, and he accordingly furnished this certificate, together with the other certificates, to Mr Donohoe. (The Corporation did not have to be given notice of the applications for temporary licences, but were normally represented in the District Court when the list was being dealt with by the District Justice and were so represented on the day in question). The reason for the delay in furnishing the four certificates was because the document from Messrs Bourke, Strand Electric Ltd was not provided until the 21st February, 1978.

8.25 Had Mr Butterly taken the appropriate expert advice, he would have been told that the Illingworth document was of no relevance to the use of the carpet tiles as wall linings, but was solely related to their performance as floor coverings. His failure to take any such advice—and his employment of unqualified draughtsmen such as Mr White and Mr Gardner—led to the wall lining being used, and playing a major part in the spread of the fire.

8.26 The Tribunal accepts Mr Whitehead's evidence that his company did not manufacture carpet tiles for use as wall linings, and that he was unaware of the intention to use them on the walls of the Stardust. As Mr Dewar did not give evidence, the Tribunal is not in a position to reach any conclusion as to why he should have led Mr Conway to believe, as the latter stated on oath he did, that the carpet tiles could be so used. It is right to say, however, that no blame can reasonably be attached to Mr Conway for the consequence of their use as wall linings: he never held himself out to either Mr Butterly or Mr Dewar as having any technical qualifications, and he forwarded the document from Messrs Illingworth to Mr Butterly in the honest but mistaken belief that it confirmed their suitability for use as wall linings.

8.27 It should also be noted that Mr Butterly repeatedly made it clear that he regarded his responsibility in relation to ensuring the fire safety of the premises as being discharged once he had satisfied Dublin Corporation's requirements. This was also the attitude of Mr Patrick Butterly. It was, in the view of the Tribunal, a wholly unacceptable approach for persons to adopt who were converting a building into a place of public resort intended to attract audiences in excess of one thousand people.

(2) The Management of the Building

8.28 When the building was opened to the public, the owners were under a high degree of responsibility to ensure that the premises were properly and efficiently managed so as to ensure fire safety. This they manifestly failed to do.

8.29 The numerous instances in which the management failed to comply with the requirements of the Bye-laws, and the Fire Protection Standards issued by the Department of the Environment, are set out in detail in Chapter 1. They need not be repeated here, but the principal areas in which there were serious shortcomings which contributed to the loss of life and injuries on the night of the fire can be defined as follows:—

(i) there was not merely a failure to ensure that exits remained unlocked and unobstructed during the time the public were on the premises: a deliberate policy was pursued of keeping them locked at such times.

(ii) Exits were regularly allowed to be obstructed during the time the public were on the premises.

(iii) No permanent and responsible member of the staff took charge of the arrangements for fire safety.

(iv) No instructions of any sort were given to any of the staff as to what should be done in the case of fire.

(v) No fire drills were ever held on the premises.

(vi) No evacuation schemes were ever drawn up or practices held in relation to them, either at the recommended half-yearly intervals or at all.

(vii) No notices as to the action to be taken by patrons and staff in the case of fire were posted anywhere in the building.

(viii) No training in the use of fire-extinguishers was ever given to any member of the staff.

(ix) No precautions were taken to ensure that all members of the staff knew the location of the fire-extinguishers in the building.

(x) No fire plan was ever provided in the building.

8.30 Had proper fire drills and evacuation procedures been in operation at the premises, serious mistakes and omissions would have been avoided and the number of deaths and injuries reduced. Most importantly,

(1) all exit doors would have been unlocked and unobstructed; the side leaves of outer Exit 2 would have been opened.

(2) The centre leaves of outer Exit 2 would not have been wedged in the mat-well.

(3) An urgent warning to patrons to leave the premises by the nearest exits would have been broadcast from the stage by a member of the staff as soon as the fire was seen, i.e. at 01.41 or 01.42 at the latest.

(4) A number of staff members, trained in the use of fire-extinguishers, would have known where they were located and would have made prompt and possibly more effective use of them.

(5) The fire brigade would have been alerted at the first indication of fire.

8.31 Both Mr Patrick Butterly and Mr Eamon Butterly must share the responsibility for these matters. Mr Eamon Butterly, however, bears a special responsibility for the practice of keeping the emergency exits secured with chains and padlocks until midnight at the earliest on disco nights, a recklessly dangerous practice which regularly endangered the lives of over one thousand people and, in the event, led to one exit being locked and chained on the night, and possibly contributing to avoidable deaths and injuries. In addition, he bears a special responsibility for the obstructed state of Exits 4 and 5, which also possibly contributed to avoidable injuries and death. While all the doormen who knew of the practice must share some degree of responsibility for the consequences which ensued, a special responsibility attached to Mr Thomas Kennan, who, as the head doorman, was directly responsible for implementing the policy. Mr Leo Doyle, as his deputy, also must bear some of the responsibility for carrying the policy into effect.

(3) Conclusions

8.32 There were serious errors and omissions in the design, supervision and execution of the conversion of the building, some of which constituted breaches of the relevant regulations and guidelines. The owners' representatives, Mr Eamon Butterly and Mr Patrick Butterly, were primarily responsible for these errors and omissions, and their advisers, Mr William

White and Mr Harold Gardner, were also in part responsible. In particular, Exit 2, the main entrance, was unsuitable having regard to fire safety requirements, and carpet tiling with a significantly lower surface spread of flame rating than was required, was used as a wall lining.

8.33 These errors and omissions contributed significantly to the deaths and injuries which resulted from the fire.

8.34 There were serious errors and omissions in the management of the building, for which Mr Eamon Butterly and Mr Patrick Butterly were responsible. In particular, exits were not maintained in an unlocked and unobstructed condition, properly trained staff were not employed and appropriate fire drills and evacuation procedures were not in use. These errors and omissions also constituted breaches of the relevant regulations and guidelines.

8.35 These errors and omissions also contributed significantly to the deaths and injuries resulting from the fire.

II — THE RESPONSIBILITY OF DUBLIN CORPORATION

(1) Granting of Planning Permission and Bye-law Approval

8.36 The successful application for planning permission envisaged the use of the building as a "Licensed Amenity Centre". It must have been clear to Dublin Corporation that the granting of Planning Permission and Bye-law Approval would, subject to the necessary licences being obtained, enable the owners to use the premises for purposes such as the holding of disco dances; and that the occupant capacity of the Stardust, determined in accordance with the Draft Building Regulations, was about 1,750. It should also have been clear to them that it was probable that the uses envisaged for the building would mean the presence of a large quantity of combustible material in the form of furniture which was not subject to any form of control or regulation. In these circumstances, it was essential that the drawings submitted for approval should be scrutinised on behalf of the Corporation with great care by persons qualified to assess the degree of hazard involved and the precautions which were required at the design stage.

8.37 The necessity for a careful scrutiny of such an application was accentuated by the occurrence in recent years of major fire disasters in entertainment centres in other countries, such as the Summerland Fire Disaster in the Isle of Man on the 2nd August, 1973, and the Beverly Hills Supper Club fire in Kentucky on the 28th May, 1977. Each of these had been the subject of a lengthy report, the Summerland Report being particularly relevant, since it drew particular attention to the necessity for incorporating the appropriate structural precautions in a building such as this at the design stage, and emphasised the responsibility attaching to the owners, their professional advisers and the local authority.

(i) *The Structure and Staffing of the Relevant Department*

8.38 At the relevant time the procedure in the case of new buildings or conversions of existing buildings which required planning permission and bye-law approval was as follows. In the case of all developments which appeared to warrant it—which would automatically include places of public resort—the plans were furnished to the Chief Fire Officer for his observations. Applications for bye-law approval, which normally accompanied planning applications, were considered by the Senior Building Surveyor in charge of "the Building Control Section in the Planning Department. He also circulated the plans submitted to him to the Chief Fire Officer for his observations. He then made a report recommending the grant or refusal of bye-law approval, as the case might be, or the grant of approval subject to conditions.

8.39 In the case of planning applications, if the observations of the Chief Fire Officer were received within the statutory period for dealing with the application (see para. 1.127) his requirements (if any) were embodied in the form of a condition subject to which the

permission was granted. If they were not received within that period, a condition was normally imposed on the grant of permission, requiring the applicant to ascertain the requirements of the Chief Fire Officer and to comply with them before commencing the development.

8.40 The Dublin Planning Officer at the relevant time was Mr Charles Aliaga Kelly, whose responsibilities extended also to the functional area of Dublin County Council.

8.41 The Chief Fire Officer at the relevant time was the late Captain Thomas O'Brien. The hierarchy of the Fire Brigade under his control—the functions of which also extended to Dublin County—is described at para. 4.4.

8.42 The Fire Prevention Department of the Brigade dealt with all applications referred to the Fire Brigade under the Planning Act and Bye-laws. There were also referred to the Fire Prevention Department applications for Public Dancing, and Music and Singing Licences, in respect of certain places of public resort (see paras. 1.98 and 1.99). There were one hundred and sixty such places within the Fire Brigade jurisdiction. Applications under the Licensing Acts, 1833-1962, for intoxicating liquor licences were referred to them on occasions. They dealt with applications for Fire Safety Certificates under the Factories Act, 1955: and they were consulted regularly by various departments of the Corporation on fire safety matters, e.g. on the conditions that should be inserted in new leases of Corporation property. They also carried out such inspections as were carried out under the Fire Brigades Act, 1940, in response to complaints in relation to specific premises.

8.43 The number of applications referred to the Fire Prevention Department under the Planning Acts and the Bye-laws for the years preceding the fire are as follows:—

1976	1977	1978	1979	1980
1,127	1,438	1,634	1,824	1,800 (approx.)

8.44 The number of inspections carried out by the Department under the different procedures already referred to for the years preceding the fire were as follows:—

	1975	1976	1977	1978	1979
Planning Acts	134	Not recorded	287	344	356
Fire Brigades Act, 1940	582	290	219	223	161
Factories Act, 1955	175	150	137	193	124
Public Dance Halls Act, 1935	Not recorded	Not recorded	Not recorded	Not recorded	321
Other legislation including Public Resort Bye-Laws	406	390	322	358	206

8.45 The staff of the Fire Prevention Department at the relevant time consisted of four Technical Officers, three of whom were Senior Executive Fire Prevention Officers and one an Executive Fire Prevention Officer, together with one typist. Each of the Technical Officers was a graduate in Civil Engineering. There was no head of the Department, but the Senior Technical Officer, Captain John Williams, acted in that capacity.

8.46 The staff had decreased in numbers since 1973 when there were, in addition to the officers already mentioned, four officers who were not graduates, viz. two District Officers and two Station Officers. The permitted establishment of the Department at the time of the fire was seven, the vacancies being for three Executive Fire Prevention Officers. Captain O'Brien and Captain Williams both said that the number of staff in the Fire Prevention Department was inadequate. Captain O'Brien said that not merely was the actual number

of staff inadequate, but the permitted establishment was also inadequate. In his view, there should have been at least twelve officers in the Fire Prevention Department.

8.47 After the fire, the Fire Brigade establishment was increased. Three new posts of Assistant Chief Fire Officer were created, one of whom was to be head of the Fire Prevention Department. Captain Williams was promoted to this post, but was not replaced in his post as Senior Executive Fire Prevention Officer.

8.48 None of the members of the Fire Prevention Department, including its acting head, had ever pursued any post-graduate or similarly specialised courses in fire safety engineering. Their knowledge of fire safety engineering, and fire safety in general, was derived principally from what they learned during the course of their work. They attended, from time to time, courses run by the Department of the Environment for Fire Prevention Officers. Two officers had attended a course in Galway Regional Technical College in 1973/4, but of those one had died and the other had been promoted to Third Officer and was no longer a member of the Fire Prevention Department, although, according to Captain O'Brien, he did "a certain amount of fire prevention work".

8.49 Captain O'Brien said that there were two principal reasons for the shortage of staff in the Fire Prevention Department. In the first place, a career in that Department appeared to be unattractive to professional officers, since they felt that it confined their experience to one branch of engineering and thereby limited their professional future. In the second place, the Fire Prevention Department Staff did not receive additional money in respect of work done in "unsocial" hours, unlike the members of the fire-fighting branch of the Fire Brigade. This meant that it was difficult to attract members of the fire-fighting service to positions in the Fire Prevention Department. Captain O'Brien said that, in the result, it was not possible to fill the existing vacancies for professional engineers in the Fire Prevention Department, although attempts had been made to do so in the usual manner through the Local Appointments Commission. It also meant that it had not been possible to recruit additional non-technical staff from the fire-fighting branch of the Brigade. He said that the attempt at recruiting non-technical personnel from the fire-fighting area was confined to the fire-fighting service of the Dublin Fire Brigade as this was the normal procedure. Captain O'Brien also agreed with the suggestion put to him that the fire-fighting service also offered more opportunities for the personnel to have other part-time jobs.

8.50 The evidence established that, while it was difficult to attract personnel from the fire-fighting service to posts in the Fire Prevention Department, the filling of such posts from outside the existing fire service had been opposed by the relevant trade union.

8.51 The Fire Prevention Department normally applied the Draft Building Regulations (see para. 1.102) in deciding whether a building satisfied fire safety requirements. Captain O'Brien said that if there was a conflict between the Regulations and the Fire Protection Standards of the Department of the Environment (para. 1.101) the Building Regulations should normally prevail. Captain Williams said that, while in routine cases compliance with the Draft Building Regulations was sufficient, cases did arise in which requirements additional to those contained in the Regulations were imposed.

8.52 Captain O'Brien said that the difficulties arising from the inadequacy of staff were seriously increased by the absence of the Building Regulations having the force of law. Had such regulations existed, many of the applications which now had to be referred to the Fire Prevention Department could have been dealt with by the Building Control Section of the Planning Department.

8.53 The Senior Building Surveyor at the relevant time was Mr Dermot King. He was assisted by four District Surveyors.

(ii) ***The Assessment of the Applications for Planning Permission and Bye-law Approval***

8.54 The first application sent from the Planning Department to the Chief Fire Officer for his observations was Plan No. 403/76 which was sent on the 23rd March, 1976. It was dealt with in the Fire Prevention Department—as were all the subsequent applications—by one of the technical officers already referred to, Mr Edward Clarke. His observations were sent on the 5th April, 1976, to the Planning Department and were as follows:—

> "With reference to the attached plans for the above mentioned proposal, I recommend that additional information be sought as follows:
>
> (1) Stairs to be enclosed in 1 hour fire-resisting construction and to discharge direct to open air at ground floor level.
>
> (2) Alternative means of escape from 1st floor.
>
> (3) 5'0" exits from amenity area.
>
> (4) All internal wall and ceiling linings to have a minimum Class 1 surface spread of flame ratings *(sic)*.
>
> (5) Emergency lighting system independent of the mains to Fire Brigade requirements to be installed.
>
> (6) Suitable and adequate first-aid fire fighting equipment".

8.55 There were also contained what were described as general Fire Department requirements applicable (unless otherwise specified) to all buildings and building proposals (see para. 1.121).

8.56 This application was refused on the 9th April, 1976, but the Chief Fire Officer's requirements were not conveyed to Mr White until the 6th July, 1976 (see para. 1.125).

8.57 The next application (Plan No. 1586/76) was sent to the Chief Fire Officer on the 21st September, 1976. (The application had been received on the 25th May, 1976, but on the advice of Mr Aliaga Kelly, the applicant was required to re-advertise the proposal). On the 29th October, 1976, the Corporation decided to grant approval for this proposal, and, as the observations of the Chief Fire Officer had not been received at that date, the following condition was included:—

> "3. Before commencement of the proposed development the applicant shall consult with the Chief Fire Officer and shall ascertain and comply with his requirements (if any) in regard to the prevention of a fire hazard in the development".

8.58 On the 10th November, 1976, the Chief Fire Officer sent his observations in the following form:—

> "1. Five no. fire exits direct to open air from amenity area.
>
> 2. Exit doors to open outwards.
>
> 3. Internal wall and ceiling linings to possess Class 1 surface spread of flame rating.
>
> 4. Suitable and adequate first-aid fire fighting equipment".

8.59 Mr Clarke said that he omitted the requirement as to alternative means of escape from the first floor in relation to this application because he had been assured by Mr White that the first floor was not to be used as a means of escape. It appears that the observations of the 10th November, 1976, were not sent to the owners or their architect.

8.60 The next application (Plan No. 3170/76) was for a revised scheme in respect of which additional information was sought and never furnished. It was sent to the Chief Fire Officer for his observations on the 1st December, 1976, and his observations were sent on the 18th January, 1977, in the following form:—

> "(1) Alternative means of escape from storage area first floor.
>
> (2) Stairs to be enclosed in a one hour fire resisting construction and to discharge direct to open air at ground floor level.

(3) Kitchen to be enclosed by a one hour fire resisting construction.

(4) 4 no. exits from amenity area to be a minimum of 5'0" wide.

(5) 4 no. exits from function room to be a minimum of 4'0" wide.

(6) Suitable and adequate first-aid fire fighting equipment".

It does not appear that these observations were sent to the owners or their architects.

8.61 The first application for Bye-law Approval was on the 13th February, 1976. Mr King, having examined the plans, informed Mr White by a letter of the 15th March, 1976, that the information submitted was inadequate. A further application was then made on the 25th May, 1976, and Mr King again found the information furnished inadequate and so informed Mr White by letter of the 2nd July, 1976. This letter also set out the requirements of the Chief Fire Officer as contained in the observations of the 5th April, 1976. A further application having been made on the 15th November, 1976, Mr King issued a notice of disapproval on the 11th January, 1977, two of the reasons for the disapproval being as follows:—

"4. Exit inadequate, e.g. number of doors, width of routes, stairways, etc.

9. Details of wall and ceiling linings not given".

8.62 The next application was on the 9th May, 1977, and was made by Mr Gardner on behalf of the owners. It was sent by Mr King to the Chief Fire Officer on the 1st July, 1977, with the following comment:—

> "Attached herewith plans (3) and specification in connection with proposed conversion of part of above factory building to an amenity premises. Planning permission has already been granted.
>
> Please let me have your immediate observations on the proposed scheme. Work has already been started".

This had a note written on it in the Fire Department and apparently initialled by the Chief Fire Officer as follows:—

> "Captain Williams—please deal with this as urgent".

8.63 Mr Clarke wrote to Mr King on the 8th July, 1977 as follows:—

> "With reference to yours of 1st July, 1977, means of escape as shown on Plan No. 1492/77 re above are inadequate".

8.64 On the 19th July, 1977, the Planning Department wrote as follows to Mr Gardner:—

> "With reference to your letter and drawings of 17th June, 1977, I wish to inform you that they are unacceptable to the Fire Department because of inadequate means of escape. For any further information on the above please contact the Chief Fire Officer, Tara Street, Tel. 778221".

8.65 On the 23rd July, 1977, Mr Gardner wrote to the Planning Department as follows:—

> "With reference to your letter of 19th inst., I have since seen the Fire Officer and he is now satisfied that the means of escape Exits *(sic)* are adequate".

8.66 Mr Clarke in evidence said that the conversation referred to in this letter dealt with his (Mr Clarke's) two main concerns, i.e. that the plans did not indicate the use that would be made of the first floor, and were somewhat ambiguous in relation to Exit 1. He said that Mr Gardner satisfied him on both these points and that thereafter he considered that the plans should be approved for Building Bye-law purposes.

8.67 There was a further exchange of letters between Mr King and Mr Gardner relating to the details of the front entrance doors (see para. 1.61). On the 30th November, 1977, Mr King issued his recommendation in the following form:—

"This *(sic)* above plans and amendments were lodged as applications under the bye-laws relating to places of public resorts on various dates since 9th May, 1977/

Planning permission was granted on 29th October, 1976—Order No. (P. 2646).

The present application conforms generally with the planning application, but has been the subject of much discussion between the present architect, Mr Gardner, and the Corporation as regards the Bye-laws. Many internal amendments were necessary to bring the premises into compliance with the building bye-laws and bye-laws relating to Places of Public Resort.

It is proposed to use the premises for bar/carbaret with dancing and there is accommodation for seating of 1,458 people in the main carbaret lounge.

The proposal now complies generally with the Bye-laws for Places of Public Resort and I recommend that approval be granted under the bye-laws subject to the following conditions . . . .".

8.68 There followed the eight conditions which were subsequently incorporated in the order granting approval dated the 6th January, 1978 (see para. 1.111).

8.69 Mr Clarke, the officer in the Fire Prevention Department who examined the plans submitted for Planning Permission and Bye-law Approval, had held his position fcr approximately twelve years. He was a Civil Engineer but, in common with the other members of the Fire Prevention Department, had no other specialised qualifications and had never pursued any specialist course in fire science or other aspects of fire safety. He had attended two three-day courses in fire prevention in University College, Dublin, and had applied for permission to pursue a course in York University, but had been refused permission by his superiors for the latter, because of shortage of staff in the Department.

8.70 Mr Clarke said that, in considering applications referred to him by the Planning Department, he took into account the provisions of the Draft Building Regulations. The Draft Building Regulations in existence at the time of the fire had been published by the Department of the Environment on the 29th November, 1976, but Mr Clarke could not recall whether an advance copy had reached his Department at the time when he furnished his observations on the successful application for Planning Permission to the Planning Department, i.e. the 10th November, 1976. Prior to that date, he had been applying the earlier Draft Building Regulations, which had not been published, but had been circulated to various interested bodies, including the Corporation, for their comments. He said that in addition to the Building Regulations, he also took into account some of the requirements of the Fire Protection Standards, such as those dealing with fire-extinguishers. He did not take into account the requirements of the Bye-laws relating to Places of Public Resort, as they would be dealt with by Mr King's Department. Mr Clarke said that, in determining the appropriate number of escape routes for the purposes of the Draft Building Regulations, he applied the formula contained in Regulation P 3, using an occupant load factor of 0.7. He was satisfied that, using the formula, the exits were capable of coping with 1,700 people.

8.71 Mr Clarke said that he was satisfied with Exit 2 when he considered the plans, and did not consider that either the staircase or the location of the Cloakroom gave rise to any problem, particularly as there were five other exits from the ballroom with openings five feet (1.52 m) wide. (It should be noted that, during the course of the lodgement of plans for Bye-law Approval, there were changes in the plans in relation to Exit 2. Originally, the plans showed the Cloakroom as running the whole way down the side of the foyer at Exit 2, incorporating the area subsequently used for the Cash Office, the Cash Office being on the left-hand side. Mr Clarke never saw the later plans showing the actual layout of the foyer at Exit 2, including the Cloakroom and the Cash Office). He said that in the future such matters would be considered more carefully by the Fire Prevention Department.

8.72 In relation to the requirement that suitable and adequate first-aid fire-fighting equipment should be provided, Mr Clarke said that he advised Mr Gardner verbally to place fire-extinguishers near exits and within 100 feet (30 m) of any point, and that this would have been the extent of the advice given by the Fire Prevention Department. He agreed that the actual location of the fire-extinguisher in the West Alcove was a long way from an exit.

8.73 So far as the furniture in the building was concerned Mr Clarke said that he did not take this into account. It was not dealt with in the Draft Building Regulations and, to the extent that it was dealt with in the Public Resort Bye-laws, was a matter for Mr King's Department. He thought that there should be some means whereby he could consider the fire safety aspect of a building, in relation not only to the building, but also to the furnishings.

8.74 Mr King is a graduate in Civil Engineering and became Senior Building Surveyor in 1977. He considered the applications, having regard to the provisions of the Building Bye-laws and the Public Resort Bye-laws. Any matters relating to fire safety which were not covered by the Bye-laws, he left to be dealt with by the Fire Prevention Department.

8.75 Mr King said that among the plans submitted for Bye-law Approval, there was a section in detail of the stage area, which indicated that the wall finish at that point would be a tirolean plaster finish. This would have attracted a Class 1 rating for surface spread of flame. He said that he was never asked to approve the carpet tiles actually used as the wall lining. He also said that, whereas he was empowered under the Public Resort Bye-laws to require the owners to replace the blinds isolating the alcoves, he was not empowered to require them to make any changes in the wall linings.

8.76 Mr King said that, while he considered it reasonable in the circumstances to dispense with the requirement of the Public Resort Bye-laws as to the height of the seating at the back of the West Alcove, this waiver should strictly have been in writing. He agreed that the corridor at Exit 1 did not comply with Bye-law 12 of the Building Bye-laws (see para. 1.160) and that, while this was not indicated by the plans, it would have been apparent from an inspection.

8.77 Mr King said that revised drawings were never furnished to the City Manager in accordance with Building Bye-law 2 (e). He said that, in regard to the seating as shown on the plans lodged for Bye-law Approval, he was satisfied that it complied with the Public Resort Bye-laws. He did not think that Bye-law 7 (b) was applicable, since it appeared to envisage theatre seating, rather than seats and tables. He agreed that the Bye-law did require seating to be firmly fixed to the floor, but was not aware at the application stage of the intention to have any loose seating.

(2) Enforcement of the Applicable Legislation and Regulations by Inspection or otherwise

8.78 In the years 1976 and 1977, 1,127 and 1,438 planning applications respectively were referred to the Chief Fire Officer for his observations. Mr Aliaga Kelly said that the shortage of staff in the Fire Prevention Department was such that in many cases, the observations of that Department were not received by the Planning Department in sufficient time to be incorporated in the conditions attached to a planning permission; and that this had led to the practice, in existence for about five or six years at the time of the fire, of imposing a condition requiring the applicant to ascertain and comply with the requirements of the Chief Fire Officer. He said there was no procedure for ensuring compliance with such a condition in cases where the applicant, for some reason, failed to consult with the Chief Fire Officer as to his requirements. He agreed that the procedure was "a bit vague" and said that he had never known of any attempt by the Planning Department to enforce such a condition. He said that he thought he had verbally drawn the attention of the Manager to the unsatisfactory nature of the procedure.

8.79 In the case of the Stardust, neither the owners nor Mr Gardner took steps to ensure that they were aware of the Chief Fire Officer's observations by obtaining from Mr White the letter of the 6th July, 1976 (see para. 1.126). There was, accordingly, a clear failure to comply with the condition as to consultation with the Chief Fire Officer and compliance with his requirements, but no attempt was made by the Corporation to enforce this condition. This was because such conditions were never in practice enforced: they were of questionable legal validity, and no machinery existed for ensuring that they were enforced.

8.80 There was also confusion as to the effect of such conditions. Mr King, when writing to Mr Gardner on the 25th August, 1976, referred to his already having received the Chief Fire Officer's Report. As has already been pointed out, (para. 1.126) this should have directed Mr Gardner's attention to the necessity for obtaining from Mr White any letters received by him from the Planning Department, which would, of course, have included the letters of the 2nd and 6th July, 1976, containing the Chief Fire Officer's requirements. If, however, he had enquired from Mr King as to where the Chief Fire Officer's requirements were to be found, he would have been told by Mr King, according to the latter's evidence, that they were contained in the letter of the 19th July, 1977, which referred solely to the inadequate means of escape and contained no reference to the wall linings. In the event, this was of no practical significance since Mr Gardner did not enquire from Mr King what he ment by the "Chief Fire Officer's Report".

8.81 No inspection was carried out by any member of the Fire Prevention Department—or by any other member of the Fire Brigade—to ensure that the requirements of the Fire Brigade, as communicated to the Planning Department, had been complied with. There was no procedure under which all buildings, in respect of which such requirements had been laid down, were inspected by the Fire Brigade in order to ensure that the requirements had been complied with.

8.82 In general, routine inspections of places of public resort were not carried out by the Fire Brigade, but were regarded as a matter for the Surveyor of Places of Public Resort, i.e. Mr King. However, where such premises did not have a dancefloor area exceeding 500 sq. ft. (46 m^2), the Public Resort Bye-laws were treated as inapplicable and the responsibility for inspections was regarded as being that of the Fire Brigade. (This practice was adopted because of the advice given by a former law agent for the Corporation as to the correct interpretation of the Bye-laws.) Since the Stardust had a dancefloor area well in excess of 500 sq. ft., it was not visited as a matter of routine by the Fire Brigade.

8.83 All buildings, in whatever category they fell, were inspected by the Fire Brigade under the provisions of the Fire Brigades Act, 1940, in order to ascertain whether a fire precautions notice should be served under that Act, but this was only done in response to complaints. No such inspection was carried out in the case of the Stardust.

8.84 The Fire Brigade also, from time to time, visited premises such as the Stardust in connection with applications under the various Licensing Acts, either for original certificates or renewals. Again, however, the Fire Brigade did not carry out such an inspection in the case of the Stardust.

8.85 It was at one stage the practice, in the case of places of public resort, for members of the fire-fighting service to inspect them while performances were actually taking place. Because of shortage of staff, this practice was discontinued for some years prior to the fire.

8.86 There were no Inspectors of Places of Public Resort in Mr King's department at the relevant time. Mr Martin Donohoe held a position described as "Inspector of Places of Public Resort (Electrical)" in the Electrical and Public Lighting Department, his superior officer being Mr Maurice Lowe, a Senior Engineer. As his title indicated, Mr Donohoe's primary function was to inspect and report on the condition of electrical installations in such places. If he came across other matters which appeared to him to require attention —such as the obstructing of exits—he duly reported them to Mr Lowe; and this in fact happened in realation to the Stardust (see para. 3.200). He did not make "during

performance" inspections of places of public resort as such, and was never in the Stardust during the hours when disco dances were in progress. Apart from checking on the electrical installations generally, his principal concern in the Stardust was to ensure that visiting groups, by the use of their own equipment, did not interfere with the electrical installations or cause any obstruction to passageways, etc.

8.87 Mr King visited the premises himself on three or four occasions between January, 1978, and the date of the fire. On the occasions subsequent to the opening of the premises in March, 1978, the carpet tiles were on the walls. Mr King said that, in the subdued lighting conditions, he did not notice the type of wall covering being used. He said that, in any event, he did not regard the wall linings as being the subject of the Bye-laws.

(3) Conclusions

8.88 The Fire Prevention Department was grossly understaffed at the time the applications for Planning Permission and Bye-law Approval were referred to them. They remained grossly understaffed throughout the period preceding the fire and at the time of the Tribunal's public hearings. Such staff as there was did not have the specialist qualifications required for a proper assessment of an application such as this. The Tribunal is satisfied that this resulted in an inadequate assessment of the drawings and specifications furnished. An adequate assessment would have resulted, in the context of the Bye-law application, in the applicant being asked to provide for wall linings which complied with the Draft Building Regulations and to submit a new design for Exit 2.

8.89 An adequate assessment by a person acquainted with modern developments in fire science would also have involved consideration being given to the proximity of the suspended ceiling to the banked seating in the West Alcove (see para. 7.96).

8.90 The Tribunal does not think that blame can reasonably be allotted to Mr Clarke. In common with the other officers of the Fire Prevention Department, he had a work-load so great that a proposal of this nature simply could not receive the sort of detailed consideration it merited; and again in common with other members of the Department, he was handicapped by his lack of specialist knowledge and the absence of any adequate facilities which might have enabled him to obtain such knowledge.

8.91 The practice of attempting to incorporate the Fire Prevention Department's requirements in planning permission was totally unsatisfactory. It led to the imposition of conditions of doubtful legal validity which were, in practice, unenforcable. In addition, the back-log of work in the Fire Prevention Department had the inevitable consequence that the requirements of the Department were not communicated to the Planning Section until after the decision to grant permission had been given.

8.92 The fact that there was no inspection whatever of this building by any member of the Fire Brigade, either in the Fire Prevention Department or fire-fighting service, from the day it opened until the fire, was one of the most disquieting facts to emerge at the Inquiry. Coupled with the fact that the only regular inspections of places of public resort carried out during this time were by Mr Martin Donohoe, whose primary function was to ascertain the existence of electrical faults, and who was not normally present during performances at the Stardust, it meant that certain crucial features of the building and its management went unobserved. In particular, the significance of the use of the carpet tiles as wall lining was not appreciated. (The inspections carried out by Mr King are considered in paras. 8.87 and 8.93.) The failure to carry out any "during performance" inspections whatever during the whole lifetime of the building, as converted, meant that the practice of locking and chaining the exit doors until midnight at the earliest on "disco" nights was not known to the Corporation. "During performance" inspection would also have brought to light such undesirable practices as the locking of the two side-leaves of outer Exit 2, and the wedging of the centre leaves of outer Exit 2 in the well of the doormat when patrons were leaving at the end of the night (see para. 3.5). In addition, an adequate inspection of the premises by qualified staff, particularly members of the Fire Brigade, would have revealed the total absence of any fire drill or evacuation procedures, and the fact that

there was no member of the staff who had anything like the required knowledge of fire safety.

8.93 Even such inspection as was carried out was not satisfactory. The Tribunal is satisfied that no blame should be attached to Mr Donohoe, who properly drew the attention of his superiors to matters which were strictly not his responsibility, such as the locking and obstruction of exit doors. Some blame however, must, in the view of the Tribunal, be allotted to Mr King. It is difficult to understand why an official of his experience should have failed to investigate the presence of lining material on the walls of which he had not previously been informed and of which the drawings he had considered gave no indication. The Tribunal is satisfied that the only explanation for this was that Mr King was adopting an unduly narrow view of his functions and regarded matters not strictly within the Bye-laws as outside his terms of reference. This was not an acceptable approach for a senior official of the Corporation who was well aware of the total lack of inspection in buildings such as the Stardust by the Fire Prevention Department of the Corporation, and of the inadequate and unsatisfactory arrangements for the inspection of places of public resort generally.

8.94 Had there been any adequate inspection of the Stardust by either the Fire Prevention Department or the Senior Building Surveyor's Department, it would have brought to light not merely the critical failures in regard to the wall linings and the practice of locking the doors during performances: it would also have revealed a wide range of failure on the part of the management to comply with the Building Bye-laws, the Public Resort Bye-laws, the Fire Protection Standards and the Draft Building Regulations (see Chapter 1). Many of these shortcomings, such as the absence of any officer responsible for fire safety, the absence of any evacuation scheme, the failure to hold fire drills, the absence of notices giving information to the patrons as to what to do in the event of a fire, the absence of a fire plan, and the absence of any keyboard upon which the padlocks and chains could be hung while the public were on the premises, directly contributed to the deaths and injuries in the fire. Many of the others had little or no significance in relation to the fire, but their existence, and the fact that they either entirely escaped the notice of the Corporation or, if noticed, went without comment, illustrates again the wholly unsatisfactory and inadequate nature of the inspection arrangements.

8.95 The inspection of the electrical installation carried out, for which the Electrical and Public Lighting Department was responsible, was also not adequate. An adequate inspection would have revealed the defects in the installation of which details are given in Chapter 1 (see para. 1.214); and in particular, the absence of lids on so much of the trunking would have been drawn to the attention of the management.

8.96 It is also clear that, although such inspections as were carried out revealed serious breaches by the management of the bye-law requirements in relation to the locking and obstruction of exits, the action taken by the Corporation to secure compliance with these crucially important requirements was seriously inadequate. No prosecution was instituted at any stage in respect of these breaches. This is no reflection on Mr Martin Donohoe who, in carrying out his inspections, went beyond what was strictly required of him.

The Tribunal's conclusions as to the shortcoming in the rescue operations conducted by the Fire Brigade on the night of the fire are contained in Chapter 4, Part X. The grave inadequacies of both the fire-fighting service and the Fire Prevention Department of the Dublin Fire Brigade, established in evidence at the Tribunal, were primarily the responsibility of Dublin Corporation. In particular, the responsibility must rest with the Chief Fire Officer, the late Captain O'Brien, and with the City Managers and Assistant Managers who had responsibility for the matter in the years preceding the fire. In fairness to both Captain O'Brien and the management of the Corporation, the fact was that much of the difficulty encountered in relation to staffing, particularly in the Fire Prevention Department, was due to problems of pay structures and trade union objections to staff reorganisation. It was clearly not within the capacity of the Corporation to resolve such difficulties at a local level. So far as the inadequate training of Fire Brigade personnel was

concerned, the Corporation were also clearly handicapped by the absence of courses in such training in this country.

8.98 The same considerations do not apply, however, to the inefficient nature of the rescue operation on the night of the fire, which was primarily the responsibility of the officials already referred to.

Ill — THE RESPONSIBILITY OF THE DEPARTMENT OF THE ENVIRONMENT

8.99 There were two specific areas of responsibility in the case of the Department of the Environment. In the first place, they were empowered by virtue of Section 86 of the Planning Act, 1963 (when operative) to make building regulations which were intended to be applicable throughout the State and to replace local bye-laws where they existed (see para. 1.102). In the second place, they exercised a supervisory role under the Fire Brigades Act, 1940, in relation to the discharging of their functions by local authorities.

(1) The Draft Building Regulations

8.100 The absence of a modern code of building regulations having the force of law seriously increased the work-load on the already under-staffed Fire Prevention Department of Dublin Corporation. It was, accordingly, of vital importance that steps should be taken by the Department of the Environment to bring into force, at the earliest possible moment, either a complete code of building regulations or a partial code dealing with fire safety.

8.101 The nature of the problem in the Dublin Fire Brigade was brought specifically to the attention of the Secretary of the Department of Local Government, as it was then called, on the 20th October, 1971, when the principal officer of the Engineering Department forwarded the observations of Captain O'Brien on a ministerial circular of the 31st May, 1971.

8.102 In the course of his observations, Captain O'Brien said:—

> "Plans submitted for approval under the Local Government (Planning and Development) Act, 1963, are referred when necessary to me. The number has grown from 458 in 1963 to 1,937 in 1971 and involved 93 on-site inspections. In the absence of a code of building regulations incorporating structural fire precautions, means of escape in case of fire and means of assistance for the fire brigade I have directed that this part of the work must receive special attention in order to ensure that all the latest standards of good practice in these respects are included in requirements for new buildings and that existing buildings are brought up to a high standard, with particular reference to means of escape at a time when other alterations in the building are proposed. The figure quoted for 1971 refers only to the actual number of plans received at Fire Brigade Headquarters, and gives little indication of the work involved in this section such as the attendance of fire officers at local authority planning meetings for the purpose of determining which plans require to be deferred and making on the spot requirements in the case of minor proposals as well as the numerous meetings with architects and other interested parties in efforts to provide the best possible solution to the many problems involved. This work occupies over 75% of the time of the Fire Prevention Section and in my opinion places an unfair burden on it. It would be a considerable relief if a code of building regulations were available and the bulk of this work transferred to Building Surveyors (specially trained where necessary) in the Planning Department".

8.103 On the 30th November, 1972, the Department of Local Government sent a circular to the managers of local authorities explaining the policy of the Department, which then had an exclusive statutory function in relation to planning appeals, in dealing with fire precaution matters on such planning appeals. In the course of the letter, the difficulties encountered

in incorporating all necessary fire safety requirements in a planning permission were referred to, and the letter then went on:—

> "While it can be argued that a fire escape is a structural feature forming part of the design and layout of the building, it would scarcely be possible to argue that certain other fire precaution requirements are, and so they would all be dealt with under the Building Regulations. Work on the preparation of these is proceeding and priority is being given to the section dealing with fire precautions".

8.104 In November, 1972, the Minister for Local Government appointed a Working Party on the Fire Service. Its report, which was laid before the Oireachtas by the Government in July, 1975, included a recommendation that the sections of the Building Regulations dealing with fire standards and safety should be brought into operation "at the earliest date possible". (While a number of members of the Working Party submitted minority reports, there was no dissent from this recommendation).

8.105 In pursuance of a recommendation by the Working Party, the Minister, by a circular letter of the 28th October, 1976, invited local authorities to submit reviews of the strength and adequacy of the fire service in their respective areas. The review by Dublin Corporation was submitted to the Secretary of the Department of the Environment on the 17th April, 1978, and included the following comment on the operation of the Fire Prevention Department:—

> "Apart from the difficulties experienced in filling positions in this section the activities in this field are seriously hampered by . . . . the absence of building standards which include structural fire precautions, means of escape in case of fire and means of assistance for the fire brigade".

8.106 As already indicated (see para. 1.103) no building regulations had been made at the time of the fire. Mr Aidan McDonald, the Principal Officer in the Housing Administration Section of the Department of the Environment, which had overall responsibility for producing the Building Regulations, said in evidence that they would not now be made before the 1st January, 1983, at the earliest.

8.107 Mr McDonald said that the delay of nearly twenty years in producing building regulations having the force of law was due to a number of factors. In the first place, only six local authorities in the country had made building bye-laws under the Public Health Acts, 1878 to 1964, and new organisations would therefore have to be set up in all the other local authorities in order to administer the regulations. He also said that the Department was aware that those local authorities who did have bye-laws were having considerable difficulty in keeping their staff levels adequate. In the second place, the building industry had urged that the introduction of the regulations in the existing draft form would necessitate a system of inspection and approval by local authorities which would present serious problems for the building industry. The Department considered that these objections were well-founded and that attempts should be made to produce a new control system based on "self-certification" by the industry. (A "self-certification system" means, in essence, that the designer of a building issues a certificate that it complies in all respects with the relevant regulations. Such a system normally envisages the imposition of penalties on the designer in the event of a false or misleading certificate being given). This, he said, would require the introduction of amending legislation to enable such regulations to be made.

8.108 Mr McDonald said that, in addition to these difficulties, there were also staffing difficulties in producing the regulations, due to the frequent transfers to other work of a succession of Assistant Principal Officers dealing with the regulations. At one stage, the Assistant Principal Officer concerned with this work was transferred for ten months to another department dealing with the preparation of legislation in connection with the Parliament of the EEC.

(2) The Supervisory Role of the Department of the Environment

8.109 The responsibility for fire prevention and fire-fighting throughout the State was imposed by Section 2 of the Fire Brigades Act, 1940 (since replaced by the Fire Services Act, 1981) on local authorities. If a complaint in writing was made to the Minister for the Environment alleging that a local authority had failed to comply with the Act, the Minister had power to order an inquiry and direct such steps as he considered reasonable to be taken by the local authority to remedy the failure. The evidence established that, while a general complaint had been made by the Chief Fire Officers' Association that no local authority in the State had fulfilled its duties under the Act and a specific complaint had been made in relation to the County Borough of Limerick, no complaint had been made under the section in relation to Dublin Corporation's discharge of its duties under the Act.

8.110 The Minister also exercises certain statutory functions in relation to the staffing of the fire service. Under the Local Government Acts his consent is required to the creation of additional offices, the declaration of qualifications for officers' recruitment procedures, discipline, remuneration, superannuation and other general conditions of service. His consent is not required to the recruitment of servants, i.e. in the case of the fire brigade, all ranks below the level of district officer.

8.111 In addition to these express statutory functions, the Minister had, in practice, other methods of influencing the operation of the fire service. In the first place, borrowing by local authorities for investment in the fire service is subject to the sanction of the Minister. In the second place, the Department accepts that it has a general advisory role in relation to the operations of local fire services. This function is discharged by the Fire Adviser to the Department.

8.112 The letter dated the 17th April, 1978, from the then Dublin City and County Manager, Mr James Molloy, which accompanied the review of the Dublin fire service, contained the following observation:—

> "The review demonstrates time and again the immense problems caused in the efficient operation of the fire service by the differential in pay existing between operational and staff positions through the payment to the former for the working of unsocial hours. The repercussions of the non-filling of non-operational posts and the restrictions on the payment of unsocial hours to those normally receiving it, is felt throughout the service particularly in relation to training (including the training of a sufficient number of drivers for fire appliances and ambulances), maintenance of equipment and fire prevention. I am informed by the Chief Fire Officer that there is great dissatisfaction among the more senior officers about the present pay structure and that morale is seriously affected. The review proposes a new organisation structure for the fire service which will require an adequate pay differential between the different levels of responsibility. This matter needs urgent attention".

8.113 The review, which was carried out by Mr Ua Muirgheasa, the Assistant City Manager to whom the fire functions had been delegated, assisted by the Principal Officer (Engineering Department) and Captain O'Brien, said the following in relation to the unsocial hours problem:—

> "The award by the Labour Court of unsocial hours pay to ranks employed on shift work has highlighted the fact that the remuneration of senior grades has not kept pace with that of the lower grades and a Third Officer may now have less 'take home pay' than a Station Officer even though he is required to be available to respond to fires at night and at weekends. It also means that officers of the rank of District Officer, Station Officer and Sub-officer cannot be employed on special duties of a continuous nature such as fire prevention, administration, technical services and training which would result in a loss of unsocial hours pay. It also means that such officers, together with firemen, cannot be sent on courses of training which would result in a loss of unsocial hours pay. This is a

very unsatisfactory position and a serious threat to efficiency, discipline and morale".

8.114 The review recommended that:—

(i) the wages and salaries of all ranks should be fixed in relation to the basic pay of a fireman, so that at all times there was a reasonable differential between the maximum of each rank and the minimum of the rank immediately above it;

(ii) unsocial hours pay should be applied to all officers who were required to be available to respond to fires and other incidents at night and weekends; and

(iii) unsocial hours pay should be applied to all ranks who were required to attend courses of training either as students or instructors in the same way that it was applied to personnel on annual leave.

8.115 Mr Brian Breathnach, a Principal Officer in the Local Administration Section of the Department, said that had specific proposals been submitted along these lines, they would not have been approved by the Department. He said that they would have had serious repercussions in other areas of the public sector and that, in particular, they would have had four anomalous and undesirable consequences:—

(a) they would have given the benefit of unsocial hours payments to personnel not actually working unsocial hours;

(b) they would have given cause for grievance to employees who had to work the unsocial hours;

(c) they would have had undesirable repercussions in other areas of the public service where unsocial hours payments are made; and

(d) in the long run, the situation would revert to the present situation, since there would probably be pressure for the restoration of a further unsocial hours differential from the employees actually working unsocial hours.

8.116 Mr Breathnach also said that the Corporation's proposal to relate the pay of all ranks, including professional officers, to the pay for firemen, would have the result that internally promoted firemen who would not normally have formal qualifications, would be paid more than senior officers in engineering and related grades in other services. He said that this would lead to salary claims by other local authority engineering grades and was in any event "a significant departure from the well established methods of pay determination in the public service as a whole and .... unsound in principle".

8.117 Mr Breathnach said that, in April, 1979, agreement was reached at national level between the Local Government Staff Negotiation Board and trade unions representing Local Authority Engineers on a package of productivity/flexibility measures which required the introduction of a new grading structure to facilitate their implementation. The agreement applied to all local authority engineering and cognate grades, including grades in the fire service. It provided for the creation of a new local authority engineering grading structure with new qualifications and particulars of office for the newly created grades, and for negotiations to be held locally to determine the number of new posts to be created in each local authority under the new structure. Pending the introduction of the new structure in each authority, it was necessary, in order to reach agreement, for the management side to concede that no new posts would be created or open competitions held for posts at the relevant level. Under the terms of the agreement, all existing officers in the grades affected, except County and Deputy County Engineers and their equivalent, had to compete, through the local appointments commission, for appointment to the new grades.

8.118 Mr Breathnach said that Dublin Corporation was represented on the management team that negotiated the 1979 agreement. The negotiations on the implementation of the agreement in individual local authorities continued up to late 1980, so that the Corporation

was prevented from having open recruitment to engineering grades generally up to that time.

8.119 In accordance with the conciliation agreement, the Corporation submitted for approval a revised structure of professional grades of the fire service on the lines envisaged in the agreement. This revised structure, which was different from that outlined in the review, was sanctioned by the Department.

8.120 In May, 1981, the Corporation put forward new proposals to the Department as to how posts at different levels should be filled. In particular, they suggested that Third Officers, who are not required to have formal academic qualifications, should be placed on the same salary scale as senior engineers in Dublin Corporation. This would have meant that Third Officers would be on a higher scale than 85% of the professionally qualified officers of the Corporation. These proposals were also rejected by the Department because of the repercussive effects on other salaries and grading structures within the Corporation, in the rest of the local authority service and throughout the public sector. Mr Breathnach said that the Department indicated to the Corporation that it was anxious to assist in the strengthening of the fire service and would consider, without delay, any revised proposal that the Corporation had. He said that the Corporation had since made a further submission on the matter and that discussions with them were continuing.

8.121 Mr Breathnach said that the Department had frequently urged the Corporation to try to introduce greater flexibility into the non-professional staffing of the fire service by rostering fire prevention duties among all the District Officers. He said, however, that the Department had been informed by the Corporation that the staff concerned had opposed it and that the question of securing more flexible arrangements was being pursued by the Department.

8.122 Mr Breathnach said that, while staff training was primarily a matter for the local authority, the report of the Working Party had indicated the need for a comprehensive programme of education and training for the fire service. Arising out of this, a sub-committee on central training arrangements for the fire services was established in October, 1975, under the Local Government Manpower Committee (which advises the Minister on manpower needs and related matters). The Sub-committee reported in December, 1977 and their report was circulated to all local authorities and was regarded by the Department as a reasonable basis for the provision of central training courses to supplement local training arrangements. The Department had introduced a scheme in March, 1981, providing for the payment of a subsidy of 50% of loan charges in respect of loans raised by local authorities for fire service projects, including training facilities. In addition, the Department was endeavouring, in consultation with the staff side, to arrange a diploma-level course covering fire prevention and fire-fighting for fire services personnel generally at one of the regional colleges.

8.123 The Sub-committee on central training arrangements had also issued an interim report in August, 1976, recommending that breathing-apparatus training be given urgent consideration. The Department had, accordingly, given priority to breathing-apparatus courses with the aim of creating a corps of qualified instructors throughout the fire service including Dublin, in the use and maintenance of breathing-apparatus. Dublin Corporation had nominated personnel for attendance at such courses and seven of the nominees had qualified as instructors. The Department had also arranged other courses, including a general course for Chief Fire Officers. In September, 1980, the Department issued guidelines on recruit training, and in April, 1981, comprehensive guidelines on the use of breathing-apparatus.

8.124 Mr Breathnach said that it was thought in the Department that the most effective way of establishing a continuing, comprehensive programme of training for all fire services personnel was through the setting-up of a statutory body, and that it was proposed to establish such a body—to be described as the Fire Services Council—in the Fire Services Bill, 1981. Since the hearings concluded, the Fire Services Act, 1981, containing a provision for the establishment of such a body, has become law.

(3) Conclusions

8.125 The Tribunal accepts that the Department of the Environment were obliged to assess, with the greatest care, the difficulties involved in introducing building regulations having the force of law. A delay, however, of just under twenty years in introducing such regulations is wholly unacceptable. The attention of the Department had been drawn on more than one occasion during the decade preceding the fire, to the serious additional work-load being imposed on the Fire Prevention Department of Dublin Corporation because of the absence of such regulations. This, coupled with the knowledge possessed by the Department as to the grave difficulties being experienced by the Corporation in adequately staffing that Department, should have led to this matter being dealt with as one of the greatest urgency. It was deplorable that, far from it being treated as a matter of urgency, the Department official principally concerned with the regulations was transferred to other work for a period of nearly a year.

8.126 The Tribunal is satisfied that, following the submission by the Corporation of the 1978 review, accompanied as it was by a clear warning from the then City Manager as to the critical state of morale and efficiency in the Dublin Fire Service, the Department should have treated the introduction of the regulations, or at least so much of them as related to fire safety, as an urgent priority. It was the responsibility of the Department at that stage to warn local authorities throughout the country that the regulations would be introduced within a specified period and that it would be their responsibility to ensure within that time that they were in a position to enforce them. The Department failed to treat the introduction of the regulations as the urgent matter which it clearly was.

8.127 The manner in which the Department carried out their supervisory role must next be considered. The Tribunal was precluded by the Terms of Reference laid down by the Oireachtas from conducting a general investigation into the operation of the fire services in the Republic or even in the Dublin area. The evidence furnished to the Tribunal was, accordingly, limited to the manner in which the staffing problems of the Dublin Fire Brigade were dealt with by the Department in the years immediately preceding the fire.

8.128 It has already been pointed out that these problems were, in some respects, beyond the capacity of the Corporation to solve. The Department, for reasons which are perfectly understandable, declined to approve some proposals advanced by the Corporation with a view to alleviating the problem.

8.129 The population of the area for which the Dublin Fire Brigade was responsible represented over one quarter of the population of the entire country. Dublin is the capital and seat of Government and the Dublin area contains the largest industrial and commercial area in the country, together with the largest seaport and airport. During the period when there was the most rapid expansion in the history of the area, the staff of the Fire Prevention Department actually declined to what can only be regarded, in terms of its workload, as a derisory complement of four officers and one typist. In the view of the Tribunal, the crisis in the Dublin fire service ceased at that stage to be a local problem and become a national scandal. Once the local authority had shown that it was not capable of dealing with a crisis of this magnitude, it became the responsibility of Central Government, and specifically the Department of the Environment, to deal with it as a matter of urgency.

8.130 There was undoubtedly a response of a kind from the Department: the evidence established that they impressed on the Corporation the necessity of adopting new recruiting procedures and, in more general terms, they established what was at least a basis for alleviating the staff problem by establishing the 1979 Conciliation Agreement. It should also be said that, generally speaking, where the Minister was asked to give his sanction to the creation of new offices, it was forthcoming.

8.131 In other respects, however, the response was gravely inadequate. The problems of the Dublin Fire Brigade were not merely a reflection of management/union difficulties common to other branches of the public service: they were inseparably bound up with the absence of training in the Brigade, with all its attendant implications for morale and

efficiency. The Working Party on the Fire Service had expressely drawn the attention of the Minister in 1975 to this problem, and had recommended the establishment of a National Fire Service Training Centre. There was no evidence to suggest that any steps had been taken to implement this recommendation in the period of nearly six years which elapsed between the presentation of the Report and the fire.

8.132 In more general terms, it should have been apparent to the Department of the Environment that the limited role assigned to the Minister under the 1940 Act in relation to the fire services was not adequate in modern conditions, and that amending legislation was urgently required to ensure the more effective supervision by Central Government of the discharge of their fire safety duties by local authorities. The Tribunal is satisfied that the Department of the Environment failed adequately to respond to the grave conditions referred to in the Corporation review of 1978.

CHAPTER 9

Conclusions and Recommendations

CHAPTER 9

Conclusions and Recommendations

PART 1 — CONCLUSIONS

I — THE FIRE

9.1 Forty eight people died as a result of the fire and one hundred and twenty eight suffered injuries sufficiently serious to require their being detained in hospital.

9.2 The fire began in banked seating, upholstered in polyurethane foam with a PVC covering, in a corner of an alcove of the ballroom which was curtained off on the night of the fire.

9.3 The fire was first detected in the form of an increase in heat in the area of the alcove shortly before 01.33. The fire was next detected in the form of a smell of smoke, followed shortly afterwards by the first visual observation of a fire.

9.4 The fire when first seen—at approximately 01.41—appeared to be confined to one seat in the back row of the alcove nearest the Main Bar. It was also seen, however, in its early stages on a number of seats, although visible to some of the onlookers on one seat only. Whether present or not on more than one seat when first seen, it spread with great rapidity to other seats.

9.5 As the fire spread, the roller blind isolating the alcove from the rest of the ballroom was lifted by one or more doormen; and three doormen, a barman and at least one patron entered the alcove with portable fire extinguishers and attempted to extinguish the fire. These attempts were entirely ineffectual.

9.6 While the attempts at extinguishing the fire were still going on, and within a period of two minutes at the most from the blind having been raised the "false" or suspended ceiling which covered the alcove, as well as other areas of the ballroom, began to collapse, flames began to shoot at ceiling level into the rest of the ballroom, and clouds of thick black smoke began to fill the alcove and spread into the rest of the ballroom. At this point, those fighting the fire abandoned their attempts and left the alcove.

9.7 At approximately this stage in the development of the fire, the disc jockey announced

> "We have a slight problem, don't panic. Walk to the nearest exits".

9.8 Almost immediately before the announcement by the disc jockey, a number of the patrons had begun to leave the ballroom in a state of what some of the witnesses described as "panic". Others, however, remained in the ballroom watching the fire, dancing, or, in the case of approximately six people, asleep in another alcove.

9.9 Almost immediately after the disc jockey's announcement, the "panic" increased sharply. The Main Entrance (Exit 2) became jammed for a minute or more with a large crowd of people backing up in the ballroom. Conditions of congestion, also developed at other exits,

but were less acute. At this stage, approximately four minutes after the fire had been first seen, virtually the entire alcove and all its contents were on fire.

9.10 At this point, the lights in the building failed and this also increased the "panic". A number of patrons who were endeavouring to escape found themselves trapped in the toilet.

9.11 The first alarm of the fire by a member of the staff was given in the main foyer at 01.42. A barman rang the fire brigade at 01.43.

9.12 Within the period of five minutes after the failure of the lights, virtually all the contents of the ballroom went on fire. At the beginning of this period, the flames and smoke which had entered the roof void above the suspended ceiling broke through the roof of the building. By the time the first fire brigade appliance arrived (at 01.51) the fire had begun to diminish.

9.13 The first phase of the Major Accident Plan was activated at 02.06 and the second phase at 02.12. The second phase was "stood down" at 02.54, at which point the fire was virtually completely extinguished.

9.14 The fire was probably caused deliberately, the most likely mechanism being the slashing of some of the seats with a knife and the application of a lighted match or cigarette lighter to the exposed foam, or the ignition of newspapers on or under the seats. One of the seats so ignited was in the back tier.

9.15 The rapid spread of the fire was caused by three principal factors:—

(1) the presence of a tier of combustible seats, at least one of which was ignited, against a wall completely lined with carpet tiles having a relatively high surface spread of flame rating and heat evolution;

(2) the presence of large quantities of combustible seating in the alcove; and

(3) the presence of a low suspended ceiling in the alcove which increased the radiation downwards, thus assisting the spread of the fire to the rest of the alcove.

9.16 The floor carpeting in the alcove played a secondary role in the growth of the fire, but did at some critical point assist the spread of the fire from one seat to another.

9.17 The collapse of the ceiling in the early stages of the fire probably slowed down the flow of smoke and combustion products throughout the ballroom to a significant extent and probably resulted in a substantial mitigation in the number of casualties.

9.18 The venting of the fire through the roof probably slowed down the fire spread and may have accounted for the survival of a number of people in the ballroom.

9.19 The raising of the blind did not have any significant effect on the spread of the fire.

9.20 There were no hose-reels in the building and the use of portable extinguishers was entirely ineffective.

9.21 The combustion of the furnishings in the alcove produced quantities of carbon monoxide sufficient to cause or contribute to many of the deaths. The combustion of the PVC covering produced quantities of hydrogen chloride sufficient to cause high levels of irritancy. The combustion of the polyurethane foam produced quantities of hydrogen cyanide, but it was unlikely that the quantities were sufficient to contribute substantially to the total lethal effect of the combustion gases.

9.22 None of the victims suffered significant crush injuries resulting from trampling, "panic" or exit accidents.

II — COMPLIANCE OF THE BUILDING WITH THE APPLICABLE LEGISLATION, REGULATIONS AND GUIDELINES

9.23 Planning permission was required for the conversion of the building into a licensed amenity centre and was obtained by the owners.

9.24 The permission was subject to a condition requiring the applicant to consult with the Chief Fire Officer and to ascertain and comply with his requirements in regard to the prevention of a fire hazard in the development. This condition was not complied with.

9.25 The use of the carpet tiles on the walls of the ballroom and the main entrance foyer was a breach of the requirements of the Chief Fire Officer. The decision to use them was made by Mr Eamon Butterly, the general manager, without the benefit of any expert advice and in reliance on a document from the manufacturer which related to their use as floor coverings and not as wall linings. Neither the owners nor Mr Harold Gardner, the architectural draughtsman whom they commissioned to prepare drawings for bye-law approval, took the necessary steps to ascertain what the requirements of the fire brigade were and to ensure that they were complied with, as required by the planning permission.

9.26 The condition obliging the applicant to ascertain the requirements of the Chief Fire Officer and to comply with them was of dubious legality, but was not objected to at any relevant time by the owners.

9.27 The Building Bye-laws and Public Resort Bye-laws of Dublin Corporation were not applicable to the building, Dublin Corporation having failed to take the necessary legal steps to ensure that they were. They were, however, treated as applicable by all those concerned with the building, and compliance with the Public Resort Bye-laws was expressly required by the licence granted under the Public Dance Halls Act, 1935. The owners applied for approval under both sets of bye-laws and were granted approval in both cases, subject to conditions.

9.28 There were a number of serious instances of failure by the owners to comply with the requirements of the Public Resort Bye-laws:—

(a) the owners did not take due precautions for the safety of the public, the performers or the employees;

(b) timber partitions were used to enclose portions of the building which should not have been so enclosed;

(c) exit doors were persistently locked and chained in breach of the Bye-laws while the public were on the premises;

(d) the means of escape were not kept in an unobstructed condition; and

(e) employees were not allotted specified duties to be performed in the event of fire, and fire drills were never held on the premises.

9.29 The electrical installation was also defective in a number of respects: in particular, trunking lids were not fitted in several areas and conduit fittings were missing.

9.30 No Building Regulations had been made by the Minister for the Environment under the Planning Acts. There were a number of serious failures to comply with the requirements of the Draft Building Regulations issued by the Department of the Environment on the 29th November, 1976:—

(a) some materials used were not of a suitable nature and quality;

(b) the structural fire precautions were inadequate with respect to the main entrance at Exit 2;

(c) the area of the walls covered with carpet tiles having a surface spread of flame rating lower than Class 1 significantly exceeded the permitted area under the Draft Building Regulations;

(d) the travel distances in relation to a number of escape routes in the ballroom significantly exceeded those permitted under the Regulations as then circulated; and

(e) inadequate ventilation was provided in rooms which should have had adequate ventilation.

9.31 There were a number of serious failures to comply with the Fire Protection Standards of the Department of the Environment:—

(a) the wall linings in the ballroom and foyer were not within Class 1 of the surface spread of flame rating;

(b) the fire-fighting equipment was not located in prominent positions at central points in every case;

(c) means of escape were not kept clear and unobstructed to their full effective width;

(d) fire drills were not held regularly or at all on the premises; and

(e) there was no member of the staff responsible for the organisation and supervision of fire-fighting and fire prevention arrangements.

III — RESPONSIBILITY FOR UNSATISFACTORY FEATURES OF THE CONVERSION AT THE DESIGN STAGE

9.32 The unsuitable nature of the main entrance and its non-compliance with the requirements of the Draft Building Regulations were not appreciated by the persons commissioned by the owners to take the necessary steps for securing Planning Permission and Bye-law Approval, Mr William White and Mr Harold Gardner, neither of whom had any recognised professional qualifications. The decision to commission them for this purpose was made by the two active directors of the company which owned the building, Mr Patrick Butterly and Mr Eamon Butterly.

9.33 The unsuitable nature of the main entrance and its lack of compliance with the Draft Building Regulations was not appreciated by the Fire Prevention Department of the Dublin Fire Brigade.

9.34 The Department was grossly understaffed and such staff as there was had not the appropriate specialised training or qualifications.

IV — ENFORCEMENT OF THE LEGISLATION AND REGULATIONS AND INSPECTION OF THE BUILDING

9.35 The condition subject to which the Planning Permission was granted (as to consultation with the Chief Fire Officer and compliance with his requirements) was of dubious legal validity and was not enforced.

9.36 The inspection of the building carried out on behalf of Dublin Corporation was gravely inadequate. No inspections of the building were carried out by any member of the Fire Prevention or Fire-fighting Department of the Fire Brigade from the time it opened to the public until the fire. No proceedings were taken by the Corporation in respect of breaches of the Bye-laws relating to the locking and obstructions of exit doors revealed by such inspections as were carried out.

9.37 Inspections carried out by the Senior Building Surveyor of the Corporation did not result in any action being taken in respect of the carpet tiles on the walls. This was due in part to an unacceptably narrow view taken by him of the requirements of the Bye-laws.

9.38 Mr Eamon Butterly sought deliberately to mislead the Corporation into thinking that the requirements as to the keeping of exits unlocked and unobstructed were being observed.

V — THE EVACUATION OF THE BUILDING

9.39 A prompt and efficient evacuation of the building did not take place. This was due to a number of factors, of which the principal were

(a) the fact that more than one-third of the patrons attempted to leave by the main entrance which was not suitable and did not comply with the Draft Building Regulations;

(b) the locked and obstructed condition of other exits;

(c) the absence of organisational precautions, such as the provision and training of staff and the establishment and maintenance of evacuation procedures and fire routines, drills and practices; and

(d) the rapid spread of the fire.

9.40 One of the emergency exits was locked and chained and two others were obstructed by skips containing empty bottles or by seats. The evacuation was also hampered by the fact that locks and chains were draped across exit doors which were unlocked, in order to give patrons the impression that they were locked.

9.41 The locking and chaining of one of the emergency exits was the result of a policy initiated by Mr Eamon Butterly of having all the emergency exits locked and chained until midnight at the earliest, in order to prevent unauthorised persons from gaining admission to the ballroom.

9.42 The decision to keep the exits locked and chained was made by Mr Eamon Butterly, although the objective which he wished to achieve—of preventing unauthorised persons gaining access to the ballroom—could have been achieved by the employment of additional doormen. This policy was pursued by Mr Butterly with a reckless disregard for the safety of the people on the premises. It was implemented by the head doorman, Mr Thomas Kennan and his deputy, Mr Leo Doyle, although they knew it to be extremely dangerous. Mr Phelim Kinahan, the floor manager, and Mr Jack Walsh, the assistant manager, were also aware of this policy and raised no objection to it.

9.43 No member of the staff was responsible for fire safety. Fire drills and evacuation procedures were never held on the premises. There were no warning notices telling the staff and patrons what was to be done in the event of a fire or other emergency. The fire brigade were not telephoned until 01.43 although the fire had been visible since 01.41.

9.44 The actions taken by some members of the staff to deal with the evacuation were ill-judged: thus one of the doormen wedged the outer door of the main entrance foyer in such a position that it caused conditions of extreme congestion in the main foyer and led to the doors being closed for a short period at a critical time. The side leaves of this entrance remained locked and shuttered throughout the fire. None of the doormen knew that they could be opened.

9.45 There was no arrangement for the making of an immediate and urgent announcement to the patrons in the event of an emergency, and it was left to one of the disc jockeys to make the announcement already referred to. Partly as a result of this, many of the patrons, instead of leaving the ballroom immediately on the appearance of fire, stood and watched the development of the fire, thereby placing themselves in a position of great danger.

9.46 The evacuation was also hampered by the failure of the lighting, which added to the confusion and disorder already prevailing in the ballroom.

9.47 Had the appropriate precautions been in existence to ensure an efficient evacuation on the night of the fire, the injuries sustained would have been unquestionably less and the death toll would almost certainly have been reduced.

VI — THE RESCUE OPERATIONS

9.48 The members of the Fire Brigade carried out their duties on the night of the fire in a dedicated manner and, in the case of those firemen and fire officers who took part in the actual evacuation of the building, at considerable risk to themselves. The evidence clearly established, however, that the management (including the general organisation), the training and the equipment of the Dublin Fire Brigade had not been modernised so as to enable it to cope with a disaster of these proportions in a satisfactory manner.

9.49 There were serious shortcomings in the training of officers and firemen.

9.50 There was no proper command procedure and this led to the inefficient and wasteful use of appliances and manpower at the fire ground.

9.51 The crews were seriously hampered by their lack of knowledge of the building and the location of hydrants, a situation which could have been avoided by a system of pre-fire planning.

9.52 At least six, and possibly eight or even ten firemen were employed in a wasteful and time-consuming search for hydrants, although there were three hydrants inside the grounds of the building itself, one on the road just opposite the building, and a static water-tank in the grounds of the building, the existence of none of which was known to the Fire Brigade when they arrived.

9.53 The lack of co-ordination at the fire-ground was increased by the absence of an "incident control point" and the fact that none of the officers carried personal radios.

9.54 The mobilisation of the necessary appliances from Tara Street FS was unnecessarily delayed because of the out-of-date nature of the Central Control Room. The fireman on duty had to use a dial telephone to alert Kilbarrack FS. There was a serious lack of data in the Control Room and in the appliances themselves which would have been of assistance to the crews travelling to the fire, e.g. details of the building itself and the location of hydrants and other water sources, such as the water tank.

9.55 In the case of one of the appliances, only two sets of breathing-apparatus were carried, although four should have been available.

9.56 The water flow and pressure at the time of the fire were adequate, but the actual pressure in the fire-ground itself was probably for a time inadequate, which may have been due to the length and nature of the hose that had to be laid from one hydrant. This did not, however, materially affect the fire-fighting operation.

9.57 Although injury and discomfort to a number of the survivors would probably have been avoided by a more efficiently mounted rescue operation, no avoidable deaths were shown to have resulted. Had the course of the fire been different, however, the consequences in terms of human lives lost as a result of the deficiencies in the Brigade could have been calamitous.

9.58 The Fire Brigade was seriously hampered by a factor wholly outside its control, i.e. the hysterical behaviour of a large crowd gathered outside the building.

9.59 The first Gardai to arrive at the scene found themselves handicapped by lack of numbers in dealing with the large and hysterical crowd. However, the first Gardai to arrive reacted promptly and correctly by sending for more personnel.

9.60 The actual provision of ambulances was adequate in the circumstances, but again personnel were hampered in the early stages by the behaviour of the crowd.

9.61 There were serious deficiencies in the operation of the Major Accident Plan. The officer in the Central Control Room at Dublin Castle who responded to the Fire Brigade's call had never heard of the Plan. Some of the bodies who were furnished with the Plan and who were expected to assist in its implementation had differing versions of it. The Fire

Brigade officer who decided to activate the Plan requested a Garda to transmit the appropriate message: the appropriate procedure was for the officer—who was, in fact, the Senior Officer of the Brigade then available—to radio himself to the Garda Communications Centre at Dublin Castle.

9.62 The attention of the Tribunal was drawn to extensive reports in the media and on Radio Telefis Eireann that, during the course of the rescue operations, an unnamed person had assisted in the operations by driving a car against one of the exit doors and forcing it open. The person who made this claim, Mr Paul Byrne, gave evidence before the Tribunal and acknowledged that it was a complete fabrication. The Tribunal is satisfied that the statements made by Mr Byrne to the media on this matter were entirely without foundation.

VII — THE INVESTIGATION BY THE GARDAI

9.63 The investigation by the Gardai was carried out under the supervision of Detective Superintendent John Courtney. 1,649 statements were taken by the Gardai from persons who appeared to be in a position to assist the investigation. It was carried out in an exhaustive manner and with a meticulous attention to detail which reflects the highest credit on the officers concerned.

9.64 There were serious shortcomings in the forensic investigation by the Gardai and the Department of Justice. It was not carried out, as it should have been, by a senior Garda officer and the senior scientist in the Forensic Science Laboratory of the Department of Justice. In some instances, samples of material which could have been crucial were not taken and important tests were not carried out.

9.65 Mr Eamon Butterly and some members of the staff—Mr Michael Kavanagh, Mr Thomas Kennan, Mr Leo Doyle, Mr Patrick J. Murphy, Mr Frank Downes and Mr Phelim Kinahan—did not give the Gardai the assistance to which they were entitled in the early stages of the investigation. In the case of Mr Michael Kavanagh, this took the form of a deliberate attempt to deceive the Gardai and the public at large on a matter of the utmost importance, i.e. the question as to whether the exit doors were locked on the night of the fire.

9.66 The suggestion made on behalf of the next-of-kin that the failure to assist the Gardai was the consequence of an organised conspiracy to supress the truth as to the locking of the exits and that two members of the staff in particular, Mr Leo Doyle and Mr John Fitzsimons, were responsible for the organisation of the conspiracy, was without foundation.

9.67 There was also no foundation for the suggestion that any of the members of the staff had been bribed by Mr Eamon Butterly or some other person connected with the management of the building in order to conceal the truth as to the locking of the exits.

9.68 It was suggested to Mr Eamon Butterly during the course of the hearing that he had

(a) forged a document from a security firm purporting to give details of the remuneration to be paid to security men; and

(b) obtained, by fraud, an order from the Circuit Court declaring him entitled to an Intoxicating Liquor Licence.

Both suggestions were without foundation.

VIII — RESPONSIBILITY FOR THE DISASTER OF THE OWNERS AND THEIR ADVISERS, THE CORPORATION AND THE DEPARTMENT OF THE ENVIRONMENT

9.69 The low level of professional expertise availed of by the owners contributed specifically in two respects to the scale of the disaster. In the first place, it led to the carpet tiles being

used as wall linings. In the second place, it meant that inadequate consideration was given to the suitability of the main entrance foyer. Both features constituted a non-compliance with the Draft Building Regulations.

9.70 Mr Patrick Butterly and Mr Eamon Butterly failed to ensure that the preparation of the drawings for the conversion and the supervision of the work of conversion itself was undertaken by properly qualified and experienced persons. The persons actually commissioned to do this work, Mr William White and Mr Harold Gardner, had not suitable qualifications and experience.

9.71 Mr Eamon Butterly and Mr Patrick Butterly made it repeatedly clear that they regarded their responsibilities in relation to ensuring the fire safety of the premises as being discharged once they had satisfied Dublin Corporation's requirements. This was entirely unacceptable.

9.72 The inadequate consideration given to the drawings by Dublin Corporation, the inadequate inspection of the building and the serious deficiencies in the fire prevention and fire-fighting services of the Corporation all contributed significantly to the disaster. The responsibility for these matters ultimately lay with the Chief Fire Officer, and the City Managers and Assistant Managers with responsibility in these areas in the years immediately preceding the fire.

9.73 The Department of the Environment bear a share of the responsibility for the scale of the disaster in three areas:—

(a) their failure to make Building Regulations under the Planning Acts, notwithstanding the lapse of a period of nearly twenty years since the enactment of the legislation, a failure which greatly increased the workload on the already overburdened and understaffed Fire Prevention Department in Dublin Corporation;

(b) their failure to respond to the crisis of morale and efficiency in the Dublin Fire Brigade, although warned of its seriousness by the then City Manager in 1978; and

(c) their failure to ensure that adequate training facilities existed for firemen and fire officers in Ireland, although they had been advised as far back as 1975 of the importance of establishing a national training centre for such personnel.

IX —GENERAL

9.74 The tests carried out for the purposes of the Inquiry established that it was not easy to measure certain significant characteristics of materials, and that other characteristics which could indicate the fire risk more accurately were not included within the tests. New tests and changes in the existing testing procedures are, accordingly, required.

PART 2 — RECOMMENDATIONS

I — INTRODUCTION

9.75 There are serious shortcomings in the approach to fire safety in Ireland which must be remedied as a matter of urgency.

A fire safety code is concerned with two principal areas: *fire prevention and fire protection.* Fire prevention is concerned with ensuring that fires do not start in the first place. Fire protection is concerned with ensuring that, once a fire has started, the damage to persons and property is limited so far as possible.

9.76 Fire prevention, accordingly, deals with matters such as the contents of buildings, including the furniture and the energy systems, the processes carried on in the building, etc. Fire protection can be further divided into two areas, *passive* and *active. Passive* fire protection refers to those features of a building which can be incorporated at the design

and construction stage and which have the effect of containing the spread of fire—such as the use of appropriate wall linings—and of ensuring the safe escape of persons in the event of fire by the provision of adequate means of escape. *Active* fire protection is concerned with ensuring that a system exists under which fires are detected and extinguished with as much rapidity as possible, by the use of alarm detection and sprinkler systems, the provision of portable extinguishers and hose reels, the presence of a trained staff capable of dealing with a fire in an emergency, the holding of fire drills, organisation of evacuation procedures, etc. In broader terms, it should include the provision by either the central or local authority of a properly staffed and equipped fire brigade capable of minimising the loss of life, injuries and damage to property caused by fire.

9.77 It is clear that Ireland is in urgent need of a modern fire safety code, embodied in appropriate legislation and regulations, and implemented by effective fire safety organisations.

II — EDUCATION AND TRAINING IN FIRE SAFETY: THE BACKGROUND

9.78 The knowledge as to fire safety which should reasonably be required of anyone must depend on the role in society of the person concerned. At one end of the scale there is the ordinary citizen who may unwittingly cause a major conflagration at home, at work or at recreation. At the other end of the scale there is the scientist whose advice on complex scientific problems is necessary in the framing of effective regulations to provide society with the fire safety it needs. This again is paralleled in the fire-fighting service, where the degree of knowledge which might be expected in the case of a fireman on the fire-ground is manifestly different from that required of the senior officers and, in particular, the Chief Fire Officer seeking to deploy the resources available to him most effectively in a largely urban area with a population approaching one million. Similarly, what is required of an inspector concerned to ensure that emergency exits in any crowded disco are unlocked while the public are on the premises is different from what is required of a Senior Fire Prevention Officer assessing all the fire safety aspects of a large and complex design. Again, a draughtsman who is part of a team concerned with such a design should not be expected to have the same knowledge of fire safety as the experienced architect or engineer who is heading the design team.

9.79 The means by which the necessary knowledge is conveyed may also vary widely. In the case of the ordinary citizen, such knowledge as he needs is probably best disseminated at the school level and through publicity in the media.

9.80 It is obvious that in the immediate aftermath of the disaster, there has been a heightened awareness of the importance of fire safety among the public at large. The danger is that, as its impact fades with time—except among those directly affected—this awareness may begin to diminish. The Tribunal recommends that, in order to ensure that the public's appreciation and understanding of fire safety and fire precautions are kept at an acceptable level, there should be a continuing programme of dissemination of information at both the school level—where the necessary information can be conveyed, in part at least, simply and effectively by posters—and in the media. A programme of this nature is already the responsibility of the Fire Prevention Council.

9.81 In the case of all fire-fighting personnel, however, the necessary knowledge can only be obtained by a combination of training and experience. An essential feature of any training programme is the existence of a National Training Centre (para. 9.207 below), the curriculum of which necessarily includes some instruction in the aspects of fire safety engineering of particular relevance to the work of firemen and fire officers. In the case of senior officers—in the Dublin Fire Brigade, the Chief Fire Officer and Assistant Chief Fire Officer—the knowledge imparted at the Training Centre should be supplemented by attendance at more specialised courses in the universities or other third-level institutions.

9.82 Attendance at courses of this nature is essential for fire prevention officers, those professionally concerned with the design of buildings, and local authority officers responsible for assessing such designs in the context of fire safety.

9.83 Finally, at the level where scientific advice is required in the framing of legislation and regulations dealing with fire safety and in the supervision by Central Government of the activities of fire authorities at the local level, a significantly more specialised knowledge of the scientific aspects of fire safety is required. This will require attendance at courses of a more specialised nature by some, at least, of the personnel of the Inspectorate of Fire Services recommended to be established below (see para. 9.193).

9.84 Fire safety engineering, properly understood, includes not merely active and passive fire protection engineering—dealing with such matters as the elements in the design of a building which contain the spread of fire and the provision of adequate escape routes—but also "fire science", i.e. fire chemistry and fire dynamics. In addition, it embraces fire-fighting techniques generally, fire safety design and management, fire investigation, the interaction between fire and people, and the management of consumer items and energy sources.

9.85 The evidence established that courses in aspects of fire safety engineering were provided from time to time at third level institutions and in schools of technical education. The existing courses leading to primary degrees in architecture and engineering in the universities naturally include some treatment of aspects of fire safety engineering. These apart, there were and are no specialised courses in this discipline available on a continuous basis in the universities and other third level institutions. The establishment of a university department to deal with all aspects of fire safety engineering is probably not practicable having regard to the available resources: the establishment of courses in those aspects of the subject which are at present not adequately dealt with is, however, not merely practicable but, in the view of the Tribunal, of the highest importance. Thus, courses should certainly be established in fire chemistry and fire dynamics at the university level—and, in time, additional courses might be established in the other more specialised branches of the subject.

9.86 There has been a tendency among students of architecture and engineering to regard fire safety as simply a question of knowing what is required in terms of compliance with the regulations. The recommendation of the Tribunal of Enquiry into the Summerland disaster that those responsible for the design of buildings should treat fire safety as an integral part of the design concept itself, has not yet been reflected in the approach to the subject at university level. There is still clearly a need for a new approach to the structuring of such courses which will in time bring to an end the attitude of mind, too prevalent at the moment, that compliance with fire safety requirements is something that can be dealt with outside the context of the overall design of the building.

9.87 The first beneficiary of the establishment of such courses should be the Inspectorate of Fire Safety recommended to be established by this Report. Their existence should ensure that the personnel of the Inspectorate have a knowledge of fire science sufficient to enable them to give informed and expert advice on the making of regulations relevant to fire safety, their general application and enforcement. The establishment of the new courses generally should also improve the standard of knowledge of fire safety engineering required among those pursuing primary degrees in architecture or engineering. The object should be to ensure that those pursuing such degrees, whether they subsequently become practising architects or engineers concerned with the design of buildings, officers in local authorities concerned with the assessment of such design in the context of fire safety or members of the fire service, have a basic knowledge of the principles of fire safety engineering which includes the principles of fire chemistry and fire dynamics, in addition to the essentials of active and passive fire protection.

9.88 The Tribunal recommends that the Minister for the Environment, through the agency of the Inspectorate of Fire Services, should, in consultation with the Higher Education Authority, take steps to promote the establishment of the appropriate courses in fire safety

engineering in the universities and other third level institutions. The detail of the curricula to be provided is a matter for those concerned with the establishment of such courses. However they are structured, it is essential that there should at all times be continuous co-operation and liaison between the universities, other third level institutions and the National Training Centre in regard to the provision of such courses.

Ill — RESPONSIBILITY FOR FIRE SAFETY

9.89 In the case of all buildings, but particularly buildings where the public assemble, the obligation to ensure fire safety should rest on four parties: the owner, the occupier, the designer and the regulating authority. The fact that the regulating authority is normally responsible not merely for the framing of the relevant regulations but also for ensuring that they are complied with, does not absolve the owner, occupier or designer from ensuring that all reasonable measures are taken for the safety of the public while they are on the premises.

9.90 The extent of this obligation to ensure safety must obviously depend on the nature of the building, its use and the number of people who normally occupy it. The increasing complexity of modern building codes has placed a correspondingly greater burden on local authorities responsible for their administration and enforcement; and this has led to some support for the view that the emphases of such codes should be on a system of "self-certification" or "self-regulation". Such systems require the designer and the builder or, indeed, a specialised agency advising on the matter, to certify that a building has been designed and constructed in accordance with the relevant building code; and impose heavy penalties on those who sign false or misleading certificates.

9.91 Such a system would deal with matters other than fire safety; and its desirability and practicability raise questions outside the scope of this Report. It is sufficient to say that, in the opinion of the Tribunal, its adoption in the area of fire safety is clearly undesirable, although its merits in other areas of building control are clear. The first object of any fire safety code is the protection of life; and it is essential, in the view of the Tribunal, that the public authorities should continue to play a central role in ensuring that this object is achieved.

9.92 This is not to say that owners, architects and engineers should be relieved of the clear duties that they owe to take care in certain circumstances for the safety of other persons. However, to relieve the public authorities of their responsibility in this area would be to confer an immunity on them which they do not enjoy in other areas. Recent decisions of the Courts in the United Kingdom *(Button v. Bognor Regis UDC (1972) 1 QB 373; Anns and Others v. Merton London Borough Council (1978) AC 728)* have made it clear that, where local authorities enjoy powers of inspection and control in relation to buildings, they are obliged to take reasonable care to ensure that these powers are used by them in such a manner as to avoid damage to property, e.g. by making proper use of them to inspect foundations of buildings before they are covered up. It is clear from the decision of the Supreme Court in *Siney v. Dublin Corporation ([1980] IR 400)* that the general principles underlying these decisions will probably, in the future, be adopted by our Courts. In the view of the Tribunal, it would be anomalous and unacceptable to adopt a different principle in the field of fire safety, where as much as, or possibly more than the stability of structures is at stake.

9.93 There is also a serious practical difficulty as to the qualifications and experience required of those who certify that buildings, in fact, comply with regulations. Mr McDonald, of the Department of the Environment, said that the approach being adopted, after discussion with the relevant institutions, was that a person with professional qualifications in architecture and engineering and at least two years' experience of building construction should be capable of acting as a certifier.

9.94 For such persons—or even persons with greater experience—to be acceptable as certifiers in the field of fire safety, knowledge of fire safety engineering in Ireland would require to be far more extensive than the evidence indicated it to be. The absence of courses in fire

safety engineering indicates, in the opinion of the Tribunal, that there is a long way to go before a sufficient corps of certifiers with the requisite knowledge and skills will be available to justify the introduction of a system of self-certification.

9.95 The Tribunal accepts that it would be desirable and in the public interest that the level of expertise and knowledge in the professions as to fire safety should be increased and more widely disseminated. It may well be that, in the future, this may be achieved by a form of self-certification imposing a greater onus than at present exists on persons who assume the responsibility for the design and construction of buildings in which fire safety considerations are particularly relevant. This should not, in the view of the Tribunal, in any circumstances lead to a situation in which local authorities are relieved of their fundamental responsibility to ensure that the public are protected from fire hazard, whether that fire hazard is the result of lack of professional expertise in the design of a building or arises from any other cause.

IV — THE ADEQUACY OF THE EXISTING LEGISLATION AND REGULATIONS

(1) General

9.96 There is no legally enforceable system of universal application in the Republic of Ireland which requires the fire safety aspect of all new buildings to be considered before permission for their erection is granted. Fire safety control, in the case of new buildings, is exercised only through the legally questionable, and in practice unenforceable, machinery of the Planning Acts, and in such areas as they are enforced, local Bye-laws, which in the case of Dublin are in many respects out of date.

9.97 The Fire Services Act, 1981, replacing the Fire Brigades Act, 1940, contains provisions enabling fire authorities to serve Fire Safety Notices and to apply to the High Court for orders restraining the use of buildings which are considered to be fire hazards. These provisions are, however, concerned only with existing buildings.

9.98 The Minister for the Environment has power under Section 86 of the Planning Act (when operative) to make building regulations, including regulations relating to fire precautions. At the time of writing, no regulations have been made under this section.

(2) The Draft Building Regulations

9.99 The presence of the wall linings with their low surface spread of flame rating played a major part in the disaster. In addition, the unsatisfactory nature of Exit 2 was a contributing factor in the deaths and injuries. Had the express requirements of the Draft Building Regulations in relation to both these matters been enforced and observed, the consequences of the disaster might have been significantly diminished. It is entirely unacceptable that the Regulations dealing with matters of this nature should continue to be of no legal effect. In addition, the absence of enforceable regulations has greatly increased the workload on the already under-staffed Fire Prevention Department of Dublin Corporation.

9.100 The Tribunal accordingly recommends that the Minister for the Environment brings into force Section 86 of the Planning Act, 1963, and makes immediate use of his power under the Section to make building regulations. Such regulations should incorporate the recommendations of the Tribunal.

9.101 It is obviously important that such regulations deal not merely with fire safety, but also with the other matters which normally come within the scope of such regulations, e.g. the strength and stability of structures, ventilation, sound insulation, etc. It would, of course, be preferable that such regulations be not introduced piecemeal. Since, however, there is no prospect of bringing the current Draft Regulations into force before the 1st January, 1983, at the earliest, the Tribunal has no doubt that there is no alternative to the bringing into force as soon as possible of such parts of the Draft Regulations as deal

with fire safety, incorporating the latest amendments circulated in February, 1981, and the amendments recommended by the Tribunal. Making every reasonable allowance for the necessity of incorporating the recommended amendments in the form of enforceable regulations, the Tribunal sees no reason why the Regulations incorporating these amendments should be made any later than three months from the presentation of this Report.

9.102 The following are the portions of the Draft Building Regulations which require introduction as soon as possible.

Part A

9.103 This part should be introduced in its entirety, with such amendments as are necessary if only the parts dealing with fire safety matters are being introduced.

9.104 In order to enable a more flexible approach to be adopted to Places of Assembly, it is recommended that the definition of "Places of Assembly" in the table of "Purpose Groups" should be further sub-divided. Such buildings clearly present very different levels of hazard, depending on their nature, and three broad types of risk can be distinguished. In the first category (Group A Occupancy), there are places of assembly, such as open-air sporting and recreation grounds, which present a low level of fire risk. In the second category (Group B Occupancy), there are building such as non-residential colleges and schools, churches, museums, art galleries, libraries, etc., which present a medium level of fire risk. In the third category (Group C Occupancy), there are buildings such as theatres, cinemas, restaurants, discos, public houses and dance halls which present a high level of fire risk. It is with this third category that this Report is principally concerned.

9.105 An appropriate model, in the opinion of the Tribunal, for such a sub-division of Places of Assembly can be found in Schedule 1 of the Building Standards (Scotland) Regulations, 1981 *[see Appendix 11).*

PartB

9.106 Part B should be introduced in its entirety with such amendments as are required by its being confined to fire safety matters.

Parts N, P and Q

9.107 Parts N, P and Q should be introduced in their entirety.

Parts R and S

9.108 So much of Parts R and S should be introduced as relates to fire safety.

9.109 Schedules 1,2,3, 4, 7, 8 and 9 should be introduced in their entirety.

9.110 The existing Draft Building Regulations do not deal at all with the subject of electrical installations in buildings. This omission is of particular significance in relation to fire safety. It is essential that the regulations, as introduced, should contain their own code relating to electrical installations and incorporate the requirements of the ETCI Rules and the requirements of the Regulations for Electrical Installations (15th Edition, 1981) issued by the Institution of Electrical Engineers. In the case of places of assembly, the code should be modelled on the relevant sections of the Places of Entertainment Technical Regulations of the GLC.

9.111 The introduction of the Building Regulations will impose a heavy additional workload on local authorities. The Tribunal recommends that the Department of the Environment should direct local authorities to take steps, as a matter of urgency, to recruit and train the staff necessary to implement the Regulations.

9.112 The Building Regulations when introduced will, of course, need to be regularly reviewed, both in the light of their actual operation and developments in this and other countries in relation to fire safety. Under the present system, the preparation of such regulations appears to be primarily the function of the Housing Administration Section of the Department of the Environment, although comments on the Draft Regulations were furnished to that section by the Fire Adviser to the Department, Captain John Connolly. The Tribunal is of the opinion that there should, in the future, be a clearly defined obligation to consult with the Inspectorate of Fire Services, recommended to be established in para. 9.193 before making such regulations insofar as they relate to fire safety.

(3) Places of Assembly

(i) *New Buildings*

9.113 The question of what special controls should be applied to places of assembly—i.e. places where the public regularly assemble in significant numbers—in addition to controls already existing, either in the form of local bye-laws or various licensing codes, is a complex one. The magnitude of the Stardust disaster should not be allowed to obscure the fact that, according to the latest figures available from the Department of the Environment, the majority of deaths and injuries from fire occur in private dwellings *(see Appendix 10)*. The statistics available from the UK Home Office also indicate that, of buildings other than private dwellings, those most vulnerable to fires which cause either death or injuries or both are hotels, boarding houses, mental hospitals and old peoples homes*. Any new system of control for Places of Assembly must be carefully assessed as to (a) its necessity and (b) its effectiveness, in order to ensure, particularly in the case of an economy as small as ours, that the limited resources available are deployed as effectively as possible.

9.114 Special controls over places of assembly are normally contained in two types of regulations:—

(i) particular building regulations which deal with matters peculiar to such places of assembly, such as safety curtains and proscenium arches in theatres, etc; and

(ii) management regulations which deal with the day-to-day operation of such places of assembly and cover matters such as the maintenance of exits in an unlocked condition, the holding of fire drills, etc.

9.115 In some cases—as in the case of regulations made by the Greater London Council—there are two sets of regulations dealing with these separate areas. The Public Resort Bye-laws in existence in Dublin deal with both matters in one set of regulations.

9.116 The Public Resort Bye-laws, which were modelled on the corresponding London Bye-laws in existence at the time of their adoption, provide in some respects a satisfactory and workable code for Places of Assembly. In view, however, of the history of their interpretation, application to extended areas of the city, observation and enforcement as dealt with in earlier parts of this Report, the Tribunal recommends that they be repealed and replaced by new regulations made on a national basis.

9.117 The Building Regulations, which the Tribunal has recommended should be introduced immediately, should contain particular regulations applicable to Places of Assembly in Group C Occupancy for which the most acceptable model is the Places of Public Entertainment—Technical Regulations of the Greater London Council. In addition, they should include the detailed provisions referred to subsequently.

9.118 Management regulations should be made by the Minister for the Environment under Section 37 of the Fire Services Act, 1981, care being taken that they do not duplicate the requirements of the Building Regulations. These Regulations will, of course, apply both

*"Future Fire Policy: A Consultative Document": HMSO (1980) and "Review of Fire Policy and Examination of the Deployment of Resources to Combat Fire": Home Office (1980).

to existing and to new buildings. The Tribunal recommends that Section 37 should be amended so as to make it clear that regulations made under this section by the Minister are intended to be in addition to, and not in substitution for, building regulations made under the Planning Acts. The model for the Management Regulations should be the Places of Public Entertainment Regulations (Management) of the Greater London Council, adapted, where necessary, to Irish conditions.

(ii) ***Existing Buildings***

9.119 The alterations in the law already proposed will not deal adequately with existing buildings used as Places of Assembly. They will not be covered by the Building Regulations, unless special provision is made to that effect although they will, of course, be subject to the new Management Regulations.

9.120 Many of these are subject to regular inspection under one or other of the licensing codes dealing with intoxicating liquor, music and singing, dancing and gaming. These controls exist because of the social objectives of the relevant legislation: fire safety is a somewhat fortuitous by-product.

9.121 It is also by no means clear that all premises which are at risk necessarily come within the ambit of the annual renewing sessions of the licensing courts. This may be because of the fact that the premises are used only occasionally for public entertainment or because the activity being carried on does not require a licence.

9.122 The Tribunal has therefore considered the possibility of legislation on the model of the English Fire Precautions Act, 1971, which provides for Fire Certificates to be issued by a fire authority in respect of premises put to uses designated by the Home Secretary. To date in the United Kingdom, the only uses designated have been (a) hotels and boarding houses and (b) factories, offices, shops and railway premises. (The latter extension was intended to rationalise existing legislation). The Home Office review suggests that, in terms of cost effectiveness, i.e. the comparative costs of compliance and enforcement, the designation of places of public resort would not be justified.

9.123 The approach in the UK may well, in part, reflect a higher standard of fire safety generally, better staffed fire prevention departments, better systems of inspections, more rigorous insistence by local authority on compliance with regulations, and greater adherence by the managers of such places to the relevant regulations. The absence of some or all of these factors in Ireland suggests the necessity, in the light of the Stardust experience, of insisting on extending the areas of control in existing places of assembly. It is unrealistic to suppose that, notwithstanding the Stardust disaster and any recommendations of the Tribunal, one will overnight have a situation in which all these factors will have been eliminated.

9.124 The growing number of disco and similar premises in the Dublin area, many of them in basements, weighs down the balance decisively in favour of a system under which the area of control is extended in the case of existing places of assembly. Accordingly, the Tribunal recommends that those sections of the Building Regulations which deal with means of escape—including the new provisions recommended to be included in paragraphs 9.155 to 9.159 inclusive below—should be applicable to existing places of assembly in Group C Occupancy. In addition, those sections of the Building Regulations which deal with wall linings (paras. 9.130 to 9.131), floor coverings (paras. 9.141 to 9.144), warning and detection systems (paras. 9.145 to 9.148), sprinkler systems (paras. 9.151 to 9.153), wiring of emergency lighting (para. 9.154), displaying of plans (para. 9.160) and isolation of kitchens (para. 9.162) should be applicable to existing places of assembly in Group C Occupancy. This will necessitate an express requirement in the new Management Regulations that all such places of assembly comply with the requirements of the Building Regulations just mentioned, it being made clear that such requirements can in no circumstances be more onerous than the requirements contained in the Building Regu-

lations. These requirements should be subject to dispensation or relaxation in particular cases (see para. 9.164).

9.125 The Tribunal further recommends that the Fire Services Act, 1981, should be amended so as to include a requirement that, in the case of any places of assembly, existing or proposed, in Group C Occupancy with an occupant capacity in excess of one hundred, it shall be unlawful for the premises to be open to the public until such time as a Fire Certificate has been issued signed by the Chief Fire Officer, specifying the particular use which the certificate covers, the means of escape in case of fire, the means of fighting fire and the warning system (if any).

9.126 There should be special provisions enabling the local authority to issue "Occasional Fire Certificates" in the case of buildings and other constructions in Groups A or B Occupancy which are used occasionally for potentially hazardous purposes, such as the holding of dances, etc. These would include buildings and constructions such as schools, parish halls, marquees, etc. In these cases, the fire authority should have a discretion to dispense in the Occasional Certificate with all or any of the normal requirements of the Fire Certificate. They should, however, be empowered to require the licensee to make special arrangements with the fire brigade to provide proper fire protection on such occasions enabling the fire authority, where appropriate, to require the payment of a stipulated fee in respect of the provision of such protection.

9.127 The owner of the building should be under a statutory duty to notify the fire authority of any alterations in, or additions to, the building or its contents, or of any changes in the use being made of it, subsequent to the issuing of the Fire Certificate.

9.128 The Tribunal also recommends that there should be a requirement that the fire certificate issued under the Fire Services Act, 1981, in respect of any place of assembly shall be at all times displayed in a prominent position, to be approved by the fire authority, in the premises to which it relates.

V — SPECIFIC REQUIREMENTS TO BE INCLUDED IN BUILDING AND MANAGEMENT REGULATIONS

9.129 The experience of the fire suggests that, in the case of places of assembly in Group C Occupancy certain precautions must be regarded as essential. The relevant areas are as follows:—

(1) Wall Linings

9.130 In the case of all such places of assembly, the use of wall linings other than those in Class 1 should be prohibited. The exemption for a limited area as extensive as that permitted by Regulation N13 of the Draft Building Regulations is dangerous: it might have enabled the applicant in the present case to argue that, had the rest of the ballroom other than the West Alcove been covered with Class 1 lining, he was entitled to use Class 3 lining on this alcove. It should be sufficient to permit an exemption for an area not greater than $20m^2$, the area permitted by the Draft Building Regulations for dwellings and institutional buildings. The area of 20 m^2 permitted by such an exemption should be provided in separate areas, each not greater than 5 m^2 and spaced at least 2 m apart.

9.131 In the case of all premises with a regular occupancy in excess of one hundred, Class 0 should be required. In the case of basement premises, Class 0 should also be required.

(2) Furniture

9.132 The Tribunal has found in Chapter 7 that the presence of the seats in the West Alcove was a major factor in contributing to the disastrously rapid spread of the fire. The form of upholstering used—polyurethane foam covered in PVC-coated fabric—is widely used in places of assembly throughout Ireland and in many private dwellings as well. There are, at present, no statutory or other controls on the use of furnishings of this type in

places of assembly: the only statutory control on furnishings are the regulations requiring that where it is sold for ordinary domestic use, it should carry a warning label. The question as to the appropriate control which should be imposed in relation to its use in places of public assembly is one that requires the most serious consideration.

9.133 The Tribunal is satisfied, in the light of the evidence, that regulations prohibiting the use of polyurethane foam and PVC covering as upholstery in places of assembly would not be the most effective method of dealing with the problem posed by such synthetics. An internationally accepted standard for assessing the performance of seating units from the fire safety point of view does not exist and must await the conclusions of research now being undertaken in the UK and elsewhere. It is also clear that the use of retardants and inter-linings, while they can be of assistance, again does not provide an answer to the problem.

9.134 The danger created by the presence of furniture of this nature will, in the view of the Tribunal, be significantly reduced if other precautions recommended by the Tribunal are adopted. The obligatory use of Class 1 or Class 0 wall linings has already been referred to: in the later stages of these recommendations, the Tribunal also recommends, as compulsory requirements in defined circumstances, the physical separation of the furniture from the wall linings and the presence of warning and detection systems and of hose reels. In addition, in certain premises the use of a sprinkler system may, again in defined circumstances, be obligatory under the Tribunal's recommendations; and all the buildings concerned will, of course, be subject to the normal requirements for means of escape, such as travel distances, number of exits, availability of exits and the provision of emergency lighting. The implementation of the recommendations will also ensure, again in defined circumstances, that there is a person responsible for fire safety in the particular premises, there are regular fire drills and rehearsals of evacuation procedures and suitable precautions for the maintenance in an effective condition of all fire protection measures in the building.

9.135 The Tribunal is satisfied that the most effective method of dealing with furniture in places of assembly in the present state of scientific knowledge, is to require that, in the case of all places of assembly all the furniture should satisfy certain requirements of BS 5852: Parts 1 and 2. Part 2 of that standard, which replaces BS DD 58 (see para. 6.72) has been circulated since the public sittings of the Tribunal closed and is expected to be published shortly. It specifies the ignitibility of the furniture when subjected to flaming ignition sources ranging from greater than that of a burning match up to that approximating to four double sheets of full-size newspaper.

9.136 The Tribunal recommends that, in the case of places of assembly in Occupancy Group C generally, the Management Regulations should require that the furniture, when tested under BS 5852: Part 1: 1979 achieves a "pass", and that, when tested under BS 5852: Part 2: 1982, it achieves a "pass" in respect of ignition source 5 (a small crib with a heat output similar to that of one double sheet of normal newspaper).

9.137 It is appreciated that such a requirement does not provide for a more stringent control for higher risk places of assembly. The Tribunal considers that within a period of three years, furniture for places of assembly in Occupancy Group C in basements which have an occupancy in excess of one hundred, should be required to achieve a pass in respect of ignition source 7, i.e. approximating to four double sheets of full-size newspaper. The Management Regulations should be amended to provide for such a requirement in three years.

9.138 A difficulty arises in relation to possible changes in the seating quality and arrangements subsequent to the granting of a Fire Certificate by the fire authority. In the case of buildings used continuously as places of assembly, an adequate system of inspection by the fire authority should overcome this problem.

9.139 There remains the problem of premises used occasionally for Group C Occupancy purposes e.g. schools, parish halls, lecture theatres, etc. The Fire Certificate should not be

issued unless the furniture in such places complies with the requirements of BS 5852: Parts 1 and 2, already referred to in paras. 9.136 and 9.137.

9.140 In the case of all places of assembly in Group C Occupancy, the positioning of 'fixed' furniture closer than 600 mm to a wall lining of Class 1 or lower should be prohibited. It is recommended that this requirement should be waived if (a) a sprinkler system (confined, where appropriate, to the area of risk) is installed in the premises or (b) the owner satisfies the fire authority by the production of appropriate test data that no hazard related to heat output will be presented by the positioning of the furniture.

(3) Floor Coverings

9.141 Although the floor carpeting played a secondary role in the growth of the fire, it did facilitate the spread of the fire from one seat to another at some critical point, thereby accelerating the spread and growth of the fire.

9.142 The Tribunal is satisfied that some degree of control should be extended to the use of floor coverings in places of assembly but should be confined to situations of high risk.

9.143 The Tribunal accordingly recommends that in all places of assembly coming within Group C Occupancy which have an occupancy in excess of one hundred and which are in basements, the regulations should include a requirement that textile floor coverings are tested to BS 4790 (the "hot metal nut method") and give a result in the low radius of effects of ignition in accordance with BS 5287: 1976 (Assessment and labelling of textile floor coverings tested to BS 4790).

9.144 In the case of other places of assembly in Occupancy Group C which are not in basements, the Tribunal recommends that the results of the hot metal nut method should give a medium radius of effects of ignition.

(4) Warning and Detection System

9.145 In the case of all places of assembly coming within Group C Occupancy, a warning system should be essential. The regulations should provide that a warning system must be installed in such premises and must comply with BS 5839: Part 1: 1980.

9.146 The first visible sign of the fire was smoke in the area of the West Alcove at about 01.40. It had been detected even earlier in the form of increased heat. The presence of a heat or smoke detector system might well have led to the earlier discovery of the fire, alerting of the brigade and evacuation of the building.

9.147 In the case of all places of assembly coming within Group C Occupancy, and which have an occupancy in excess of 100, the regulations should provide that a heat or smoke detection system must be installed where it is required by the fire authority. Whether such a system is necessary—and, where necessary, the form it should take—must depend on the nature of the premises and, in particular, the hazard which its contemplated use may present. The fire authority must take this into account before deciding whether such a system is necessary and what form it should take; and, in coming to a decision, should apply the criteria recommended in BS 5839: Part 1: 1980.

9.148 In order to ensure, so far as possible, that persons in places of assembly leave immediately by the nearest exit at any indication of fire, the Management Regulations should expressly require the management to make an immediate announcement—over the public address system, if such exists—in the event of fire, advising persons on the premises, in the interests of their own safety, to leave at once by the nearest available exit. The Tribunal is aware that since the disaster the practice has been adopted in many places of assembly of notifying the patrons of the existence and location of emergency exits. The Tribunal recommends that the Management Regulations should expressly require such an announcement to be made at least once in any period of three hours during which the public are on the premises.

(5) Hose Reels

9.149 In the case of all places of public assembly in Group C Occupancy which have an occupancy in excess of one hundred, the installation of hose reels in positions to be approved by the local authority should be compulsory.

9.150 The installation of hose reels may, of course, be an ineffectual and even dangerous measure if the water supply to the particular premises is not maintained at all times at the appropriate pressure.

(6) Sprinkler Systems

9.151 Had a sprinkler system been in operation on the night of the fire in the West Alcove, it is extremely unlikely that the fire would have spread in the manner that it did. There has traditionally been a tendency in Ireland and the UK to treat such systems as more relevant to the protection of property than of life, but the experience of the fire indicates that this approach requires urgent re-consideration.

9.152 The circumstances in which sprinkler systems should be mandatory require careful consideration. There are many factors which have to be taken into account: the nature of the use of the building, its contents, the readiness of access for the fire brigade, the existence of other precautions in the building, such as hose reels, warning and detection systems, etc. the size of the building itself, and its configuration, i.e. whether it is basement, multi-storey or single storey. The existing Building Regulations contain only extremely limited requirements as to the use of sprinkler systems and are clearly not adequate.

9.153 It is not possible to indicate in detail all the circumstances in which sprinkler systems may be necessary: this is a matter for detailed regulation. In the opinion of the Tribunal, however, their use in certain circumstances should be compulsory. In dealing with the particular category of buildings with which the Tribunal is concerned, i.e. buildings of Group C Occupancy, it is clear that in the case of basements (where access for the fire brigade may be more difficult) where there is a regular occupancy in excess of one hundred, the installation of such a system should be essential. In other cases coming within Group C Occupancy, the Regulations should enable the fire authority to exercise a considered judgement as to the necessity for requiring all or some areas of a particular building to be sprinklered. In arriving at a conclusion, they should be required to have regard to the various other safety factors already referred to; and the Tribunal recommends that they should make use of the guidelines referred to in para. 9.173 below. In the framing of such regulations, careful consideration should also be given to the compulsory requirements in other countries, e.g. Denmark, the United States, Canada and New Zealand.

(7) Wiring of Emergency Lighting

9.154 The Tribunal is satisfied that the use of mineral-insulated copper-sheathed cable for the emergency lighting system is practicable. Such cable should comply with BS 6207: Part 1. Mineral-insulated copper-sheathed or equivalent heat and flame-resisting wiring should be made compulsory in places of assembly in Group C Occupancy.

(8) Escape Routes

9.155 The experience of the fire has demonstrated vividly the catastrophic effects which can flow from the tendency of persons in a public building to use the main entrance as a means of escape in the event of an emergency. The Tribunal is satisfied that, in the case of Group C Occupancy places of assembly, there should be a requirement that the escape route provided by the main entrance to the building should be capable of discharging at least one third of the occupant capacity in two and a half minutes, using the criteria already employed in the Draft Building Regulations. The greatest care should be taken in the drafting of the appropriate regulation to ensure that the term "main entrance" is clearly defined; and that the regulations also ensure that escape routes leading into the vestibule or lobby forming part of the main entrance, and the vestibule or lobby itself, are

of the appropriate width having regard to this requirement. This requirement should be *in addition to* the other requirements of the Regulations as to the number and minimum width of the escape routes generally.

9.156 The Regulations should also provide that exit doors should be so constructed that the door will swing open when a force of not less than that specified in BS 5725: Part 1: 1981 is applied to a panic-bar mechanism complying with this standard in the direction of travel to the exit.

9.157 The Regulations should also prohibit the placing of hangings or draperies over exit doors and the placing of mirrors in or adjacent to exits in such a manner as to confuse the direction of exit.

9.158 The congested conditions in Exit 2 were contributed to by the jamming of the outer doors in the mat-well (see para. 3.75). The Building Regulations should require that, where exit doors open inwards over mat-wells, any mat used shall be fixed securely in the well.

9.159 The Building Regulations should be modified to include all the provisions, where not already included in the Draft Regulations, of Parts 5 and 6 of the Greater London Council Code of Practice—Means of Escape in Case of Fire.

(9) Miscellaneous

9.160 The Building Regulations should make compulsory the displaying of a plan on incombustible material at the entrance of each Group C Occupancy place of assembly with a regular occupancy in excess of fifty, showing the basement, the ground floor and each storey of the building, including the means of escape.

9.161 The Management Regulations should require the display of notices in a number of places in prominent locations in Group C Occupancy places of assembly, indicating how the fire brigade is to be alerted, the measures to be taken to ensure the safety of the public and staff, and the escape routes to be taken by the public and staff.

9.162 The Building Regulations should also contain detailed provisions for the isolation of the kitchens in Group C Occupancy places of assembly from the rest of the building, similar to those contained in the corresponding French Regulations.

VI — APPLICABILITY OF RECOMMENDATIONS TO EXISTING BUILDINGS

9.163 It has been indicated in Section IV by the Tribunal that certain of its recommendations should be part of the new Management Regulations and that certain requirements of the Building Regulations should also apply to existing buildings. These include the requirements as to the wall linings, furniture, floor coverings, wiring, sprinklers and means of escape in places of assembly with Group C Occupancy, such as discos, dance halls, and public houses. The acceptance of this recommendation will mean that existing buildings used for such purposes will have to comply with the new requirements proposed as to these matters. The Tribunal is fully conscious of the practical difficulties, expense and possibly, in some cases, hardship that may be caused to the owners and proprietors of existing buildings which fail to comply with the standards that the Tribunal deems essential in such places. In the view of the Tribunal, however, to exempt existing buildings from these requirements, in the light of the knowledge and experience derived from the Stardust disaster, would be anomalous and unacceptable.

9.164 In order to ease, as far as possible, the burden which the application of the Regulations to existing buildings will undoubtedly impose on the owners of such buildings, the Tribunal recommends that the Fire Services Act, 1981, be amended so as to enable the Minister for the Environment to dispense with, or relax, compliance with the Management Regulations in any particular case. As in the case of the Building Regulations, the Minister in exercising this power should, in general terms, bear in mind criteria of the nature referred to in Part VIII below.

VII — ENFORCEMENT OF LEGISLATION AND REGULATIONS

9.165 The Fire Services Act, 1981, contains extensive provisions in relation to the service of fire safety notices by the local authority in the case of potentially dangerous buildings. These provisions have cured defects which existed in the Fire Brigades Act, 1940, in relation to the contents of such notices.

9.166 The Act also gives the High Court jurisdiction to restrain the use of buildings where a risk to persons in the event of fire is sufficiently serious.

9.167 The Tribunal is satisfied that, provided there is an adequate system of inspection by local authorities (see para. 9.182 below) these provisions should be adequate. The necessity remains however, of ensuring that all the appropriate fire prevention and fire protection features are incorporated in new buildings at the design and construction stage; and the new regulations recommended by the Tribunal will be of little affect unless adequate means exist for their enforcement.

9.168 In the case of the Planning Acts, the increased powers given to planning authorities by the 1976 Act, (including the power of the High Court to grant injunctions restraining the use of land and ordering appropriate steps to be taken to ensure that buildings comply with planning permission) have proved workable and effective. In the case of the Building Regulations, however, the only sanction is a fine of £250 and a continuing fine of £50 for every day for which the contravention is continued. The Tribunal recommends that Section 27 of the 1976 Planning Act should be amended so as to enable the Court to order that the necessary steps be taken by the owners of the building to comply with any provision of the Building Regulations which has been contravened. Such a provision may, of course, greatly increase the workload of the High Court which already has large arrears, and the Tribunal recommends that the Section be amended by giving the Circuit Court jurisdiction in the case of land and buildings below a specified valuation.

9.169 The Tribunal recommends that the District Court should have power, in the case of any breach of the Building or Management Regulations, to order the immediate closing of a place of assembly on an application by the fire authority.

9.170 The flagrant disregard by the management of the Stardust of the requirements that exit doors remained unlocked and unobstructed while the public were on the premises was one of the most serious features of the disaster. The Tribunal recommends that the Fire Services Act be amended by creating a new statutory offence, i.e. the failure by the management of a place of assembly to take all reasonable steps to ensure that exit doors required by law to be unlocked and unobstructed remain unlocked and unobstructed. This offence should be punishable by a fine not exceeding £10,000.00 or imprisonment for a term not exceeding six months. It should be a recordable offence for the purposes of the Licensing Acts, 1833 to 1962, leading to the mandatory forfeiture of the licence in the event of any such offence being committed.

VIII — RELAXATION OF CONTROL FOR FIRE PROTECTION IN ASSEMBLY BUILDINGS

9.171 When Sections 86, 87 and 88 of the Planning Act, 1963, are brought into operation, the Minister for the Environment will have power to dispense with or relax the requirements of the Building Regulations in any particular case. The Tribunal accepts that such a power is reasonable and, indeed, desirable; but it considers that it is important that certain guidelines should be established to govern its exercise.

9.172 In each case, the nature of the hazard must be assessed before considering what precautions should be insisted on. In assessing the hazard, three factors should be considered in each case:—

(a) the use category,

(b) the occupancy level, and

(c) the vertical configuration of the building.

9.173 An example of a model which might be used in determining whether approval should be granted will be found in Appendix 9. It is emphasised, however, that models of this nature merely provide guidelines for the designers and the regulating authority. In all cases, the entire building must be assessed in the light of its possible performance in the event of a fire, having regard to the nature of its use, the level of occupancy, its size and height and any other relevant factors.

9.174 It is essential that fire authorities be provided with expert guidance on a regular basis as to the considerations which should be borne in mind in exercising any discretion afforded to them by the Regulations. The Inspectorate of Fire Services which is recommended to be established (para. 9.193) should be required by statute to give advice and assistance to fire authorities in exercising any such discretion if requested to do so.

IX — PROCEDURE ON APPLICATIONS TO LOCAL AUTHORITY FOR PERMISSION, APPROVALS AND FIRE CERTIFICATES

9.175 All applicants for planning permission should be notified that it may be necessary for them, before commencing any development, to apply for approval under the Building Regulations and the Management Regulations and to obtain a Fire Certificate before the premises are opened to the public.

9.176 The Tribunal recommends that the Management Regulations contain a provision that no places of assembly shall be opened to the public until, in the case of new buildings, approval has been obtained under the Building Regulations and, in the case of both existing and new buildings, a Fire Certificate has been obtained from the fire authority.

9.177 All applications for approval under the Building Regulations should be dealt with by the Building Control Department of the local authority.

9.178 All applications under the Management Regulations should be made directly to the Chief Fire Officer. Copies of all plans, specifications, etc. approved by the Building Control Department must be automatically forwarded to the Fire Prevention Department.

9.179 All applications for Fire Certificates or Occasional Fire Certificates should be made directly to the Chief Fire Officer.

9.180 All premises in respect of which approvals are granted under the Building Regulations should be inspected by the Building Control Department within a specified time from the notification to the Department, in accordance with the regulations, that the building has been completed.

9.181 All buildings in respect of which applications have been referred to the Fire Prevention Department should be inspected by a member of the Department within a specified period from the receipt by that Department of the notification that the building has been completed. (The Building Control Department should in all cases transmit a copy of the notice under the Regulations from the applicant to the Fire Prevention Department that the building has been completed). In the case of approvals under the Management Regulations, the building must be inspected by the Fire Prevention Department at least seven days before it is opened to the public.

9.182 Inspections should be carried out at regular intervals by members of the Fire Prevention Department to ensure that all fire safety requirements are being observed. These inspections should include regular "during performance" inspections.

9.183 The inspections should be carried out in accordance with a programme of such inspections related to the nature of the use of the building.

9.184 The staff of the Building Control Department of Dublin Corporation should be increased immediately so as to ensure that there are sufficient to carry out the increased work of consideration of plans and inspections of buildings required by these recommendations.

9.185 The staff of the Fire Prevention Department should be increased immediately to the number which, in the opinion of the Chief Fire Officer, is the minimum necessary to deal with its responsibilities.

9.186 Not all of the appointees to the Fire Prevention Department need be graduates: some can be non-technical officers at sub-officer level or upwards, either transferred from within the Dublin Fire Service or recruited from other branches of the fire service. The non-technical officers should not be used on the assessment of plans, but can be used for inspections, particularly "during performance" inspections. In the event of difficulty being experienced in filling the new posts, attempts should be made to fill the non-technical posts by introducing the appropriate rostering arrangements as between the Fire Prevention Department and the Fire Fighting Department.

9.187 The Tribunal recommends that officers carrying out inspections on behalf of either the Building Control Department or the Fire Prevention Department should be required to possess, as a minimum:—

(a) a detailed knowledge of the relevant regulations; and

(b) a working knowledge of electrical, gas and other energy installations sufficient to enable them to ascertain the existence of problems in these areas and the necessity of obtaining more expert advice from the relevant department.

9.188 The Tribunal is mindful of the fact that the recommendations made in the preceding paragraphs will require the surmounting of the difficulties as to payment for unsocial hours, differentials between technical and non-technical officers, recruitment from outside the fire service etc., referred to in Chapter 8. It is not the function of the Tribunal to suggest ways and means of overcoming these difficulties. It can only stress the acuteness and urgency of the problem and the heavy responsibility that lies upon the three parties immediately concerned, the Department of the Environment, Dublin Corporation and the relevant trade unions, to ensure that the problem is dealt with as a matter of the greatest urgency.

X — THE FIRE SERVICE

(1) Control by Central Government

9.189 Some of the recommendations which follow affect not merely the Dublin Fire Brigade but the fire service throughout the State. The Tribunal has borne in mind that it was precluded by its terms of reference from conducting a general investigation into the fire services throughout the State. It is, however, satisfied that a number of the shortcomings in the present arrangements in Dublin which have come to light during the Tribunal's hearings cannot be adequately dealt with other than on a national basis.

9.190 The inability of the Dublin Fire Brigade to cope with the acute problems in organisation, staffing and training which developed during the 1970's indicates clearly, in the opinion of the Tribunal, that a more active role must be played by Central Government, which alone has the resources to deal with problems of the magnitude revealed in the Dublin Fire Brigade.

9.191 The demands placed by modern society on fire brigades are changing constantly with changes in society itself. New sources of hazard, such as oil-refineries and natural gas installations and, in the possible future, nuclear power stations, create fresh problems of fire prevention and fire protection. At the same time, fire science and technology are constantly developing. This in turn can provide the fire-prevention and fire-fighting branches of a modern fire brigade with better tools with which to do their respective jobs. Because of demographic changes, the development of new areas of population, etc. the

standards of fire cover required for different areas may vary. The greatly increased use in recent years of fire brigades at the scene of traffic accidents and other emergencies not necessarily related to fires is another example of the many changing circumstances which have to be taken into account.

9.192 The necessity of fire brigades to adapt themselves to the changing demands of modern society is clear. In the opinion of the Tribunal, an adequate response to these changes can only be achieved by individual fire brigades if control and direction by Central Government is ensured. The Tribunal accordingly recommends that, with the objective of bringing the fire service in Ireland up to an acceptable level of efficiency, the Minister for the Environment should have overall central responsibility for the fire-fighting and fire prevention services provided by fire authorities. The Fire Services Act, 1981, should be amended so as to confer this responsibility expressly on the Minister. The Tribunal notes that a similar recommendation was also contained in the Report of the Working Party on the Fire Services in 1975. Such an approach to fire-safety would be in harmony with developments in other countries, and in particular, in Ireland's partners in the European Economic Community.

9.193 To enable the Minister to discharge this responsibility, it will be necessary to establish an Inspectorate of Fire Services. The functions and duties of the Inspectorate are a matter for detailed legislation. In general terms, however, it should exercise responsibility in three broad areas:—

(a) supervision and direction of the fire-fighting services throughout the State by regular inspection;

(b) supervision of fire prevention and fire protection measures throughout the State; and

(c) the establishment and maintenance of a National Training Centre for fire personnel.

9.194 In order to ensure the satisfactory operation of the fire-fighting services in each area, it will be necessary for the Inspectorate to prescribe standards of fire cover to be provided throughout the State. Each fire authority would then be in a position to determine whether it was meeting the prescribed standards. (It may well be that in particular areas the standards that might be prescribed by such an Inspectorate are already adequately met). The Inspectorate should also be responsible for ensuring, so far as practicable, standardisation in fire appliances and fire equipment, and that proper standards in the manning of appliances by each fire authority are met.

9.195 In order to carry out its duties in this area, the Inspectorate must be given power to inspect on a regular basis each of the fire services operating in the State, to give advice to local fire authorities and, where necessary, to give directions to the fire services. Provision should be made for an appeal by a fire authority to the Minister from directions by the Inspectorate.

9.196 The role of such an Inspectorate in a properly organised modern fire service is of such crucial importance that its precise status requires careful consideration. The Tribunal is of the opinion that, since its proposed functions are of a more wide-ranging nature than those assigned to certain existing Inspectorates, these functions should be precisely defined by the legislation. In particular, the Inspectorate should have a direct reporting relationship with the appropriate senior officer of the appropriate Department i.e. the Secretary of the Department of the Environment. The Inspectorate should be required to present an annual report which should be laid by the Minister for the Environment before each house of the Oireachtas.

9.197 The Tribunal has already expressed its view that, in order to fill the lacuna which at present exists in legislation and regulations, the Minister should immediately exercise his powers under the Planning Act, 1976, and the Fire Services Act, 1981, to make necessary regulations. This should be regarded as an interim procedure only, designed to deal with

the present urgent problem. The Tribunal recommends that, on a long-term basis, the Minister should be under a statutory obligation to consult with the Inspectorate before making regulations under Section 37 of the Fire Services Act, 1981. Since the Building Regulations deal with a wide range of matters other than fire safety, responsiblity for their review should continue to rest with the Minister for the Environment; but before making regulations relevant to fire safety, he should be required to consult with the Inspectorate. The same considerations apply to the making of regulations under other codes which may be relevant to fire safety, e.g. the Safety in Industry Acts, 1955 and 1980, the Dangerous Substances Act, 1972 and the Explosives Act, 1875: the appropriate Minister should be under a similar obligation to consult with the Inspectorate before such regulations are made.

The establishment and maintenance of a National Training Centre is dealt with at para. 9.207.

(2) Structure

9.198 The morale and efficiency of the Dublin Fire Brigade has been at a disturbingly low level for a number of years. The Tribunal considers that, with a view to raising the morale and efficiency of the Brigade generally, certain major changes in its staff structures should be made.

9.199 The system of recruitment to fire brigades differs from country to country: in some cases, there is what is called a "two-tier" structure, in other cases a "one-tier" structure. Where a two-tier structure is employed, posts above a certain level are filled either by promotion from the ranks of firemen and upwards or by the appointment to the posts of persons with university degrees or equivalent qualifications. Where a one-tier structure is employed, all posts up to the highest level are filled by promotion from the lower ranks; and this normally means that posts at the highest level are not filled by persons with university degrees or equivalent qualifications. The advantage of the two-tier structure is that it ensures that members of the fire brigades at the appropriate levels have the necessary specialised knowledge of fire safety engineering which can only be derived from attendance at university courses or their equivalent. The advantage of the one-tier structure is that it ensures that all posts in the fire service up to the highest level are filled by persons who have a wide practical experience of all aspects of fire fighting.

9.200 The Irish system is unique among the systems studied by the Tribunal in combining the worst features of the one-tier and two-tier systems. It consists of a two-tier system, under which the posts of Chief Fire Officer, Assistant Chief Fire Officer and Executive Fire Prevention Officer are filled by persons having primary degrees in engineering or architecture or their equivalent. Such persons on their appointment, accordingly, may have no practical experience of fire-fighting. At the same time, below these levels, fire officers have no specialised knowledge from university degrees or their equivalent of fire safety engineering. In addition, of course, the absence of a national training centre and the general inadequacy of training in the Brigade has been a major contributory factor to its low level of morale and efficiency.

9.201 The establishment and maintenance of the National Training Centre which is recommended at a later point (see para. 9.207) is, in the opinion of the Tribunal, the most important and seriously overdue reform which is required in order to improve morale and efficiency. All firemen and officers will, as a matter of course, attend the National Training Centre; but it will also be necessary to ensure that senior officers have, in addition to the training supplied by the National Training Centre and practical experience derived from fire-fighting operations, the necessary specialised qualification required by their particular posts. This will require, in the case of such senior officers as Chief Fire Officer, Assistant Chief Fire Officer and Executive Fire Prevention Officer, that they should have attended before their appointment, the appropriate specialised courses to be provided at the universities and other third level educational institutions recommended to be provided earlier in this Report (para. 9.81).

9.202 The Tribunal considers that the morale and efficiency of the Brigade and its level of professional competence will be significantly enhanced if many more posts from Station Officer level upwards are filled by graduates. By retaining a two-tier system of recruitment, but ensuring that the second tier begins at that level, the present system under which senior officers, including the Chief Fire Officer may have only limited experience of fire-fighting on their appointment, could be phased out. This again, in the view of the Tribunal, could only have a beneficial effect on the morale and efficiency of the Brigade.

9.203 In order to establish the new system of two-tier recruitment recommended in the preceding paragraph, it will be necessary for the Inspectorate of Fire Services and the Director of the National Training Centre to establish a new system of recruitment. The object should be to recruit to the fire brigades graduates in the appropriate disciplines from the universities and other third level institutions who will be required to undergo the same training courses as those provided for firemen seeking promotion to Sub-Officer and Station Officer in the brigade. Participation in this training scheme will necessarily involve the newly recruited personnel in participation in the fire-fighting activities in the brigade. In addition, they can be employed in a wide range of duties in the fire brigade; and this will, of course, enable the serious understaffing of the Fire Prevention Department to be brought to an end. They can also be employed, however, in other duties which are more appropriately dealt with by personnel with specialist qualifications, such as administration and personnel matters, the purchase of fire equipment and the operation of the Control Room (see para. 9.224 below). The introduction of this system of recruitment should in time provide the necessary corps of trained personnel with specialist qualifications who can be appointed to vacancies at Station Officer level as and when they occur. The Tribunal notes that the two-tier system of recruitment is in operation in all the member nations of the European Economic Community with the exception of the United Kingdom; and it has no doubt that it should continue in Ireland, but with the major reforms to which reference has just been made.

9.204 While the modified two-tier system of recruitment recommended in the preceding paragraph should eliminate the problems at present encountered, under which certain senior officers have only limited experience of fire-fighting operation, it will not provide an immediate solution to the problem of what should be the appropriate technical qualifications for such senior officers. Until the more advanced courses recommended to be established in para. 9.88 and the new Training Centre are in existence, it will not be possible, as a practical matter, to require that such officers have a specialised qualification in fire safety engineering. As an interim measure, the Tribunal recommends that, in the case of appointments to posts at the level of Chief Fire Officer, Assistant Chief Fire Officer and Executive Fire Prevention Officer, in addition to the present requirement of a primary degree in architecture or engineering, there should be a requirement that the officer in question has pursued a specified course in fire prevention and fire-fighting at a recognised fire training centre, such as the Home Office Fire Service Technical College at Morton in the United Kingdom. It will be necessary to establish a corps of officers throughout the country who will have undergone training at this college. In the case of the Dublin Fire Brigade, this may mean the filling of the post of Chief Fire Officer, now vacant, on a temporary basis until officers with the appropriate experience in specialised training are available as candidates. The necessary arrangements should be made as a matter of urgency with the UK Home Office to facilitate the attendance of such officers at the appropriate training courses.

9.205 The Tribunal is satisfied that, having regard to the increasingly complex nature of the service which the fire brigade is required to provide, a university degree or its equivalent should still be required for the higher ranks of the service, i.e. Chief Fire Officer, Assistant Chief Fire Officer and Executive Fire Prevention Officer. It is recognised, however, that the existence of the possibility of promotion to the highest rank is of crucial importance so far as the morale of all ranks from firemen upwards is concerned, and the Tribunal recommends that, with a view to ensuring that the morale of the Brigade is treated as a matter of the highest importance, the Inspectorate and the National Training Centre should ensure that all ranks have available to them opportunities for pursuing courses leading to university degrees or their equivalent. The Tribunal recommends that there

should be the closest co-operation between the Training Centre and third level educational institutions so as to facilitate the attendance by firemen and fire officers at such courses, and to ensure that such matters as the recognition of examinations and the giving of credits in respect of them and the organisation of courses, are the subject of such co-operation.

9.206 No useful function appears to be achieved by having a separate rank in the Dublin Brigade of "District Officer" and the Tribunal recommends that this grading should be phased out.

(3) Training

9.207 The Tribunal recommends the establishment of a National Training Centre for fire personnel. It is satisfied that the United Kingdom model of having regional training centres should not be adopted, having regard to the much smaller population in this country and the necessity for deploying the limited financial and personnel resources involved in the establishment and staffing of such a structure as economically and efficiently as possible.

9.208 The Minister for the Environment is given power under Section 15 (3) of the Fire Services Act, 1981, to provide for the establishment and maintenance of a National Training Centre. The Tribunal considers that its establishment and maintenance should be the responsibility of the Inspectorate. It will be a matter for the Inspectorate to determine in detail the training and facilities to be provided by the Centre and to make decisions on such matters as suitable premises and the staffing of the centre. The recommendations which follow represent the minimum requirements as to training, which in the view of the Tribunal, its earlier findings have made essential.

9.209 The first essential in the establishment of such a Centre is the recruitment of a qualified Director and trained instructors. In the absence of an existing training centre—and of any adequate courses in fire safety engineering in the universities—it will be necessary to have the initial training of instructors carried out at Morton in the UK. While this should provide the necessary initial training which will be required as a matter of urgency if a suitably trained corps of instructors is to be available, the Director and staff should not, in the view of the Tribunal, content themselves with having instructors trained at Morton. The fact that the Training Centre is being established from scratch, so to speak, gives its founders a unique opportunity to incorporate the best elements of other overseas training centres; and the Director and staff should familiarise themselves thoroughly with the training courses in these institutions before the Irish Centre is established.

9.210 It must be emphasised that much of the expenditure on the Centre may go to waste if standardisation of equipment is not insured in brigades throughout the State. This again points to the paramount importance of ensuring central supervision and direction of the fire services by the Inspectorate.

9.211 The details of the training and the nature of the examinations provided at the National Training Centre are a matter for the proposed Inspectorate and the Director of the Centre. They should, however, provide an examination structure regulating promotion at every level from fireman upwards. They should also provide for refresher courses to be arranged by the Training Centre for all officers and firemen. In-station training at the local stations should continue to be the responsibility of the Station Officer, but in each case he should act in accordance with guidelines issued by the National Training Centre.

9.212 It would be of the greatest benefit to the Dublin Fire Brigade if the officers were given the opportunity of familiarising themselves with the operations of brigades in other countries. The Tribunal recommends that the Northern Ireland Fire Authority should be invited to co-operate with the Dublin Fire Brigade in enabling senior officers of the latter Brigade to spend some time in familiarising themselves at first hand with the operations of the Northern Ireland Brigade. The Tribunal, having seen those operations for itself at first

hand, is satisfied that the results of such a scheme could be of great benefit to the Dublin Brigade.

9.213 In the case of Dublin Fire Brigade, it is also important that firemen at different stations should be familiar, not only with their own areas, but also with other areas of the City. This can be of considerable importance if an appliance has to act in a back-up capacity for a fire outside the area which it normally serves. Arrangements should be made, so far as practicable, to rotate firemen on a regular basis between different stations.

(4) Pre-fire Planning

9.214 It is essential that the personnel in each fire station should have readily available to them relevant information as to the buildings in their area which present special risks or where the consequences of fire could be specially serious, e.g. hospitals, schools, cinemas, dance halls, factories, warehouses, timoer yards, etc. It should be the responsibility of each Station Officer to ensure that the personnel in his station visit all such places in their area and record the relevant information. This is most easily done in the form of simple fire-risk plans indicating the main features of the building, including in particular means of access for the fire brigade, location of hydrants inside and outside the building, the location of any other available water sources in the immediate area, the general layout of the interior of the building, the location of any inflammable or explosive material, etc. (A sample of an appropriate form of fire risk plan is reproduced in Appendix 13). The names, home addresses and home telephone numbers of relevant persons, such as fire officers and security officers, should also be recorded. There should be no difficulty in crews on appliances making these visits on a systematic basis during their watches, while remaining in radio contact with the Control Room to deal with any calls.

9.215 Each station should have a map showing the location of hydrants in their area and copies of these maps should be carried on appliances at all times.

(5) Mobilisation

9.216 A new Central Control Room in Tara Street is urgently required. The Control Room should use the latest equipment, including computers, used in other countries.

9.217 There should be available in the Central Control Room a data-base for the computer system of streets, and general mobilising information throughout the area of the Dublin Fire Brigade.

9.218 This data-base should include the following information which can be retrieved in the case of an alarm call from any point:

(a) the first station to be mobilised;

(b) the extent of the first attendance required;

(c) the back-up stations in the event of no appliance being available from the first station or more appliances being required because of the extent of the fire or the nature of the building; and

(d) any special feature of the building, including its use, presence of dangerous materials, access for the fire brigade, location of hydrants or other water sources, etc.

9.219 The data-base should also contain information as to dangerous substances and their treatment in the event of accident.

9.220 Upon receipt of a fire call, the operator in the Central Control Room should be in a position directly to alert the relevant local station by depressing a key and give all the relevant information on a public address system. The necessary mobilising information from the computer data-base should be immediately available to him.

9.221 All emergency calls and related radio traffic to and from the Central Control Room should be automatically tape-recorded.

9.222 The time of departure of each appliance should be recorded in the Central Control Room by means of a device in the station which operates automatically as soon as the appliance leaves.

9.223 The tape-recording mechanism referred to in para. 9.221 should have an automatic time-recording injection every ten seconds.

9.224 The Central Control Room is at present staffed exclusively by fire-fighting personnel. The Tribunal recommends that the new Control Room should be operated by suitably trained personnel. In this context, consideration should be given to the introduction of a new staffing structure based on the recruitment of "Fire Control Officers". It should be possible to provide a career structure in this branch of the fire service which is attractive to both men and women who do not wish to participate in the fire-fighting branch of the service.

9.225 When the new Central Control Room is established with the trained personnel recommended by the Tribunal, consideration should be .given to routing all 999 calls, **iflcludittg** calls for police and ambulance services, directly through the Central Control Room and """"not through the automatic telephone exchange. (This is the system employed in some continental countries). Tt would clearly be preferable to have an operator receiving the calls who was in a better position to assess the nature of the emergency service that was, in fact, required, i.e. Gardai, ambulance, fire brigade, life boat or coastal rescue or a combination of one or more of these, than an operator in the telephone exchange.

(6) Appliances and Equipment

9.226 The equipment carried on the appliance in the Dublin area is generally satisfactory, but in all cases four breathing-apparatus sets should be carried on pumping appliances in future. The sets should be stowed in the crew-cab so as to enable members of the crew to don breathing-apparatus, if required, while travelling to the fire-ground.

9.227 The fire-risk plans (see para. 9.214) and the hydrant maps should be carried at all times on all appliances.

9.228 There must be readily available in each station a check-list of all the equipment on every appliance. It should be the express duty of the officer in charge of each watch to check that all items of equipment mentioned on the check-list are on the appliance and are in proper working order.

(7) Command and Control at the Fire-ground

9.229 A proper system of command on the fire-ground was not in operation on the night of the fire. It is imperative that, in the future, a proper command structure exist and is known to all ranks to exist.

9.230 In order to ensure a proper and recognised command structure the Tribunal recommends that the first senior officer to arrive at the fire-ground be regarded as the officer in command. This officer, upon arrival at the fire-ground must, make his own assessment of the tactics to be adopted as rapidly as possible and give the appropriate orders immediately to the officer in charge of each appliance. It should then be a matter for the officer in charge of each appliance to ensure that his crew carry out the orders of the officer in command.

9.231 In some continental countries, the normal procedure is for the responsible fire officer—who will have received the alarm on his personal radio wherever he happens to be—to travel to the fire-ground in his own car. This means that he normally arrives in advance of the first appliance and assesses the scene himself so that he is in a position to give orders to

the appliances as they arrive. In this country, the practice is for Station Officers or District Officers to travel on the appliances. While the continental system may have much to recommend it, the Tribunal is satisfied that the system employed in Ireland is satisfactory and workable, provided the other recommendations of the Tribunal are fully implemented.

9.232 In order to ensure co-ordination and control at the fire-ground the Tribunal recommends that, where there is an attendance of more than one appliance, the first appliance to arrive be immediately established as the "Incident Control Point". The first appliance to arrive must immediately notify all other appliances by radio that it is acting as the control point. The officer in command must remain in control, notwithstanding the fact that officers senior to him may arrive on other appliances. If, however, the fire is sufficiently serious to warrant the presence of a Third Officer or higher rank, then the senior officer in question may take control at his discretion.

(8) Communications

9.233 A modern communications network is essential for the efficient operation of the Fire Brigade. Such a system should ensure rapid communication between the fire-ground, the Control Centre, local fire stations, other appliances and other emergency services such as Gardai and ambulances.

9.234 All officers travelling to the fire-ground should be able to communicate by radio with each other, with the Incident Control Point, and with the Central Control Room. In addition, pocket-alerters should be available to officers when on duty outside the confines of the fire station.

(9) Water Supply

9.235 It should be the duty of each station to carry out regular and systematic checks on all the hydrants in its area to ensure that they are in proper working order. All defects should immediately be notified to the Waterworks Department and a record kept in the station. To enable this system to function properly, it will, of course, be essential that the hydrant maps already referred to be available in each fire station.

9.236 Officers and firemen should be instructed that, on arrival at the fire-ground, they are empowered to take all steps that they deem necessary to ensure an adequate supply of water for fire-fighting purposes; and, for that purpose, may open any valves etc. after notifying the Waterworks Department but without awaiting the arrival of a turncock. The present practice of awaiting the arrival of a turncock should in normal circumstances be adhered to, since his presence at the fire-ground may be essential if particular problems arise; but provided firemen are properly trained and have a working knowledge of the hydrants in their area, it should not be necessary in all circumstances to await the arrival of a turncock.

9.237 The most effective method of ensuring that hydrants remain prominent and easily accessible is not to have them underground. This would prevent such mishaps as came to light in the Inquiry e.g. the concreting over of the possible location of a hydrant, the failure to ascertain the existence of a hydrant because it was in a grassed area, and the obscuring of hydrants by the presence of parked cars. The replacement of all the existing hydrants in the Dublin area by pillar hydrants, as used in other countries, would almost certainly be prohibitively expensive. The Tribunal recommends that, if the replacement of the existing hydrants by pillar hydrants is not practicable, the minimum precaution that should be taken is to identify plainly the area of the road and pavement at which a hydrant is located with clear warning signs and markings indicative of a restriction on parking. Such special markings should be so designed as to indicate to the public, as well as the Fire Brigade, the location of hydrants, and should be equivalent to those used to protect areas reserved for the parking of ambulances outside hospitals, etc.

XI — ADMINISTRATION

9.238 The reporting relationship between the administrative and technical staff of Dublin Corporation is unnecessarily hierarchical and could be productive of delays in necessary action being taken in the field of fire safety. The Chief Fire Officer should be in a position to report directly to the Assistant City Manager with responsibility for the fire service without the necessity of reporting in the first instance to any other official. All other officers whose functions may relate to fire safety matters should also be in a position to communicate directly on such matters with the Chief Fire Officer and with the Assistant City Manager with responsibility for the fire service. They would include the Planning Officer, the Senior Building Surveyor, the Senior Engineer of the Waterworks Department, the Senior Engineer of the Electrical and Public Lighting Department and the Chief Engineer with responsibility for roads.

XII — STANDARD TESTS ON MATERIALS

9.239 The Tribunal recommends that national standards organisations should develop new tests for determining the classification of the flame spread and fire propagation properties of wall linings. The classification of wall linings under the relevant standard should also include a reference to the capacity of the lining to produce flaming droplets.

9.240 The Tribunal also recommends that national standards organisations should take the necessary steps to establish a scientifically acceptable test for the measurement of the rate of heat release of items of furniture once they are ignited.

XIII —GENERAL

9.241 The Department of Health, the body from whom the Major Accident Plan emanated, should take steps to ensure that all the bodies to whom copies of the plan have been sent are operating the same plan and that details such as telephone numbers of hospitals, etc. are kept up to date. Immediate steps should be taken to ensure that all officers on duty in the Communications Centre of Dublin Castle are familiar with the Plan and that copies of it are available in the Room at all times.

9.242 When activating the different stages of the Major Accident Plan the senior fire officer present at the time should consult by radio with the senior officer on duty in Tara Street FS, who in turn should notify the Garda Communications Centre. The practice should not be adopted of notifying a Garda at the fire-ground and leaving it to him to communicate with his own station.

9.243 Where it is consistent with the priority of saving lives, care should be taken, when fatalities occur in a fire, to identify the locations in which particular bodies are found by flagging or numbering. Doctors, dentists, hospitals and health centres should keep accurate and detailed records which should not be destroyed for a period of at least five years (including, in particular, X-Ray plans) so as to facilitate the identification of victims of disasters. At the end of five years the records (other than X-Rays) should be stored on microfiche.

9.244 In the forensic investigation of fire, the Gardai should use only nylon bags, and not plastic bags, for transmitting samples to the Forensic Science Laboratory.

9.245 The investigating Garda at the scene of the fire, where it appears necessary to require the analysis of material by the Forensic Science Department, should take care to ascertain that he knows the precise nature of the samples required and the purpose for which they are required.

9.246 In any disaster of significant proportions the forensic investigation should be carried out under the direction of a senior Garda Officer and a senior scientist from the Forensic Science Laboratory of the Department of Justice.

9.247 The Tribunal is fully conscious of the fact that the implementation of many of its recommendations will necessitate increased expenditure by both the public sector and the private sector on fire safety; and it has constantly borne in mind the paramount importance of ensuring that, in a small country with limited resources, such resources as are available are used where they will be most effective. The first objective must be to identify fire hazards and to implement measures commensurate with the nature and extent of the likely hazards.

9.248 In considering the expenditure necessitated by the introduction and implementation of a fire safety code appropriate to modern conditions, it should be remembered that the savings in purely material terms effected by such changes, although not quantified must necessarily be significant. In 1980, the last year for which statistics are available, the estimated material fire loss for Ireland was £22,515,499 (Appendix 10). This figure does not, however, include all the disruptive effects to the economy in general which flow from the buildings being damaged or destroyed by fire, including the interruption of business activity and the generation of additional unemployment. In addition, of course, it does not establish the saving, in material terms, effected by the protection of buildings from fire; nor does it establish the financial loss due to death and injuries.

9.249 Nearly fifty years ago, the Report of a Tribunal of Inquiry into a fire at Pearse Street, Dublin said that

> "The condition of the Dublin Fire Brigade as disclosed by this and a number of recent city fires calls for immediate attention. A regular system of Government inspection is desirable to ensure the maintenance of proper standards of efficiency in fire brigades . . . .".

9.250 Seven years ago the Report of the Working Party on the Fire Service urged the adoption by the Minister for the Environment of central responsibility for the fire-fighting and fire prevention services provided by local authorities and the establishment of a National Training Centre for fire prevention and fire-fighting personnel.

9.251 The consequences, in purely material terms, of the neglect of fire safety by Central Government, local authorities and the public at large, cannot be doubted, although the extent is difficult to measure. But the saving of lives and the avoidance of injury must remain the primary objectives of fire safety systems; and it is clear that their continuing neglect in Ireland has now contributed to a disaster on an appalling scale which will cast a shadow across one Dublin community for years, and perhaps generations, to come.

CHAPTER 10

Costs

CHAPTER 10

Costs

10.1 Section 6 of the Tribunals of Inquiry (Evidence) (Amendment) Act, 1979, provides as follows:

> "6 (1) Where a tribunal, or, if the tribunal consists of more than one member, the chairman of the tribunal, is of opinion that, having regard to the findings of the tribunal and all other relevant matters, there are sufficient reasons rendering it equitable to do so, the tribunal or the chairman, as the case may be, may by order direct that the whole or part of the costs of any person appearing before the tribunal by counsel or solicitor, as taxed by a Taxing Master of the High Court, shall be paid to the person by any other person named in the order.
>
> (2) Any sum payable pursuant to an order under this section shall be recoverable as a simple contract debt in any court of competent jurisdiction.
>
> (3) Any sum payable by the Minister for Finance pursuant to an order under this section shall be paid out of monies provided by the Oireachtas".

10.2 Applications for an award of costs under this section against the State were made on behalf of the following parties:—

(1) the owners and occupiers, Scotts Foods Limited and Silver Swan Limited;

(2) Dublin Corporation; and

(3) the next-of-kin of twenty one of the deceased and of sixty five persons who were injured in the fire whose representation by counsel and solicitor was authorised by the Tribunal on the 2nd March, 1981, but who applied to the Tribunal on the 6th April, 1981, for liberty to cease such representation, which application was granted by the Tribunal.

10.3 Section 9 clearly confers on the Tribunal a wide discretion in relation to the awarding of costs. There are, however, in the opinion of the Tribunal, certain general principles which should normally be applicable in exercising that discretion.

10.4 In the first place, it does not follow that because a party has been authorised to appear or be represented at the Tribunal's hearings such party is necessarily entitled to be indemnified from public funds in respect of the costs and expenses he has incurred in relation to' his representation and attendance at the hearings. It was urged on behalf of the owners and occupiers that it was inequitable that private persons with limited resources, whose representation and attendance at the hearings were essential for the proper conduct of the Tribunal's business, should have to bear their own costs; and that the effect of requiring such parties to bear their own costs would be to encourage concealment, duplicity or obstruction. It was also urged that the only circumstances in which such a party should be refused an award of costs is where the party has frustrated the work of the Tribunal or has not, in the view of the Tribunal, been sufficiently candid or co-operative.

10.5 The Tribunal is satisfied that these propositions are not well-founded. The attendance of parties such as the owners and occupiers at the hearings of the Tribunal is, of course, an essential part of the inquiry which the Tribunal is required to undertake; but their attendance, and the legal representation authorised on their behalf may also, in their view, be required by the necessity to protect their own interests. That was clearly so in the case of the owners and occupiers. Not merely were they legitimately concerned to be heard in relation to their possible responsibility for the events which the Tribunal had to investigate: the nature of the damage to their property and the circumstances surrounding it made it inevitable that consideration would be given by them to an application for compensation under the criminal injuries code against the relevant local authority.

10.6 The principle contended for on behalf of the owners and occupiers before the Tribunal was considered by the Tribunal of Inquiry into the Whiddy Island disaster. The Tribunal respectfully adopts the statement of that Tribunal (Mr Justice Costello) as to the principles applicable which was in the following terms:

> *"Total* based their application on the submission *that prima facie* the costs of all public inquiries should be borne by the state, including the costs of all parties granted representation before the Tribunal of Inquiry.
>
> The Tribunal cannot agree with this sweeping proposition and regards it as being founded on a misconception of the nature of Tribunals established under the Act of 1921, and of the role of persons professionally represented before such Tribunals. Tribunals of Inquiry are essentially carrying out investigatory functions and need not require that any person be represented by solicitor and counsel before them. Persons may apply to appear before the Tribunal by solicitor and counsel and applications are granted when the applicant may be prejudicially affected by the evidence or by the Tribunal's findings. It certainly does not follow that when persons incur legal expenses in defence of their own interests, *prima facie* those expenses should be paid out of public funds ....".
>
> (Report of Tribunal of Inquiry into disaster at Whiddy Island, Bantry, Co. Cork, para. 24.1.2(b)).
>
> "The basis on which the application for its costs (by Gulf) was made was, firstly, that 'precedent in other jurisdictions supports the proposition that anyone given leave to appear at the Inquiry should be paid his cost by the State, unless his conduct before or during the Inquiry has obstructed or prolonged it to the extent that this has happened'. Gulf gave no details to support their assertion that precedent elsewhere justified their application, and the Tribunal doubts its validity as a general proposition. However, the Tribunal is concerned with applying the provisions of the Act of 1979, and precedents from other jurisdictions, unless based on a similarly worded statutory provision, give little assistance in determining how its discretion should be exercised in the present instance". (ibid., para. 24.1.2(c)).

10.7 It was also submitted on behalf of the owners and occupiers that if no general award of costs was made in their favour, there should at least be a limited award of costs in respect of their attendance at, and representation before, the Tribunal during those parts of the hearings which dealt with matters such as the legislation, regulations and standards applicable to the building, for which they would have no possible responsibility.

10.8 The Tribunal rejects this contention. The extent of the participation by a party in the hearings of the Tribunal, whether by attendance at them or the conduct of examination of witnesses on his behalf by counsel, is entirely a matter for the party himself, subject, of course, to his obligation to give evidence on oath as to the matters being enquired into, if the Tribunal so requires. The decision to participate in those sections of the hearings which related to the applicability and adequacy of the legislation, regulation and guidelines and such matters as the efficiency or otherwise of the fire-fighting services provided by the local authority, matters which were clearly not within the area of responsibility of the owners and occupiers, was a decision by the owners and occupiers themselves.

10.9 Counsel for the Attorney General said that he was instructed to apply for an Order adjourning the question of costs until the findings of the Tribunal had been made known. He conceded that neither the Act of 1921 nor the amending Act of 1979 expressly conferred any power on the Tribunal to reserve the question of costs for further consideration until after its findings had been made known, but said that equally the Tribunal was not expressly precluded from adopting that course if it was thought appropriate to do so.

10.10 It is not necessary for the Tribunal to express any view as to whether the Acts of 1921 and 1979 confer a power of the nature suggested by Counsel on behalf of the Attorney General. It is sufficient to say that, even if such a power exists, the Tribunal would not consider it appropriate to exercise it in the present case. The Tribunal is satisfied that the circumstances of the present Inquiry render it singularly undesirable that the public hearings should be re-opened even on the most limited of bases, once the Report of the Tribunal has been presented. It must have been clear at the conclusion of the evidence that grave questions of responsibility for the scale of the disaster arose in the case of both the owners and the occupiers and Dublin Corporation; and, if an application were contemplated on behalf of the Attorney General that some or all of the costs incurred out of public funds generally in relation to the Inquiry should be borne by either or both of these parties, in whole or in part, the appropriate occasion for doing so was before the public hearings of the Tribunal closed.

10.11 Counsel for Dublin Corporation adopted the submissions made on behalf of Counsel for the owners and occupiers. In addition, he urged that, were his clients to bear from their own resources the cost of their representation, it would necessarily follow that other services provided by his clients would have to be partially reduced.

10.12 The Tribunal rejects the contention made on behalf of Dublin Corporation. Again, it respectfully adopts the following statement in the Whiddy Island Disaster Report:—

> "If a local authority properly incurs legal expenses in the discharge of its public duties, then it can discharge such expenses out of the financial resources to which it is entitled by law. The Tribunal does not consider that Section 6 of the Act of 1979 should be interpreted as meaning that when a local authority appears before a Tribunal by solicitor and counsel, an order for costs against the Minister for Finance should, as a matter of course, be made. No doubt there may be special circumstances which might make it equitable that an Order be made under the Section . . . .". (ibid., para. 24.1.2 (g)).

In the present case, the Tribunal is satisfied that there are no such special circumstances and the application made on behalf of Dublin Corporation is therefore rejected.

10.13 When the Tribunal was established, the Government announced that two firms of solicitors had been assigned to appear on behalf of the next-of-kin of the deceased and those injured, at the hearings of the Tribunal and that the Attorney General had undertaken to discharge the costs and expenses incurred in relation to such representation. On the 2nd March, 1981, an application was made to the Tribunal for liberty to be represented on behalf of twenty one of the deceased and sixty five of the injured. Shortly before the taking of evidence before the Tribunal commenced, the Government announced that a third firm of solicitors had been assigned to appear on behalf of the next-of-kin of deceased and injured and that a similar undertaking had been given by the Attorney General in respect of the relevant costs and expenses. On the 30th March, 1981, counsel instructed by the solicitors in question made an application to the Tribunal on behalf of twenty four of the next-of-kin and ninety of the injured for an Order granting them liberty to be represented. On the 6th April, 1981, counsel on behalf of the next-of-kin of the twenty one deceased and sixty one injured persons in respect of whom no undertaking as to their costs had been given by the Attorney General applied for liberty for his clients to cease being represented before the Tribunal, which application was granted. At the time, counsel expressly reserved his position in relation to the costs incurred by his clients up to the date of the Order giving them liberty to cease being represented.

10.14 At the close of the Tribunal's hearings, counsel for the next-of-kin of the deceased and injured concerned applied for an Order in respect of these costs and expenses. He submitted that his instructing solicitors had been acting in good faith for a number of persons whose interests might clearly be affected by the Inquiry and the Report of the Tribunal, and that they should be indemnified in respect of their costs in the same manner as the next-of-kin of deceased and injured who had chosen to avail of the services of the firms of solicitors assigned by the Government, particularly as, he claimed, the solicitors had never disclosed the precise number of clients they represented. (This latter statement is not correct: in the case of each of the next-of-kin and injured to whom liberty to be represented was granted, a list of the persons in respect of whom the application was made was furnished to the Tribunal's Registrar).

10.15 When the Tribunal was ruling on the 2nd March, 1981, on the applications on behalf of the next-of-kin for liberty to be represented, it expressed its view that there was no justification for allowing representation to all the next-of-kin and injured who wished to be separately represented. If the principle were to be accepted that each of the next-of-kin and injured was entitled, as of right, to be separately represented the work of the Tribunal would have been unduly protracted. In the case of the application on behalf of the next-of-kin of the twenty one deceased and sixty one injured, which was the subject of the special application for costs, the Tribunal expressed its view that representation on their behalf was justified having regard to the large numbers involved. At the same time, the Tribunal warned that, in view of the availability of representation for any of the next-of-kin and injured and the undertaking on behalf of the State as to the costs of such representation, it would have to be clearly understood that the next-of-kin of the twenty one deceased and sixty one injured would be represented at their own risk as to costs. The Tribunal said that, if any application were made, it would have to bear in mind the fact that such representation was already available at the State's expense.

10.16 It must have been clear to those advising the next-of-kin and injured concerned that, once the Government had announced that legal representation would be available to all of the next-of-kin and injured who wished to avail of it, it was unlikely that the Tribunal would permit a separate representation of any of the next-of-kin and injured who did not wish to avail of the representation being afforded by the State, except at their own risk as to costs. The Tribunal is satisfied that the same considerations must apply to any costs that were incurred by the next-of-kin and injured concerned before the Order of the Tribunal of the 6th April, 1981, giving them the liberty to cease being represented; accordingly, this application is rejected.

TABLE OF APPENDICES

Table of Appendices

APPENDIX 1

Notice published in the national newspapers upon appointment of the Tribunal of Inquiry

Appendix 1

Notice published in the Irish Independent, Irish Press, Irish Times and Cork Examiner upon appointment of the Tribunal of Inquiry.

TRIBUNAL OF INQUIRY

Established in pursuance of a Resolution passed by Dail Eireann on the 18th day of February, 1981, and by Seanad Eireann on the 19th day of February, 1981. A preliminary public Sitting of the Tribunal of Inquiry appointed by the Minister for the Environment on the 20th day of February, 1981, in pursuance of the above Resolution, will be held in the Incorporated Law Society, Blackhall Place, Dublin 7 on Monday, the 2nd day of March, 1981, at 11.00 a.m. An announcement will be made later as to the date when the first public Sitting to take evidence will be held.

The Terms of Reference of the Tribunal are as follows:

1. to inquire into the following definite matters of urgent public importance:

   (1) the immediate and other causes of, and the circumstances leading to the fire at the Stardust Club, Artane, Dublin, on the 14th February, 1981,

   (2) the circumstances~of and leading to the loss of life and personal injury at the Stardust Club on the 14th February, 1981,

   (3) the measures, and their adequacy, taken on and before the 14th February, 1981, to prevent and detect, and to minimise and otherwise to deal with fire at the Stardust Club,

   (4) the means and systems of emergency escape from the Stardust Club, and their adequacy, on the 14th February, 1981,

   (5) the measures (including the application of the Draft Building Regulations published on the 29th November, 1976), and their adequacy, taken on and before the 14th February, 1981, at the Stardust Club to prevent and to minimise and otherwise to deal with any other circumstances that led to or contributed to the loss of life and personal injury aforesaid or might have led or contributed to loss of life or personal injury,

   (6) the adequacy of the legislation, statutory regulations and bye-laws relevant to fire prevention and safety, so far as material to the granting of planning and bye-law permission for, and the conduct, running, supervision, and official inspection and control of, the Stardust Club, and the adequacy of the application, observance and enforcement of such legislation, statutory regulations and bye-laws in relation to the Stardust Club;

   and

2. to make such recommendations as the Tribunal, having regard to its findings, thinks proper in respect of the statutory and other provisions in relation to fire, fire prevention and means and systems of emergency escape from fire, their adequacy and enforcement and any other matters that the Tribunal considers relevant.

Any person interested in the Inquiry should attend in person or by Counsel or Solicitor.

Any person who desires to give evidence before the Tribunal relevant to the foregoing Terms of Reference should forward his name and address as soon as possible to G. L. Frewen, Registrar to the Tribunal, at the Incorporated Law Society, Blackhall Place, Dublin 7, and should indicate the matters upon which he desires so to give evidence and the nature of his evidence.

Any interested person who requires a subpoena to secure the attendance of witnesses at the Inquiry should forward the names and addresses of such to the Registrar.

BY ORDER OF THE TRIBUNAL,
THE 23rd DAY OF FEBRUARY, 1981.

APPENDIX 2

Chronological list of persons who gave evidence before the Tribunal

Appendix 2

Chronological list of persons who gave evidence before the Tribunal.

The letter 'S' or 'R' appearing after a witness's name indicates that a Statement or Report by the witness was accepted in evidence.

1.	Maurice Garde, (R)	Detective Garda, Mapping Section.
2.	Joan Flanagan,	Patron.
3.	Mary Keating,	Patron.
4.	Linda Bishop,	Patron.
5.	Sandra Hatton,	Patron.
6.	Valerie Walsh,	Patron.
7.	Sandra Hyland,	Patron.
8.	Sandra Wilson,	Patron.
9.	Pamela McGuinness,	Patron.
10.	Sharon O'Hanlon,	Patron.
11.	Gerard Quinn,	Patron.
12.	Mark O'Hanlon,	Patron.
13.	Frances Winston,	Patron.
14.	Adrienne Rahaman,	Patron.
15.	Anthony Bannon,	Patron.
16.	Margaret Courtney,	Patron.
17.	Patrick Burke,	Patron.
18.	Yvonne Keogh,	Patron.
19.	Gabriel Russell,	Patron.
20.	Robert Duffy,	Patron.
21.	David Foley,	Patron.
22.	Maureen Brazil,	Patron.
23.	Carmel Richardson,	Patron.
24.	Linda Higgins,	Patron.
25.	Deirdre Brady,	Patron.
26.	Paula Farrell,	Patron.
27.	Susan Darling,	Patron.
28.	Veronica McCormack,	Patron.
29.	Paul Doyle,	Patron.
30.	Deirdre Ryan,	Patron.
31.	Kathleen Manning,	Patron.
32.	Tina Leavy,	Patron.

33.	Jacqueline McCarthy,	Patron.
34.	Elaine Whelan,	Patron.
35.	David Murray,	Patron.
36.	Karen Dunne,	Patron.
37.	William Carrigan,	Patron.
38.	Michael Nolan,	Patron.
39.	Catherine Darling,	Patron.
40.	Deirdre Dames,	Patron.
41.	Ruth Cumiskey,	Patron.
42.	Ann Mahony,	Patron.
43.	Anthony Preston,	Patron.
44.	Peter (otherwise Bobby) Kelly,	Patron.
45.	Carmel McCarthy,	Patron.
46.	Joseph McCarthy,	Patron.
47.	Jean Hogan,	Patron.
48.	Patrick Bride,	Patron.
49.	Kathleen Fennell,	Patron.
50.	Carol Byrne,	Patron.
51.	Paul Keogh,	Patron.
52.	Martina Doyle,	Patron.
53.	Jacqueline Byrne,	Patron.
54.	Michael Kelly,	Eye-witness.
55.	Cerina Massey,	Patron.
56.	Maria Brady,	Staff Supervisor.
57.	Gwendolyn McGinley,	Patron.
58.	Adrienne Murphy,	Patron.
59.	June Crowe,	Patron.
60.	James Feery,	Patron.
61.	David Mulligan,	Patron.
62.	Noel Quigley,	Patron.
63.	David Rynne,	Barman.
64.	Thomas Dunne,	Former patron.
65.	Lorraine Brady,	Patron.
66.	Bernadette Fullard,	Patron.
67.	Martin Dowling,	Patron.
68.	Gerard Donohoe,	Patron.
69.	David Weldridge,	Patron.
70.	Andrew Boylan,	Patron.
71.	Paul Foley,	Patron.
72.	Trevor King,	Patron.

73.	Vincent Flood,	Garda photographer.
74.	Anthony McDonald,	Disc jockey's assistant.
75.	Bernadette Daly,	Patron.
76.	Joseph Heapes,	Patron.
77.	Thomas Dooner,	Patron.
78.	Jean Fitzsimons,	Patron.
79.	Paul Powell,	Patron.
80.	Kenneth Coleman,	Patron.
81.	Seamus CafFrey,	Patron.
82.	Patrick Dempsey,	Patron.
83.	Eilish Carlyle,	Patron.
84.	Alfred Reilly,	Patron.
85.	John Reilly,	Eye-witness.
86.	Harriet Kearney,	Patron.
87.	Mark Swaine,	Patron.
88.	Derek Farrelly,	Patron.
89.	Christina Fullam,	Patron.
90.	Margaret Fitzsimons	Patron.
91.	Joseph McCabe,	Patron.
92.	Harriet Reilly,	Patron.
93.	Ann Tuck,	Patron.
94.	Damien Fallon,	Patron.
95.	Anthony Bartley,	Patron.
96.	Liam Gallagher,	Patron.
97.	Patrick O'Keeffe,	Patron.
98.	Doreen Desmond,	Patron.
99.	Margaret Lynch,	Patron.
100.	Nicholas Prior,	Patron.
101.	Kenneth Farrell,	Patron.
102.	Aidan Lynch,	Patron.
103.	David Carroll,	Patron.
104.	Brian Baitson,	Patron.
105.	Raymond English,	Patron.
106.	Linda Farrelly,	Patron.
107.	Derek Brown,	Patron.
108.	Martin Quinn,	Patron.
109.	Frederick Phelan,	Patron.
110.	Gerard Patje,	Patron.
111.	Patricia O'Hare,	Patron.
112.	David Bridgeman,	Barman.

113.	John Crowe,	Barman.
114.	Elizabeth Hunter,	Receptionist.
115.	Pamela Farrell,	Patron.
116.	Adrienne Evans,	Patron.
117.	Harry Mahood,	Patron.
118.	Peter McMahon,	Patron.
119.	Paula O'Connor,	Patron.
120.	Ann Hyland,	Patron.
121.	Peter Griffin,	Patron.
122.	David Brady,	Patron.
123.	Belinda Pearse,	Waitress/cleaner.
124.	Pauline Gaynor,	Patron.
125.	Donna McConnell,	Patron.
126.	Gary Sullivan,	Patron.
127.	Thomas Kennan,	Head Doorman.
128.	Marian Mulvaney,	Waitress.
129.	Patricia Murray,	Waitress.
130.	Kieran Gallagher,	Patron.
131.	Michael Kavanagh,	Doorman.
132.	Patrick J. Murphy,	Doorman.
133.	Leo Doyle,	Doorman.
134.	Austin Bell,	Doorman.
135.	Phelim Kinahan,	Doorman.
136.	John Fitzsimons,	Doorman.
137.	Laurence Neville,	Barman.
138.	Elizabeth Prizeman,	Waitress.
139.	Rose Quinn,	Patron.
140.	Francis Downes,	Doorman.
141.	John Furley,	Doorman.
142.	Michael Griffin,	Doorman.
143.	Gabriel O'Neill,	Doorman.
144.	Frank Kenny,	Doorman.
145.	Paul Byrne,	Patron.
146.	Jack Walsh,	Assistant manager.
147.	Brian Peel,	Manager.
148.	Thomas Gallagher,	Detective Garda.
149.	Sharon Marley.	Waitress.
150.	Teresa Marley,	Catering manageress.
151.	Elizabeth Marley,	Waitress.
152.	Patrick J. McGrath,	Maintenance man.

153.	Helen Crowley,	Waitress.
154.	Maeve Naughton,	Waitress.
155.	Vera Byrne,	Waitress.
156.	Caroline Maher,	Lounge-girl.
157.	Valerie Rooney,	Lounge-girl.
158.	Patricia Gallagher,	Waitress.
159.	Pauline McConalogue,	Lounge-girl.
160.	Declan Burnett,	Glass-washer.
161.	Joseph McGrane,	Glass-washer.
162.	Paula Foy,	Lounge-girl.
163.	Phyllis Cobbe,	Lounge-girl.
164.	Elaine Stapleton,	Lounge-girl.
165.	Patricia Gaynor,	Lounge-girl.
166.	Michelle Murray,	Lounge-girl.
167.	Robert O'Callaghan,	Eye-witness.
168.	Bernadette Kenny,	Eye-witness.
169.	William Cummins,	Eye-witness.
170.	Patricia Cummins,	Eye-witness.
171.	Siobhan Cummins,	Eye-witness.
172.	Michael Diggin,	Eye-witness.
173.	Liam Cummins,	Eye-witness.
174.	May Carey,	Eye-witness.
175.	Joseph Kavanagh,	Eye-witness.
176.	Patricia Kavanagh,	Eye-witness.
177.	Christopher Keely,	Eye-witness.
178.	Edith Keely,	Eye-witness.
179.	Anne Kelly,	Eye-witness.
180.	Maria Blair,	Eye-witness.
181.	Alan Buffini,	Eye-witness.
182.	Anthony Pasquetti,	Eye-witness.
183.	Dolores Hickey,	Eye-witness.
184.	John Somers,	Eye-witness.
185.	Sandra Somers,	Eye-witness.
186.	Margaret Bracken,	Eye-witness.
187.	Ann Doyle,	Eye-witness.
188.	Anthony Kenny,	Eye-witness.
189.	Paul Kenny,	Eye-witness.
190.	Ciaran Meehan,	Eye-witness.
191.	Elizabeth Gannon,	Eye-witness.
192.	Alan Medcalfe,	Eye-witness.

193.	Gladys Evans,	Eye-witness.
194.	Mary Hughes,	Eye-witness.
195.	Yvonne McCormack,	Eye-witness.
196.	Brenda Kelly,	Eye-witness.
197.	Ronald Kelly,	Eye-witness.
198.	Evelyn Devlin,	Eye-witness.
199.	Rita McCready,	Eye-witness.
200.	Agnes Pearse,	Cleaner.
201.	Ann Craig,	Eye-witness.
202.	James O'Toole,	Eye-witness.
203.	Breda Stapleton,	Kitchen worker.
204.	Pauline Ennis,	Kitchen worker.
205.	Nora Bradley,	Kitchen worker.
206.	Margaret Downes,	Kitchen worker.
207.	Gerard Guilfoyle,	Barman.
208.	George Moloney,	Electrician.
209.	Colm O Briain,	Disc Jockey.
210.	Patrica Eyre,	Waitress.
211.	Daniel Hughes,	Discjockey.
212.	Ann Hoare,	Kitchen worker.
213.	Edward Farrell,	Barman.
214.	Alan Maher,	Barman.
215.	John Andrews,	Barman.
216.	Colm O'Toole,	Barman.
217.	Joan Barrett,	Cloakroom attendant.
218.	Harry Wade,	Trespasser.
219.	Christopher Holt,	Securityman.
220.	Cormac Rose,	Barman.
221.	John Ring,	Aluminium shutter supplier.
222.	Andrew Beare,	Carpet-tile fitter.
223.	John Hipwell,	Building sub-contractor.
224.	Thomas Malone,	Joinery sub-contractor.
225.	James Moffitt,	Ceiling-tile fitter.
226.	Henry Dempsey,	Furniture supplier.
227.	Michael Morrissey,	Band-leader.
228.	Aidan Cullen,	Barman.
229.	Peter Dolan,	Barman.
230.	John Reid,	Trespasser.
231.	Mary McPartlin,	Cleaner.
232.	Laurence McCann,	Barman.

233.	Catherine Morrissey,	Cleaner.
234.	Martin Finn,	Barman.
235.	Seamus Murphy,	Barman.
236.	Alice Finn,	Cleaner.
237.	Thomas Blair,	Eye-witness.
238.	John Aylward,	Barman.
239.	Edward Kinsella,	Barman.
240.	Niall McGuire,	Lounge-boy.
241.	John Dignam,	Barman.
242.	John Hartnett,	Trespasser.
243.	John Finnegan,	Trespasser.
244.	Desmond Burns,	Trespasser.
245.	Dermot O'Neill,	Assistant cashier.
246.	Catherine McGrath,	Cashier.
247.	Niall Somerville,	Trespasser.
248.	Michael Kennedy,	Detective Sergeant.
249.	Bosco Muldoon,	Detective Garda.
250.	Bartholomew Doherty	Garda.
251.	James Faughnan,	Patron.
252.	Liam Hennessy,	Patron.
253.	Raymond Coleman,	Eye-witness.
254.	Rory Mooney,	Fireman, H.Q. Control Room.
255.	George Glover,	Fireman, H.Q. Control Room.
256.	Noel Mooney,	Fireman, Station Officer.
257.	Brian Parkes,	Fireman, Sub-officer.
258.	James Rowan,	Fireman, Station Officer.
259.	Seamus Quinn, (R)	Detective Garda, Ballistics Section, Garda Technical Bureau.
260.	Michael Norton, (R)	Forensic scientist, State Forensic Science Laboratory.
261.	Patrick Hobbs,	Fireman, Sub-officer.
262.	John Kavanagh,	Fireman, Sub-officer.
263.	Patrick Gavin,	Detective Garda.
264.	John McMahon,	Fireman, Station Officer.
265.	Christopher Magee,	Fireman.
266.	George Nice, (R)	Head, Fire Research Station Borehamwood, England.
267.	H. L. Malhotra, (R)	Head, Buildings & Structures Division, Fire Research Station, England.
268.	Peter Hinkley, (R)	Head, Materials Components & Structures Section, Fire Research Station, England.
269.	William Woollev, (R)	Head, Combustion Products Section, Fire Research Station, England.

270.	Trevor Mills,	ESB electrician.
271.	Eric Timon,	ESB supervisor.
272.	Vincent Ryan,	ESB electrician.
273.	Laurence O'Reilly,	ESB supervisor.
274.	James Fee,	Technician, Textiles Division, Institute for Industrial Research & Standards.
275.	Thomas Kelly,	Consultant to Tribunal (Varming, Mulcahy, Reilly Associates).
276.	David Tucker, (R)	Fire consultant (Dr Keith Gugan & Associates)
277.	Arthur Green, (R)	Fire consultant (Cremer & Warner Ltd)
278.	William Mooney,	Photographer.
279.	Frederick Porges, (R)	Electrical & ventilation consultant (Cremer & Warner Ltd)
280.	Vincent Keane,	Fireman.
281.	Stephen McDonald,	Fireman.
282.	Michael Ring,	Roller-blind supplier.
283.	Brian Spencer,	Plasterer.
284.	John Fleming,	Plumber.
285.	John Hughes,	Fireman, Sub-officer.
286.	Gerald Eastham, (R)	Fire consultant (Fire Check Consultants)
287.	Robert Watt, (R)	Fire consultant (Dr J. H. Burgoyne & Partners)
288.	Liam Clarke,	Fireman.
289.	Martin Messitt,	Fireman.
290.	James Hempenstall,	Fireman.
291.	Bernard O'Rourke,	Airport fireman.
292.	Kevin McLoughlin,	Fireman.
293.	Terence Potts,	Fireman.
294.	James McDonnell,	Fireman.
295.	Brian Flood,	Fireman.
296.	Noel Hosback,	Fireman.
297.	William Redmond,	Fireman.
298.	Noel Keegan,	Fireman.
299.	Thomas Doyle,	Fireman.
300.	Robert Kenny,	Fireman.
301.	Francis Matthews,	Fireman.
302.	Paul Shannon,	Fireman.
303.	Edmond O'Dowd,	Fireman.
304.	Noel Byrne,	Corporation turncock.
305.	Hubert Mooney,	Corporation turncock.
306.	James Gallagher,	Garda, Radio Control Centre.

307.	Joseph Kiernan,	Fireman, Third Officer.
308.	Thomas P. O'Brien,	Chief Fire Officer, Dublin Corporation.
309.	James Hill,	Senior Executive Engineer, Dublin Corporation, Waterworks Department.
310.	James Wright, (S)	Senior Executive Officer, Planning Department, Dublin Corporation.
311.	Charles Aliaga Kelly.	Chief Planning Officer, Dublin Corporation.
312.	Dermot H. King,	Senior Building Surveyor, Planning Department, Dublin Corporation.
313.	Sheila Merne,	Typist Supervisor, Planning Department, Dublin Corporation.
314.	Maurice Lowe,	Senior Engineer, Electricity & Public Lighting Department, Dublin Corporation.
315.	Martin Donohoe,	Electrical Inspector for Places of Public Resort, Dublin Corporation.
316.	Thomas G. Conroy,	Planning Assistant, Dublin Corporation.
317.	Charles Wade,	Planning Assistant, Dublin Corporation.
318.	Patrick McDonnell,	Senior Planning Assistant, Dublin Corporation.
319.	Edward Clarke,	Senior Executive Fire Prevention Officer, Dublin Corporation.
320.	John Williams,	Assistant Chief Fire Officer, in charge of Fire Prevention Section, Dublin Corporation.
321.	Brendan Prendiville, (R)	Surgeon.
322.	John F. Harbison, (R)	State Pathologist.
323.	John Courtney,	Detective Superintendent, in charge of Garda investigation team.
324.	William White,	Architect.
325.	Harold Gardner,	Architectural draughtsman.
326.	Aidan McDonald,	Civil Servant, Housing Administration Section, Department of the Environment.
327.	William Staunton,	Detective Garda.
328.	James Hoban,	Detective Garda.
329.	Thomas Brady,	Chief Ambulance Officer, Eastern Health Board.
330.	Anthony Murray,	Ambulance driver.
331.	Peadar Sheridan,	Ambulance attendant.
332.	Peter O'Toole,	Patron.
333.	Ann Roe,	Patron.
334.	Martin Daly,	Fireman on ambulance duties.
335.	Pauline Reid,	Patron.
336.	Thomas Carty,	Garda Sergeant, eye-witness.
337.	Michael Curran,	Garda Inspector.
338.	William Ronayne,	Detective Inspector.

339.	Denis Curley,	Patron.
340.	Patrick Drennan,	Club photographer.
341.	Margaret Drennan,	Patron.
342.	Sean Flood,	Disc jockey.
343.	Caroline Jolley,	Patron.
344.	Elizabeth Kavanagh	Patron.
345.	Anthony Bolger,	Patron.
346.	William Aspill,	Patron.
347.	James Shortall,	Patron.
348.	Patrick Browne, (S)	Civil Servant, Office of Registrar of Companies, Dublin Castle.
349.	Brian Breathnach, (R)	Civil Servant, Local Administration Section, Department of the Environment.
350.	John McKenna, (R)	Psychologist.
351.	Anthony Tennyson, (R)	Electrical expert (Tennyson Associates).
352.	Paul Firth,	Garda photographer.
353.	Declan Conway,	Carpet-tile salesman.
354.	John Boyle,	Post Office Telephone Supervisor, Central Exchange.
355.	Sean Haughey, (S)	Assistant City Manager, Dublin Corporation.
356.	Brendan McArdle,	Detective Garda.
357.	Eamon Butterly,	Managing Director, Silver Swan Ltd.
358.	John Burke,	Television cameraman, eye-witness.
359.	Michael McDonagh,	Managing Director, security firm.
360.	Patrick Lennon,	Cellarman.
361.	Graham Whitehead,	Company secretary, Illingworth & Co., Carpet Manufacturers.
362.	Patrick Butterly,	Director, Silver Swan Ltd.
363.	Maurice Cassidy,	Solicitor, Law Agent's Department, Dublin Corporation.

APPENDIX 3

Alphabetical list of all witnesses heard by the Tribunal

Appendix 3

Alphabetical list of all witnesses heard by the Tribunal, 6th April — 26th November, 1981, inclusive.

No. and Name	Description	Transcript	
		Book No.	Page No.
311. ALIAGA KELLY, Charles	Chief Planning Officer, Dublin Corporation	96	46
215. ANDREWS, John	Barman	70	10
346. ASPILL, William	Patron	106	65
238. AYLWARDJohn	Barman	73	18
104. BAITSON, Brian	Patron	26	1, 39
15. BANNON, Anthony	Patron	6 51	95 1
217. BARRETT, Joan	Cloakroom attendant	71	1
95. BARTLEY, Anthony	Patron	24	88
222. BEARE, Andrew	Carpet-tile fitter	71	64
134. BELL, Austin	Doorman	41 43 49	18 10 75
4. BISHOP, Linda	Patron	4	46
180. BLAIR, Maria	Eye-witness	63 64 107	86 18 69
237. BLAIR, Thomas	Eye-witness	73 74	13 77
345. BOLGER, Anthony	Patron	106	50
70. BOYLAN, Andrew	Patron	18	31
354. BOYLE,John	Post Office Telephone Supervisor, Central Exchange	109	24
186. BRACKEN, Margaret	Eye-witness	64	37
205. BRADLEY, Nora	Kitchen W'orker	66	46
122. BRADY, David	Patron	31	21
25. BRADY, Deirdre	Patron	8 9	106 1
65. BRADY, Lorraine	Patron	17	11
56. BRADY, Maria	Staff Supervisor	15 64	1 97

No. and Name	Description	Transcript	
		1 Book No.	Page No.
329. BRADY, Thomas	Chief Ambulance Officer, Eastern Health Board	104	27
22. BRAZIL, Maureen	Patron	8	38
349. BREATHNACH, Brian	Civil Servant, Local Administration Section, Department of the Environment	106 109	110 45
48. BRIDE, Patrick	Patron	13	29
112. BRIDGEMAN, David	Barman	27 28	49 1
107. BROWN, Derek	Patron	26	56, 91
348. BROWNE, Patrick	Civil Servant, Office of Registrar of Companies, Dublin Castle	106	103
181. BUFFINI, Alan	Eye-witness	63 64 108	92 21 1
358. BURKE, John	Television Cameraman, Eye-witness	115	1
17. BURKE, Patrick	Patron	7	25
160. BURNETT, Declan	Glass-washer	61	41
244. BURNS, Desmond	Trespasser	73	89
357. BUTTERLY, Eamon	Managing Director, Silver Swan Ltd	110 111 112 113 114 115 116 117	8 1 2, 68 1 1 22 1 1
362. BUTTERLY, Patrick	Director, Silver Swan Ltd	117 118	81 1
50. BYRNE, Carol	Patron	13	84
53. BYRNE, Jacqueline	Patron	14	34
304. BYRNE, Noel	Corporation Turncock	92	29
145. BYRNE, Paul	Patron	55 57	83 1
155. BYRNE, Vera	Waitress	60	60
81. CAFFREY, Seamus	Patron	21	90
174. CAREY, May	Eye-witness	63	61
83. CARLYLE, Eilish	Patron	22	1
37. CARRIGAN, William	Patron	10	109
103. CARROLL, David	Patron	25	92
336. CARTY, Thomas	Garda Sergeant, Eye-witness	105	2

No. and Name	Description	Transcript	
		Book No.	Page No.
363. CASSIDY, Maurice	Solicitor, Law Agent's Department, Dublin Corporation	119	30
319. CLARKE, Edward	Senior Executive Fire Prevention Officer, Dublin Corporation	99 100	47 1
288. CLARKE, Liam	Fireman	91	1
163. COBBE, Phyllis	Waitress	62	20
80. COLEMAN, Kenneth	Patron	21	69
253. COLEMAN, Raymond	Eye-witness	74	94
41. COMISKEY, Ruth	Patron	11 51	53 41
316. CONROY, Thomas G	Planning Assistant, Dublin Corporation	99	17
353. CONWAY, Declan	Carpet-tile salesman	108 109	68 1
323. COURTNEY, John	Detective Superintendent in charge of Garda investigation team	101	42
16. COURTNEY, Margaret	Patron	7	1
201. CRAIG, Ann	Eve-witness	65	65
113. CROWE, John	Barman	28 29	55 1, 90
59. CROWE, June	Patron	15	63
153. CROWLEY, Helen	Waitress	60	20
228. CULLEN, Aidan	Barman	72	50
173. CUMMINS, Liam	Eye-witness	63	57
170. CUMMINS, Patricia	Eye-witness	63	49
171. CUMMINS, Siobhan	Eye-witness	63	51
169. CUMMINS, William	Eye-witness	63	38
239. CURLEY, Denis	Patron	105	43
337. CURRAN, Michael	Garda Inspector	105	26
75. DALY, Bernadette	Patron	20	74
334. DALY, Martin	Fireman on ambulance duties	104	84
40. DAMES, Deirdre	Patron	11	38
39. DARLING, Catherine	Patron	11	24
27. DARLING, Susan	Patron	9	27
226. DEMPSEY, Henry	Furniture supplier	72	31, 49
82. DEMPSEY, Patrick	Patron	21	102
98. DESMOND, Doreen	Patron	25	25
198. DEVLIN, Evelyn	Eye-witness	64	90
172. DIGGIN, Michael	Eye-witness	63	55

No. and Name	Description	Transcript	
		Book No.	Page No.
241. DIGNAMJohn	Barman	73	27
250. DOHERTY, Bartholomew	Garda	74	56
229. DOLAN, Peter	Barman	72	56
68. DONOHOE, Gerard	Patron	17 51	93 19
315. DONOHOE, Martin	Electrical Inspector for Places of Public Resort, Dublin Corporation	98 99 119	42 1 32
77. DOONER, Thomas	Patron	20 21	109 1
67. DOWLING, Martin	Patron	17	68
140. DOWNES, Francis	Doorman	50 51 52	85 47 1
206. DOWNES, Margaret	Kitchen Worker	66	50
187. DOYLE, Ann	Eye-witness	64	41
133. DOYLE, Leo	Doorman	40 41 42 43 55	37 1 2 1 57
52. DOYLE, Martina	Patron	14	9
29. DOYLE, Paul	Patron	9	60
299. DOYLE, Thomas	Fireman	92	1
341. DRENNAN, Margaret	Patron	105	70
340. DRENNAN, Patrick	Club Photographer	105	46
20. DUFFY, Robert	Patron	7 8 56	99 i 1 1
36. DUNNE, Karen	Patron	10	99
64. DUNNE, Thomas	Former Patron	17	2
286. EASTHAM, Gerard	Fire Consultant, (Fire Check Consultants)	89 90	72 3
105. ENGLISH, Raymond	Patron	26	20
204. ENNIS, Pauline	Kitchen Worker	66	20
116. EVANS, Adrienne	Patron	29	103
193. EVANS, Gladys	Eye-witness	64	76
210. EYRE, Patricia	Waitress	69	2
94. FALLON, Damien	Patron	24	63

No. and Name	Description	Transcript	
		Book No.	Page No.
213. FARRELL, Edward	Barman	69	76
101. FARRELL, Kenneth	Patron	25	66
115. FARRELL, Pamela	Patron	29	96
26. FARRELL, Paula	Patron	9	7
88. FARRELLY, Derek	Patron	23	51
106. FARRELLY, Linda	Patron	26	41, 89
251. FAUGHNAN, James	Patron	74	78
274. FEE, James	Technician, Textiles Division, Institute for Industrial Research and Standards	86	24
60. FEERY, James	Patron	15	79
49. FENNELL, Kathleen	Patron	13	57
236. FINN, Alice	Cleaner	73	4
234. FINN, Martin	Barman	72	98
243. FINNEGANJohn	Trespasser	73	56
352. FIRTH, Paul	Garda Photographer	107	64
78. FITZSIMONSJean	Patron	21	40
136. FITZSIMONSJohn	Doorman	45 46 47 48	75 1 1 3, 14
90. FITZSIMONS, Margaret	Patron	23	90
2. FLANAGAN, Joan	Patron	4	7
284. FLEMING, John	Plumber	89	30
295. FLOOD, Brian	Fireman	91	33
342. FLOOD, Sean	Discjockey	105	83
73. FLOOD, Vincent	Garda Photographer	19 109	7 30
21. FOLEY, David	Patron	8	23
71. FOLEY, Paul	Patron	18	52
162. FOY, Paula	Lounge-girl	62	1
89. FULLAM, Christina	Patron	23	68
66. FULLARD, Bernadette	Patron	17	31
141. FURLEYJohn	Doorman	52 53	52 1
306. GALLAGHER, James	Garda, Radio Control Centre	92 109	53 32
130. GALLAGHER, Kieran	Patron	33	54
96. GALLAGHER, Liam	Patron	24	110

No. and Name	Description	Transcript	
		Book No.	Page No.
158. GALLAGHER, Patricia	Waitress	61	1
148. GALLAGHER, Thomas	Detective Garda	56	45
191. GANNON, Elizabeth	Eye-witness	64	71
1. GARDE, Maurice	Detective Garda, Mapping Section	3 4 12 107 109 110	14 i i 1 66 35 4
325. GARDNER, Harold	Architectural Draftsman	102 103	13 1
263. GAVIN, Patrick	Detective Garda	81	3
165. GAYNOR, Patricia	Lounge-girl	62	64
124. GAYNOR, Pauline	Patron	32	15
255. GLOVER, George	Fireman, Headquarters Control Room	75	31
277. GREEN, Arthur	Fire Consultant, (Cremer & Warner Ltd)	87 88 108	60 4, 66 67
142. GRIFFIN, Michael	Doorman	53 54	39 1
121. GRIFFIN, Peter	Patron	30 31	90 1
207. GUILFOYLE, Gerard	Barman	66 67	56 1
322. HARBISON, John F	State Pathologist	101	26
242. HARTNETTJohn	Trespasser	73	35
5. HATTON, Sandra	Patron	4	67
355. HAUGHEY, Sean	Assistant City Manager, Dublin Corporation	109	73
76. HEAPES, Joseph	Patron	20	89
290. HEMPENSTALL, James	Fireman	91	10
252. HENNESSY, Liam	Patron	74	86
183. HICKEY, Dolores	Eye-witness	64	23
24. HIGGINS, Linda	Patron	8	77
309. HILL, James	Senior Executive Engineer, Dublin Corporation Waterworks Department	96	1
268. HINKLEY, Peter	Head, Materials Components and Structures Section, Fire Research Station, England	83 84	64 1

No. and Name	Description	Transcript	
		Book No.	Page No.
223. HIPWELLJohn	Building sub-contractor	71 72 111	91 1 67, 96
212. HOARE, Ann	Kitchen Worker	69	67
328. HOBAN, James	Detective Garda	104	18
261. HOBBS, Patrick	Fireman, Sub-officer	80	21
47. HOGANJean	Patron	13	2
219. HOLT, Christopher	Security man	71	24
296. HOSBACK, Noel	Fireman	91	39
211. HUGHES, Daniel	Disc Jockey	69	15
285. HUGHESJohn	Fireman, Sub-officer	89	44
194. HUGHES, Mary	Eye-witness	64	78
114. HUNTER, Elizabeth	Receptionist	29	59
120. HYLAND, Ann	Patron	30	58
7. HYLAND, Sandra	Patron	5	1
343. JOLLEY, Caroline	Patron	106	1
344. KAVANAGH, Elizabeth	Patron	106	30
262. KAVANAGH, John	Fireman, Sub-officer	80	73
175. KAVANAGH, Joseph	Eye-witness	63	65
131. KAVANAGH, Michael	Doorman	36 37 38 48 49	23 7 1 11 79
176. KAVANAGH, Patricia	Eye-witness	63	69
280. KEANE, Vincent	Fireman	88	71
86. KEARNEY, Harriet	Patron	23	22
3. KEATING, Mary	Patron	4	24
298. KEEGAN, Noel	Fireman	91	53
177. KEELY, Christopher	Eye-witness	63	73
178. KEELY, Edith	Eye-witness	63	77
179. KELLY, Anne,	Eye-witness	63	81
196. KELLY, Brenda	Eye-witness	64	83
311. KELLY (ALIAGA), Charles	Chief Planning Officer, Dublin Corporation	96	46
54. KELLY, Michael	Eye-witness	14	61
44. KELLY, Peter	Patron	12	18
197. KELLY, Ronald	Eye-witness	64	86

No. and Name	Description	Transcript	
		Book No.	Page No.
275. KELLY, Thomas	Consultant to Tribunal (Varming, Mulcahy, Reilly & Associates)	86 107 88	28 57 49, 69
127. KENNAN, Thomas	Head doorman	32 33 34 35 36	90 80 1 1 1
248. KENNEDY, Michael	Detective Sergeant	74	48
188. KENNY, Anthony	Eye-witness	64	44
168. KENNY, Bernadette	Eye-witness	63	24
144. KENNY, Frank	Doorman	55	1
189. KENNY, Paul	Eye-witness	64	54
300. KENNY, Robert	Fireman	92	4
51. KEOGH, Paul	Patron	13 14	101 1
18. KEOGH, Yvonne	Patron	7	60
307. KIERNAN, Joseph	Fireman, Third Officer	92 93 95	70 1 12
135. KINAHAN, Phelim	Doorman	41 44 45 48	62 2 1 12
312. KING, Dermot H.	Senior Building Surveyor, Planning Department, Dublin Corporation	96 97 119	80 1, 36 1
72. KING, Trevor	Patron	18 19	96 1
239. KINSELLA, Edward	Barman	73	19
32. LEAVY, Tina	Patron	10	1
360. LENNON, Patrick	Cellarman	117	19
314. LOWE, Maurice	Senior Engineer, Electricity and Public Lighting Department, Dublin Corporation	97 98	81 1
102. LYNCH, Aidan	Patron	25	76
99. LYNCH, Margaret	Patron	25	35
265. MAGEE, Christopher	Fireman	81	38
214. MAHER, Alan	Barman	70	1
156. MAHER, Caroline	Lounge-girl	60	80
42. MAHONY, Ann	Patron	11	70

No. and Name	Description	Transcript	
		Book No.	Page No.
117. MAHOOD, Harry	Patron	30	2
267. MALHOTRA, H. L.	Head, Buildings and Structures Division, Fire Research Station, England	82 83 85	14 3 2, 60
224. MALONE, Thomas	Joinery sub-contractor	72	12
31. MANNING, Kathleen	Patron	9	99
151. MARLEY, Elizabeth	Waitress	58	39
149. MARLEY, Sharon	Waitress	57	85
150. MARLEY, Teresa	Catering Manageress	57 58	100 1
55. MASSEY, Cerina	Patron	14	98
301. MATTHEWS, Francis	Fireman	92	6
192. MEDCALFE, Alan	Eye-witness	64	73
190. MEEHAN, Ciaran	Eye-witness	64	65
313. MERNE, Sheila	Typist Supervisor, Planning Department, Dublin Corporation	97	29
289. MESSITT, Martin	Fireman	91	3
270. MILLS, Trevor	ESB Electrician	86	3
225. MOFFITJames	Ceiling-tile fitter	72 73	19 54
208. MOLONEY, George	Electrician	67 68	9 1
305. MOONEY, Hubert	Corporation Turncock	92	35
256. MOONEY, Noel	Fireman, Station Officer	75 76	51 2
254. MOONEY, Rory	Fireman, Headquarters Control Room	74 75	100 1
278. MOONEY, William	Photographer	88 90	2 58
233. MORRISSEY, Catherine	Cleaner	72	97
227. MORRISSEY, Michael	Band-leader	72	43
249. MULDOON, Bosco	Detective Garda	74	53
61. MULLIGAN, David	Patron	16 51	1 16
128. MULVANEY, Marian	Waitress	33	1
58. MURPHY, Adrienne	Patron	15	57
132. MURPHY, Patrick J.	Doorman	38 39 40	47 1 1
235. MURPHY, Seamus	Barman	72 73	99 1

No. and Name		Description	Transcript	
			Book No.	Page No.
330.	MURRAY, Anthony	Ambulance Driver	104	33
35.	MURRAY, David	Patron	10	82
166.	MURRAY, Michelle	Lounge-girl	62	72
129.	MURRAY, Patricia	Waitress	33	42
356.	McARDLE, Brendan	Detective Garda	110	2
91.	McCABEJoseph	Patron	23	106
232.	McCANN, Laurence	Barman	72	88
45.	MCCARTHY, Carmel	Patron	12	66
33.	MCCARTHY, Jacqueline	Patron	10 51	18 37
46.	MCCARTHY, Joseph	Patron	12	77
159.	McCONALOGUE, Pauline	Lounge-girl	61	20
125.	McCONNELL, Donna	Patron	32	45
28.	McCORMACK, Veronica	Patron	9	36
195.	McCORMACK, Yvonne	Eye-witness	64	81
199.	McCREADY, Rita	Eye-witness	64	92
359.	McDONAGH, Michael	Managing Director, Security firm	115	16
326.	McDONALD, Aidan	Civil Servant, Housing Administration Section, Department of the Environment	103 104	33 1, 46
74.	McDONALD, Anthony	Disc Jockey's Assistant	20	13
281.	McDONALD, Stephen	Fireman	88	81
294.	McDONNELL, James	Fireman	91	29
318.	McDONNELL, Patrick	Senior Planning Assistant, Dublin Corporation	99	44
57.	McGINLEY, Gwendolyn	Patron	15	53
161.	McGRANE, Joseph	Glass-washer	61	75
246.	McGRATH, Catherine	Cashier	74	23
152.	McGRATH, Patrick J.	Maintenance man	58 59 60	88 4 1
9.	McGUINNESS, Pamela	Patron	5 51	49 24
240.	McGUIRE, Niall	Lounge-boy	73	20
350.	McKENNAJohn	Psychologist	107	1
292.	McLOUGHLIN, Kevin	Fireman	91	20
264.	McMAHONJohn	Fireman, Station Officer	81	8
118.	McMAHON, Peter	Patron	30	21

No. and Name	Description	Transcript	
		Book No.	Page No.
231. McPARTLIN, Mary	Cleaner	72	82
154. NAUGHTON, Maeve	Waitress	60	39
137. NEVILLE, Laurence	Barman	48 49	18 1, 80
266. NICE, George	Head, Fire Research Station, Borehamwood, England	82	1
38. NOLAN, Michael	Patron	10 11	113 6
260. NORTON, Michael	Forensic Scientist	78 79 80 89	63 1 2 59
209. 6 BRIAIN, Colm	Disc Jockey	68	15
308. O'BRIEN, Thomas P.	Chief Fire Officer, Dublin Corporation	93 94 95 106	47 3 1, 13 98
167. O'CALLAGHAN, Robert	Eye-witness	62 63	101 1
119. O'CONNOR, Paula	Patron	30	38
303. O'DOWD, Edmond	Fireman	92	25
12. O'HANLON, Mark	Patron	6	45
10. O'HANLON, Sharon	Patron	5 51	67 30
111. O'HARE, Patricia	Patron	27	31
97. O'KEEFFE, Patrick	Patron	25	1
245. O'NEILL, Dermot	Assistant Cashier	73 74	110 1
143. O'NEILL, Gabriel	Doorman	54 55	11 35
273. O'REILLY, Laurence	ESB Supervisor	86	15
291. O'ROURKE, Bernard	Airport Fireman	91	18
216. O'TOOLE, Colm	Barman	70	41
202. O'TOOLEJames	Eye-witness	65	69
332. O'TOOLE, Peter	Patron	104	42, 55
257. PARKES, Brian	Fireman, Sub-officer	76	22
182. PASQUETTI, Anthony	Eye-witness	63 64 108	102 1 6
110. PATJE, Gerard	Patron	27	12

No. and Name	Description	Transcript	
		Book No.	Page No.
200. PEARSE, Agnes	Cleaner	65	1
123. PEARSE, Belinda	Waitress/Cleaner	31 32	50 1
147. PEEL, Brian	Manager	57	18
109. PHELAN, Frederick	Patron	26 27	110 1
279. PORGES, Frederick	Electrical and Ventilation Consultant, (Cremer & Warner Ltd)	88	29, 50
293. POTTS, Terence	Fireman	91	25
79. POWELL, Paul	Patron	21	56
321. PRENDIVILLE, Brendan	Surgeon	101	1
43. PRESTON, Anthony	Patron	11	81
100. PRIOR, Nicholas	Patron	25 51	47 8
138. PRIZEMAN, Elizabeth	Waitress	50	1
62. QUIGLEY, Noel	Patron	16	40
11. QUINN, Gerard	Patron	5 6	90 1
108. QUINN, Martin	Patron	26	92
139. QUINN, Rose	Patron	50	57
259. QUINN, Seamus	Detective Garda, Ballistics Section, Garda Technical Bureau	77 78 80 85 87	23 1 72 58 29
14. RAHAMAN, Adrienne	Patron	6 51	71 3
297. REDMOND, William	Fireman	91	48
230. REIDJohn	Trespasser	72	75
335. REID, Pauline	Patron	104	95
84. REILLY, Alfred	Patron	22	17
85. REILLYJohn	Eye-witness	99 99	99 1
92. REILLY, Harriet	Patron	24	1
23. RICHARDSON, Carmel	Patron	8	61
221. RINGJohn	Aluminium Shutter Supplier	71	60
282. RING, Michael	Roller-blind Supplier	89	1
333. ROE, Ann	Patron	104	72
338. RONAYNE, William	Detective Inspector	105	29

No. and Name	Description	Transcript	
		Book No.	Page No.
157. ROONEY, Valerie	Lounge-girl	60	98
220. ROSE, Cormac	Barman	71	38
258. ROWAN, James	Fireman, Station Officer	76 77	72 1
19. RUSSELL, Gabriel	Patron	7	94
30. RYAN, Deirdre	Patron	9	75
272. RYAN, Vincent	ESB Electrician	86	9
63. RYNNE, David	Barman	16 51	82 10
302. SHANNON, Paul	Fireman	92	17
331. SHERIDAN, Peader	Ambulance Attendant	104	37
347. SHORTALL, James	Patron	106	81
184. SOMERSJohn	Eye-witness	64	29
185. SOMERS, Sandra	Eye-witness	64	35
247. SOMERVILLE, Niall	Trespasser	74	34
283. SPENCER, Brian	Plasterer	89	25
203. STAPLETON, Breda	Kitchen W^Torker	66	2
164. STAPLETON, Elaine	Lounge-girl	62	33
327. STAUNTON, William	Detective Garda	104	5
126. SULLIVAN, Gary	Patron	32	63
87. SWAINE, Mark	Patron	23	35
351. TENNYSON, Anthony	Electrical Expert (Tennyson Associates)	107	21
271. TIMON, Eric	ESB Supervisor	86	7, 23
93. TUCK, Ann	Patron	24	51
276. TUCKER, David	Fire Consultant (Dr Keith Gugan and Associates)	86 87 90 108	52 1 59 45
317. WADE, Charles	Planning Assistant, Dublin Corporation	99	42
218. WADE, Harry	Trespasser	71	10
146. WALSH, Jack	Assistant Manager	56	6, 47
6. WALSH, Valerie	Patron	4 51	90 6
287. WATT, Robert	Fire Consultant (Dr. J. H. Burgoyne and Partners)	90 108	18 11, 46

No. and Name	Description	Transcript	
		Book No.	Page No.
69. WELDRIDGE, David	Patron	17 18 20	Ill 1, 51 1
34. WHELAN, Elaine	Patron	10	66
324. WHITE, William	Architect	101 102	9, 59 2
361. WHITEHEAD, Graham	Company Secretary, Illingworth & Co., Carpet Manufacturers	117	39
320. WILLIAMS, John	Assistant Chief Fire Officer in charge of Fire Prevention Section, Dublin Corporation	100	19
8. WILSON, Sandra	Patron	5	20
13. WINSTON, Frances	Patron	6	66
269. WOOLLEY, William	Head, Combustion Products Section, Fire Research Station, England	85	17
310. WRIGHT, James	Senior Executive Officer, Planning Department, Dublin Corporation	96	30

APPENDIX 4

List of Exhibits

Appendix 4

List of Exhibits

1. Location map.
2. Front and side elevations of Stardust.
3. Large plan of Stardust (detailed), Lantern Room and Silver Swan.
4. Small piece of safety blind.
5. Knife confiscated from patron.
6. Album of Garda photographs of premises.
7. Keys to Exits 1, 3, 4, 5 and 6, together with one Chubb padlock and 16-link chain.
8. Two tickets (one forged) for concert in Stardust on the 15th January, 1981.
9. Copy of "Evening Press" of the 14th February, 1981.
10. Tape cassette recorded by John Fitzsimons.
11. Membership Card for Stardust Disco Club.
12. H.J. Gardner's plan of Stardust—Lantern Room—Silver Swan.
13. Two Armstrong Ltd booklets dealing with Suspended Ceilings.
14. (a) Plan supplied to Mr Henry Dempsey by Mr Eamon Butterly showing proposed layout for tables and seats in Stardust and
    (b) formal order for tables and seats.
15. Armstrong Ltd booklet "Fire and Suspended Ceilings".
16. Colour photograph of fire taken by Mr Thomas Blair.
17. Occurrence Book, Tara Street Fire Station.
18. Carbon copy of docket made out by Sub-Officer Hughes when alarm call was received.
19. Blank specimen form for recording of incoming calls in Fire Station.
20. Adflow Engineering Ltd leaflet dealing with Fog Gun.
21. Burnt match found in Corner of West Alcove where fire originated.
22. Photograph (taken by Dr R. Watt) of burnt seat cover.
23. Storey Bros. & Co. Ltd trade leaflet on "Plastolene" blinds.
24. Cigarette ash, silver wrapping paper and remains of Afton Major cigarette packet found under second seat from front, second row from wall of Main Bar.
25. Technical Report of special investigation by The Fire Research Station of the Building Research Establishment, Borehamwood, Herts., England.
26. Two photographs (taken by Dr R. Watt) of water-tank situated in roof-space above hot-water cylinder in Main Bar.
27. Electricity Supply Board Certificate of Completed Installation at the Stardust; General Conditions relating to Supply of Electricity; and letter dated the 25th August, 1981, from ESB Secretary to Tribunal Solicitor.
28. Four photographs taken by Mr David Tucker and Dr Keith Gugan, three of water-tank in roof space and one of conduit pipe for electric wiring.
29. Three top covers of immersion group terminal units.

30. Four photographs taken by Mr David Tucker and Dr Keith Gugan of terminal blocks on hot-water cylinder in Main Bar.

31. Simplex 3-position electric switch.

32. Fire Certificate pursuant to United Kingdom Fire Precautions Act, 1971.

33. Fire Protection Equipment Leaflet PE4 (Portable Fire Extinguishers)—published by UK Fire Protection Association.

34. Occurrence Book, North Strand FS.

35. Occurrence Book, Kilbarrack FS.

36. Log Book, Dublin Corporation Waterworks Department.

37. Fire Book, Dublin Corporation Waterworks Department.

38. Tape cassette, extracts from master-tapes kept in the Garda Communications Centre, Dublin Castle (See, also, Exhibit 52).

39. Location Map T.P. 11713/2 of 26th March, 1981 accompanying Chief Fire Officer O'Brien's Report, indicating approximate positions in which fatal casualties were found, siting of fire appliances and routing of hoses.

40. Brigade Order Book containing copies of Orders pertaining to control, administration, discipline and internal economy of Dublin Fire Brigade, period 27th October, 1938, to 6th December, 1955.

41. Brigade Order Book (as before)—period 28th March, 1956, to 1st October, 1980.

42. Dublin Corporation Fire Brigade Drill Book, 1957, outlining drills (a) general, (b) foot drills, (c) hand appliance drills and (d) motor appliance drills.

43. Dublin Corporation Waterworks Department Location Map WW 3081 of 10th April, 1981, showing Mains layout near the Stardust, Kilmore Road.

44. Ordnance Survey Map 3132-24, scale 1 : 1,000 showing environs south of the Stardust (Thorndale, Whitethorn and Pinebrook).

45. Dublin Corporation Assistant City Manager's Order dated the 5th January, 1978, granting permission (subject to eight conditions) for conversion of premises for use as cabaret.

46. Dublin Corporation Notice of Approval of Plans under the Building Bye-laws for conversion of premises (subject to eight conditions).

47. Photocopies of (a) Publican's Licence (Ordinary) issued by Collector of Customs & Excise to Scotts Foods Ltd on the 1st October, 1980; and (b) Restaurant Certificate issued by the District Court to Scotts Foods Ltd on the 25th September, 1980.

48. Composite Report of seven doctors who attended to casualties in various hospitals (presented by Mr J. B. Prendiville, FRCSI).

49. Four photographs taken by Dr R. Watt of test with burning paper serviettes on a seat taken from the Stardust.

50. Four fragments of glass found in debris under seats in DE alcove by Mr Arthur Green, fire expert retained by An Garda Siochana.

51. Central Telephone Exchange Emergency Records of alarm call from Stardust Ballroom, Artane at 01.43 on the 14th February, 1981.

52. Tape cassette, further extracts from master-tapes kept in the Garda Communications Centre, Dublin Castle (See, also, Exhibit 38).

53. Scale drawings of (a) Exit 5, and (b) Main Foyer at Exit 2.

54. Copies of front and side elevations of Stardust (Exhibit 2) and large plan of premises (Exhibit 3) marked by Detective Garda Maurice Garde to show line of direction of photograph taken by Mr Thomas Blair (Exhibit 16).

55. Plan of Stardust with layout of seats and tables for 1,460 prepared by Mr H. Gardner and supplied to Mr J. Hipwell, building contractor.

56. Specimen of Evo-stik aluminium-faced sealing strip "Flashband" together with Primer.

57. Typed, unsigned letter dated the 11th February, 1981, on note paper headed "Apollo Security Ltd" sent by Mr Michael McDonagh to Mr Eamon Butterly.

58. Colour film taken by Mr John Burke, RTE television cameraman, during the disaster on the 14th February, 1981.

59. Seven items identified by Mr Eamon Butterly:

    (a) receipt for monies received from promoter, with footnote "N.B. Over 21's Only. Management reserve the right to refuse admission";

    (b) pink publicity leaflet for forthcoming presentations in the Stardust Club and Lantern Room;

    (c) white leaflet for same;

    (d) copy of typed list showing sponsors of coming presentations in Lantern Room and Stardust and dates booked;

    (e) letter dated the 12th February, 1981, from Mr George O'Reilly to Mr Eamon Butterly;

    (f) copy of letter dated the 20th February, 1981, from Kevans, Solicitors, to the Chairman of the RTE Authority;

    (g) reply of Director of Legal Affairs RTE, dated the 5th March, 1981.

60. Brown notebook recording premises inspected by Dublin Corporation Planning Department, period 1973 to 1980.

61. Spiral Notebook Diary, 1977, Dublin Corporation Planning Department.

62. Spiral Notebook Diary, 1978, Dublin Corporation Planning Department.

63. Hely Chambers One Day Octavo Diary, 1978, Dublin Corporation Planning Department.

64. Collins Diary, 1978, Mr Martin Donohoe, Dublin Corporation Planning Department.

APPENDIX 5

Applications for legal representation before the Tribunal

Appendix 5

Applications for legal representation before the Tribunal.

Applicant	Date of application	Whether allowed or refused	Solicitor	Counsel
The Attorney General	2/3/81	Allowed	Chief State Solicitor	Mr Hugh Geoghegan, SC, Mr John Murray, SC
Scotts Foods Ltd and Silver Swan Ltd	2/3/81	Allowed	Kevans	Mr Niall McCarthy, SC, Mr Peter Sutherland, SC, (replaced by Mr Dermot Gleeson, SC, on 15/7/81) and Mr Brian Dempsey
Dublin Corporation	2/3/81	Allowed	WJ.A. Dundon, Law Agent, Dublin Corporation	Mr R.J. O'Hanlon, SC (replaced by Mr Dermot Kinlen, SC, and Mr Thomas Smyth, SC, on 30/3/81) and Mr James Connolly
Next of kin of Miss Carol Bissett, deceased, and thirteen other fatal casualties, and twenty nine injured parties	2/3/81	Allowed	Michael E Hanahoe &Co.	Mr Paul Carney, SC, and Mr Kevin Haugh
Next of kin of Mr Brendan O'Meara deceased, and eleven other fatal casualties, and seventy four injured parties	2/3/81	Allowed	Ms Maire Bates, Coolock Community Law Centre	Mr Patrick Geraghty, SC, and Miss Inge Clissman
Next of kin of Miss Margaret Kiernan, deceased, and twenty other fatal casualties, and sixty one injured parties	2/3/81	Allowed (but Counsel withdrew on 6/4/81)	B. P. O'Reilly & Co.	Mr Garret Cooney, SC, and Mr Thomas Morgan
Next of kin of Mr Brian Hobbs, deceased	2/3/81	Refused	Lehane and Hogan	Mr Patrick McEntee, SC, and Mr Seamus O Tuathail
Miss Sandra Caffrey, an injured party	2/3/81	Refused	Lawlor O'Reilly & Co.	Mr Adrian Cunningham
Next of kin of Mr James Buckley, deceased, and twenty five other fatal casualties, and one hundred and twenty one other injured parties.	30/3/81	Allowed	Liam Lysaght & Co.	Mr Patrick McEntee, SC, and Mr Martin Giblin

APPENDIX 6

The Applicability of the Bye-Laws to the Building

Appendix 6

Applicability of the Bye-Laws to the Building

1. At the time the Public Resort Bye-laws and the Building Bye-laws were made by Dublin Corporation, the area in which the building is situated was not within the boundary of the County Borough of Dublin. A question accordingly arose as to whether the bye-laws became applicable to the premises, following the incorporation of the area in the County Borough of Dublin by the Local Government Provisional Order Confirmation Act, 1953, and remained applicable thereafter.

2. The Local Government (Dublin) Act, 1930, provided *inter alia* for the incorporation in the County Borough of Dublin of certain areas then forming part of County Dublin and referred to in the Act as the "added rural area". Section 21 (2) provided that

   "No bye-law, rule or regulation in force in the existing city [the County Borough of Dublin] immediately before the appointed day shall apply or be extended to the added rural area merely by virtue of the inclusion of such area in the City by this act, but the City Council may at any time by resolution extend and apply such bye-law, rule or regulation to the added rural area ....".

3. Clause 4 of the Provisional Order, which was confirmed by the Local Government Provisional Order Confirmation Act, 1953, provided that the area thereby added to the County Borough ofDublin

   "shall be included in and form part of the city for all purposes".

4. Following the passing of this Act, the Corporation was advised by Senior Counsel that it would be necessary for the City Council to pass a resolution, under Section 21 (2) of the Act of 1930, if it was desired to ensure that particular bye-laws became applicable to the area added to the County Borough ofDublin by virtue of the Act of 1953. There was, however, no record of any such resolution having been passed.

5. Section 27 of the Act of 1930 provided that, after the passing of the Act, further extensions of the County Borough of Dublin into the area of Dublin County Council could be effected by means of a resolution of the City Council, the making of a Provisional Order by the Minister for Local Government, as he then was, on the application of the Corporation, and the confirmation of the Provisional Order by the Oireachtas. Sub-section (5) provided that upon the coming into force of the Provisional Order, the other provisions of the Act of 1930 dealing with the extension of the County Borough of Dublin into the area of Dublin County Council would also apply to the further areas so added. It was by virtue of such a resolution, followed by a Provisional Order confirmed by the Act of 1953, that the area in which the building is situated became added to the County Borough.

6. The effect of Section 27 (5) would appear to be that, when the area in which the building was situated was added to the County Borough by virtue of the Act of 1953, the provisions of Section 21 (2) of the Act of 1930 also became applicable; and it would appear to follow that, in order for the bye-laws to be applicable, it would be necessary for the City Council to pass the resolution envisaged by that Section.

7. This was the basis of the advice given to the Corporation by Senior Counsel in 1953. The Tribunal is satisfied that the effect of that section was clearly to require the passing of such a resolution; and that, in its absence, there was no automatic extension of the applicability of the bye-law to the area in which the building is situated. While the use of the words "for all purposes" might point, at first reading, to a different conclusion, it is clear that, had the legislature intended to amend Section 21 (2) and Section 27 (5) of the Act of 1930, it would not have done so in this indirect manner. The scheme provided by Section 21 (2) of the Act of 1930

for the extension of bye-laws by resolution of the City Council was clearly intended to apply as new areas were added to the city by virtue of Provisional Orders confirmed by the Oireachtas. There is no reason why this system should have been altered in 1953 in favour of a system under which all bye-laws became directly applicable; and the use of the words "for all purposes" in Clause 4 of the Provisional Order of 1953 seems too tenuous a basis for imputing such an intention to the legislature.

8. The Tribunal is, accordingly, satisfied that the Building Bye-laws and Public Bye-laws were not applicable to the building at any material time.

APPENDIX 7

Levels of Carbon Monoxide, Cyanide and Alcohol in 45 Victims of the Disaster

Appendix 7

Levels of Carbon Monoxide, Cyanide and Alcohol in 45 Victims of the Disaster

Fire Victim No.	Carbon Monoxide % Saturation of Blood	Cyanide Micrograms u/u	Alcohol Milligrams %	
			Blood	Urine
1	36	27.7	6.3	
2	25	11.2	25.8	
3	50	36.4	125.1	
4	31	13.5	2.1	
5	26	17.0	Nil	
6	14	blood unsuitable	90.5	
7	39	13.2	36.3	
8	25	53.9	Nil	
9	40	7.6	145.1	
10	30	17.4	Nil	
11	26	16.3	Nil	6.5
12	20	19.1	207.8	287.4
13	42	123.3	211.0	
14	39	58.6	14.0	
15	27	7.1	212.5	249.9
16	45	19.5	79.2	103.6
17	36	14.6	92.7	134.2
18	34	72.1	11.7	14.7
19	10	4.5	126.4	
20	27	39.7	72.9	109.1
21	33	10.5	Nil	Nil
22	36	66.7	115.0	133.5
23	59	30	155.5	140.9
24	20	8.4	152.0	244.3
25	20	12.4	148.9	175.6
26	41	12.7	129.7	
27	56	11.4	90.8	126.5
28	30	33.1	1.9	4.9
29	39	11.7	4.4	
30	42	26.4	102.5	143.6
31	15	12.1	103.8	
32	55	100.5	175.6	
33	48	28.8	124.7	
34	29	49.2	63.7	
35	50	122.7	158.8	
37	18	9.3	92.8	111.0
38	50	153.0	23.9	
39	3	6.5	101	187.2
40	30	40.7	Nil	13.3
41	24	59.2	123.4	164.8
42	56	37.4	195.3	294.2
43	61	61.8	178.7	233.3
44	42	22.7	Nil	
45	46	5.0	74.4	
47	0	3.9		

APPENDIX 8

Samples removed by Detective Garda Seamus Quinn from the north-west corner of the West Alcove

Appendix 8

Samples removed by Detective Garda Seamus Quinn from the north-west corner of the West Alcove.

SQ1 Nylon bag containing a piece of foam labelled "Last row, left seat".

SQ2 Plastic bag containing a piece of fire-damaged chipboard labelled "Last row, left seat".

SQ3 Plastic bag containing a piece of fire-damaged chipboard labelled "Last row, left seat".

SQ4 Plastic bag containing a piece of wet fire-damaged foam labelled "Back row, centre seat".

SQ5 Plastic bag containing fire-damaged carpet tiles labelled "Back of centre seat, last row".

SQ6 Plastic bag containing a piece of smoke-blackened damp chipboard labelled "Back row, centre seat".

SQ7 Plastic bag containing a piece of damp smoke-blackened chipboard labelled "Back row, centre seat".

SQ8 Plastic bag containing a piece of damp, fire-damaged foam and labelled "Last row, right seat".

SQ9 Plastic bag containing a piece of fire-damaged, damp foam labelled "Back of right seat, last row".

SQ10 Nylon bag containing a piece of fire-damaged PVC labelled "End row, right seat".

SQ11 Plastic bag containing carpet tiles labelled "Last row, right rear seat".

SQ12 Plastic bag containing a sample of chipboard which was smoke-blackened on the under side and the upper surface undamaged by fire or smoke. The bag was labelled "Last row, right seat".

SQ13 Plastic bag containing a sheet of partially burned PVC labelled "Back of centre seat, last row".

SQ14 Plastic bag containing a sample of chipboard and labelled "Last row, right seat".

APPENDIX 9

Recommended Criteria for Fire Protection in Assembly Buildings

Appendix 9

Recommended Criteria for Fire Protection in Assembly Buildings

1. The estimation of risk in an assembly building can be based on three factors: the use to which the building is put, the number of likely occupants, and the vertical configuration of the building. For each factor it is possible to identify three levels of risk, thereby giving a matrix of nine variables.

2. The factors and their sub-factors are as follows:

   Use
   Group Occupancy A
   Group Occupancy B — See Appendix 11
   Group Occupancy C

   Occupancy level
   (i) Less than 50
   (ii) Between 50 and 100
   (iii) More than 100

   Vertical Configuration
   I Single-storey
   II Multi-storey
   III Basement

3. If values of 1, 5 and 10 are associated respectively with each sub-factor in each category and the values are added, the relative risk varies from a low value of 3 to the highest value of 30.

4. Eight fire protection measures can be identified concerned with the nature of linings, the nature of furnishings, inter-relation between linings and furnishings, a detection system, a warning system, the provision of extinguishers, installation of hose reels and the installation of a sprinkler system. These numbers have a zero value when not present or controlled, and an assigned value when existing.

5. The following values are assigned to the various factors listed in paragraph 4:

Linings—Class 1	3	Class 0	7
Furniture (not controlled)	0	Non-ignitible (BS 5852)	4
Furniture abutting on linings	0	Furniture separate from linings	5
Detection: None	0	Installed	5
Warning system: None	0	Installed	2
Extinguishers: None	0	Installed	3
Hose reels: None	0	Installed	9
Sprinklers: None	0	Installed	10

6. The total value of protection is obtained by adding the values attached to the various factors and it must not be less than the risk assessment made on the bases of paragraphs 3 and 4.

7. Control of linings is imperative in all cases: it must be either Class 1 or Class 0.

8. The model is constructed on the assumption that the building is subject to all the requirements of the Building and Management Regulations in relation to means of escape, and in particular the requirements as to travel distances, number of exits, availability of exits and the provision of emergency lighting.

9. The model is also constructed on the assumption that the requirements of the Management Regulations apply to the building relating to the provision and training of adequate staff for dealing with such aspects of a fire emergency as:
   (i) warning the fire brigade:
   (ii) evacuating the premises: and
   (iii) attempting to extinguish the fire.

APPENDIX 10

Fire Statistics relating to Ireland, April, 1966 — December, 1980.

Appendix 10

Statistics relating to fire services in the period April, 1966 — December, 1980**

Financial Year April/March 1966/67-1973/74 Jan/Dec 1975 etc.	Total cost of Fire Service	Personnel Employed		Total Number of Fires Attended	Total Number of Fires in Private	Fatalities resulting from fire	Estimated material fire loss
		Full-Time	Part-Time				
	£						£
1966/67	930,625	498	1,840	9,143	5,400	20	2,551,538
1967/68	1,061,229	501	1,839	9,950	5,430	26	2,449,674
1968/69	1,186,671	504	1,895	11,622	7,371	31	4,594,882
1969/70	1,435,907	515	1,881	13,219	7,519	32	5,400,533
1970/71	1,780,296	527	1,919	13,686	6,541	42	6,122,284
1971/72	2,154,061	615	1,896	15,884	7,675	38	6,964,755
1972/73	2,621,809	660	1,924	17,940	8,376	34	6,664,500
1973/74	3,310,851	686	1,957	16,379	8,274	57	7,283,969
+ 1974	3,578,178	741	1,983	13,858	6,536	22	8,979,182
1975	6,421,728	802	1,972	22,710	10,471	38	10,314,847
1976	8,117,785	870	1,980	24,806	12,511	55	15,329,830
1977	9,515,637	902	1,993	27,044	14,748	44	17,441,924
1978	11,182,570	917	2,004	*24,561	* 15,509	*38	17,464,409
1979	13,255,082	923	2,041	29,716	18,124	116	25,727,788
1980	18,812,271	954	2,083	30,969	18,721	69	22,515,499

+Covers period from 1st April, 1974 to 31st December, 1974.

*Figures included in respect of Dublin and Dun Laoghaire Brigades were available for an 8 month period only and were available for 10 months only in the case of Dundalk Brigade.

**Abstracted from Fire Statistics, 1980, Department of the Environment.

APPENDIX 11

Recommended classification of assembly buildings by occupancy based on the Building Standards (Scotland) Regulations, 1981

Appendix 11

Recommended classification of assembly buildings by occupancy based on the Building Standards (Scotland) Regulations, 1981

OCCUPANCY GROUP A	Bus passenger roadside shelters Passenger stations Public conveniences Grandstands Stadia Sports pavilions Gymnasia Indoor bowling alleys Indoor games courts Riding schools Skating rinks Swimming baths (including any swimming pool, changing rooms, turkish baths or similar facilities pertaining thereto) Funfairs Menageries and zoos Amusement arcades
OCCUPANCY GROUP B	Non-residential clubs, colleges and schools, clinics, surgeries, consulting rooms and related accommodation Church buildings and similar buildings Court rooms Museums, art galleries Libraries to which persons other than employees have access Fire stations[1] Police stations[1]
OCCUPANCY GROUP C	Theatres, cinemas, radio and television studios to which the public are admitted Casinos and bingo halls Concert halls Restaurants, cafes, canteens Exhibition halls Dance halls (including discotheques), dancing schools Public houses[2]

Footnotes:

[1] Fire stations and police stations with sleeping or residential accommodation attached should not be included in these occupancy groups.

[2] Public houses which are classified in Scotland as Group B should be classified in Ireland as Group C.

APPENDIX 12

Extract from Tara Street Fire Station Occurrence Book for the 14th February, 1981.

Appendix 12

Extract from Tara Street Fire Station Occurrence Book for the 14th February, 1981.

DATE: 14th February, 1981 Saturday No. HQ Station

	____M	OCCURRENCES	Left	Returned
Fire	01.43	Phone 317287 Fire at Stardust Club, Kilmore Road, Artane		
	01.44	FB 41 D/O Rowan and crew mobile	01.44	06.59
	01.44	FB 42 S/O Parkes and crew mobile	01.44	06.19
	01.44	FB 61 S/O Mooney and crew mobile	01.44	07.01
	01.44	FB 105 S/O Hobbs and crew mobile	01.44	05.12
	01.44	FB 106 S/O Kavanagh and crew mobile	01.44	04.10
X34	01.44	FB 34 and crew mobile	01.44	04.17
Dist call	01.51	Per R/T FB 61 S/O Mooney rept a Dist call Stardust Club Artane .... (illegible) Gardai W.W.Y.D.		
X104	01.51	Omitted at 01.44 FB 104 mobile for Stardust Club, Artane		
	01.52	FB 32 mobile for Stardust with S/O McMahon	01.52	04.46
X74	01.52	FB 74 and crew mobile for Stardust	01.52	
X St James	01.52	St. James responding with one amb at Stardust, had only one amb available		
	01.52	Waverley had no amb available		
X24	01.57	FB 24 responding per R/T to Stardust Club, Artane		
H/T64	01.58	FB 64 at Mater Hosp		
X84	01.58	FB 84 responding to Stardust Club		
H/T14	01.58	FB 14 at Rotunda Hosp		
X14R/T	01.59	FB 14 per R/T to Stardust Club No. 1		
Jervis St Hosp on call	01.59	Jervis St Hosp now available for casualties		
X44	01.59	Omitted at 01.44 FB 44 mobile for Stardust Club		
HT34	02.06	FB 34 at Mater Hosp		
	02.07	Per R/T FB 74 broken down in Pearse St being replaced from yard		
Dr Steevens on call	02.11	Dr Steevens will not accept casualties reluctantly, FB 104 Mater		
Major Accident Plan Phase 2	02.12	Phase 2 Major Accident Plan now in operation from the Gardai		

	____M	OCCURRENCES	Left	Returned
	02.12	FB 104 now returning to Stardust Artane		
Fire	02.14	FB 22 S/O Potts and crew mobile for Stardust	02.14	04.42
	02.14	FB 11 S/O Kavanagh and crew mobile for Stardust	02.14	02.55
HT74	02.16	FB 74 arrd at St James		
X 74 R/T	02.16	FB 74 mobile for Stardust, Artane		
HT44	02.17	FB 44 at Vincents Hosp		
	02.18	FB 34 at Dr Steevens Hosp		
X 34 R/T	02.19	FB 34 mobile for Stardust, Artane		
Fire	02.23	By phone 710338 van on fire at O'Connell Bridge		
	02.24	FB 51 S/O Ryan and crew mobile	02.24	02.49
HT84	02.24	FB 84 at Dr Steevens		
X 84 R/T	02.24	FB 84 mobile for Stardust	02.24	
HT64	02.27	FB 64 at St James		
Fire Swords	02.27	Swords FB responding to Stardust Artane	02.27	03.54
24 HT	02.28	FB 24 at St. James		
14 HT	02.28	FB 14 at St. James		
X 14 R/T	02.30	FB 14 responding to Stardust Artane		
HT54	02.30	FB 54 at St. James		
X 64 R/T	02.31	FB 64 responding to Stardust		
Malahide	02.31	Malahide FB responding to Stardust		
Stop	02.33	Per R/T S/O Ryan rept. S/C Call (?) O'Connell Bridge		
54 R/T	02.33	FB 54 responding to Stardust		
	02.34	Per R/T FB 11 returning to Stn per instruction of Mr Kiernan		
	02.35	Malahide FB recalled		
	02.38	FB 24 at HQ standing by		
	02.43	FB 06 on his way for Storeman		
HT34	02.46	FB 34 at Richmond Hosp		
HT44	02.46	FB 44 at Jervis Street		
X24	02.46	FB 24 responding to Stardust		
X94	02.47	FB 94 responding to Stardust		
	02.49	FB 104 responding to Stardust		
	02.49	FB 51 rtd closing down		
34 HT	02.51	FB 34 at Richmond broken down		
Fire Under	02.54	Per R/T FB 01 Major Accident being stepped down, amb will be requested as needed. Fire Under.		

APPENDIX 13

Specimens of fire risk information plans for special risk buildings, as carried on fire appliances and retained in central control room in Northern Ireland

Fire Authority for Northern Ireland

SECTION 2 (1) d. INSPECTION CARD

PRE			
STA			
ANT			
ANT			

STATION AREA ANTRIM

RISK = HOUSE

TRADE OR BUSINESS NURSING HOME FOR PSYCHIATRIC PATIENTS

CONTACT MR F:?:9:or DUTY. ENGINEER AT HOLYWELL HOSPITAL — Telephone No.

KEY HOLDER ... NURSING SISTER.IN CHARGE — Telephone No

ROUTE FROM STATION	STEEPLE ROAD ACROSS STILES WAY TO BUSH ROAD		
HAZARDS	PROPERTIES	LOCATION	ACTION
Elderly ambulant and non-ambulant patients some may be under sedation		Wards and Rest Rooms	Evacuate to sections of building not involved or outside as necessary.
L.P.G. Tank	Explosive Irritant Asphyxiant Anaesthetic	See Sketch Plan	Caution Limits of gas cloud may not be visible if leaking. If cooling tank apply heavy water spray to entire tank from safe position.
Oil Storage	Domestic Fuel Oil	Entrance via enclosed yard	Foam Jets

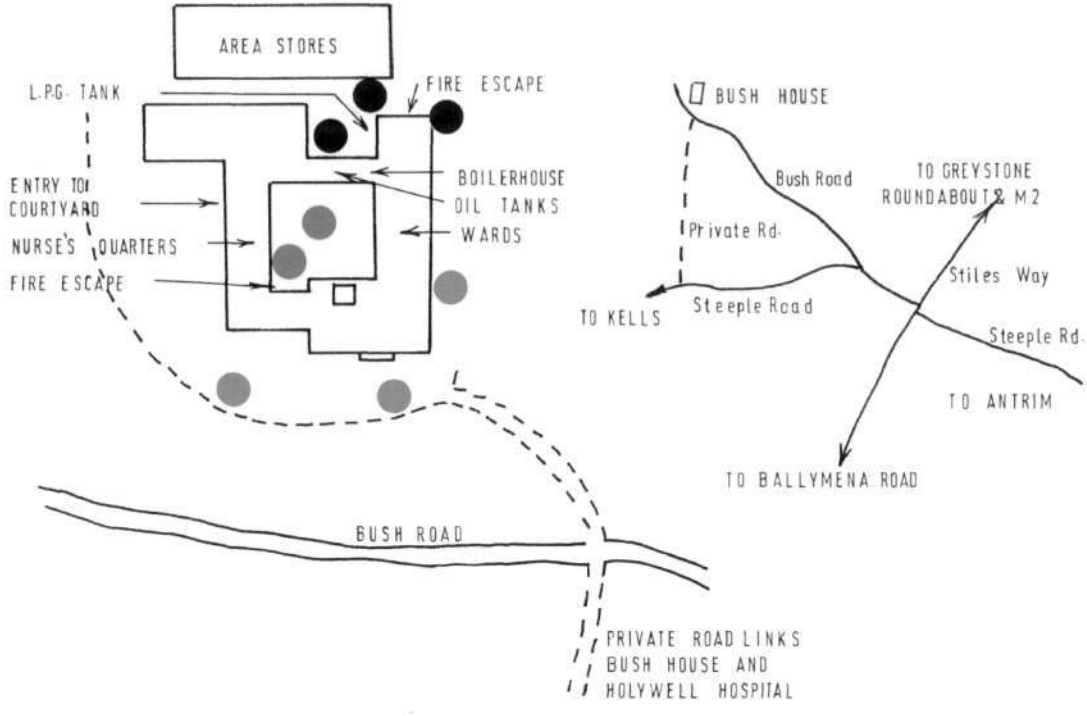
CARD No

INSPECTIONS

DATE						
STATION/WATCH						

BUSH HOUSE
Scale 1:1250

SITE PLAN
Scale 1: 20000



PLAN

FIXED INSTALLATIONS	Internal hose reels 30m throughout

Type and Size of Building with Date of Construction.

Range of buildings 48m by 40m, 2 floors, stone and brick walls, timber floors, slate roof on timber rafters. Const. approx. 1850 modernised as Nursing Home 1920 last redecoration June 1978

HYDRANTS

(See Other Water Supplies)

- 0 – 75
- 75 – 150
- 150 – 250
- 250 +

LENGTHS OF HOSE

OTHER WATER SUPPLIES

Hyds. fed from private resv. at Tullymoyle 1 mile away (as Holywell). Supply from County main, open valve at Steeple Rd. Entrance to Holywell, under supervision of Holywell Duty Engineer. By-pass valves at entrance to Holywell

MAIN SWITCH / STOP VALVE	
ELECTRICITY / GAS	
In enclosed Yard	At L.P.G. Tank

Fire Authority for Northern Ireland

SECTION 2 (1) d INSPECTION CARD

S			
O			

STATION AREA

RISK .....

TRADE OR BUSINESS **HOSPITAL—MATERNITY & GERIATRIC**

CONTACT **SENIOR STAFF ON DUTY** Telephone No.: .....

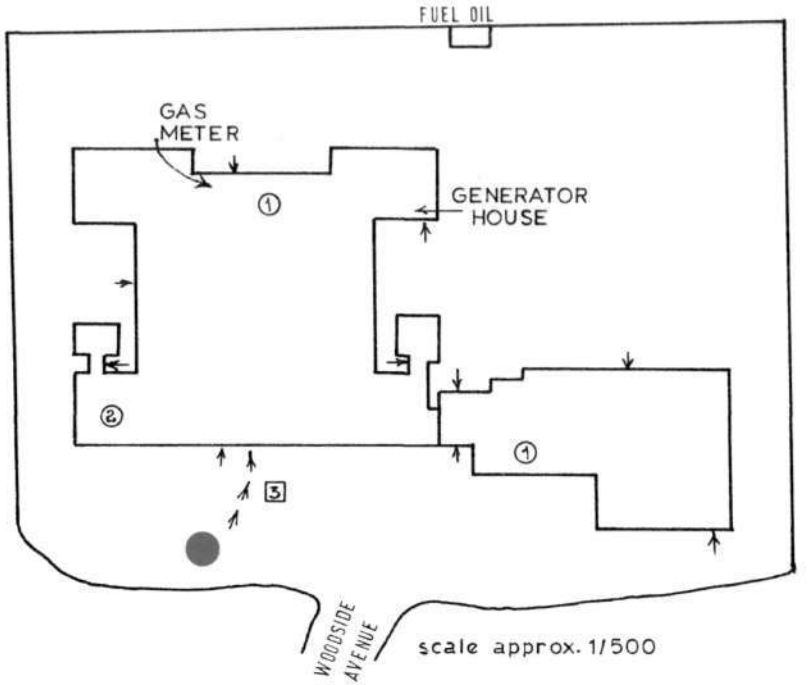
KEY HOLDER ..... Telephone No.: .....

ROUTE FROM STATION	MOUNTJOY ROAD — WOODSIDE AVENUE		
HAZARDS	PROPERTIES	LOCATION	ACTION
Life Risk		Throughout Hospital	
Oil Tank	Flammable when heated	At rear of hospital	Use Foam Jets

CARD No
2

INSPECTIONS

DATE						
STATION/WATCH						



PLAN

FIXED INSTALLATIONS

Type and Size of Building with Date of Construction.

Type 4 — 1850

180′ × 80′

HYDRANTS

- 0 – 75
- 75 – 150
- 150 – 250
- 250 +

LENGTHS OF HOSE

→ → → □

OTHER WATER SUPPLIES

MAIN SWITCH/STOP VALVE

ELECTRICITY/GAS

Generator Hsg.

Cupboard in Kitchen

APPENDIX 14

The Tests in Detail

A

Appendix 14

The Tests in detail

INDEX

(G) : Interaction between seats and wall tiles

(1) Balcony rig tests—Tests G1, G2 and G3
- (i) Aim
- (ii) Experimental construction
- (iii) Instrumentation
- (iv) Test procedure
- (v) Test results

(H) : Ad hoc large-scale experiments on fire growth

(1) Spread of fire between tiers of seating, interaction between seating units, carpet tiles and floor covering—ignition source remote from wall—Test HI
- (i) Aim
- (ii) Experimental construction
- (iii) Instrumentation
- (iv) Test procedure
- (v) Test results

(2) Fire-spread along tiers and interaction between seating units, wall carpet tiles and floor covering—ignition source on seat adjacent to wall—Test H2
- (i) Aim
- (ii) Experimental construction
- (iii) Instrumentation
- (iv) Test procedure
- (v) Test results

(I) : Large-scale simulation test

(1) Reproduction of development of fire in section of West Alcove (Test I)
- (i) Aim
- (ii) Experimental construction
- (iii) Instrumentation
- (iv) Test procedure
- (v) Test results

(J) : **Smoke production**

(K) : Toxic product emission

(1) Analyis of gaseous products
- (i) Aim
- (ii) Instrumentation
- (iii) Test procedure
- (iv) Test results
  - (a) Carbon monoxide, carbon dioxide and oxygen
  - (b) Hydrogen cyanide and hydrogen chloride
  - (c) Fingerprint analyses

(L) : **Discrepancies between materials used in certain tests and materials in building**

(1) Introduction
(2) Changes to burning rates of seating units
(3) Interaction between seats and wall tiles—Experiments Gl and G2
(4) Ad hoc large-scale experiments on fire growth—Tests H1 and H2
(5) Large-scale simulation (Test **I)**

(M) : **Other non-standard tests**

(1) Ceiling tiles from Lantern Room
(2) Orange "Wavin" piping
(3) Plastics air duct
(4) Green material from the area of the roller blind

(5) Material from PVC quilt of cylinder in Main Bar
(6) Corrugated asbestos from roof
(7) Material from roller blind
(8) Seating unit from Stardust
(9) Sample of material from table top
(10) Sample of carpet tile
(11) Floor covering material
(12) Two shirts
(13) Tests for ignitibility of seating units from the Lantern Room
(14) Tests for ignitibility of seating units (Cremer & Warner Ireland Ltd)
(15) Same (Dr. J. H. Burgoyne & Partners)

A (1) DESCRIPTION OF MATERIALS USED IN FRS TESTS

(i) Wall Tiles

Stateroom

Supplied by E. Illingworth & Co as carpet tiles 0.5 m square.
Description: Polyester tufted pile on PVC backing.

Polyester pile yarn weight	0.814 kg/m^2
Polypropylene scrim	0.15 kg/m^2
PVC backing	2.5 kg/m^2, 2.5 mm thick
Pile height above backing	5 mm
Overall weight	3.5 kg/m^2 or 0.9 kg per tile
Theoretical heat output	68 MJ/m^2 or 17 MJ per tile.

Simulated Stateroom

Description as above.

Yarn woven on polypropylene scrim at Kidderminster Technical College.
PVC backing coat and backing applied at ICI by FRS and ICI staff.

Polyester pile yarn weight	0.8 kg/m^2
Polypropylene scrim	0.15 kg/m^2
PVC backing	2-3 kg/m^2, 2-4 mm thick
Pile height above backing	8 mm
Overall weight	3-4 kg/m^2 or 0.75-1 kg per tile
Theoretical heat output	58-76 MJ/m^2 or 14-20 MJ per tile

(ii) Wall Tile Adhesive

Supplied by Shell Composites Ltd.

Description: Laybond Super Quickstick—a synthetic resin per polymer solution in a blend of volatile solvents.

Application rate: 3 litres per 10 m^2.

(iii) Seating Units* (see Figure A1)

Description: PVC covered polyurethane foam on a tubular steel framework.

Weight: framework — 10 kg; back — 7.4 kg; squab — 4.4: 22 kg.

Framework

Black painted tubular steel of 25 mm square cross-section. All ends stopped with black plastics inserts.

Overall dimensions: length — 900 mm; width — 410 mm; height — 960 mm.
Squab height from floor — 470 mm.
Typical distance between seats — 15 mm (±5)

Seat back

Polyurethane foam 24-26 kg/m^3.

Dimensions (mm): 870 x 615 x 50 compressed to 850 x 600 x 50 by PVC covering.
Weight of foam back: 0.67 kg.
PVC (red) covering 1.2 mm thick including cotton scrim.
Weight: 1.7 kg.
Chipboard 850 x 600 mm x 18 mm thick.
Weight: 4.7 kg.

The seating units installed in the West Alcove had higher seat backs (see Table LI).

Seat squab

Polyurethane foam 30 kg/m^3.

Dimensions (mm) — 920 x 390 x 50 compressed to 910 x 380 x 50 by PVC covering.

Weight —0.56 kg.

PVC (red) covering 1.2 mm thick including cotton scrim.

Weight —0.5 kg.

Polypropylene scrim

Weight —0.033 kg.

Chipboard — 910 mm x 380 mm x 18 mm thick.

Weight: 3.3 kg.

Theoretical heat output of seating unit

Material	Weight kg	Calorific value MJ/kg	Theoretical heat output MJ	Total
Polyurethane foam	1.23	23	28	
PVC	2.2	18	40	
Chipboard	8	15	120	
Polypropylene	0.033	43	1	190 MJ

(iv) **Table Unit** (see Figure A2)

Description: Melamine faced chipboard top on a steel framework.
Two sizes were used — 2 seating unit and 3 seating unit.
Weight:

	2 seating unit	3 seating unit
Top	14.5 kg	20 kg
Frame	11.5 kg	13 kg
	26.0 kg	33 kg

Framework

Two cylindrical legs 60 (sometimes 90) mm diameter spaced at 830 or 1660 mm centres for 2 or 3 seat units respectively. Legs supported on 150 mm square plates 3 mm thick. Lateral support provided at top by 25 mm angle welded to top lip of legs. Length of angles 1200 or 2000 mm for 2 or 3 seating unit.

Table top

Screwed to framework.

Melamine — natural rosewood, 1.25 mm thick glued to top and edges of chipboard with contact adhesive.

Chipboard 30 mm thick, width 385 mm. Length 1830 and 2500 mm for 2 and 3 seating units respectively.

Theoretical heat output of table unit

2 seating unit	3 seating unit
200 MJ	300 MJ

(v) **Floor Carpet**

Alcoves — Nylfloor2000
Supplied by E. Illingworth and Co.
Description: A non-woven nylon/polyester soft floor covering.

Fibre

Nylon — 0.22 kg/m^2; polyester content — 0.12 kg/m^2.

Scrim

Polypropylene — 0.03 kg/m^2.

Bonding agent

Styrene, butadiene — 0.462 kg/m^2.

Backing

Synthetic fibre waste (acyrlic) — 0.271 kg/m^2; nominal thickness — 5.2 mm; supplied in rolls — 1.5 m wide, 33 m length; theoretical heat output — 39 MJ/m^2.

Dance floor area — Villatex Ultra

Supplied by E. Illingworth and Co., as 0.5 m square floor tiles.

Description: Nylon/polypropylene fibre bonded carpet.

Fibre:

Nylon at 0.24 kg/m^2; polypropylene at 0.2 kg/m^2; viscose at 0.05 kg/m^2 0.49 kg/m^2.

Main Fabric:

Polypropylene at 0.95 kg/m^2.

Backing

Bitumen at 2.27 kg/m^2 on polypropylene scrim at 0.23 kg/m^2.

Theoretical heat output

140 MJ/m^2 or 35 MJ per tile.

(vi) **Roller Blinds**

Fabric supplied by Storey Brothers and Co Ltd.

Description: Flexible vinyl sheeting printed on one side and reinforced internally with woven polyester fabric.

PVC content — 0.4 kg/m^2.

Polyester — 0.056 kg/m^2.

Nominal thickness — 0.5 mm.

Fabric was made up with roller blind units, spring loaded and running in aluminium channels.

Length of fabric about 4.4 m.

Potential heat output: 8 MJ/m^2.

(vii) **Ceiling Tiles**

Supplied by Armstrong World Industries Ltd.

Description: Mineral fibre suspended ceiling system.

Ceiling tiles: Armstrong Celtic Minatone tiles, 600 x 600 x 15 mm.

Suspension: Armstrong Trulok system (concealed grid).

A. (2)

TABLES SUMMARISING THE RESULTS OF THE PRINCIPAL TESTS FROM FRS, FIRTO AN

Table (I) Standard Test Results

Material/assembly	BS476 Pt7	BS476 Pt6	DD70 Time to ignite given for ignition at 5 W/cm^2 and at lowest intensity at which ignition occurred	BS 5852	BSDD 58	BS 3119	BS 5438	BS 2782 508C	BS 4790	ASTM E662 Mean D_m(max)	BS476 Pt4
Wall lining 'Stateroom' carpet on low density base	Class 4 TestC3	1 = 25.7 li= 12.7 Test C2	35s at 5 W/cm^2 184s at 2 W/cm^2 Test CI								
'Stateroom' carpet on high density base	Class 3 TestC3									Smouldering—640 Flaming—406 Test C4	
Simulated 'Stateroom' on low density base	Class 3 TestC3		19s at 5 W/cm^2 204s at 2 W/cm^2 Test CI								
Seating Unit PVC with foam underlay (from seat)			4s at 5 W/cm^2 39s at 1 W/cm^2 Test C6	Cigarette* Flamet TestC5	Flame 1* Flame 2t TestC5						
PVC with foam underlay (from suppliers)				Cigarette* Flame* Test C5							

* = Pass f = Fail

^ **Table (I) Standard Test Results (continued)**

Material/assembly	BS476 Pt7	BS476 Pt6	DD70 Time to ignite given for ignition at 5 W/cm^2 and at lowest intensity at which ignition occurred	BS 5852	BSDD 58	BS 3119	BS 5438	BS2782 508C	BS 4790	ASTM E662 MeanDm(max)	BS476 Pt4
PVC (fabric backed)						Char length Complete specimen Test C8	No flaming No hole or spread to edge, no afterglow TestC7				
PVC (fabric back removed)								230 mm spread TestC9		Smouldering 344 Flaming 230 Test CIO	
Polyurethane foam										Smouldering 257 Flaming 163 Test CIO	
PVC on chipboard			6s at 5 W/cm^2 70s at 1 W/cm^2 TestC6								
Polypropylene on chipboard			14s at 5 W/cm^2 256s at 2 W/cm^2 TestC6								

Table (I) Standard Test Results (continued)

Material/assembly	BS476 Pt 7	BS476 Pt6	DD70 Time to ignite given for ignition at 5 W/cm^2 and at lowest intensity at which ignition occurred	BS 5852	BSDD 58	BS 3119	BS 5438	BS2782 508C	BS 4790	ASTM E662 Mean D_m(max)	BS476 Pt4
Table Melamine on chipboard			23s at 5 W/cm^2 313s at 1 W/cm^2 TestC6								
Chipboard			22s at 5 W/cm^2 203s at 2 W/cm^2 Test C6								
Roller Blind Polyester reinforced PVC						Flamingj>6s Char 91 mm TestC 12	Flaming 1.6s No hole or flame to edge No afterglow TestC13	49 mm spread Test CI 1			
Ceiling tile	Class 1 TestC 15	1=6.8 ii = 3.7 TestC 14									Combustible Furnace t/c—64°C Specimen t/c—239°C 80s flaming TestC 16

o

Table (I) Standard Test Results (continued)

Material/assembly	BS476 Pt 7	I BS476 Pt6	DD70 Time to ignite given for ignition at 5 W/cm^2 and at lowest intensity at which ignition occurred	BS 5852	BSDD 58	BS 3119	BS 5438	BS 2782 508C	BS 4790	ASTM E662 MeanDm(max)	BS476 Pt4
Floor Carpet Ultra			28s at 5 W/cm^2 159s at 2 W/cm^2 TestC18						Flaming 2 min Damage radius above 50 mm below 20 mm Test CI7		
Nylfloor			6s at 5 W/cm^2 43s at 2 W/cm^2 TestC 18						Flaming 4 min 40s Damage radius above 45 mm below 40 mm TestC17		

Table (II) Non-standard fire tests on individual items and assemblies

Material/assembly	Ignition by radiation in vertical orientation		Ignition by DD58 sources	Ignition by		Weight loss on burning	Drop formation
	Pilot	Spontaneous		Liquid fuels	Newspaper etc		
Wall lining 'Stateroom' carpet on high density base Simulated 'Stateroom' Seating units up Squab down position angled Squab slashed PVC & polyurethane assembly Ceiling tile assembly	Test Dl llsat5W/cm^2 36s at 2 W/cm^2	Test D5 ^>2s at 8 W/cm^2 8s at 6 W/cm^2 80s at 5 W/cm^2 172s at 4 W/cm^2	Test D5 Cigarette* Cigarette* Flames 1 & 2* Flame 3f Flame 1* Cigarette* Flamef	Test El and E2 No 'match' ignition with small quantities of: Methylated spirits White spirit Diesel fuel Whiskey Test E3 Ignited by diesel/petrol Ignited by 200 cc alcohol/water Test E6 No naming drops of paraffin or diesel fuel penetrated assembly to fall to floor. Spontaneous ignition of paraffin on underside of tile occurred	Test E3 4/5 sheets ignited floor carpet and seating unit Test E4 Multiple units ignited by newspaper Test E5 Seating unit ignited by fuel—contaminated sawdust	Test D2 Maximum rate of weight loss (g/m^2/s) 17 at 5 W/cm^2 18 at 4 W/cm^2 Test D3 23 at 5 W/cm^2 21 at 4 W/cm^2	Test D4 At 5 W/cm^2 fibre burned in situ. At 1-3 W/cm^2 flaming drops formed.

* = Pass f = Fail

Table (III) Systematic ad hoc experiments

Material assembly	Information required	Information obtained		Rig	Test Designation	Table No.	Figure No.
	Heat output information	TestFl Point ignition source	Test F2 Line ignition source		Fl &F2		
Seating unit	Weight loss rate (over 6 min)	1.8 g/s	6.2g/s			F2	
	Mass flow peak	0.98 kg/s	1.09 kg/s			F3	F3
	Convective heat flow (peak)	76.5 kW	103.4 kW	Room/corridor rig		F4	F4
	Time of peak heat outflow	4 min 30s	2 min			F4	F4
	Heat output (O2 concentration) peak	190 kw	300 kW			F6	F16
	time of peak	4 min 30s	2 min 30s				
	duration of >50% peak	2 min 30s	2 min	Figure Fl			
	Heat flux (max)—seat top	>7.2W/cm^2	11.5 W/cm^2			F5	F9
	—seat in front	1.0 W/cm^2	1.2 W/cm^2			F5	F6
	Radiation (max)—seat behind	0.7 W/cm^2	1.0 W/cm^2			F5	Fl1
	—seat in front	1.3W/cm^2	1.76 W/cm^2			F5	F12
	—seat over aisle	0.6 W/cm^2	0.8 W/cm^2			F5	F13
Wall lining		Test F3 'Stateroom' tiles	Test F4 Control test		F3&F4	F8-11	
'Stateroom' carpet tiles	Mass flow (peak)	1.15 kg/s	0.94 kg/s	Room/corridor rig		F8	F18
	Heat flow peak	106 kW	83.9 kW	Figure Fl		F9	F19
	Time of peak heat flowf	3.5 min	5 min 10s			F9	
	Heat output (O2 concentration) peak	500 kW	260 kW			Fl1	F28
	time of peak	3 min	2 min 45s				
	duration of 50% peak	3 min 30s	7 min 30s				
	Heat flux (max) adjacent seat	2.42 W/cm^2	0.64 W/cm^2			F10	F24
	Radiation on seat (max) in front	1.73 W/cm^2	1.57 W/cm^2				F25

1

|30s peak on stack C registered 130 kW.

Table (III) (continued)

Material/assembly	Information required		Information obtained			Rig	Test designation	Table No.	Figure No.
	Data on fire growth over wall and spread from unit to unit		TestGl 'Stateroom' tiles	Test G2 Simulated 'Stateroom' tiles	Test G3 Control				
Assembly of two seating units and 21 wall tiles in section of simulated alcove using crib source	Heat flux at ceiling level (0-7 from crib)	—maximum	ll.OW/cm^2	11.2 W/cm^2	1.9 W/cm^2	Balcony rig 3.6m X 1.2m Two walls and insulated ceiling	G1G2 G3	G2	G3-5
		—time of maximum	3 min 50s	3 min 30s	3 min 20s				
		—duration over 50% max	~1.5 min	~1.5 min	~3.5 min				
	Heat flux in aisles between seats at seat top height	—maximum	2.4 W/cm^2	3.9 W/cm^2	0.2 W/cm^2			G3	G6-8
		—time of maximum	3 min 50s	2 min 50s	5 min				
		—duration over 50% max	~2 min 30s	~2 min 50s	~2 min 45s				
	Radiation level at seat top height 0.9 m from wall	—maximum	8.0 W/cm^2	5.0 W/cm^2	0.16 W/cm^2			G3	G9-11
		—time of maximum	3 min 30s	3 min	5 min				
		—duration over 50% max	2 min	2 min 20s	3 min				
	Gas temperature at ceiling level over crib	—Maximum	910°C	900°C	540°C			G4	G12-14
		—time of maximum	2 min 30s	4 min 50s	5 min				
		—duration over 50% max	5 min 30s	4 min 15s	6 min				
	0.7 from crib	—maximum	890°C	930°C	380°C			G4	G12-14
		—time to maximum	4 min	3 min	3 min 30s				
		—duration over 50% max	5 min	5 min	6 min				

Table (IV) Ad hoc experiments on large scale HI and H2

Material/assembly	Information required		Information obtained	Rig	Test designation	Table No.	Figure No.
Assembly of 5 seating units in 3 tiers in tiered section of simulated alcove (with wall tiles and carpet)	Data on spread of fire between tiers of seating						
	Heat flux on seat behind	—Maximum	1.1W/cm^2	Tiered rig at Cardington. 12m X 4.8m Sides closed Front 4.8m open	HI	H2	H5
		—Time of max	5 min 30s				
		—Duration over 50% max	3 min				
	Heat flux on seat in front	—Maximum	1.15 W/cm^2	Figure HI		H2	H6
		—Time of max	6 min 30s				
		—Duration over 50% max	4 min				
	Radiation from ceiling on seat top in front	—Maximum	0.25 W/cm^2			H3	H7
		—Time of max	5 min				
		—Duration over 50% max	3 min				
Assembly of 12 seating units in 2 tiers. Corner wall only with insulated ceiling. Rear wall tiled, floor carpeted	Data on spread of fire along rear wall						
	Heat flux on rear wall	—Maximum	13.3 W/cm^2	Tiered rig at Cardington. 12m X 4.8m 12m wall as rear One side wall removed and front open	H2	H7	H12
		—Time of max	8 min				
		—Duration over 50% max	2 min 30s			H10	H16
	Radiation of seat tops of	—Tier 2—Maximum	21.2 W/cm^2	Figure H8			
		—Time of maximum	7 min				
		—Duration over 50% maximum	30s				
		—Tier 3—Maximum	14.7 W/cm^2				H17
		—Time of maximum	7 min				
		—Duration over 50% maximum	1 min 15s				
		—Tier 4—Maximum	11.3 W/cm^2				H18
		—Time of maximum	7 min				
		—Duration over 50% maximum	1 min 15s				
		—Tier 5—Maximum	9.3 W/cm^2				H19
		—Time of maximum	7 min				
		—Duration over 50% maximum	1 min				

Table (V) Large scale simulation test I

Material/assembly	Information required	Information obtained	Rig	Test designation	Table/ Figure No
Assembly of 5 tiers of seats, consisting of one row of 3-unit seats and one of 11 unit seats with tables. Floor and wall carpeting and roller blinds and suspended ceiling also installed.	Data on interaction of all components in section of finished replica of corner of Stardust West alcove Heat flux on rear wall—Max and time of max —Duration of 50% of max level	14.3 W/cm^2 at 1 min 45s 20s	L-shaped Cardington rig- Alcove 5.5m X 8.5m Extension 8.7m X 5m	Test I	19
	Heat flux on ceiling—Max and time of max —Duration of 50% max	25 W/cm^2 at 1 min 45s 30s			19
	Heat flux on tiers measured on tiers—1—Max and time of max —2—Max and time of max —3—Max and time of max —4—Max and time of max	13 W/cm^2 at 1 min 45s 15.5 W/cm^2 at 1 min 45s 20 W/cm^2 at 1 min 45s 11 W/cm^2 at 1 min 45s			18
	Radiation intensity—Max and time of max lm above floor —Duration of 50% of max level	22.0 W/cm^2 at 2 min 40s			17
	Gas temperatures at ceiling—Rear wall—Max and time of max —Middle—Max and time of max —Front—Max and time of max	1220°Cat 1 min 40s 1300°Cat2min50s ,350°C at 2 min 30s			13
	Heat flow—Max and time of max Mass flow—Max and time of max	1.8MWat 1 min 40s 9.45 kg/s at 1 min 40s			

(B) THEORETICAL MAXIMUM HEAT CONTENT OF ITEMS IN STARDUST**

Location	West Alcove			North Alecve			Dance Floor Area		
Item	kg	MJ/kg*	Total MJ	kg	MJ/kg*	Total MJ	kg	MJ/kg*	Total MJ
SEATS									
PVC	310	18	5 600	590	18	10 600	550	18	9 900
Polyurethane	172	23	3 900	330	23	7 500	310	23	7 100
Polypropylene	5	43	200	10	43	400	10	43	400
Timber	1 100	15	16 500	2 100	15	31 500	2 000	15	30 000
TABLES									
Timber	940	15	14 100	1 760	15	26 400	1 730	15	26 000
WALL TILES									
Polyester	86	20	1 725	103	20	2 060	170	20	3 400
Polypropylene	16	43	680	20	43	820	30	43	1 300
PVC	270	18	4 800	320	18	5 700	520	18	9 300
FLOOR CARPET									
Nylon	40	30	1 200	90	30	2 700	110	30	3 300
Polypropylene	5	43	200	12	43	500	630	43	27 100
Polyester	25	20	500	50	20	1 000			
Viscose							20	14	300
Bitumen							1 020	35	36 000
Styrene/butadiene	80	40	3 200	180	40	7 200			
Acrylic	50	25	1 250	100	25	2 500			
DANCE FLOOR									
Timber							2 000	15	30 000
CURTAINS									
PVC	30	18	500	50	18	900			
Polyethylene	4	20	80	5	20	100			
			54 600			100 200			184 000
Floor Area	175 m²			340 m²			760 m²		
Volume	570 m³			970 m³			3 000 m³		
Fire Load	310 MJ/m²			290 MJ/m²			250 MJ/m²		

•Calorific Value Determination on Plastics. Krebelor K, Krumke M, KUNSTOFFE, Vol 55, Oct 1965, pp 758/765, except for polyester (polyethyleneterephthalate); quoted figure has been rounded down from one of 23 MJ/kg gross supplied by the Shirley Institute.

**Values quoted are approximate because of uncertainties in both precise nature of materials involved and quantities used.

fThe seating units in the Stardust had higher seat-backs (see Table L2).

(C.) STANDARD FIRE TESTS ON INDIVIDUAL ITEMS

Standard fire tests were carried out by the FRS, FIRTO and Yarsley Technical Centre on samples of wall and floor coverings and individual items of furniture and furnishings. The results of these tests are given below (Tables G1-11) and the section includes a brief resume of the test methods.

(1) Wall Linings

Carpet tiles (Illingworth Stateroom, described in Appendix A) were stuck with adhesive to a non-combustible base to simulate their use in Stardust Disco. Samples were exposed to a test for ignitibility under conditions of external radiation and also to two tests (quoted in UK Building Regulations) as a means of classifying wall and ceiling linings.

Method of test for ignitibility of building products—BS DD 70: 1981.

A small sample of the composite lining assembly, lying flat with the surface upper-most, is exposed to radiation from a conical furnace *(Plate* /), the intensity of irradiation on the specimen surface being adjusted to give 1 to 5 W/cm^2. The time to ignition, on application of a pilot flame, at each intensity is recorded. The results of the test are given in Table CI.

Table CI Ignition of wall linings (BS **DD 70: 1981)--Test CI**

Wall lining	Type of ignition	Time in seconds to ignition at irradiance of					Lab
		5 W/cm^2	4 W/cm^2	3 W/cm^2	2 W/cm^2	1 W/cm^2	
Stateroom carpet tile on non-combustible substrate	Pilot ignition	35	46	76	184	No ignition	FRS
	Spontaneous ignition*	42	61	110	No ignition	Not attempted	
Simulated stateroom carpet on non-combustible substrate	Pilot ignition	19	Not recorded	Not recorded	202	No ignition	FRS

*This information is not required under BS DD 70 and results, although quoted, are rather unreliable since volatiles from the decomposing sample, channelled through the heating coil of the radiator, ignite at this point, flame flashing back to the surface.

Fire propagation tests for materials—BS 476: Pt 6: 1968

The test exposes, in a box furnace, a small sample of the lining assembly to heating conditions simulating a growing fire. The temperature of the flue gases is recorded continuously during test and is used to provide a measure of the rate of heat release from the product under these conditions. Two of the indices calculated from the gas temperature curve (ii and I) are used in the UK Building Regulations in the definition of materials suitable for use in areas requiring maximum safety. The results of the test are given in Table C2.

Table C2 Fire propagation tests on wall linings (BS 476: Pt 6: 1968)—Test C2

Construction of Sample	Index obtained*		Laboratory and Cert No
	ii	I	
Stateroom carpet tile adhered to asbestos millboard using "Evostik" adhesive	12.7	25.7	FIRTO TE 3925

*To achieve Class 0 in the Building Regulations for England and Wales (Class A for Scotland), the indices ij and I for a lining material must not exceed 6 and 12 respectively: the lining must also achieve Class 1 in BS 476: Pt 7: 1971, described below.

Surface spread of flame test for materials—BS 476: Pt 7: 1971

The surface of a sample of wall lining, 230 mm wide x 900 mm long, supported in the vertical plane with the long axis of the specimen horizontal is exposed at right angles to a radiant panel *(Plates 2 to 4). A* pilot flame is played for 1 minute onto the surface at the hot end and the progress of the flame front along a horizontal datum line at one-third height of the specimen is recorded. Classification of the product is determined by extent of flame spread at li and 10 minutes, Class 1 being the highest, Class 4 the lowest. The results of the test are given in Table C3 (Test G3).

Table C3 Surface spread of flame tests on wall linings (BS 476: Pt 7: 1971)—Test C3

Construction of sample	Classification	Laboratory & Cert. No.
Stateroom carpet tile adhered to asbestos millboard using "Evostik" adhesive	4	FIRTO TE 3903
Stateroom tile adhered to concrete substrate* using "Evostik" adhesive	3	FIRTO
Simulated Stateroom on asbestos millboard* using "Evostik" adhesive	3	FIRTO

*One sample only

Specific optical density of smoke generated by solid materials ASTM E662: 1980

Samples of the wall lining, 76 mm square, supported on a non-combustible base board are exposed vertically within an enclosure to radiation at 2.5 W/cm^2 from a small circular furnace. The density of smoke generated under both flaming and smouldering conditions is measured using an optical system. The results of the test, expressed in terms of maximum specific optical density (Dm) are given in Table C4 (Test C4).

(2) Seating Unit and Table

The upholstered seating comprised PVC-covered polyurethane foam (Appendix A) attached to 18 mm particle board; the back of the seat was covered only with stretched PVC and the underside of the seat with polypropylene scrim.

Samples of the seat and table components were subjected to standard fire tests, firstly to assess the ease of ignition of the upholstery system by smoking materials (BS 5852: Pt 1)**, secondly to investigate the ignitibility of the system when exposed to higher intensity localised sources (BS DD 58) *(Plates 6 and 7)* and thirdly when exposed to conditions of generalised radiation (BS DD 70). A further test, BS 5438 was also applied to investigate the performance of the fabric alone, hanging freely. A test of the smoke-producing potential of the upholstery (ASTM E662) was also carried out.

Fire tests for furniture—BS 5852: Pt 1: 1979 and BS DD 58: 1978

Samples of the combinations of foam and PVC finish are used to form an assembly representing the junction between seat back (or arm) of an upholstered chair. Two ignition sources are used; the first one a smouldering cigarette, the other a small gas flame simulating a match.

**Cited in legislation.

Table C4 Smoke density of wall linings (ASTM E662: 1979)—Test C4

Material	Mode of construction	Minimum transmittance—%			Maximum specific optical density						Lab& Cert No.
					Dm			Dm (cor.)			
		Spec 1	Spec 2	Spec 3	Spec 1	Spec 2	Spec 3	Spec 1	Spec 2	Spec 3	
Carpet	Smouldering	0.0012	0.0017	0.0014	650	630	641	552	551	579	Yarsley Technical Centre 70597/1
Tile	Flaming	0.11	0.20	0.026	391	356	473	363	326	433	

Ignition sources of higher intensities, listed in BS DD 58 may then be used if ignition does not occur.

The results of these tests on specimens comprising the polyurethane foam and PVC as used in the Stardust are given in Table C5.

Table C5 Ignition characteristics of PVC covered polyurethane (BS 5852: Pt 1: 1979 and BS DD 58: 1978)—Test C5

Material and origin		Test and ignition source	Result	Lab. & Cert. No.
PVC cover	Polyurethane foam			
From seat	Density 24 kg/m^3 from seat	BS 5852 Smouldering cigarette	Pass. Samples 1 and 2. Burned out at 5 mm	FIRTO TE3931
From seat	ditto	BS 5852 Butane flame	Fail*. Sample 1. Flaming persisted 120s	FIRTO TE3931
From supplier	Density 30 kg/m^3 from supplier	BS 5852 Smouldering cigarette	Pass. Samples 1 and 2. Burned out at less than half length	FRS
From supplier	ditto	BS 5852 Butane flame	Pass. Sample 1. Flames out 7s after removal of flame Sample 2 Flames out Is after removal of flame	FRS
From supplier	Density 22 kg/m^3 from supplier	ditto	Pass. Samples 1 and 2. Flames out Is after removal of flame	FRS
From supplier	ditto	BS DD 58 Butane flame ignition source 2	Fail**. Sample 1. Flaming persisted 120s	FRS

*A further test was carried out with the ignition flame applied directly to either the back or squab of the seating unit: no persistent flaming was achieved.

**UsingBS 5852 rig.

Method of tests for ignitibility of building products—BS DD 70: 1981

The ignitibility of the upholstery system, of other seat surfaces and of the surfaces of the table unit were measured using BS DD 70.

The results are given in Table C6.

Table C6 Ignitibility of surfaces of the seating unit (BS DD 70: 1981)—Test C6

Material	Ignition	Time to ignition (s) at intensity of					Lab.
		5 W/cm^2	4 W/cm^2	3 W/cm^2	2 W/cm^2	1 W/cm^2	
PVC-covered pu foam	Pilot	4	6	8	14	39	FRS
	Spontaneous*	5	5	12	Did not ignite	Not attempted	
Melamine-faced chipboard (table top)	Pilot	23	34	57	105	313	FRS
	Spontaneous	25	37	67	Did not ignite	Not attempted	
Chipboard (table base)	Pilot	22	38	66	203	Did not ignite	FRS
	Spontaneous	34	48	109	Did not ignite	Not attempted	
PVC-faced chipboard (rear of seat back)	Pilot	6	6	10	14	70	FRS
	Spontaneous	6	7	13	Did not ignite	Not attempted	
Polypropylene scrim on chipboard (seat-squab)	Pilot	14	27	27	256	Did not ignite	FRS
	Spontaneous	14	31	143	Did not ignite	Not attempted	

*This information is not required under BS DD 70 and results, although quoted, are rather unreliable since volatiles from the decomposing sample, channelled through the heating coil of the radiator, ignite at this point, flame flashing back to the surface.

Methods of test for flammability of vertically oriented textile fabrics and fabric assemblies subjected to a small igniting flame—BS 5438: 1976.

Samples of the individual fabric are supported vertically on an open frame and are exposed for up to 10s to a small flame impinging on the surface 35 mm above the bottom. The extent and duration of burning are recorded. Results are listed in Table C7 (Test C7).

Method of test for flame-proof materials—BS 3119: 1959

Small strips 318 mm x 51 mm of individual fabrics are suspended vertically in an enclosure and are exposed for 12s to a bunsen flame impinging on the bottom edge *[Plate 8).* The extent of burning and duration of sustained ignition are recorded. A mean extent of spread }>85 rnm associated with a flame duration of less than 8s qualifies samples (some of which must be exposed to washing, bleaching or flexing procedures) for compliance with the term "flameproof defined in BS 3120: 1959, and used in UK regulations for certain clothing fabrics. The PVC was subjected to this test and the result is quoted in Table C7 (Test C8).

Flammability of thin polyvinyl chloride sheeting—BS 2782: 508C

Samples of the thin PVC material are supported over a vertically-held semi-circular frame. The extent of flame spread over the film material is recorded when one lower edge is exposed to a small alcohol flame. Building Regulations in the UK permit wide use of PVC having a length of burning }>75 mm. Results of the three flammability tests described above on the PVC fabric in isolation are given in Table C7 (Test C9).

Table C7 Flammability of PVC fabric from seating—Tests C7 to C9

Test	Material	Result	Lab. & Cert. No.
BS 5438	Fabric backed PVC	No flame spread to edge of specimen No hole formed No separation of debris No duration of flaming No duration of afterglow	FIRTO TE 3929
BS3119	Fabric backed PVC	Length of char in one specimen exceeded 114 mm	FIRTO
BS 2782: 508C	PVC with fabric back removed	Average length of burning 230 mm	FIRTO TE 3926

Specific optical density of smoke generated by solid materials—ASTM E662: 1980

The specific optical densities for both the PVC cover and the flexible polyurethane foam used in the upholstery were determined in isolation. The results are given in Table C8 (Test CIO).

Table C8 Smoke density of upholstery components (ASTM E662: 1980)—Test CIO

Material	Mode of construction	Minimum transmittance--%			Maximum specific optical density						Lab. & Cert. No.
					Dm			Dm (cor.)			
		Spec 1	Spec 2	Spec 3	Spec 1	Spec 2	Spec 3	Spec 1	Spec 2	Spec 3	
PVC	Smouldering	0.30	0.17	0.30	333	366	333	317	350	319	Yarsley Technical Centre
	Flaming	0.62	5.6	1.7	291	165	234	281	156	224	
Polyurethane foam	Smouldering	1.3	1.0	1.1	249	264	259	230	239	234	70597/1
	Flaming	1.7	11	11	234	127	127	229	123	124	

(3) Roller Blind

The PVC fabric, reinforced with polyester fibre (Appendix A) was exposed to the two free-hanging fabric tests viz. BS 5438 and BS 3119 described above *(Plates 8 to 10)* (Tests C13 and C12). Also since UK legislation quotes a maximum spread limit on BS 2782: 508C (described above) for unsupported PVC for use in buildings, the performance of the blind material on this test was also determined (Test CI 1). The results for each of these tests are given in Table C9.

Table C9 Flammability of roller blind fabric—Tests C11 to C13

Test	Result	Lab. & Cert. No.
BS 2782 508C Test CI 1	Average extent of burning 49 mm	FIRTO TE 3927
BS 3119 TestC 12	Duration of flaming less than 6s Average length of char 91 mm	FIRTO TE 3930
BS 5438 TestC 13	No flame spread to edge of specimen No hole spread to edge of specimen No separation of debris No afterglow Average duration of flaming 1.6s	FIRTO TE 3928

(4) Ceiling tiles

The ceiling tiles (Appendix A) were subjected to the tests described earlier (BS 476: Pts 6 & 7) (Tests C14 and CI5). Samples were also examined for compliance with the requirements for non-combustibility, quoted in BS 476: Pt 4: 1970 (Test CI6), as described below. Results obtained on each of these tests are listed in Table CIO.

Non-combustibility test for materials—BS 476: Pt 4: 1970

A rectangular block of the material is inserted into a small cylindrical furnace, maintained at 750°C. The duration of flaming and the increase in the gas temperature within the furnace and in the core temperature of the sample are recorded. For classification as "non-combustible" no specimen shall flame for more than 10s nor shall the temperature rise of either thermocouple exceed 50°C over the original furnace temperature during the 20 min. test period.

Table CIO Standard fire tests on ceiling tiles—Tests C14 to C16

Test	Result	Lab. & Cert. No.
BS476:Pt4 TestC16	Combustible. Maximum furnace temperature rise 64°C. Maximum specimen temperature rise 239°C. Maximum flaming 80s.	FIRTO TE 3905
BS476:Pt6 TestC14	i, = 3.7 i_2 = 2.4 i_3 = 0.7 I = 6.8	FIRTO TE 3924
BS 476: Pt 7 TestC15	Class 1	FIRTO TE 3904

(5) Floor carpet

The floor carpet was checked for resistance to ignition from a small source (BS 4790) described below (Test CI 7) and for ignitibility under conditions of external radiation (BS DD 70) (Test CI 8).

Determination of the effects of a small source of ignition on textile floor coverings—BS 4790: 1972.

A small sample of carpet is supported horizontally in an enclosure and a metal nut, heated to 800°C* is placed centrally on its surface. The extent of spread of the burning zone is measured.

The results of the tests on the ignition of the carpet both with and without external radiation are given in Table C11.

*See para. 6.85 and footnote.

Table C11 Ignition tests on floor carpet—Tests C17 and C18

Material	BSDD70(TestC18) Time to ignite (s) at intensity of					BS 4790 (Test CI7)	
	5 W/cm^2	4 W/cm^2	3 W/cm^2	2 W/cm^2	1 W/cm^2	Radius of effects of ignition	Duration of flaming
Ultra	28	36	71	159	NI	50 mm above 20 mm below	2 min
Nylfloor	6	12	18	43	NI	45 mm above 40 mm below	4 min 40 s
Lab	FRS					FIRTO	

NI = no ignition.

(D) NON-STANDARD FIRE TESTS ON INDIVIDUAL ITEMS

(1) Wall linings

Ignitibility

Results of the ignitibility tests using BS DD 70 are appropriate only to the ignition of specimens, supported horizontally, using a small pilot flame. Specimens of the wall lining, applied to a non-combustible board, were held vertically, facing a radiant panel 0.3 m square, and placed at distances calibrated to receive known intensities of radiation *[Plates 11 and 12).* The times to ignition, when exposed to radiation at different levels with a small flame of heat output 350 W applied for 10s to the centre of the 170 mm square samples, are given in Table Dl (Test D1).

Table D1 Pilot ignition of vertically supported wall lining specimens—Test D1

Intensity of irradiation W/cm^2	Mean ignition time s	Lab.
5	11	FRS
4	7	
3	30	
2	36	
1	No ignition	

Flame spread

Data from the laboratory records of the Surface Spread of Flame Test (Test C3) were further analysed (Figure Dl) to give an indication of the rates of lateral flame spread under radiation conditions.

The extent of spread for individual specimens at different times is given in Table D2. Statistical investigation into the difference in performance between carpet tiles adhered to asbestos millboard (as required by the standard tests) and that of the carpeting applied to a solid non-combustible base shows that the probability of this occurring by chance is less than 0.01

Table D2 Rate of flame spread over surface of Stateroom carpet tile (BS 476: Pt 7)

Specimen No.	Time (min s) to reach following distances alortg specimen surfaces (mm)							
	50	100	150	200	300	400	600	700
1	0.30	0.55	1.10	1.20	1.45	3.05	5.55	7.30
2	0.20	0.50	1.15	1.30	1.45	2.15	4.40	5.20
3	0.30	0.50	1.10	1.30	2.10	3.10	6.30	10.00
4	0.25	0.50	1.05	1.20	2.15	3.20	5.10	8.30
5	0.20	0.50	1.10	1.25	2.15	3.10	6.15	9.50
6	0.25	0.55	1.15	1.25	NR	2.35	5.55	10.00
Mean	0.25	0.52	1.11	1.25	2.02	2.56	5.44	8.37
Carpet	50	100	200	250	450	500	550	600
on Concrete	0.30	1.00	1.35	1.55	2.10	2.25	5.15	9.00

NR=Not recorded

Weight loss on burning

A measure of the rate of burning in terms of weight loss of the carpet tiles was obtained by irradiating specimens 170 mm square, vertically supported in front of a gas fired panel, allowing free air flow (Test D2). A pilot flame liberating 350 W was applied for 10s to ignite the surface under different intensities of irradiation; a continuous record of weight loss was made and the results are given in Table D3 and Figures D2 and D3.

Table D3 Rate of weight loss of two types of carpet tile under different irradiances—Test D2

Carpet Tile	Irradiance W/cm^2	Rate of loss of weight—$g/m^2/s$					
		30s	1 min	2 min	3 min	4 min	Lab.
Stateroom	4 5	13 8	18 17	9 7.6	5.4 4.7	3.9 3.9	FRS
Simulated Stateroom	4 5	2.4 23	21 18	11 11	8.2 8.9	8	

Drop formation

The possibility that drops of polymer* might be formed from the carpet tile fibre, scrim or underlay under different conditions of exposure was investigated by exposing a vertically supported carpet tile, adhered to a rigid non-combustible base board, to radiation from a 310 mm square gas fired panel (Test D3). Results are given in Table D4.

Table D4 Drop formation from carpet tile—Test D3

Exposure	Radiation Intensity	Behaviour	Lab.
Upper half only exposed	Instantaneous exposure at 5 W/cm^2	Rapid intumescence of underlay. Fibre melted; burning in situ.	
Total surface exposed	Exposure increased gradually from 1-3 W/cm^2	Gradual melt formation and delamination of PVC from substrate. Drops formed, falling from expanded surface.	1 FRS

*Probable composition: PET & PP from fibre at interface of fibre and underlay.

(2) **Seating Unit**

Ignition

Additional information required on the ease of ignition of the upholstered seats included investigation of ignition of the seat unit as constructed, of the effect of different ignition sources, of different seat configurations, of vandalism of the covering etc. Details of the tests (Test D4) are given in Table D5 (Plates 13, 14 and 15).

Table D5 Ignitibility tests on seat unit—Test D4

Seat position	Ignition source	Ignitibility performance
Squab fully raised	Cigarette injunction—vertical —horizontal	P. Cigarette partially burnt. Local melting of PVC. P. 33 35 >J 33 33
Squab partially raised	Cigarette horizontal	P. 33 33 33 33 33 33
Squab down	Cigarette horizontal	P. Cigarette fully burnt. No smouldering.
Squab down (2 tests)	Butane flame (DD 58 and BS 5852) on squab	P. Flame out 2s and Is after removal.
Squab down (2 tests)	Butane flame 1 on back	P. Flame out Is and Is after removal
Squab down (2 tests)	Butane flame 2 (DD 58) on squab	P. Flame out 3s and 13s after removal.
Squab down (2 tests)	Butane flame 2 on back	P. Flame out 8s and 4s after removal.
Squab up (2 tests)	Butane flames 1 and 2 applied to webbing on vertical underside of squab	P. Flame out on removal.
Squab varied in angle—90° 45° 15° 5° (7 tests)	Butane flame 1 applied to angle between squab and back	Flame out in 6 tests but persisted in one.
Squab down	Butane flame 3 applied to squab Butane flame 3 applied to face of back	F. Flames > 120s (extinguished manually) F. Flames >90s (extinguished manually)
Squab down and damaged	Cigarette applied on slashed pvc, direct on foam and into foam	P. No progressive smouldering observed.
Squab down and damaged	Match placed on exposed foam	F. Ignition. Flames extinguished manually after 70s.

^ **P**—Passed (no sustained ignition)
yi F—Failed (ignition sustained)

Tests were also carried out (Test D5) to determine the ignitibility without pilot source (spontaneous ignition) of vertically supported samples of upholstery, exposed to radiation from a 300 mm square radiant panel giving itensities of radiation higher than those used in DD 70. Samples 170 mm square were constructed, the PVC covering being held in tension over the foam. The results are given in Table D6.

Table D6 Spontaneous ignition of samples of PVC-covered PU foam—Test D5

Intensities of radiation W/cm^2	Time to ignition s	Lab.
8-9	>2	FRS
6	6-8	
5	80	
4	172	

(E) AD HOC IGNITION EXPERIMENTS ON INDIVIDUAL ASSEMBLIES

At the request of the Assessors to the Tribunal a number of ad hoc experiments were carried out in an attempt to reproduce the early stages of the fire as described by witnesses. Since the only item of furnishing which could be ignited by a match was a seating unit and even that was uncertain without prior damage, the experiments involved the ignition of paper and flammable liquids. Experimental rigs were constructed as shown in Figures E2 and E4.

(1) Seating unit/Wall lining assembly

(i) *Ignition of seat squab by flammable liquids—Test El*

Tests were carried out on approximately 300 x 500 mm samples of the seat squab, consisting of chipboard and foam + PVC covering. Small quantities (approximately 20 cc) of various liquid fuels were spilt on top and the ignition possibilities noted.

(a) Industrial alcohol (methylated spirits), poured on to pad ignited by a match. Small blue "dancing" flames observed; flaming out about 20 seconds.

(b) White spirit used, not possible to ignite by a match.

(c) Diesel fuel used, not possible to ignite by a match.

(d) Whiskey (Irish and Scotch), possible to ignite, the results the same as in (a).

(e) Mixture, equal quantities, of alcohol, as in (a), and water used, possible to ignite but the results as in (a).

(f) Mixture of diesel and petrol (90/10) ignited easily, sustained flaming yellowish in colour observed, PVC covering ignited and large quantities of smoke and toxic fumes produced. Fire extinguished.

(ii) *Ignition of and spread from a burning seating unit—Test E2*

The construction (Figure El) comprised a non-combustible board wall with a 160 mm high tier in front of it. Six carpet tiles (3 wide x 2 high) were stuck to the wall and a seating unit (A) was placed hard against them with its edge contiguous with the left hand edge of the tiles. A second seating unit (B) was in front at ground level with a table between. A "blank" seating unit (C) having a chipboard squab and back was placed to the left of A with a gap representing the width of an aisle. No ceiling or side enclosure was provided. The lighting conditions were adjusted to provide a red background light in the laboratories with flashing red disco lights playing. The camera was located in front and to one side to simulate the presence of a person in the next aisle and two tiers below.

(a) About 200 cc of white spirit poured over the top edge of the back of Unit A: no ignition occurred on the application of a match flame. Back of seat wiped clean.

(b) About 200 cc of alcohol/water mixture spilled over the top edge of Unit A, some fell on the carpet tile, on the wall and on the back of the seating unit. Ignition occurred with a match, "dancing" blue flames over the whole length of back rest top, quickly reduced to localised flaming in one or two spots, no ignition of the PVC covering material or the wall carpeting.

(c) Unit A was moved forward to produce a gap of 20 mm between the seating unit top and the wall carpeting. Fuel as in (b) was poured just above the top to allow some to fall in the gap. It was possible to cause ignition by a match on seating unit top and in the gap but flames died down without ignition of PVC covering or the wall carpeting.

(d) The squab of Unit A was lifted up to form a V-gap with the back, fuel as in (b) was poured in the gap, some fuel dripped down but some remained in place. Ignition was with a match but no sustained flaming of the seating unit occurred.

(e) Unit A was moved back against the wall and the squab placed in the horizontal position. Two crumpled sheets of newspaper were placed in the corner between the floor and the wall carpeting beneath A. The newspaper ignited with a match. It caused the local ignition of the floor carpeting and this led to ignition of the wall carpeting. Flames spread upwards in the gap between the seating unit back and the wall but in the absence of a gap at the top did not emerge above the seating unit. Lateral spread of flames occurred and flames emerged from the

sides of the seating unit and spread up on the wall surface. The upper part of the seating unit was also involved. The fire did not spread to Unit B or C. Fire extinguished.

In the above experiments it was observed that the prevailing lighting significantly influenced the observation of smoke. It seemed to be less well defined and less dense.

(iii) *Ignition on a broad front—Test E3*

The objective was to cause ignition of a single seating unit from underneath and observe the spread of fire to adjacent seating units before significant involvement of wall carpeting.

The experimental arrangement (Figure El) was as in (2) above except that seating unit C was complete and there were nine carpet tiles (3 wide x 3 high) and a 20 mm gap between the wall and seating units A and C.

(a) Two hundred cc of 50/50 alcohol/water mixture was spread over the horizontal part of seating unit A. Some of it spilled on to the floor carpet and some was splashed on to the back. The fuel was ignited by a match, it burnt readily over the whole seating unit surface and the fuel on the carpet was also ignited. The flames were light blue in colour and 150-200 mm in height. The flaming on the seating unit was confined to one or two isolated areas and it burnt at one place near the front edge for nearly one minute after which it died down. Similarly flaming on the carpet on the floor continued for a short period and died down.

(b) Two hundred cc of fuel, as above, was spilled over the top horizontal ledge of seating unit A and some of it was allowed to fall on the wall carpet and drip down. It was ignited by a match, flaming occurred over the whole length of the seating unit top, light blue "dancing" flames were 150 mm in height. The flaming gradually reduced in severity but persisted in two areas where there was sufficient fuel for it to continue. Some flaming on the wall carpet surface was seen but it did not ignite. No flame spread was seen behind the seating unit. Flaming at one point on the top of the back rest persisted and damaged the PVC cover allowing the foam to become ignited. The flame was now yellowish in colour and it was easily extinguished. Had it been allowed to burn, in due course (4-5 minutes) it is likely that it would have involved the whole back seating unit and the carpet tiles on the wall.

(c) In this test about 4/5 sheets of newspaper (small size) were crumpled and placed below the front of seating unit A on the floor carpeting.

About 200 cc of alcohol/water mixture was poured over the paper and a match used to ignite it. The whole length of the paper was quickly burning with flames over the front edge of the seating unit. Flames also spread back towards the rear of the seating unit and through the gap between the seat squab and the back. The upper part of the seating unit was ignited with the whole seating unit burning rapidly. The back rest was also involved and the whole seating unit was burning furiously at about lj mins. Flames ignited the carpet tiling on the wall above the back and, in the absence of a ceiling, the flames remained vertical with only slight tendency for lateral spread toward Unit C.

Flames under the table ignited the rear of Unit B and the top edge was burning shortly afterwards. The edge of Unit C across the aisle from A started to decompose and release flammable vapours. However they did not become ignited and the seating unit remained uninvolved until the fire was extinguished.

(iv) *Fire spread between seat backs and the wall—Test E4*

The experimental arrangement as shown in Figure E2 was set up in the rig illustrated in Figure Gl (except that no thermocouples were used). There were 15 mm gaps between the tops of the backs of the seating units and the surface of the wall carpet tiles. Nl, N2 and N3 were double sheets of newspaper.

(a) Nl was ignited and the fire burnt out without spreading.

(b) The remains of Nl were replaced by two more sheets of newspaper placed in the angle between wall and floor.

The floor carpet ignited in 1 min., this ignited the adjacent wall carpet at 2 mins. and fire then spread upwards into the gap to ignite the rear surface of the seat back at 5 min. 20s. Flames

spread to the aisle with the production of flaming drops at 6 mins. At 7 mins. the left hand edge of the adjacent seating unit ignited. At 8 mins. flames reached the ceiling and all combustibles were involved by 8i mins.

(v) *Seating unit ignited along top edge—Test E5*

The rig illustrated in Figure Gl (no thermocouples used) was used for this test. A single seating unit was placed against the rear wall with 6 carpet tiles above it. Thirteen pyramids of sawdust each soaked in 2 ml paraffin were placed in line along the top of the back cushion and ignited *{Plate 23).* Measurements were made of the heat transfer to the wall 100 cm above the back of the seating unit (Figure E3). The back seating unit slowly burnt downwards, with only short flames. There was some localised ignition of carpet tiles at 6 mins. and fire spread slowly up the tiles *(Plate 24)* but they were not extensively involved until the seat squab ignited at 10 min. 50s. Plate 25 shows full involvement of the tiles.

(2) Suspended Ceiling Assembly

Flame spread—Test E6

The possibility of fire penetrating the suspended ceiling system and involving flammable items in the room below was investigated by observing the behaviour of burning liquid fuel dispersed on the upper surface of the tiles. These were suspended in a standard grid section, similar to that used in the "Stardust", fixed with an edge channel section at 1.4 m height from the ground to a 2.4 m high non-combustible wall *(Figure E4, Plates30and31).* The test results are given in Table El.

Table E1 Fire penetration of suspended ceiling assembly—Test E6

Fuel	Application of fuel		Ignition source	Results
	Position	Rate		
1.2 1 diesel fuel	Centre tile adjacent to wall	Slow drip	Burning soaked tissue on upper surface of tile	Oil soaked into tile. Several drops penetrated wall/tile junction but did not fall. Ignition caused fire on top surface only. Application of pilot flame to soffit ignited volatiles resulting in billowing flame layer —100 mm deep. No burning drops and fuel burnt out.
1.2 1 paraffin	Centre tile adjacent to wall	Spillage	Burning soaked tissue on upper surface of tile	Drops penetrated at wall/tile junction and fell to floor. Ignition easier and volatiles on soffit ignited spontaneously. No burning drops fell to floor and fuel burnt out.

(F) BURNING RATE EXPERIMENTS ON SEATS AND WALL TILES

(1) Rate of burning and heat transfer from seating unit—Tests Fl and F2

(i) *Aim*

Precise measurements were to be obtained of the rate of burning, heat output and severity of exposure to surrounding surfaces when ignition of a seating unit had occurred. Data derived from the tests were to be used to predict the risk of ignition of adjacent surfaces or objects and the subsequent rate of fire growth.

(ii) *Experimental construction*

An experimental room/corridor assembly (Figure Fl) was adapted to permit continuous observation and visual recording of the controlled burning of individual items.

(iii) *Instrumentation*

The seating unit was erected on a platform (Figure F2) and the weight loss during test was recorded continuously by load cells. A particle board table, simulating that used with the seating unit was fixed in the appropriate position with respect to the upholstered seat but was not monitored for weight loss. The actual rate of heat emission from the unit was calculated from readings of three stack thermocouples (a, b, c) sited in the corridor (Figure Fl) to measure the distribution of temperature in the hot gas layer flowing out from the combustion chamber. Temperatures within the room were measured using a stainless steel sheathed thermocouple, sited in the hot gas layer in the doorway.

The intensity of radiation emitted from the seating unit was monitored using heat flux metres and radiometres sited as shown in Figure F2. The composition of gases in the hot gas layer was monitored using sampling lines at the points shown in Figure Fl, and oxygen concentration at the sampling point S, 9.5 m from the open end of the corridor at positions 100 and 400 mm below ceiling level.

(iv) *Test procedure*

Two different situations were considered:

(a) when ignition was initiated from a point source—in this instance, a Source No 6 (DD 58) crib laid at centre point of the length of the seat in the angle between squab and back *(Plate 16),* (TestFl);

(b) when ignition was initiated from a line source (paraffin soaked fibre insulating board strip, 12 mm x 12 mm x 900 mm), placed 40 mm from the back of the squab *(Plate 18).*

Visual and instrument recordings were timed from ignition of the source in each case. The following observations were made during test (Table Fl):

Table Fl Observations on seating unit fires—Tests Fl and F2

Occurrence	Time--mins s		Lab.
	Point source	Line source	
Flames at half-height seat back	1.00	0.26	
Ignition of seat back	1.37	0.39	
Ignition of seat squab	1.15	0.48	
Smoke layer 1.5 m below ceiling	2.30	0.56	
Flames spread over J length seat	3.20	1.15	FRS
Flames at front of seat	4.07	1.30	
Full involvement	Gradual	2.00	
Flaming drops falling	5.23	2.09	
Burn-out	8.00	4.00	

(v) *Test results*

The loss of weight in each of the tests, as recorded by the load cells, is given in Table F2.

Table F2 Rate of weight loss of seating unit—Tests Fl and F2

Time min	Weight (kg) of burning unit ignited by	
	Crib source (Test Fl)	Fibreboard source (Test F2)
0	21 70	22.96
1		22.96
2		22.82
3		22.47
4		21.60
5	21.37	21.00
6	21.05	20.72

The rates of mass flow and heat flow calculated from data from the three thermocouple stacks in the corridor are given in Tables F3 and F4 and Figures F3 to F8 for stacks (a), (b) and (c).

The heat flux and radiation intensities recorded during test at the positions shown in Figure F2 are listed in Table F5 and are represented graphically in Figures F9 to F13.

The peak values recorded indicated the maximum exposure conditions which would be experienced by items of furniture etc at these positions, and also the maximum heat flux impinging on a ceiling immediately above.

The oxygen concentrations at point S (Figure Fl) at heights 100 and 400 mm below ceiling level are listed in Table F6 together with the heat output in kW, calculated from these values. The data are shown graphically in Figures F14 to F16.

Table F3 Mass flow rates calculated from stack thermocouple readings recorded during tests to determine burning rate of seating unit

Time min	Mass flow (kg/s) calculated at points a, b and c in corridor					
	a at room end		b central location		c open end of corridor	
	Point source	Line source	Point source	Line source	Point source	Line source
0	0.45	0.32	Not Recorded	0.26	0.30	0.11
2	0.53	1.06		0.91	0.36	0.76
4	0.98	0.93		0.81	0.77	0.66
6	0.86	0.81		0.68	0.69	0.49
8	0.74	0.70		0.59	0.52	0.46
10	0.66	0.74		0.63	0.47	0.46
12	0.56	0.66		0.54	0.44	0.44
14	0.52	0.62		0.50	0.39	0.40

Point source—Test Fl Line source—Test F2

Table F4 Heat flow rates calculated from Table F3

Time mm	Heat flow (kW) calculated at points					
	a		b		(	
	Point source	Line source	Point source	Line source	Point source	Line source
0	2.0	1.5	Not	0.77	1.3	0.45
2	7.5	103.4		73.1	3.2	51.0
4	76.5	42.9		38.3	42.2	26.8
6	42.1	22.3		17.6	28.4	12.0
8	19.0	14.1	Recorded	11.9	12.9	8.2
10	12.0	17.2		15.0	8.4	10.4
12	7.2	11.4		10.4	5.9	7.0
14	6.1	8.2		7.7	4.8	5.9

Table F5 Severity of exposure at points remote from burning seat—Tests Fl and F2

Time min	Heat flux (W/cm^2) measured at points (Fig F2)				Radiation (W/cm^2) measured at points (Fig F2)					
	HI		H2		Rl		R2		R3	
	Point	Line	Point	Line	Point	Line	Point	Line	Point	Line
1	NR	6.5	NR	0.6	0.01	0.7	0.01	0.9	0.01	0.03
2	NR	9.3	NR	1.2	0.03	1.0	9.11	1.7	0.02	0.8
3	7.2	4.9	1.0	0.9	0.31	0.5	0.7	1.0	0.2	0.5
4	5.8	0.8	0.6	0.4	0.7	0.1	1.3	0.2	0.6	0.2
5	4.1	NR	1.0	0.2	0.3	0.04	0.8	0.1	0.5	0.1
6	0.8	0.5	0.6	0.2	0.1	NR	0.4	0.06	0.2	0.05

Point—Test Fl NR—Not recorded Line—Test F2

Table F6 Oxygen concentration in hot gas layer and calculated heat output—Tests Fl andF2

Time min.	Oxygen concentration (%) recorded at sampling point S (Fig Fl)				Heat output (kW) calculated from O2 concentration	
	100 mm below soffit		400 mm below soffit			
	Point source	Line source	Point source	Line source	Point source	Line source
0	21.0	21.0	21.0	21.0	0	0
1		21.0		21.0	0	0
2	21.0	18.0	21.0	18.8	0	272.5
3	20.25	18.25	20.75	18.75	42.3	252.7
4	19.00	19.8	19.8	19.8	160.5	104.1
5	18.6	20.25	19.7	20.25	184.0	56.8
6	19.5	20.7	20.0	20.7	119.9	22.2
7	20.5		20.5		38.7	
8	20.75	21.0	20.75			
9		21.0	21.0	21.0	0	
10	21.0	21.0		21.0	0	0

Point source—Test Fl Line source—Test F2

(2) Burning rate experiments on seats and wall tiles—Tests F3 and F4

(i) *Aim*

Precise data were required to assess the ignition, flame spread and rate of burning in terms of heat output of wall carpet tiles exposed to a fire, equivalent in severity to that generated by a burning seating unit in close proximity.

(ii) *Experimental construction*

The room/corridor facility shown in Figure Fl was again used, with non-combustible insulation applied to the ceiling of the fire chamber to reproduce more closely the thermal properties of the suspended ceiling system fitted in Stardust. Six Stateroom carpet tiles each 500 mm x 500 mm were adhered using "Evostik" to a non-combustible board and were exposed, as shown in Figure F17, to a wooden crib consisting of layers of sticks. This was constructed at the base of the carpet surface, and was designed to provide a heat output similar to that released during the combustion of a seating unit.

(iii) *Instrumentation*

The rate of heat emission from the wall carpet tiles was calculated from the temperature profile in the hot gas layer within the corridor, using the three thermocouple stacks, a, b and c (Figure Fl).

The heat flux incident on the adjacent wall surface at distances of 100 and 1000 mm was recorded using heat flux meters H1-H3 (Figure F17) and the intensity of radiation falling on a surface 900 mm perpendicular to the wall immediately above crib height was measured using a radiometer Rl.

The rate of weight loss of the crib was monitored using a weighing platform and load cells. A continuous record was also made of the oxygen concentration within the room and the corridor and also of the gas temperature within the fire chamber at the top of the doorway.

(iv) *Test procedure*

Two tests were carried out, one including the carpet tiles *(Plates 20 to 22)* as described above (Test F3), the second a control test in which the tiles were replaced by a non-combustible insulating mat (Test F4). Identical procedure and recordings were followed in both tests.

The following observations (Table F7) were made during the test incorporating the wall carpet tiles (TestF3).

Table F7 Observations on wall carpet tile test—Test F3

Time	Observation
0.00	Ignition of crib.
0.20	Flames up to half-height of tiles.
0.44	Tiles shrinking at perimeter and delaminating.
1.00	Flames up to 1 m over ceiling.
1.28	Molten drops falling by crib.
1.40	Ignition of delaminated parts of tiles.
2.10	Thick smoke down to half-height of tiles.
2.40	Flaming drops and flakes falling.
3.10	Smoke level constant at half-height tiles.

(v) *Test results*

The rates of mass flow and heat flow calculated from data from the three thermocouple stacks in the corridor are given in Tables F8 and F9 respectively and are shown in Figures F18 to F23.

The heat flux and radiation measurements recorded at the positions shown in Figure F17 are listed in Table F10 and shown graphically in Figures F24 and F25.

The oxygen concentrations at point S (Figure Fl) at heights 100 and 400 mm below ceiling level are listed in Table Fll for both the tile burning test and the control. The heat outputs in kW, calculated from these values are also listed and the full results shown graphically in Figures F26 toF28.

Table F8 Mass flow rates calculated from stack thermocouple readings recorded during tests to determine burning rate of wall carpet tiles—Tests F3 and F4

Time min	Mass flow (kg/s) calculated at points a, b and c in corridor					
	a		b		c	
	With tiles	Control	With tiles	Control	With tiles	Control
0	0.20	0.20	0.26	0.25	0.10	0.30
2	0.83	0.74	0.75	0.69	0.50	0.42
4	1.11	0.89	0.99	0.75	0.71	0.60
6	1.09	0.92	0.99	0.83	0.72	0.62
8	0.93	0.77	0.86	0.72	0.69	0.58
10	1.04	0.62	0.94	0.59	0.68	0.43

With tiles—Test F3 Control—Test F4

Table F9 Heat flow calculated from Table F8

Time min	Heat flow (kW) calculated at points					
	a		b		c	
	With tiles	Control	With tiles	Control	With tiles	Control
0	0.68	0.45	0.76	0.55	0.24	0.36
2	79.2	59.2	55.4	45.3	34.1	31.1
4	100.8	75.1	80.2	53.7	51.5	36.2
6	91.3	66.8	77.2	52.2	48.5	38.2
8	48.2	36.0	43.7	31.5	32.2	20.7
10	77.1	21.5	69.8	20.6	44.4	15.0

With tiles—Test F3 Control—Test F4

Table F10 Severity of exposure at points remote from burning wall tiles—Tests F3 and F4

Time min.	Heat flux (W/cm^2) measured at points				Radiation (W/cm^2) measured at	
	HI (FigF17)	H2 (FigF17)	H3 (FigF17)		Rl (FigF17)	
	With tiles	With tiles	With tiles	Control	With tiles	Control
0	0.13	0.00	0.00	0.00	0.00	0.00
2	4.45	1.72	1.28	2.59	0.96	0.88
4	5.95	2.16	1.61	2.70	1.70	1.27
6	3.38	1.59	1.21	2.40	1.73	1.56
8	0.98	0.60	0.33	0.62	1.28	1.30

With tiles—Test F3 Control—Test F4

Table Fll Oxygen concentration in hot gas layer and calculated heat output—Tests F3 andF4

Time mm.	Oxygen concentration (%) recorded at sampling point S (Fig Fl) at heights				Heat output (kW) calculated from 0_2 concentration	
	100 mm below soffit		400 mm below soffit			
	With tiles	Control	With tiles	Control	With tiles	Control
0	21	21	21	21	0	0
1	19.6	18.9	20.1	19.7	81.0	113.7
2	16.0	17.1	18.7	18.8	329.2	247.2
3	14.4	17.0	18.1	19.0	478.5	256.9
4	16.0	17.2	19.3	19.2	349.0	252.5
5	16.8	17.3	19.7	19.3	278.0	252.8
6	17.1	17.2	19.9	19.3	67.0	250.8
7	18.0	17.9	20.3	19.5	0	200.6
8	19.3	18.4	20.4	19.8	0	148.0
9	19.7	18.8	20.5	19.9	0	120.4

With tiles—Test F3 Control—Test F4

(3) Assessment of smoke and gaseous products

Assessment of the production of smoke and emission of gaseous products was made during these Tests. The details are given in J and K below.

(G) INTERACTION BETWEEN SEATS AND WALL TILES

(1) Balcony rig tests—Tests G1, G2 and G3

(i) *Aim*

The ignition of wall tiles by flames from burning seating units, the subsequent rate and pattern of fire spread were investigated using a balcony rig simulating the rear corner of the Stardust alcove in which the fire was believed to have originated.

(ii) *Experimental construction*

Details of the design of the balcony rig, approximately 3.5 m long X 1.2 m wide X 2.4 m high are given in Figures Gl and G2. Carpet tiles were attached to the rear wall in two tests but in the third non-combustible insulating material replaced these to provide an indication of the contribution to fire growth caused by interaction of the seating and wall lining.

The heat output from a burning seating unit in the corner was simulated by providing a timber crib, similar to that described earlier, designed to liberate heat at a rate similar to that of a seating unit ignited by a line source. The rate of weight loss of the crib was monitored by load cells. Adjacent to the crib, 200 mm away, the halfback of a seating unit was placed next to the wall, 1475 mm below ceiling level; the corner was protected with aluminium foil to prevent premature ignition by flames from the crib. A second halfback of a seating unit, was fixed 500 mm from the other one. The height of the seating units was identical to that of the highest row of seating in the Stardust, and the ceiling of the balcony was lined with insulating board, having thermal characteristics similar to the ceiling tiles in the Stardust.

(iii) *Instrumentation*

The intensity of radiation emitted from flames below the ceiling and incident on a horizontal upward-facing surface was measured by heat flux meters H7 and H8 in two positions as shown in Figure G2. These were sited at a height equivalent to that of the top of the seating unit backs. The heat flux received by the carpet tiles on the wall, 50 mm below ceiling height, was measured by heat flux meters H1-H5 (Figure G2) and at 1450 mm below by heat flux meter H6. Radiation emitted from the burning wall was measured at a point 900 mm away by radiometer R2, 1.4 m below ceiling height. At the same position, radiometer Rl was installed to monitor radiation at ceiling level.

(iv) *Test procedure*

Three experiments were carried out, the first using 21 Stateroom carpet tiles adhered to the rear wall (Test Gl). The second was run as a control to assess the rate of heat release and pattern of fire growth of the crib alone (Test G3), whilst the third test was required to check the similarity between the original Stateroom carpet tiles and those later fabricated to supplement the limited supply of the originals (Simulated Stateroom) (TestG2).

The following observations were made of the progress of the fire during both of the experiments incorporating the wall tiles (Table Gl and *Plates 26 to 29).*

(v) *Test results*

The progress of the flame front at ceiling level as monitored by heat flux meters H1-H5 is given in Table G2 and presented graphically in Figures G3 to G5 for each of the three tests.

The heat flux incident onto horizontal surfaces adjacent to the wall, level with the top of the seat-back are given in Table G3 and represented in Figures G6 to G8 and the radiometer readings Rl and R2 given in Table G3 and Figures G9 to G11.

The temperature of the gases 100 mm below the ceiling, 50 mm from the wall at different distances from the centre-line of the crib are given in Table G4 and shown in Figures G12 to G14; similar readings from thermocouples 900 mm from the wall are given in Table G5 and shown in Figures G15toG17.

Table Gl Observations on fire test in balcony rig—Tests Gl and G2

Occurrence	Time of occurrence after ignition (mins)	
	Stateroom tiles attached TestGl	Simulated Stateroom tiles attached Test G2
Ignition	0.00	0.00
Flames up to top of lowest row	0.15	0.15
Flames up to ceiling	0.45	1.15
Blackening of tile surface	0.45	0.30
Delamination or shrinkage at the tile edges	1.00	0.30
Fibre melt running in rivulets	—	1.00
Ignition of tiles	1.25	—
Extent of flaming under ceiling of rig	2.00 (end)	1.30 (halflength)
Molten drops fall away	—	1.30
Drops flaming	2.10	1.45
Ignition of adjacent seating unit	2.20	2.45
Ignition of second seating unit	3.15	4.45

Table G2 Heat flux measurements 50 mm below ceiling in the balcony rig tests—Tests Gl, G2 and G3

Time min.	Heat flux (W/cm^2) below ceiling at distances from centre-line of crib of														
	Over crib (H5—FigG2)			0.7 m (H4—FigG2)			1.4m (H4—Fig G2)			2.0 m (H2-FigG2)			2.7m (Hl-FigG2)		
	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol
2	NR	7.85	1.76	9.0	2.2	1.4	5.7	0.82	0.6	3.7	0.72	0.5	1.1	0.38	0.3
4	NR	10.7	2.04	8.7	5.62	1.7	8.6	11.0	0.6	8.0	10.6	0.4	4.2	5.06	0.3
6	NR	5.5	1.66	1.7	3.61	1.3	1.2	1.56	0.5	1.1	0.8	0.4	0.6	0.98	0.2
8	NR	1.88	0.52	0.6	1.00	0.4	0.6	0.67	0.1	0.6	0.63	0.1	0.3	0.56	0.1

Tiles 1—TestGl Tiles 2—Test G2 Control—Test G3 NR = Not recorded

Table G3 Heat flux and radiation measurements at other positions in balcony rig tests —Tests G1,G2 and G3

Time min.	Heat flux (W/cm^2) measured at given points (See Fig G2)									Radiation (W/cm^2) measured at given points (See Fig G2)					
	H6			H7			H8			Rl			R2		
	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol
2	5.2	4.96	4.5	1.3	0.33	0.65	1.5	0.19	0.1	0.9	0.14	0.1	0.9	0.23	0.1
4	4.35	6.11	5.6	2.5	1.56	1.0	1.7	1.66	0.13	6.5	2.45	0.14	2.19	2.19	0.1
6	4.3	6.84	7.8	1.0	0.85	1.2	0.5	0.76	0.14	1.1	0.62	0.15	1.13	1.13	0.1
8	3.0	6.36	2.2	0.3	0.39	0.3	0.3	0.45	0.1	0.6	0.3	0.1	0.62	0.62	0.1
Max	6.0	7.0	7.8	2.9	2.34	1.3	2.4	2.04	0.14	8.0	2.88	0.16	2.47	2.47	0.13

Tiles 1—TestGl Tiles 2—Test G2 Control—Test G3

Table G4 Gas temperature measured 100 mm below ceiling in balcony rig test along a line 50 mm from wall—Tests Gl, G2 and G3

Time min.	Temperature (°C) at distances from centre-line of crib of														
	Over crib			0.7 m			1.4m			2.0 m			2.7 m		
	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol
1	265	279	290	210	199	188	106	122	118	95	101	100	87	89	88
2	897	842	487	874	839	236	595	480	214	424	302	187	296	249	167
3	901	841	507	850	803	377	846	777	225	743	731	192	467	532	166
4	875	872	516	840	876	341	896	939	196	830	894	166	707	737	147
5	790	874	531	733	776	334	593	727	191	641	607	157	361	437	146
6	662	758	432	492	594	298	300	372	175	275	243	145	219	306	131
7	442	562	285	284	397	183	197	212	112	185	197	99	182	240	93
8	273	446	205	188	299	120	147	179	69	143	179	59	142	189	63

Tiles 1—Test G1 Tiles 2—Test G2 Control—Test G3

Table G5 Gas temperature measured 100 mm below ceiling in balcony rig test along a line 900 mm from wall—Tests Gl, G2 and G3

Time min.	Temperature (°C) at distances from centre-line of crib of														
	Over crib			0.7 m			1.4m			2.0 m			2.7 m		
	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol	Tiles 1	Tiles 2	Con-trol
1	175	195	211	149	151	155	26	122	125	103	102	103	93	90	84
2	523	498	307	546	379	256	28	354	221	401	277	179	314	226	152
3	822	863	320	786	873	278	69	809	245	650	647	203	488	505	170
4	755	883	360	747	925	272	234	477	232	685	526	187	448	557	161
5	568	657	389	414	514	285	348	315	235	361	273	188	239	246	160
6	474	557	305	308	394	247	317	226	212	134	177	179	160	199	149
7	308	446	211	185	290	168	269	167	149	101	147	127	117	166	110
8	203	376	154	138	227	119	229	151	102	83	135	90	97	140	79

Tiles 1—Test Gl Tiles 2—Test G2 Control—Test G3

(H) AD HOC LARGE SCALE EXPERIMENTS ON FIRE GROWTH

(1) Spread of fire between tiers of seating, interaction between seating units, carpet tiles and floor covering—ignition source remote from wall—Test HI

(i) *Aim*

The development and growth of a fire resulting from ignition of a seating unit and the possibility of spread from tier to tier was investigated using an experimental rig, designed and furnished to simulate part of the rear three tiers of the West Alcove.

(ii) *Experimental construction*

Details of the design of the tiered rig are given in Figures HI and H2. A roofed structure provided with Supalux wall and ceiling, the latter protected on the inner surface with 50 mm wired mineral wool was constructed, the floor being built up to provide a ceiling height above the tiered floor identical to that in the Stardust. Carpet tiles were attached to the rear wall as shown in Figure H3 and the floor carpeted throughout with carpet tiles. Three seating units (Figure H4) were fixed to the central tier and one unit was placed centrally on each of the tiers, above and below to provide a typical arrangement. Tables were also provided, as in the Stardust, one on the upper tier and one on the centre tier *(Plate 32).*

(iii) *Instrumentation*

Heat flux meters were positioned as shown in Figure H4 to monitor the intensity of radiation falling onto the rear seating unit (H4), onto the front seating unit (H6) and also that emitted from the central seating unit (H5). Three further flux meters were fitted into the carpet tiles on the bare wall (H1-H3, Figure H3) and a radiometer was sited, facing up to the ceiling (Rl on Figure H4) to monitor radiation conditions at seat-top level resulting from any flames or hot gases below the ceiling.

(iv) *Test procedure*

The centre seat on the centre tier was ignited using a small timber crib (No. 5 from BS DD 58), placed centrally at the junction of the squab and back of the seat. The progress of the fire was recorded photographically and the following observations were made (Table HI and Plates 33 to 35).

Table H1 Observations on tiered rig test H1

Time	Observation
0.00	Crib ignited.
0.30	Flames flashing to top of seating unit.
1.42	Ignition of seat and top of seat back.
2.00	Smoke level 0.7 m below ceiling.
3.00	Flames 1 m above seat back.
3.30	PVC on rear face of back ignited.
3.41	Drops of molten polyurethane fall to floor. Smoke at back of seating unit.
4.00	Flames spread from seating unit to table above. Smoke level down to 1 m above seating units with flames penetrating.
4.14	Squab of left seating unit ignited.
4.34	Seat back of left unit ignited.
4.38	Flames on floor from molten polyurethane spread under all seat.
4.50	Table above centre seating unit ignited. Back of unit on right ignited.
5.00	Floor and table still burning.
6.00	Back of rear seating unit smoking.
6.20	Flames flashing over rear table.
6.30	Thick smoke 0.5 m above unit.
7.30	Flames extend fully under rear table but no ignition of rear seating unit. Fire now past peak.

Note was made of the rate of flame spread over the surface of the left seating unit during the course of the test as follows:

Time	Observation
4.14	Ignition of seat.
4.34	Ignition of top.
4.50	Extent of spread 0.25 m.
4.58	Extent of spread 0.45 m.
5.38	Extent of spread 0.65 m.
6.00	Extent of spread 0.75 m.
6.20	Extent of spread ~1 m.

(v) *Test results*

The severity of heat flux monitored at the points shown in Figures H2 to H4 are tabulated in Table H2, and the radiation monitored at the top of the lowest seat back in Table H3. The results are shown in Figures H5 to H7.

Table H2 Heat flux incident at various points in tiered rig—Test HI (Figure H4)

Time min.	Heat flux (W/cm^2) measured at points					
	HI	H2	H3	H4	H5	H6
0	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	0.02	0.00	0.00	0.01	0.08
4	0.74	0.65	0.01	0.01	0.21	0.79
6	0.91	0.77	0.03	0.06	2.86	1.02
8	0.35	0.24	0.05	0.08	1.18	0.54
10	0.05	0.07	0.02	0.06	0.20	0.11

Table H3 Radiation on seat top in tier—Test H1

Time min.	Rad lation (W/cm^2)falling onto horizontal seat top (Fig H4) at location Rl
0	0.00
2	0.00
4	0.08
6	0.19
8	0.11
10	0.03

(2) Fire-spread along tiers and interaction between seating units, wall carpet tiles and floor covering ignition source on seat adjacent to wall—Test H2.

(i) *Aim*

The rate of fire spread along the rear tier of seating, and the interaction between the seating, the wall carpet tiles and the flooring was investigated using an experimental rig similar to that constructed for the first tiered rig experiment but extended laterally to provide precise information on the pattern of fire development along the rear wall.

(ii) *Experimental construction*

Details of the design of the modified tiered rig are given in Figures H8 and H9 and shown in Plate 36. The floor of the rig was again tiered to reproduce the ceiling heights of the Stardust, but finishing was restricted to the installation of twelve seating units, sited as shown in Figure H9. The floor was covered with carpeting identical to that used in Stardust and the rear wall was covered with carpet tiles, five of the original Stateroom composition, the other 65 of a type formulated to reproduce as closely as possible the original tiles. The ceiling was covered with mineral wool, supported with wire mesh and pinned to the Supalux soffit, to provide an insulating exposed surface and to ensure that premature failure of the board could not occur.

(iii) *Instrumentation*

Radiation from flames and hot gases at ceiling level was monitored by radiometers placed in the positions and at the heights of other seating units (Figures H10 and HI 1). The intensity of the heat flux at ceiling level was monitored by heat flux meters inset flush with the carpet tiles on the rear wall, 150mm below ceiling level (H60, 62-7, Figures H9 and H10). The intensity of heat flux incident on other surface was also monitored (H68-70 Figure H9) and tier seat back top (H71). The initial fire growth from ignition was monitored by H61, 1.3m below ceiling level.

(iv) *Test procedure*

Ignition of seating unit S3 (Figure H9) was effected using a No 5 (BS DD 58) crib, placed on the squab near one end. The squab was cut to expose the foam and the crib was placed on it. The progress of the fire was recorded photographically and the following observations of the progress of the fire were made (Table H4 and *Plates 37 to 41).*

Table H4 Observations of tiered rig test H2 ignition source 2

Time	Observations
0.00	Ignition of crib on S3.
1.20	Flames up to half-height of seat back.
1.54	Ignition of squab of S3.
2.39	Flaming drops fall into carpet.
2.40	Flames reach top of seating unit S3—smoke thick.
4.15	Ignition of back of S3.
4.20	Heavy smoke under canopy, 0.25 m layer. Flames 0.5 m above seat back.
4.40	Tiles on wall blackening.
4.50	Flames reach ceiling.
5.00	Ignition of top of S3 back.
5.15	Smoke layer down to 1 m below ceiling, penetrated by flames.
5.30	Ignition of wall tiles behind S3.
5.35	Flames under ceiling extend >2 m. Flame front angles over wall.
5.40	Wall tile 1 m from S3 ignites.
5.46	Seating unit S12 smoking.
5.50	Ignition of wall tile 1.5 m to right of S3.
5.54	Flaming drops fall from carpet tile.
5.56	Flame front falling in rivulets.
5.58	Ignition by flaming drop of S4 squab.

Table H4 Observations of tiered rig test H2 ignition source 2 (contd.)

Time	Observations
6.00	Ignition of S4 back.
6.08	Ignition of S2 and S1.
6.10	Flames extend into corner of rig.
6.14	Ignition of S5-6.
6.16	Ignition of table in front of S4-6.
6.17	Ignition of floor carpet below S3.
6.20	Ignition of S12.
6.27	Flames spread over S5-S6 (over squab and top).
6.28	SI0-12 all burning.
6.33	S4-6 all burning, flames flashing along back.
	Flames under smoke layer < 3 m from origin.
6.36	Table in front of S4-6 burning. Carpet below SI2 ignites.
6.44	Seating units S7-9 smoking.
6.46	Flames under smoke layer <5 m from origin.
6.52	Ignition of S7, first on squab then on top.
6.55	Flames spread along top of S7-9 and along carpet below.
7.02	Flames spread along seating unit S7-9 then along back.
	Flames extend out from canopy. Everything burning.
8.10	Extinction.

Analysis of the video recording allowed precise timing of the involvement of different materials to be made; details are given in Table H5.

Table H5 Time of involvement of specific materials in tiered rig—Test H2

Time	Wall tiles Number involved	Seating units Number involved	Flooring involved—m	
			Front tier	Rear tier
5.30	3	0.5	0	0.0
5.45	4-5			
6.00	6			
6.15	9			
6.30	25			0.8
6.45	41	9		2.5
7.00	52	10	3.5	8.0
7.15	60	12		10.5
7.30				
7.45				
8.00				
8.15				

The depth of layer of the smoke and hot gases was also measured as shown in Table H6.

Table H6 Depth of layer of hot gases in tiered rig—Test H2

Time	Depth of layer (m) at positions		
	Centre of rig	Right side	Front edge
5	0.15	0.3	~0
6	0.20	0.3	
6.45	0.40	0.5	
7.30	0.60	0.6	0.4

(v) *Test results*

The intensity of heat flux measured by meters sited 150 mm and 1.4 m below ceiling level, set flush with the rear wall of the experimental rig are given in Tables H7 and H8 and are graphically presented in Figures H12 to HI4. The heat flux above the initial fire source and on the centre seating unit immediately in front of the fire source is given in Table H9 and shown in Figure HI 5.

Radiation measurements, taken at seat-back top height for each of five tiers of seating units is given in Table H10 and shown in Figures H16 and HI9.

Table H7 Heat flux 150 mm from ceiling level falling on rear wall in tiered rig—Test H2

Time mm.	Heat flux (W/cm^2) at distance from side wall of						
	1.5m	3.0 m	4.5 m	6.0 m	7.5 m	9.0 m	10.5 m
1	0.02	0.17	0.01	0.01	0.02	0.01	0.01
2	0.02	0.05	0.02	0.01	0.02	0.01	0.01
3	0.02	0.05	0.02	0.01	0.01	0.01	0.00
4	0.04	0.31	0.04	0.02	0.02	0.01	0.01
5	0.12	1.51	0.13	0.09	0.06	0.04	0.01
6	9.87	12.50	7.81	0.62	0.16	0.12	0.09
7	10.40	13.10	8.34	9.35	8.34	7.55	4.18
8	12.00	10.40	10.20	11.20	8.83	11.70	9.78

The progress of the fire is shown graphically in Figure H20. On the basis of the time of ignition of individual items and the heat outputs at various times after ignition, determined in earlier experiments, the potential heat output (i.e. assuming complete combustion) was computed. This is shown in Figure H21.

Assessment of the emission of gaseous products was made during these Tests: details are given in K below.

Table H8 Heat flux 1.4 m below ceiling level falling on rear wall in tiered rig—Test H2

Time mm.	Heat flux (W/cm^2) at distance from side wall of		
	3.75 m	7.15m	10.50 m
1	0.01	0.01	0.01
2	0.01	0.01	0.01
3	0.01	0.01	0.00
4	0.05	0.01	0.01
5	0.38	0.02	0.01
6	2.24	0.21	0.03
7	0.41	3.39	1.33
8	0.04	0.01	0.16

Table H9 Heat flux at other points in tiered rig—Test H2

Time min.	Heat flux (W/cm^2) falling on meter	
	2.05 m from side wall 1.3 m below ceiling	On centre seat unit facing back wall 0.9 m from rear
1	0.01	0.01
2	0.02	0.01
3	0.02	0.01
4	0.02	0.02
5	0.04	0.10
6	0.52	0.80
7	9.63	2.36
8	11.29	0.00

Table H10 Radiation falling on meters at seat top heights facing ceiling in tiered rig—Test H2

Time min.	Radiation (W/cm^2) recorded at following points										
	Tier 2		Tier 3			Tier 4			Tier 5		
	Distance from side wall—m		Distance from side wall—m			Distance from side wall—m			Distance from side wall—m		
	5.45	8.8	2	5.45	8.8	2	5.45	8.8	2	5.45	8.8
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.02	0.01	0.03	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01
6	0.98	0.05	0.53	0.61	0.05	0.25	0.28	0.05	0.14	0.15	0.05
7	21.20	5.47	13.20	12.30	4.33	8.43	10.10	3.40	8.62	6.25	2.92
8	0.00	0.11	6.95	6.02	5.68	4.35	3.73	4.66	1.22	3.22	1.73
Max	21.20	8.70	14.70	13.10	8.10	9.20	11.33	7.38	9.33	7.05	6.77

Assessments of the emission of gaseous products were made during the Tests: details are given in J and K below.

(I) LARGE SCALE SIMULATION TEST

(i) *Aim*

The systematic experiments described earlier showed that, whilst the interaction of various components contributed to the rate of fire growth, there was evidence of oxygen deficiency. The effect of incorporating full furniture and furnishings and of the role played by the involvement of the suspended ceiling system (as distinct from a simulated ceiling, used in experiments described earlier) was accordingly investigated by simulation of an entire section of the West Alcove.

(ii) *Experimental construction*

Details of the construction and furnishing of the experimental rig used for this test are given in Fig. 12 and *Plate 42.*

(iii) *Instrumentation*

The rate of weight loss of seating units A1, A3-4 and C3 was monitored using load cells (Figure 12). The positioning of heat flux meters and radiometers is shown in Figure 13. Gas temperatures at ceiling level (Figure 12) and at a range of depths below ceiling level were measured using thermocouple stacks (D, E and F), of more robust construction than those (A, B and C) installed to monitor the flow of hot gases from the fire area (Figure 14). Ceiling surface temperatures (Figure 13) were also monitored.

Full video and cine coverage of the reconstruction was undertaken.

(iv) *Test procedure*

The first ignition source was similar to that referred to in Appendix E, Test E4(b) except that 3 double sheets of newspaper were used. This failed to initiate a sustained fire and a further attempt was made 13 min 40 sec later.

Ignition of the assembly was effected satisfactorily by igniting 5 double sheets of newspaper *(Plate 43* shows their position) and visual observations were recorded *(Plates 44 to 48).*

(v) *Test results*

Observations of the test are given in Table 10. The weight loss of three of the seating units is given in Table II and Figure 15.

Table 10 Observations recorded during Test I

Time after second ignition min.*?	s	Observation
*0	00	Newspaper ignited beneath seating unit.
0	05	Flames spreading up gap between seat back and squab and curling over front of squab.
1	06	Blind raised. Carpet tiles involved.
1	11	Flames starting to spread sideways in the junction between the rear wall and the ceiling.
1	15	Fire spreading along tops of backs of seats in the rear tier.
1	21	Flame tips have reached the side walls.
1	30	Whole of rear tier ignited.
		Ignition of backs of seats on second tier (B9 and B2). Flames starting to spread along the junction between the right-hand wall and the ceiling.
1	36	Fire spreads to remainder of second tier.
		Flames have spread 3 m along the junction between the right-hand wall and the ceiling.
1	45	Flaming at bottom of smoke layer beneath ceiling over entire width.
1	49	Backs of third tier ignite.
1	50	Flames at bottom of smoke layer beneath ceiling extend to beyond table on fifth tier.
1	53	Backs of fourth tier ignite.
1	54	Backs of fifth tier ignite.
1	57	Smoke layer deepens considerably. All combustible material involved.

*Time from re-ignition at 13 min 40 s.

Table 11 Weight loss of seating units during Test I

Time min.	Weight loss (kg) from seating unit		
	Al	A3	A4
0	0.00	0.00	0.00
1	0.24	0.08	0.00
2	0.26	0.62	0.30
3	0.40	1.07	0.44
4	0.53	—	0.63
5	1.50	1.34	0.69
6	1.55	1.80	1.14

The surface temperatures recorded on the soffit of the ceiling tiles at the points shown in Figures 13 are given in Table 12 and Figures 16 and 17.

Table 12 Surface temperature of ceiling soffit

Time min.	Surface temperature of tiles (°G) recorded at					
	Wall side of alcove			Simulated wall side of alcove		
	Back	Centre	Front	Back	Centre	Front
1	424	142	85	213	92	424
2	889	919	1003	829	1007	889
3	1043	1226	1301	851	1054	1043
4	975	1104	679	835	968	975
5	965	1069	753	807	893	965
6	827	935	796	798	1076	827

The gas temperatures recorded 100 mm below the soffit of the suspended ceiling system are given in Table 13 and shown in Figures 18 and 19.

Table 13 Gas temperatures 100 mm below suspended ceiling

Time min.	Gas temperature (°C) 100 mm below soffit at points					
	Wall side of alcove			Simulated wall side of alcove		
	Back	Centre	Front	Back	Centre	Front
1	247	230	182	373	287	207
2	986	1039	1130	942	1007	1099
3	1147	1308	1353	947	1002	1104
4	1053	1155	1195	895	928	1011
5	997	1115	1119	843	863	920
6	875	969	1115	845	936	1123

Temperatures were also recorded by stacked thermocouples of the gases at a range of heights at the three points shown in Figure 14. The results are given in Tables 14, 15 and 16 for selected heights, 500 mm apart, and are shown graphically in Figures 110 to 112.

Table 14 Temperatures recorded on thermocouple stack D

Time mm.	Temperature (°C) recorded in gases at following depths below centre soffit				
	0.0 m	0.5 m	1.0m	1.5m	2.0 m
1	297	108	59	47	40
2	923	1012	890	715	541
3	1279	1215	997	755	517
4	1179	1080	913	675	503
5	586	1037	876	712	511
6	619	1024	1022	916	654

Table 15 Temperatures recorded on thermocouple stack E

Time mm.	Temperature (°C) recorded in gases at following depths below centre soffit				
	0.0 m	0.5 m	1.0m	1.5m	2.0 m
1	315	107	65		49
2	945	1054	904		456
3	1038	1032	877		456
4	948	937	838		536
5	908	887	790		532
6	306	975	965		963

Table 16 Temperatures recorded on thermocouple stack F

Time mm.	Temperat ure (°C) recorded in gases at following depths below centre soffit				
	0.0 m	0.5 m	1.0m	1.5m	2.0 m
1	143	123	52	42	39
2	1165	1244	1199	1149	1157
3	875	1190	1083	867	687
4	865	1132	1086	775	587
5	853	657	951	749	448
6	839	468	867	741	616

Radiation and heat flux levels at locations indicated in Figure 13 are given in Tables 17 to 19 and Figures 113 to 118.

Table 17 Radiation intensities recorded during Test I

Time mm.	Radiation intensities (W/'cm^2) recorded at the following positions (Fig 13)							
	Rl	R2	R3	R4	R5	R6	R7	R8
1	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2	11.2	9.30	6.60	16.5	21.8	5.60	1.52	9.5
3	7.84	5.91	6.61	9.08	13.4	2.38	1.92	5.02
4	Failed	4.08	5.29	9.45	11.4	3.00	3.27	Failed
5	do.	3.01	4.44	5.93	7.06	3.44	3.01	do.
6	do.	1.88	2.90	3.90	4.43			do.

Table 18 Heat flux recorded during test at given points on tiers

Time mm.	Heat flux (W/cm^2) recorded at the following positions shown in Figure 13			
	H7	H8	H9	H10
1	1.37	0.85	0.50	0.44
2	7.09	3.84	3.90	3.88
3	5.10	3.31	3.64	3.11
4	5.10	3.10	3.52	2.77
5	5.10	2.89	3.90	3.00
6	5.35	3.31	3.77	13.87

Table 19 Heat flux recorded during test at given points on rear wall of alcove

Time mm.	Heal flux (W/cm^2) ixcorded at the following points listed in Figure 13					
	HI	H2	H3	H4	H5	H6
1	0.14	4.68	3.2	0.00	1.50	1.97
2	5.32	3.6	7.4	4.10	4.25	8.52
3	4.30	3.7	8.1	3.83	3.35	6.45
4	4.47	4.11	5.87	4.03	3.41	5.84
5	5.31	5.1	2.98	3.76	4.55	5.84
6	4.47	4.5	3.92	1.76	4.17	3.01

The mass flow data, calculated from the thermocouple stacks A, B and C and from oxygen concentration measurements are given in Table 110 together with the heat output calculated from oxygen concentration measurements; these are shown in Figures 119 and 120 respectively.

Table 110 Mass flow and heat output calculated from oxygen concentration data

Time	Mass Flow Stack A kg/s	Mass Flow Stack B kg/s	Mass Flow Stack C kg/s	Heat output (0_2 Deficiency) MW
0:00	1.343	1.731	1.922	0.000
0:10	1.370	1.757	2.002	0.000
0:20	1.392	1.803	2.132	0.000
0:30	1.406	2.014	2.273	0.012
0:40	1.743	2.026	2.147	0.037
0:50	1.820	2.320	2.339	0.067
1:00	2.021	2.412	2.625	0.156
1:10	2.540	3.024	3.322	0.266
1:20	3.452	3.973	4.555	0.504
1:30	5.186	6.209	6.791	1.778
1:40	7.686	8.548	9.453	4.922*

* Rising rapidly.

Assessment of the emission of gaseous products was made during this Test: details are given in K below.

(J) SMOKE PRODUCTION

Data on the production of smoke from the seating units and from the wall carpet tiles was obtained in the tests described in Appendix F. The rate of smoke flow, recorded in the corridor is shown in Table J1 below in terms of the volume flow (m^3/s) times optical density per metre (OD/m).

Table J1 Smoke production in burning rate experiments—Tests Fl, F2 and F3

Time min	Smoke flow (m^3/s x OD/m)**		
	Seating unit with point ignition Test Fl	Seating unit with line ignition Test F2	Wall Carpet* Tiles Test F3
1	0.000	0.231	0.006
2	0.004	0.990	0.067
3	0.100	0.433	1.670
4	0.624	0.082	0.323
5	0.557	0.049	0.106
6	0.167	0.027	0.079
7	0.062	0.012	0.071
8	0.037	0.017	0.074

*Smoke flow in the control test was insignificant and may be neglected.
**Reduced to N.T.P. (Normal temperature and pressure).

Similar data were obtained from the final large scale simulation Test I and are given in Table J2.

Table J2 Smoke production in simulation Test I

Time min.	Smoke flow* m^3/s x OD/m
0:00	0.126
0:10	0.128
0:20	0.331
0:30	1.295
0:40	3.449
0:50	15.172
1:00	15.879
1:20	20.694
1:30	28.830
1:40	54.170
1:50	8.436

*Reduced to N.T.P. (Normal temperature and pressure).

(K) TOXIC PRODUCT EMISSION

(1) Analysis of gaseous products

(i) *Aim*

The gaseous products released during the experimental fires described in Appendices F, H and I were analysed to assist in the understanding of their toxicity.

(ii) *Instrumentation*

The tests (Fl, F2, F3) carried out in the experimental room/corridor rig were instrumented to provide continuous analysis of carbon dioxide ($C0_2$), carbon monoxide (CO) and oxygen (0_2), the position of the sampling points being shown in Figure Fl. The analysers used for $C0_2$ and CO were of the non-dispersive infra-red type, the 0_2 analyser working on the paramagnetic principle. In Test F3, 0_2 was not measured in the corridor and $C0_2$ was not measured at the room exit point.

For the large-scale tests, additional analyses were carried out to estimate concentrations of hydrogen cyanide (HCN) and hydrogen chloride (HC1). Samples for these gases were drawn continuously through a heated glass-lined stainless steel tube with 'Draeger' tube measurements for HCN and HC1 and a further specific method for HC1 (nephelometry). Two sampling points were used as shown in Figure KO for Test I with analysis of HC1 and HCN at the annex point and HC1 at the vent point. One analysis point (HC1 and HCN) was used in Test H2.

In the nephelometry method (Figure Kl), the extracted gases are passed through filters and a series of bubblers containing de-ionized water. Analysis of the HC1 in the bubblers, exposed for a known period of time to the gas flow, was effected by introducing silver nitrate into an extract of the solution measured into a nephelometer head and recording the light scatter from the resultant suspension of silver chloride. Comparison of the photocell readings with calibration data provides information on concentrations of HC1 between 2 and 10,000 ppm. Interference by HCN must be anticipated but since the concentrations occurring in these tests were small in comparison with the HC1, corrections could be made.

'Fingerprinting' or spot sampling of the atmosphere was carried out at various stages of the large-scale fires H2 and I, by extracting gases into a sampling tube (Figure K2A), followed by subsequent detailed analysis of the samples using the GC-MS method. Currently under development as a research tool, provides this information on other decomposition products. The system is illustrated in Figure K2B. The sample of fire gas is transferred to a refrigerated stainless steel trap using a nitrogen stream and is subsequently heated so that a helium stream can carry the vaporised products into the chromatograph. Detection is by a flame ionisation detector with compound identification by on-line mass spectrometry/data system. Quantitative information may be obtained using an electronic integrator and calibration using a range of representative compounds together with published response factors for flame ionisation detectors.

The analytical 'fingerprint' system is essentially designed to respond to stable organic products up to a molecular weight corresponding to about Cio hydrocarbons.

(iii) *Test procedure*

Continuous analysis of CO, $C0_2$ and 0_2 was carried out during each test. In the two large-scale experiments, fire gases aspirated from the rigs were drawn through the 'Draeger' indicator tubes using the standard aspirating bellows and through the nephelometry bubblers described earlier. Fingerprint samples were also taken during Test H2 at four known times after ignition and, during Test I, from both the annex point and the vent point at five known times.

(iv) *Test results*

(a) Carbon monoxide, carbon dioxide and oxygen

The concentrations within the corridor of carbon monoxide recorded during the tests in the room/corridor rig are shown in Figure K3, of carbon dioxide in Figure K4 and of oxygen in Figure K5. Similar information recorded at room exit is given in Table Kl and of the

temperature of the gases at this point in Table K2. Data for the three gases, obtained during Test H2 (Appendix H), are given in Figures K6, K7 and K8 respectively and in Figures K9 and K10 for Test I (Appendix I), for the vent and annex points respectively.

(b) Hydrogen cyanide and hydrogen chloride

Concentrations of HCN and HC1, were measured both by the analytical tube and nephelometry methods in Tests H2 and I. The concentrations of HC1, measured by the nephelometry method are shown graphically in Figures Kll and K12 for tests H2 and I respectively and Figures K13 and K14 show the concentration at the annex point of HCN and HC1 measured using the "Draeger" analytical tubes during Test I.

(c) Fingerprint analyses

'Fingerprint' analyses for Test H2 (Appendix H) are given in Table K3 and Figs K15-K18 for samples taken at 3 min 30s, 6 min, 7 min 30s and 8 min. Analyses of the samples taken during Test I (Appendix I) at the annex point at 1 min 55s, 13 min 40s, 16 min 25s, 17 min 15s and 18 min are given in Table K4 and Figures K19-K23 and at the vent position in Table K5 and Figures K24-K28 for samples taken at 15 min 45s, 17 min 20s, 18 min 30s, 19 min 20s and 20 min 30s. These times for Tests H2 and I have not been corrected for ignition delays (about 30s and 13 min 40s respectively).

Table Kl Analysis of gases (%) at room exit point in room/corridor rig—Tests F1-F3

Time mm.	Oxygen			Carbon monoxide			Carbon dioxide		
	Point	Line	Tile	Point	Line	Tile	Point	Line	Tile
0	21.0	21.0	21.0	0.004	0.005	0.000	0.000	0.04	
1	20.9	20.9	19.7	0.006	0.129	0.016	0.13	0.91	
2	20.7	17.1	16.9	0.020	0.123	0.035	0.40	3.89	
3	20.4	17.0	9.8	0.063	0.055	0.919	0.85	3.11	
4	18.8	19.3	11.9	0.107	0.030	0.377	2.59	1.21	
5	17.5	20.2	13.5	0.079	0.026	0.147	2.77	0.77	
6	18.5	20.5	14.4	0.039	0.022	0.074	L78	0.56	
7	19.4	20.7	15.2	0.033	0.019	0.078	1.24	0.46	
8	20.0	20.7	16.8	0.027	0.018	0.075	0.80	0.40	

Point—Test F1 Line—Test F2 Tile—Test F3

Table K2 Temperature of gases at room exit point in tests Fl—F3

Time	Temperature (°C) measured in door of room/corridor rig		
	Point TestFl	Line Test F2	Tiles Test F3
1	24	116	128
2	37	289	266
3	85	252	346
4	209	138	342
5	237	96	331
6	177	77	323
7	132	67	293
8	90	60	242

Table K3 Fingerprint components (ppm) and yields during Test H2 (Appendix H)

Peak Letter	M.S. Interpretation	Sample 1 3 min 30s	Sample 2 6 min	Sample 3 7 min 30s	Sample 4 8 min
A	Methane	0.40		1.28	0.17
B	Acetylene	0.28	0.83	3.91	0.50
C	Ethylene	0.40	1.28	105.00	46.00
D	Ethane	0.04	0.06	0.92	38.00
E	Propene	0.19	0.38	0.26	1.50
F	Propyne			10.00	1.79
G	Propane				0.74
H	Acetaldehyde	0.02	0.03		
I	Hydrogen Cyanide			0.92	0.81
J	Vinyl Acetylene			1.20	1.37
K	Butene	0.07	0.13		
L	Butadiene	0.11	0.01		
M	Methyl Chloride			0.96	0.95
N	Ethylene Chloride			0.10	
O	Acetic Acid			0.02	0.07
P	Acetonitrile			1.88	1.00
Q	Acetone	1.83	0.30		
R	Acrylonitrile			0.86	0.89
S	Cyclopentadiene	0.01	0.03	1.20	0.01
T	Pentadiene		0.18		
U	Crotonaldehyde			0.03	0.20
V	Cyclohexane	0.09	0.19	0.01	0.47
W	Benzene	0.83	1.03	51.00	36.00
X	Cyclohexadiene	0.02	0.01	0.01	0.01
Y	Heptane	0.06	0.13		
Z	Toluene	0.06	0.15	2.01	1.61
AA	Cyclohexanone	0.08	0.09		
BB	Chlorobenzene	0.03	0.11	0.72	0.41
CC	Phenyl Acetylene			5.90	3.70
DD	Xylene	0.05	0.14		
EE	Styrene	0.02	0.02		
FF	Octene	0.14	0.23		
GG	Methyl Styrene		0.29		
HH	Cyanobenzene	0.28	0.32	5.30	2.60
II	Indene	0.17	0.19	0.43	3.60
JJ	Ethyl Styrene	1.50	1.00	0.48	
KK	Methyl Indene			0.69	
LL	Naphthalene	2.20	2.00	14.00	8.60

Table K4 Fingerprint components and yields during Test I (Annex Position)

Peak Letter	M.S. Interpretation	Yield (ppm)				
		Sample Al lmin 55s	Sample A2 13min40s	Sample A3 16min 25s	Sample A4 17min 15s	Sample A5 18min
A	Methane	0.80	0.30	0.50	2.40	0.30
B	Acetylene	0.10	0.02	0.90		0.50
C	Ethylene	0.10	0.041	140.00	150.00	65.00
D	Ethane	0.03	0.01J			
E	Propane	0.10	0.04	21.80	17.00	4.00
F	Propyne			13.40	12.10	5.10
G	Chloroethylene		*	3.30	1.80	0.09
H	Acetaldehyde	0.03	0.01	0.10	0.50	0.06
I	Butadiene	0.03	0.03	15.10	12.20	3.10
J	Butadiyne			0.02	0.90	0.40
K	Acetonitrile			4.40	3.80	2.00
L	Acetone	1.70	0.80		0.40	0.20
M	Acrylonitrile			11.50	7.00	2.30
N	Cyclopentadiene					0.50
O	Pentadiene			0.04	0.02	0.01
P	Crotonaldehyde	0.01	0.03	0.04	0.02	0.02
Q	Propan-2-ol	0.10				
R	Benzene	0.30	0.50	50.00	50.00	38.40
S	Cyclohexadiene	0.02				
T	Heptene	0.03	0.03			
U	Toluene	0.04	0.10	16.90	13.60	6.50
V	Octane	0.08	0.02	0.03		
W	Chlorobenzene	0.01	*	2.00	1.60	0.80
X	Xylene	0.09	0.08	1.90	3.40	
Y	Styrene	0.02	*	10.90	7.60	3.90
Z	Methyl Styrene	0.20	0.06		0.10	
AA	Furfural					0.10
BB	Cyanobenzene	0.50	0.20	7.80	5.10	5.60
CC	Indene	0.09		7.50	4.20	0.50
DD	Decene			1.90	0.60	0.30
EE	Ethyl Styrene	0.20	0.20		0.40	0.50
FF	Methyl Indene	0.40	0.50		0.50	*
GG	Naphthalene	0.30		25.30	19.90	25.90

* Present but below integration parameters.

Table K5 Fingerprint components and yields during Test I (Vent Positions)

Peak Letter	M.S. Interpretation	Yield (ppm)				
		Sample Al 15min 45s	Sample A2 17min 20s	Sample A3 18min 30s	Sample A4 19min20s	Sample A5 20min 30s
A	Methane	0.60	0.50	0.100	0.90	0.20
B	Acetylene	0.30	1.00	0.100	0.10	*
C	Ethylene	0.60	0.20	0.004	*	0.20
D	Ethane	4.50	4.10			
E	Propane	0.50	0.10	0.002	0.20	0.10
F	Propyne	1.30	0.80	0.020	*	0.01
G	Chloroethylene	0.20	*	0.070	0.06	0.01
H	Acetaldehyde	0.10	0.20	0.500	0.20	0.01
I	Butadiene	0.60	0.10	0.010	0.02	0.01
J	Butadiyne	*	0.07	0.010	0.06	*
K	Acetonitrile	0.40	0.50	0.040	0.10	
L	Acetone	0.10	*	0.100	0.30	0.05
M	Acrylonitrile	0.60	0.01	0.200	0.10	0.06
N	Cyclopentadiene	*	0.10	0.040	0.01	0.07
O	Pentadiene		*	0.010	*	0.01
P	Crotonaldehyde	0.04	*	0.040	0.02	0.03
Q	Propan-2-ol	2.00	0.20			
R	Benzene	5.20	7.00	3.200	4.20	0.50
S	Cyclohexadiene	*	0.10	*	0.01	0.02
T	Heptene					0.03
U	Toluene	0.03	0.80	0.800	0.10	0.07
V	Octane	0.30	0.20	0.020		0.05
W	Chlorobenzene	1.10	0.50	0.100	0.10	0.10
X	Xylene	*	0.30		0.10	0.20
Y	Styrene	2.70	3.50		0.10	0.20
Z	Methyl Styrene				0.20	0.20
AA	Furfural	*	0.90	3.000	0.70	0.50
BB	Cyanobenzene		0.40	0.500	0.60	1.40
CC	Indene	1.60				
DD	Decene	0.30	0.10			
EE	Ethyl Styrene	1.30	0.60	0.600		
FF	Methyl Indene	*	0.80	0.700		0.50
GG	Naphthalene	4.10	3.20	3.000	2.50	1.50

*Present but below integration parameters.

(L) DISCREPANCIES BETWEEN MATERIALS USED IN CERTAIN TESTS AND MATERIALS IN BUILDING

(1) Introduction

During the presentation of evidence to the Tribunal on the 18th September, 1981, it emerged that the seating units which had been supplied to the Fire Research Station were not identical to those in the West and North Alcoves of the 'Stardust' room, although similar to those used in the dance floor area. (See Chapter 7, para 7. 107).

The only difference as far as could be ascertained was that the back was 5| inches (14 cm) higher; otherwise the materials and method of construction were similar.

The following alterations should be made to Section A (I) (hi) (Description of Materials used in FRS Tests) at page 424.

Seating Units—framework —height 1100 mm
—seat back polyurethane foam

Theoretical heat output of seating unit (p.425): —dimensions (mm) — 870X754X50
weight of foam back — 0.82 kg
PVC (red)—weight —2.10kg
chipboard — weight — 5.80 kg

Table LI

Material	Weight kg	Calorific value MJ/kg	Theoretical heat output MJ	Total
Polyurethane foam	1.38	23	32	
PVC	2.6	18	47	
Chipboard	9.1	15	137	
Polypropylene	0.033	43	1	217MJ

The following alterations should be made to Section B (Theoretical Maximum Heat Content of Items in Stardust) — Seats — at page 436.

Table L2

Location	West Alcove			North Alcove			Dance Floor Area		
Item	kg	MJ/kg	Total MJ	kg	MJ/kg	Total MJ	kg	MJ/kg	Total MJ
Seats									
PVC	364	(No	6 550	694	(No	12 490	(No change)		
Polyurethane	193	Change)	4 440	368	Change)	8 460			
Polypropylene	5		220	10		430			
Chipboard	1 274		19 110	2 430		36 450			
Total heat content MJ	58 400			107 400					
Fire load MJ/m^2	330			315					

(2) Changes to burning rates of seating units—Experiments Fl and F2

The rate of spread over the seating units would probably be little affected.

The peak burning rates mentioned in the section Tgnitibility and burning rate of seating units' would probably be increased in the ratio of the areas of PVC covered foam (squab and back); a factor of 1.14, i.e. about 220 and 340 kW with 'point' and 'line' sources respectively.

(3) Interaction between seats and wall tiles—Experiments Gl and G2

This was not carried out with actual seating units. Because the fire source would have been slightly closer to the ceiling given the revised seat dimensions, there might have been a slightly increased rate of fire spread but not of practical significance.

(4) Ad hoc large-scale experiments on fire growth—Tests HI and H2

In Test HI the flames would have been slightly higher (possibly a factor of 1.2) above the seat. However the configuration factor of the seat behind with respect to the flames would not have been much increased and therefore ignition would not have occurred without a pilot flame. Although the configuration factor of the seat in front with respect to the burning seat would have been increased it is unlikely that this would have been sufficient to ignite the seat in front.

In Test H2, the decreased area of tiles exposed above the seats would have been compensated for by the increased area of seat backs and there would probably have been little difference in the rate of fire spread or heat output.

(5) Large-scale simulation (Test I)

The amount of available fuel gases in this experiment was such that it is unlikely that the relatively small increase in available combustible material would have had any significant effect on the outcome.

(M) OTHER NON-STANDARD TESTS

(1) Ceiling tiles from the Lantern Room

The tiles measured 62.3 cm X 62.3 cm and were 1.4 cm thick. The tiles consisted of a thin yellow surface layer of calcium carbonate, a thin layer of china clay (aluminium silicates) and the main bulk of the tile was a thick layer of rock wool. The tiles were bound together with 2.5% polyvinyl acetate.

When subjected to the heat of a bunsen burner, the tiles did not appear to ignite. The colour of the surface changed from cream to white and a small quantity of very acrid fumes similar to acetic acid was produced. After heating, the tile material broke up easily. A similar effect was produced when a tile was saturated with water.

(2) Orange "Wavin" piping

See para. 6.50.

(3) Plastics air duct

See para. 6.51.

(4) Green material from the area of the roller blind

See para. 6.53.

(5) Material from PVC quilt of cylinder in Main Bar

See para. 6.59.

(6) Corrugated asbestos from the roof

See para. 6.60.

(7) Material from roller blind

The material consisted of a mesh of woven polyester coated and impregnated with a plasticised polyvinyl chloride. The polyvinyl chloride had a magnesium silicate filler with chromium and lead pigments. The main pattern was printed on this material which was then coated on the patterned side with a further layer of clear plasticised polyvinyl chloride. The two layers were bound together with polyvinyl acetate. Measured by weight the composition of the curtain material was (1) Polyvinyl chloride 58.6%, (2) Plasticiser 24.6%, (3) Polyester mesh 10.1%, (4) Polyvinyl acetate 6.7%.

The plasticiser was a mixture of a phthalate ester and an organic phospate. This would mean that the material had some flame retardent properties. When heated in a small bunsen flame the curtain material burned but on removal of the flame the material was quickly self-extinguishing.

(8) Seating unit from the Stardust

The quantities of combustible materials in the seat were weighed and found to be as follows:—

Polypropylene backing	33.2 grams
Red polyvinyl chloride	515 grams
Mauve-coloured polyurethene foam	538 grams
Chipboard	4 138 grams
Seat Back	
Polyvinyl chloride covering	1 010 grams
Yellow polyurethene foam	571 grams
Chipboard	5 718 grams

Mr Norton tried to ignite both types of foam with a smouldering cigarette but failed. A lighted match held to the foams was sufficient to ignite them instantly. The foam burned with a yellow-coloured stable flame.

The seat covering was found to consist of the following material by weight:—

(1)	PVC	53%
(2)	Plasticiser	30%
(3)	Emulsifiers and Stabilisers	4.5%
(4)	Knitted fabric	12.5%

The plasticiser in this material was mainly phthalate ester and as such would have no flame-retardant properties. A smouldering cigarette placed on the covering was quenched after about two minutes and did not burn through the covering. A lighted match placed on the seat cover caused it to char but did not burn through to the foam. When a hole was cut in the covering and a lighted match dropped on the area of exposed foam, the foam ignited immediately and in turn ignited the seat covering. A match applied to the edge of a piece of material was sufficient to ignite it. When the match was removed, the material continued to burn mainly on the fabric side. The covering material burned with flickering flames and the generation of large quantities of thick black smoke. The mesh covering on the underneath portion of the seat was polypropylene. Mr Norton tried to ignite it with a match but failed, as the lightweight mesh quickly melted away from the heat source.

(9) Sample of material from table-top

Mr Norton found this to consist of a surface layer of melamine formaldehyde resin bonded to a thick layer of urea-formaldehyde resin. (This material is generally called formica.) This was bonded to the chipboard with an ethylene vincylacetate hot melt adhesive. When held to a flame the hot melt adhesive softened and was flammable. The urea-formaldehyde and melamine were not: they glowed in the flame and smouldered.

(10) Sample of carpet tile

The tile measured 50 cm X 50 cm. By weight the proportions of materials in the tile were:—

(1) Backing layer of PVC and filler 56%
(2) Phthalate plasticiser from PVC 17%
(3) Fibre material (mainly polyester) 27%

The weight of a single tile was 947 grammes.

Large pieces of the glue used to stick the tiles to the wall were present on the tiles. Mr Norton examined it and found it to be a neoprene-based glue which had become impregnated with the plasticiser from the PVC.

Mr Norton tried to ignite the tile using a match applied to the vertical polyester surface. The polyester melted away from the heat. The match adhered to the softened polyester and burned itself out in that position without igniting the carpet tiles. A cigarette lighter applied to the vertical surface of the tile for approximately two minutes did not ignite the tile.

(11) Floor covering material

Mr Norton found this to consist of a mixture of mainly nylon polyester fibres together with a small amount of polypropylene fibres in a matrix of styrene butadiene. The carpet was stuck directly to the floor and steps. The sample of material received was damaged in the fire indicating that it was flammable and had burned in the fire.

(12) Two shirts

See para. 6.63.

(13) Tests for ignitibility of seating units from the Lantern Room

See para. 6.42.

(14) Tests for ignitibility of seating units

(Cremer and Warner Ireland Limited).
See paras. 6.88 and 6.89.

(15) Tests for ignitibility of seating units

(Doctor J. H. Burgoyne and Partners)
See paras. 6.95 and 6.96.

FIGURES

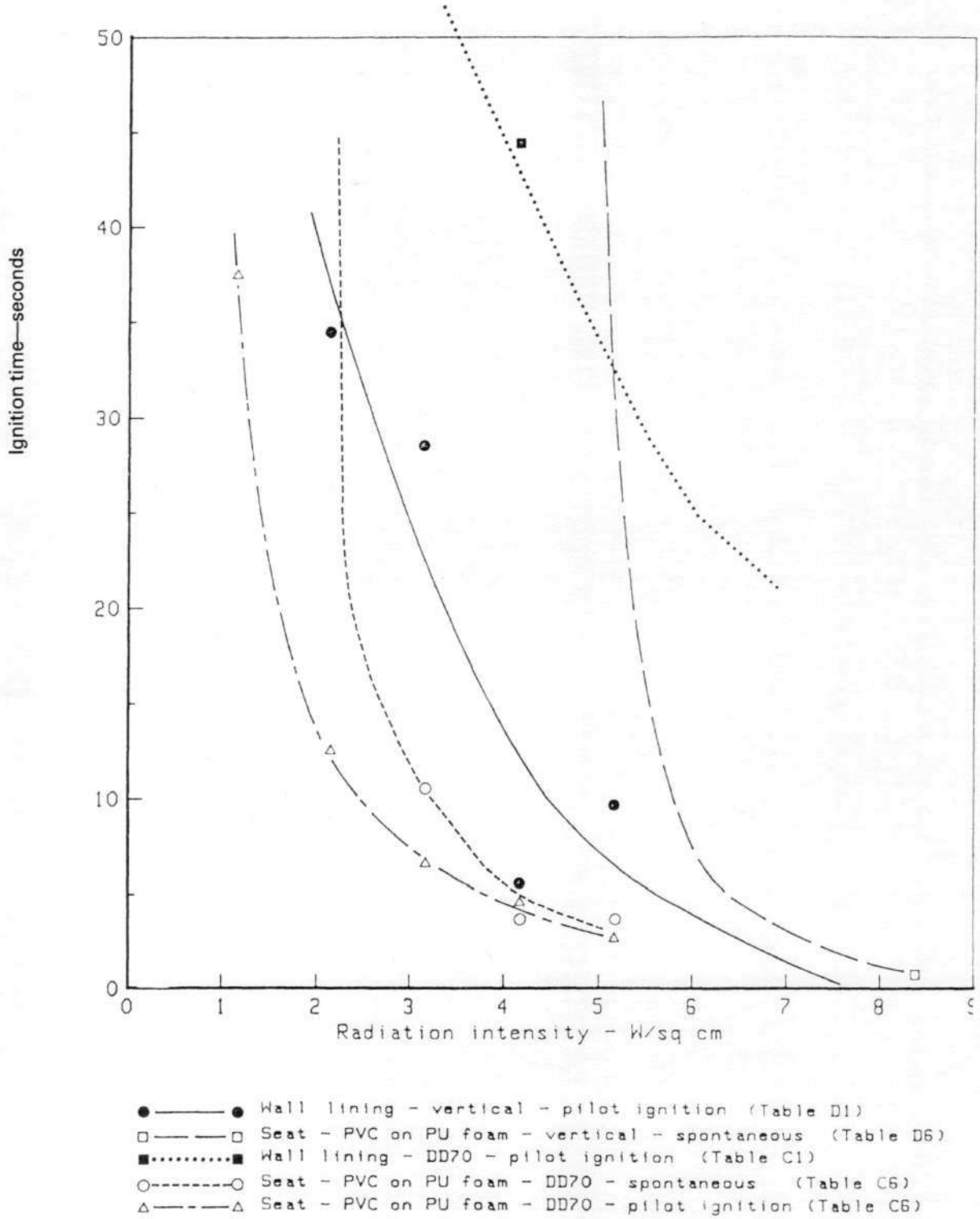


Figure 3 — *Radiation intensity required to ignite wall linings and seating units.*

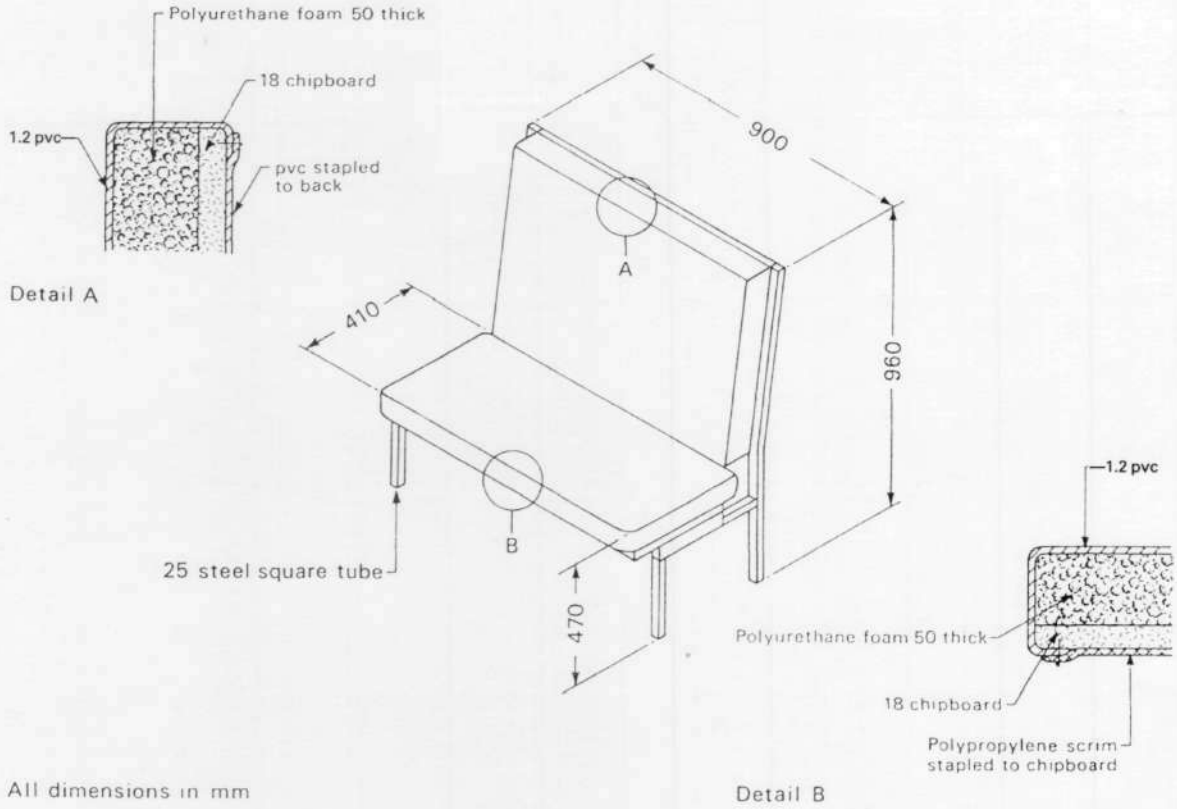
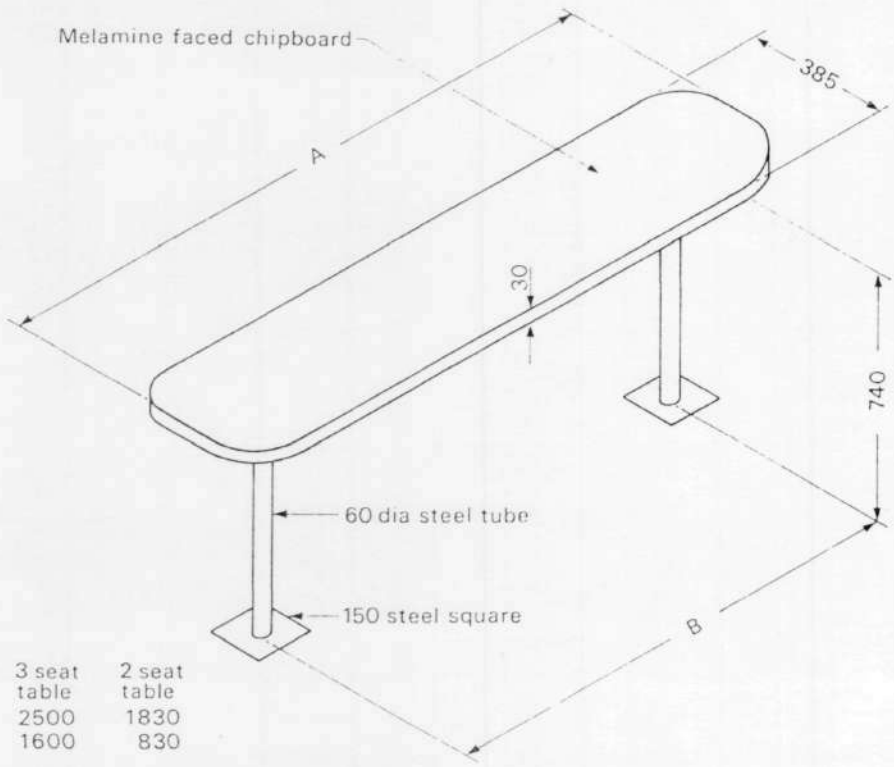


Figure A1 — *Stardust Disco seat unit.*



Dimension	3 seat table	2 seat table
A	2500	1830
B	1600	830

All dimensions in mm

Figure A2 — *Stardust Disco table unit.*

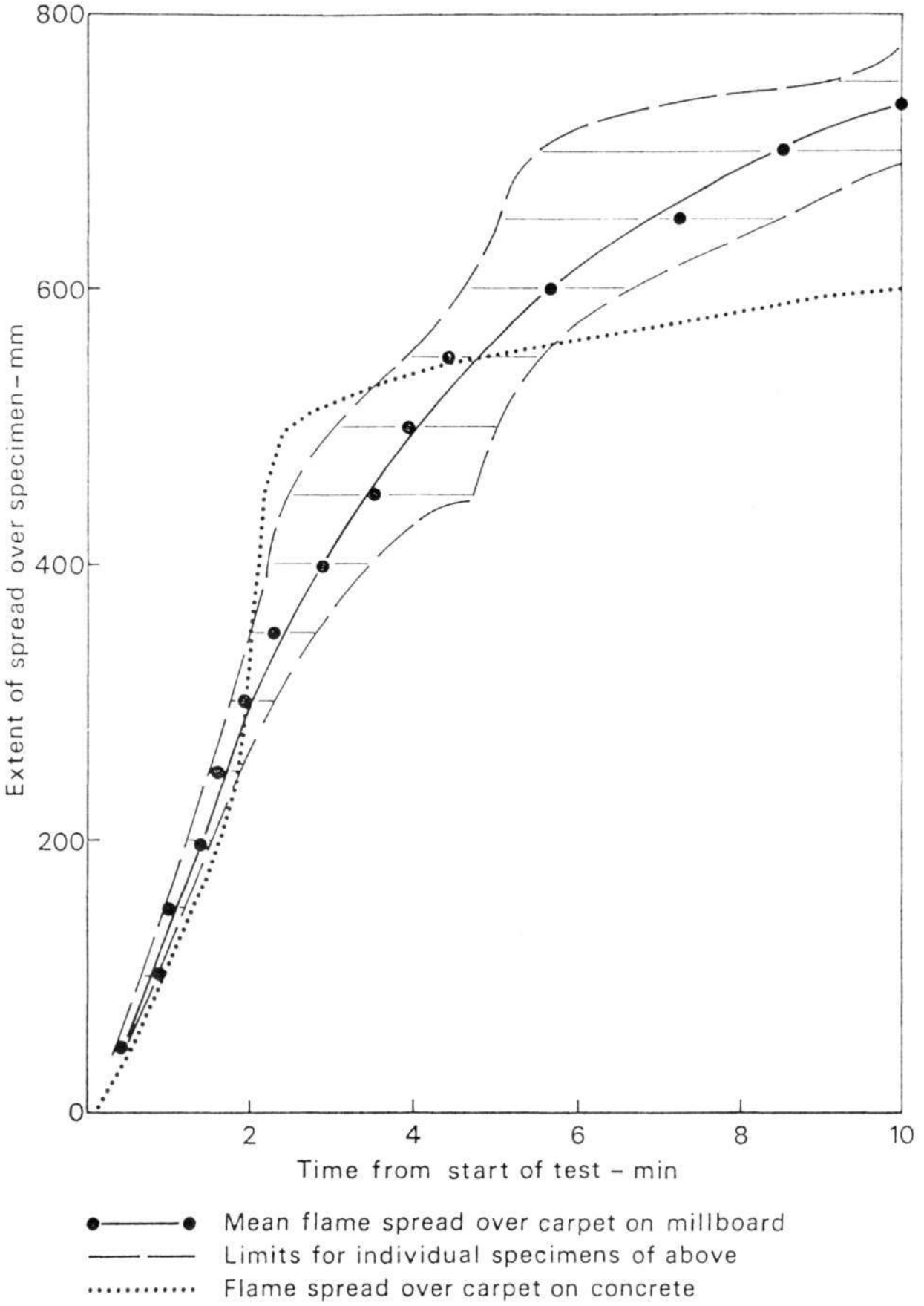


Figure D1 — *Carpet tiles — Analysis of flame spread data.*

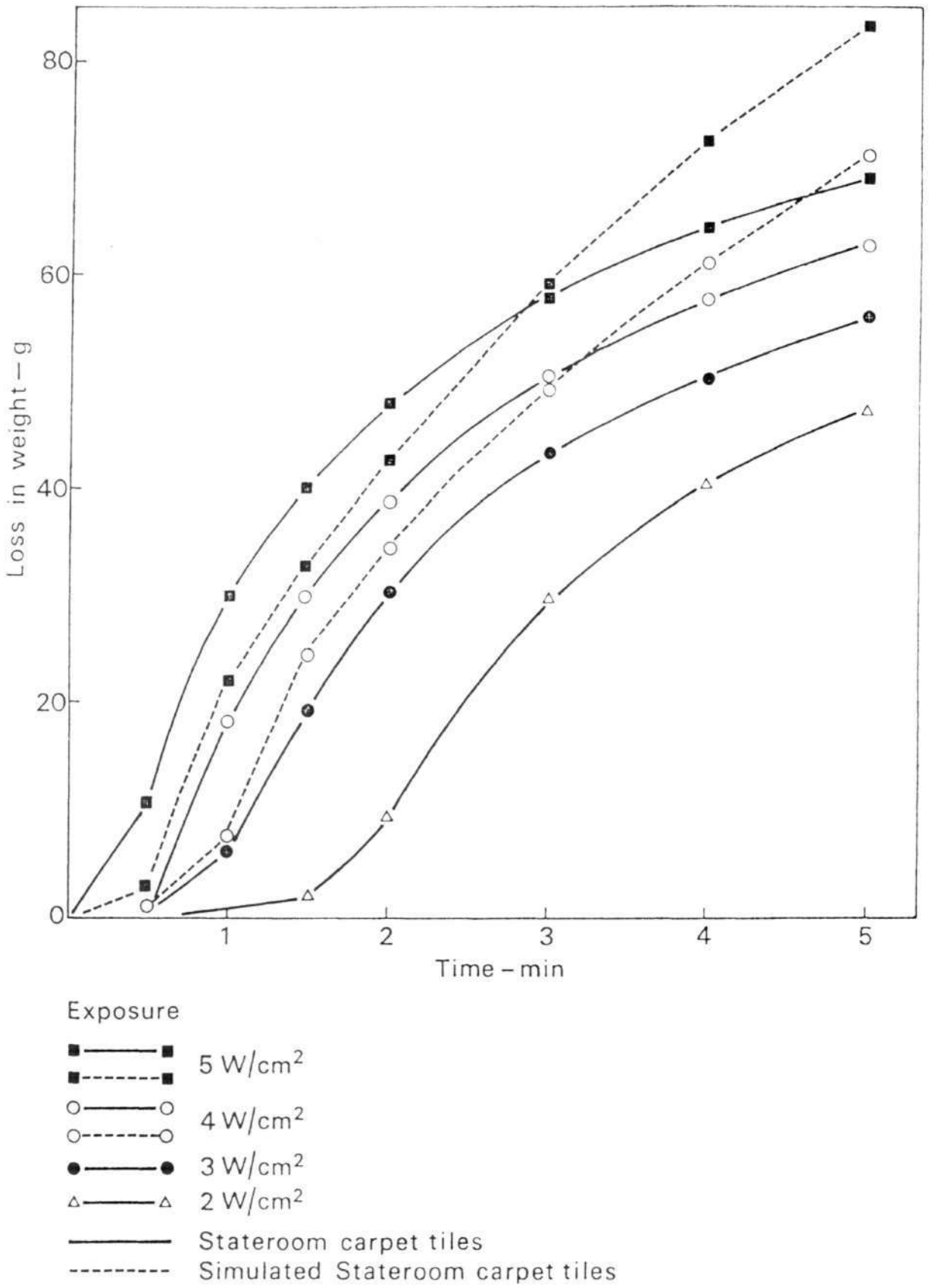


Figure D2 — *Rate of loss of weight of irradiated carpet tiles.*

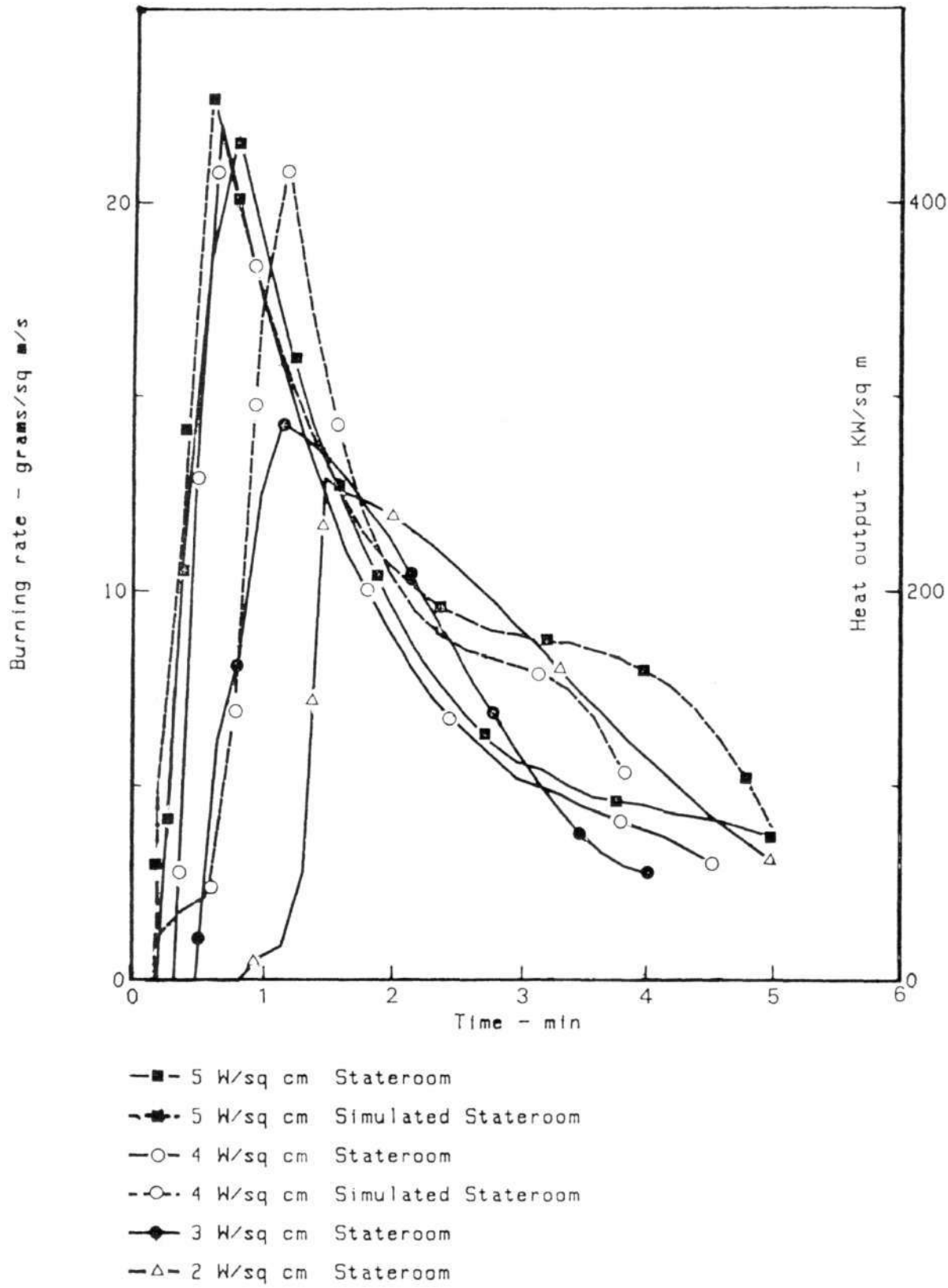


Figure D3 — *Burning rates of irradiated carpet tiles.*

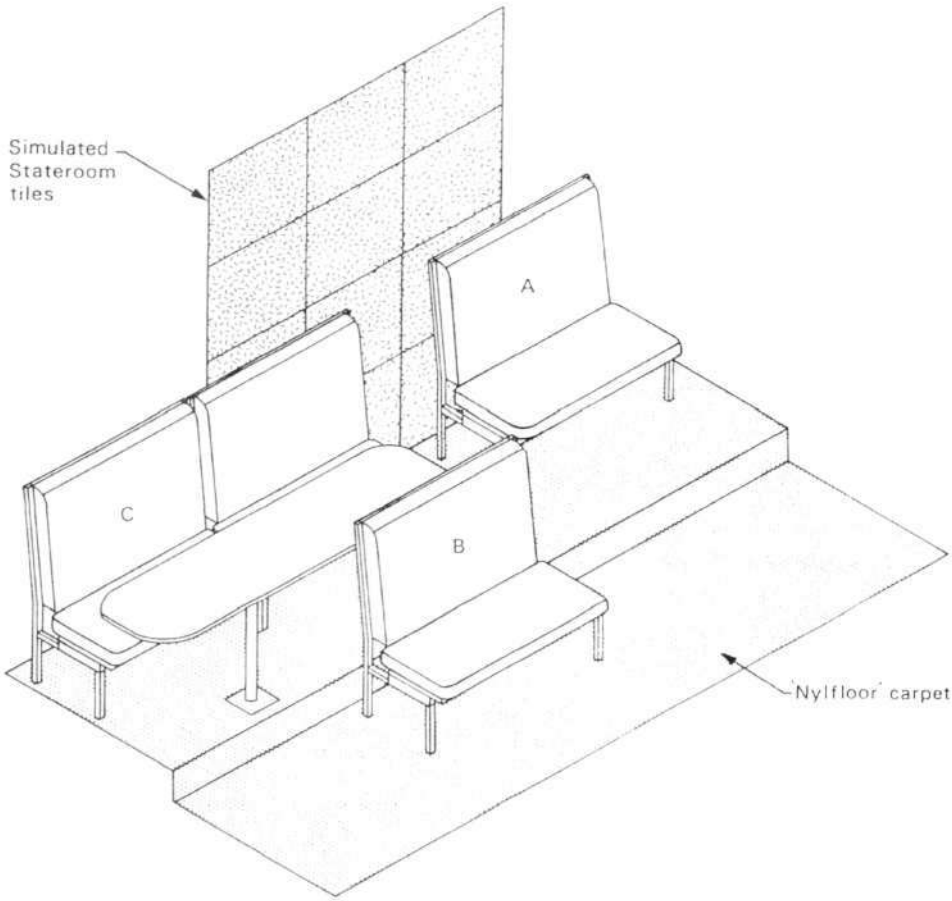


Figure E1 — *Alcohol ignition source.*

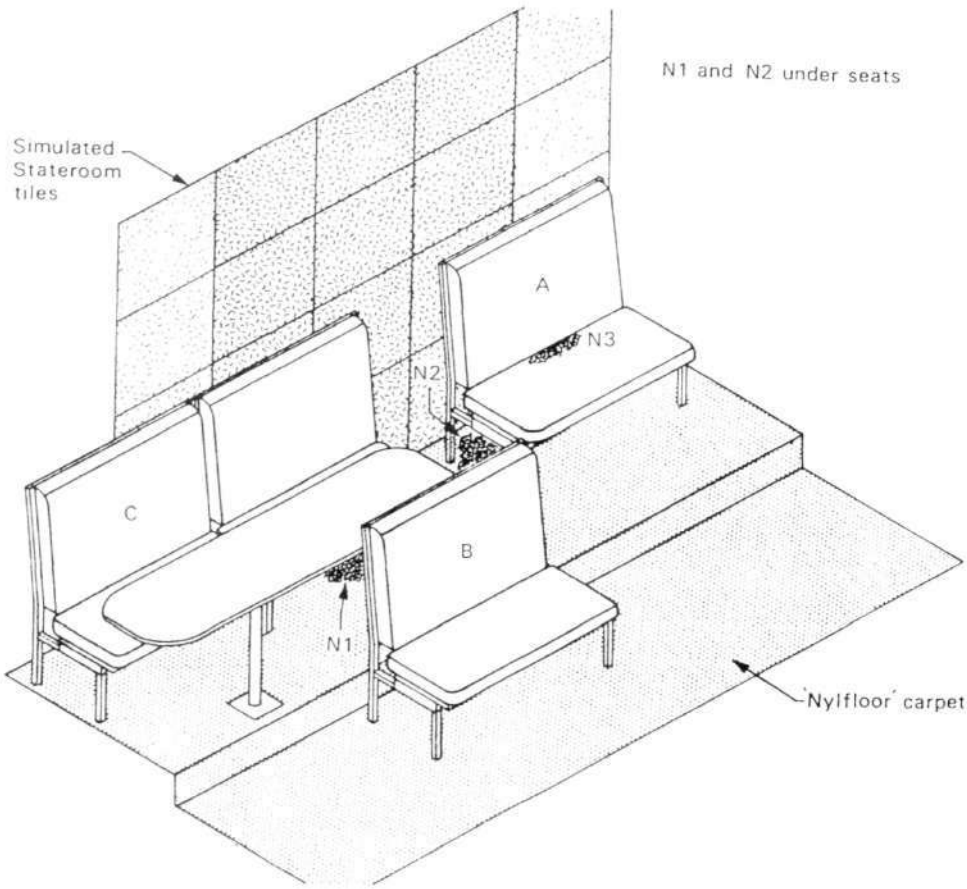


Figure E2 — *Arrangement of seats for newspaper ignition source tests.*

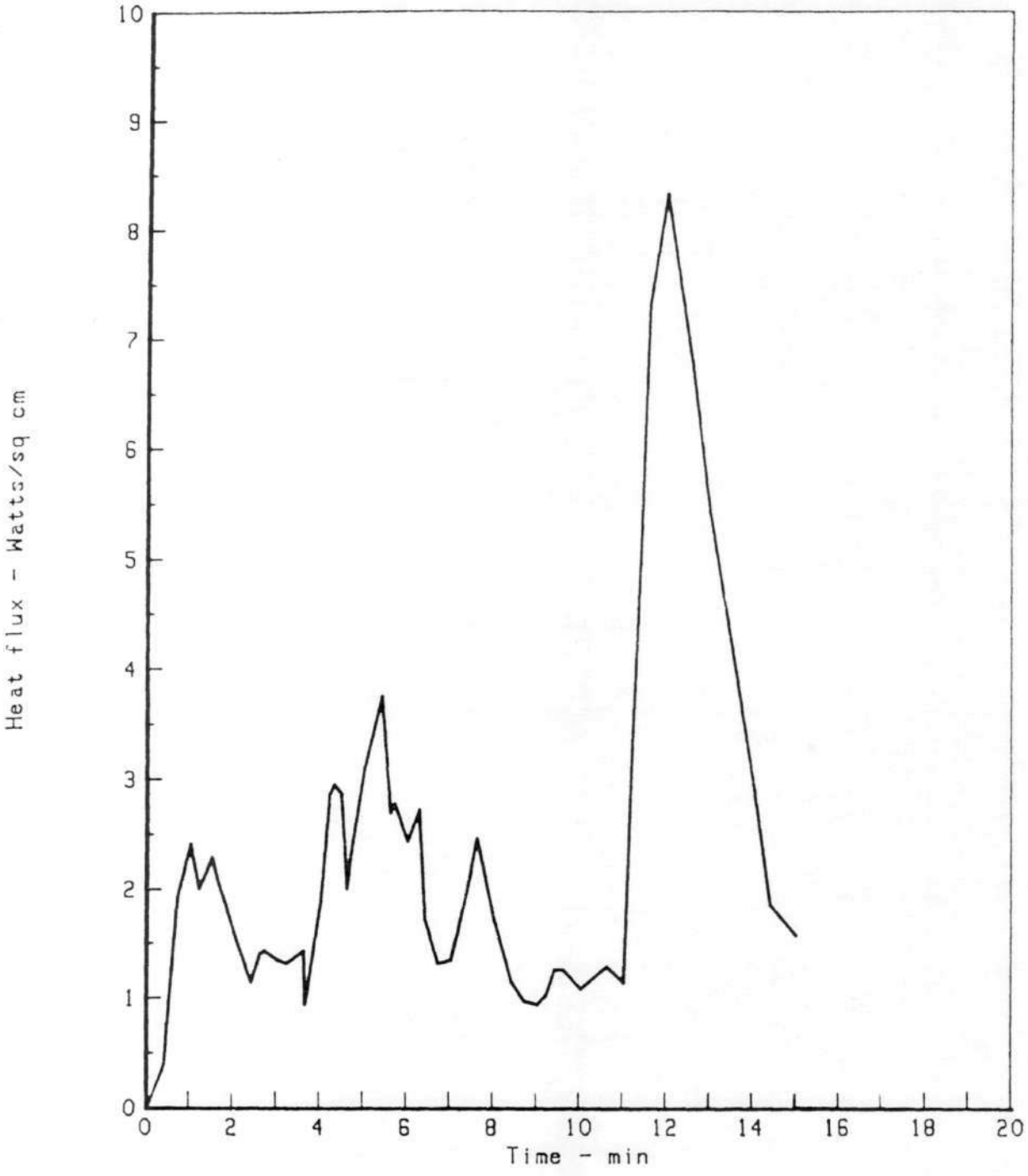


Figure E3 — *Heat flux at top of seat-back on wall, sawdust ignition source.*

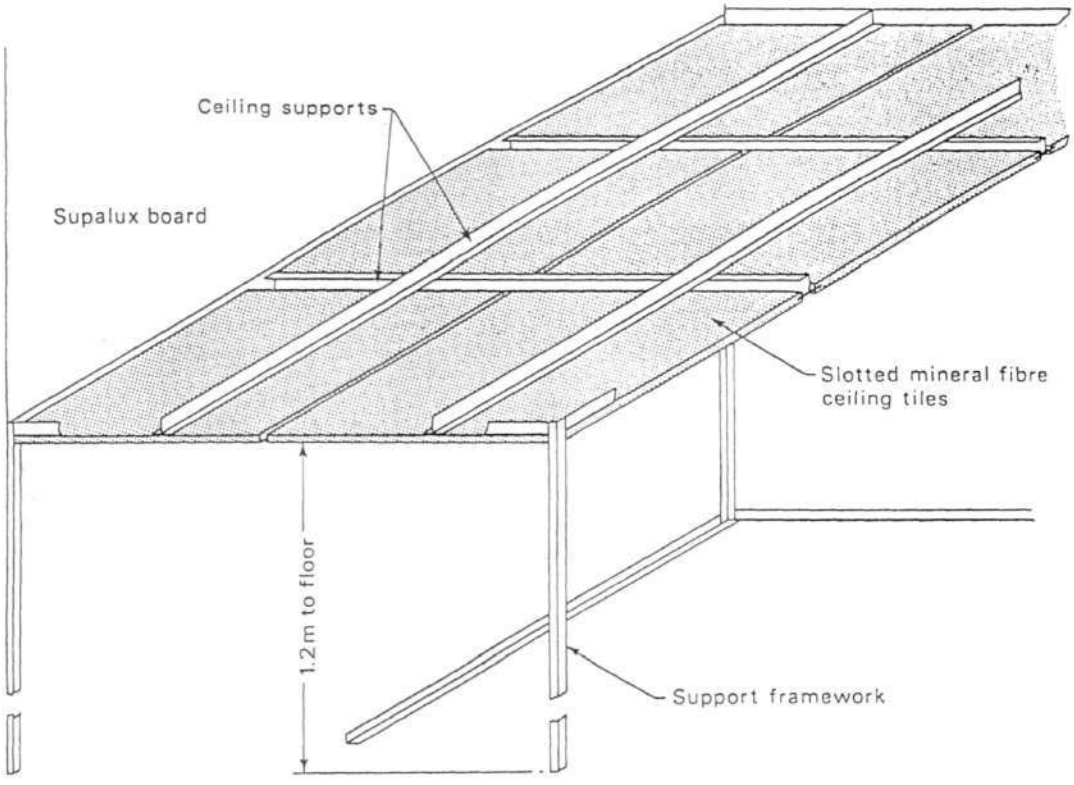


Figure E4 — *Test rig to investigate action of flammable liquids on suspended ceiling.*

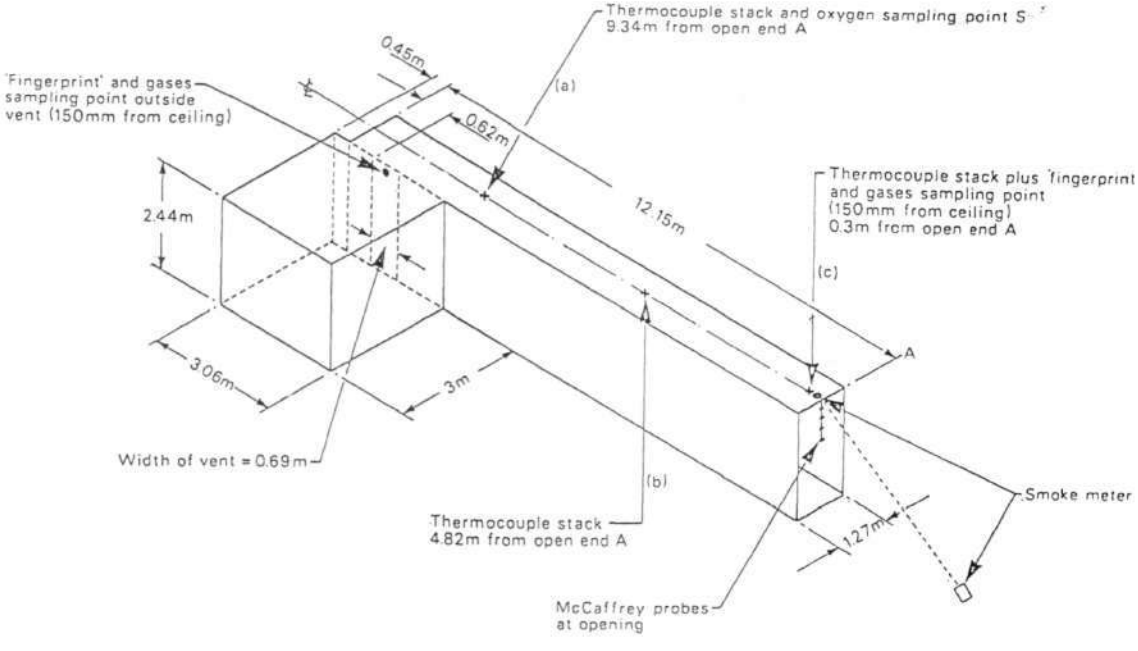
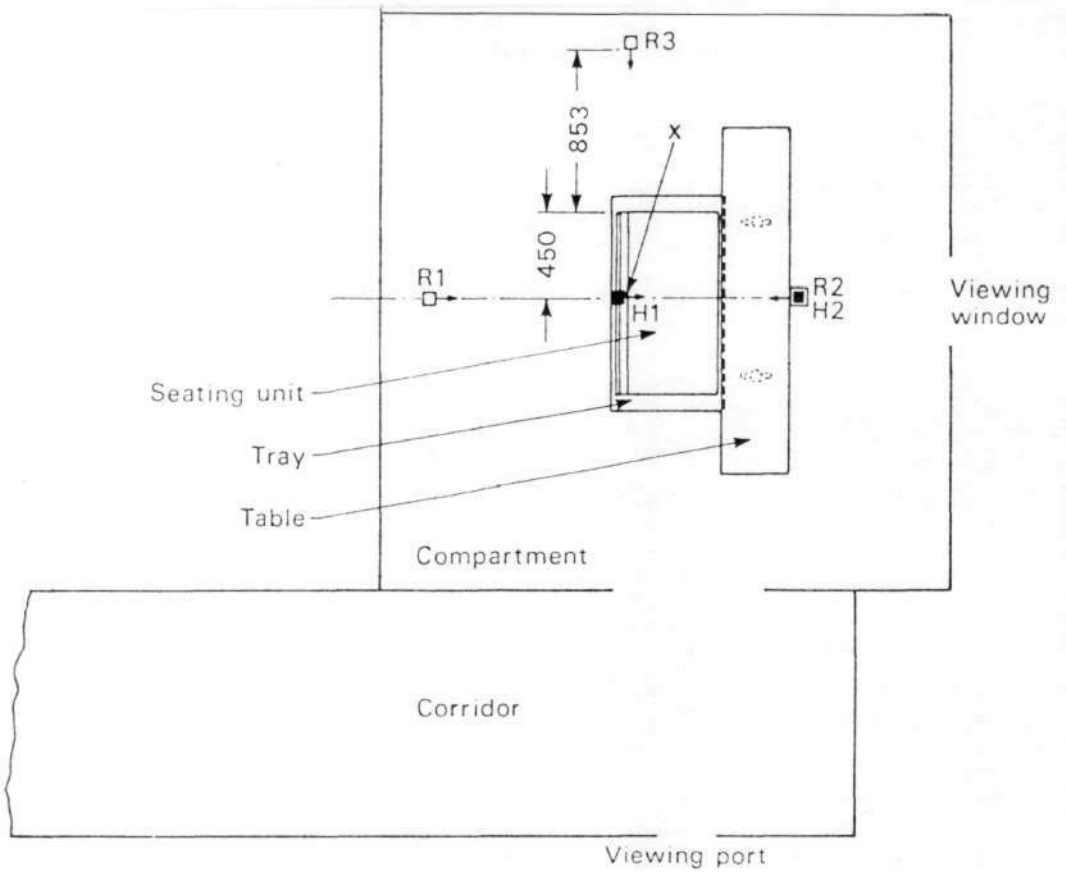
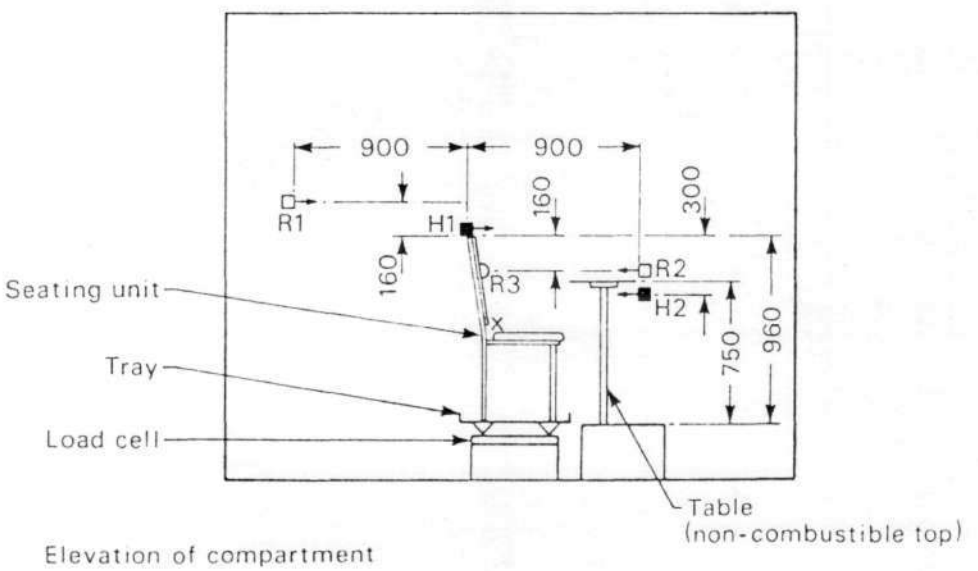


Figure F1 — *Compartment-corridor test facility.*



Plan



Elevation of compartment

Instrumentation (in addition to that shown on fig F1)
H1 – H2 Heat flux meters R1 – R3 Radiometers

x – Location of ignition source
For test F1 – Point source For test F2 – Line source

All dimensions in mm

Figure F2 — *Arrangement of compartment for Tests F1 and F2. Rate of burning of seat unit.*

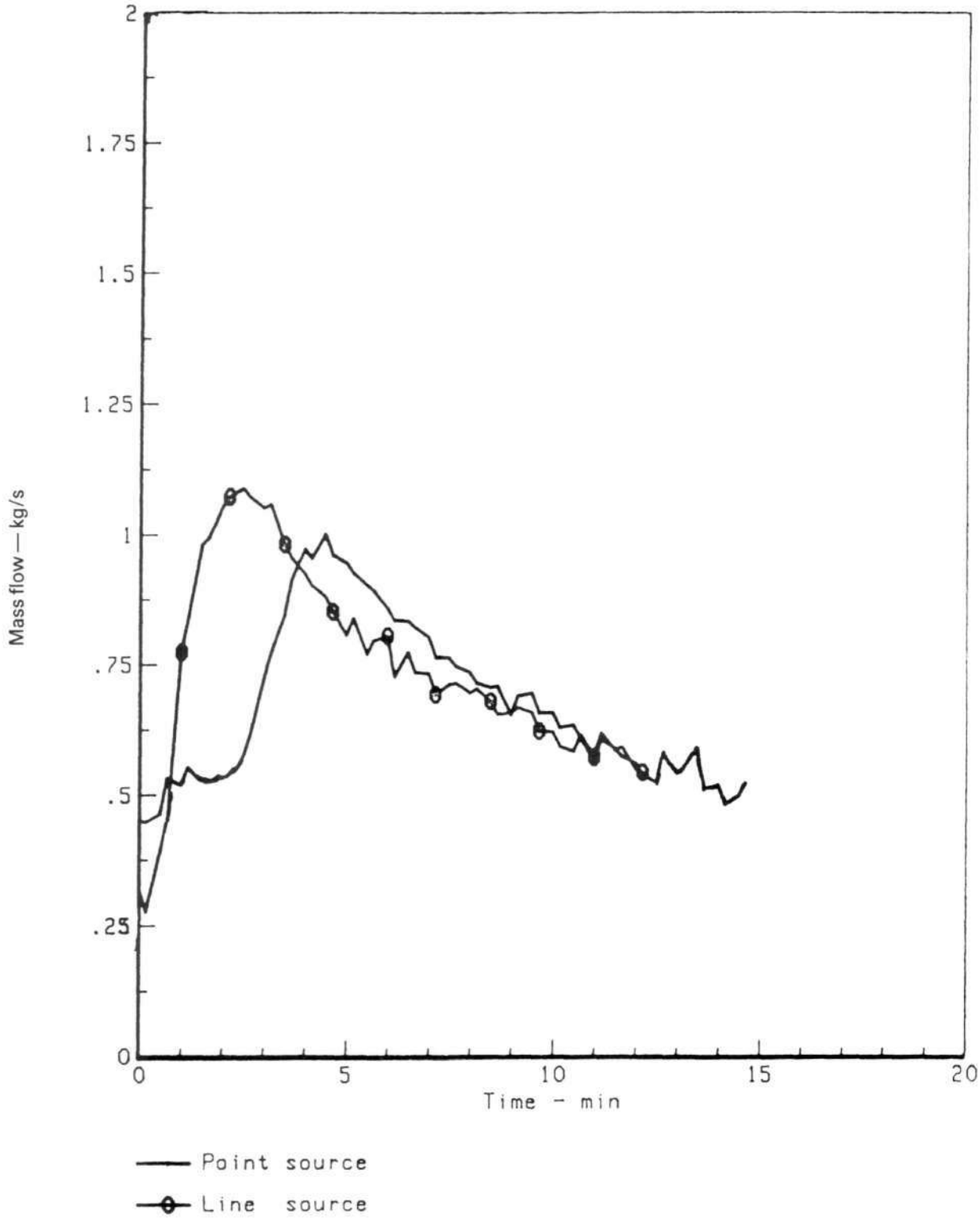


Figure F3 — *Mass flow recorded by thermocouple stack(a) (figure F1).*

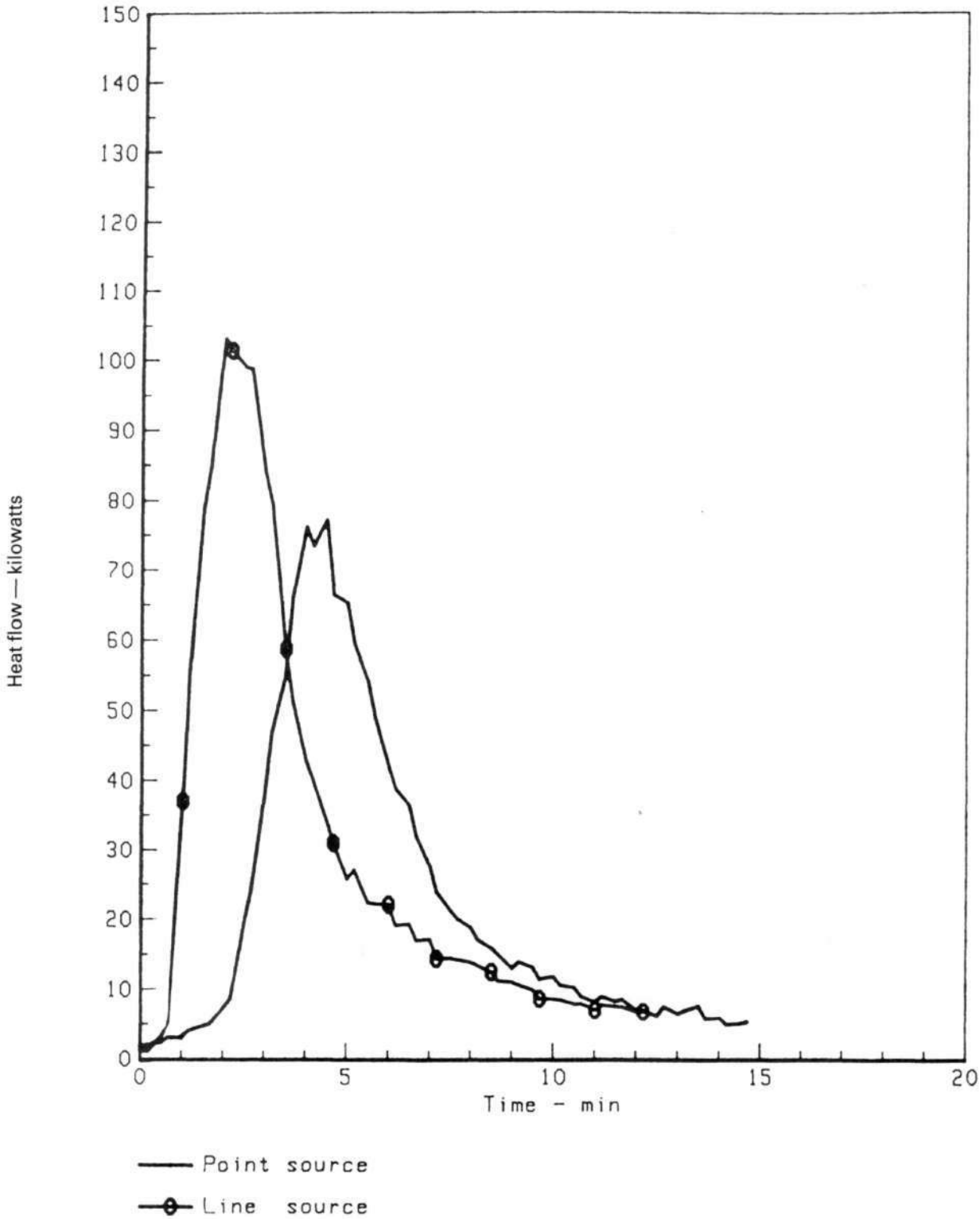


Figure F4 — *Heat flow recorded by thermocouple stack(a) (figure F1).*

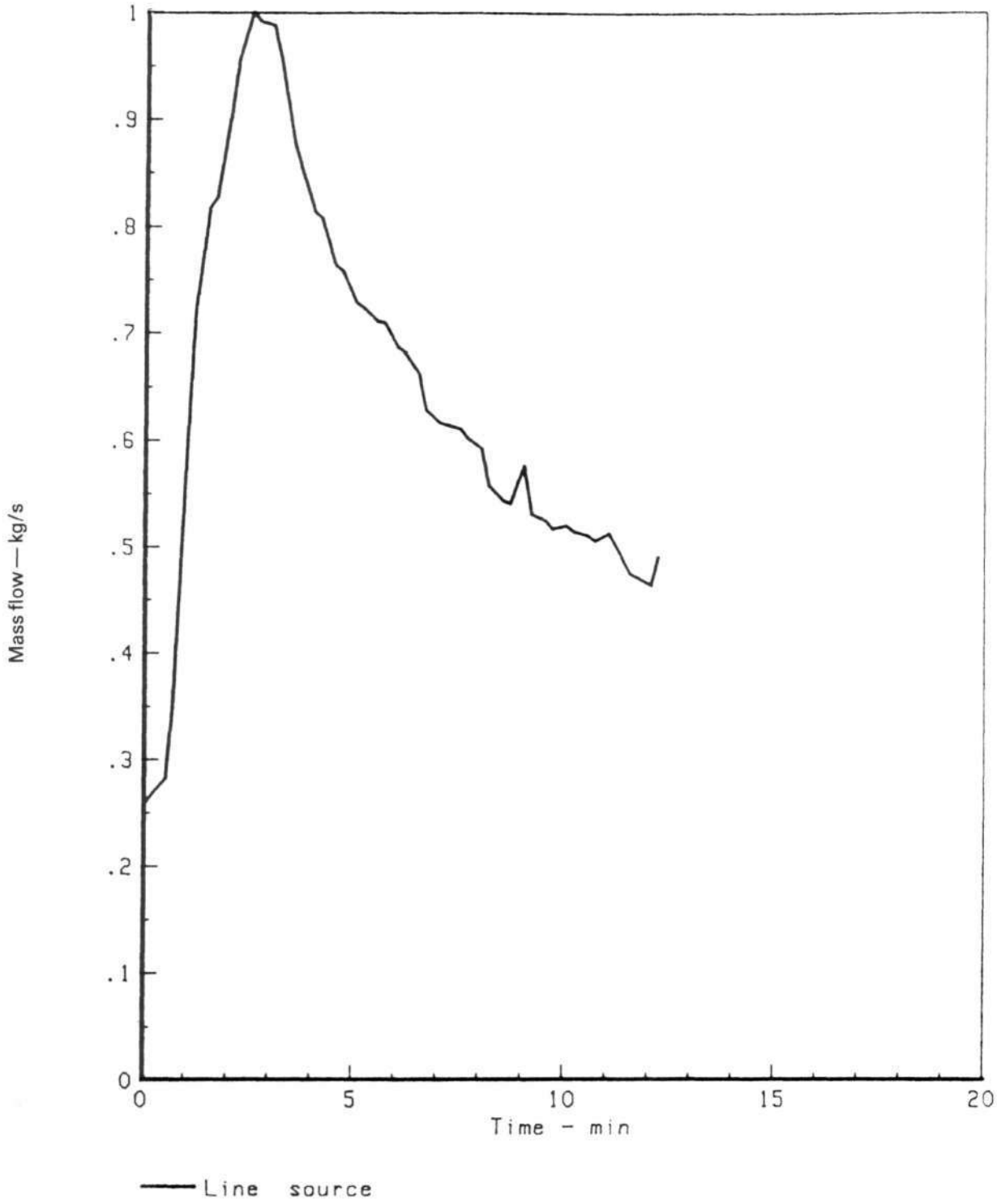


Figure F5 — *Mass flow recorded by thermocouple stack (b) (figure F1).*

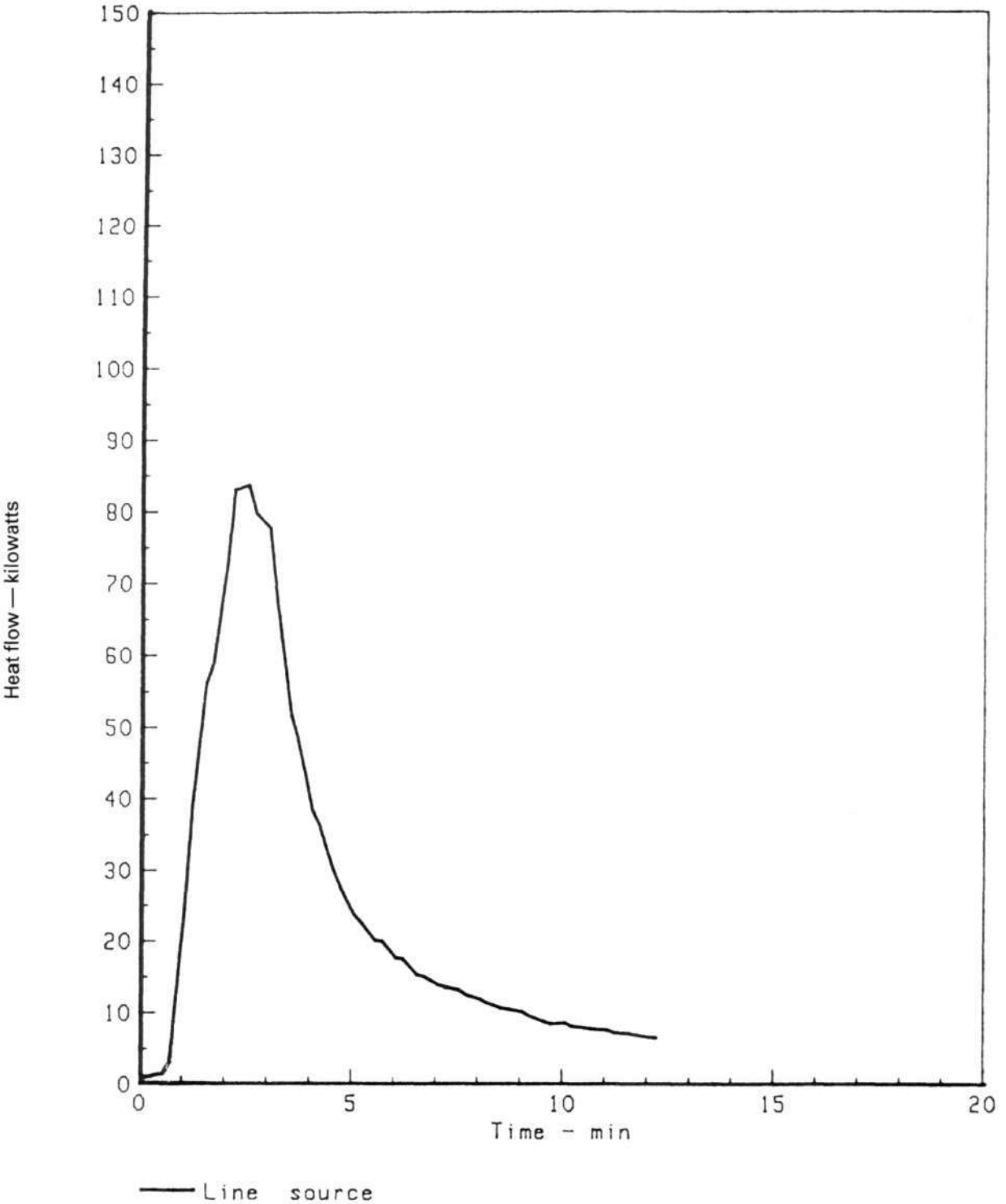


Figure F6 — *Heat flow recorded by thermocouple stack(b) (figure F1).*

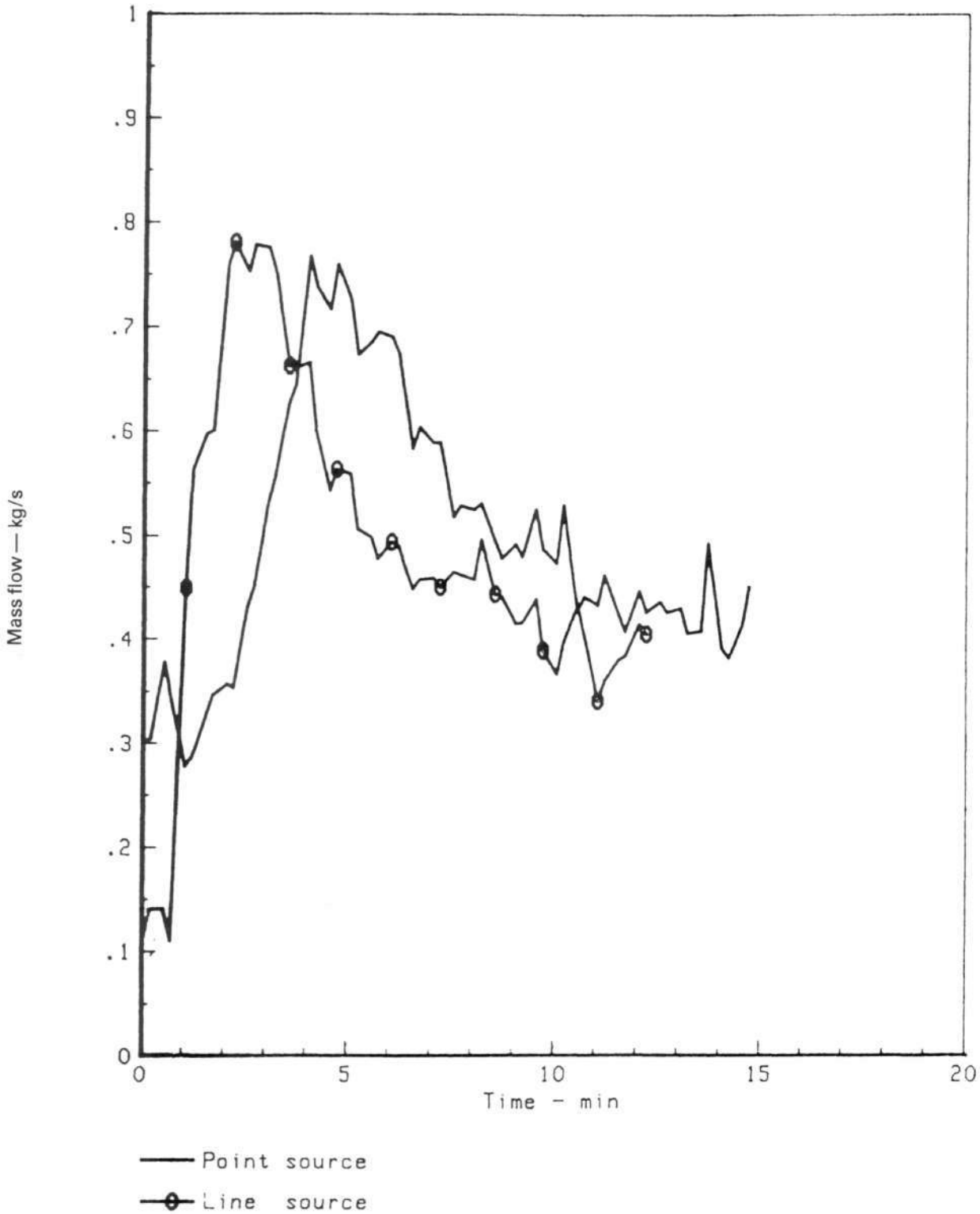


Figure F7 — *Mass flow recorded by thermocouple stack(c) (figure F1).*

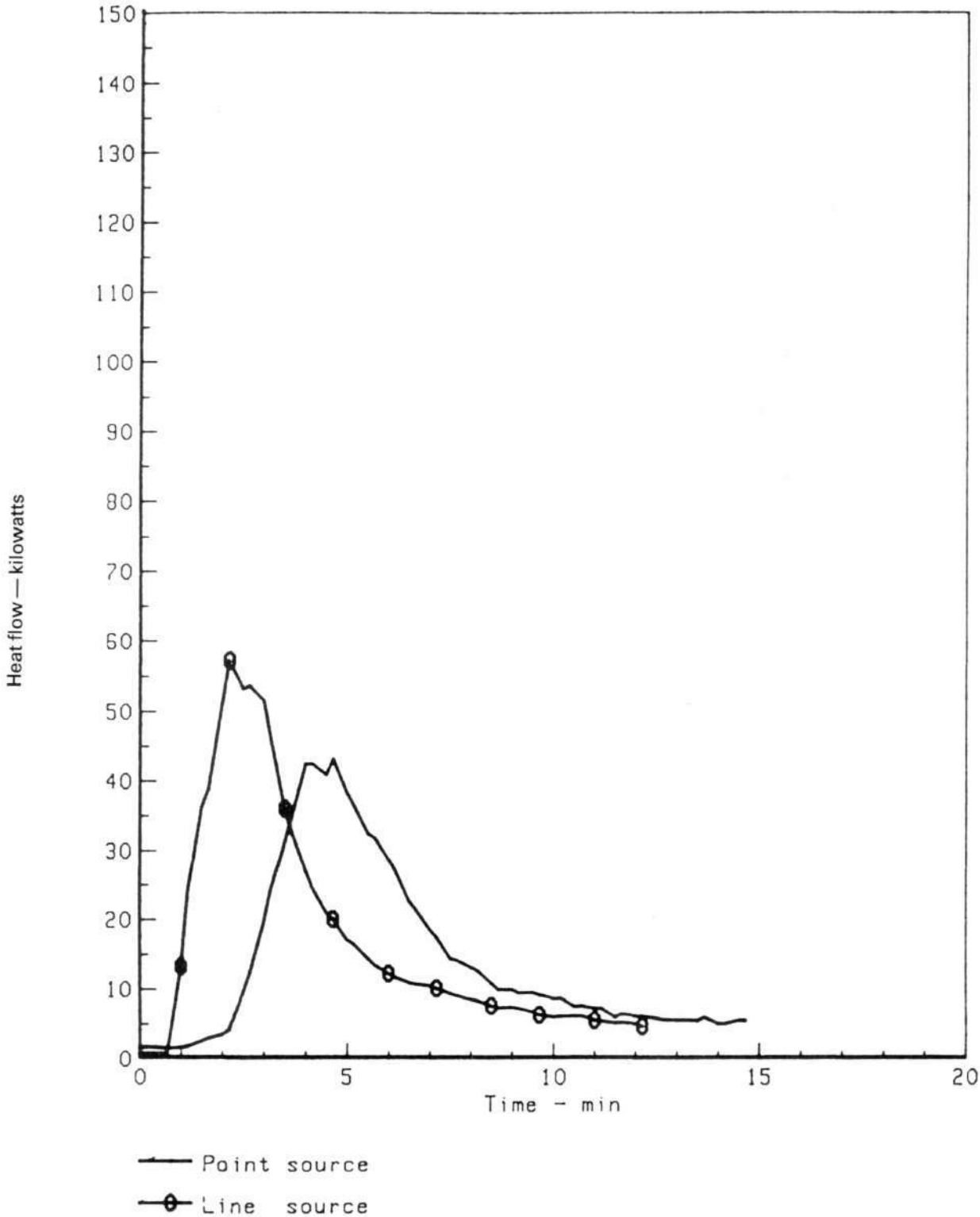


Figure F8 — *Heat flow recorded by thermocouple stack(c) (figure F1).*

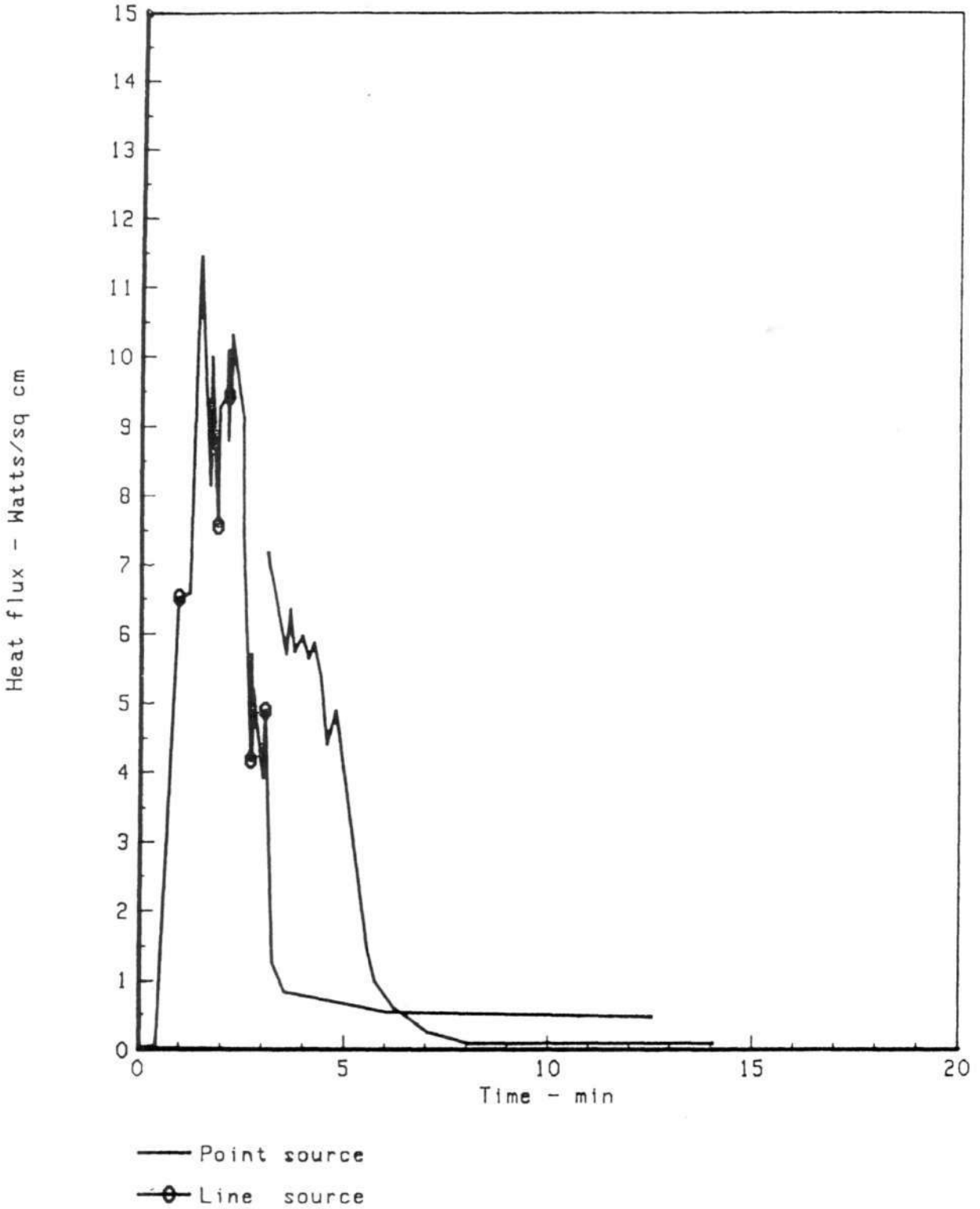


Figure F9 — *Heat flux recorded at top of seat-back (H1 on figure F2).*

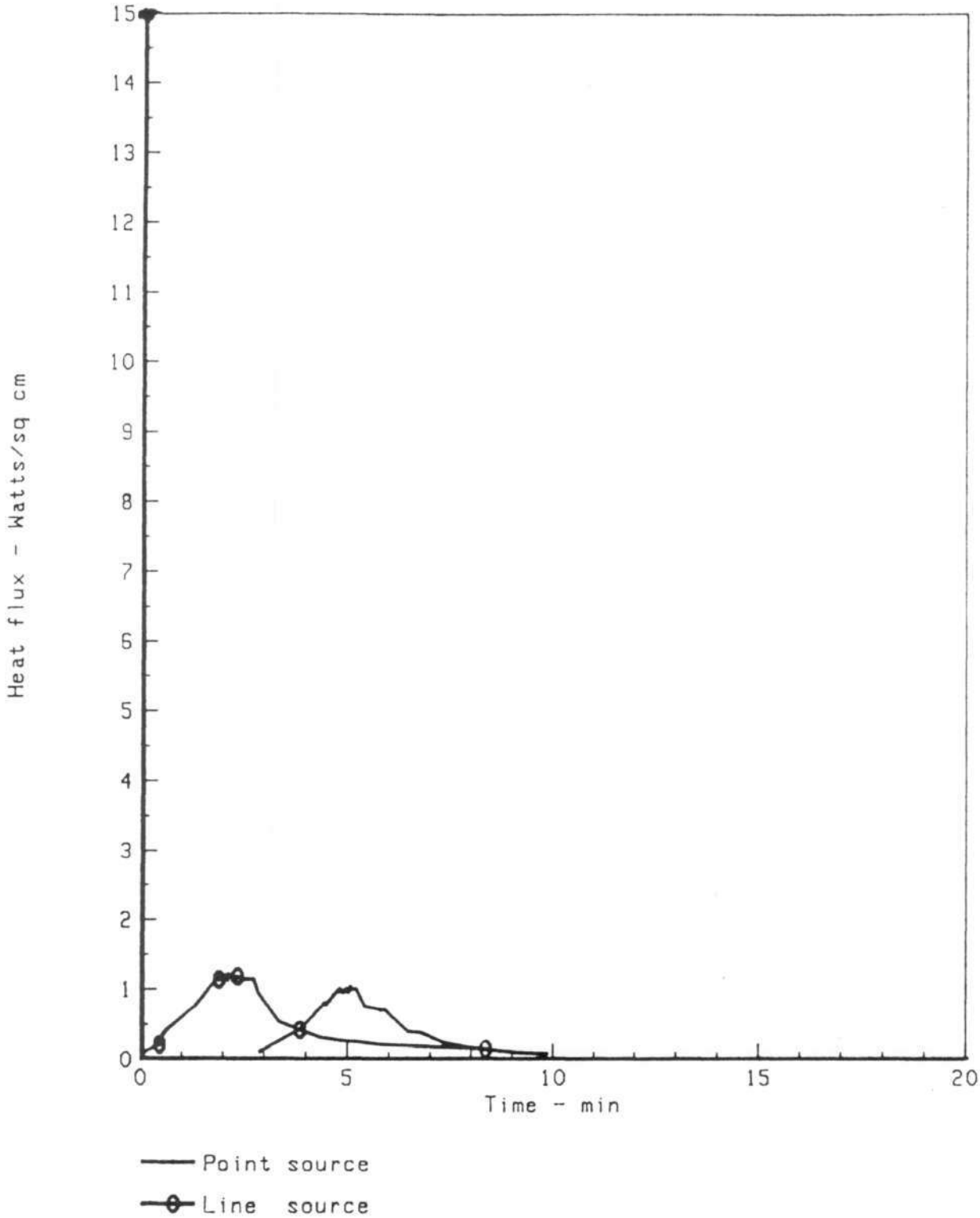


Figure F10 — *Heat flux recorded at point equivalent to back of seating unit on next tier below (H2 on figure F2).*

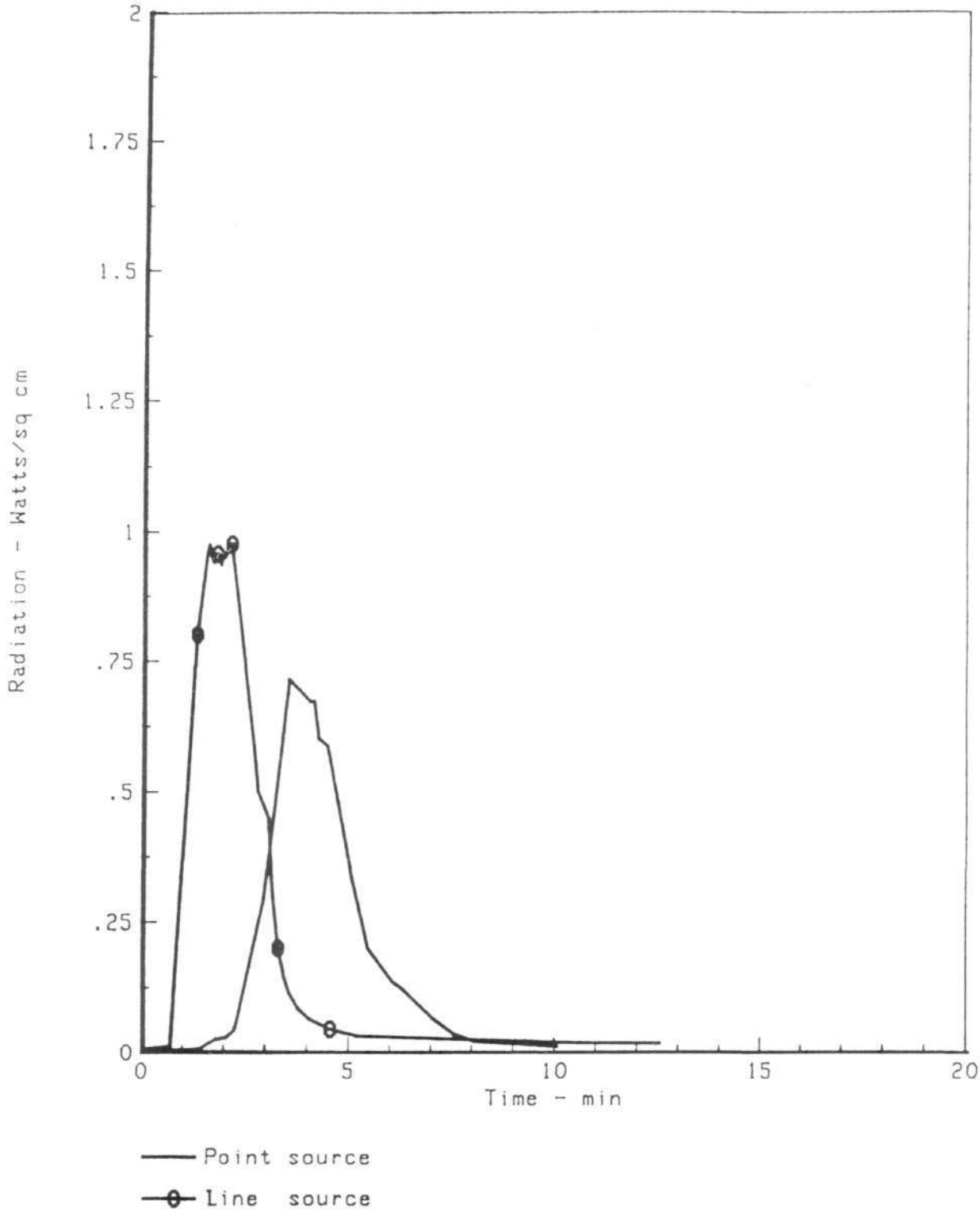


Figure F11 — *Radiation recorded 0.9m behind seat-back and level with top of seat (R1 on figure F2).*

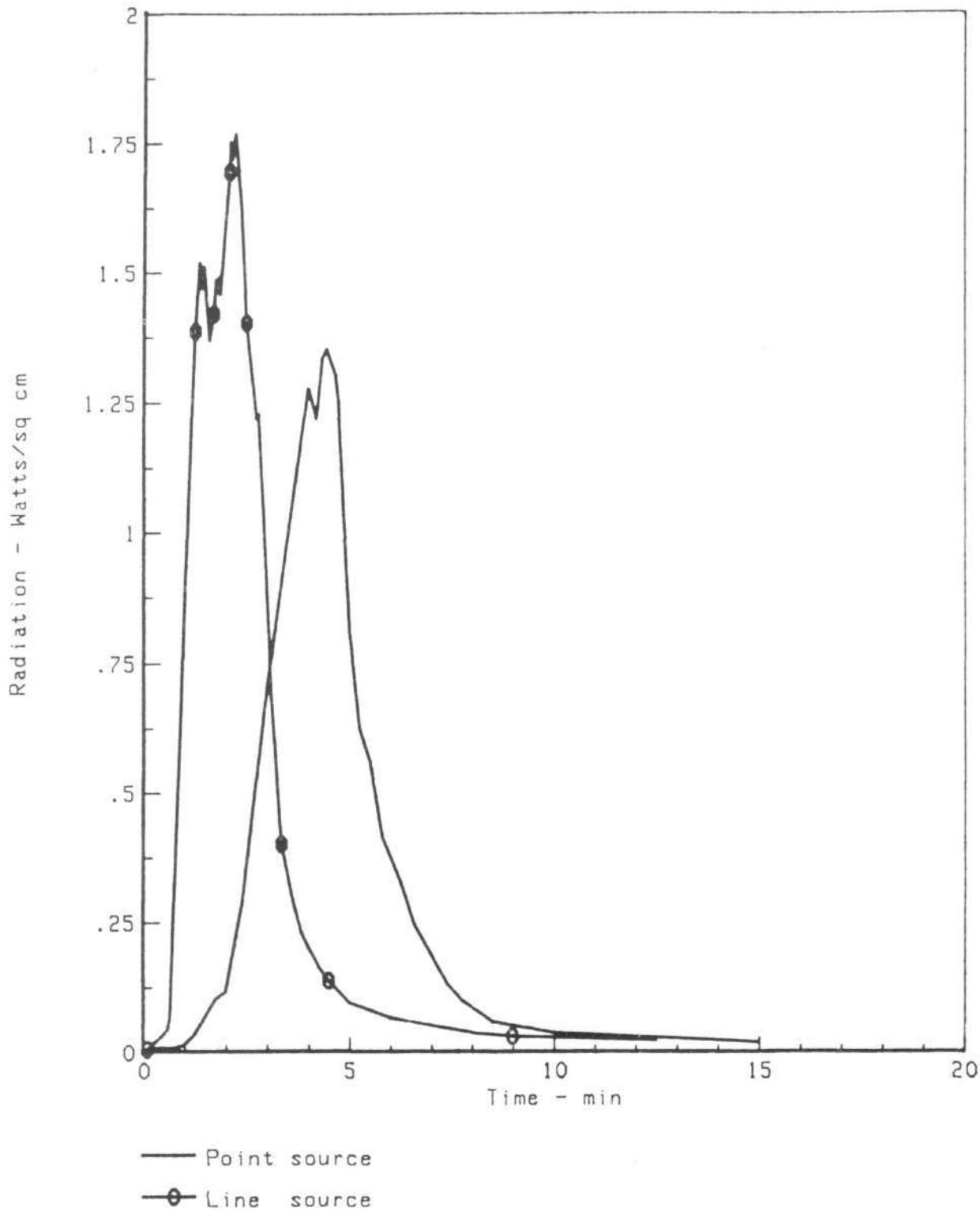


Figure F12 — *Radiation recorded at point equivalent to top of seating unit on tier below (R2 on figure F2).*

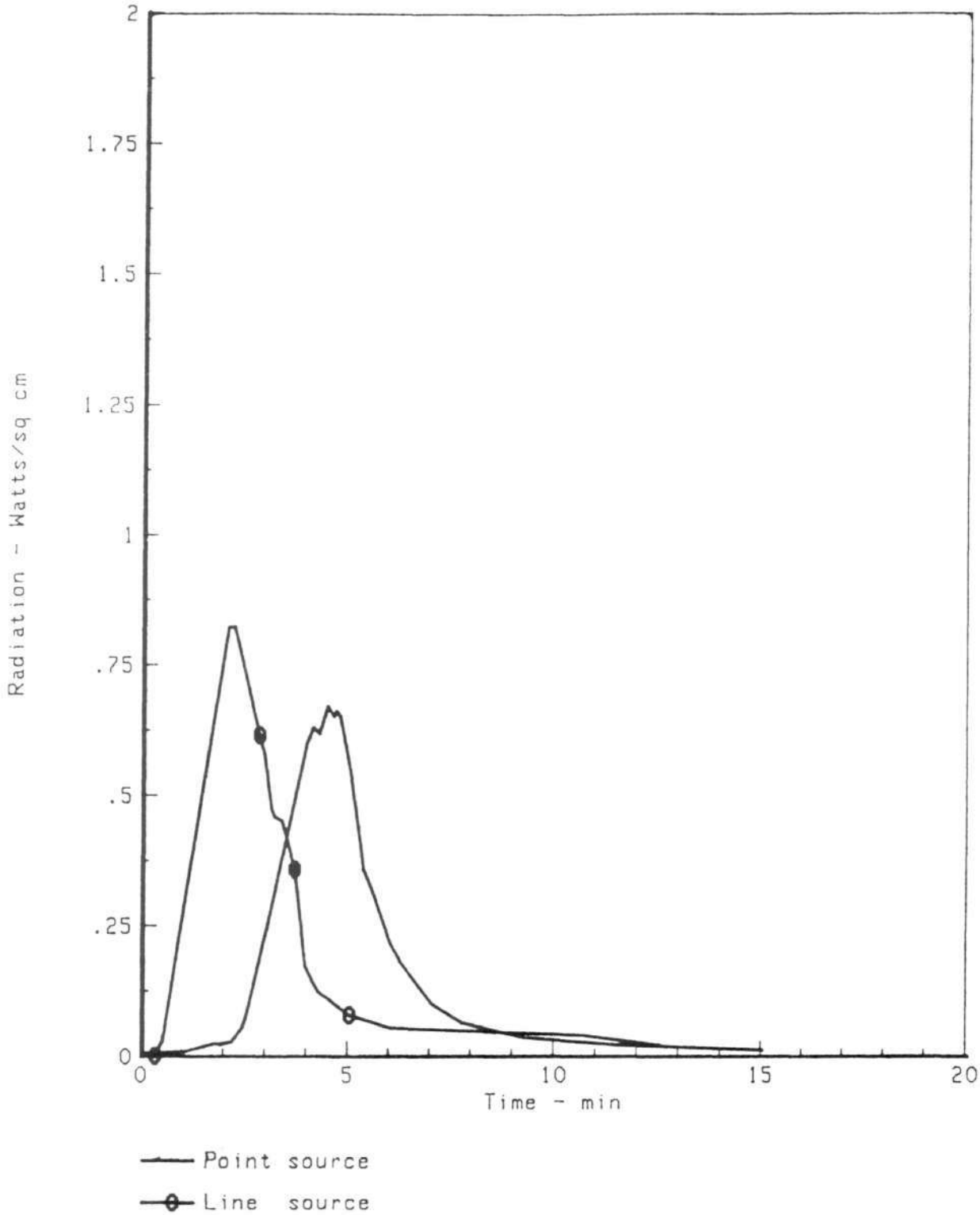


Figure F13 — *Radiation recorded at point equivalent to seating unit across aisle on same tier (R3 on figure F2).*

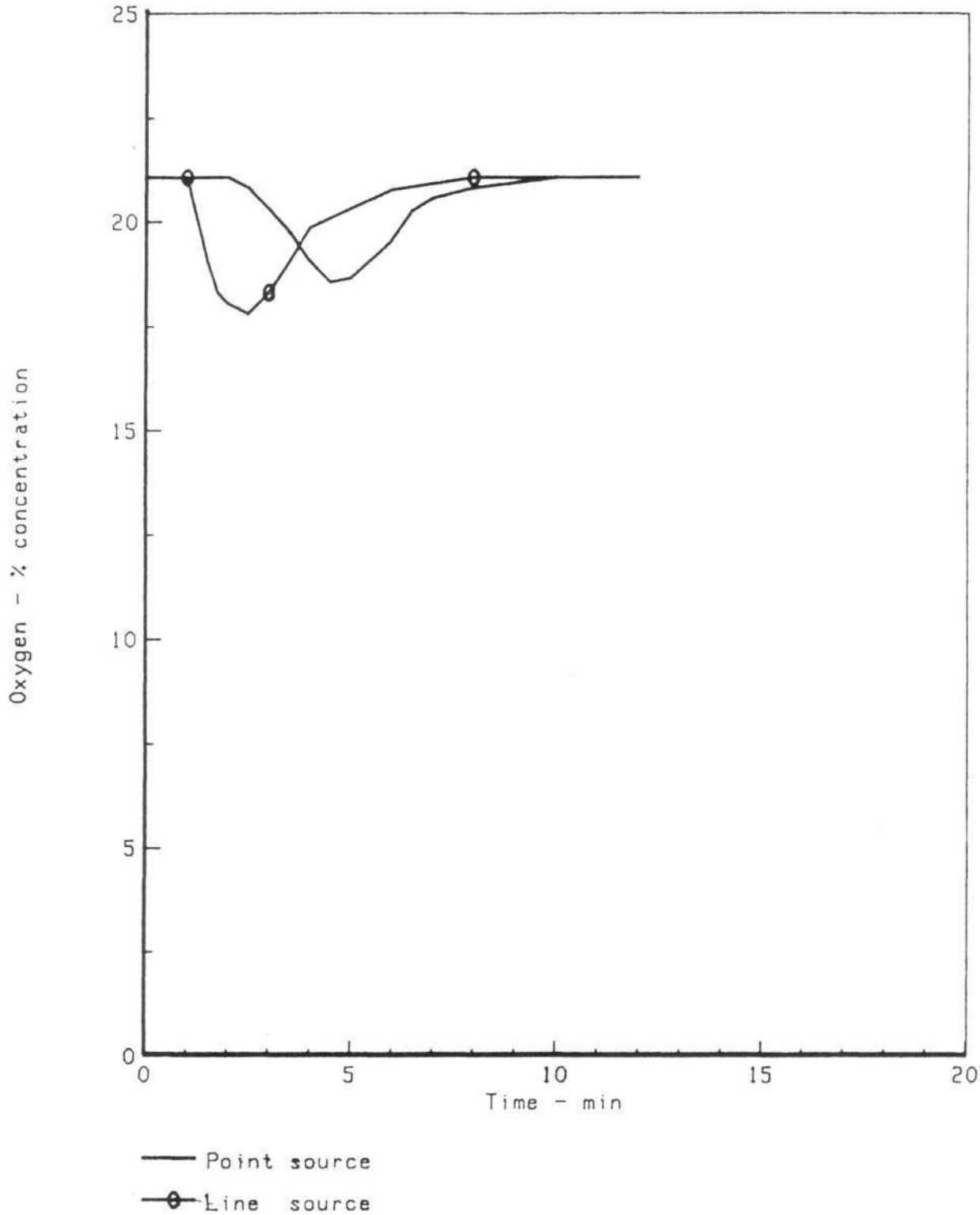


Figure F14 — *Oxygen concentration 100mm below soffit at sampling point S (figure F1).*

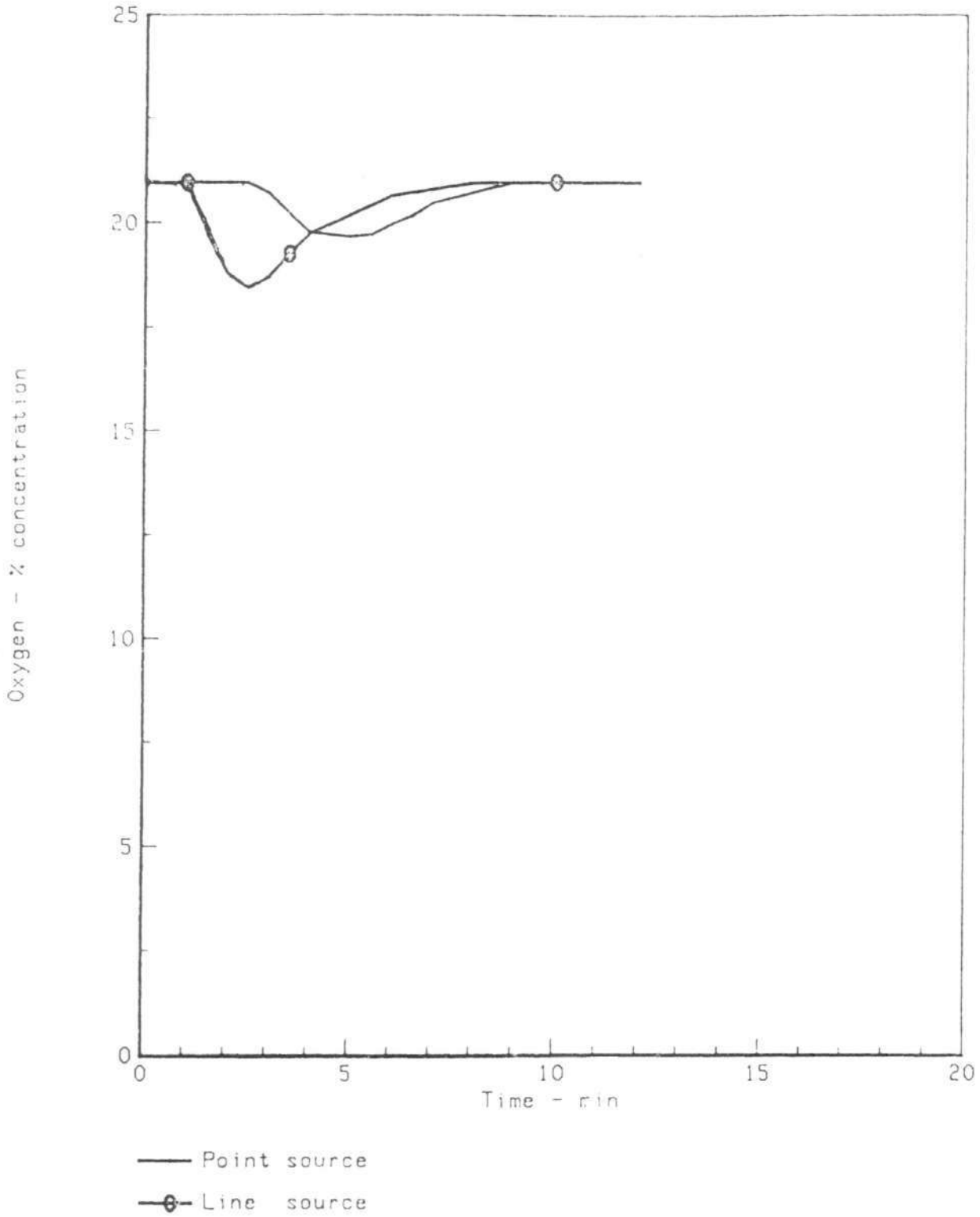


Figure F15 — *Oxygen concentration 400mm below soffit at sampling point S (figure F1).*

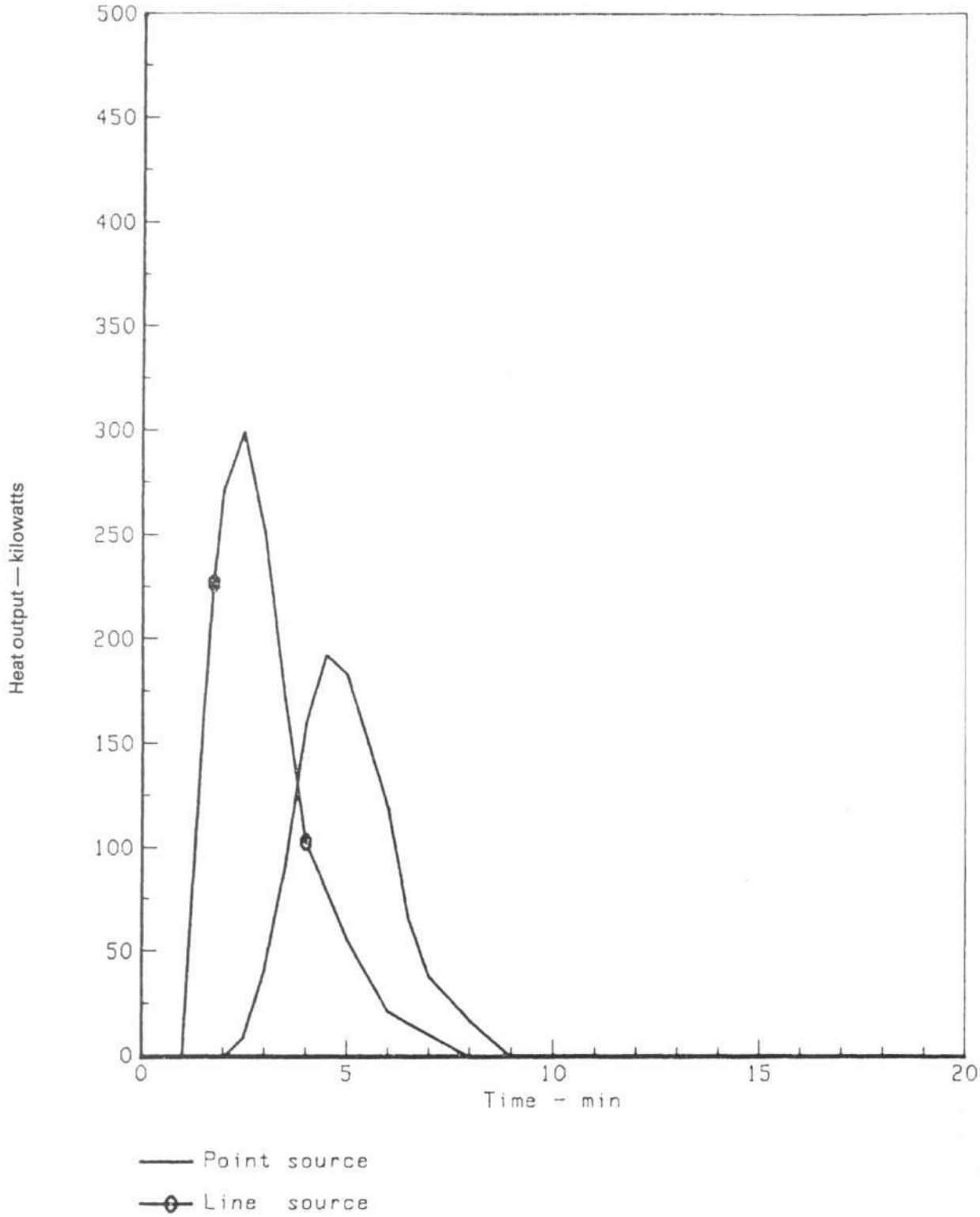
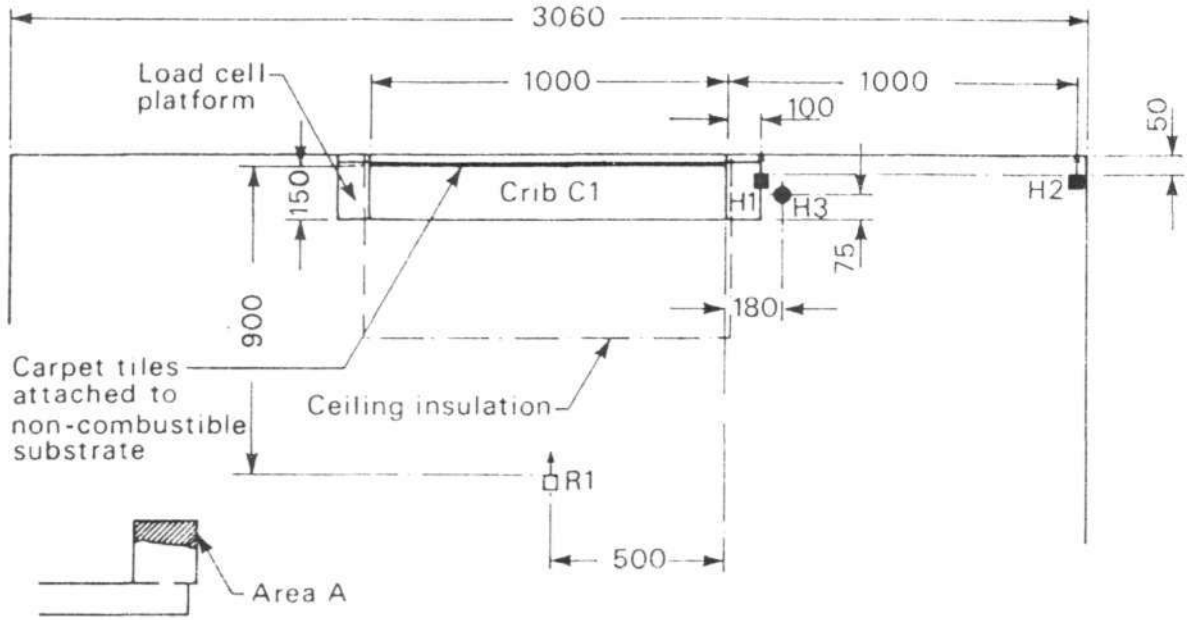
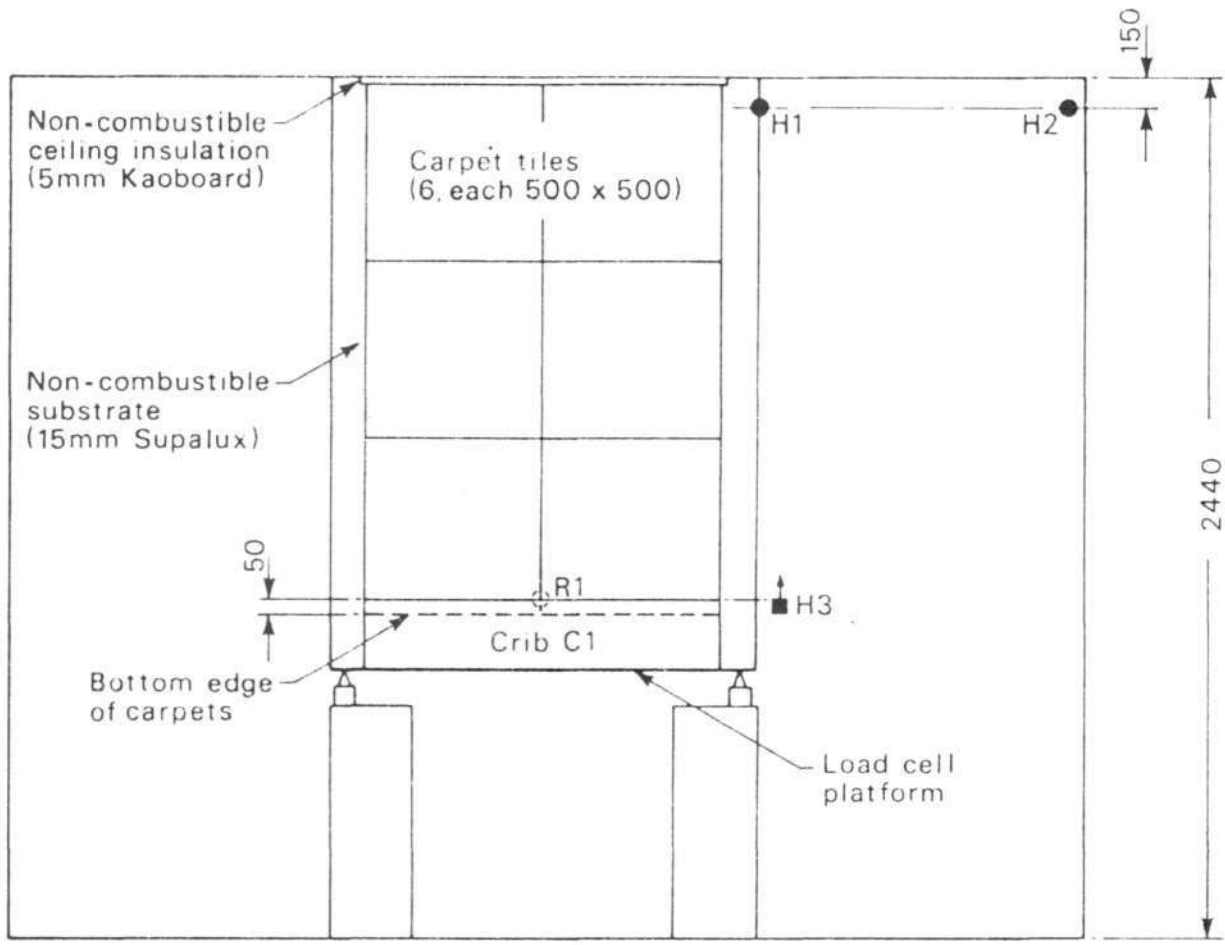


Figure F16 — *Calculated heat output based on oxygen concentration at sampling point S (figure F1).*



Plan of compartment (area A)



Elevation

All dimensions in mm

Instrumentation (in addition to that shown on fig A4)
H1 – H3 – Heat flux meters
R1 – Radiometer

Figure F17 — *Arrangement of compartment for test F3. Rate of burning of wall lining.*

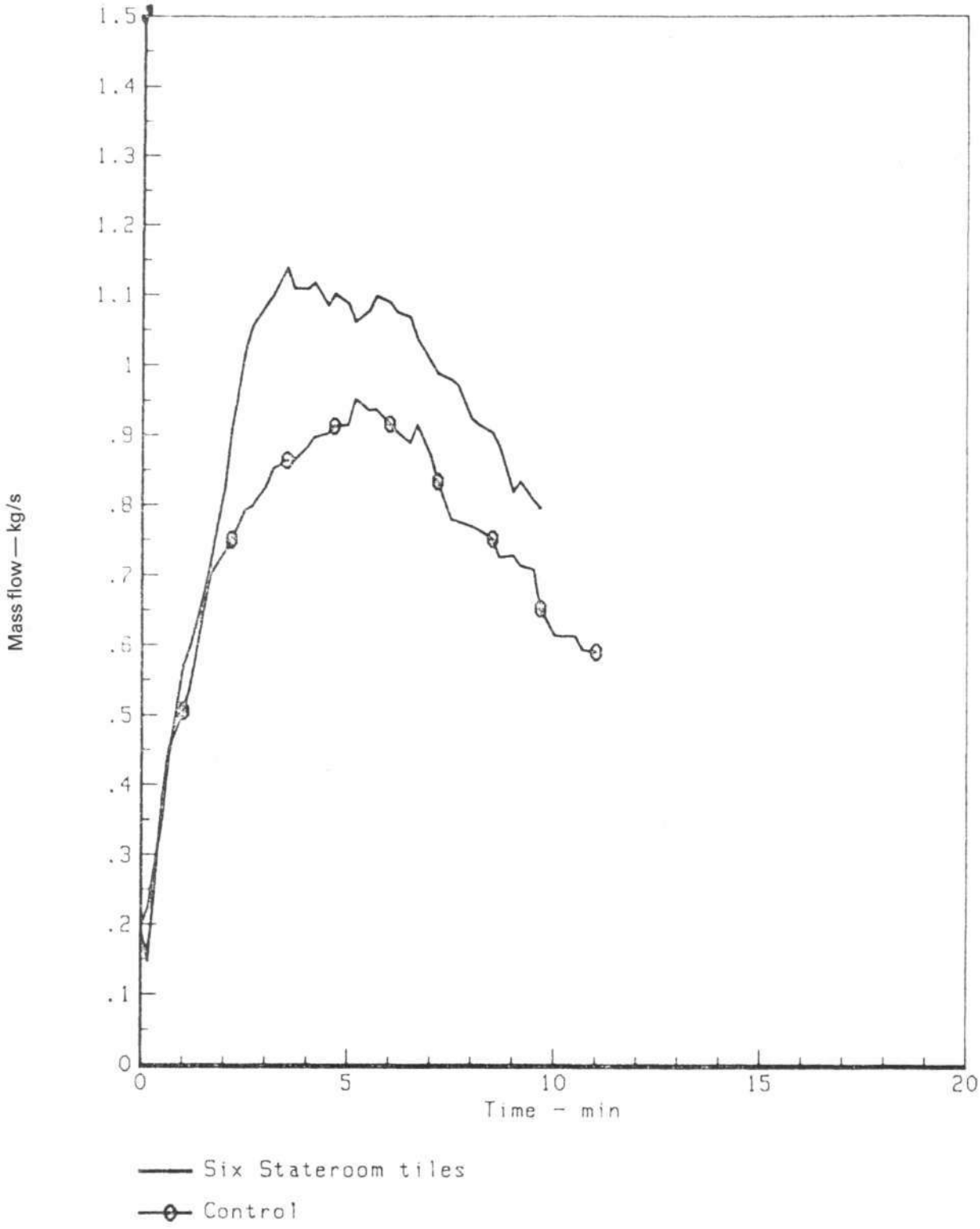


Figure F18 — *Mass flow recorded by thermocouple stack (a) (figure F1).*

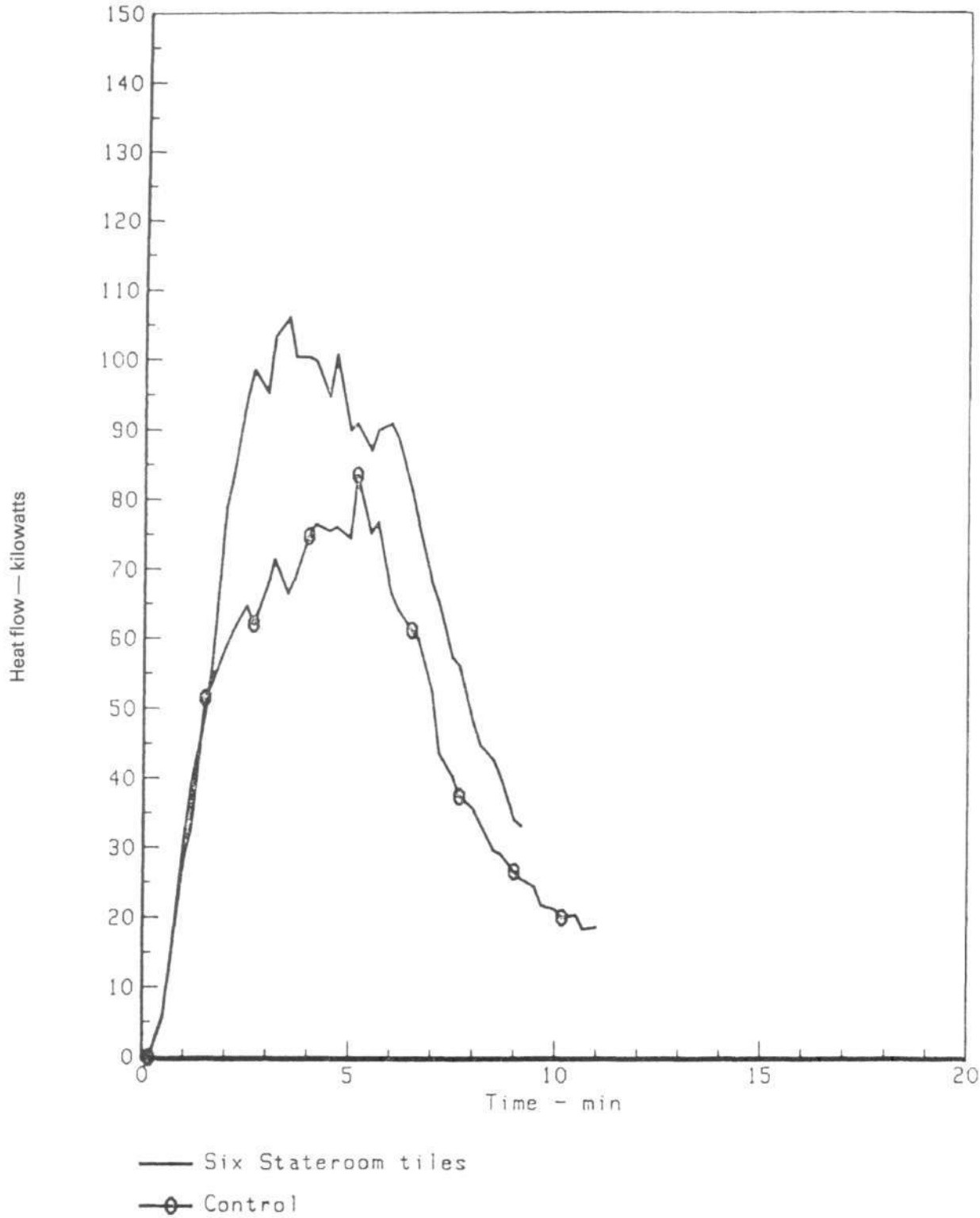


Figure F19 — *Heat flow recorded by thermocouple stack (a) (figure F1).*

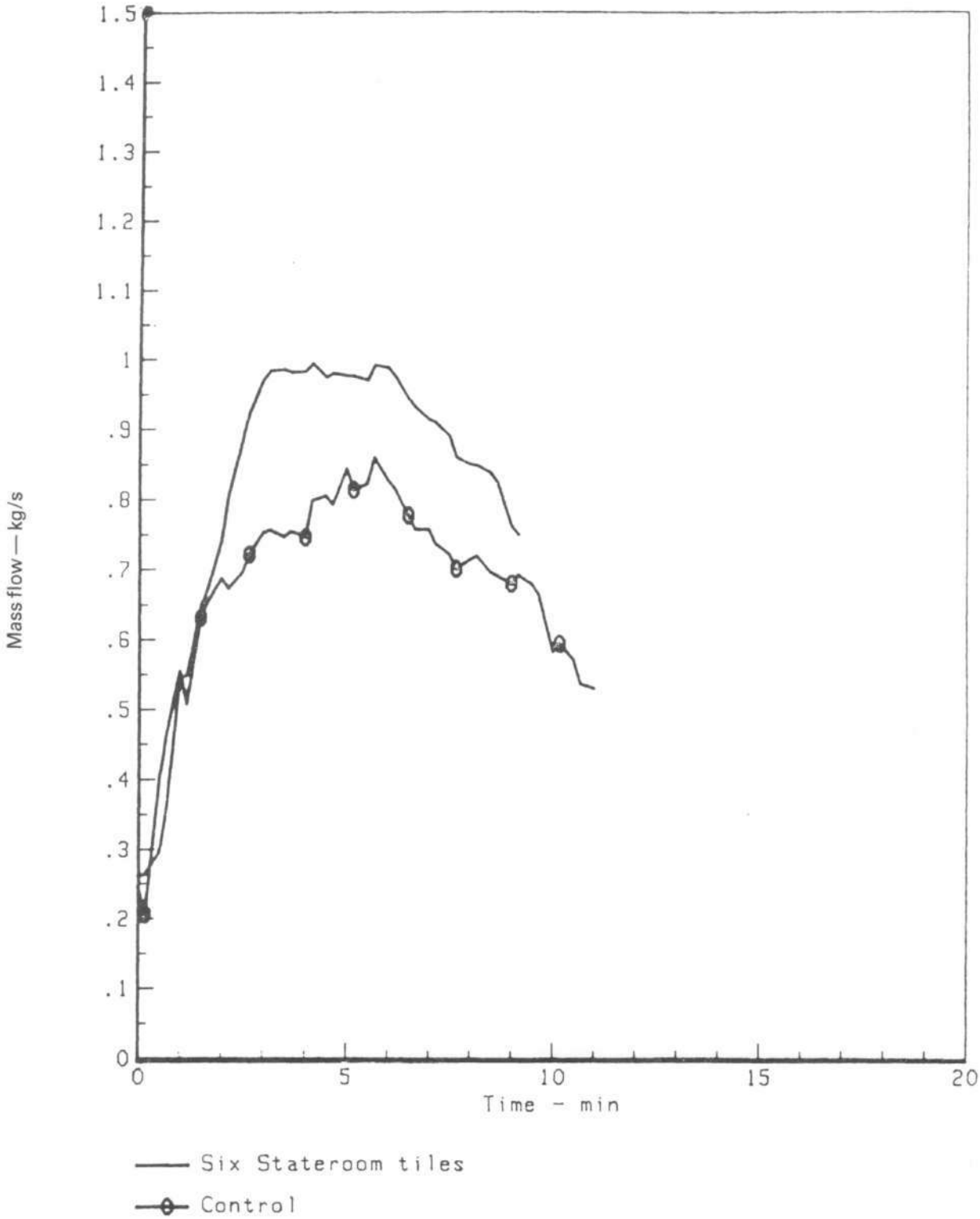


Figure F20 — *Mass flow recorded by thermocouple stack (b) (figure F1).*

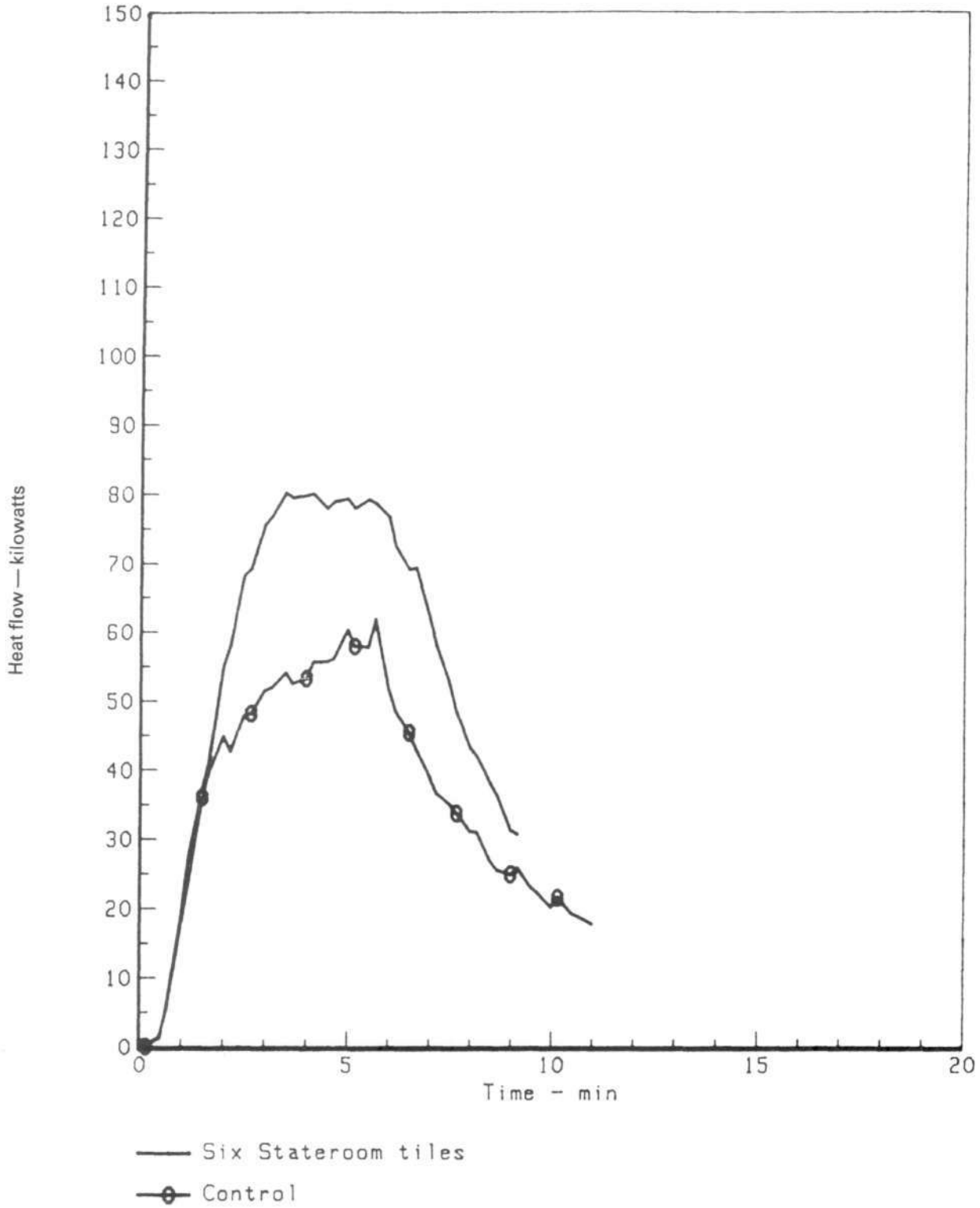


Figure F21 — *Heat flow recorded by thermocouple stack (b) (figure F1).*

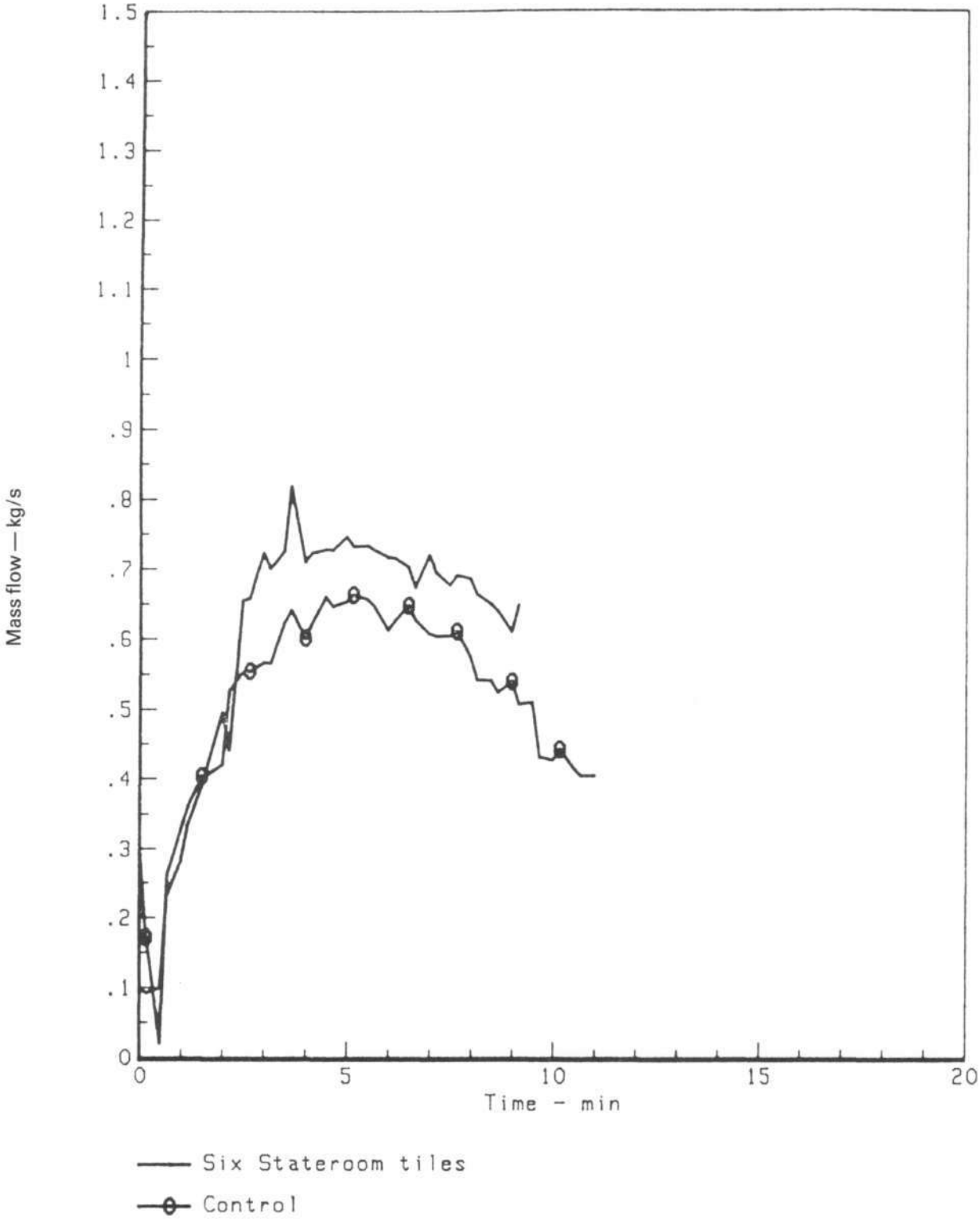


Figure F22 — *Mass flow recorded by thermocouple stack (c) (figure F1).*

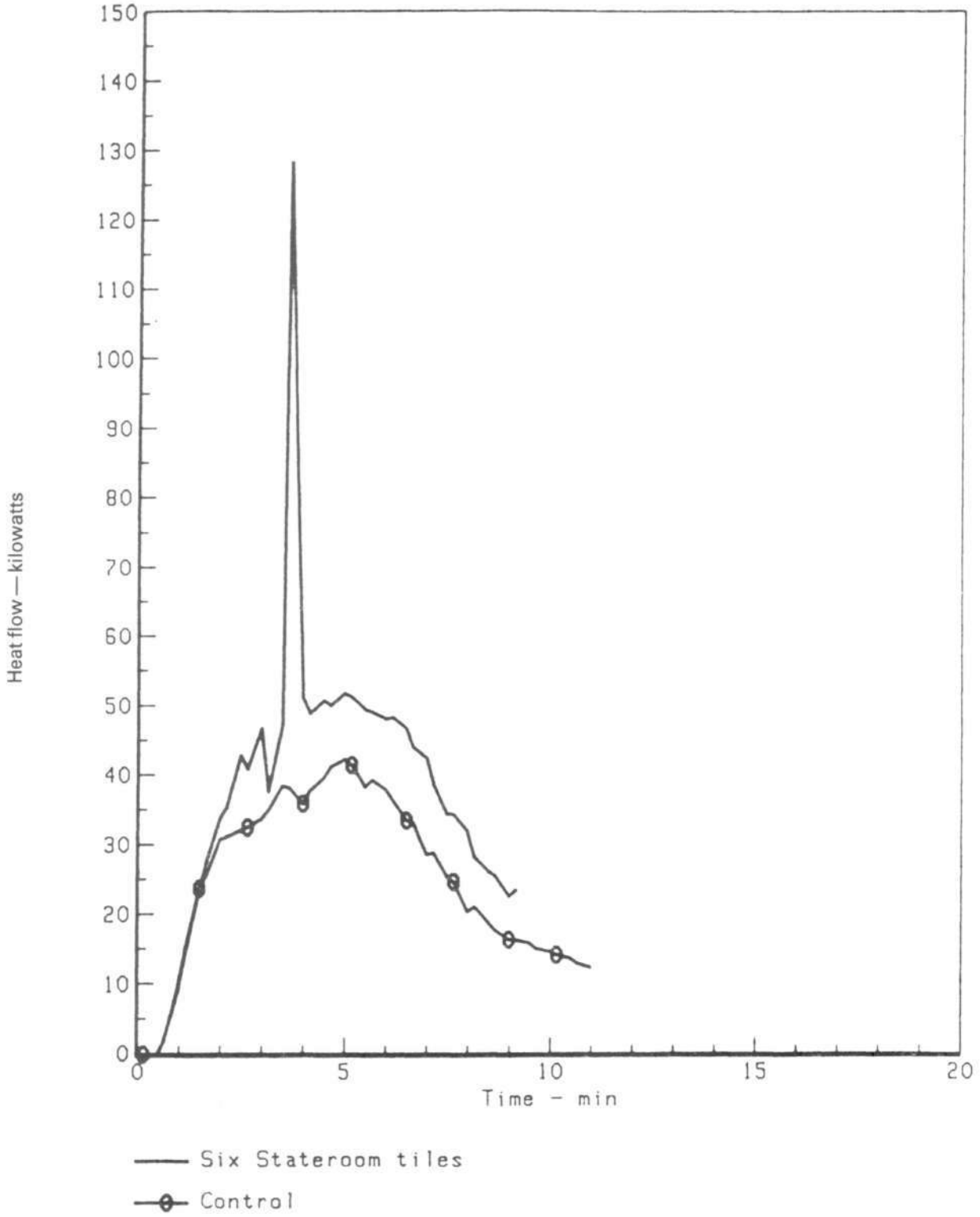


Figure F23 — *Heat flow recorded by thermocouple stack (c) (figure F1).*

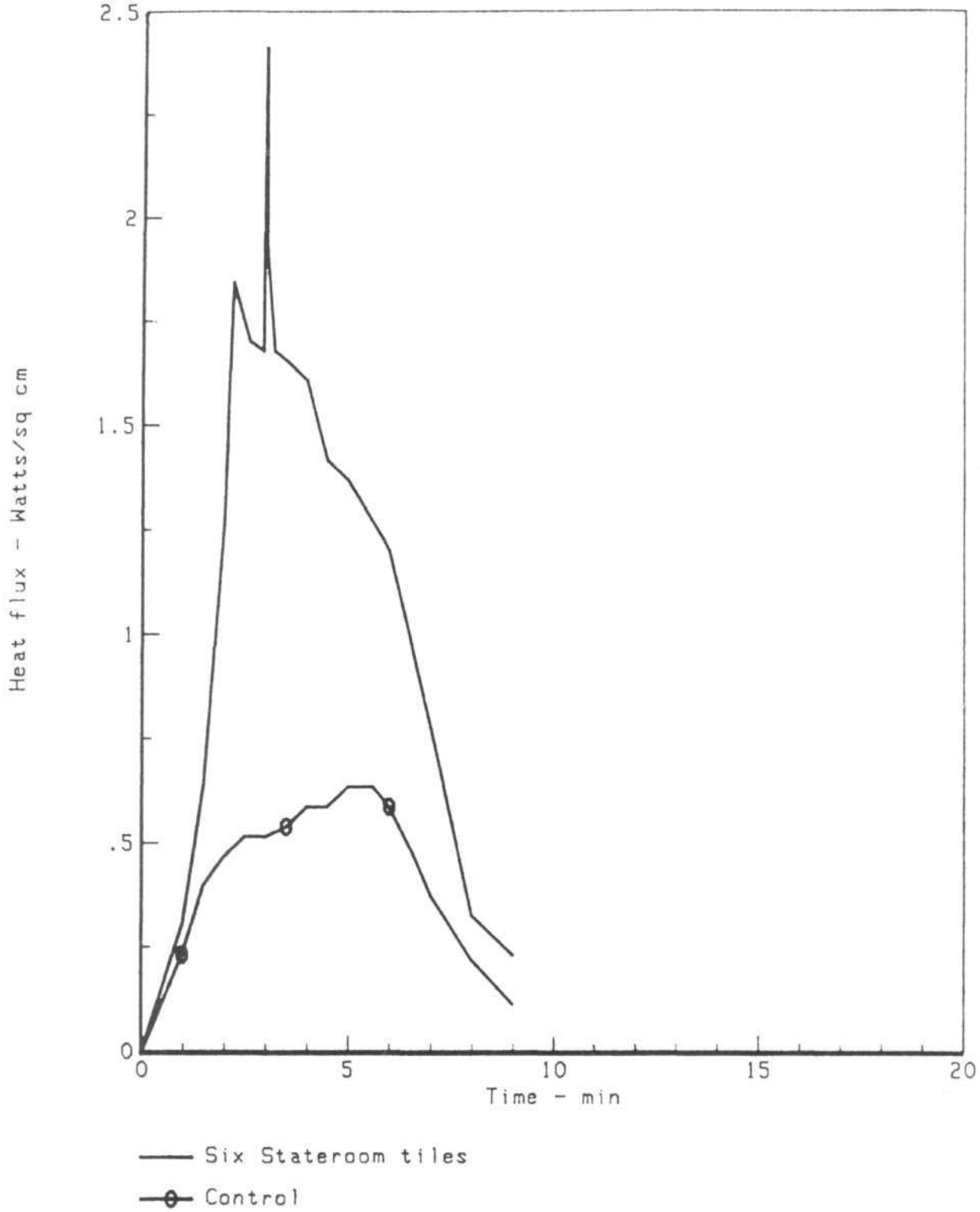


Figure F24 — *Heat flux at point equivalent to top of seating unit next to crib (H3 on figure F17).*

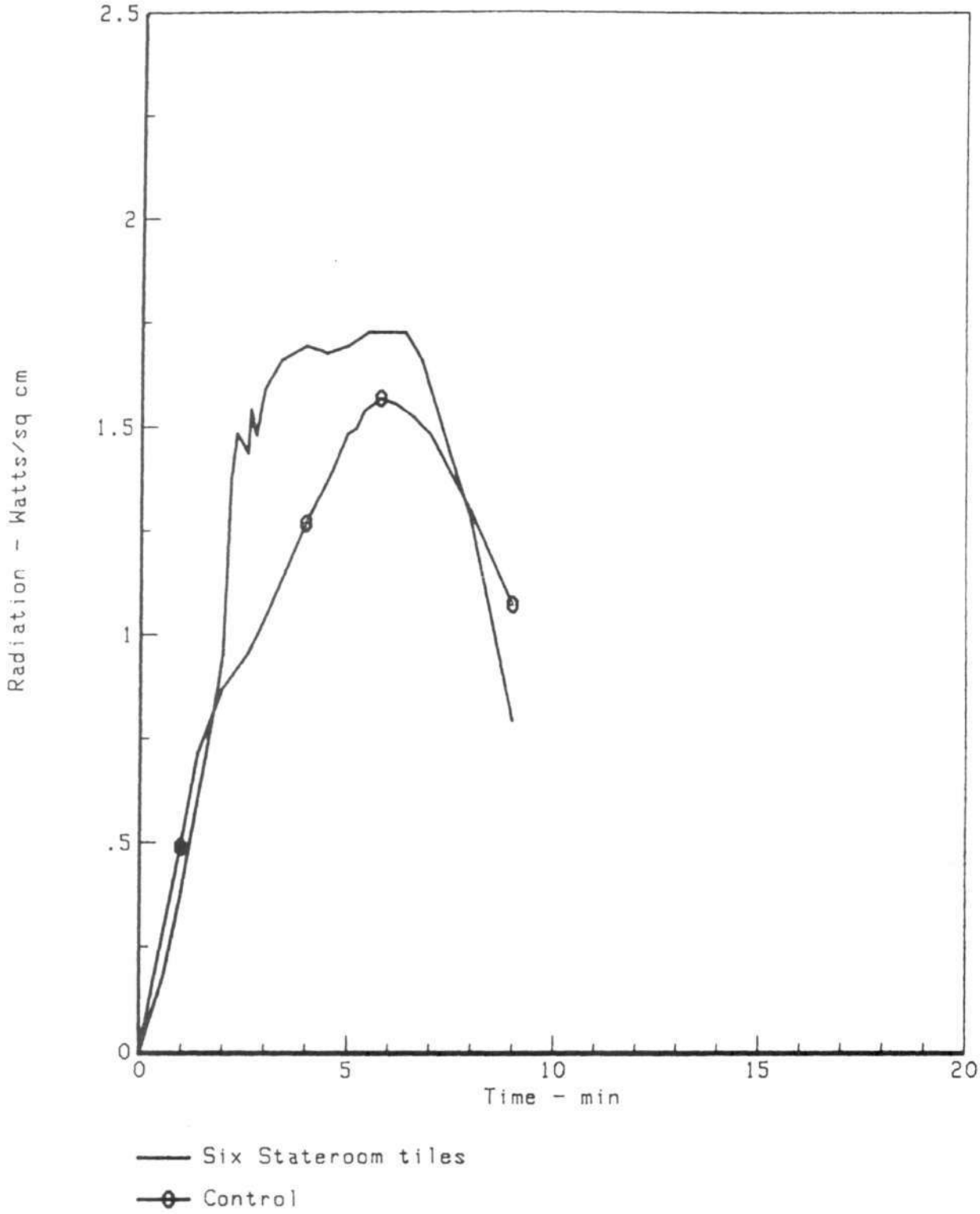


Figure F25 — *Radiation at point equivalent to back of seating unit on next tier below (R1 on figure F17).*

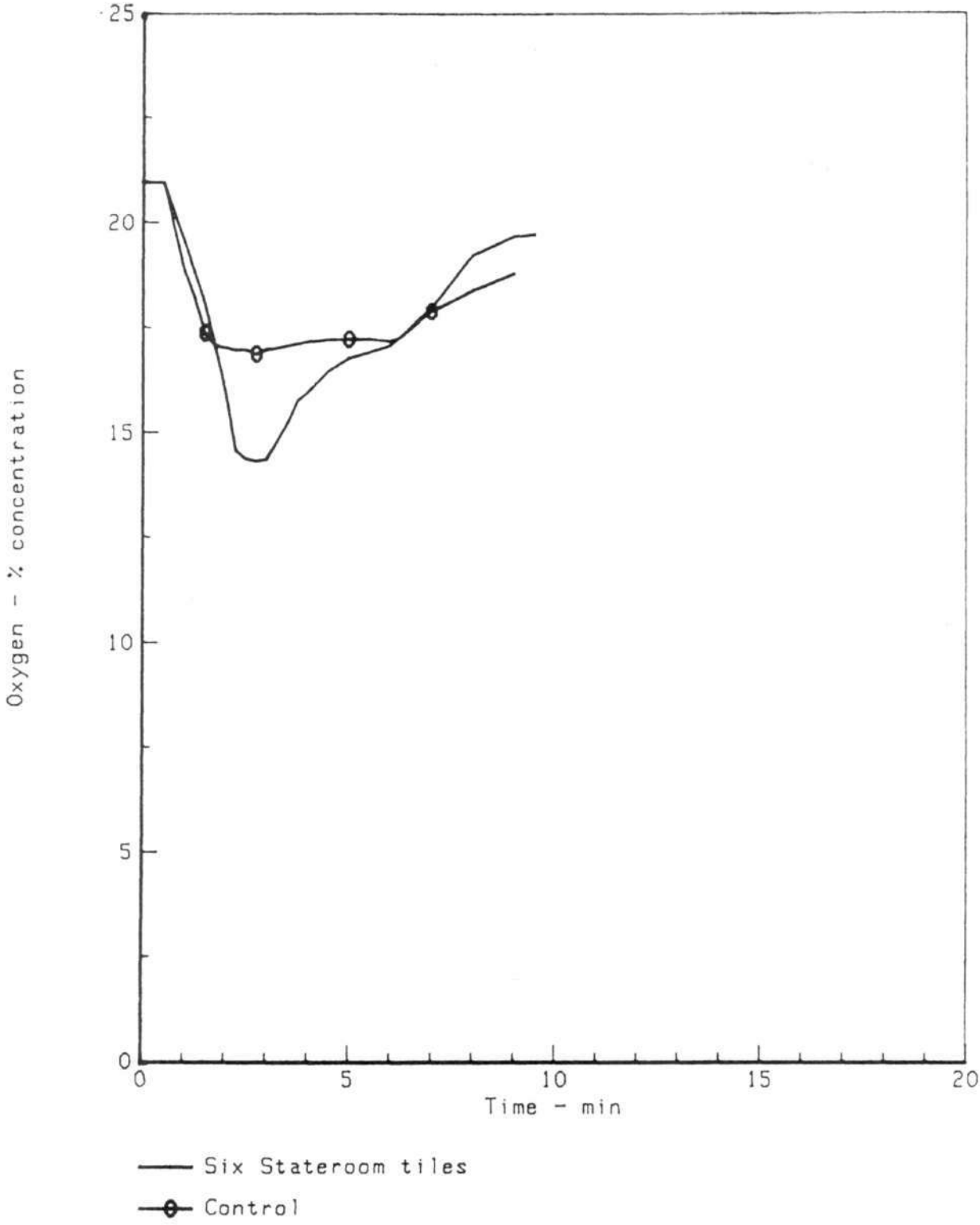


Figure F26 — *Oxygen concentration 100mm below soffit at sampling point S (figure F1).*

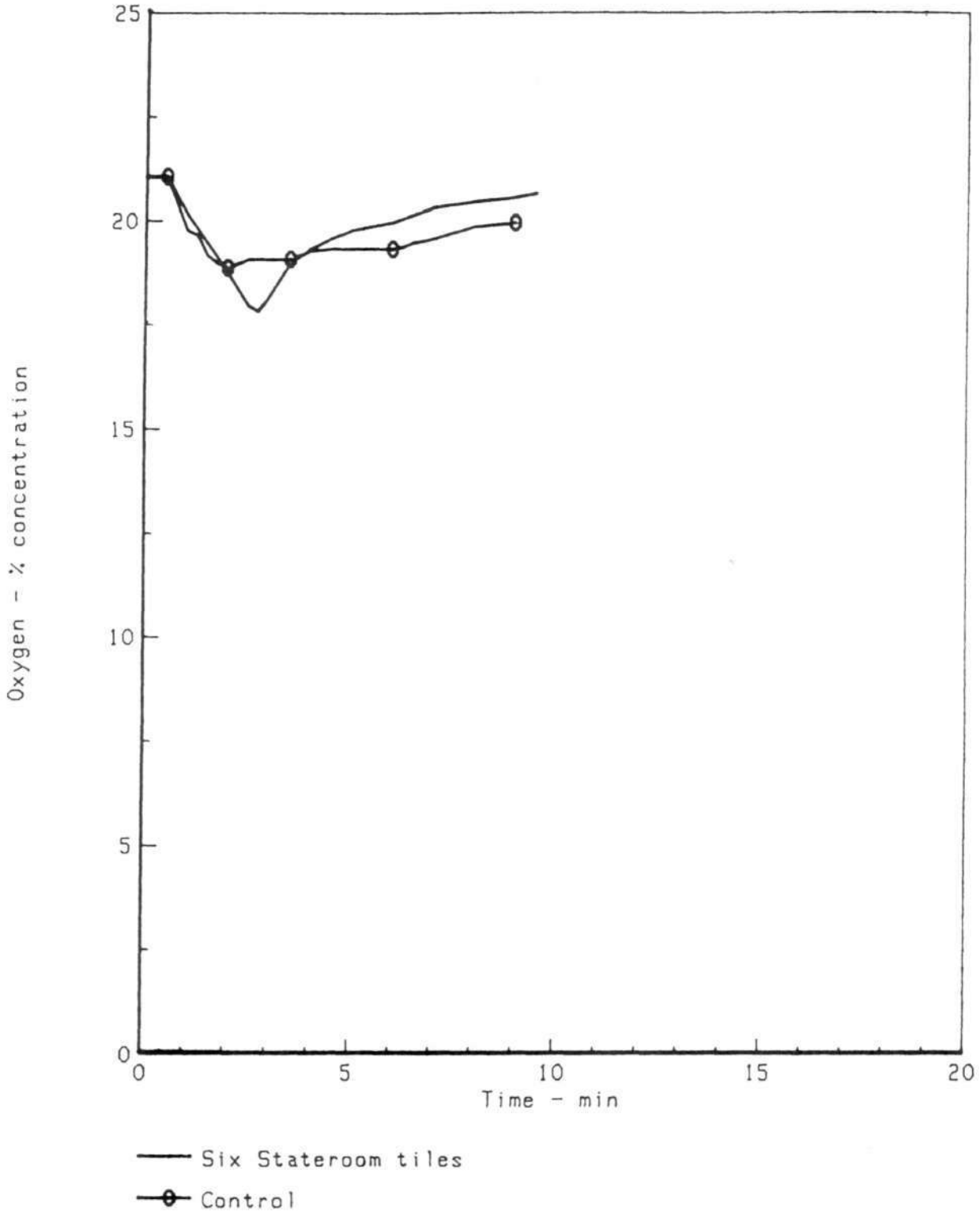


Figure F27 — *Oxygen concentration 400mm below soffit at sampling point S (figure F1).*

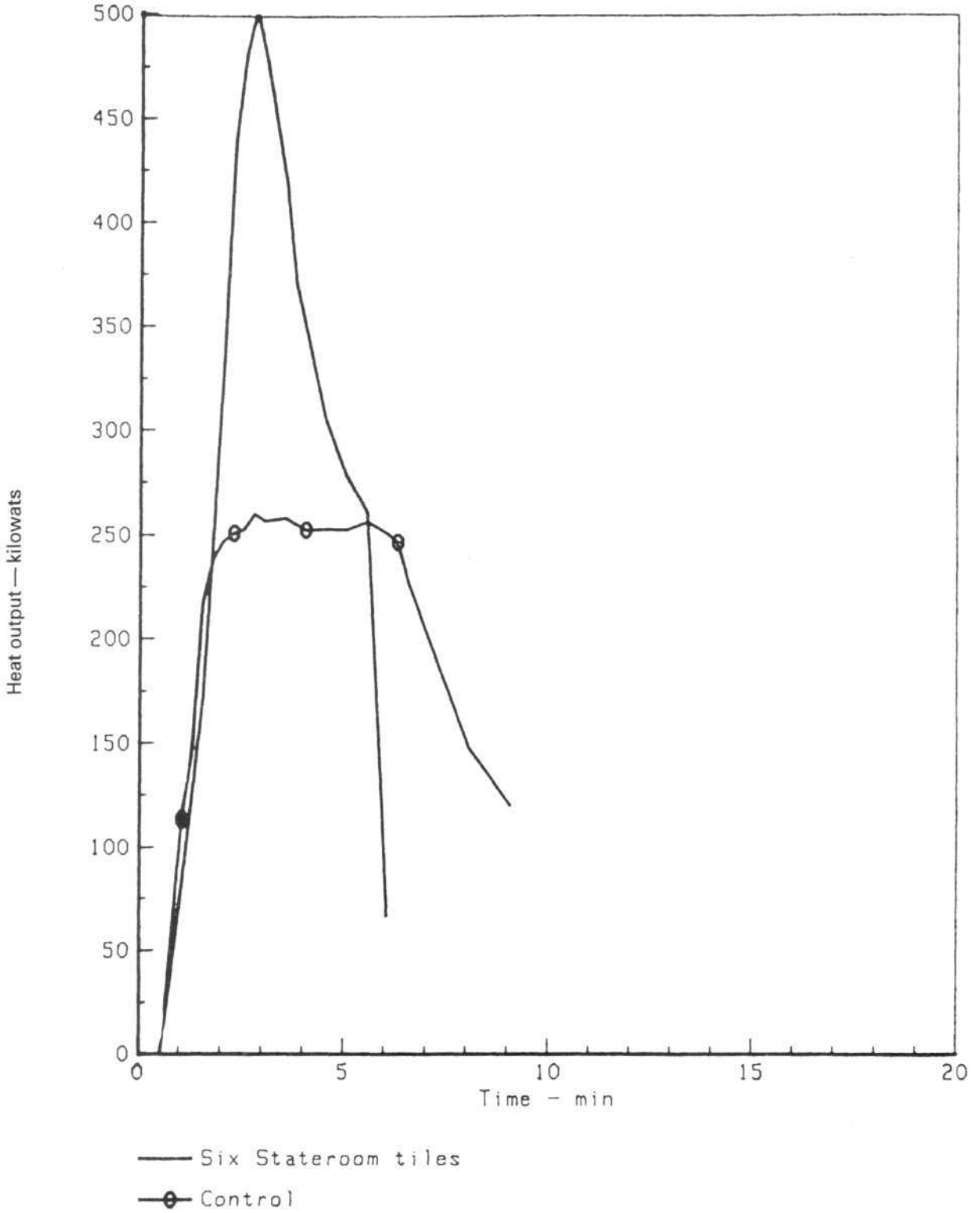
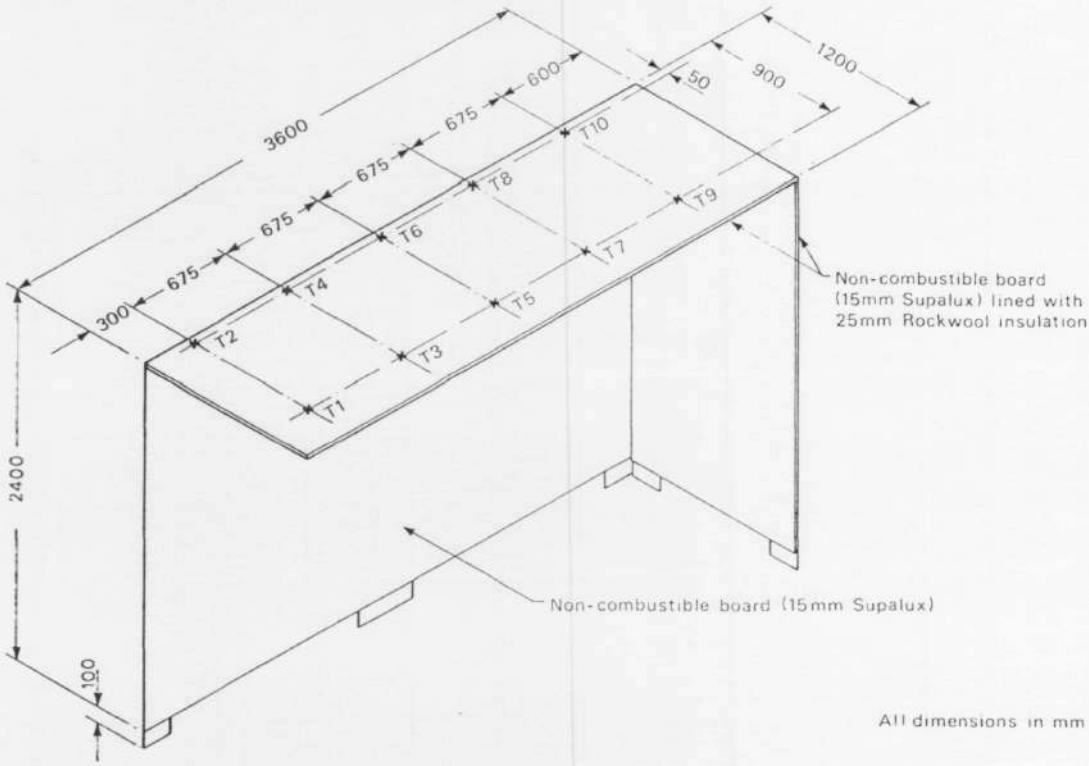
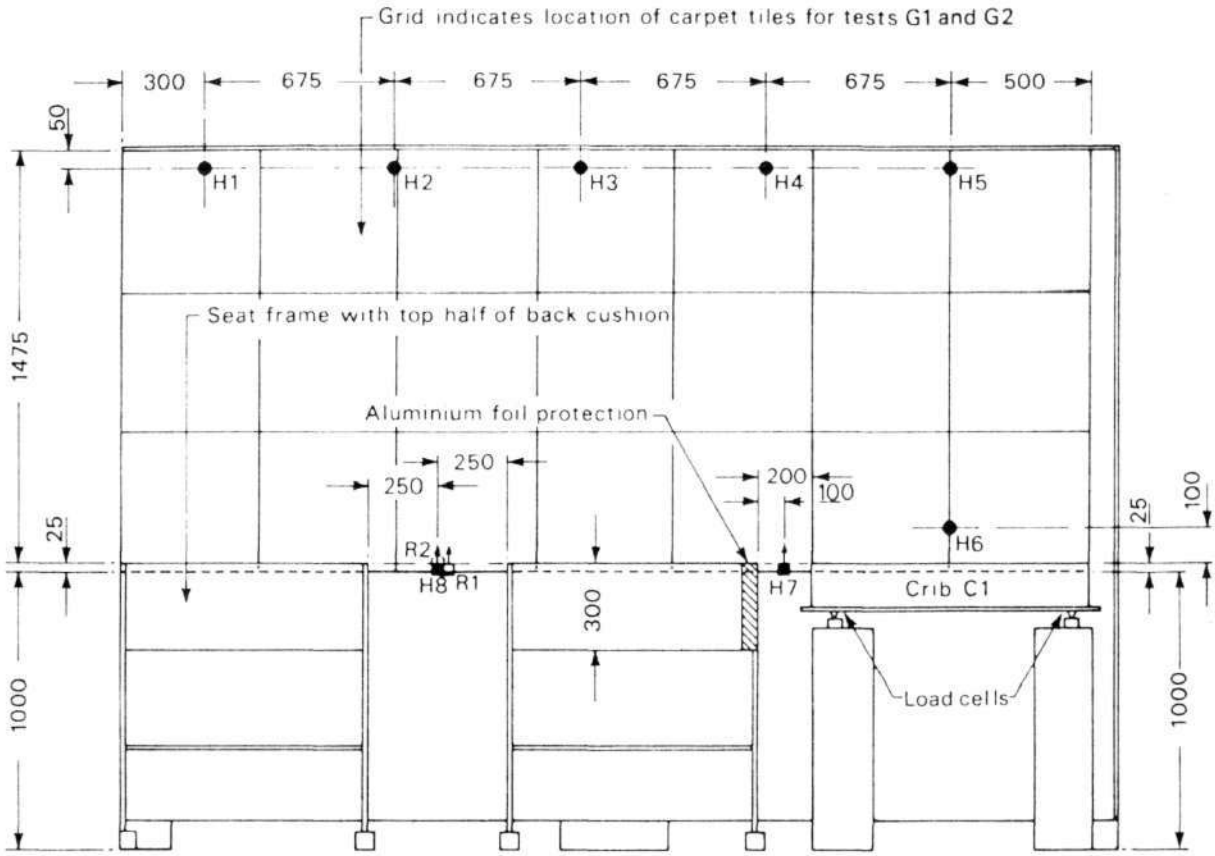


Figure F28 — *Calculated heat output based on oxygen concentration at sampling point S (figure F1).*

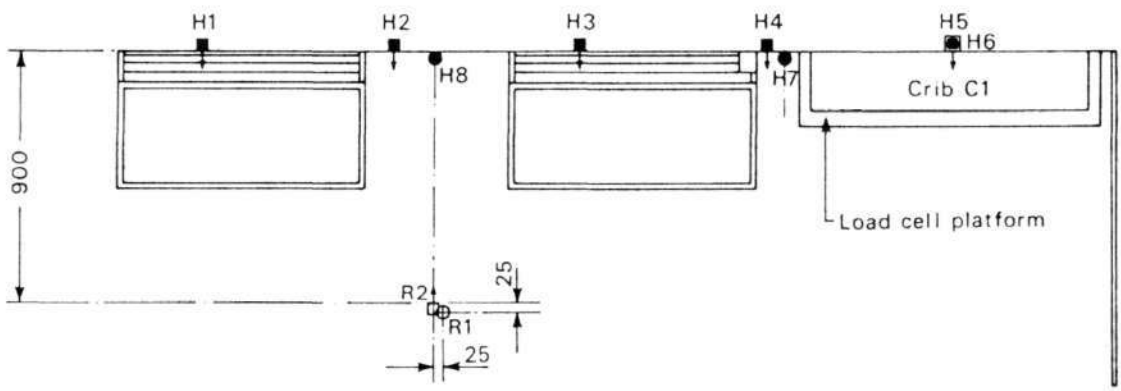


T1 – T10 — Ceiling thermocouples (protruding 50mm below insulation)

Figure G1 — *Rig and dimensions for tests on interaction between wall and burning seat units.*



Elevation



Plan (omitting ceiling)

All dimensions in mm

H1 - H8 — Heat flux meters
R1 - R2 — Radiometers
Test G1 — Wall partly covered with 21 Stateroom carpet tiles
Test G3 — No carpet tiles
Test G2 — Wall partly covered with 21 Simulated Stateroom carpet tiles

Figure G2 — *Arrangement of instrumentation for tests G1 and G2 on interaction between wall and burning seat unit.*

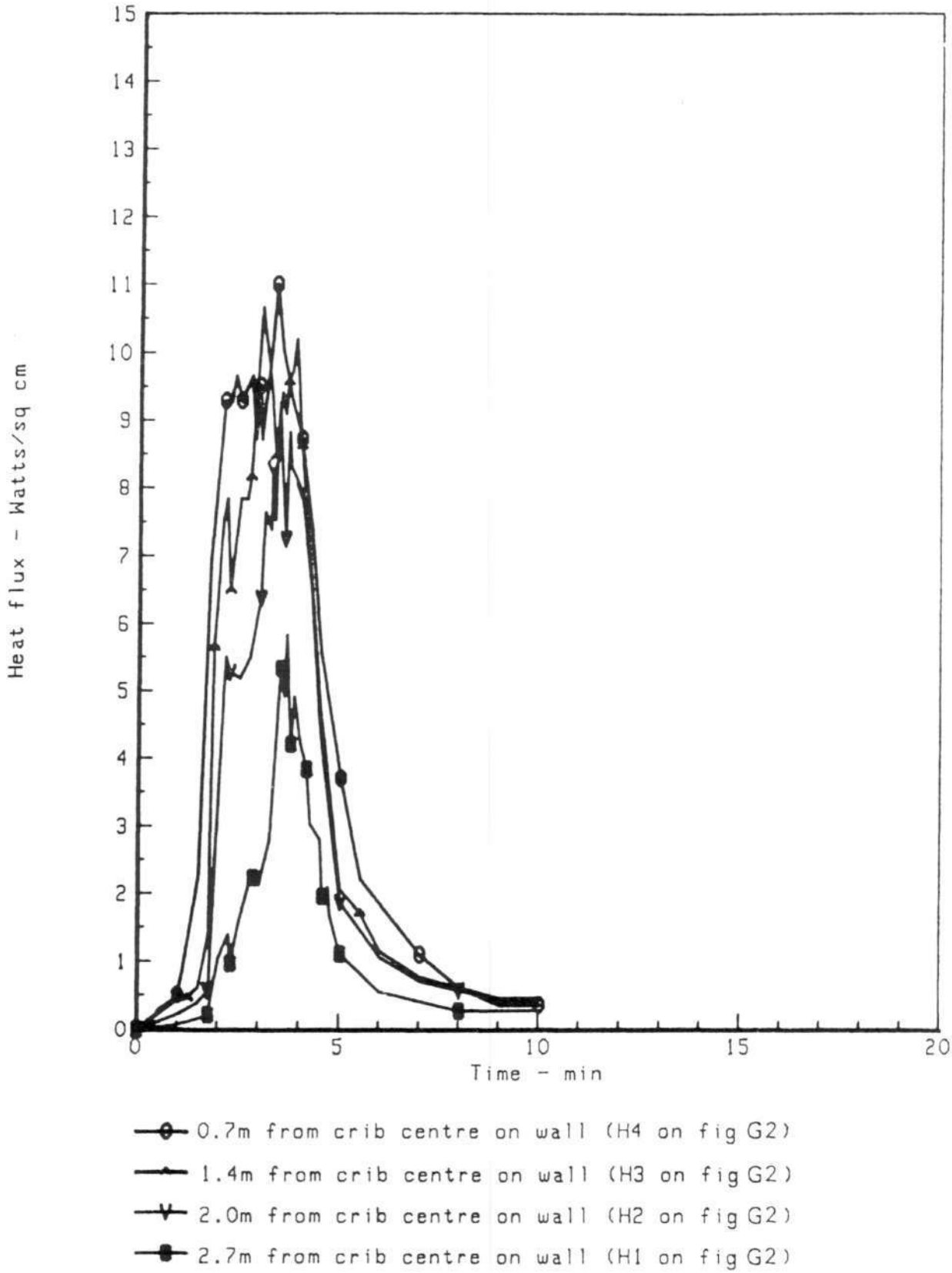


Figure G3 — *Heat flux at ceiling level in balcony rig test with Stateroom tiles.*

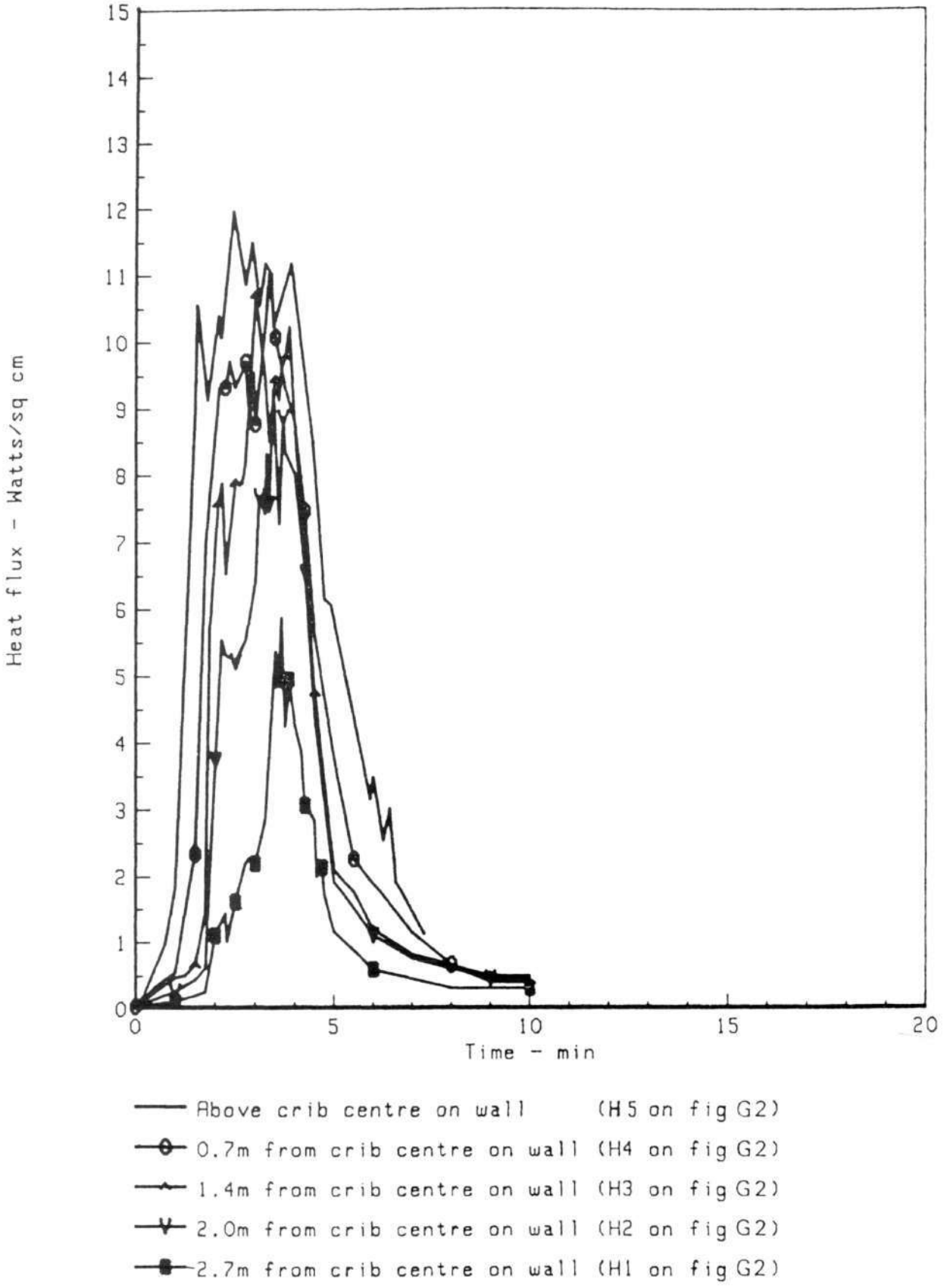


Figure G4 — *Heat flux at ceiling level in balcony rig test with simulated Stateroom tiles.*

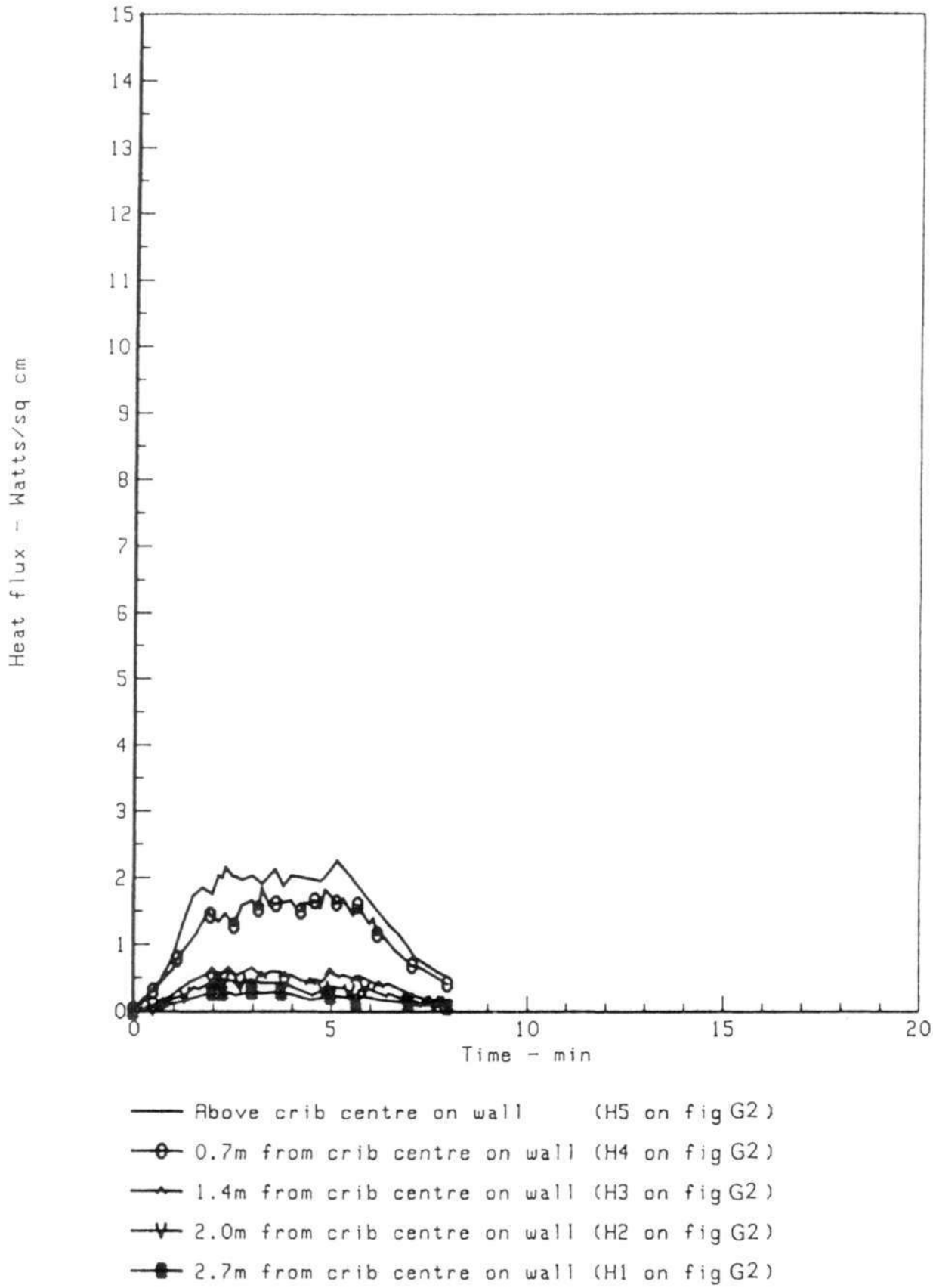


Figure G5 — *Heat flux at ceiling level in balcony rig test control test (without tiles).*

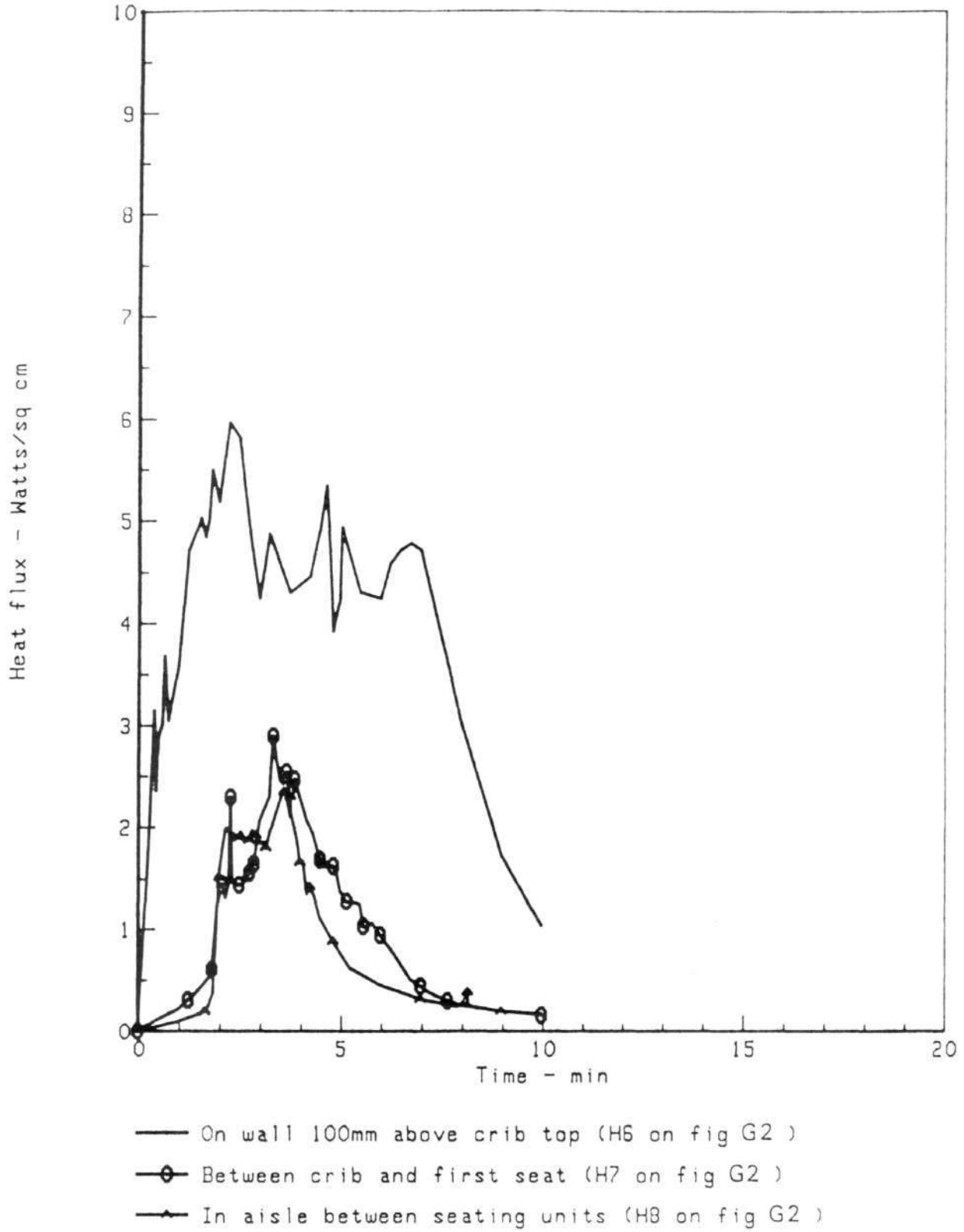


Figure G6 — *Heat flux at different points in balcony rig test with Stateroom tiles.*

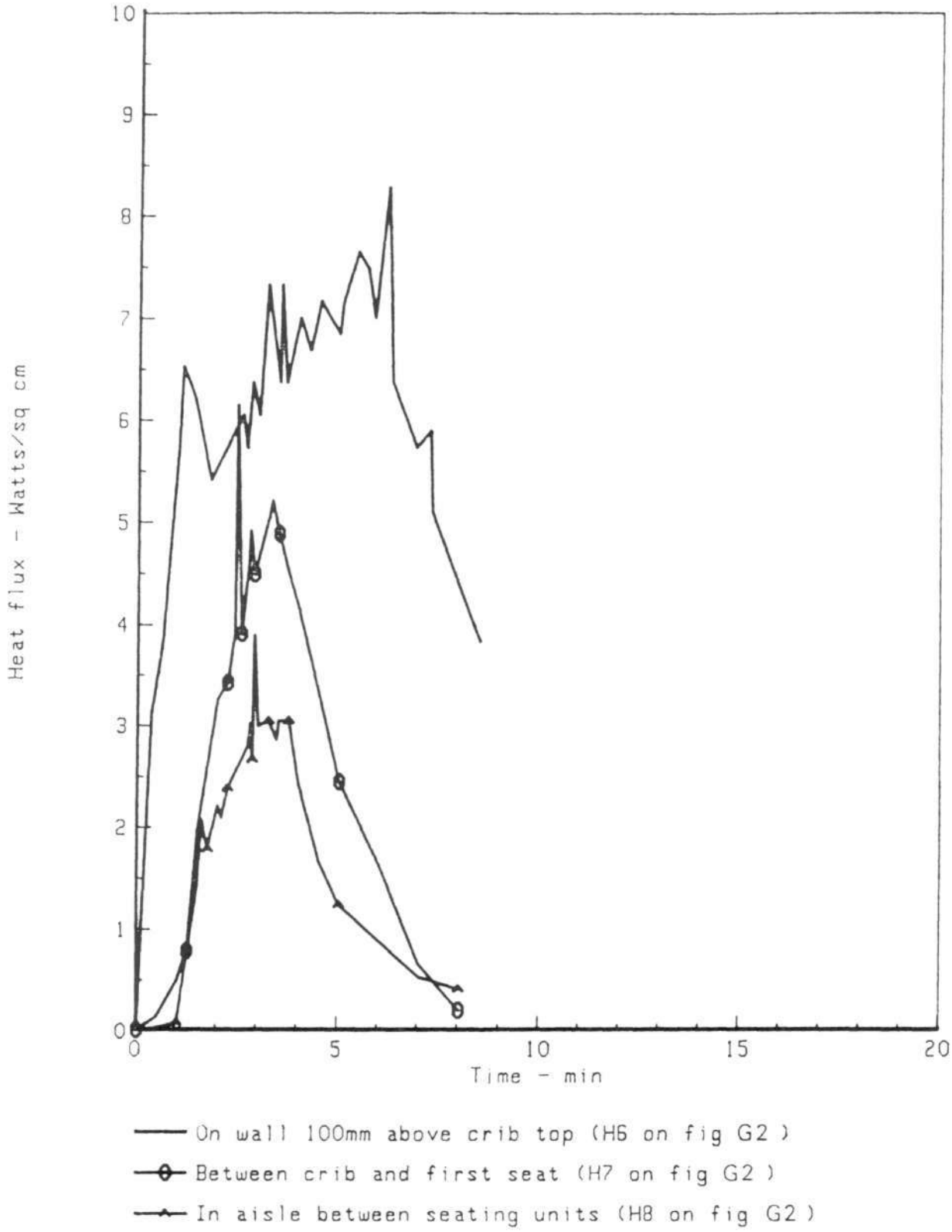


Figure G7 — *Heat flux at different points in balcony rig test with simulated Stateroom tiles.*

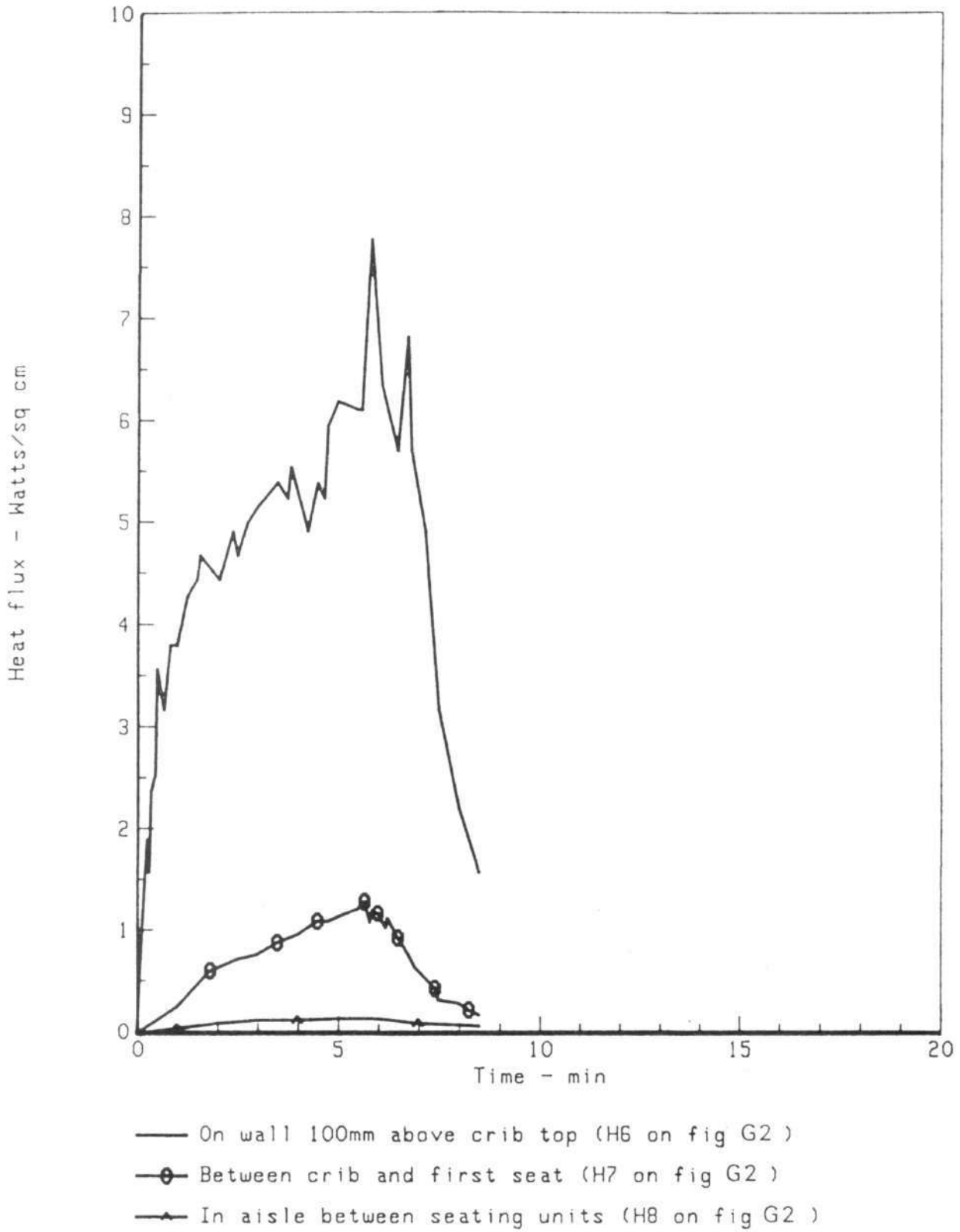


Figure G8 — *Heat flux at different points in balcony rig test control test (without tiles).*

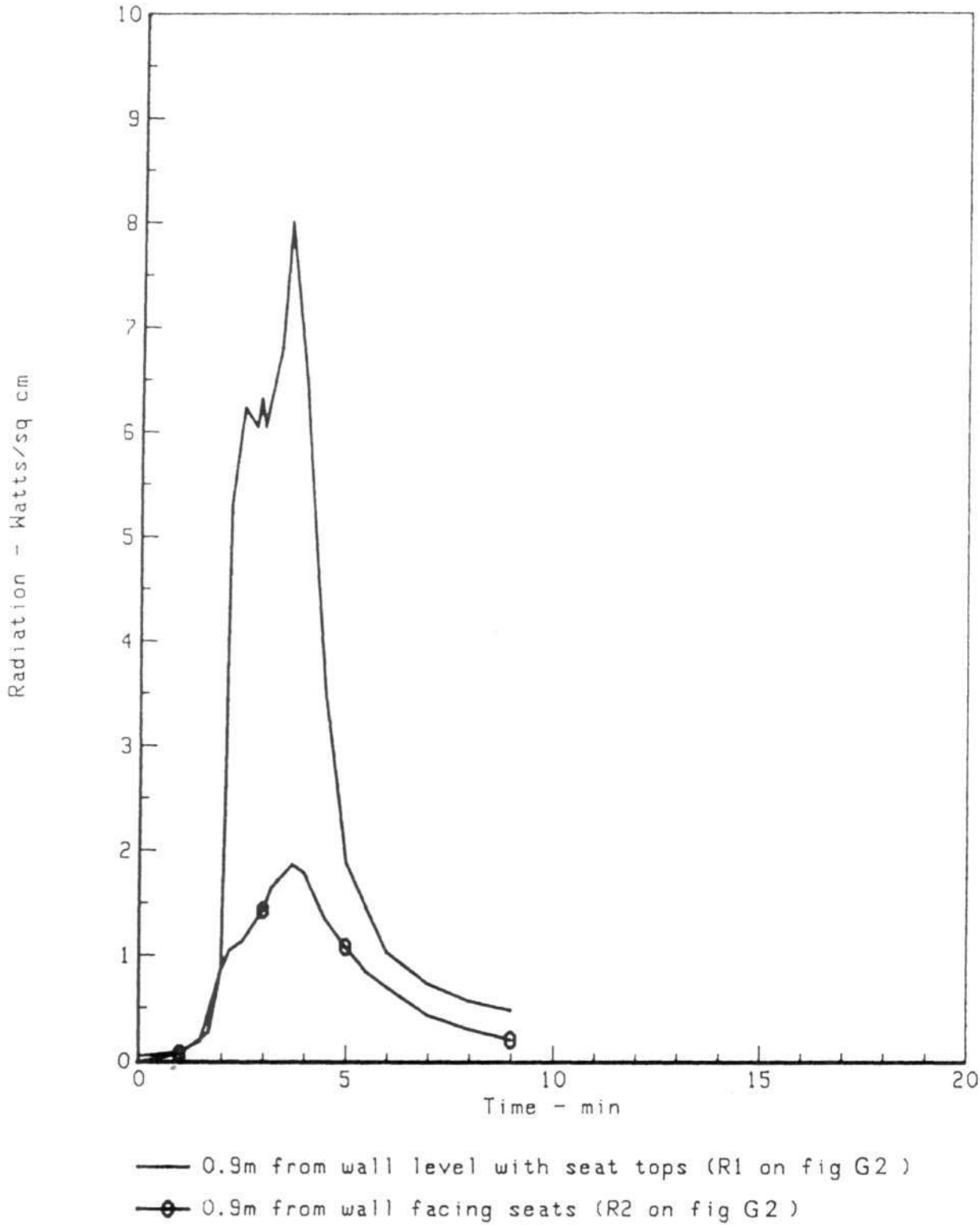


Figure G9 — *Radiation at different points in balcony rig test with Stateroom tiles.*

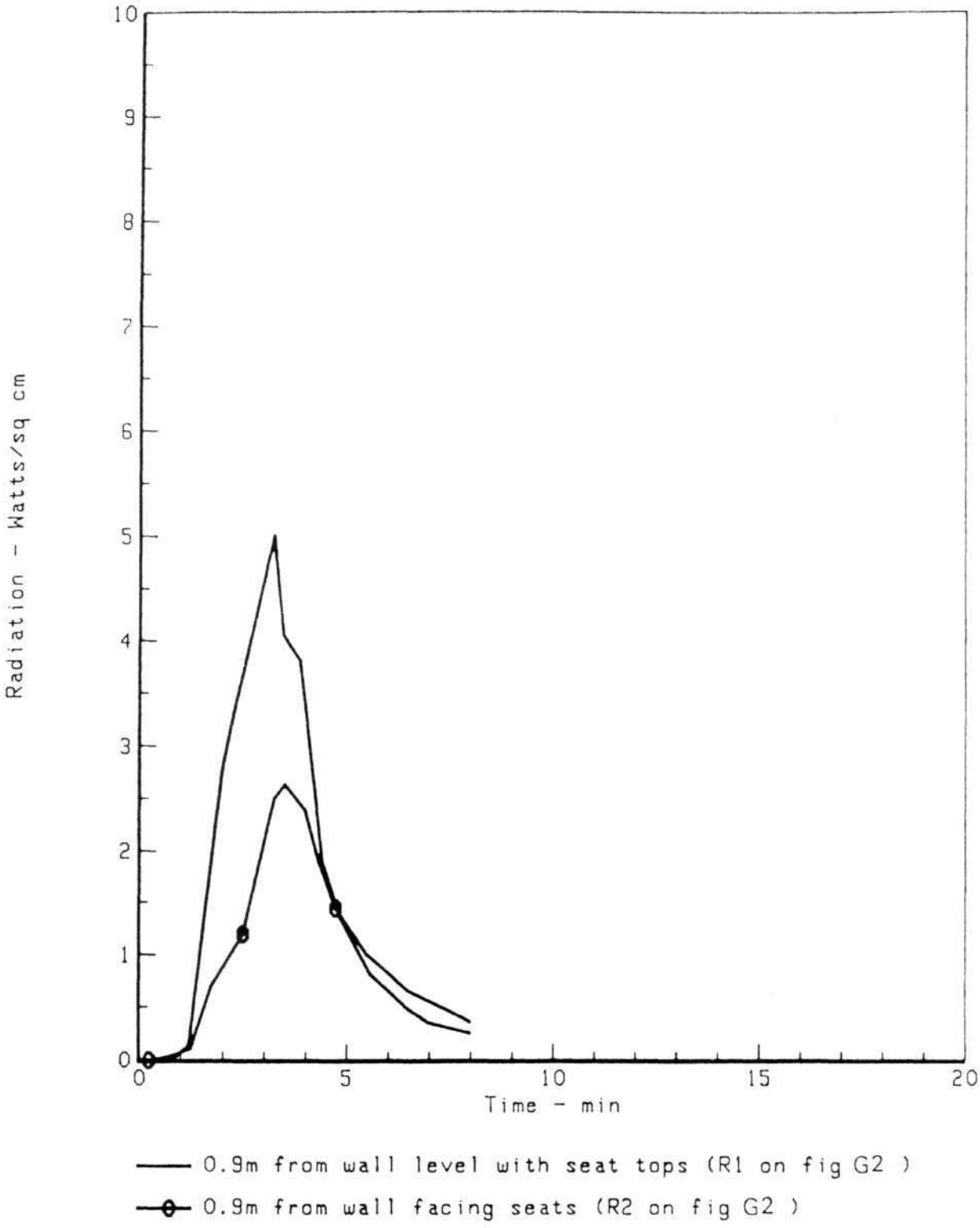


Figure G10 — *Radiation at different points in balcony rig test with simulated Stateroom tiles.*

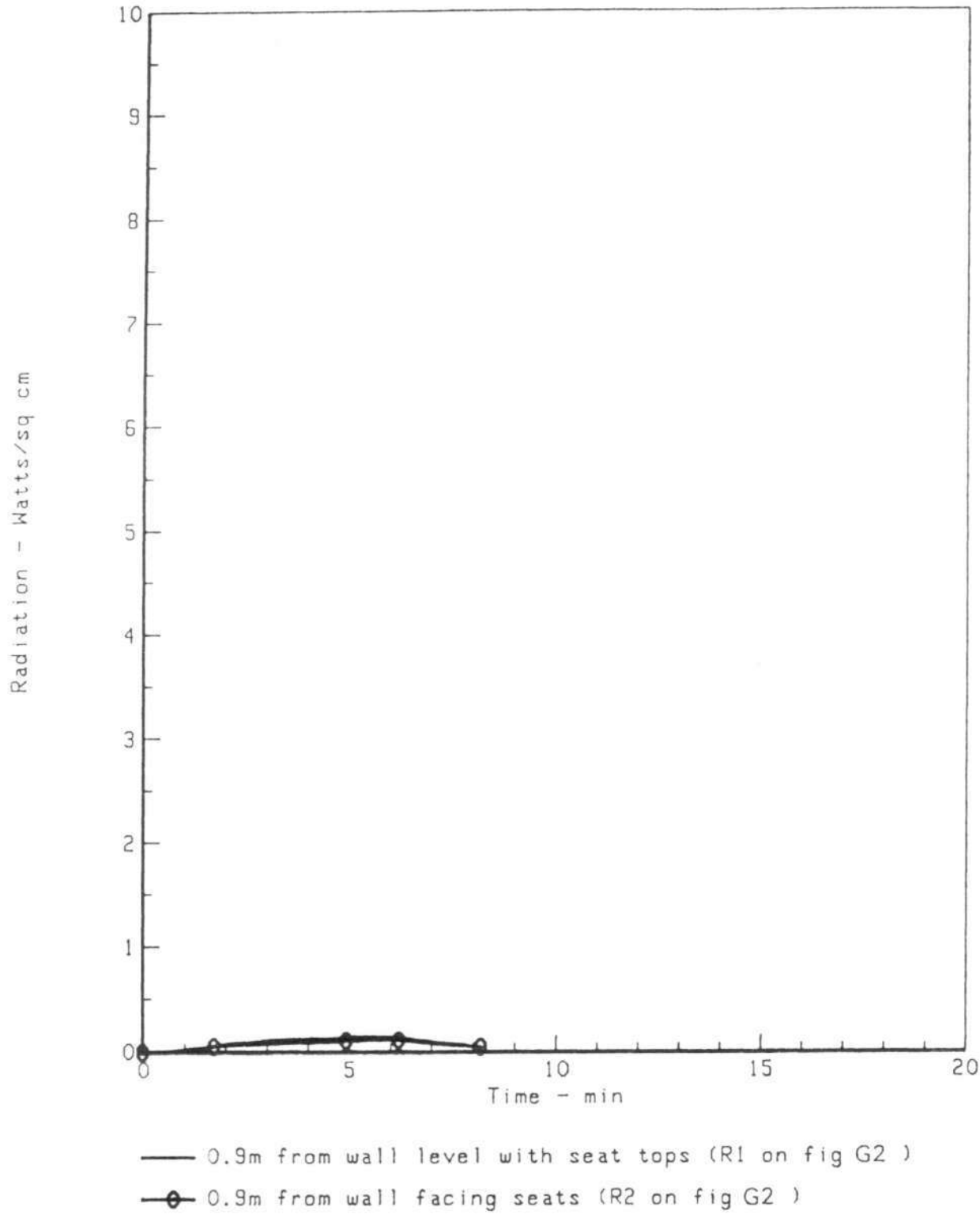


Figure G11 — *Radiation at different points in balcony rig test control test (without tiles).*

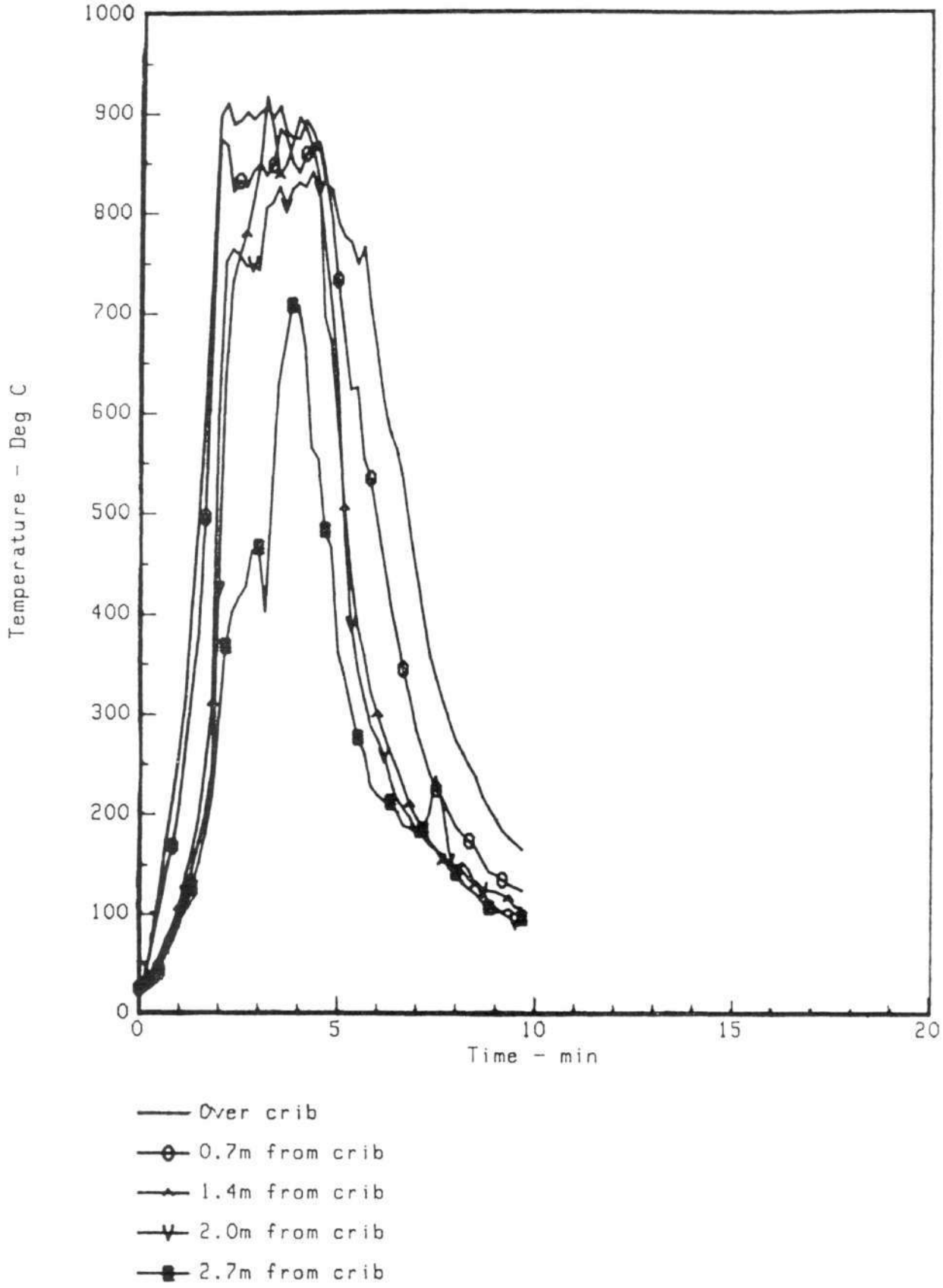


Figure G12 — *Gas temperatures at ceiling 50mm from wall in balcony rig test with Stateroom tiles.*

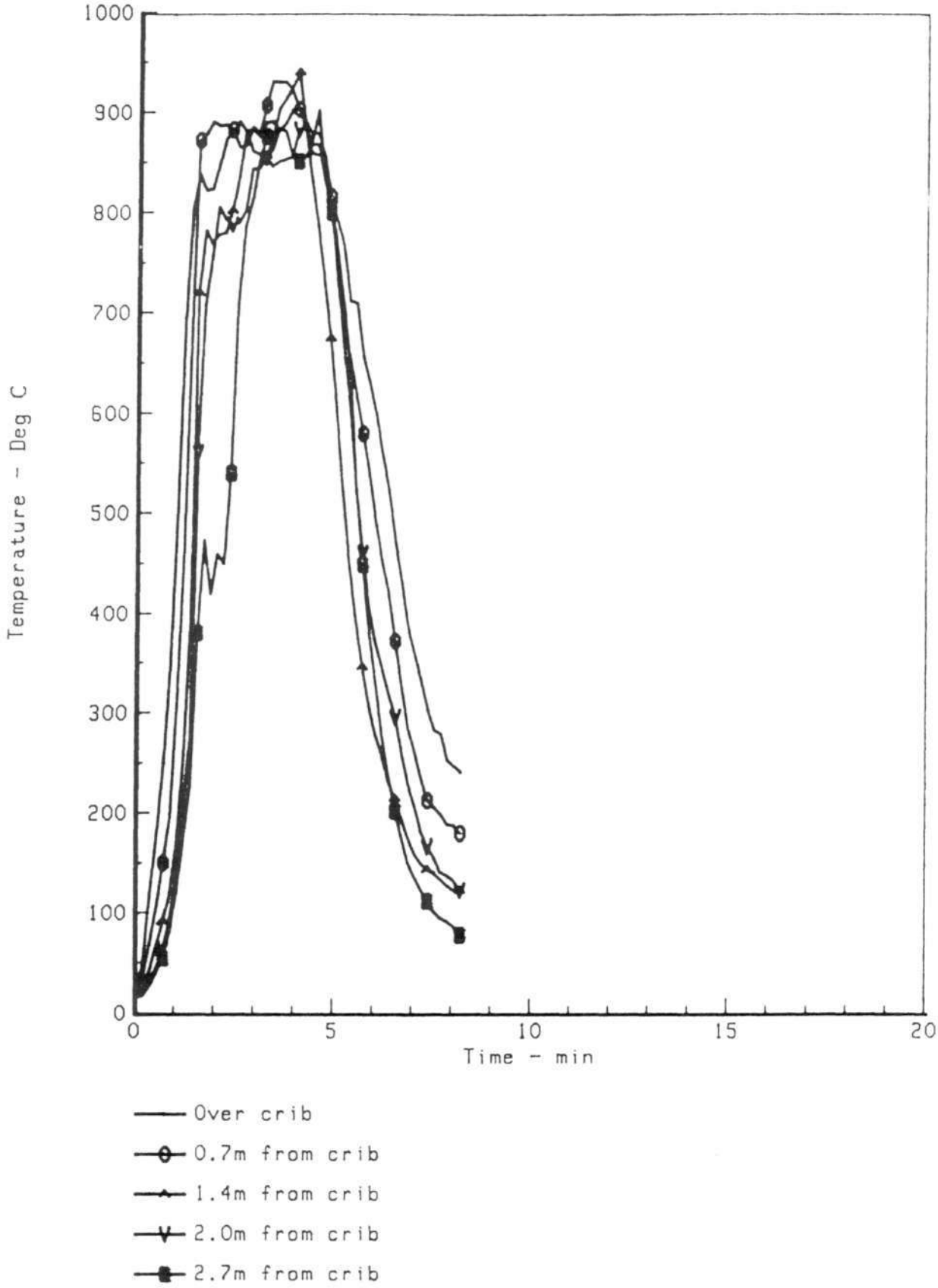


Figure G13 — *Gas temperatures at ceiling 50mm from wall in balcony rig test with simulated Stateroom tiles.*

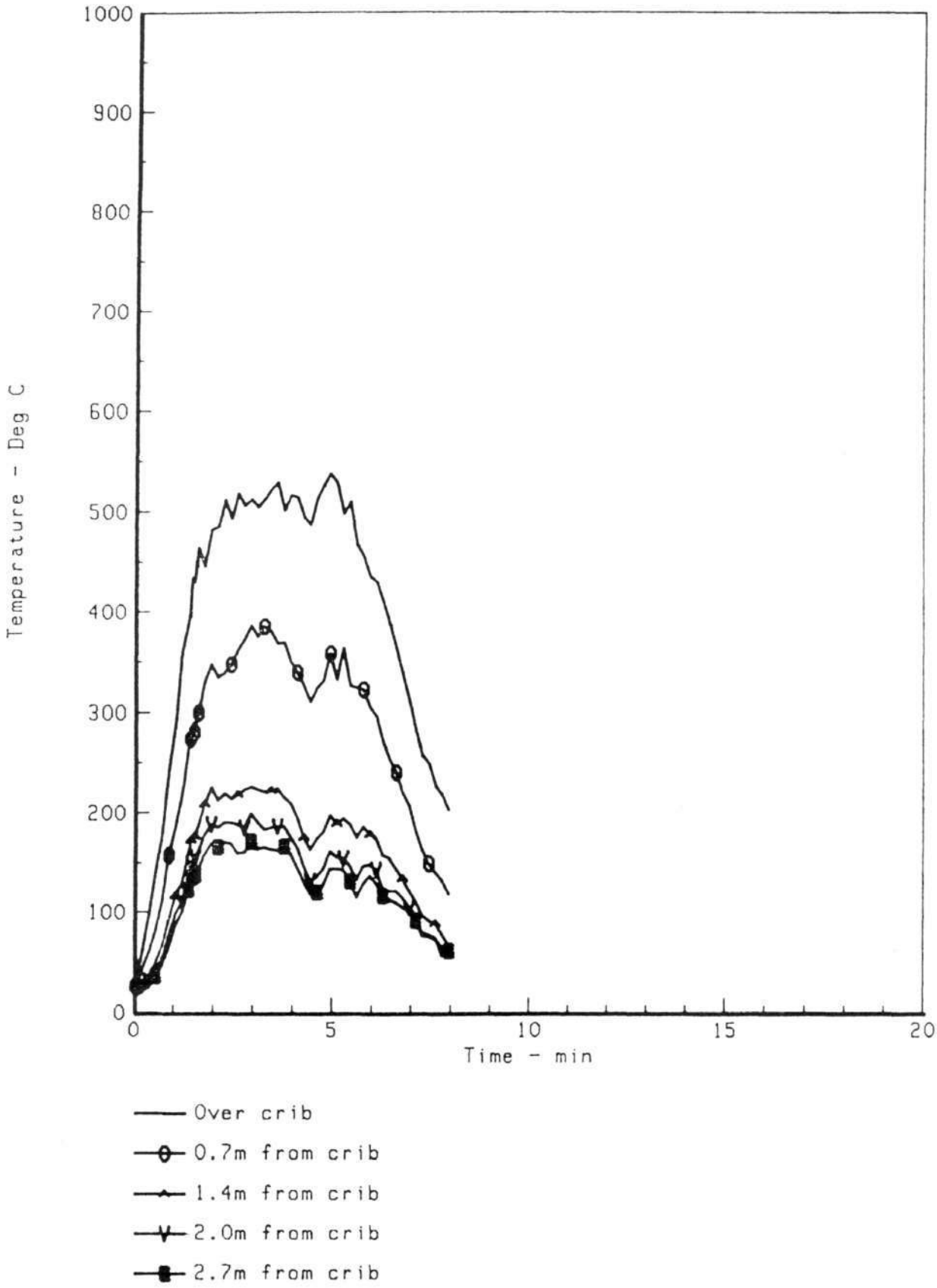


Figure G14 — *Gas temperatures at ceiling 50mm from wall in balcony rig control test (without tiles).*

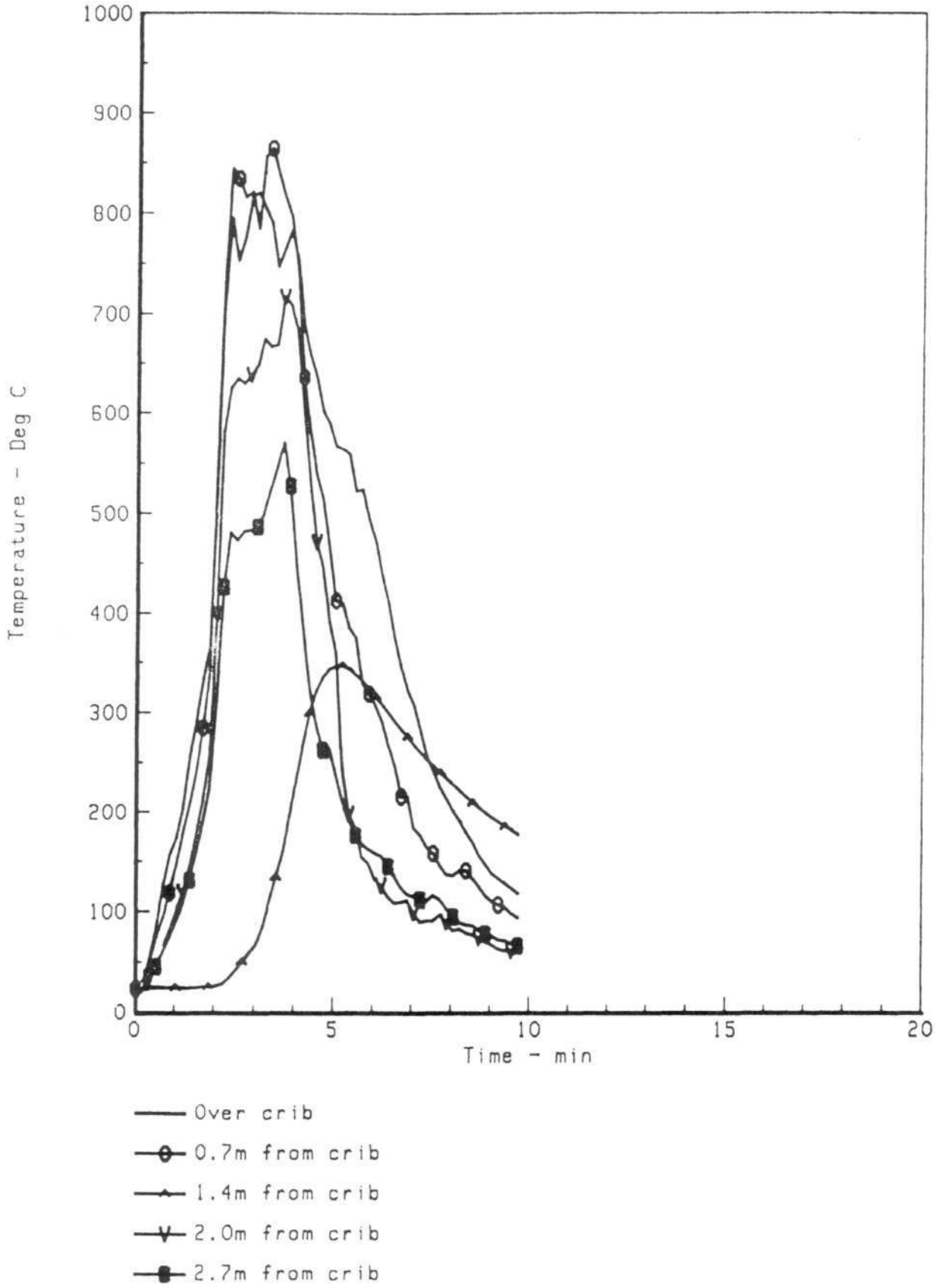


Figure G15 — *Gas temperatures at ceiling 900mm from wall in balcony rig test with Stateroom tiles.*

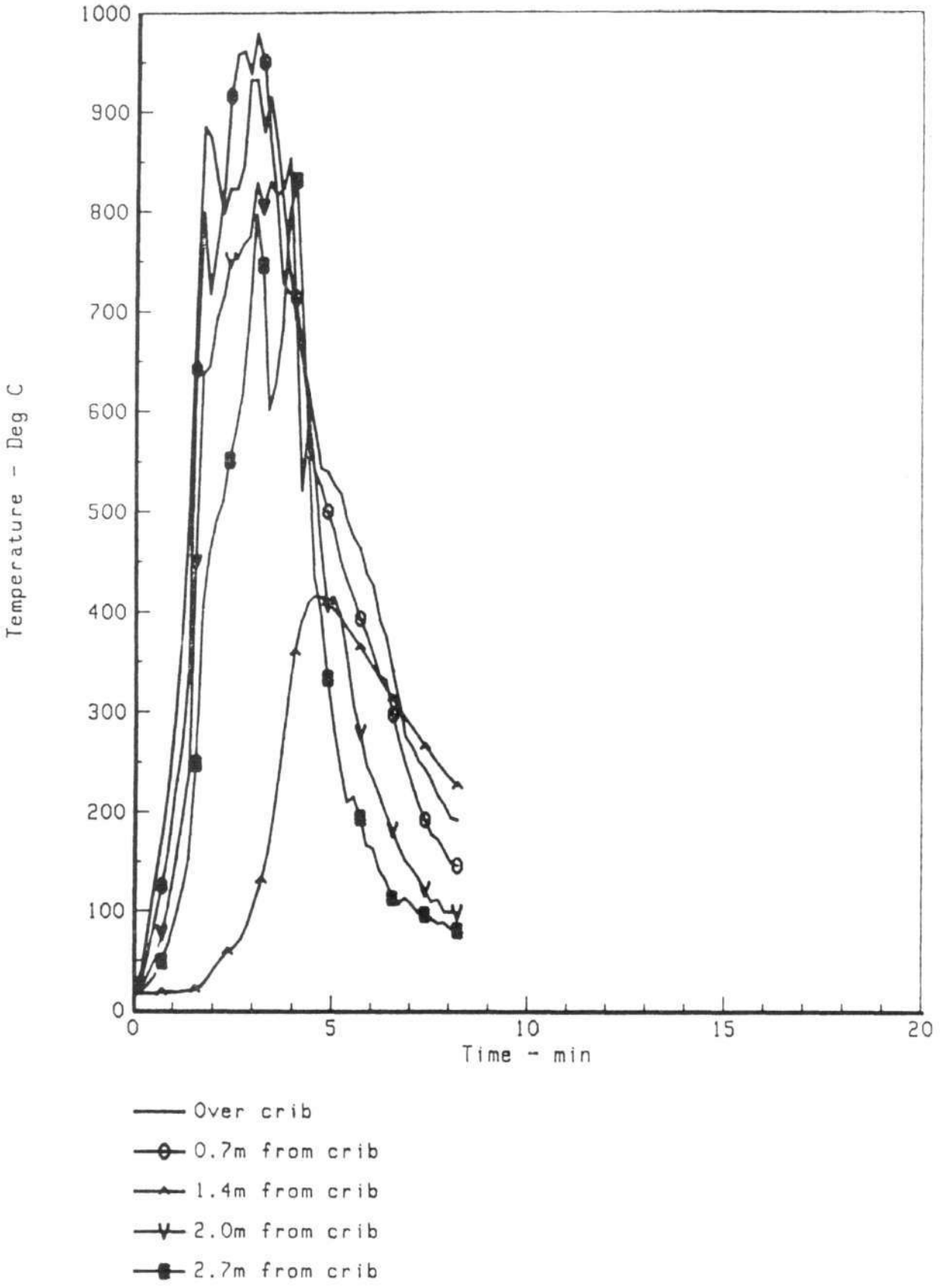


Figure G16 — *Gas temperatures at ceiling 900mm from wall in balcony rig test with simulated Stateroom tiles.*

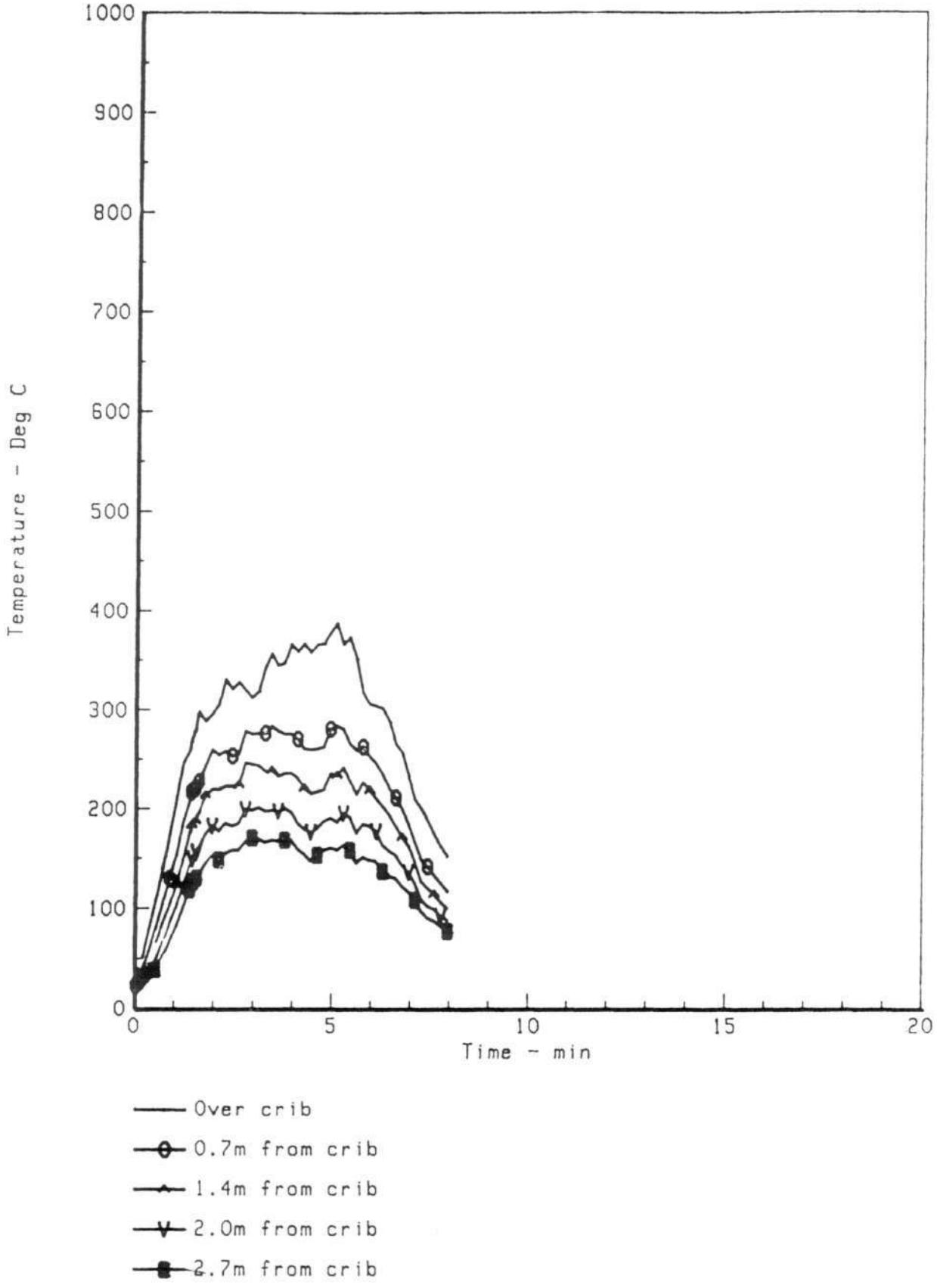
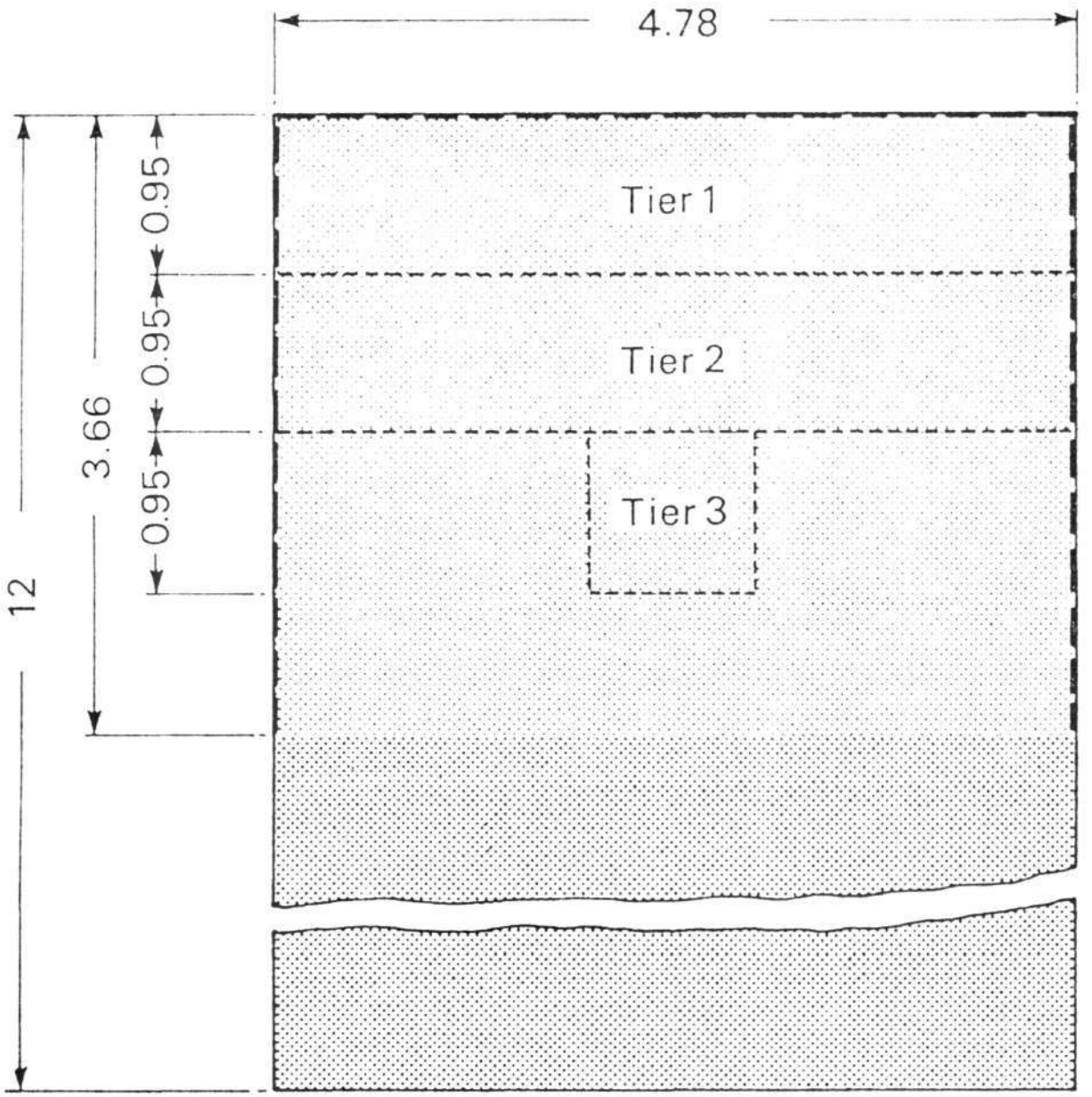


Figure G17 — *Gas temperatures at ceiling 900 mm from wall in balcony rig control test (without tiles).*



Walls lined internally with Supalux boards

Ceiling lined with Supalux boards

Ceiling lined with 50 mm thick mineral wool on wire mesh

All dimensions in m

Figure H1 — *Plan view of tiered seat rig.*

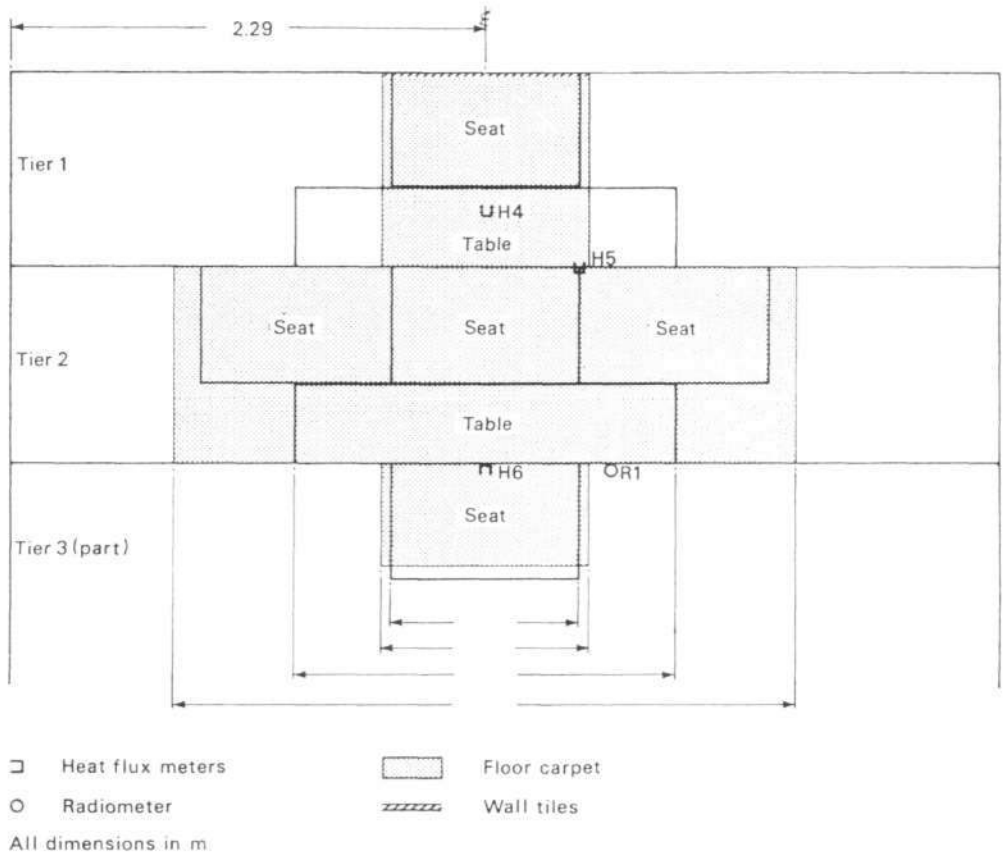


Figure H2 — *Plan view of furniture arrangement.*

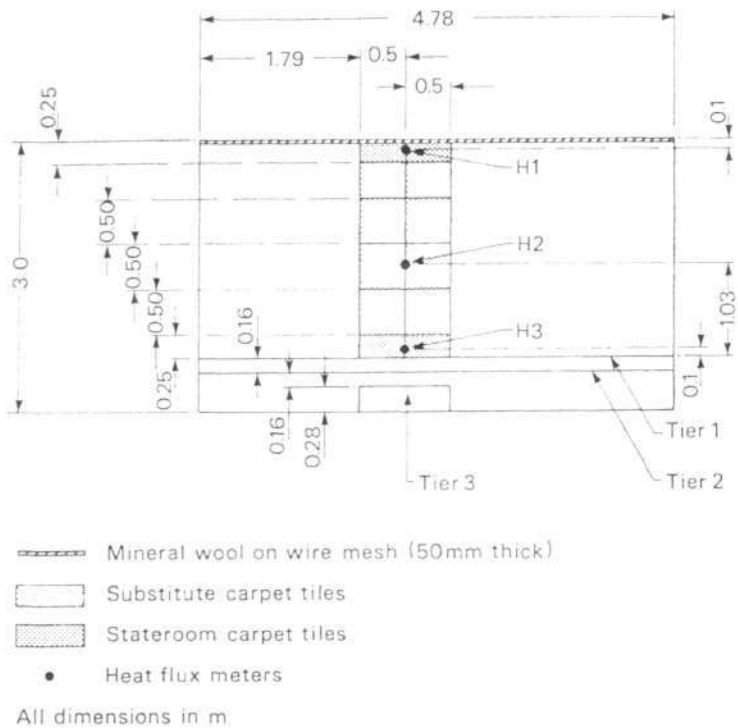


Figure H3 — *Interior of back wall of rig.*

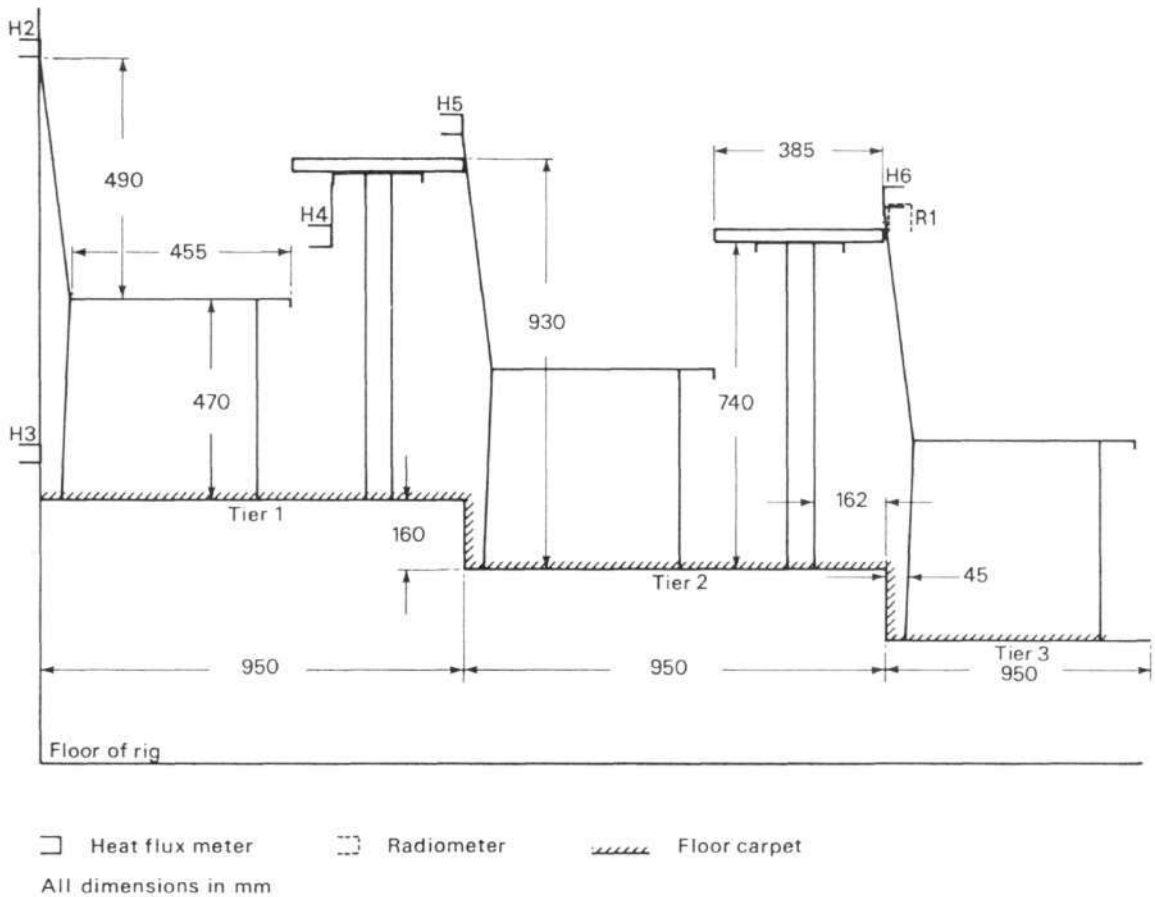


Figure H4 — *Side elevation of furniture arrangement.*

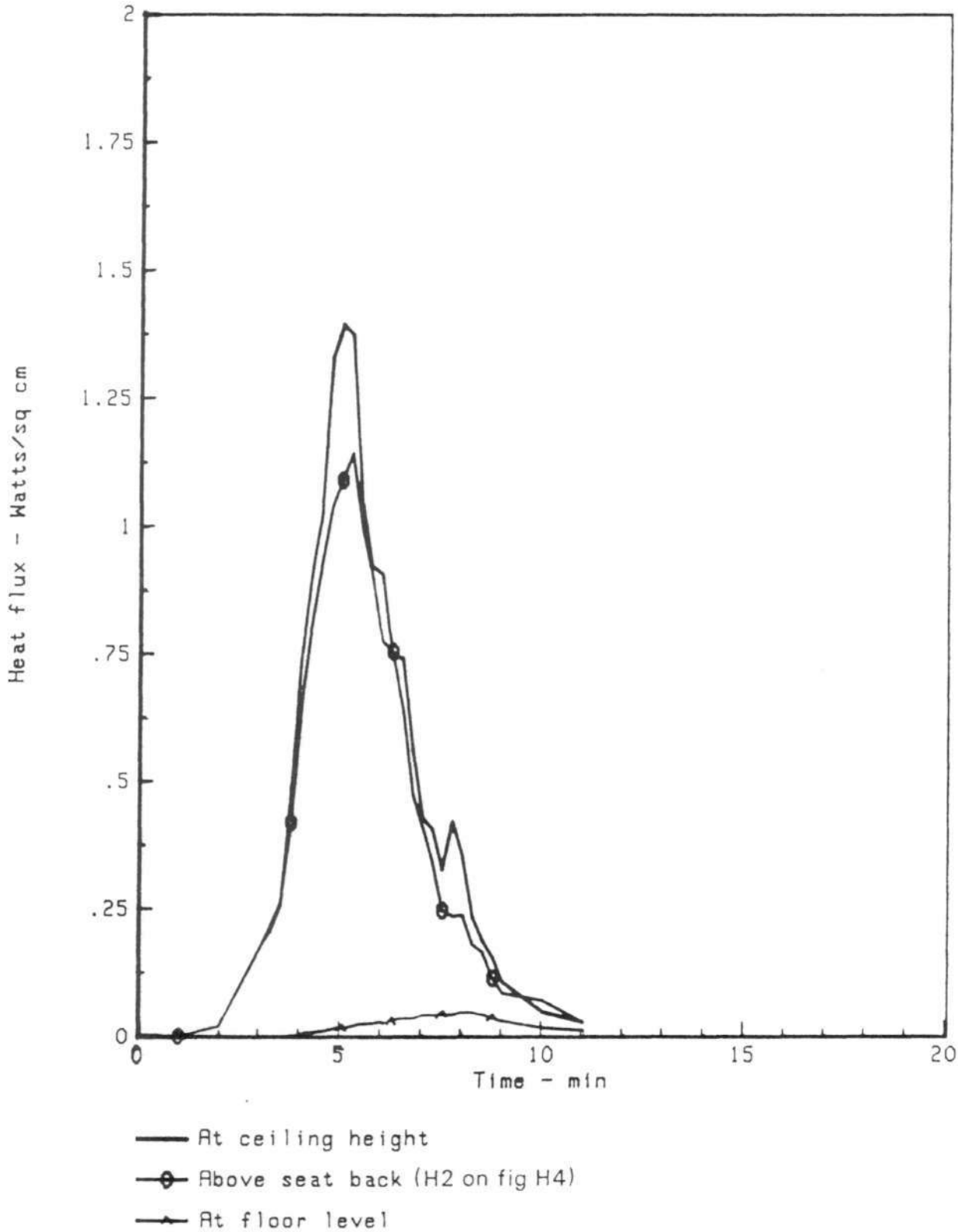


Figure H5 — *Heat flux falling on carpet tiles on back wall — Test H1 (H1-H3 on figure H4).*

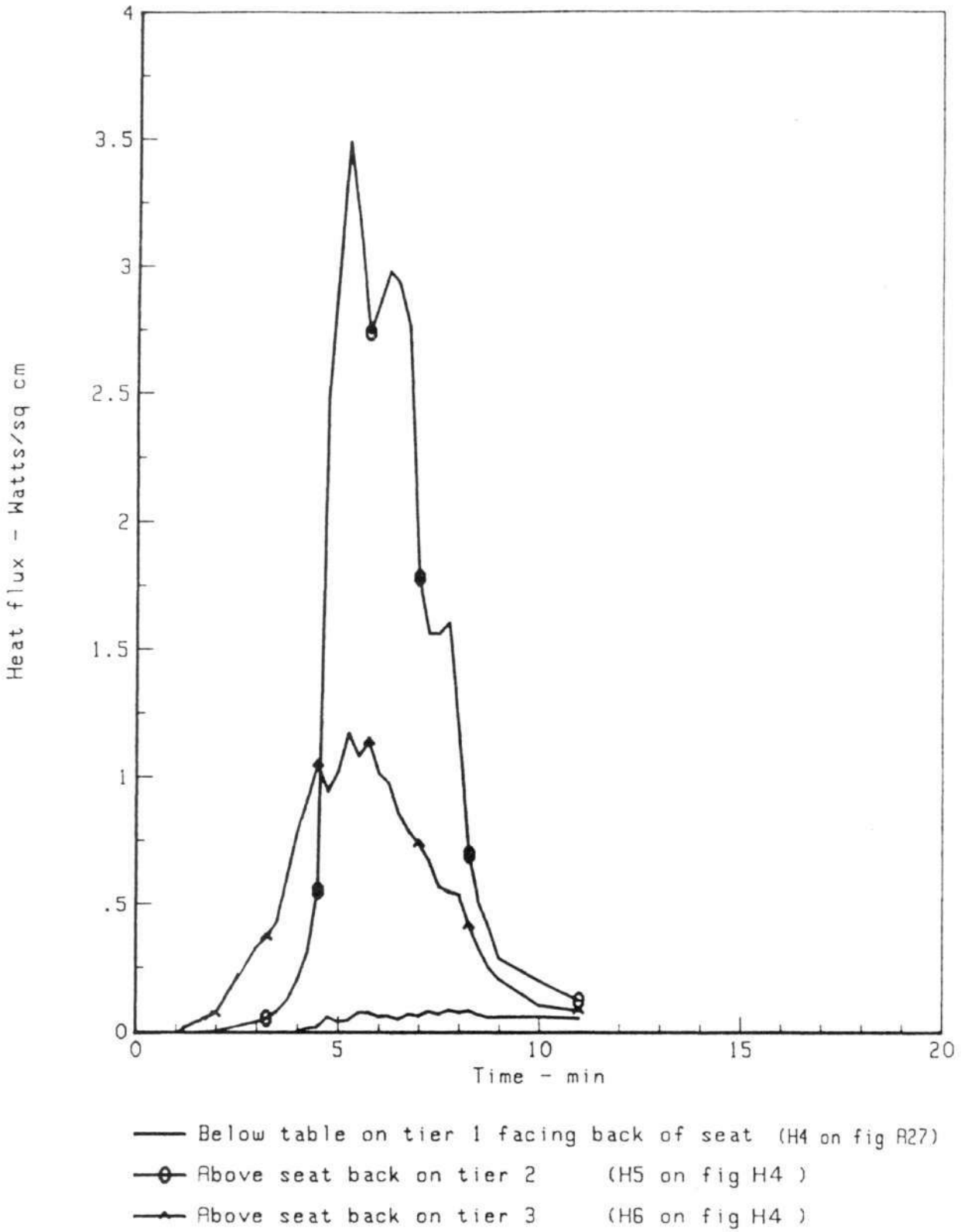


Figure H6 — *Heat flux at various points in tiered rig — Test H1 (H4-H6 on figure H4).*

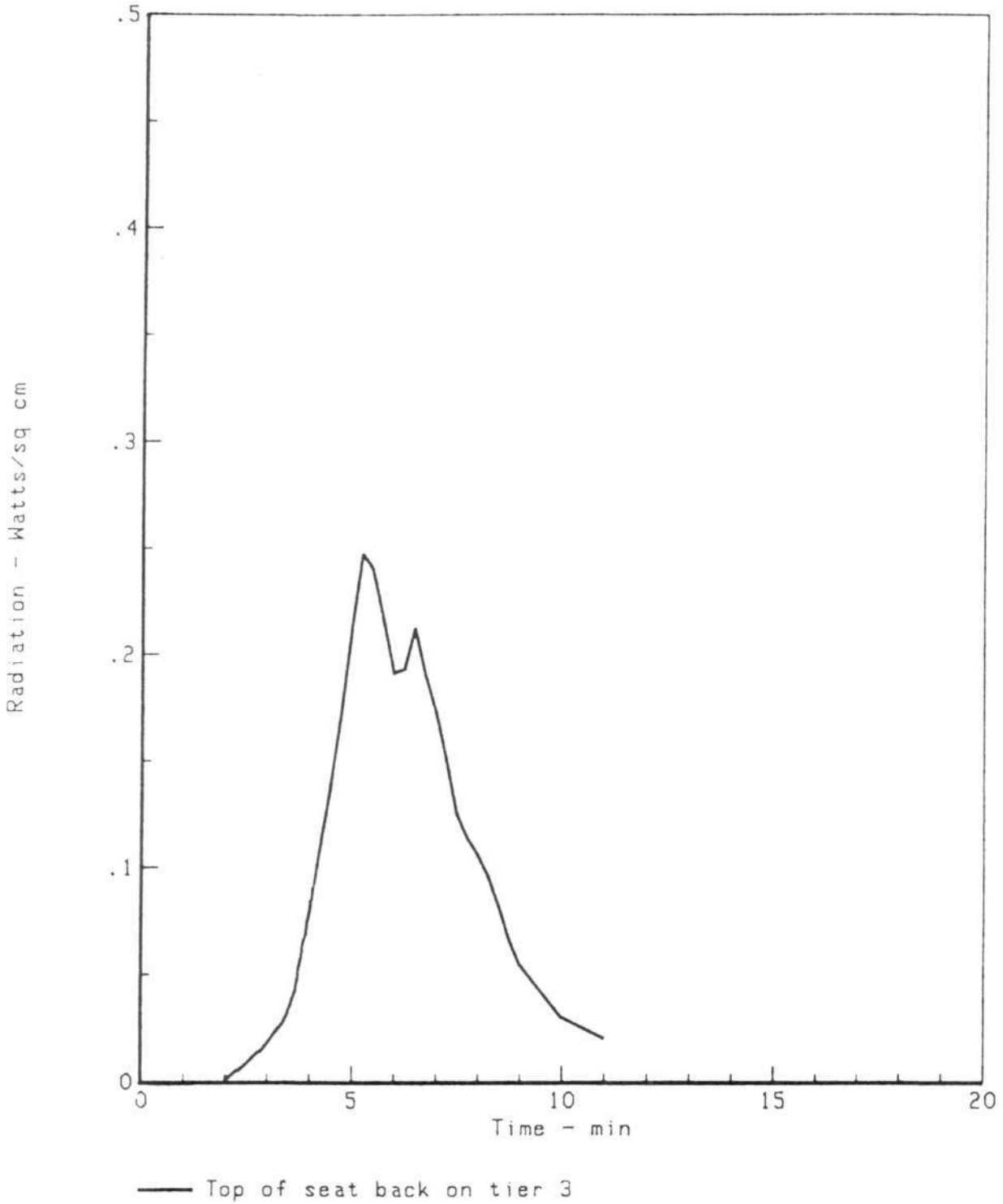


Figure H7 — *Radiation falling on seat back on Tier 3 — Test H1 (R1 on figure H4).*

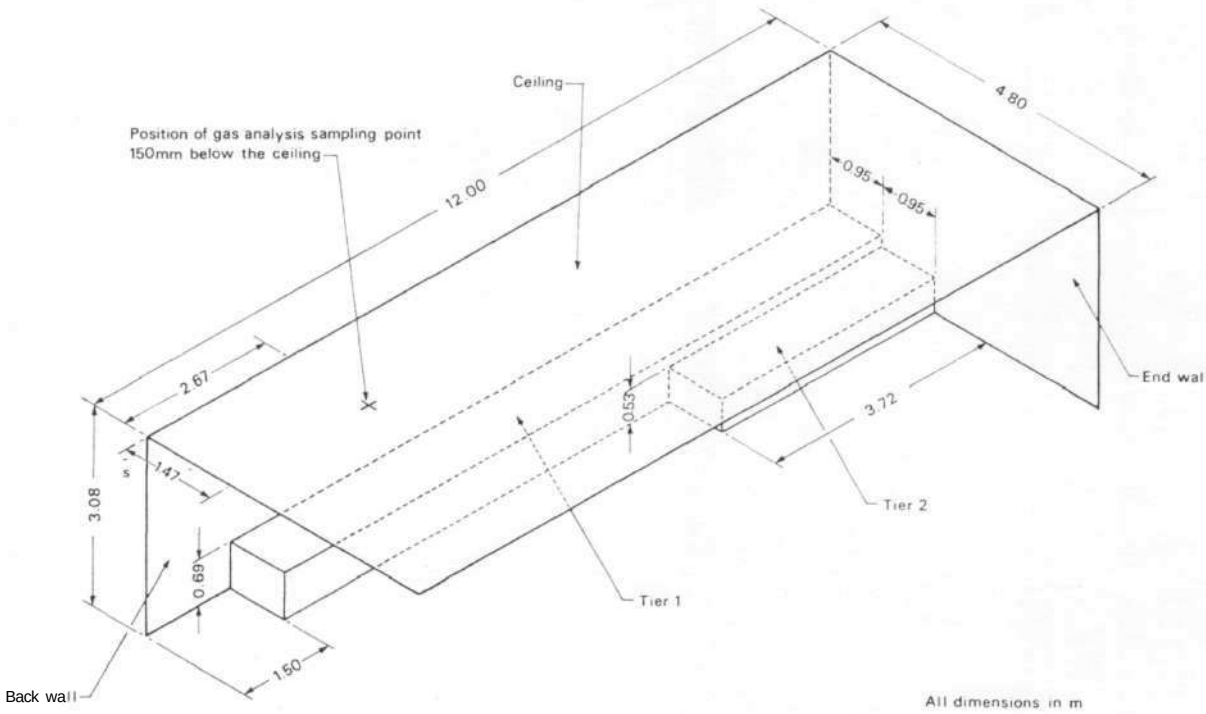
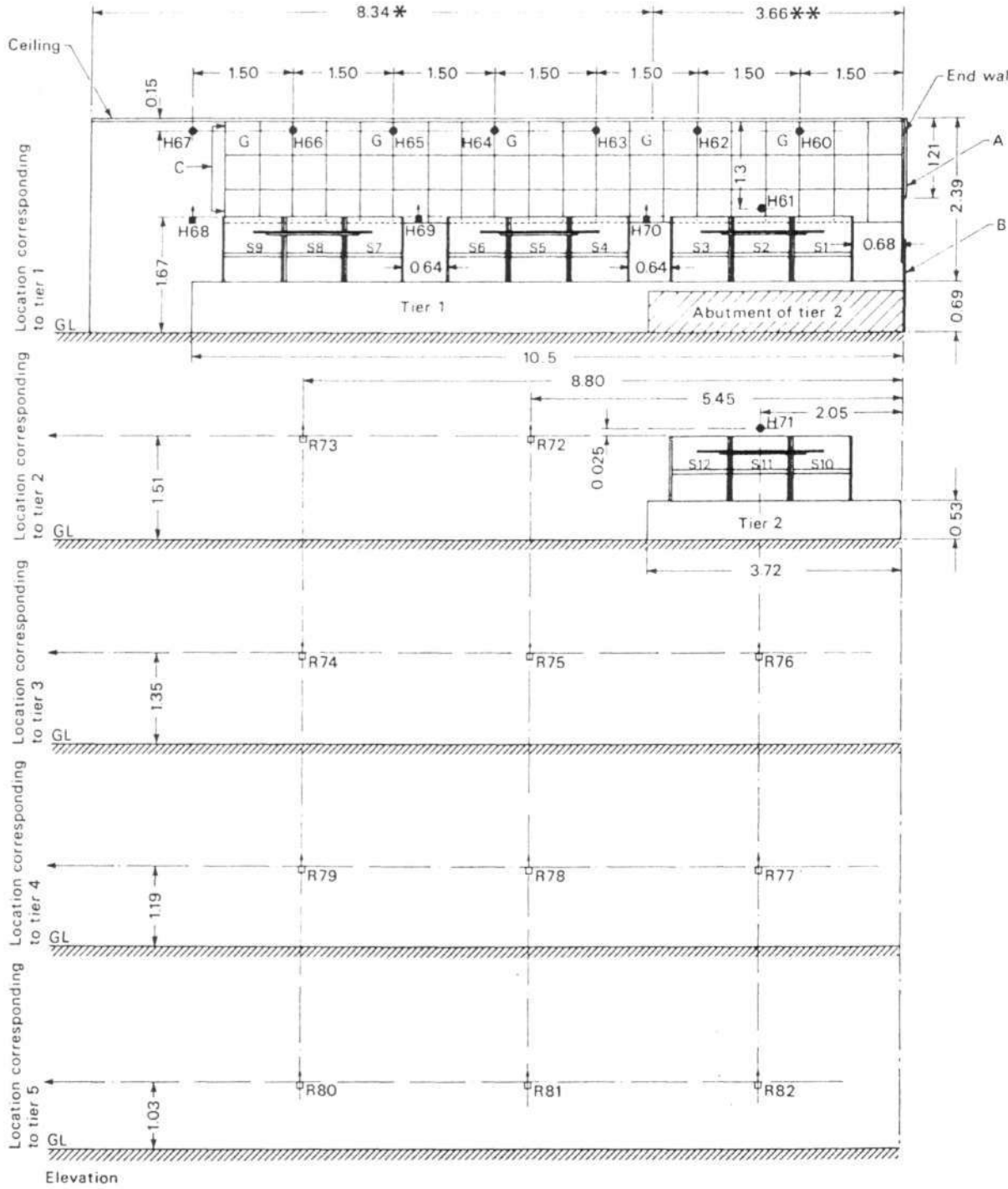


Figure H8 — *Preliminary test to determine interaction between tiered seats and wall linings — Test H2.*



Elevation

* Ceiling of asbestos wood lined with 10mm thick Supalux boards and 25mm thick mineral wool on wire mesh

** Ceiling of asbestos wood lined with 50mm thick mineral wool on wire mesh

A End wall asbestos wood skirt lined with 10mm Supalux board

B 10mm Supalux board

C 60 carpet tiles – 55 Simulated Stateroom, 5(G) Stateroom

All dimensions in m

Figure H9 — *Preliminary test to determine interaction between tiered seats and wall linings— Instrumentation — Test H2.*

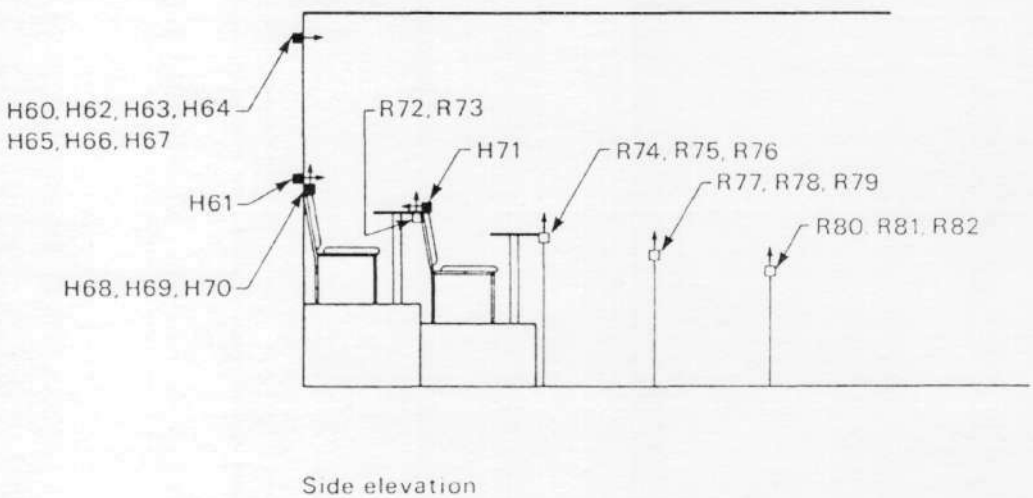


Figure H10 — *Preliminary test to determine interaction between tiered seats and wall linings— Test arrangement and location of instrumentation — Test H2.*

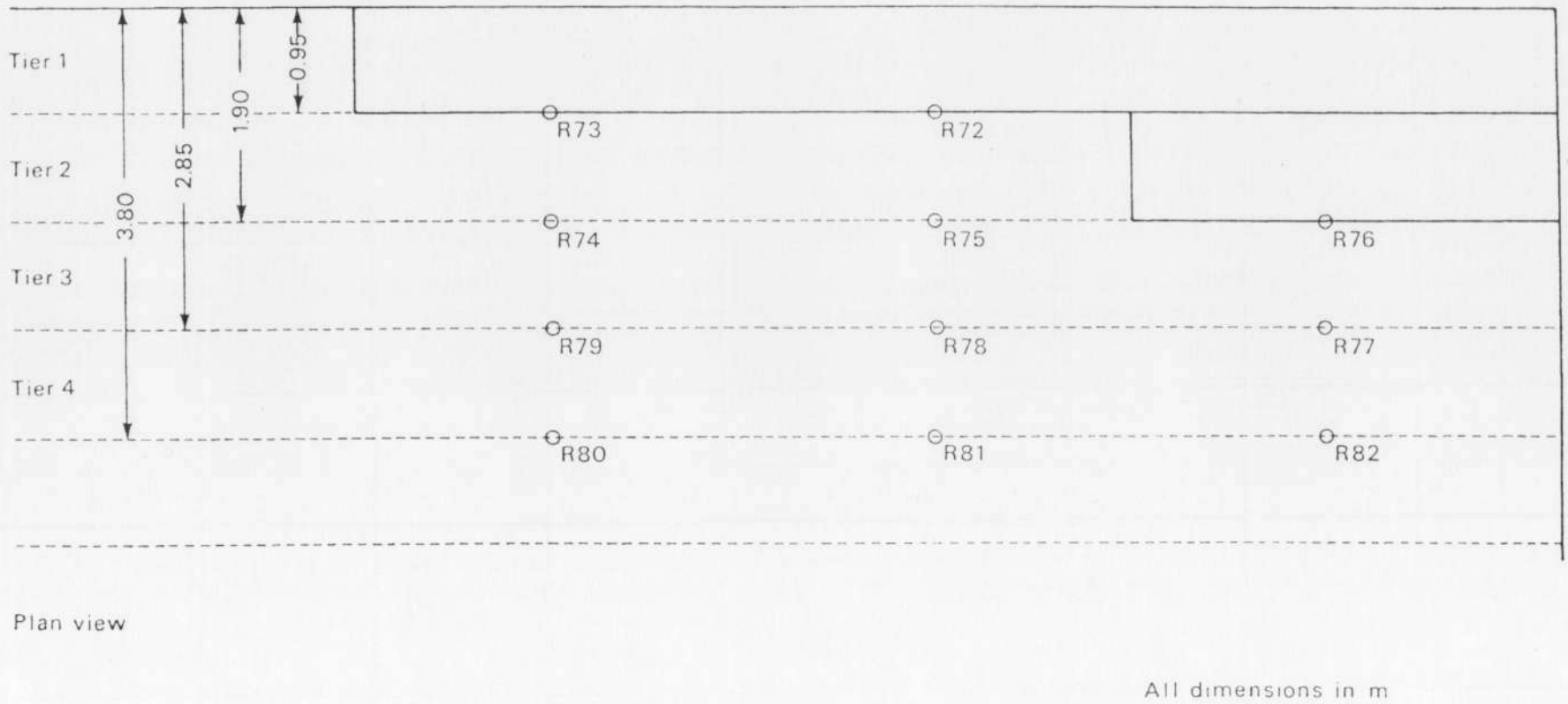


Figure H11 — *Preliminary test to determine interaction between tiered seats and wall linings — Position of tiers and location of radiometers — Test H2.*

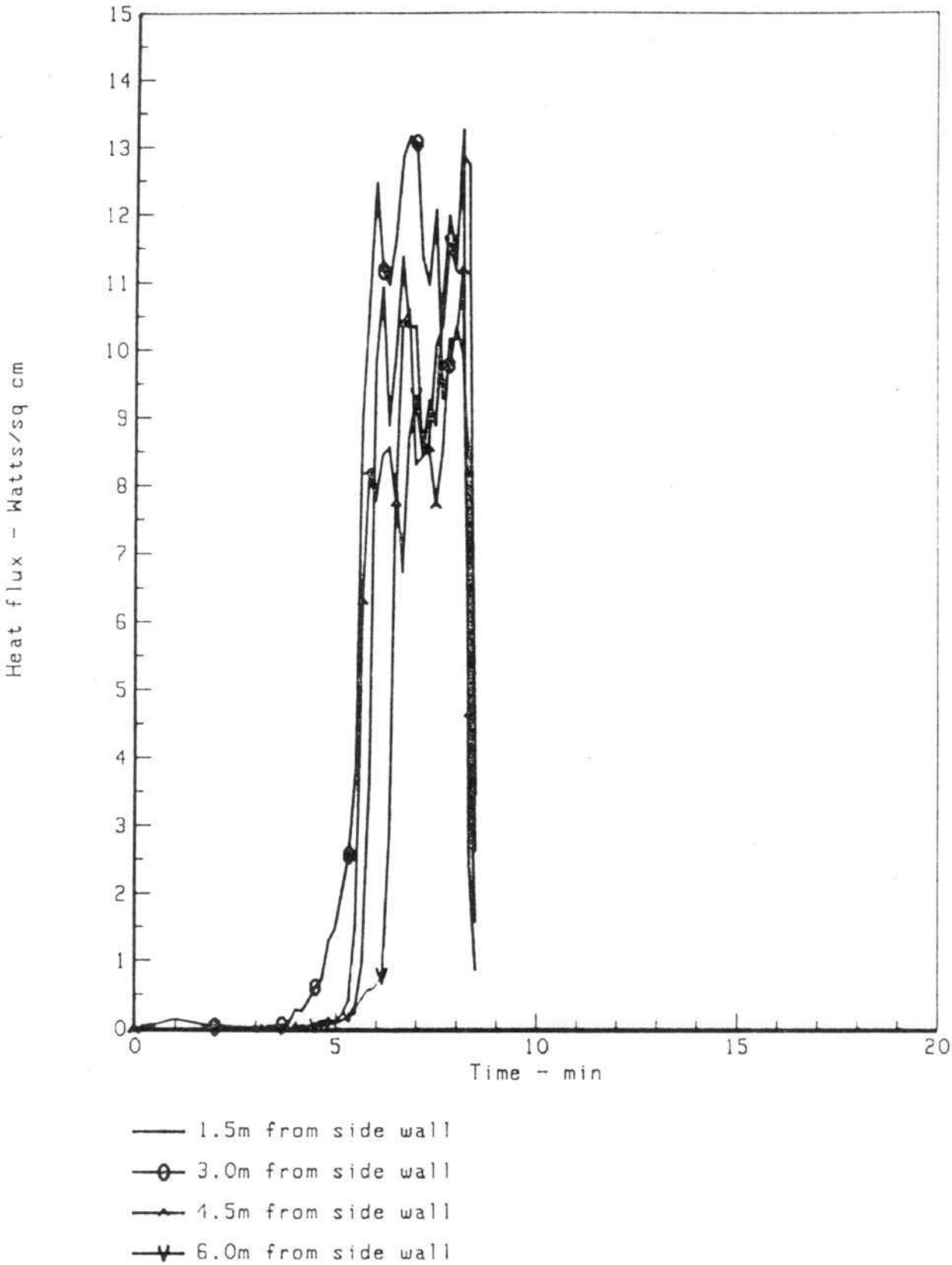


Figure H12 — *Heat flux falling on carpet tiles on rear wall 150mm below ceiling (H60 & H62-H64 on figure H9).*

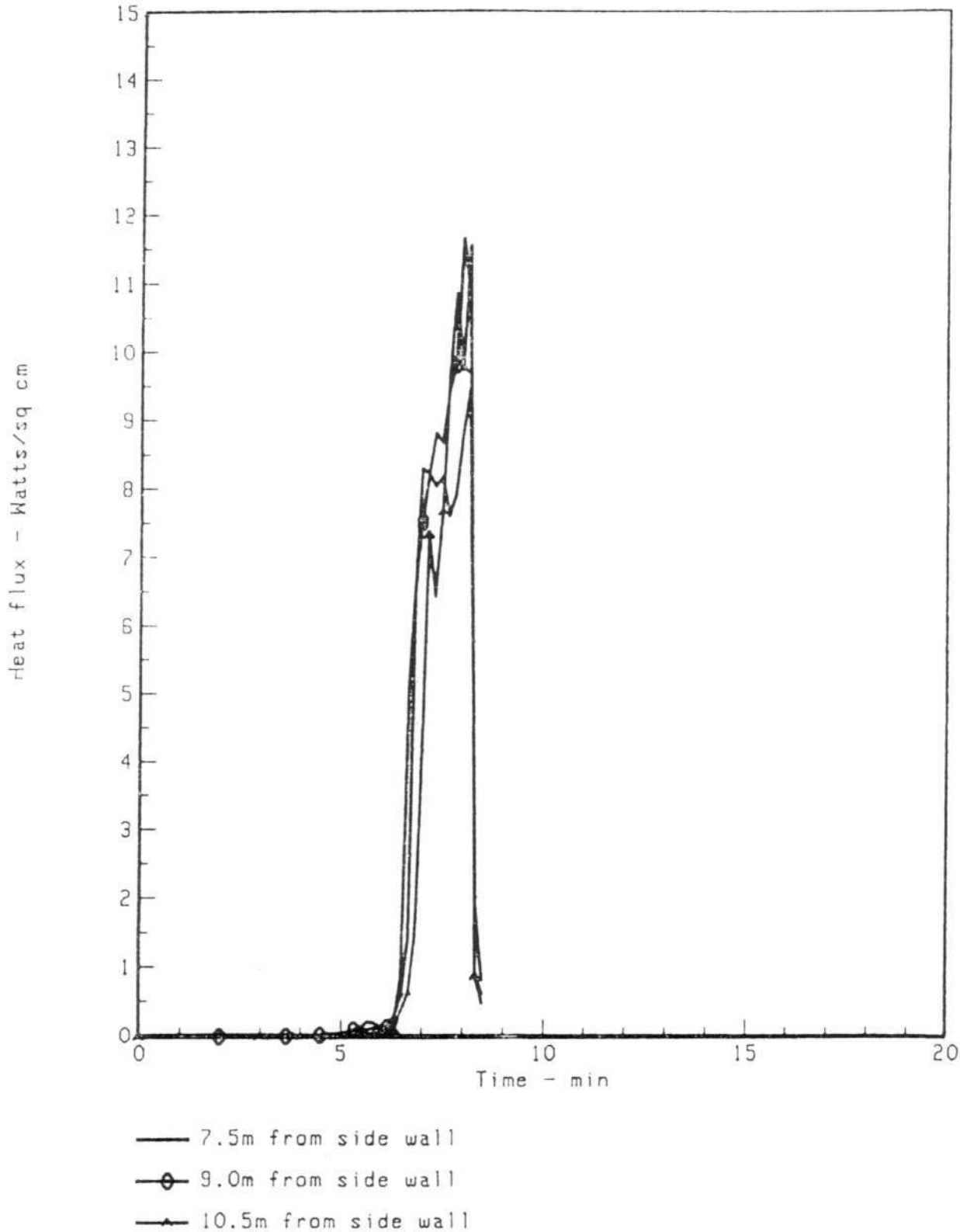


Figure H13 — *Heat flux falling on carpet tiles on rear wall 150mm below ceiling (H65-H67 on figure H9).*

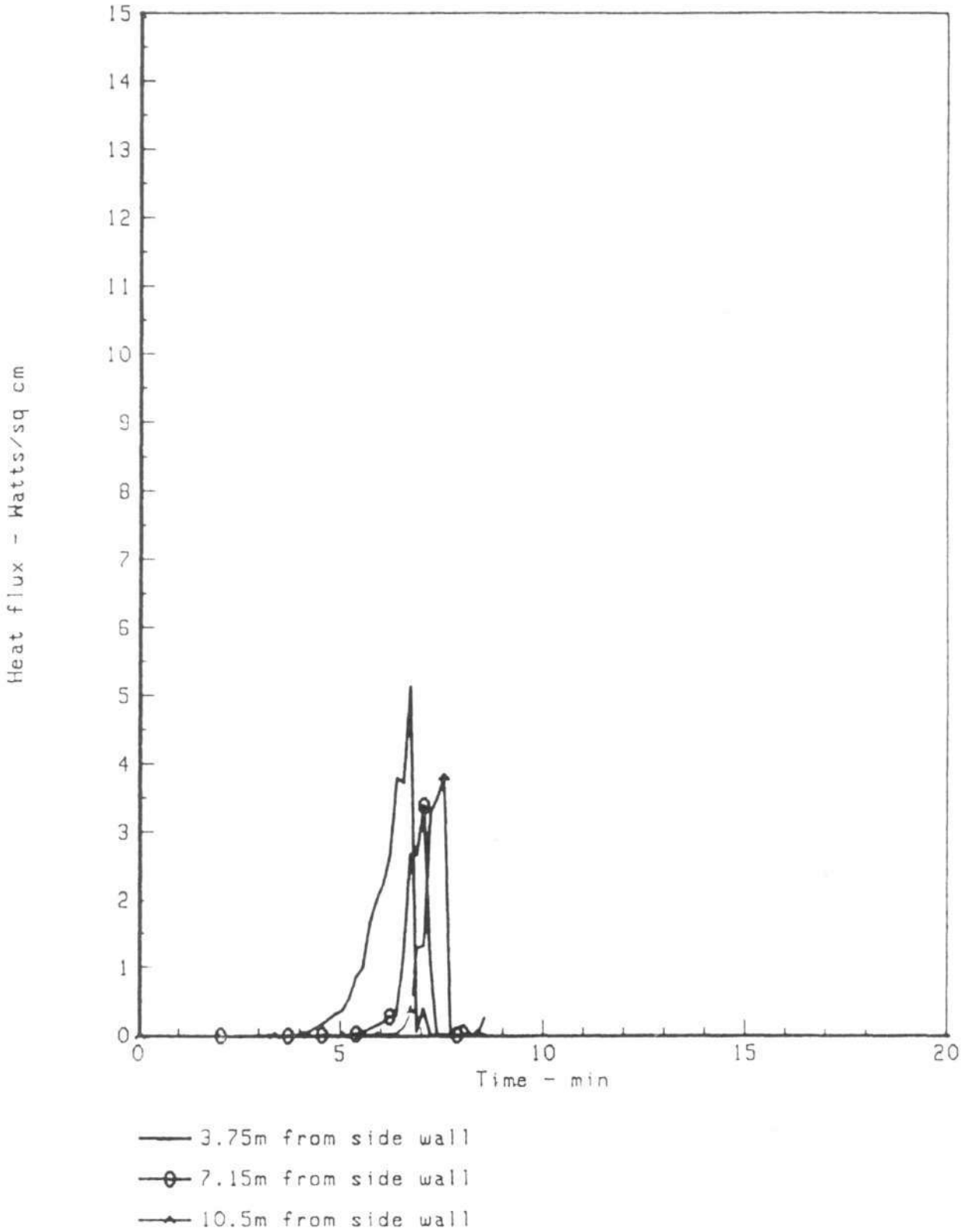


Figure H14 — *Heat flux level with top of seats in Tier 1 at various distances (H68-H70 on figure H9).*

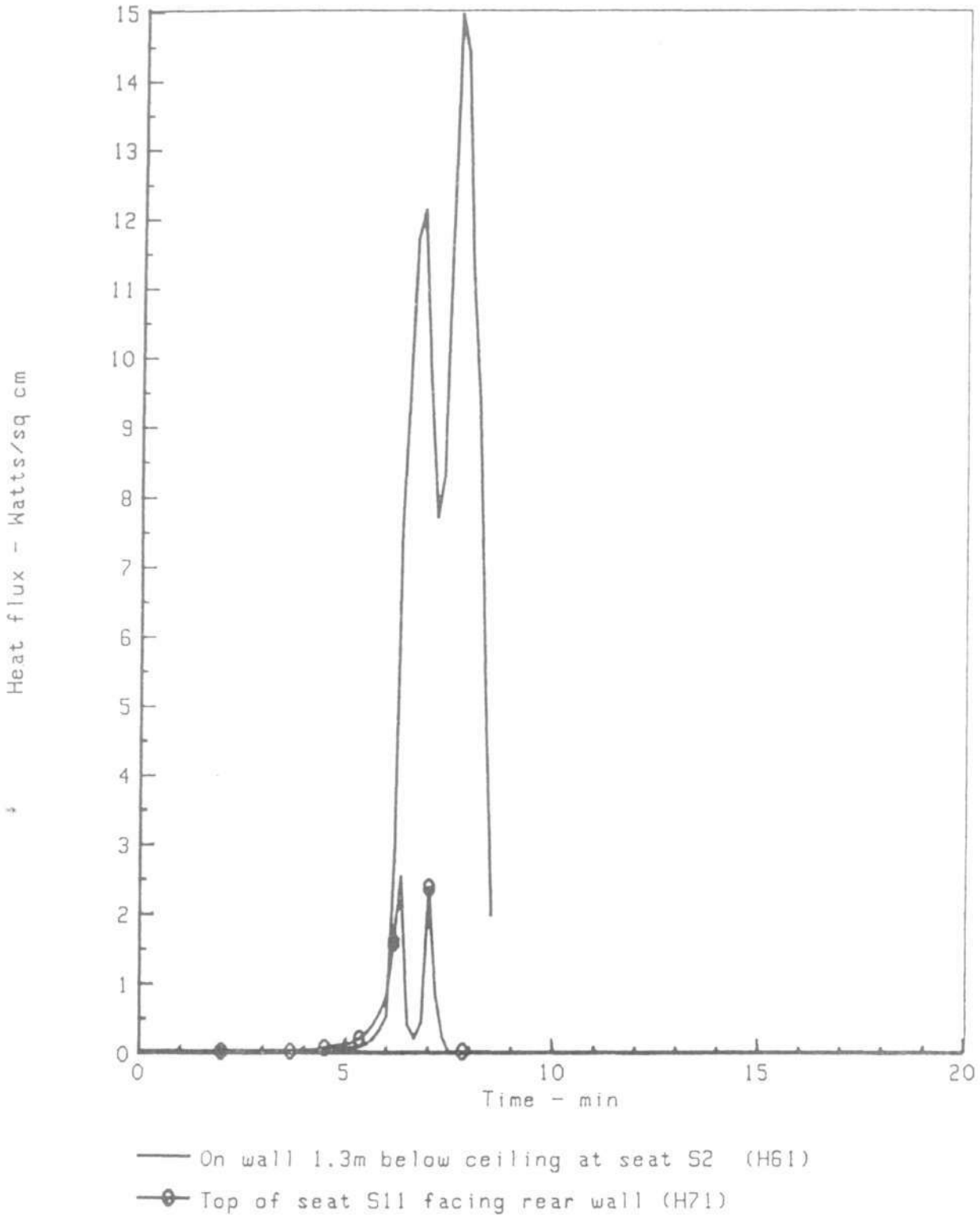


Figure H15 — *Heat flux at points indicated (as on figure H9).*

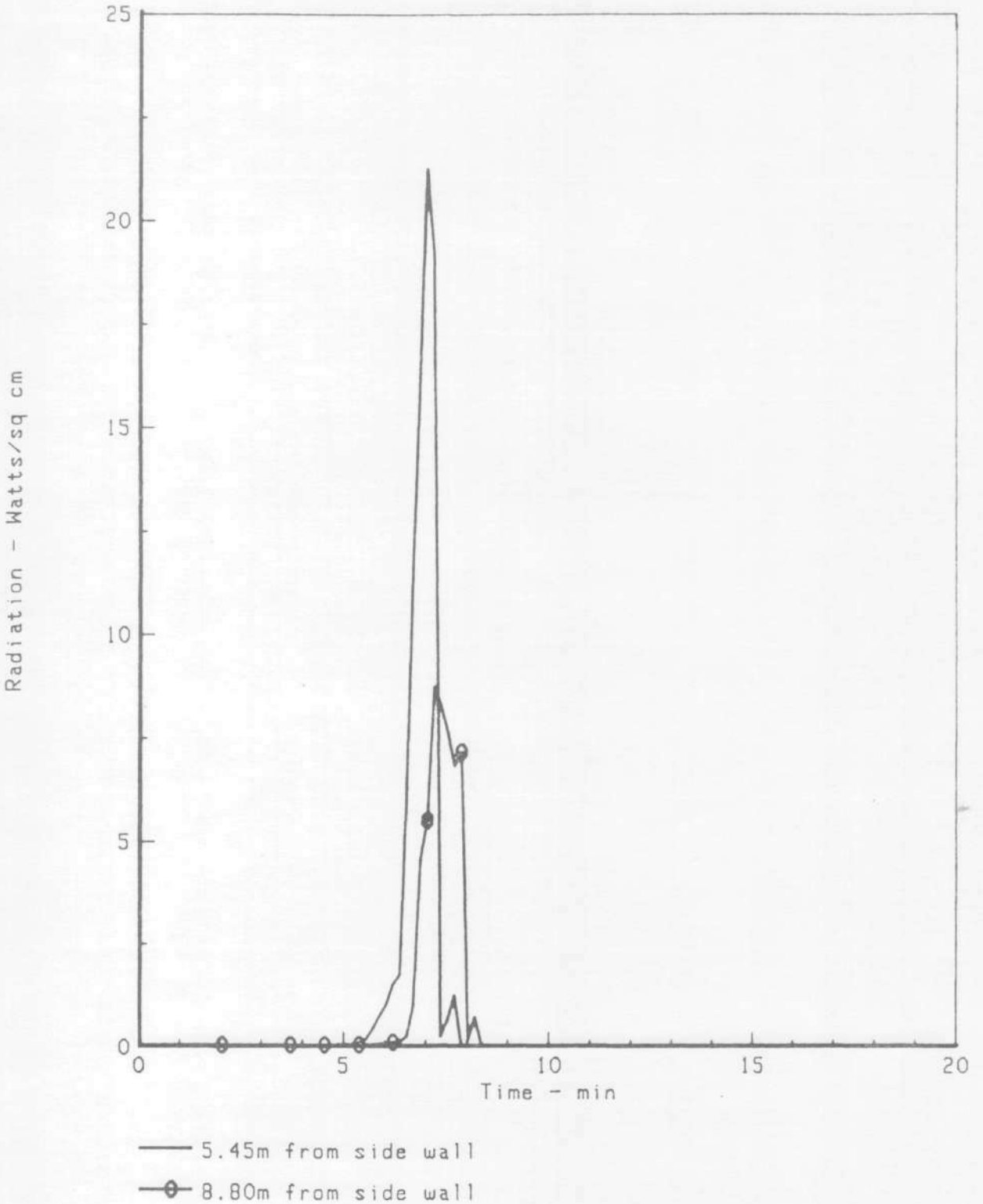


Figure H16 — *Radiation falling at seat-back top height Tier 2 (R72-R73 on figure H9).*

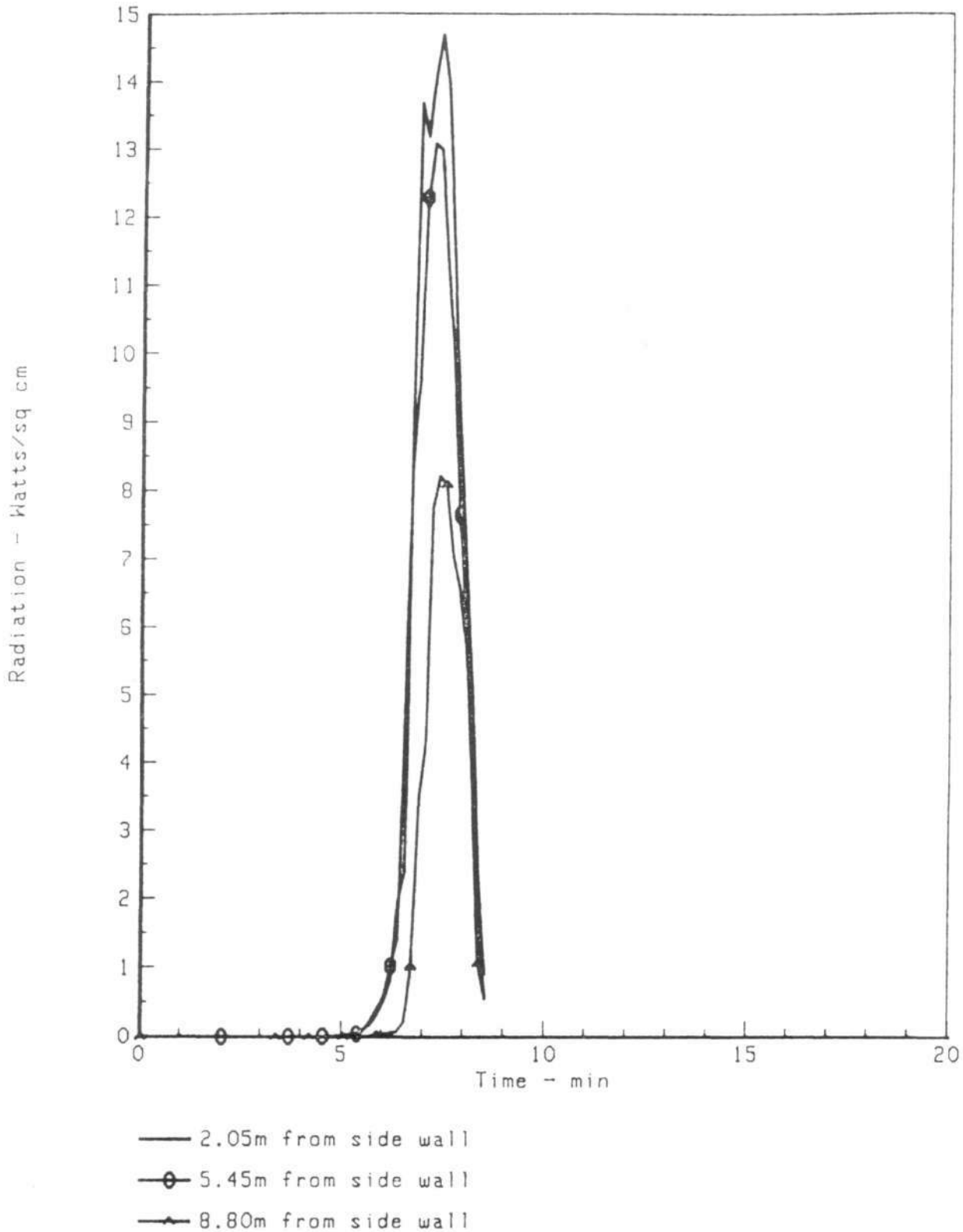


Figure H17 — *Radiation falling at seat-back top height Tier 3 (R74-R76 on figure H9).*

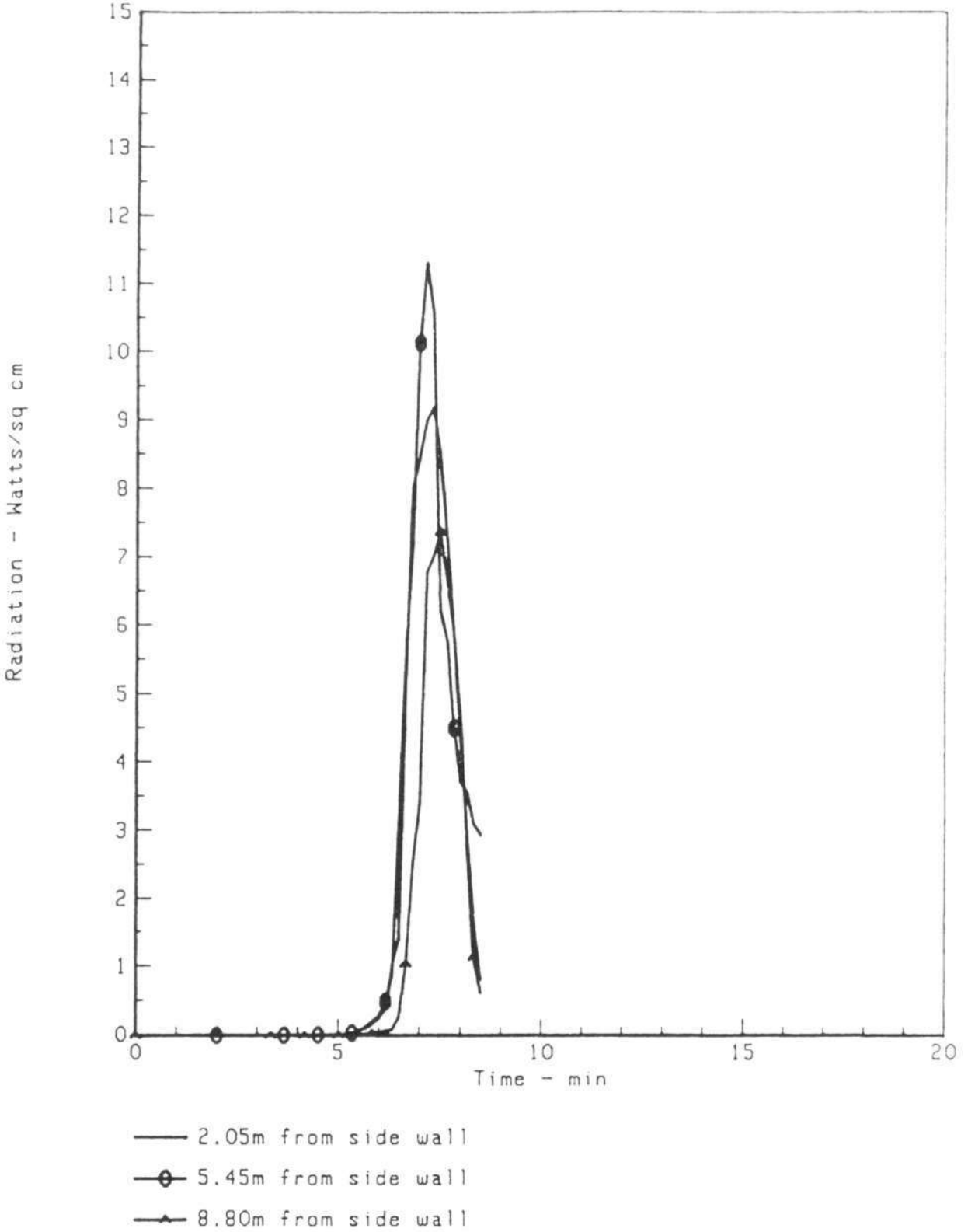


Figure H18 — *Radiation falling at seat-back top height Tier 4 (R77-R79 on figure H9).*

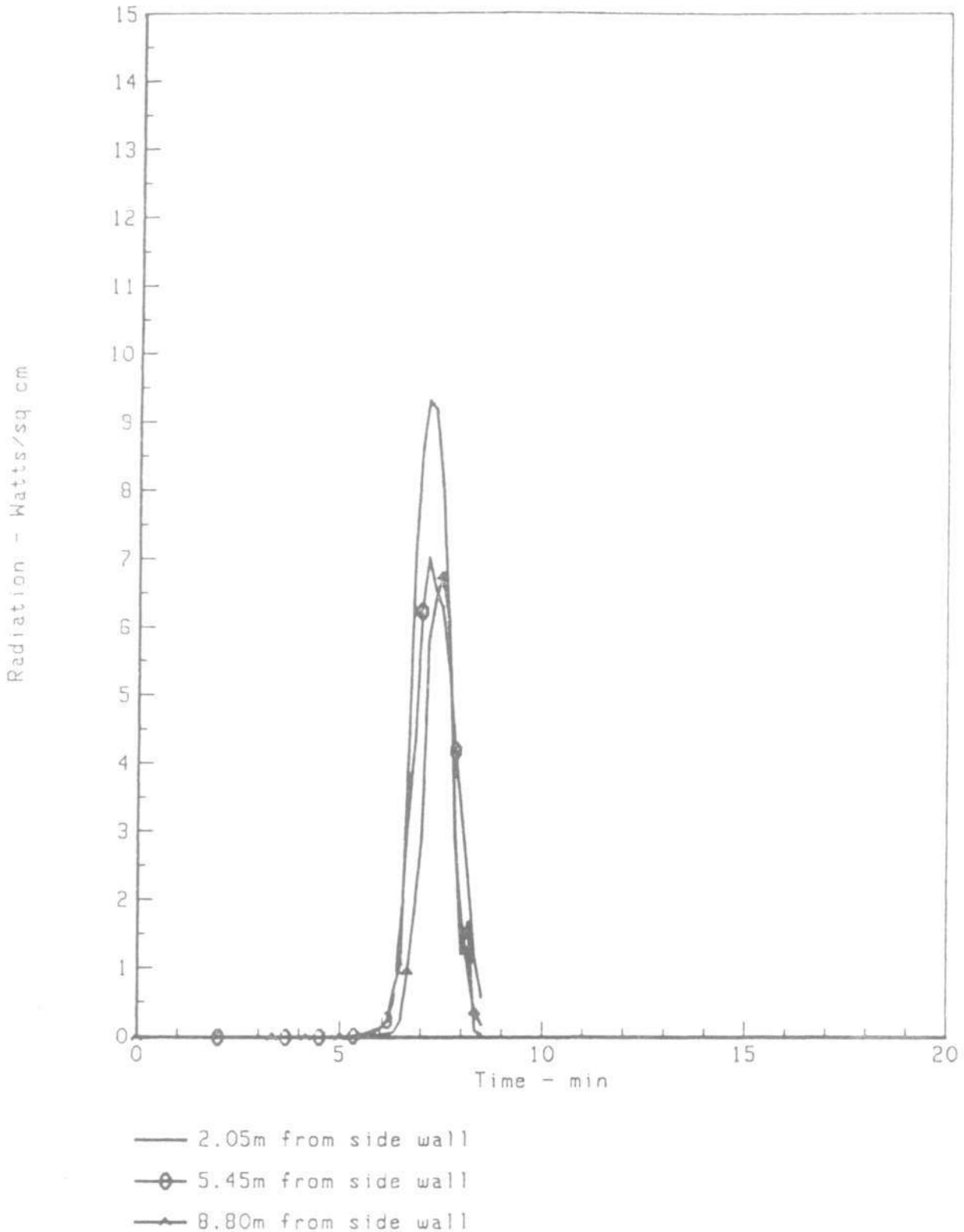


Figure H19 — *Radiation falling at seat-back top height Tier 5 (R80-R82 on figure H9).*

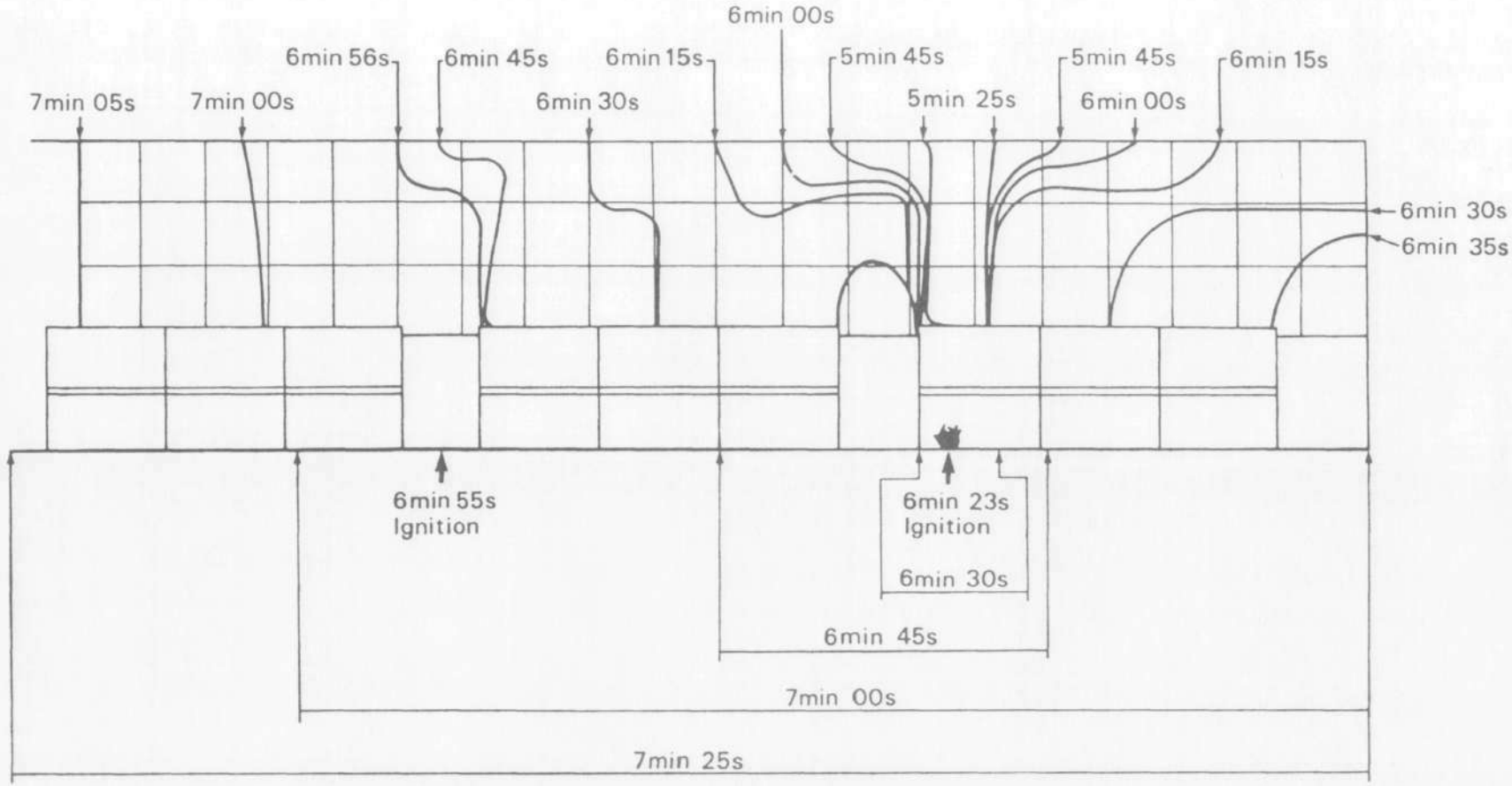


Figure H20 — *Spread of fire on carpet tiles and floor carpet — Test H2.*

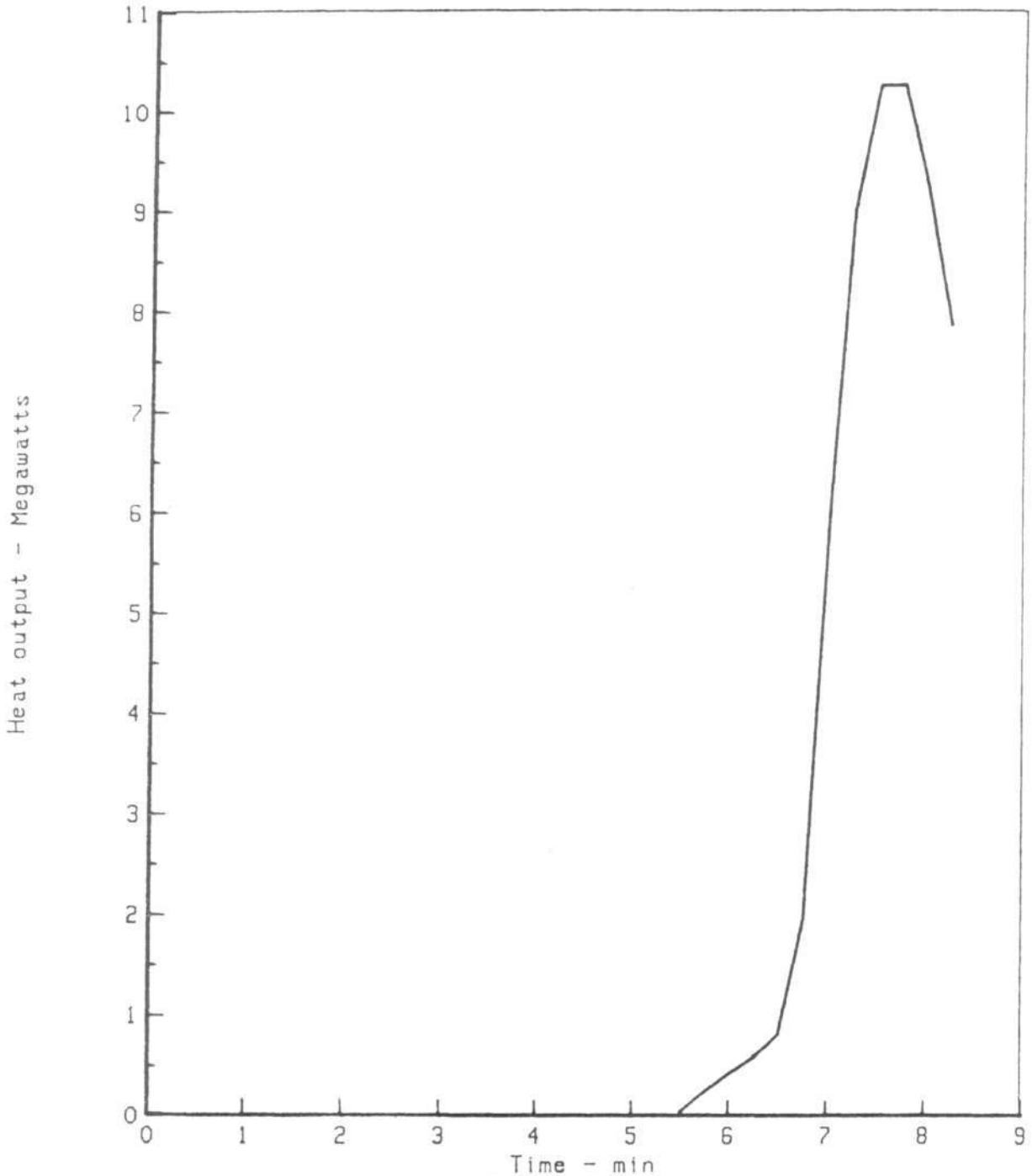


Figure H21 — *Potential heat output from spread along back row.*

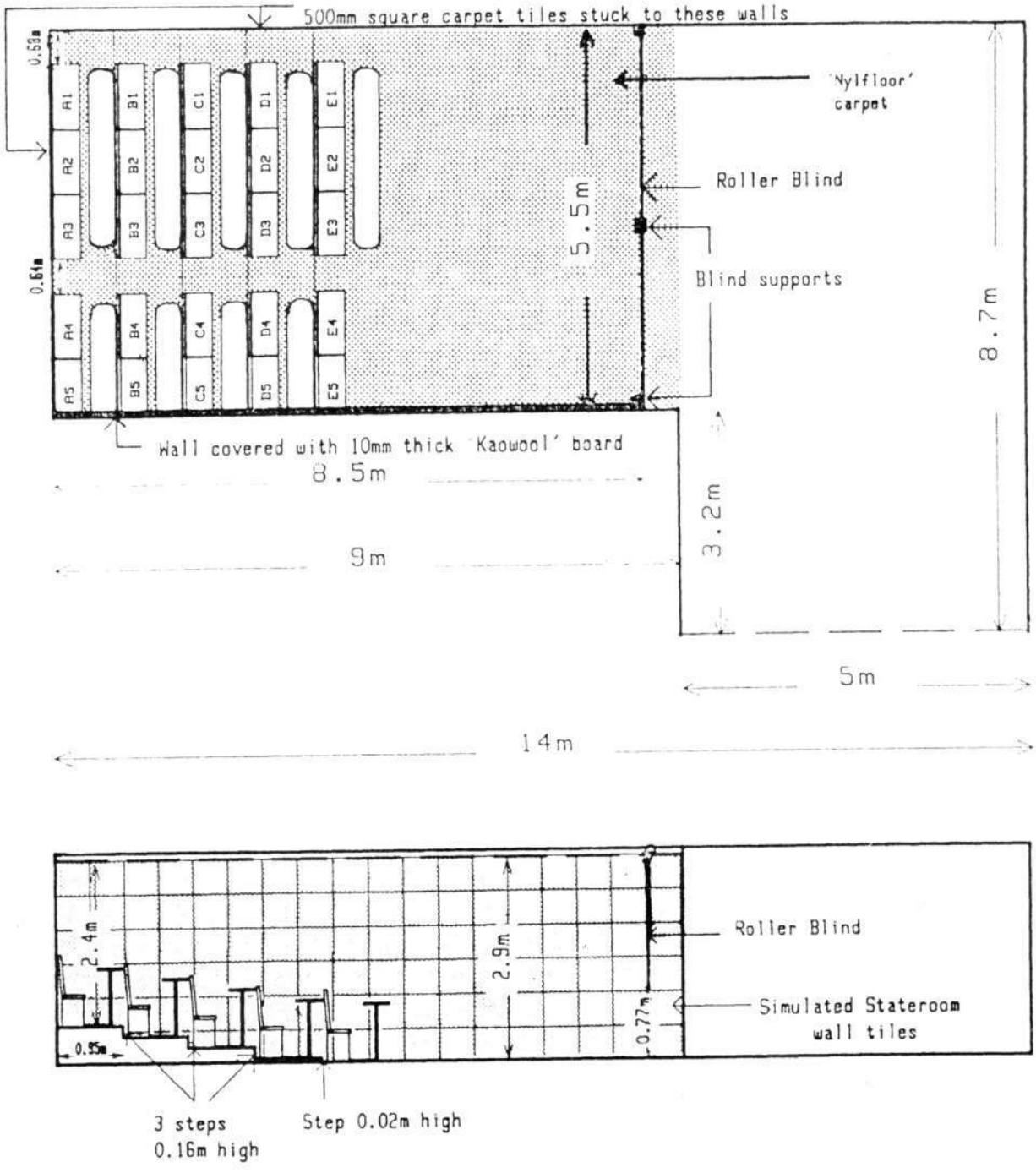
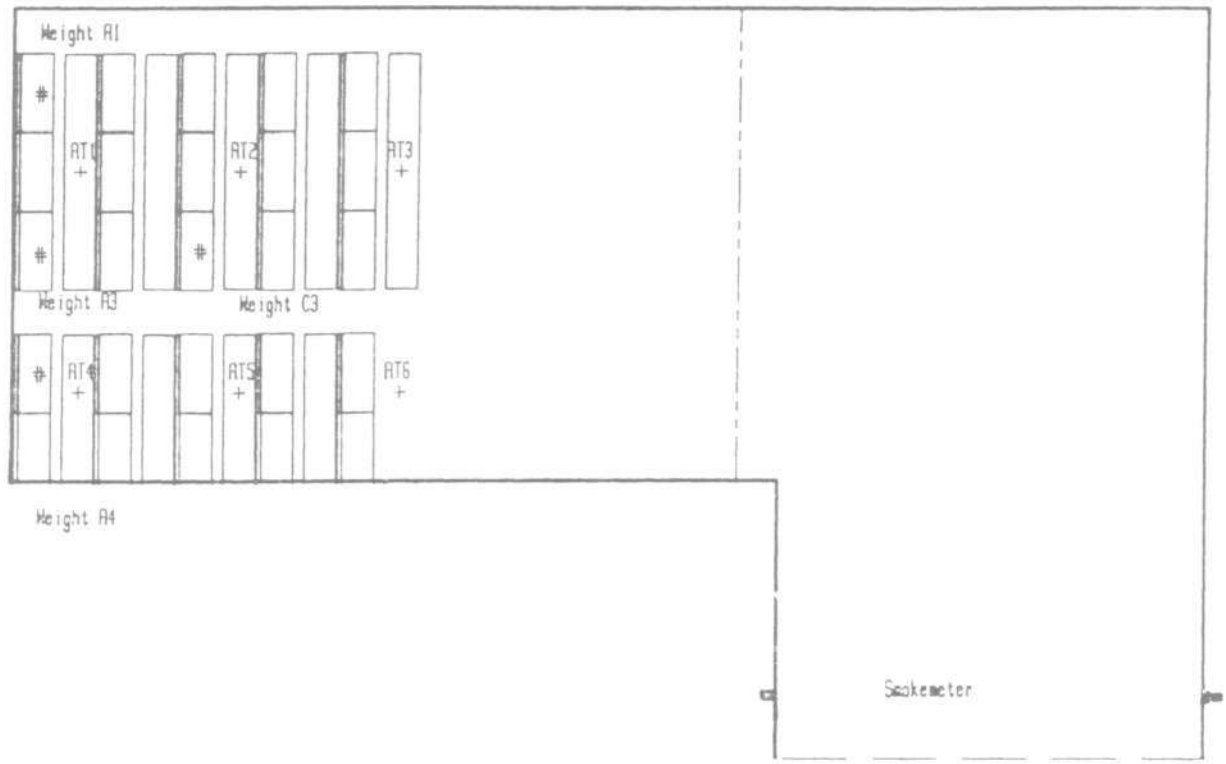
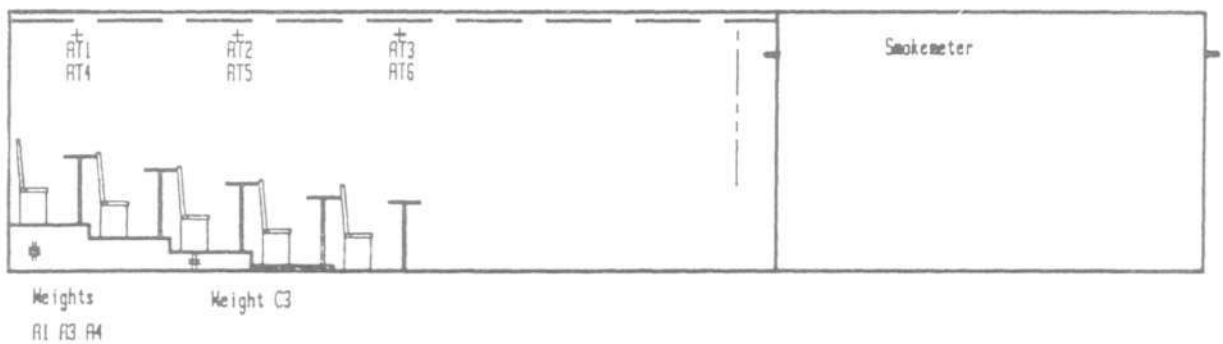


Figure I1 — *Test rig used in final demonstration showing locations of seating units and tables and roller blind.*

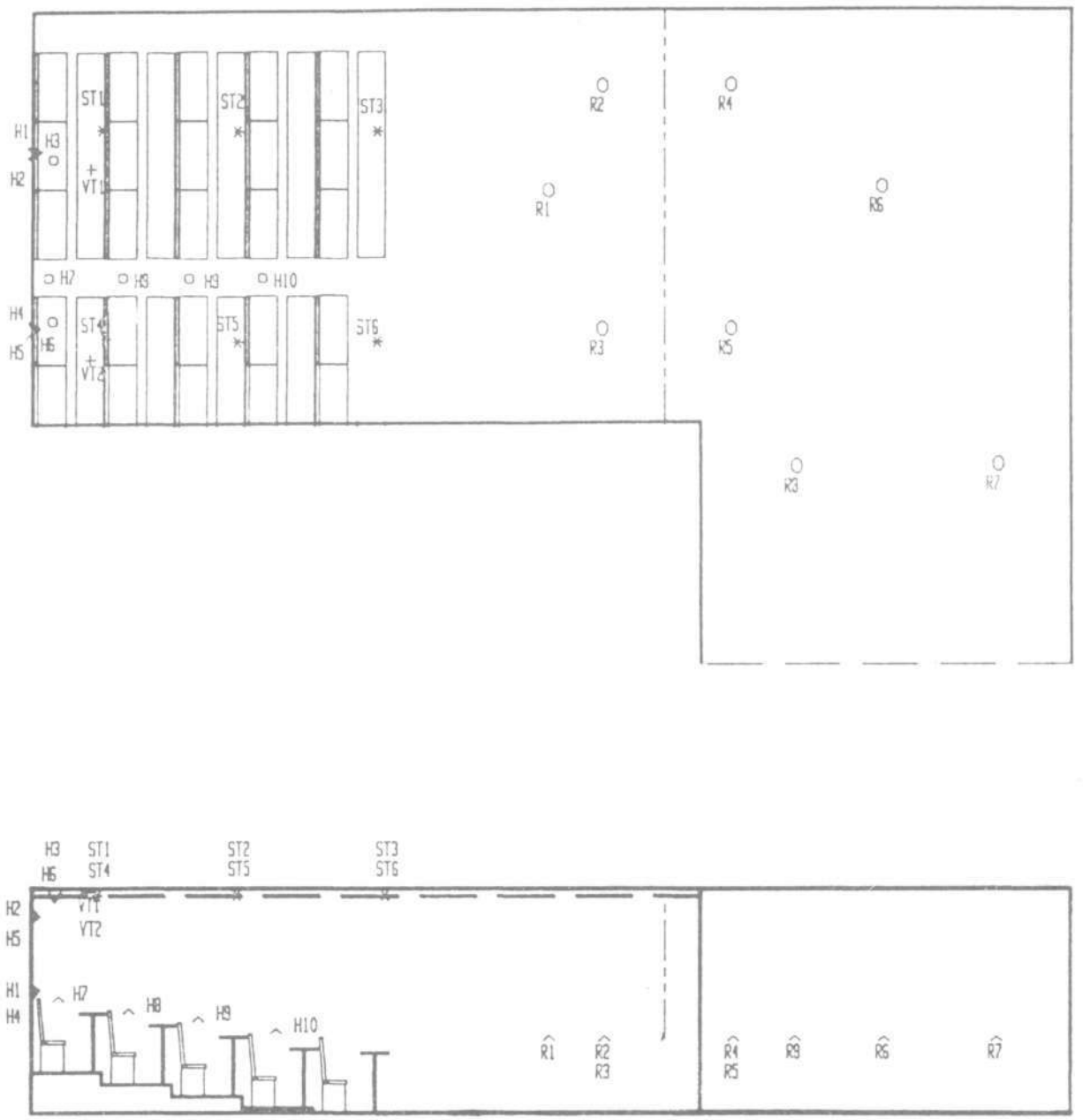




#Weight loss of seats A1 A3 A4 and C3

+AT1 to AT6 Sheathed thermocouples 100mm below ceiling

Figure I2 — *Positions of instruments for weight loss smoke and gas temperatures near ceiling.*



* ST1 to ST6 Surface thermocouples on underside of ceiling tiles

\+ VT1 and VT2 Sheathed thermocouples in void above ceiling

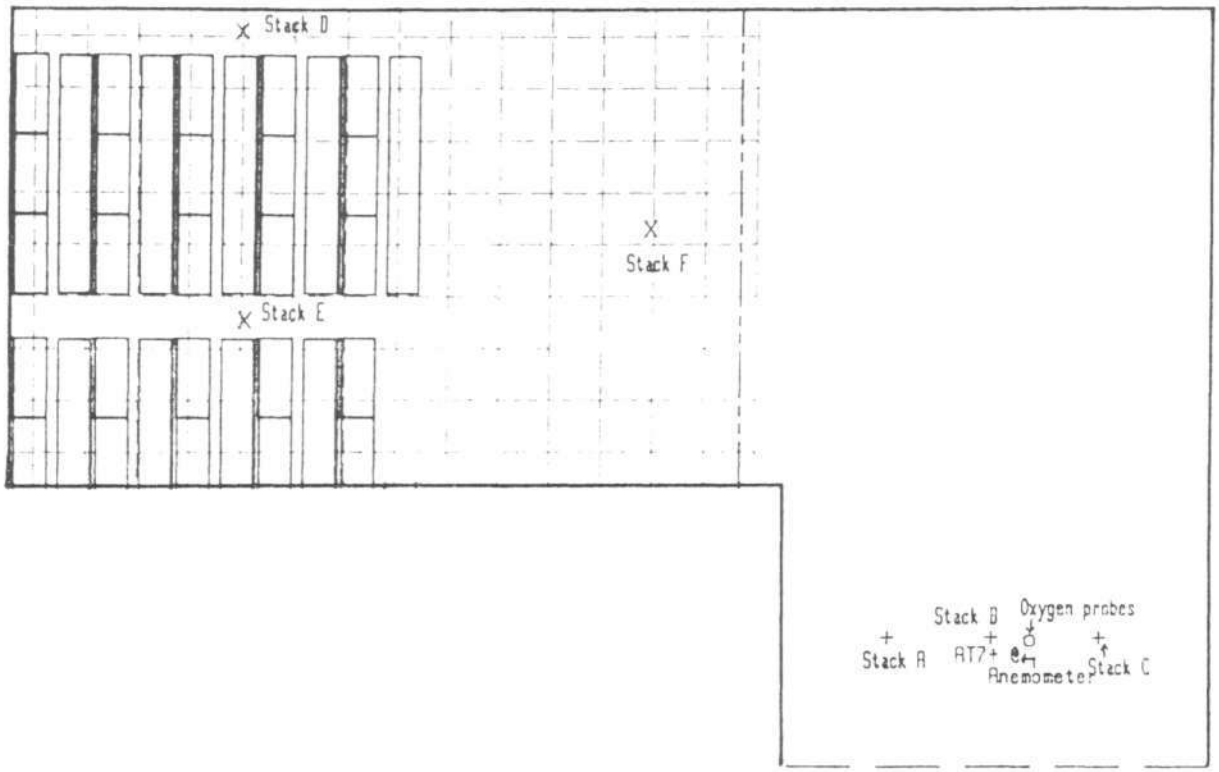
> H1 H2 H4 and H5 Heat fluxmeters flush with wall tiles

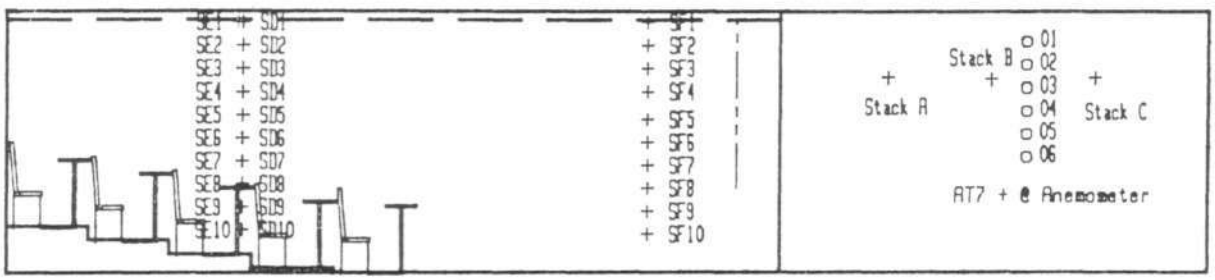
V H3 and H6 Heat fluxmeters facing down flush with ceiling

^o H7 to H10 Heat fluxmeters facing up level with seat tops on each tier

O ^ Radiometers facing up 1m above floor

Figure I3 — *Positions of instruments for ceiling and ceiling void temperatures and heat flux and radiation measurements.*





×+Stacks D, E and F 10 sheathed thermocouples per stack 0.25 m apart

+Stacks A, B and C 11 thermocouples 0.15 m apart

○01 to 06 Oxygen probes 0.15 m apart

+AT7 Sheathed thermocouple 0.8 m above floor

Anemometer 0.8 m above floor

Figure I4 — *Positions of instruments for gas temperatures oxygen and air flow. Position of ceiling tiles also shown.*

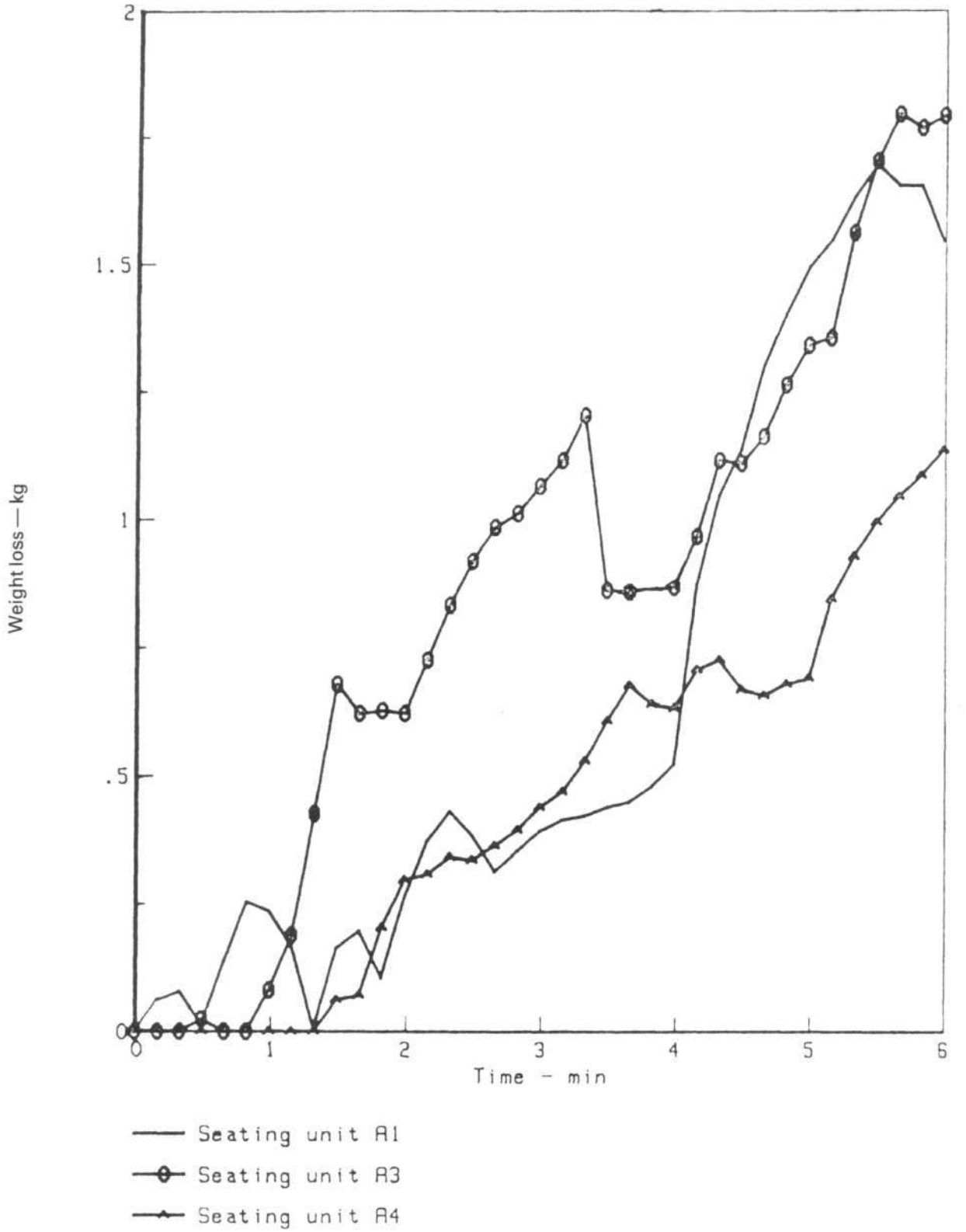


Figure I5 — *Weight loss of seats in back row (Figure I2).*

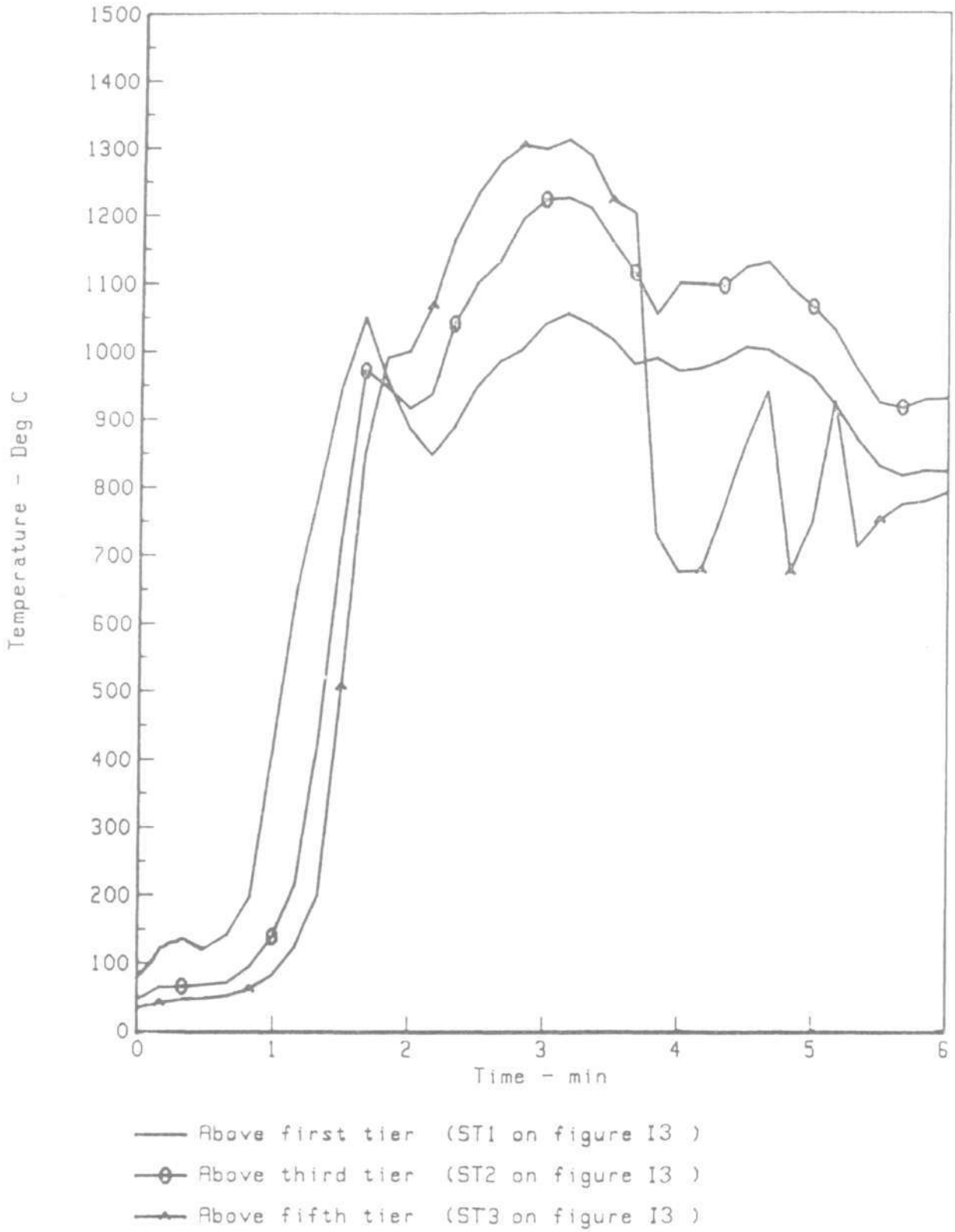


Figure I6 — *Surface temperatures on underside of ceiling tiles nearest carpeted wall.*

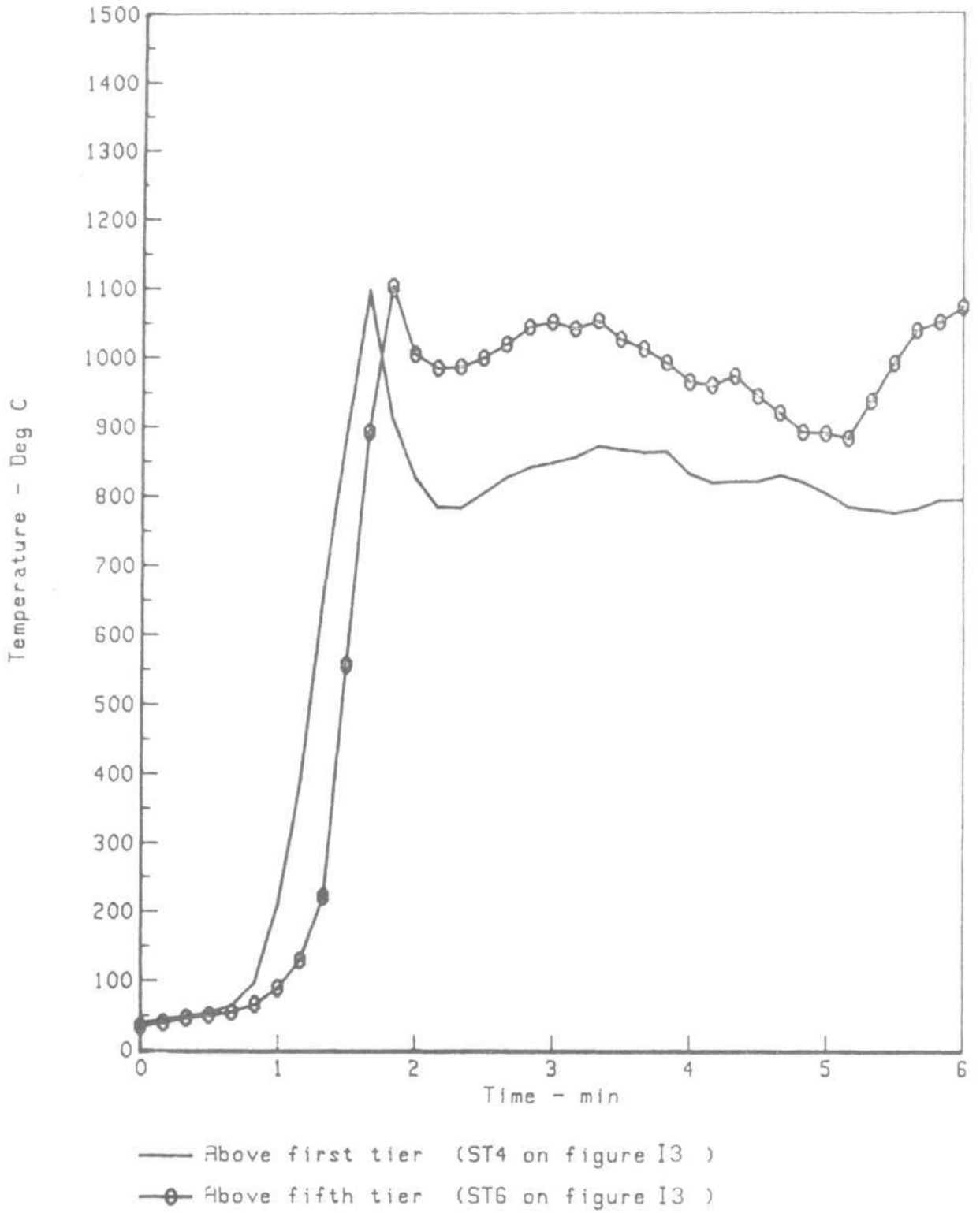


Figure I7 — *Surface temperatures on underside of ceiling tiles nearest insulated wall.*

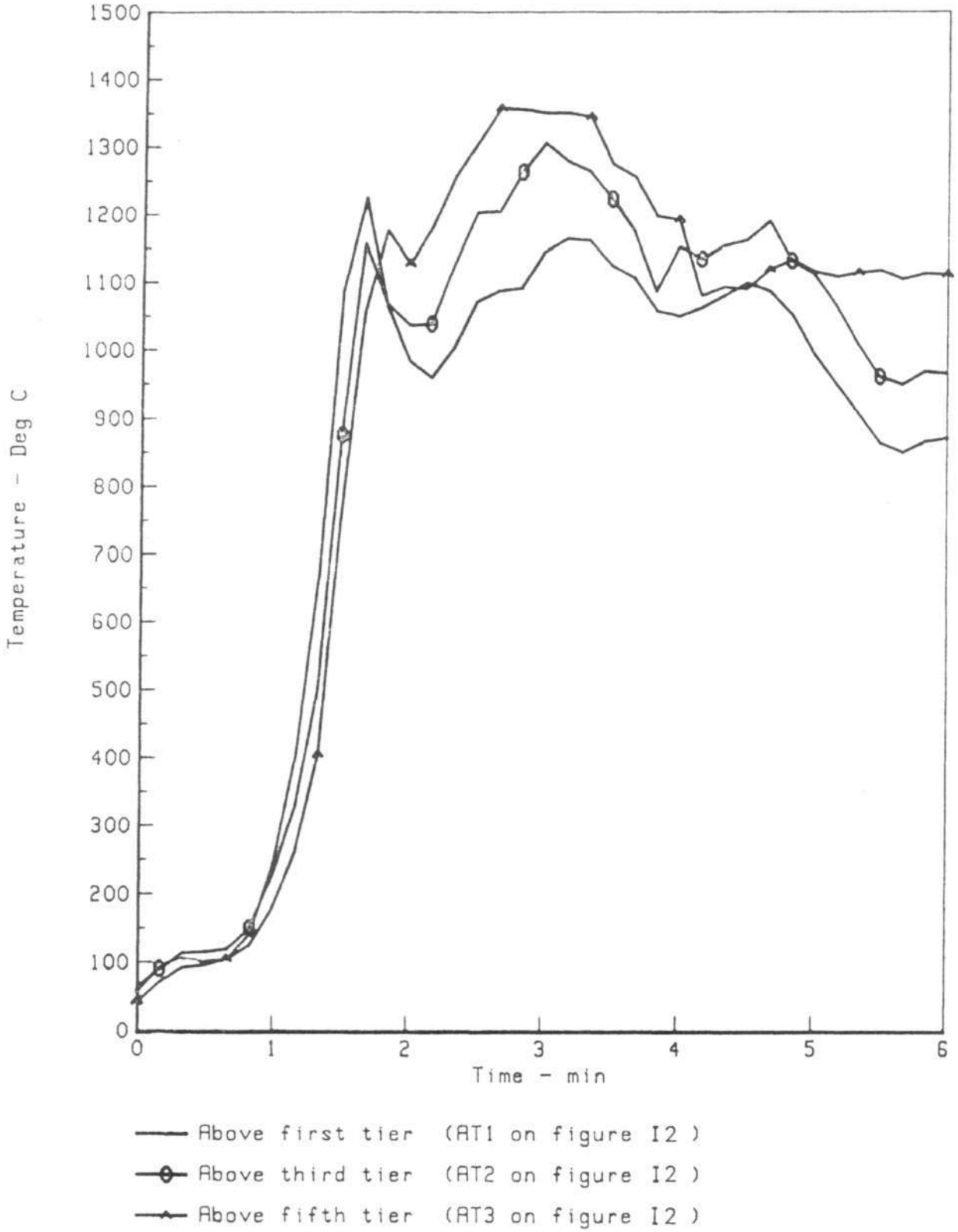


Figure I8 — *Air temperatures 100mm below ceiling nearest carpeted wall.*

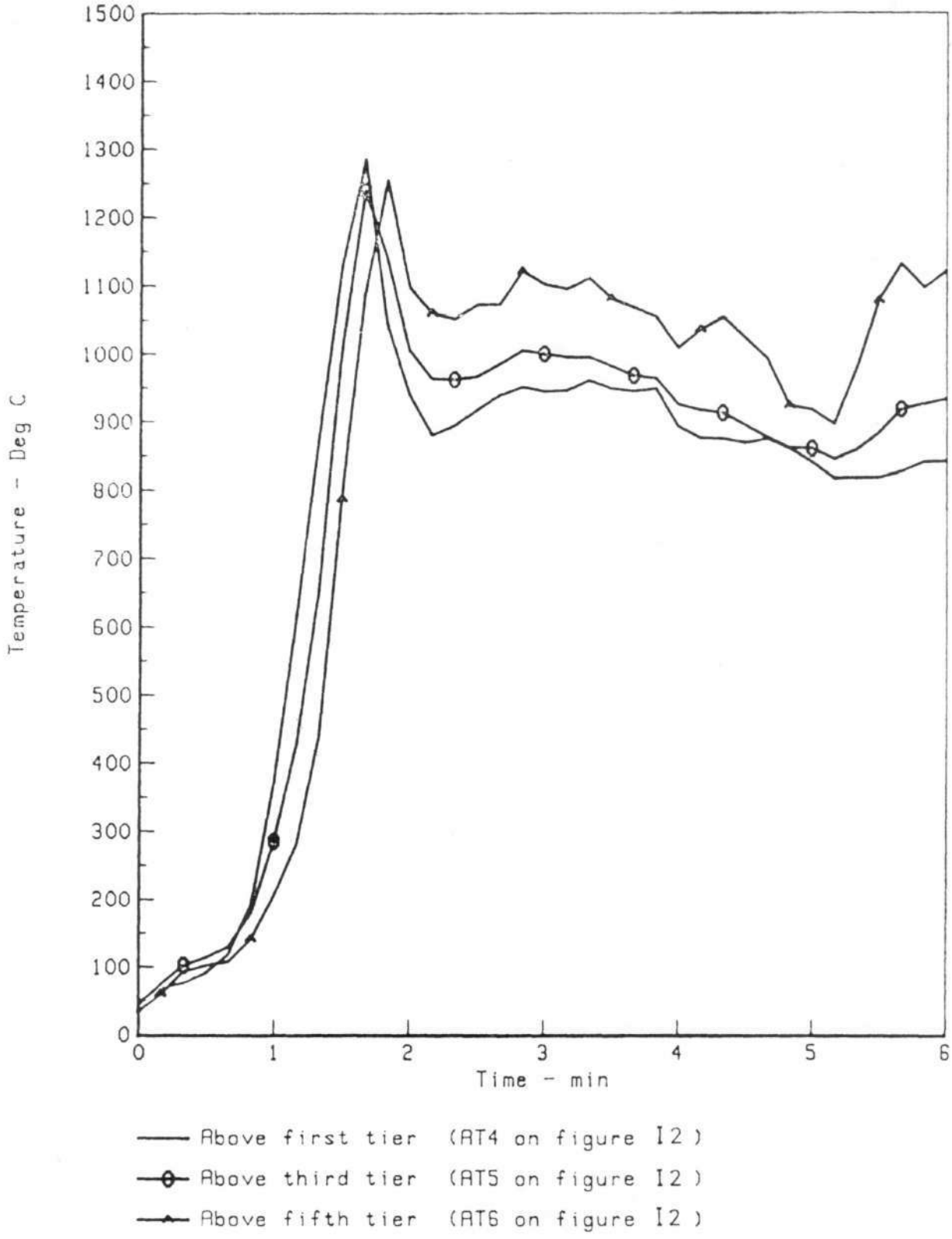


Figure I9 — *Air temperatures 100mm below ceiling nearest insulated wall.*

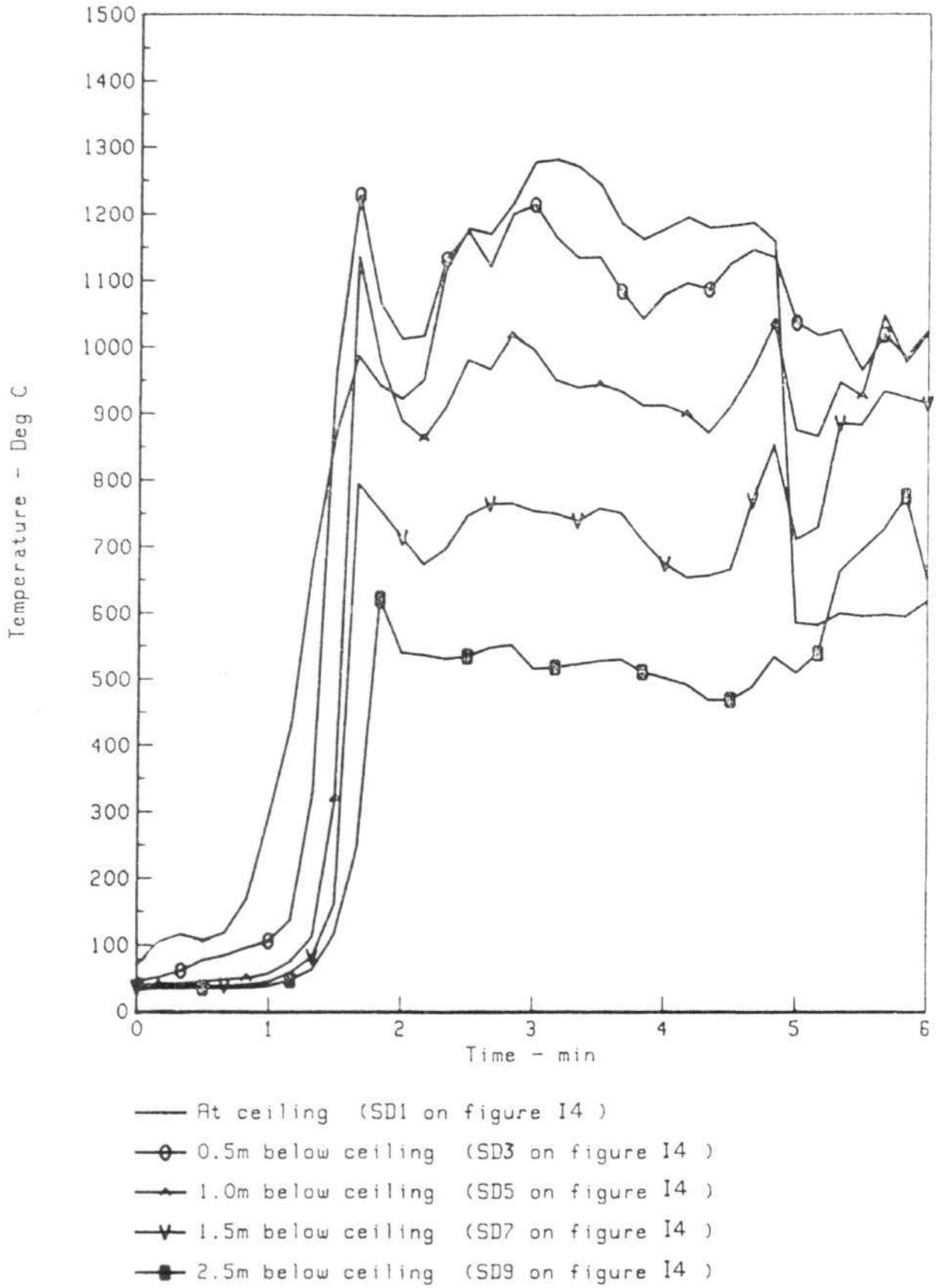


Figure I10 — *Air temperatures at intervals below ceiling in aisle nearest carpeted wall (stack D).*

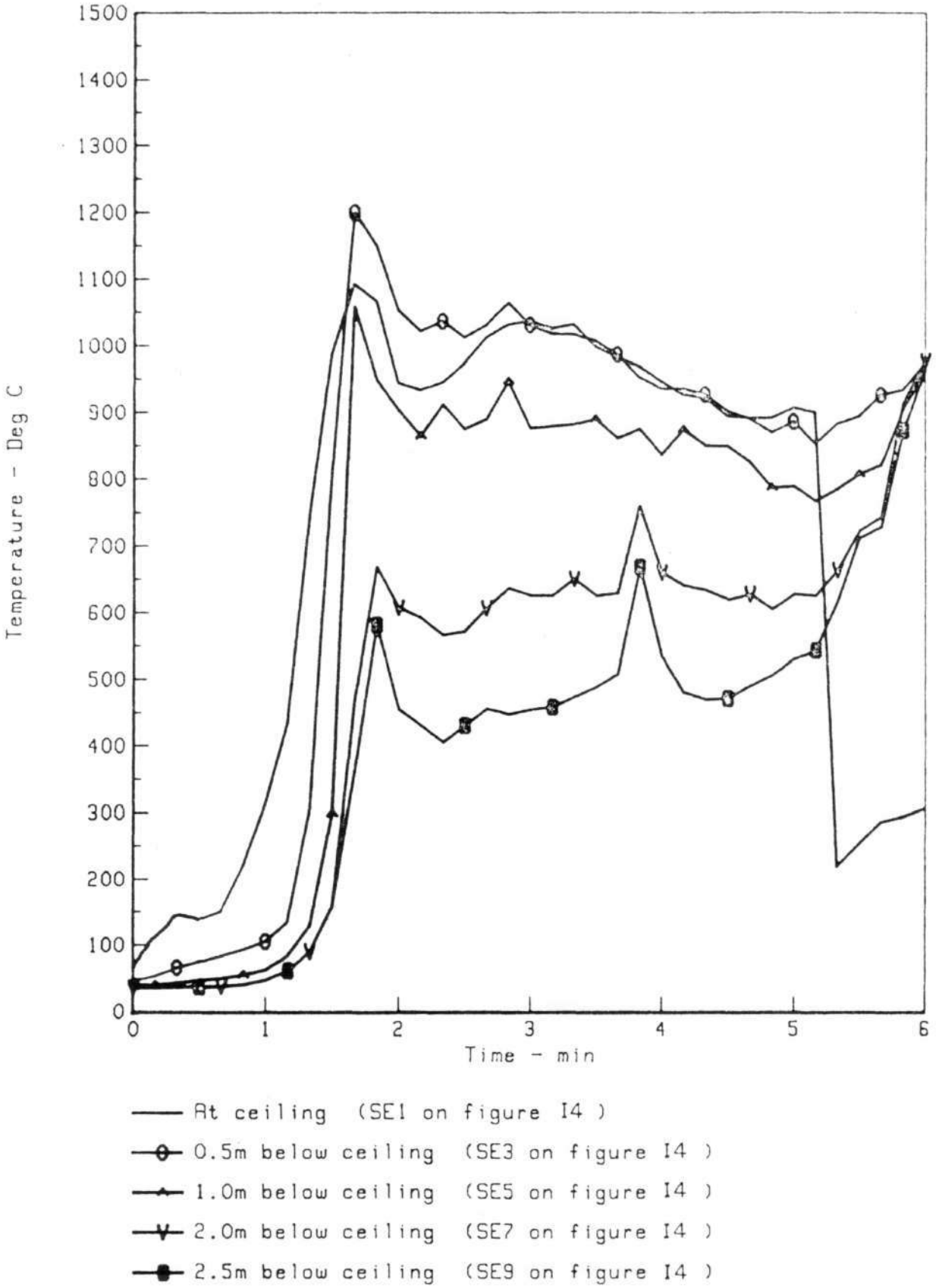


Figure I11 — *Air temperatures at intervals below ceiling in aisle nearest insulated wall (stack E).*

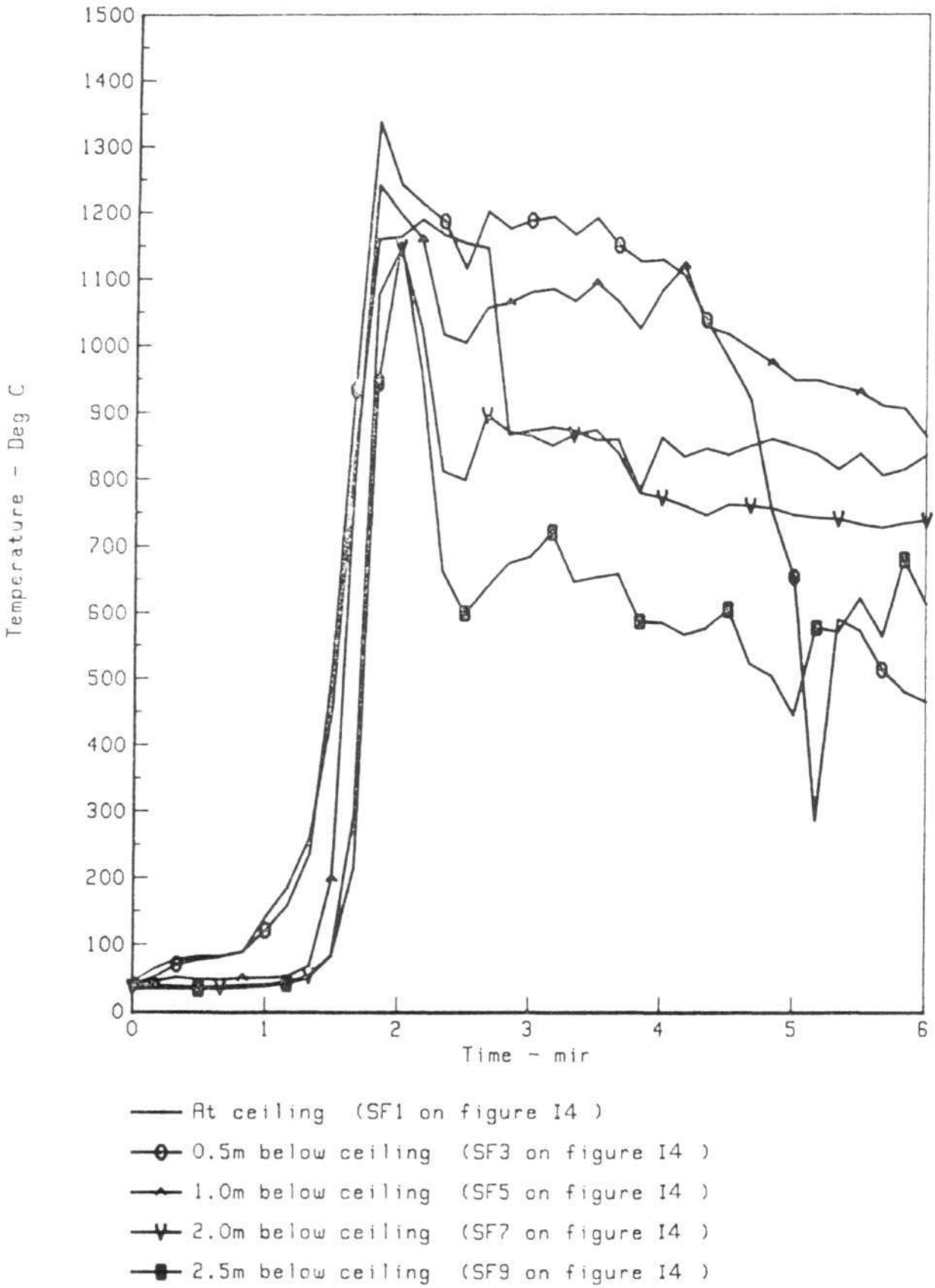


Figure I12 — *Air temperatures at intervals below ceiling in floor area near roller blind (stack F).*

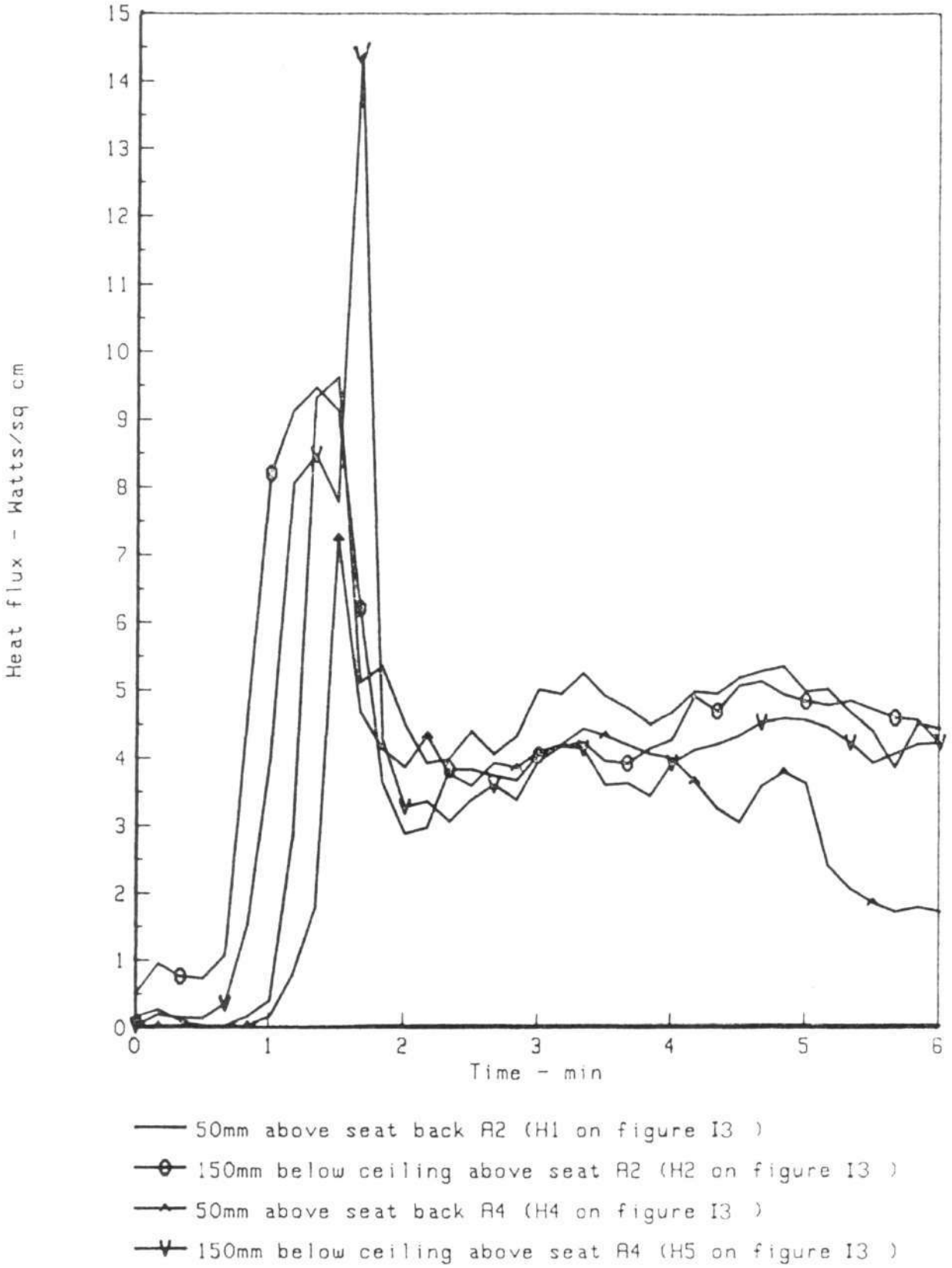


Figure I13 — *Heat flux falling on tiles on wall behind seats.*

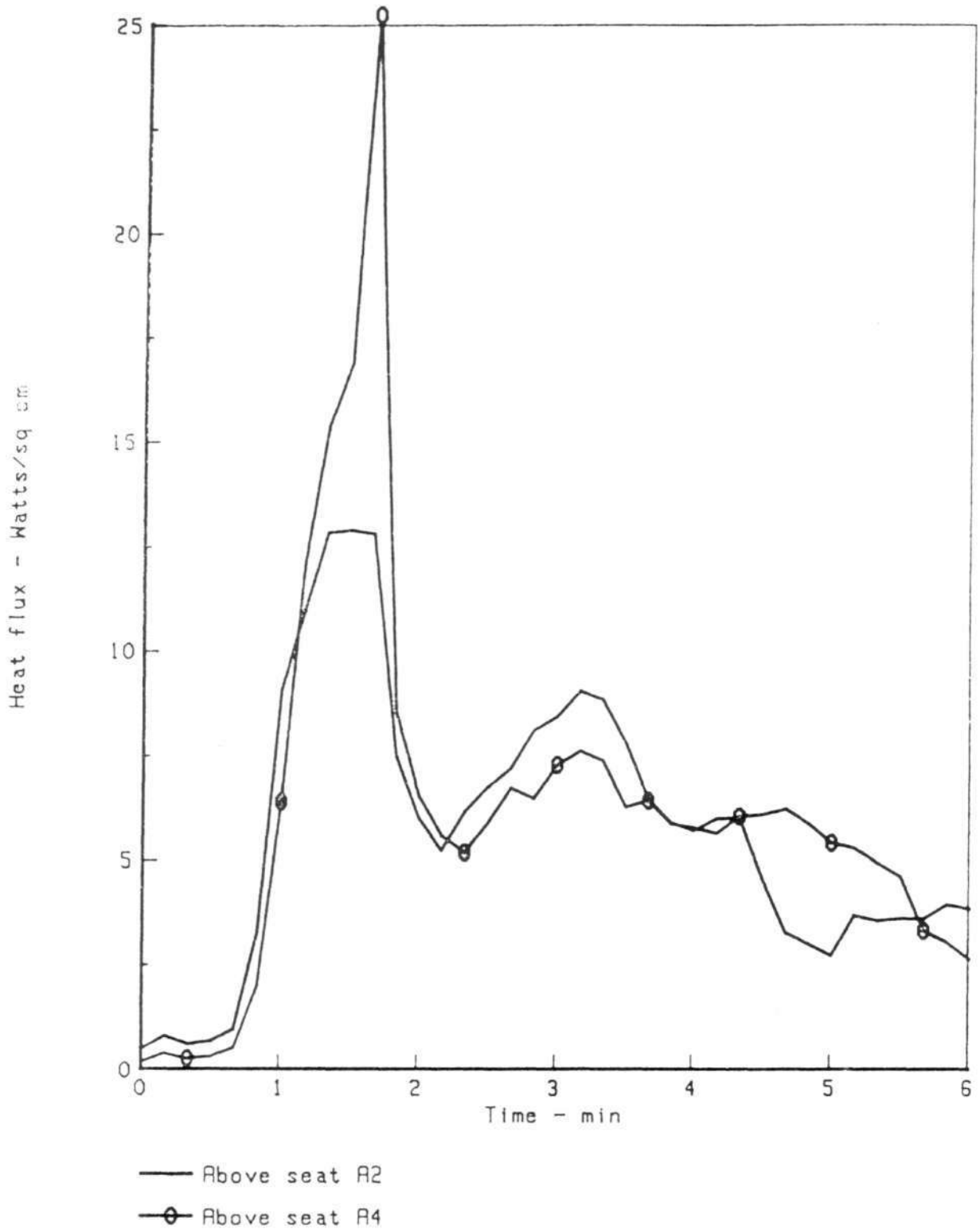


Figure I14 — *Heat flux falling on ceiling (H3 and H6 on figure I3).*

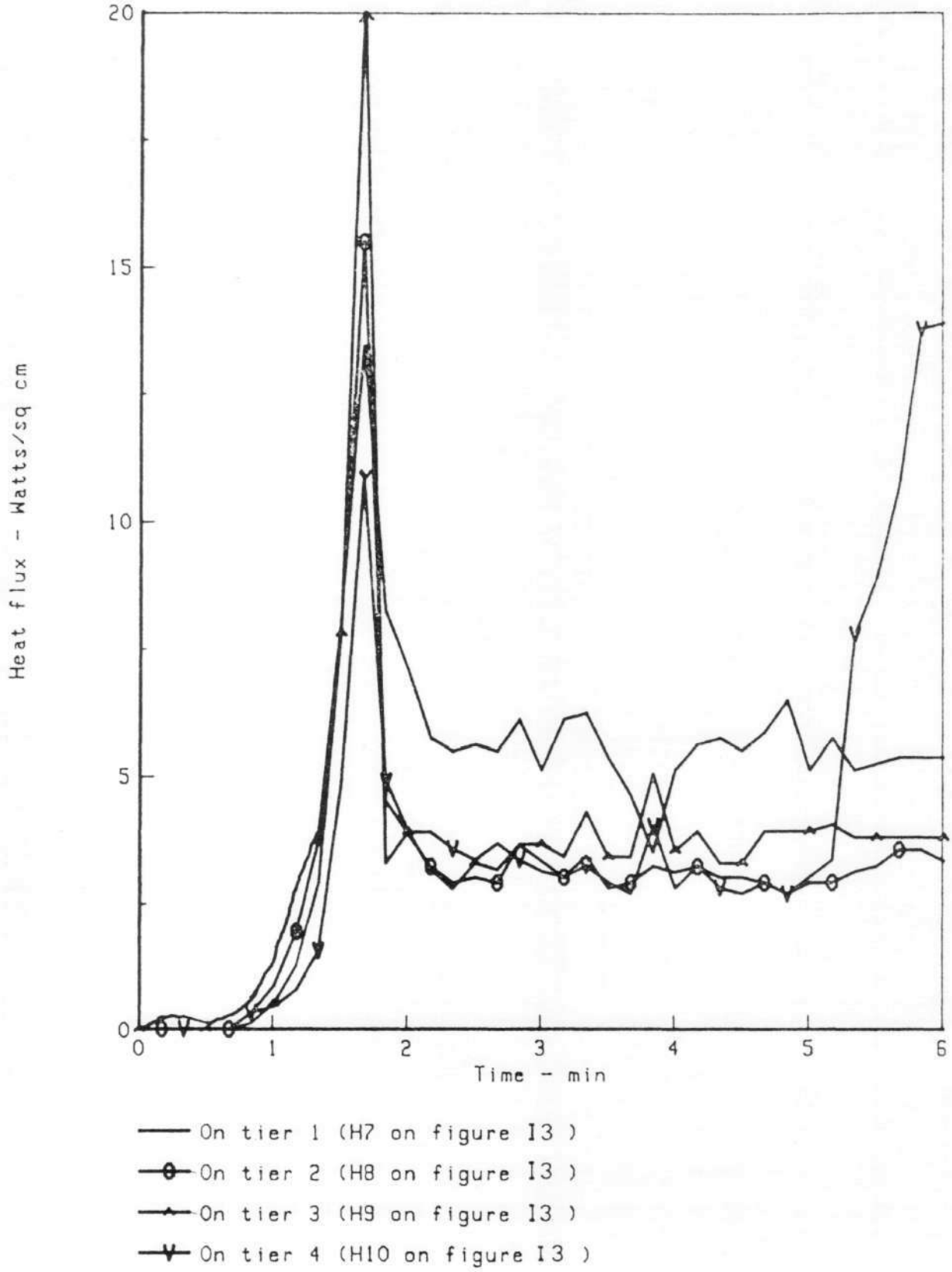


Figure I15 — *Heat flux level with seat back tops in centre aisle.*

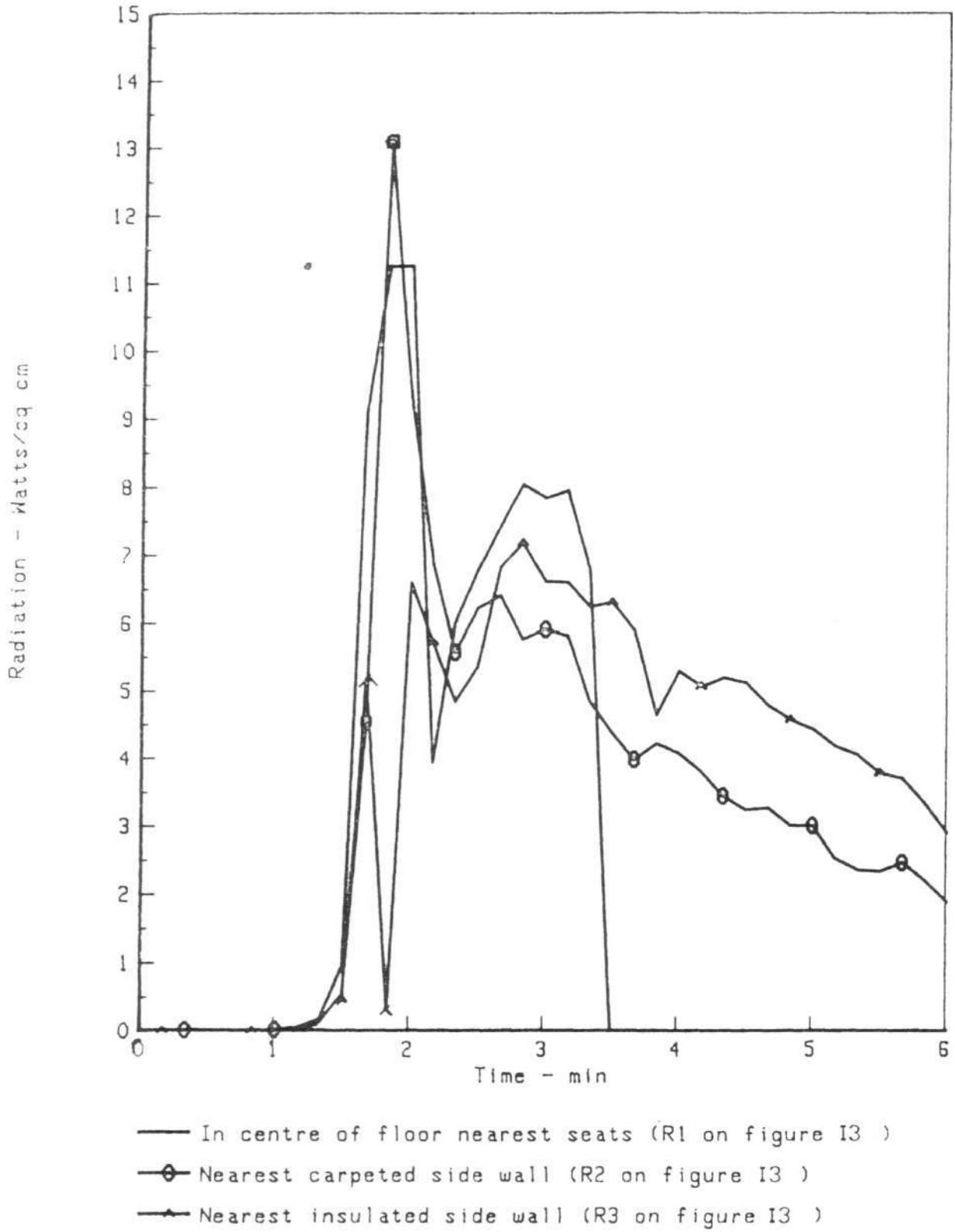


Figure I16 — *Radiation 1m above floor on seating side of roller blind.*

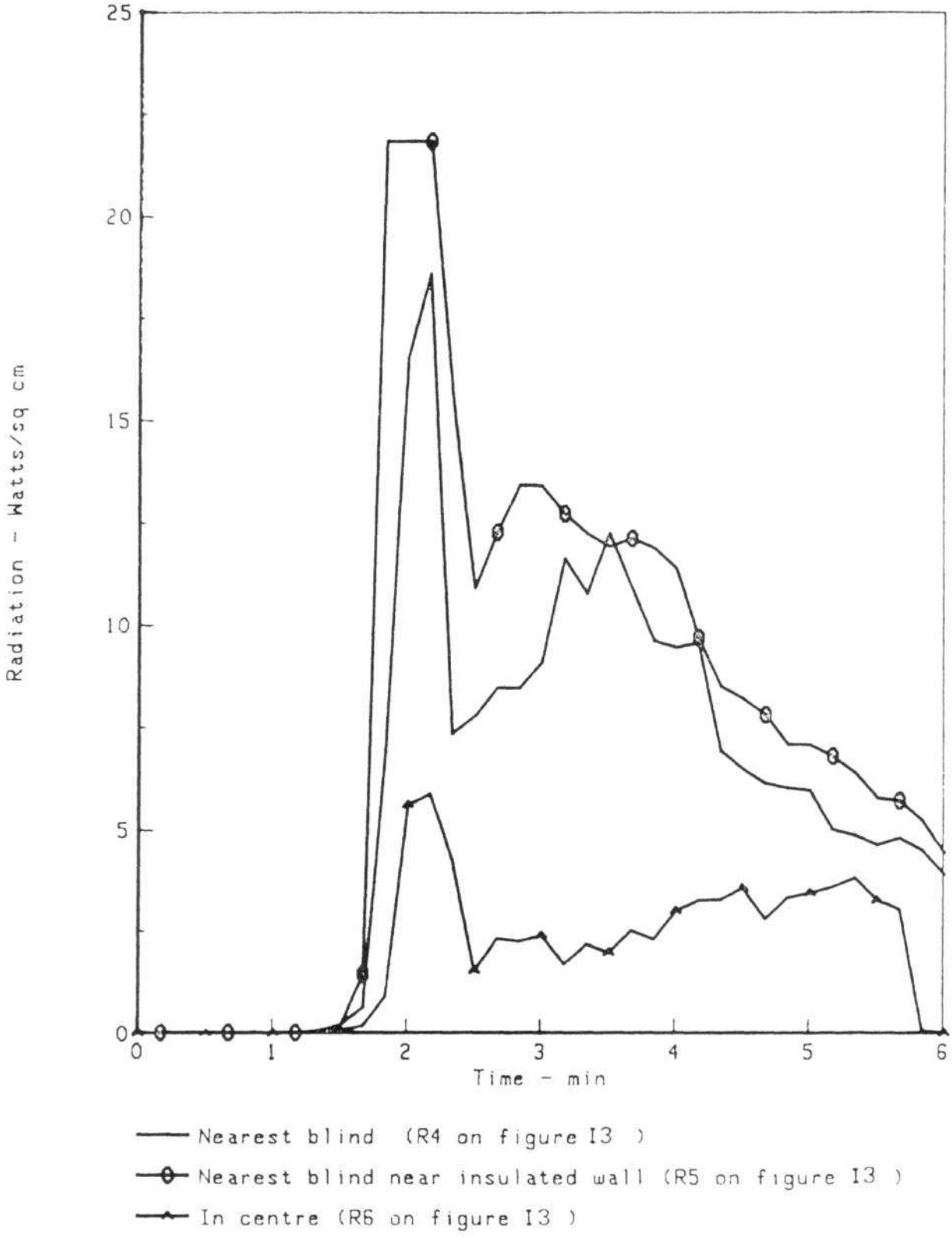


Figure I17 — *Radiation 1m above floor on entrance side of roller blind.*

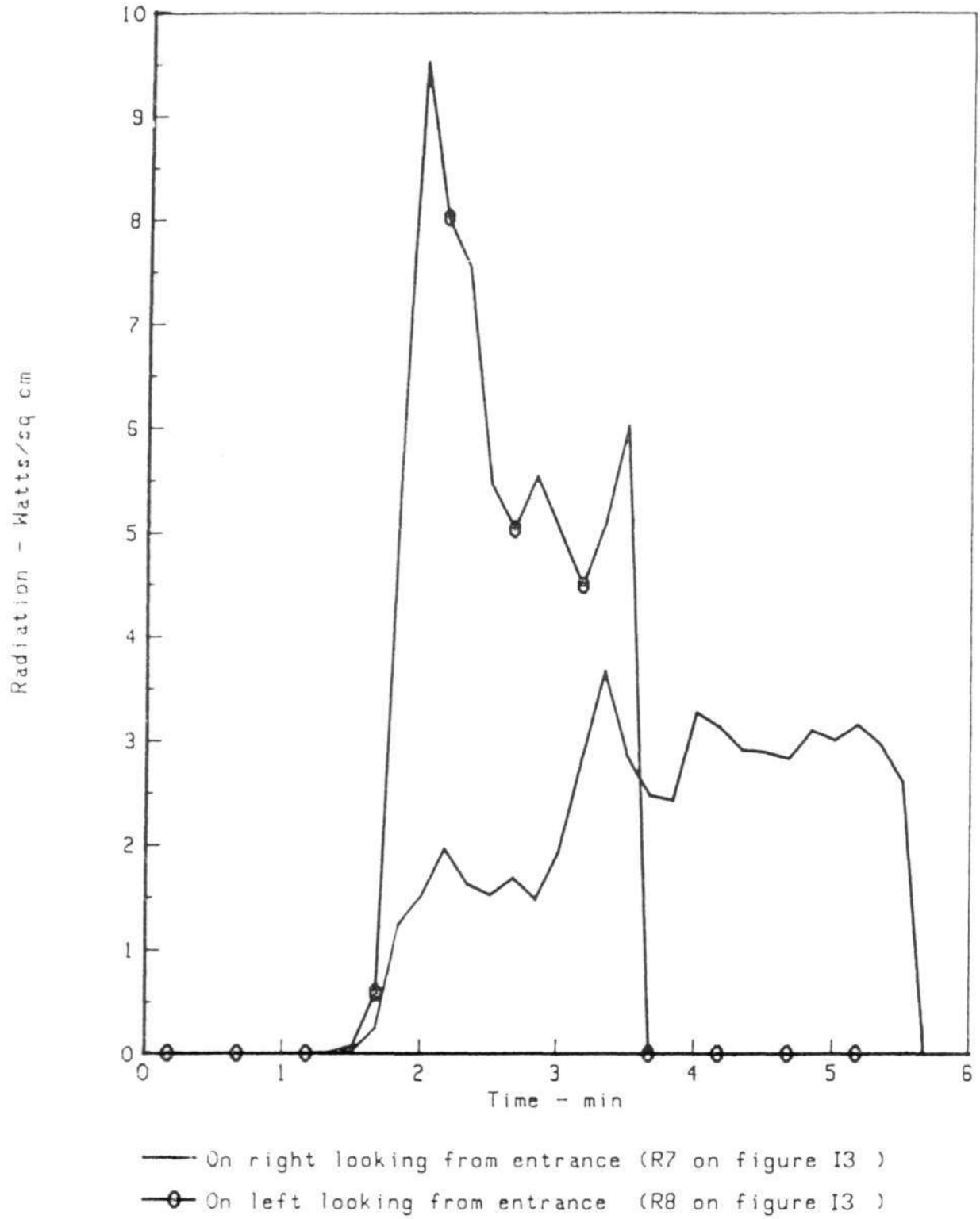


Figure I18 — *Radiation 1m above floor near entrance.*

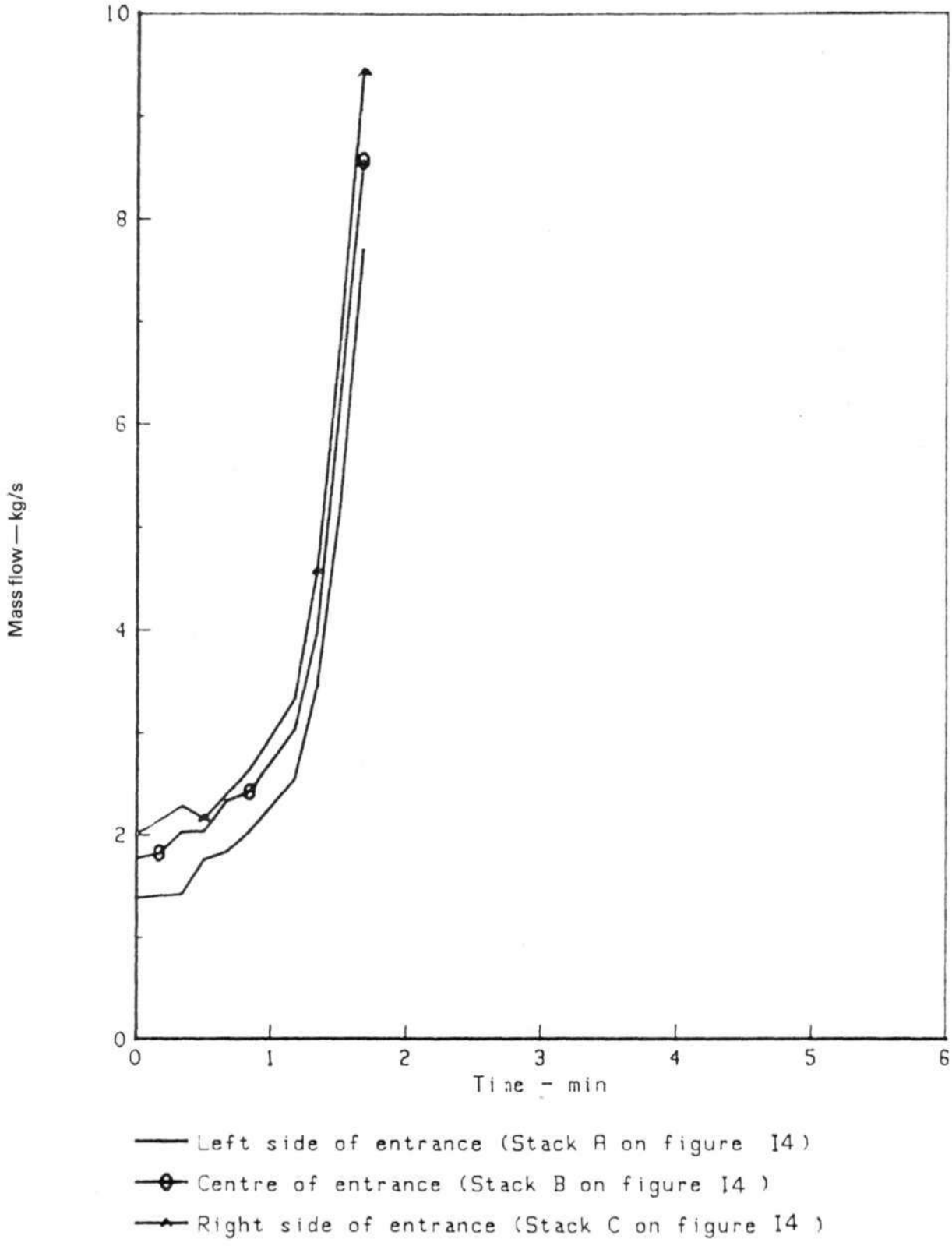


Figure I19 — *Mass flow near entrance.*

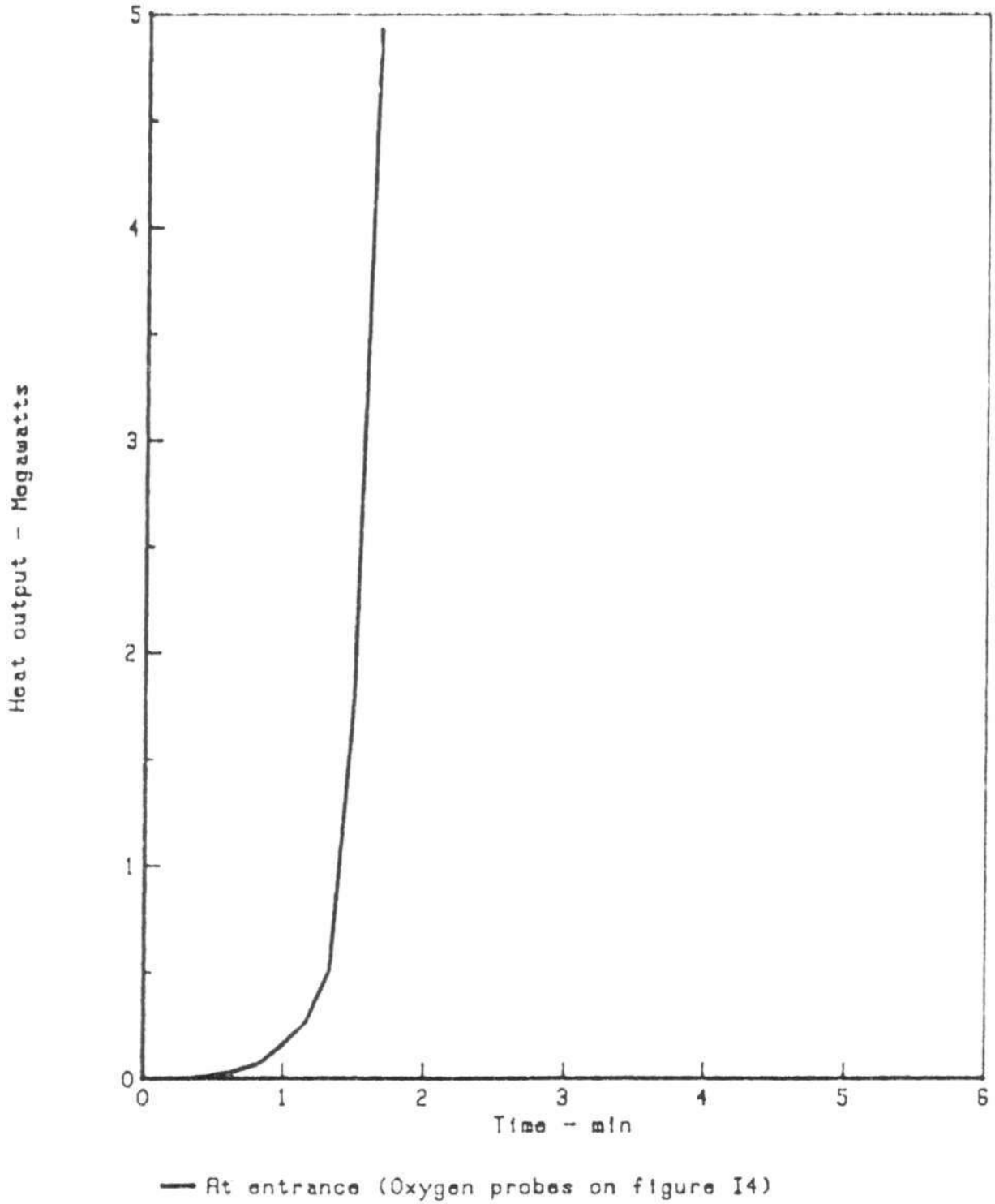


Figure I20 — *Heat output calculated from oxygen deficiency.*

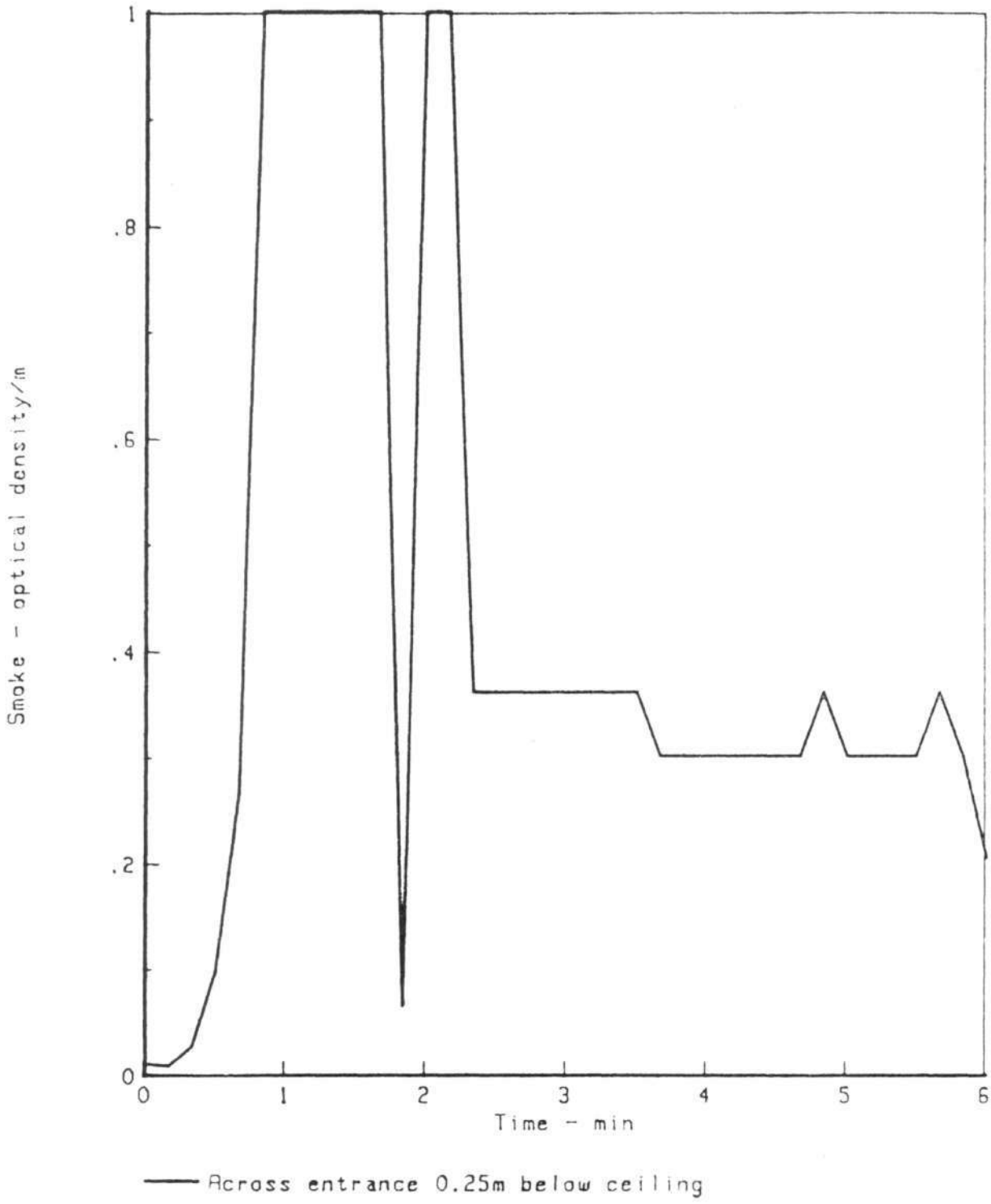
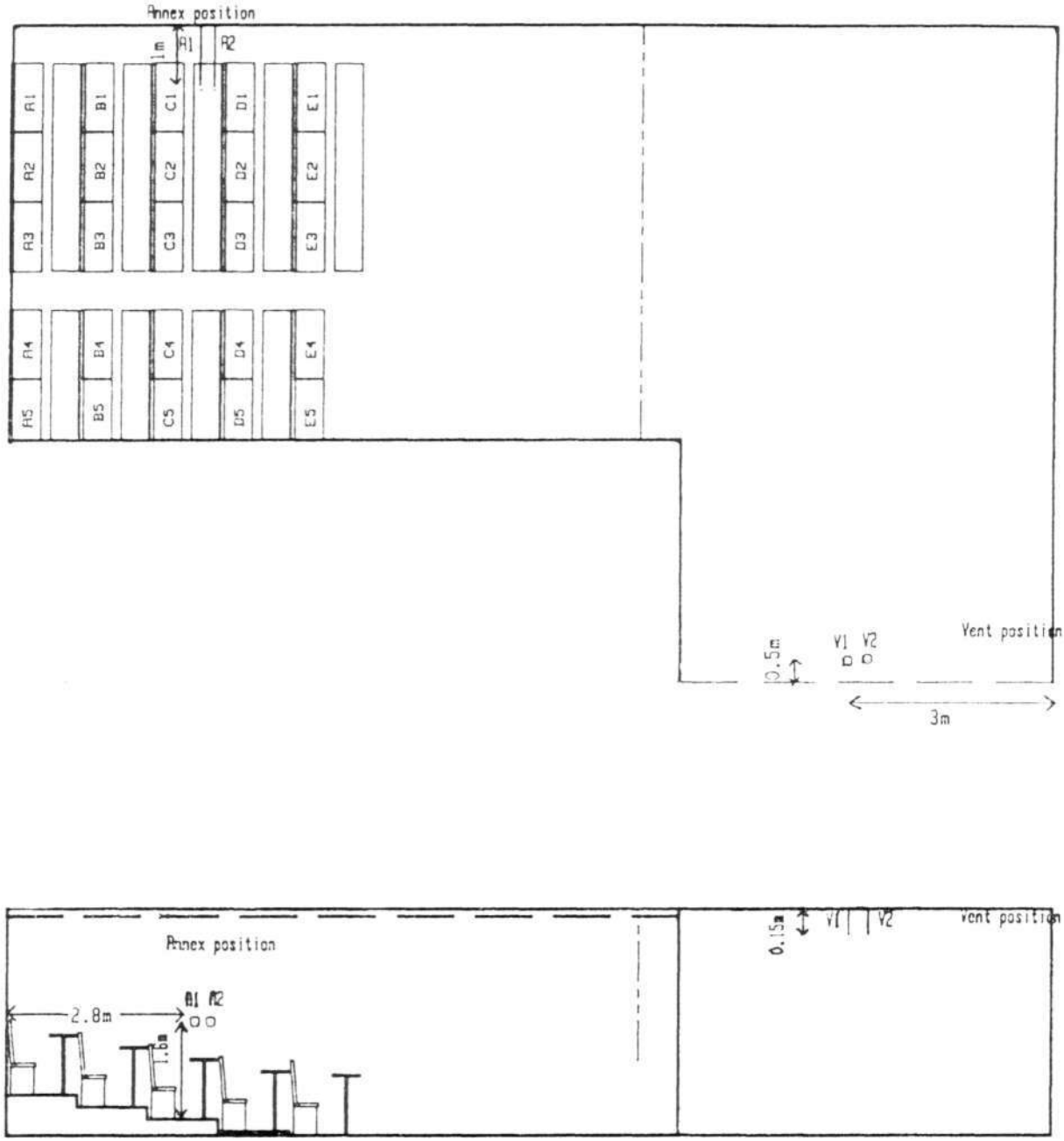


Figure I21 — *Smoke measured across entrance.*



A1 Stainless steel tubing for permanent gas analysis

A2 Glass lined tubing for HCl and HCN analysis

V1 Stainless steel tubing for permanent gas analysis

V2 Glass lined tubing for HCl analysis

Figure K0 — *Positions of gas sampling points.*

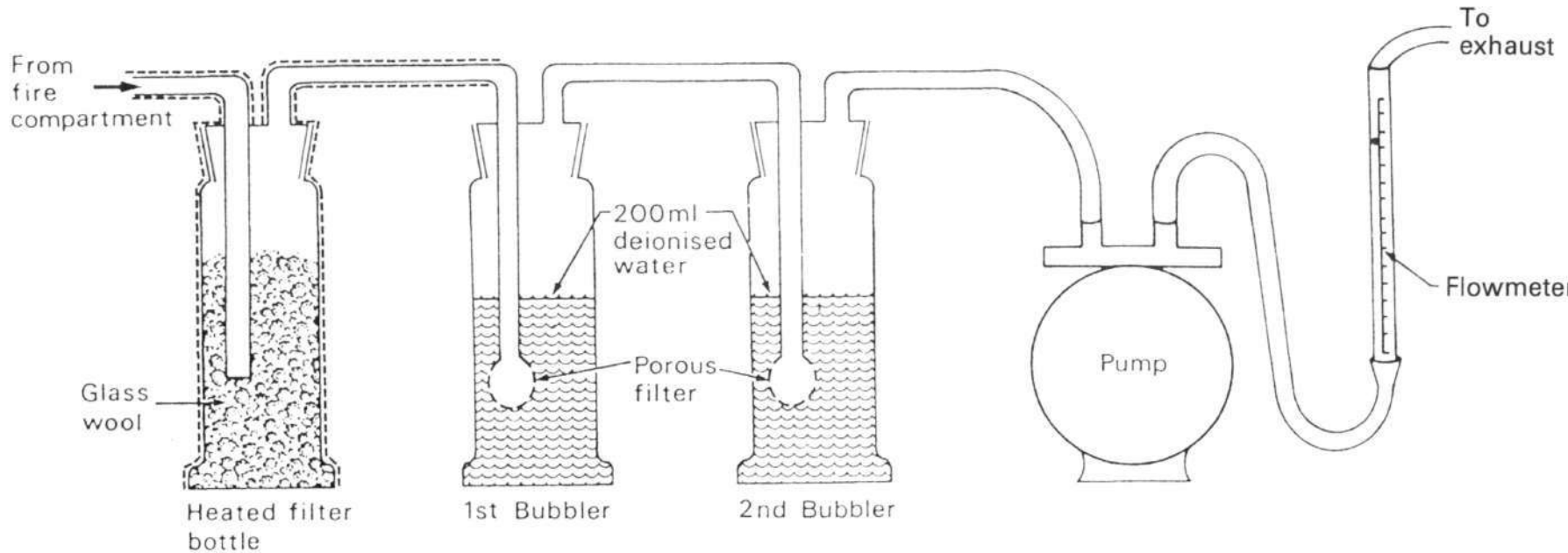


Figure K1A — *HCl collection system*

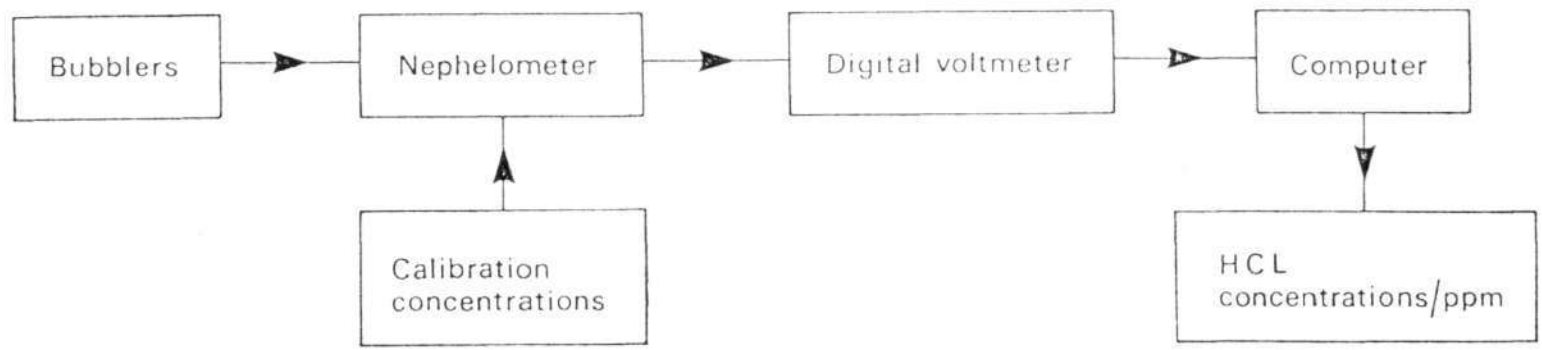


Figure K1B — *Block diagram of analysis system for HCl.*

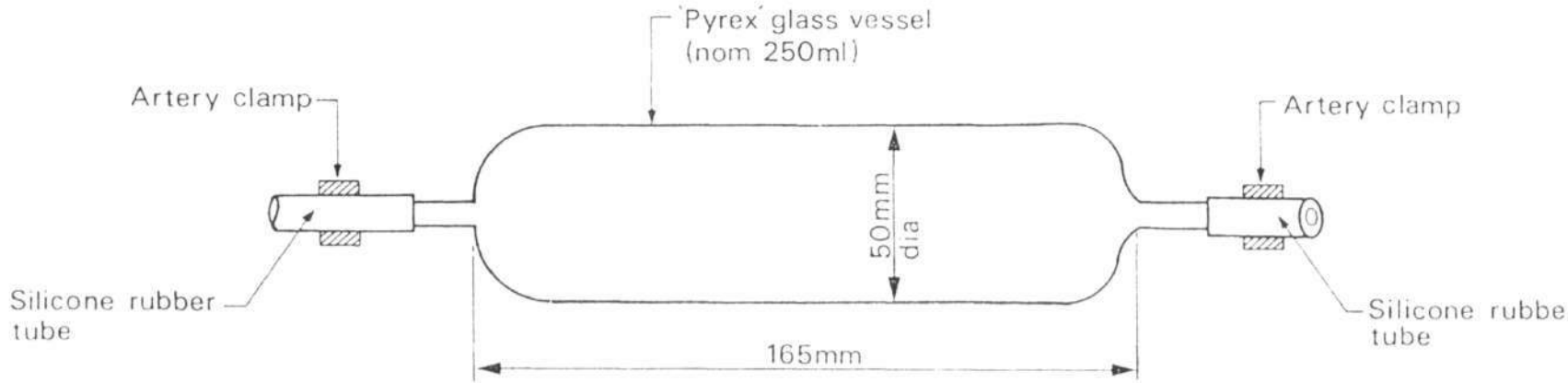


Figure K2A — *The 'Fingerprint' sampling tube*

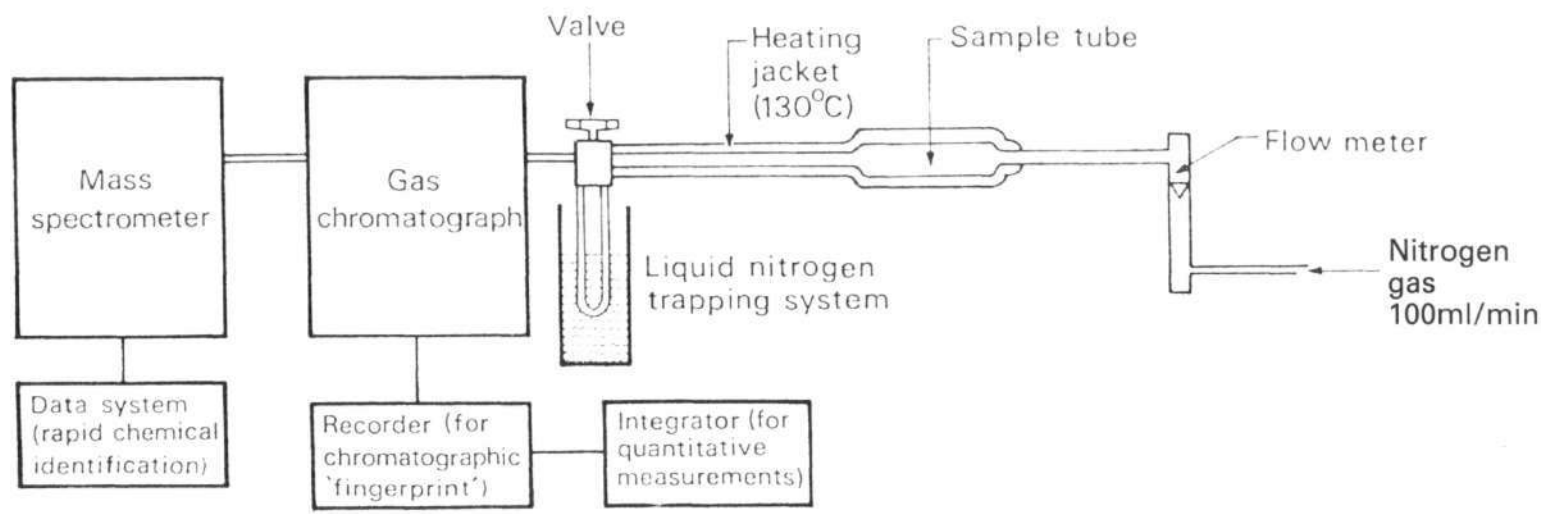


Figure K2B — *'Fingerprint' analysis system.*

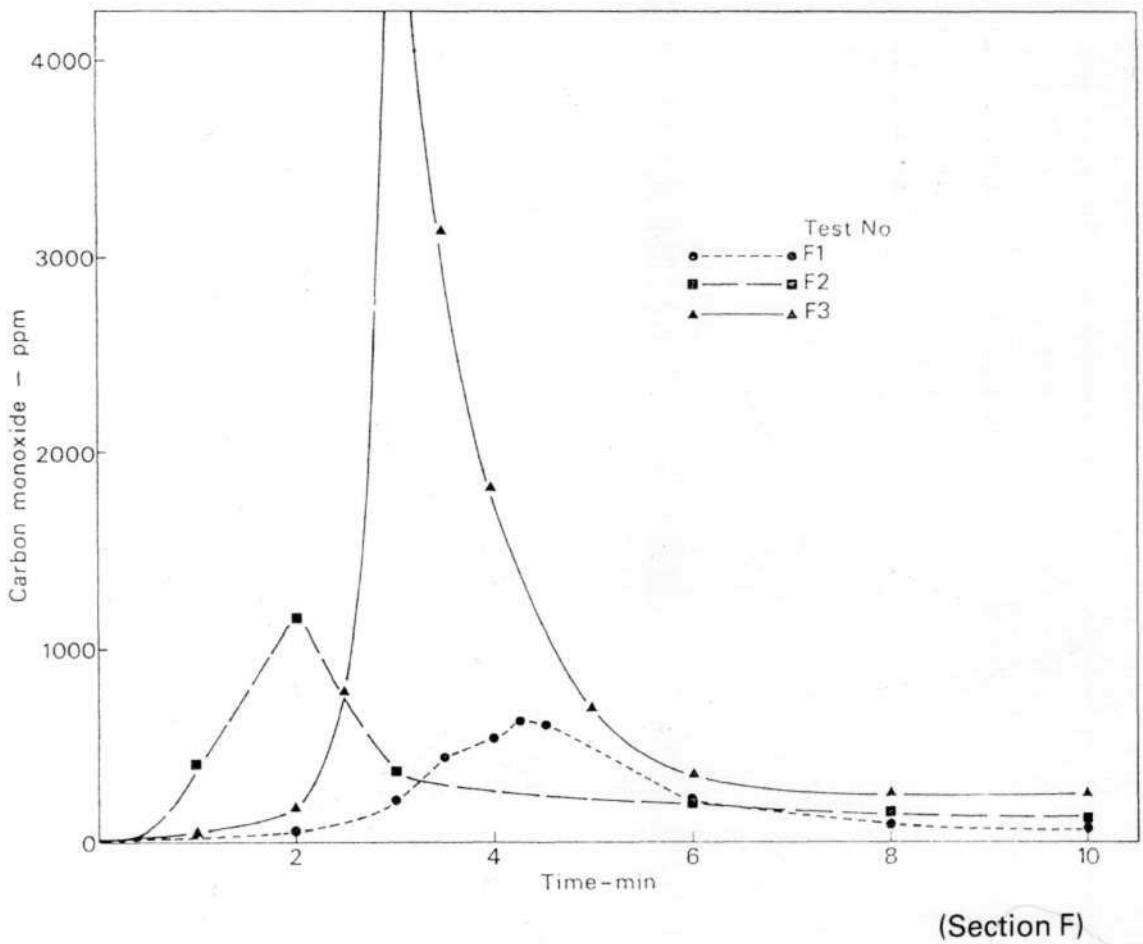


Figure K3 — *Carbon monoxide concentration in Tests F1 to F3.*

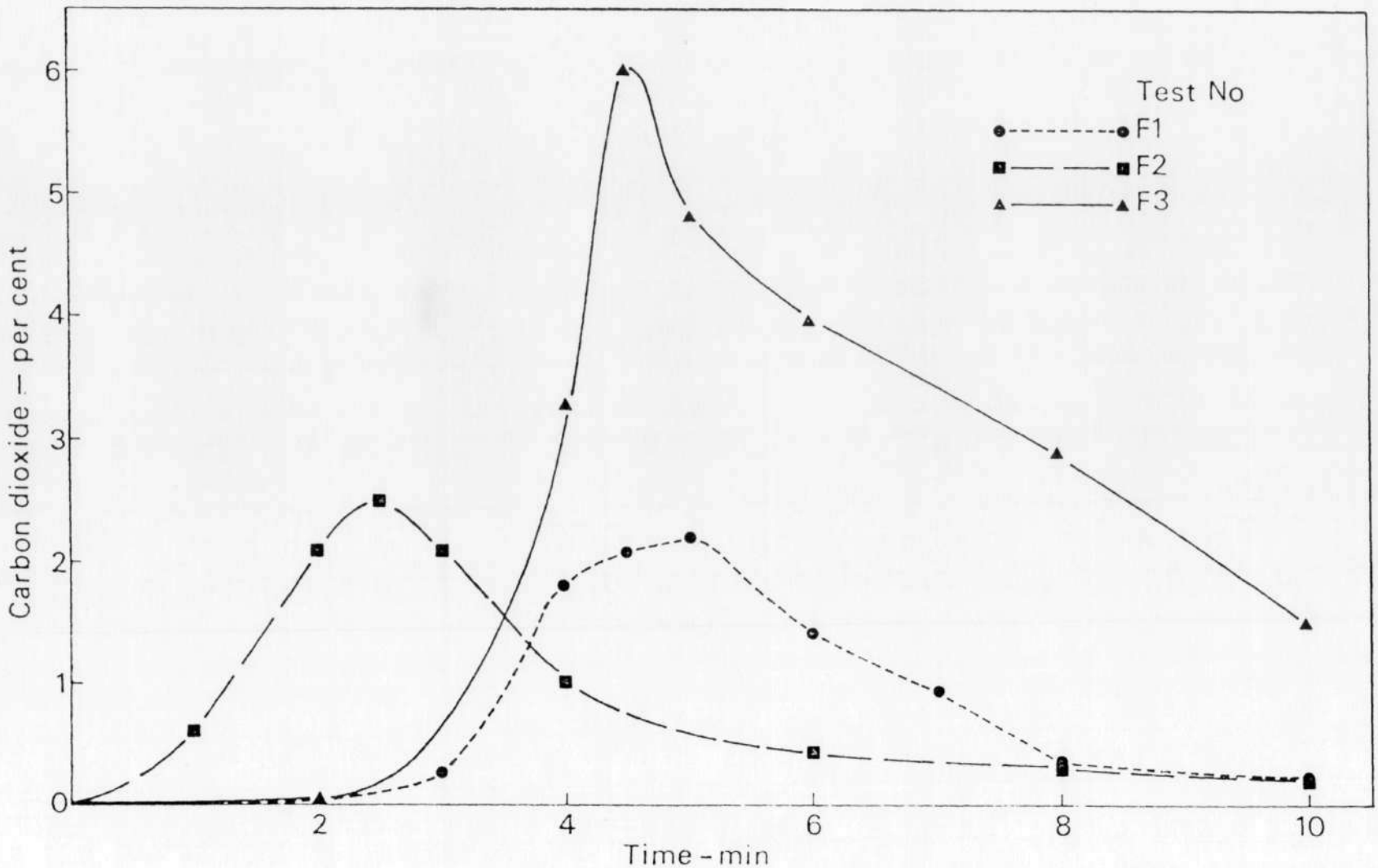


Figure K4 — *Carbon dioxide concentration in Tests F1 to F3.* (Section F)

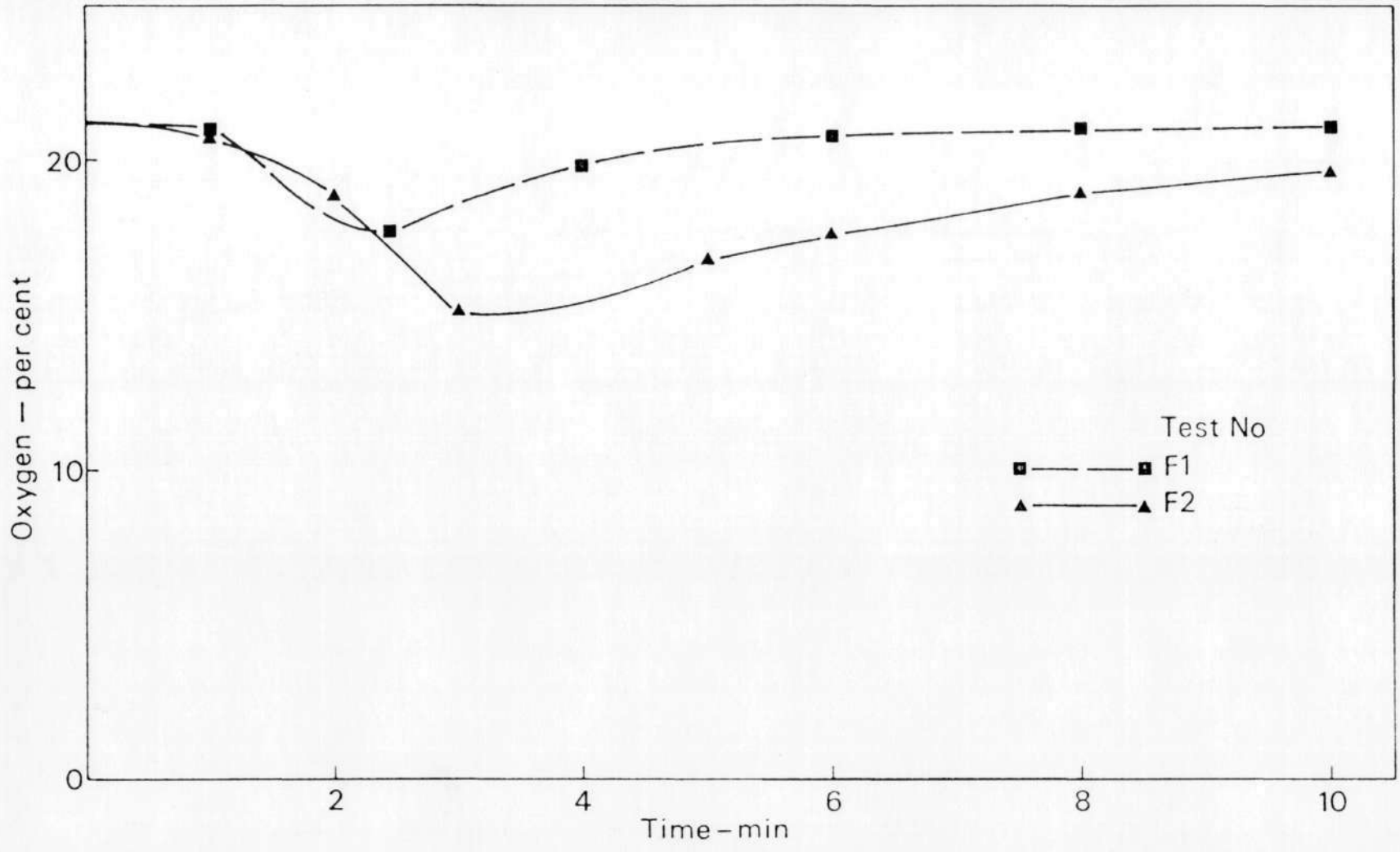


Figure K5 — *Oxygen concentration in Tests F1 and F2.* (Section F)

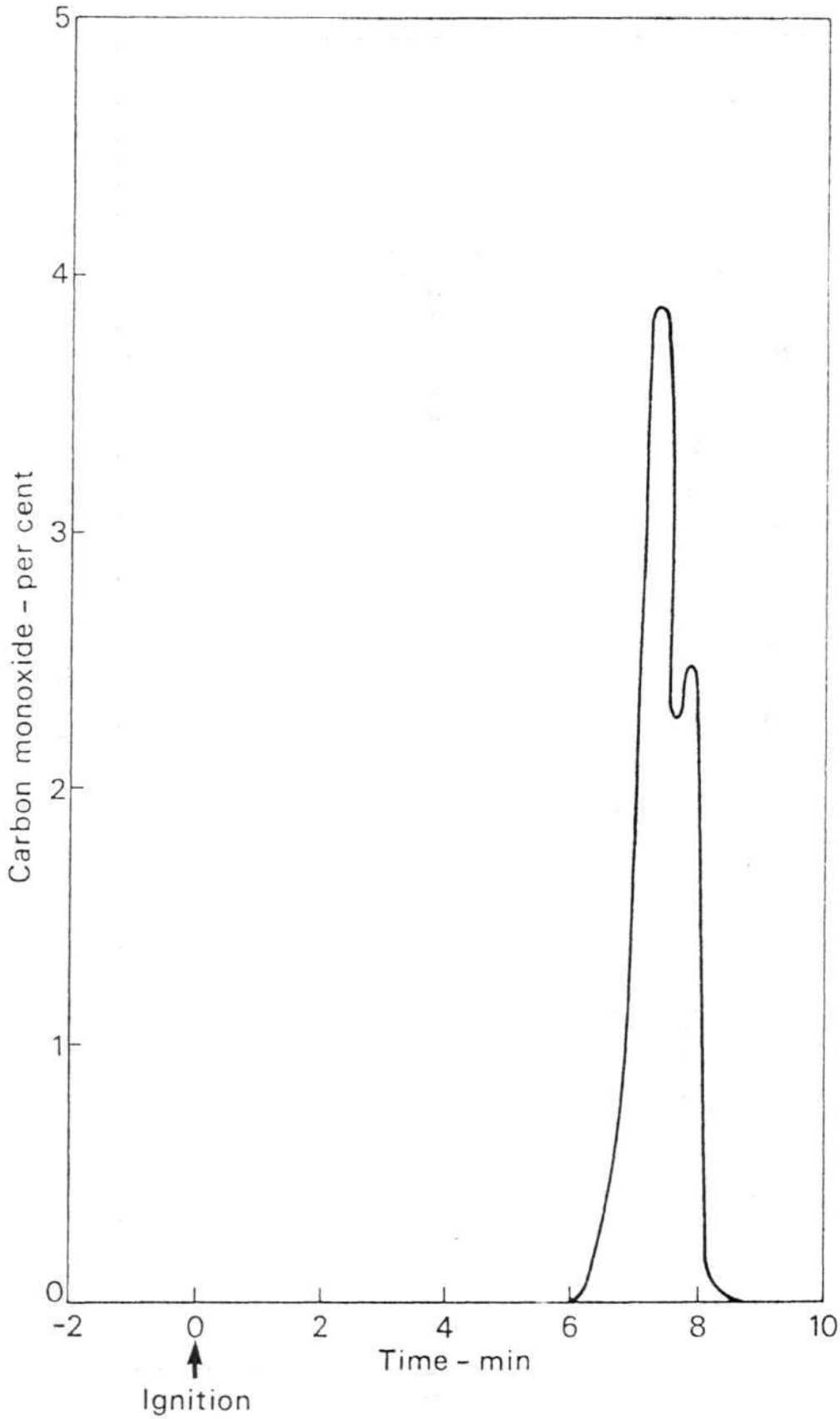


Figure K6 — *Carbon monoxide concentration — Test H2.*

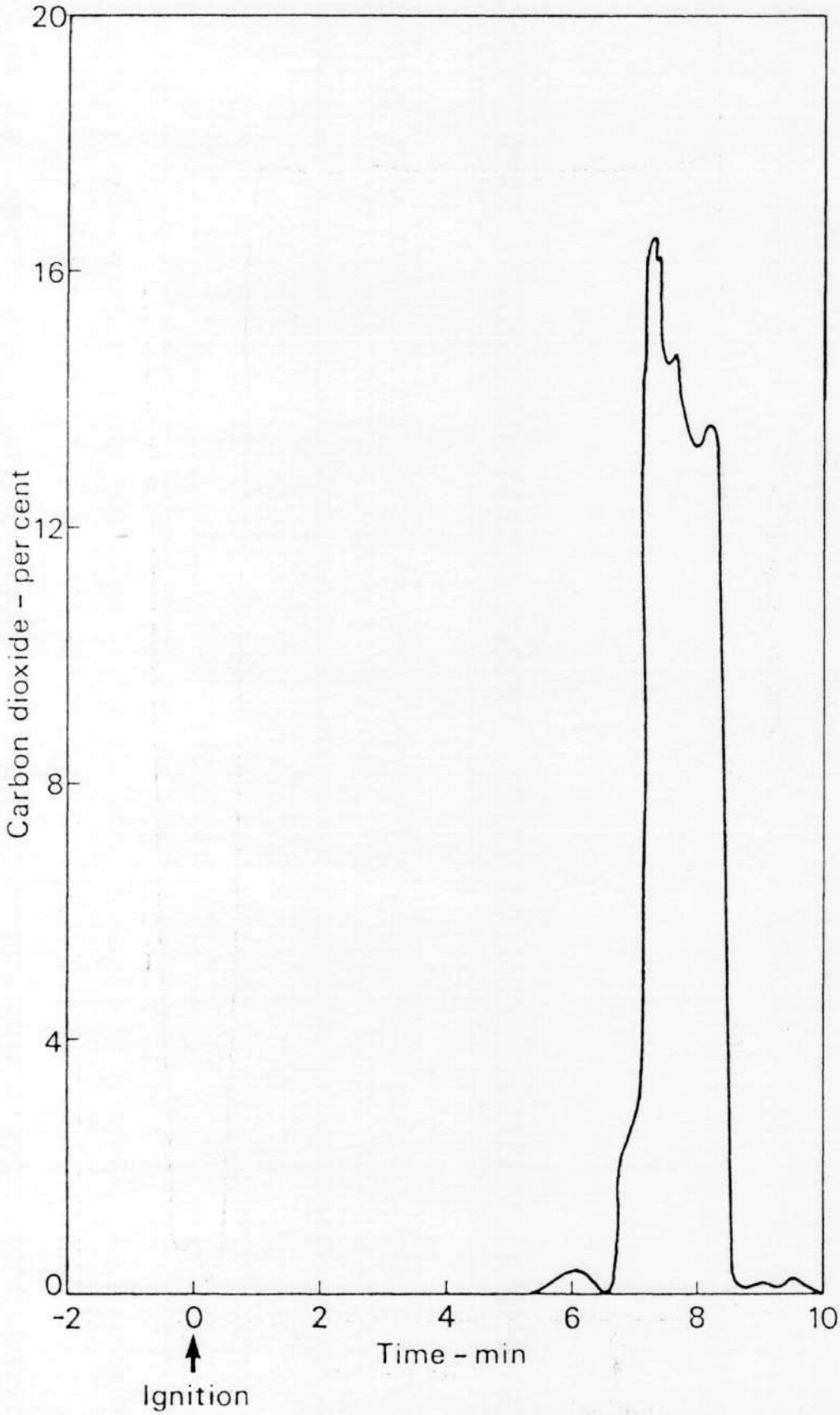


Figure K7 — *Carbon dioxide concentration — Test H2.*

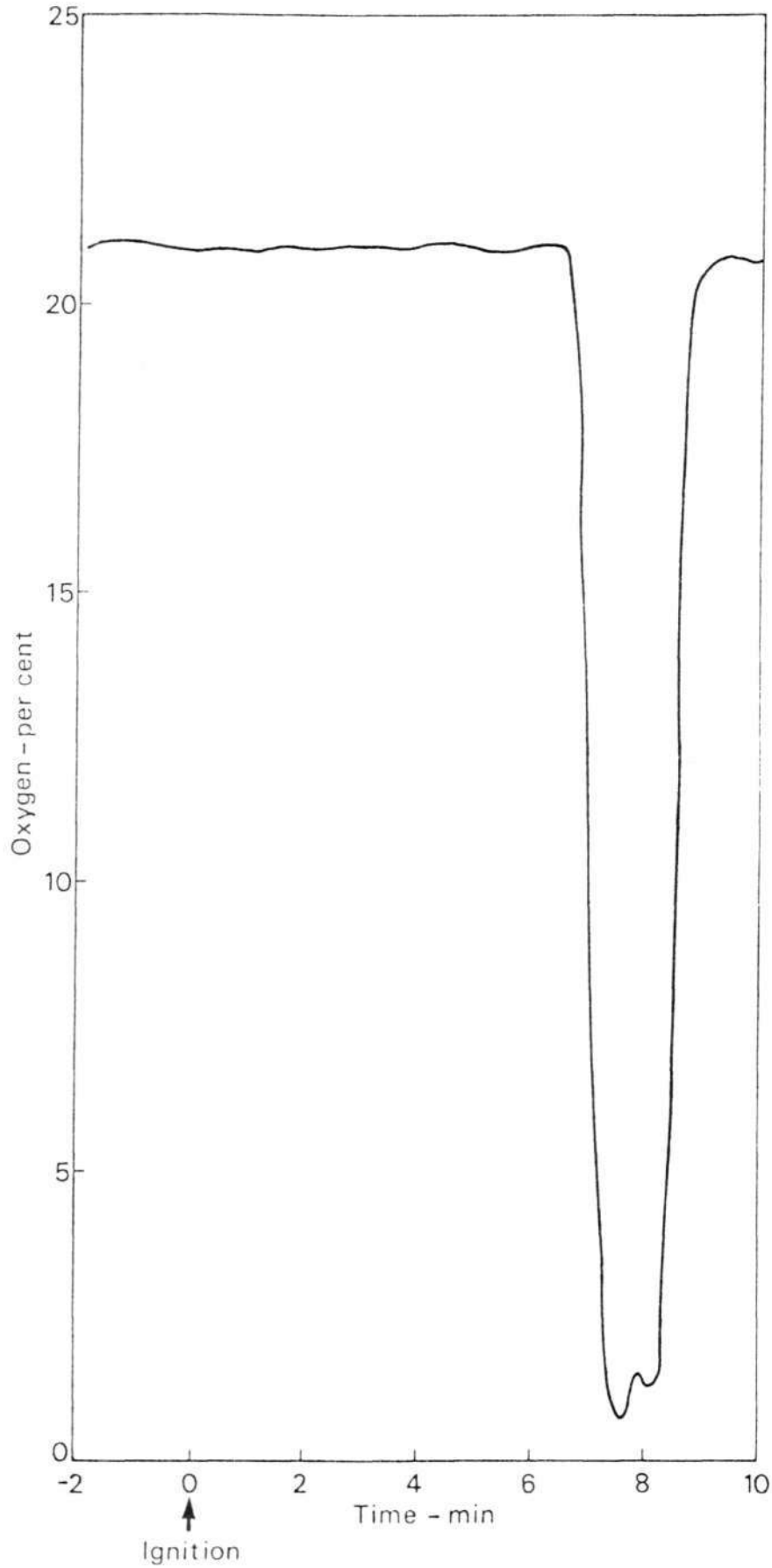


Figure K8 — *Oxygen concentration — Test H2.*

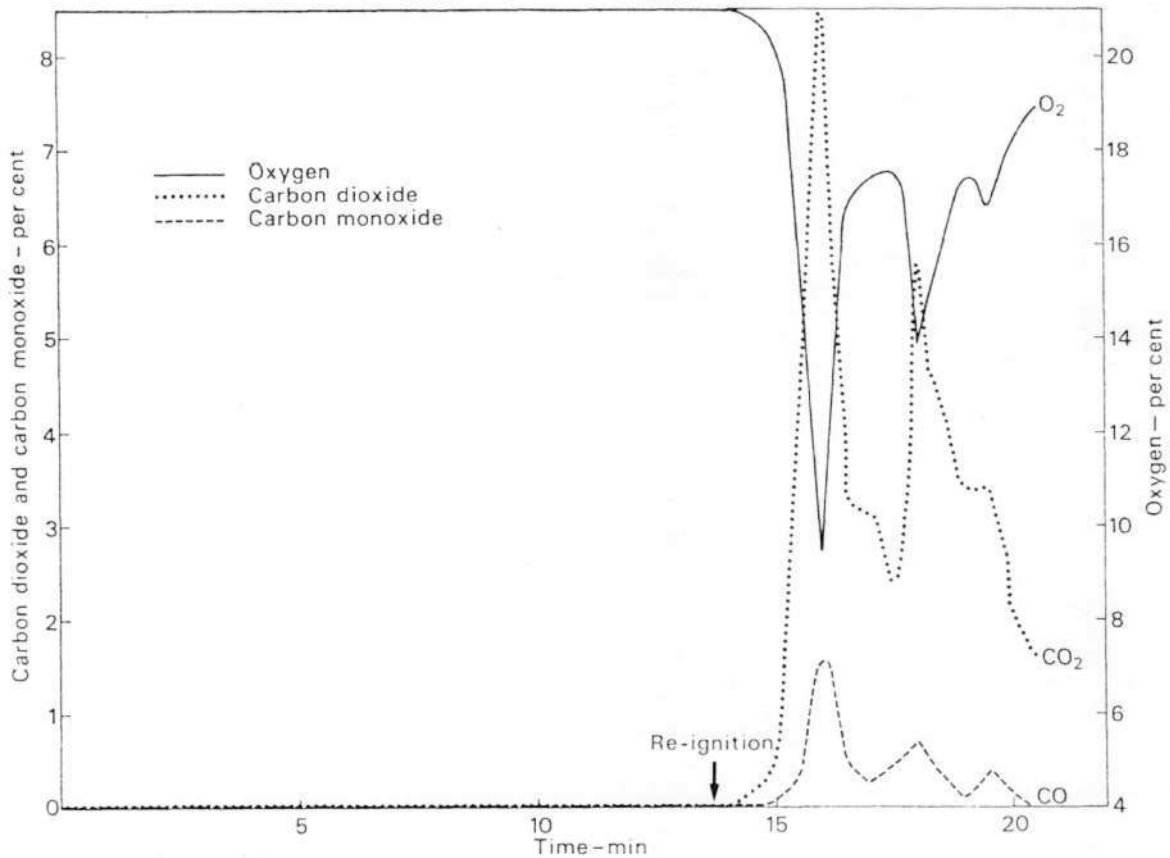


Figure K9 — *Permanent gas analysis (vent point) — Test I.*

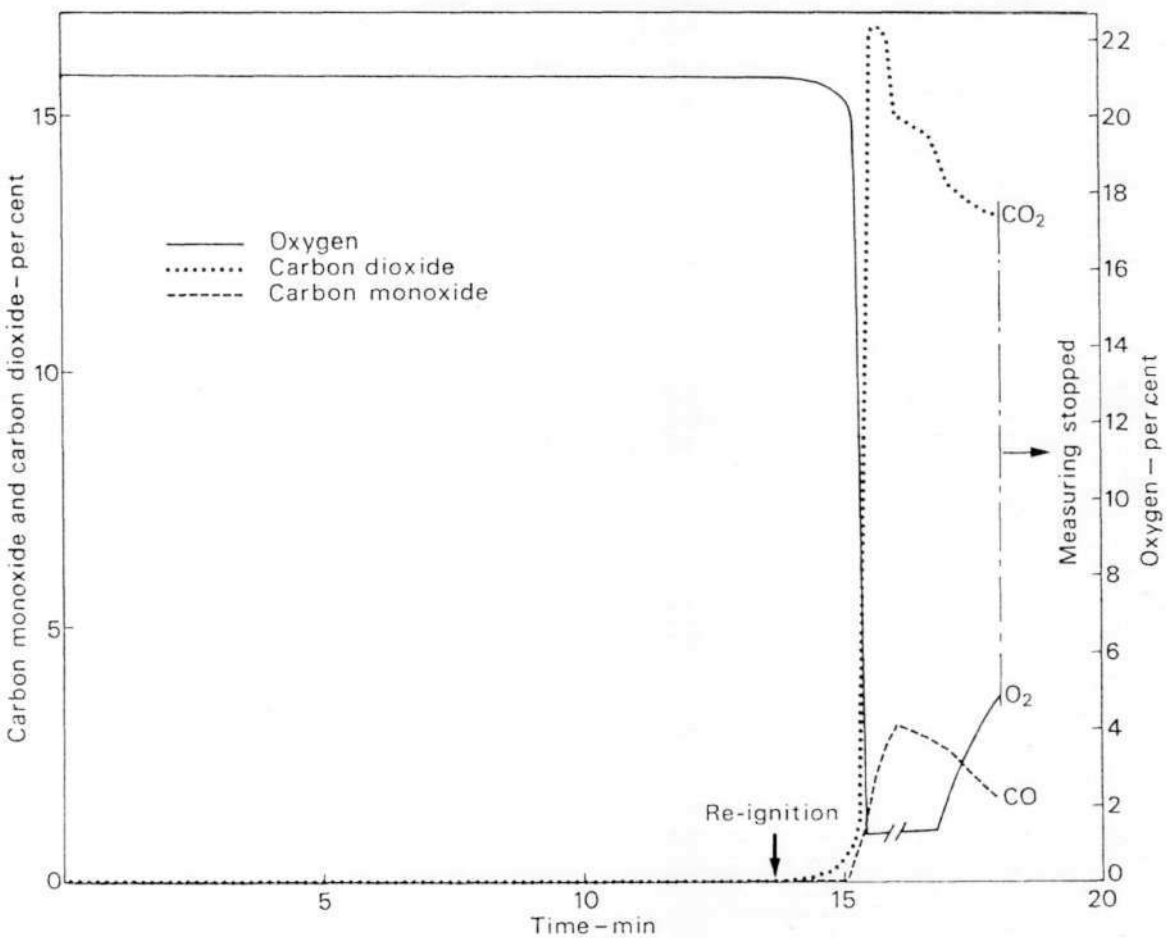


Figure K10 — *Permanent gas analysis ('annex' point) — Test I.*

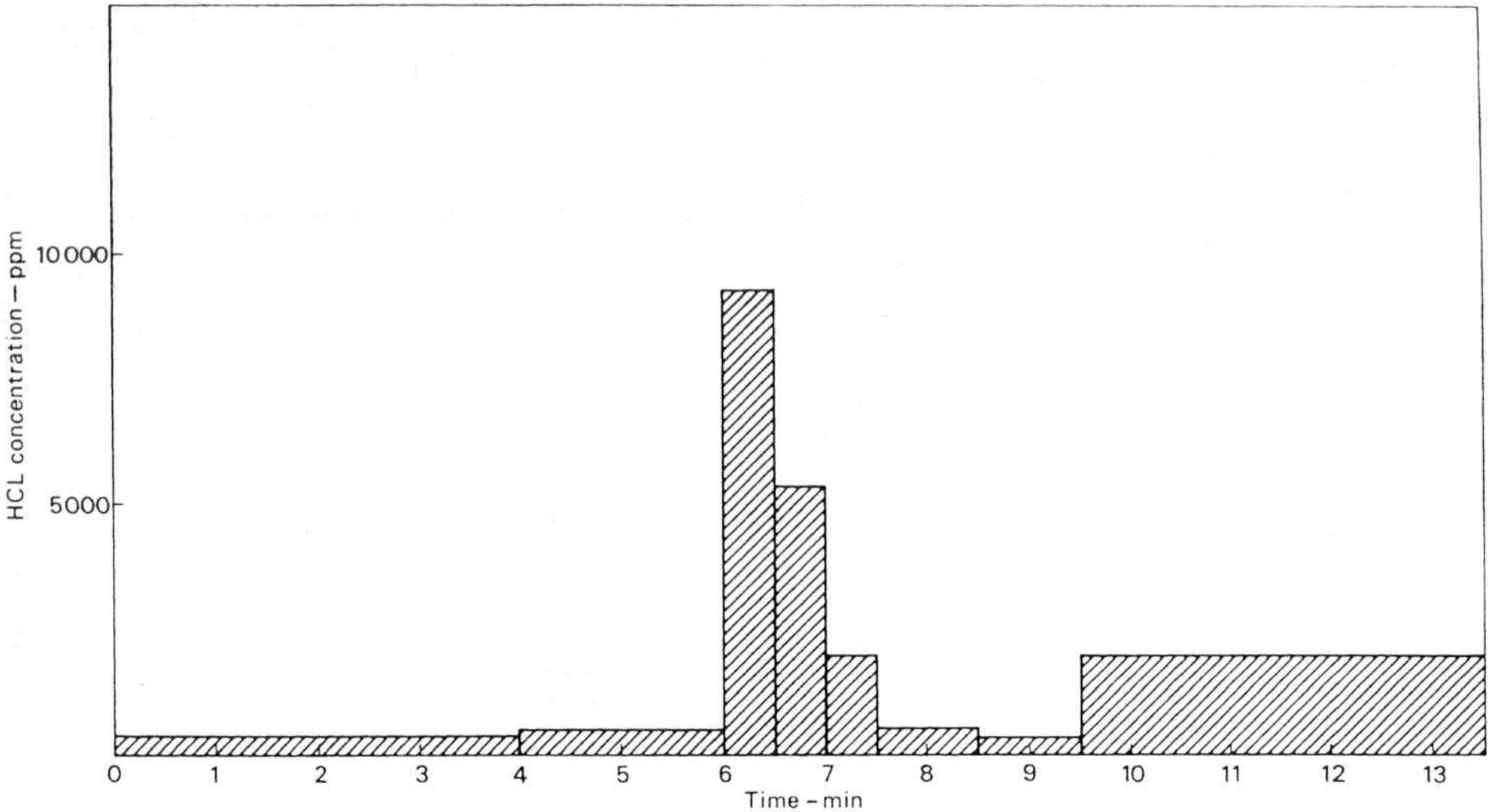


Figure K11 — *Analysis of HCl concentration (by nephelometry) — Test H2.*

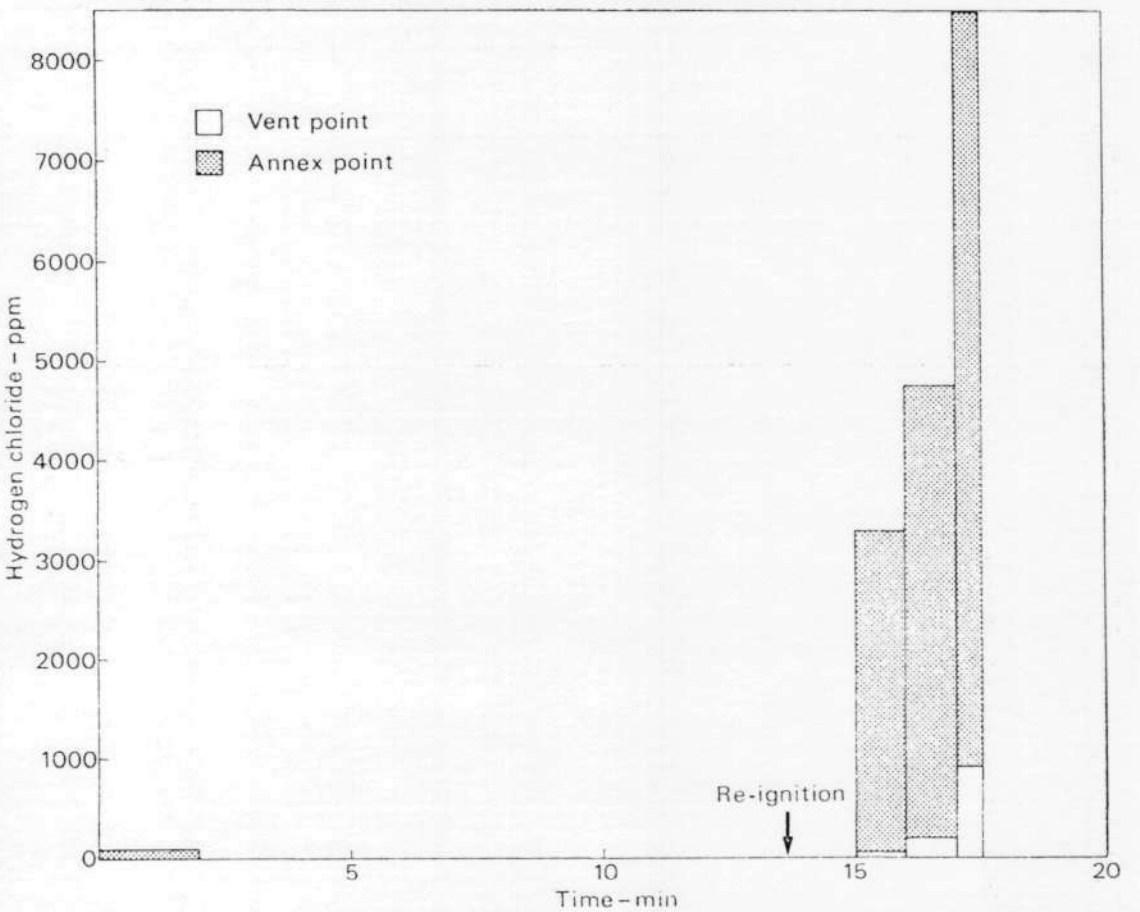


Figure K12 — *Hydrogen chloride analysis using nephelometry — Test I.*

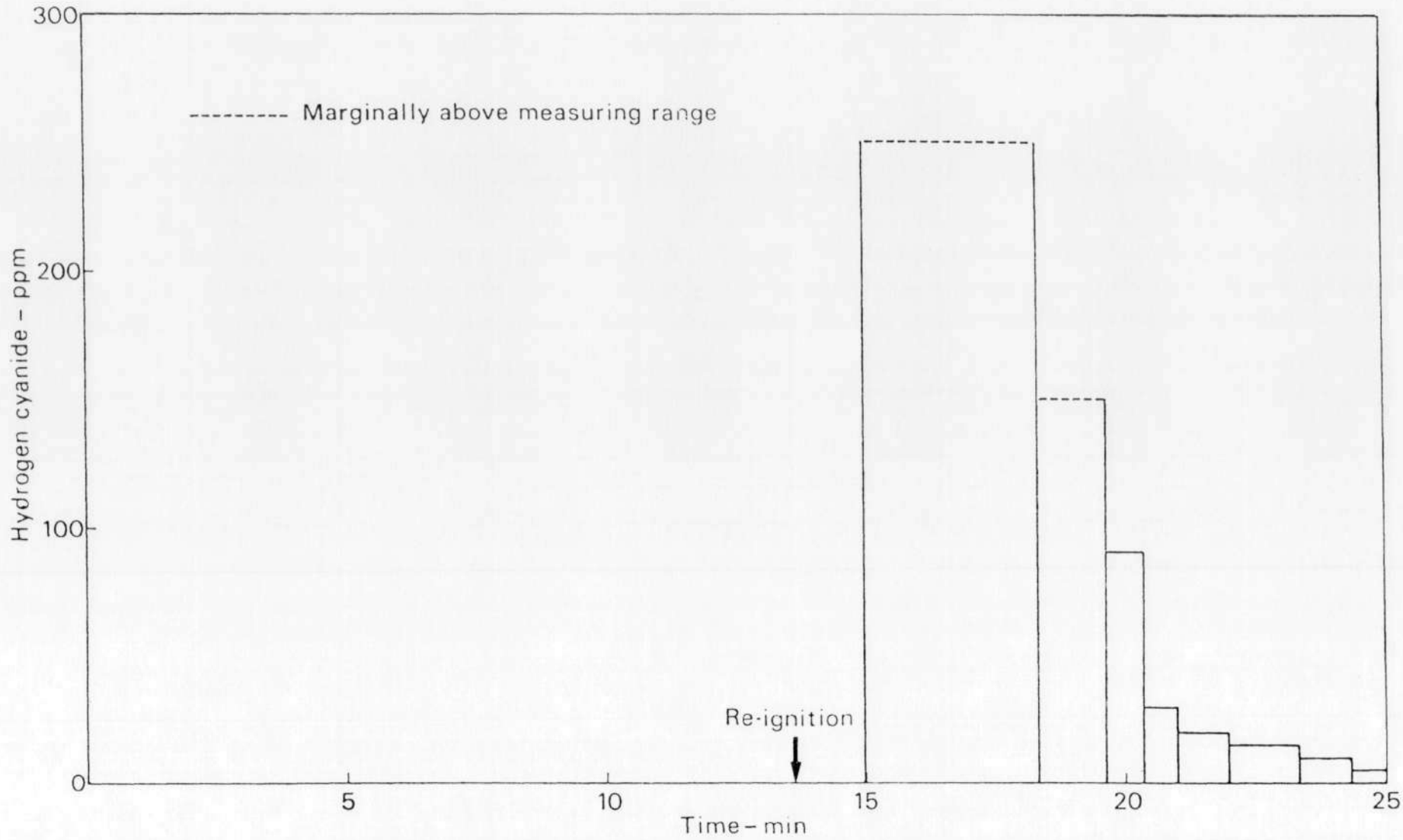


Figure K13 — *Hydrogen cyanide analysis by 'Draeger' tubes ('annex' point) — Test I.*

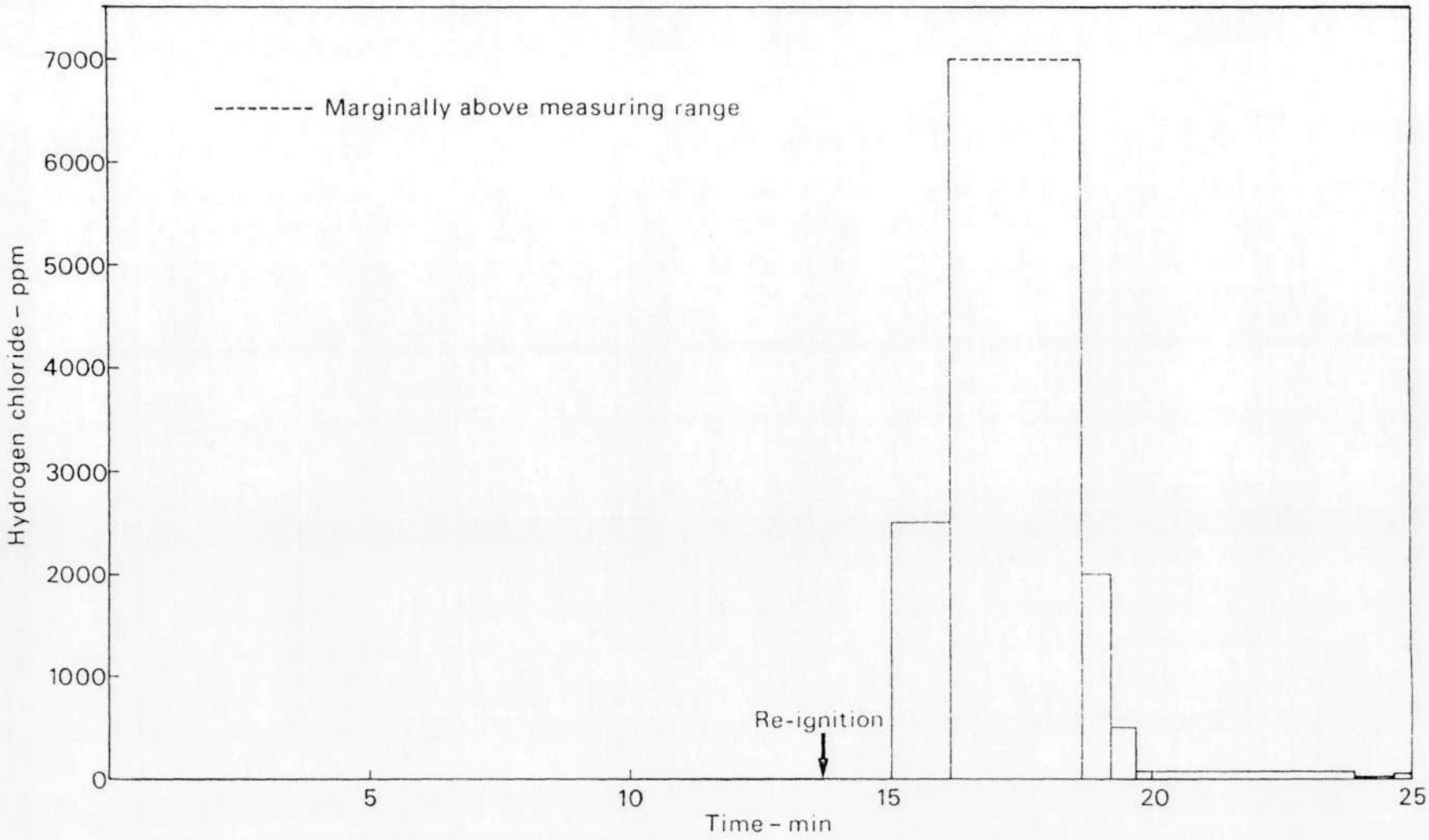


Figure K14 — *Hydrogen chloride analysis by 'Draeger' tubes ('annex' point) — Test I.*

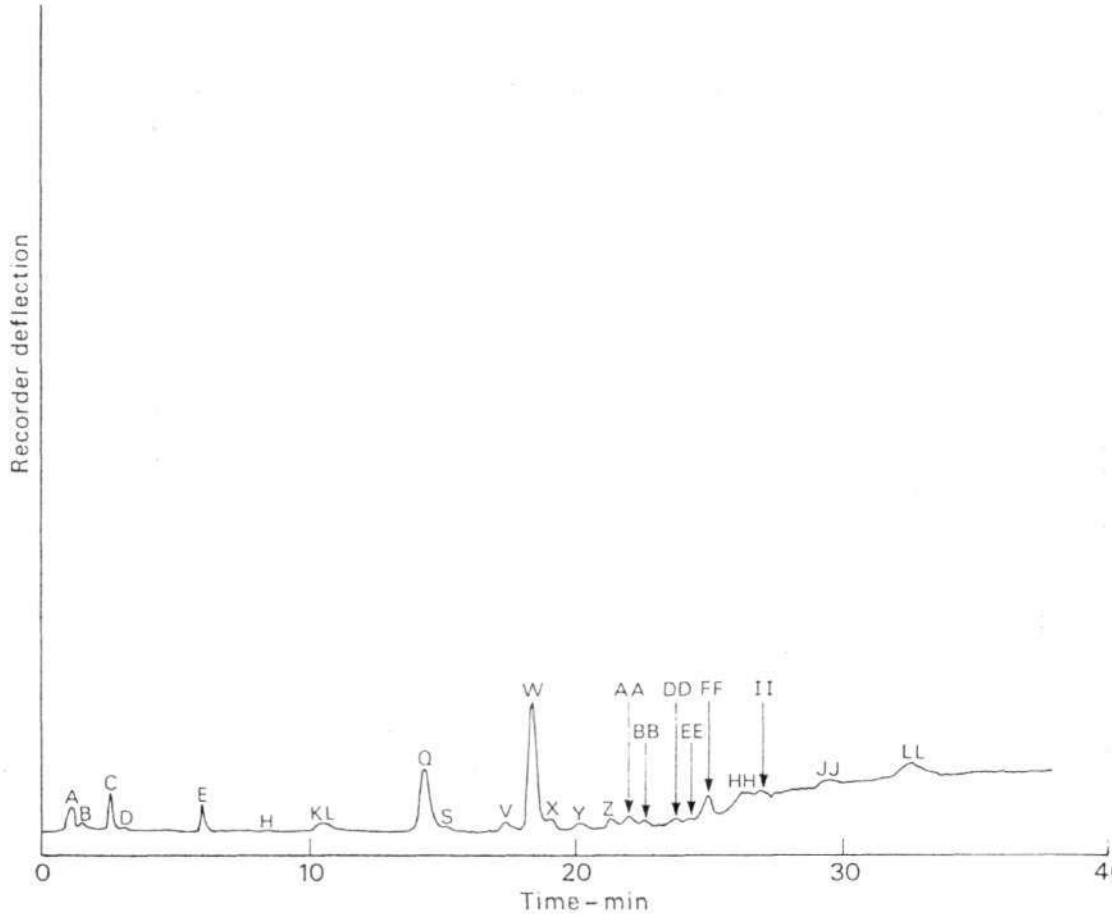


Figure K15 — *Fingerprint at 3 minutes 30 seconds.*

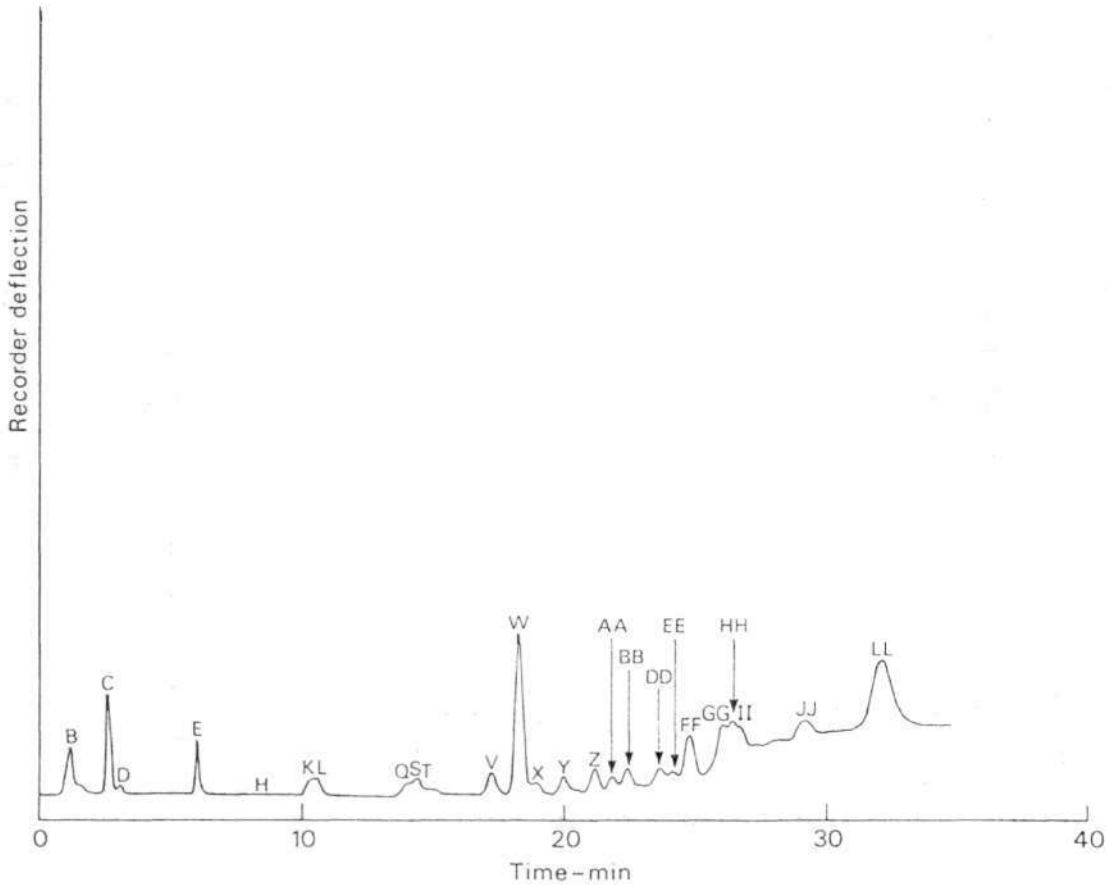


Figure K16 — *Fingerprint at 6 minutes.*

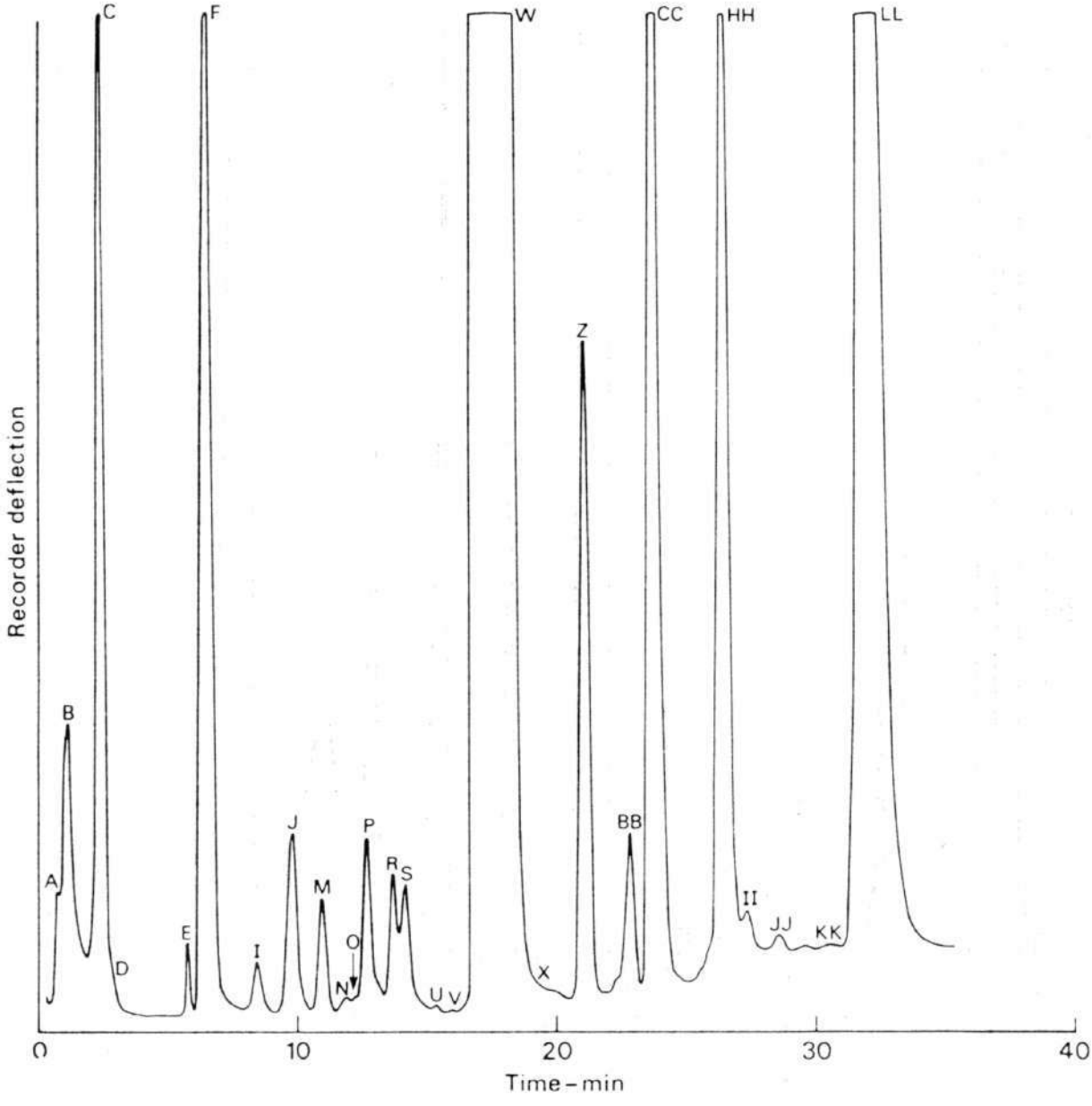


Figure K17 — *Fingerprint at 7 minutes 30 seconds.*

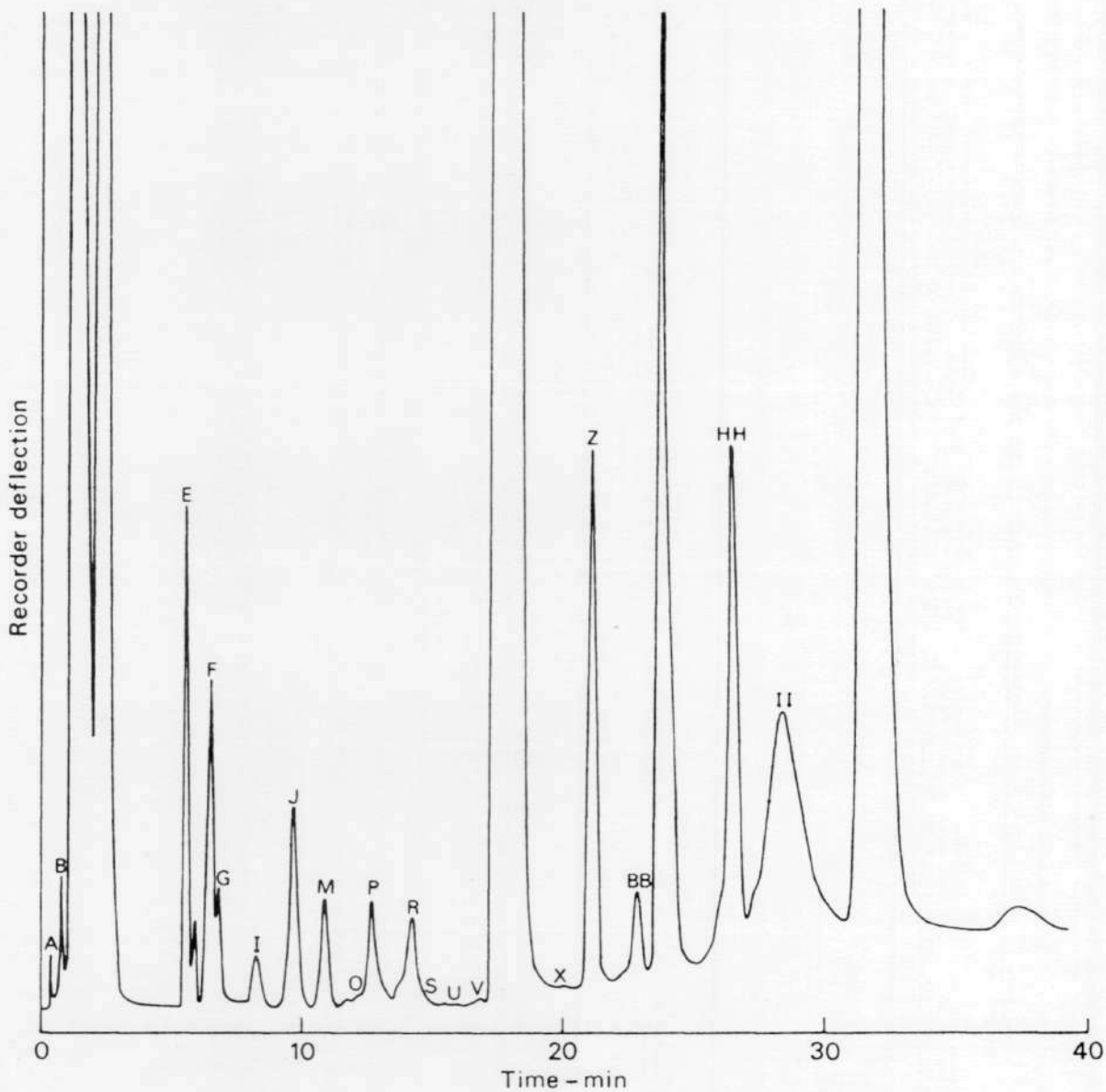


Figure K18 — *Fingerprint at 8 minutes.*

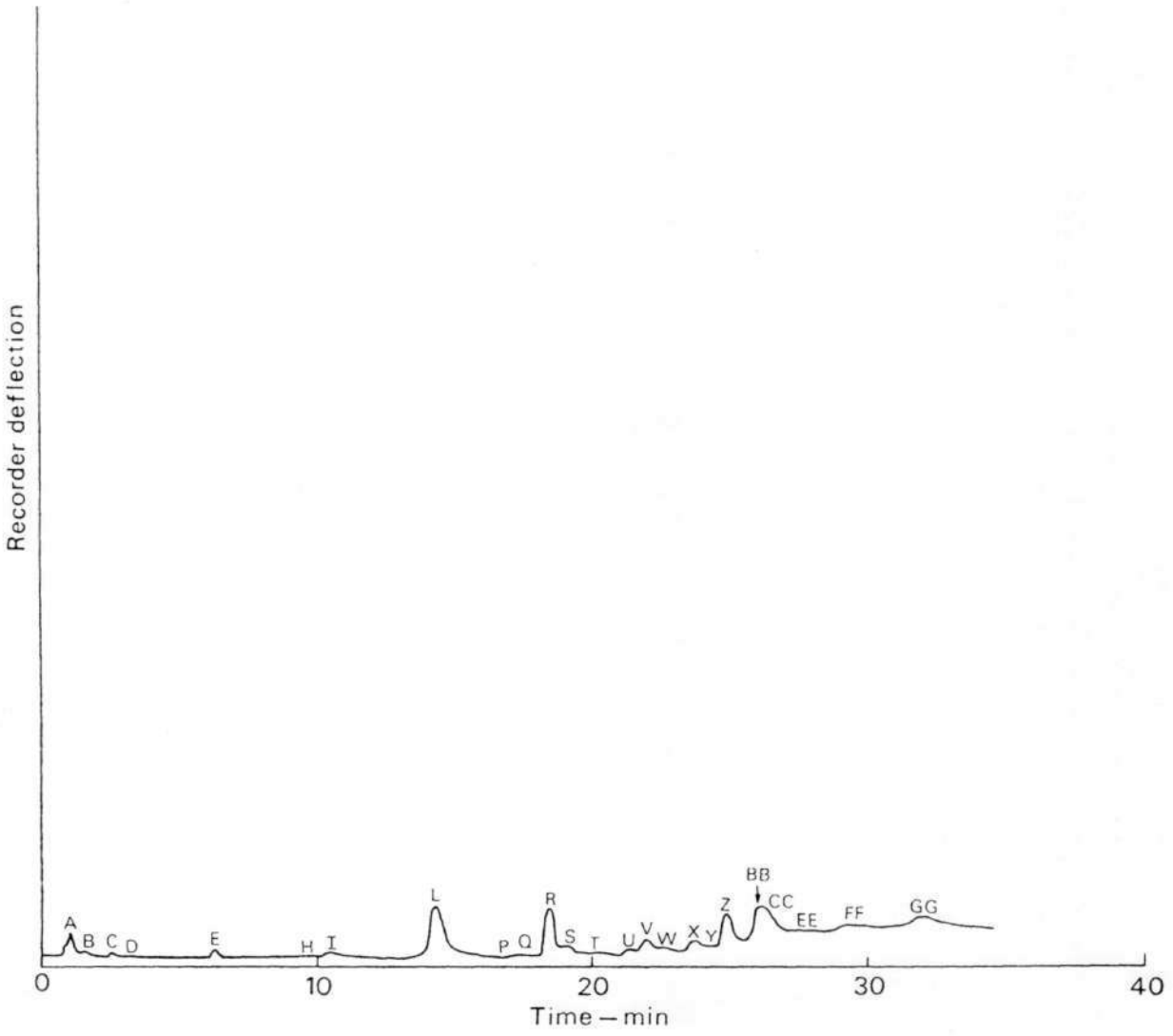


Figure K19 — *Fingerprint obtained at 1 minute 55 seconds ('annex' position).*

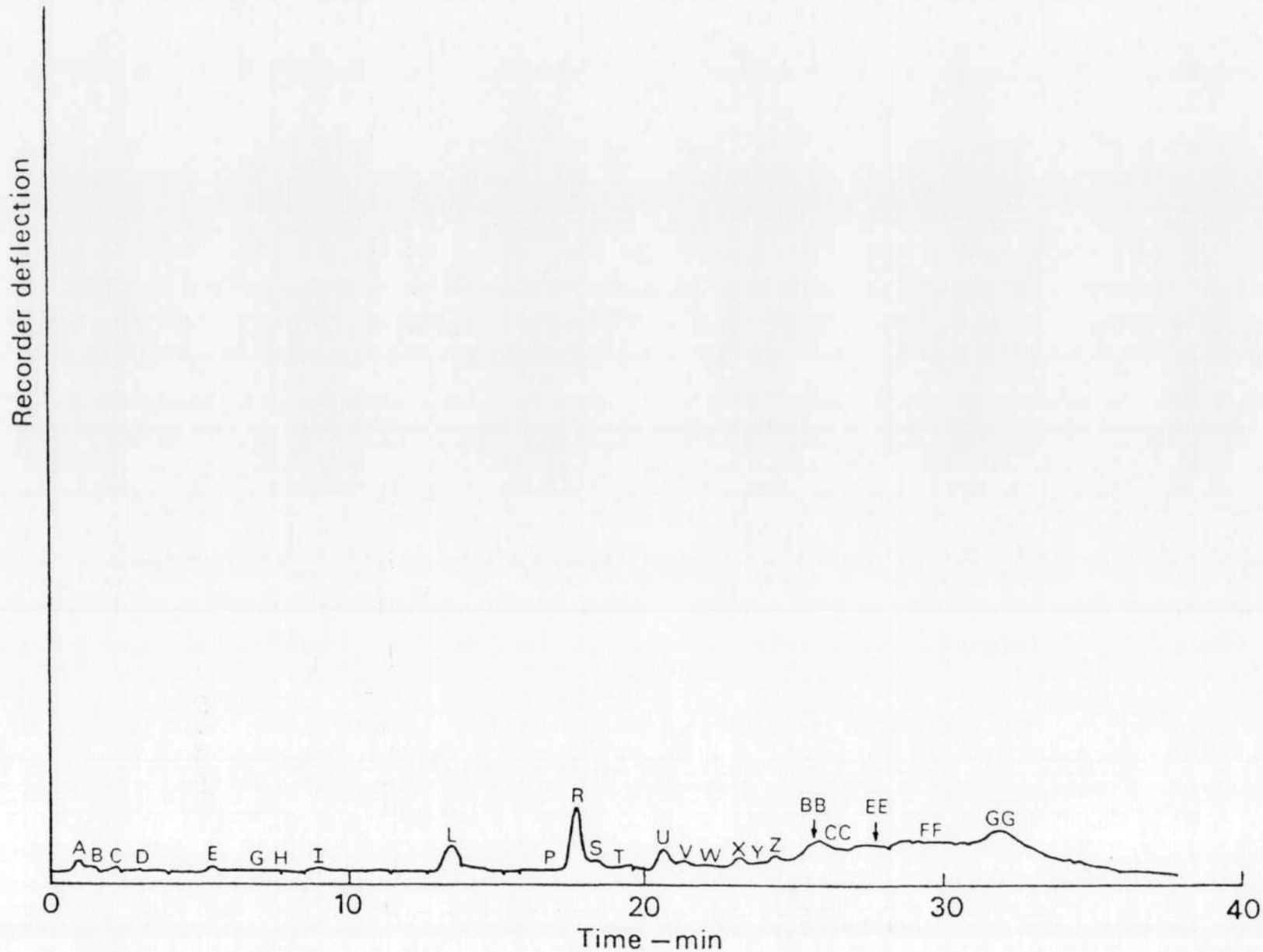


Figure K20 — *Fingerprint obtained at 13 minutes 40 seconds ('annex' position).*

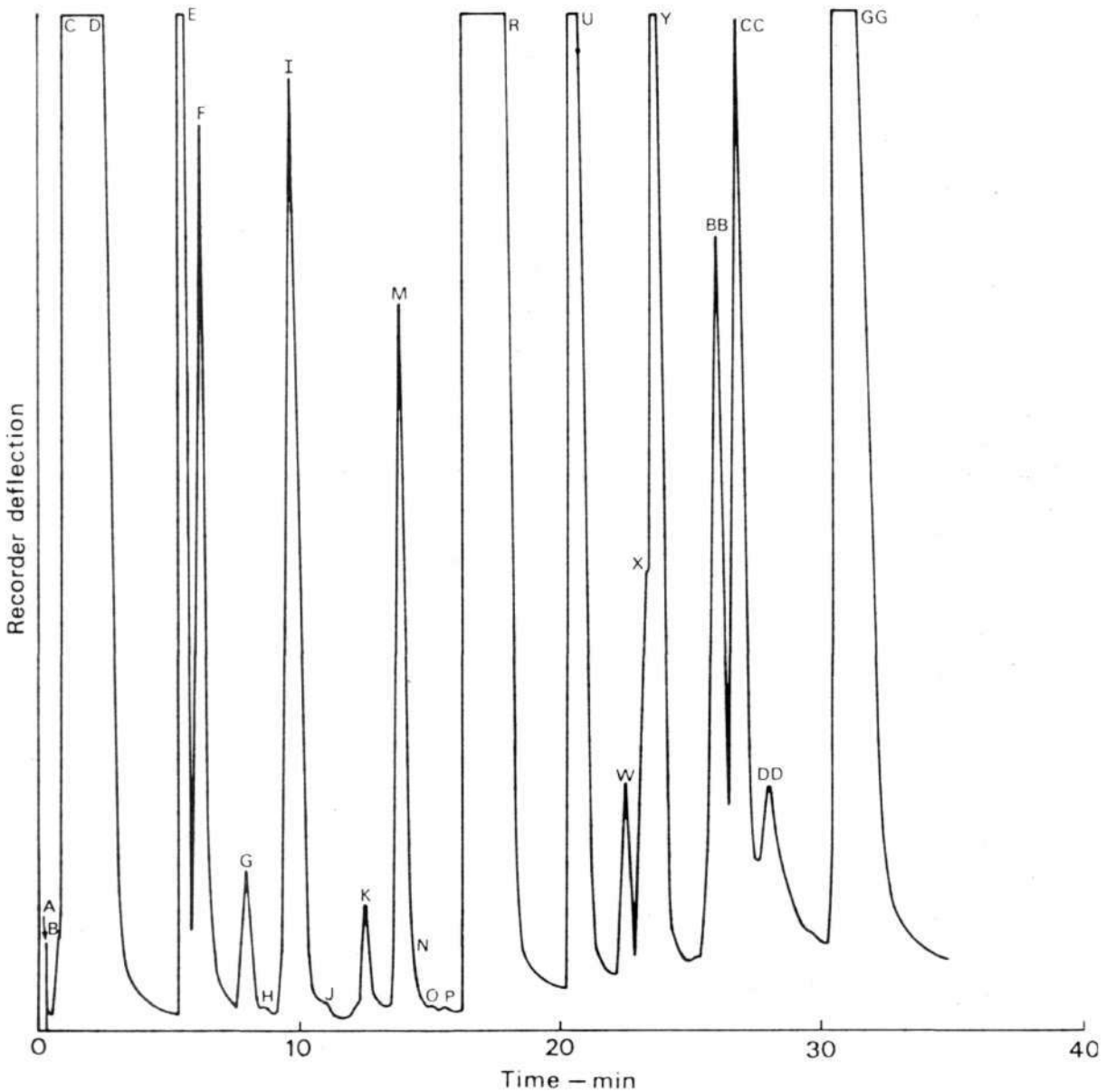


Figure K21 — *Fingerprint obtained at 16 minutes 25 seconds ('annex' position).*

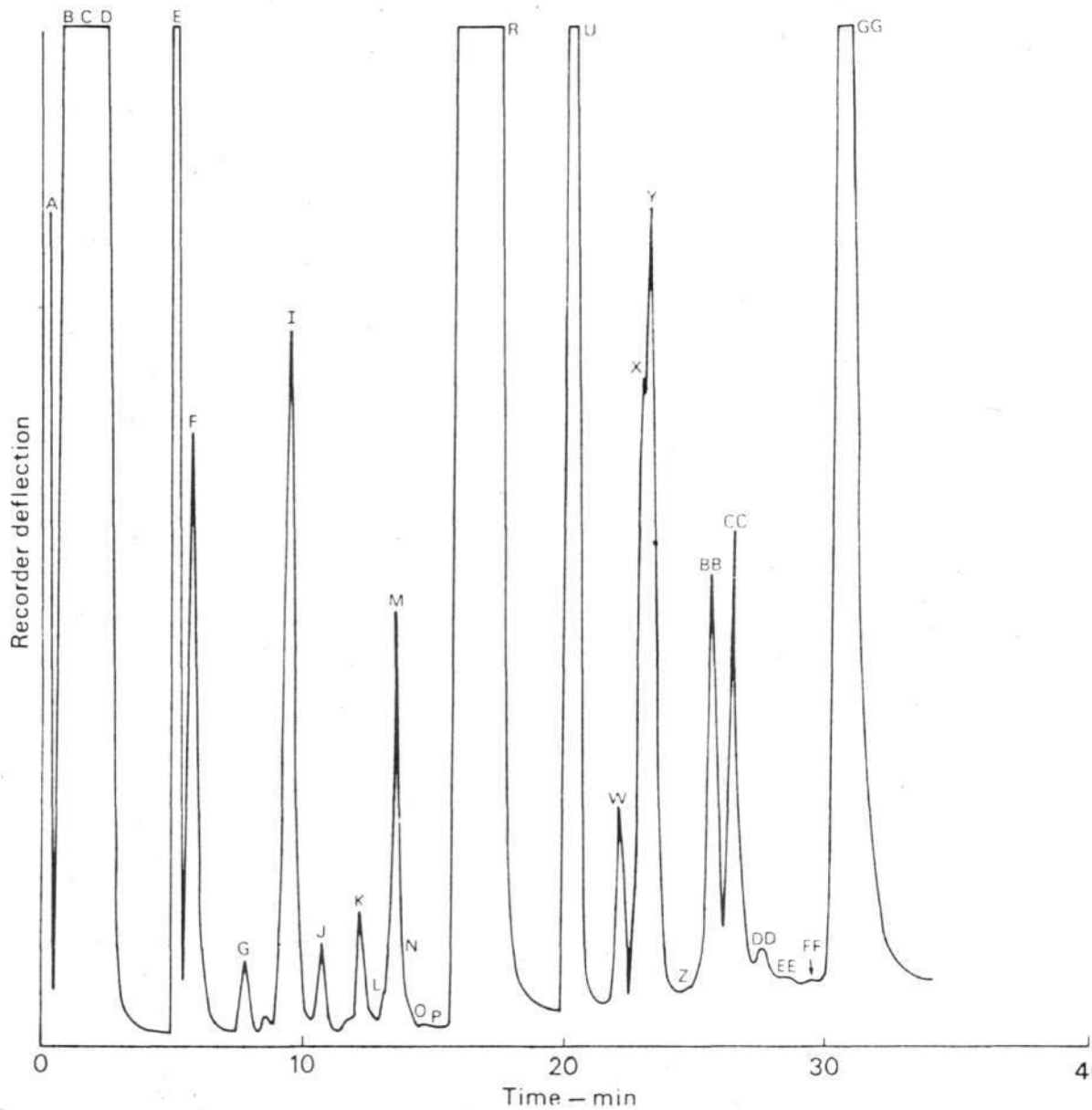


Figure K22 — *Fingerprint obtained at 17 minutes 15 seconds ('annex' position).*

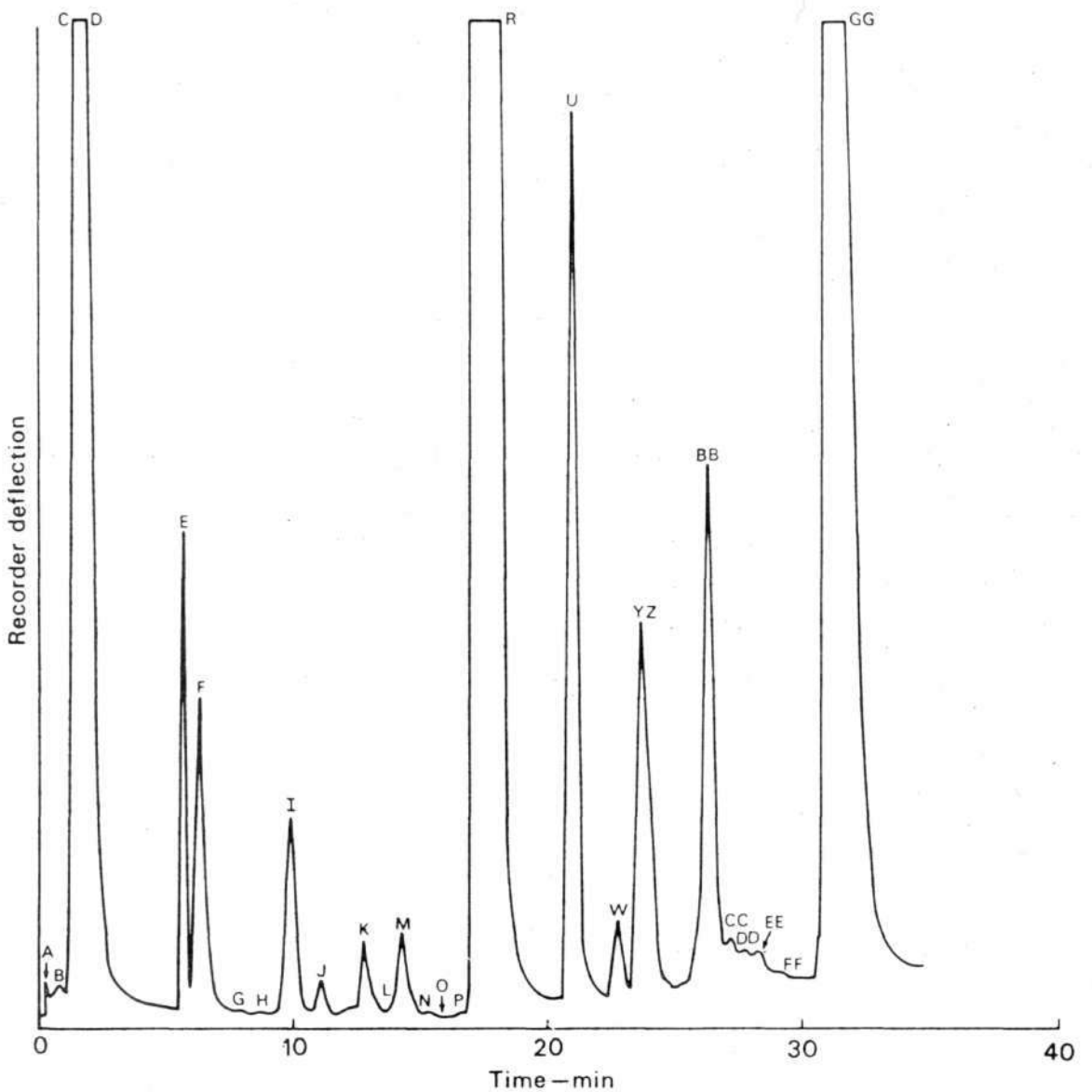


Figure K23 — *Fingerprint obtained at 18 minutes ('annex' position).*

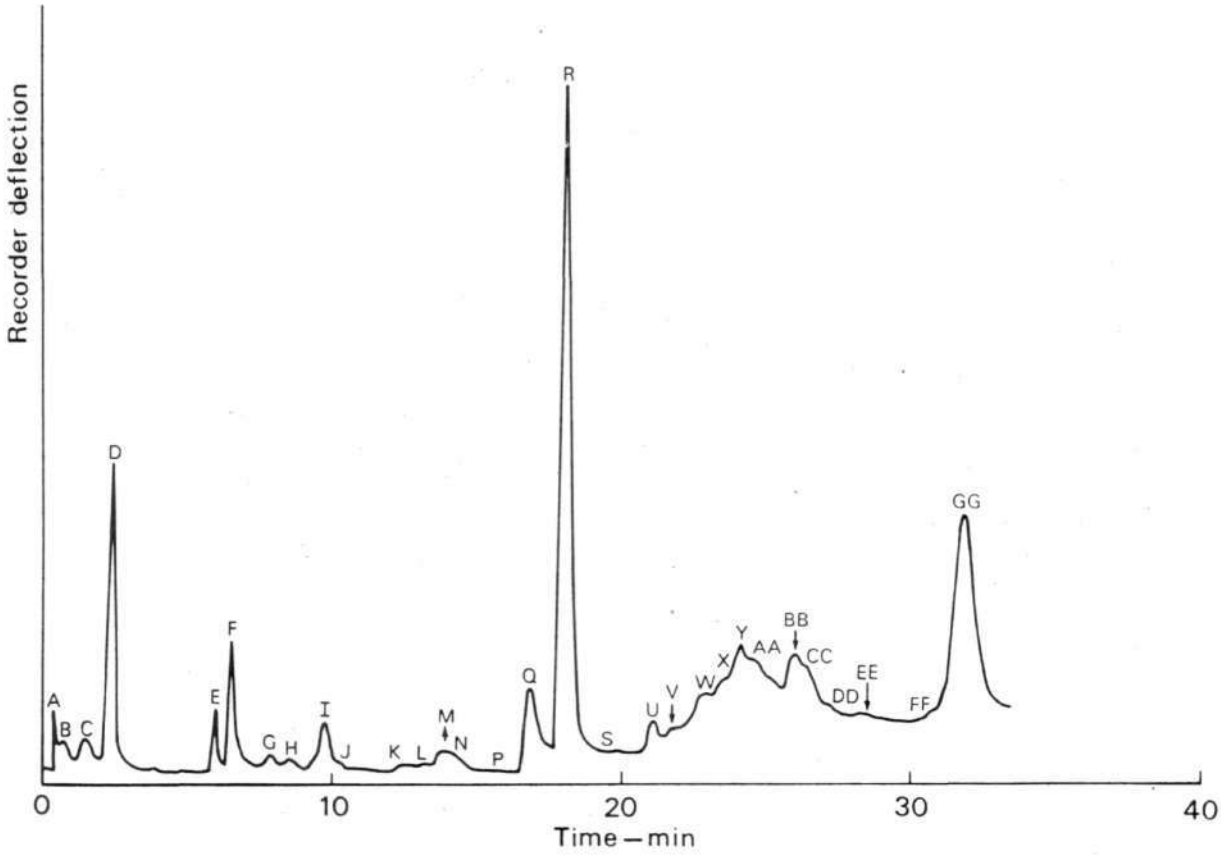


Figure K24 — *Fingerprint obtained at 15 minutes 45 seconds ('vent' position).*

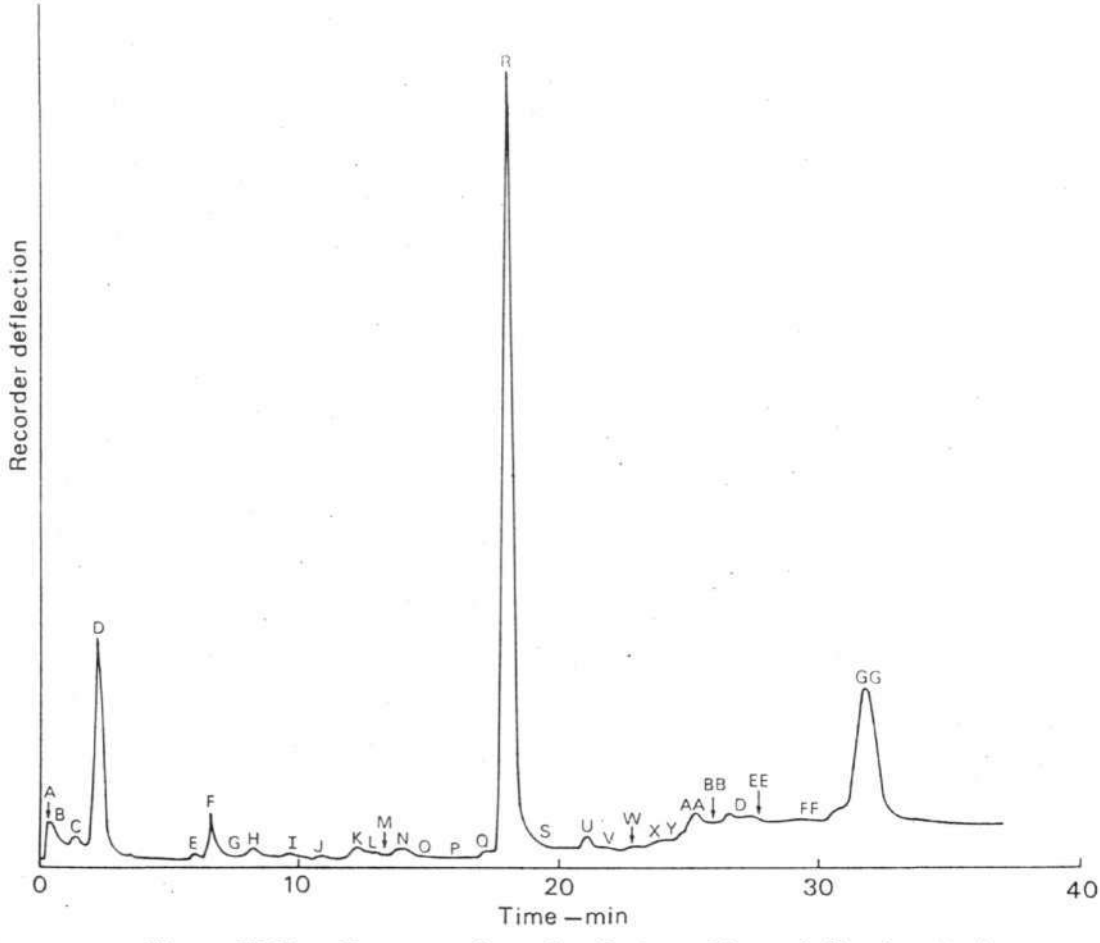


Figure K25 — *Fingerprint obtained at 17 minutes 20 seconds ('vent' position).*

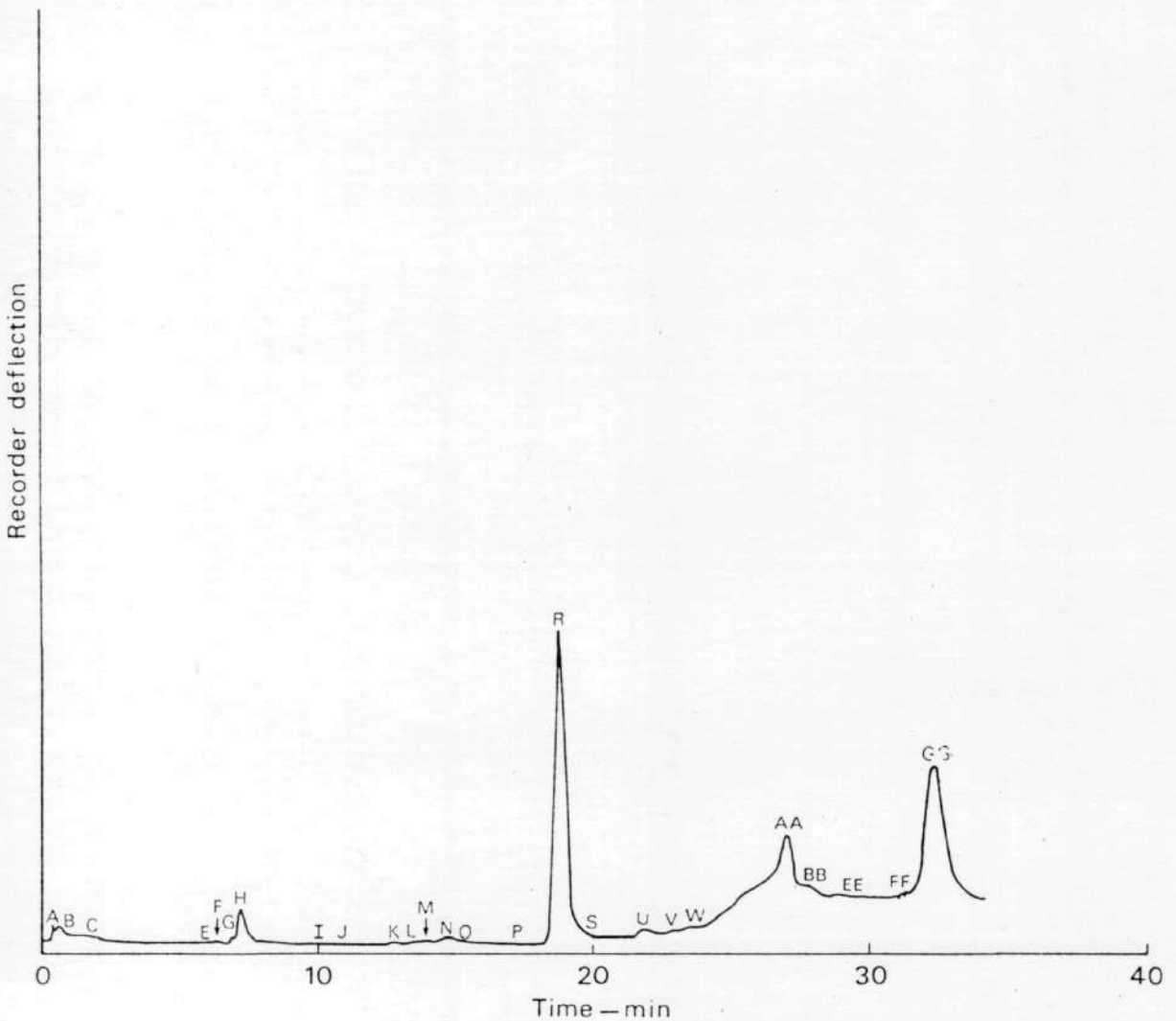


Figure K26 — *Fingerprint obtained at 18 minutes 30 seconds ('vent' position).*

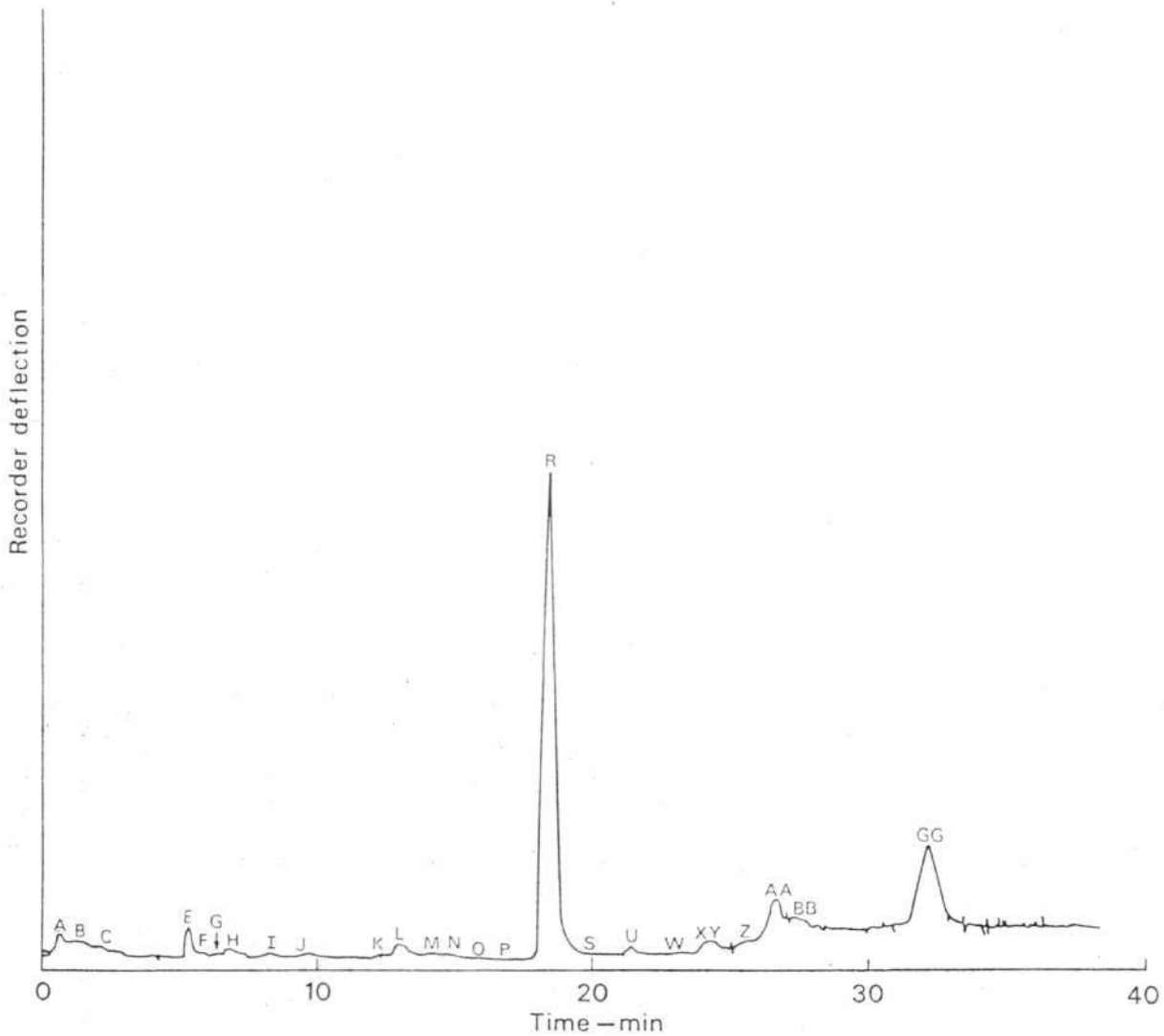


Figure K27 — *Fingerprint obtained at 19 minutes 20 seconds ('vent' position).*

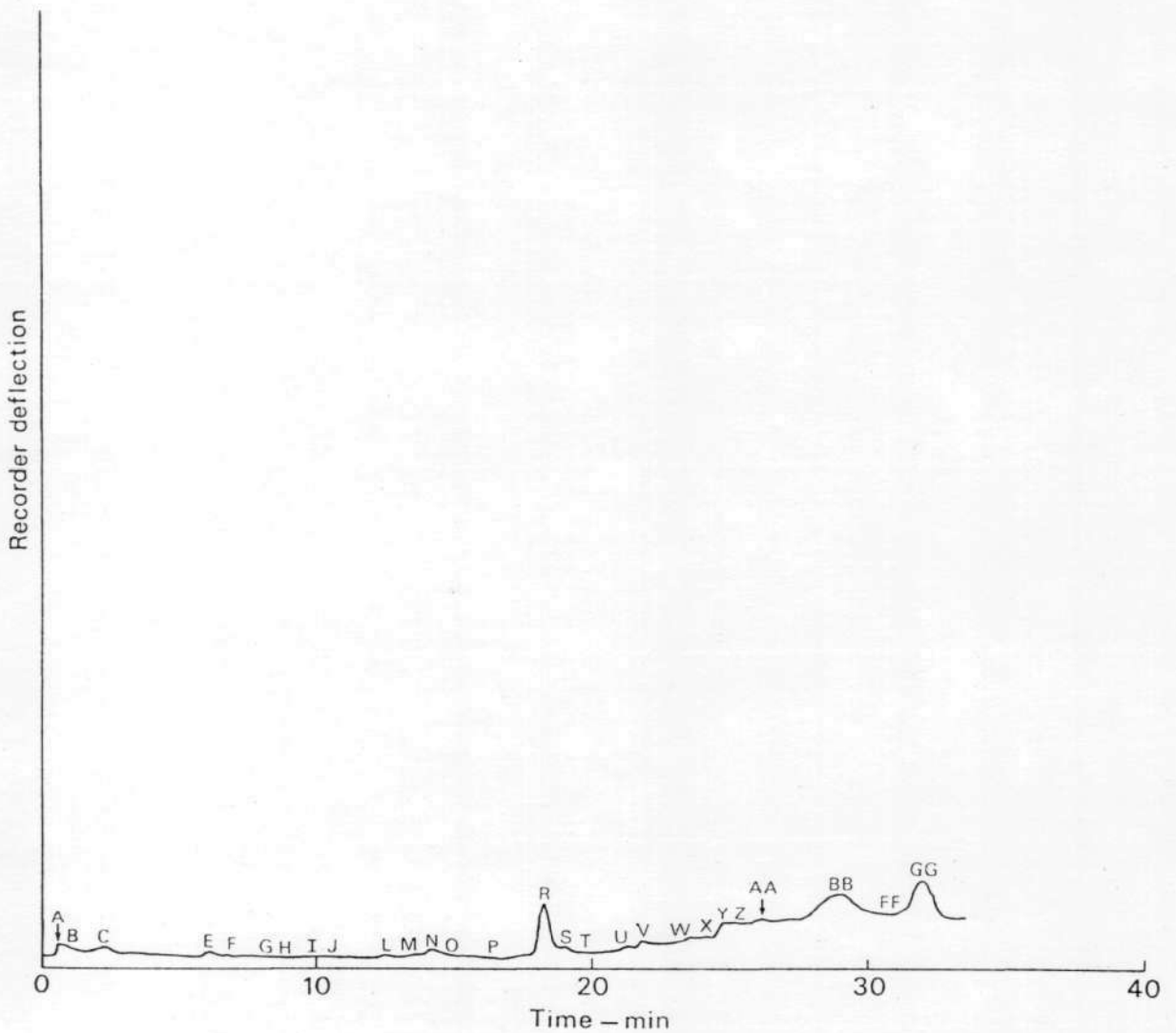


Figure K28 — *Fingerprint obtained at 20 minutes 30 seconds ('vent' position).*

List of Photographs

List of photographs

Title

Small scale tests

Rate of burning of seating unit (point source)

Rate of burning of seating unit (line source)

Burning rate tests on Stateroom tiles

Ignition at top of back of a seating unit

Experiment on interaction between seats and Stateroom carpet tiles

Tests on liquid fuels on suspended ceiling

Fire spread between tiers

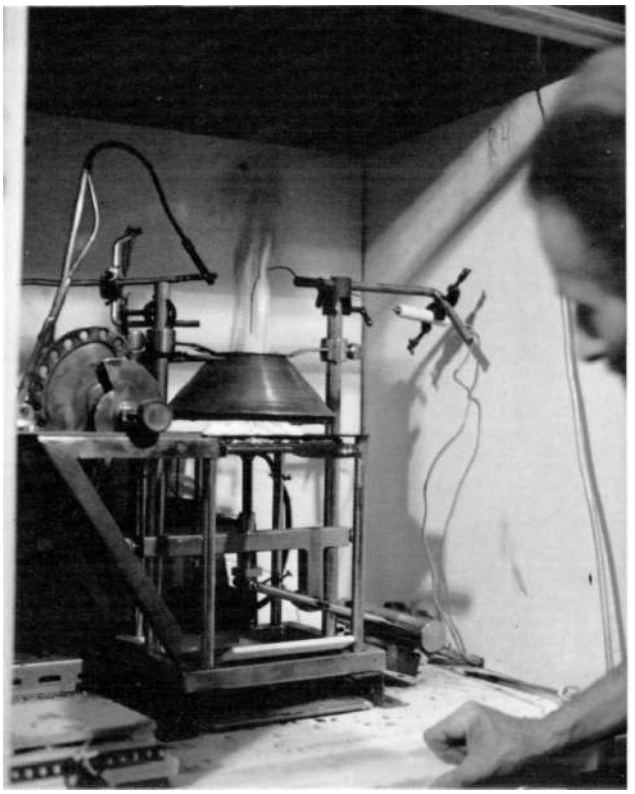
32. Arrangement of furnishings.
33. Involvement of back of seating unit.
34. Full involvement of first seating unit.
35. Lateral fire spread along seat.

Fire spread along back tier

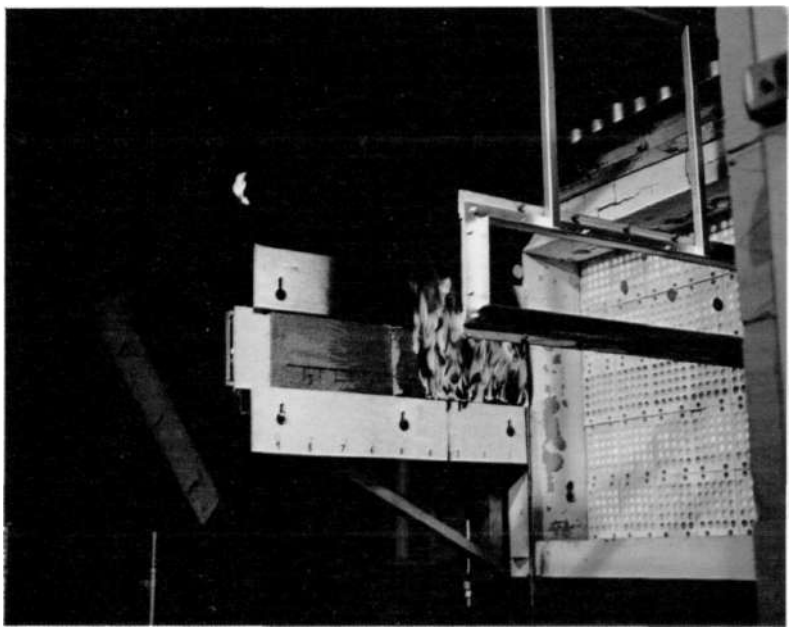
36. Experimental arrangement.
37. Involvement of back of first seating unit.
38. Fire spread up wall tiles and smoke production.
39. Lateral spread over wall tiles showing flaming runnels.
40. Lateral fire spread over second seat.
41. Fully developed fire.

Large scale simulation experiment

42. Arrangement of furnishings.
43. Newspaper ignition source.
44. Involvement of rear tier and carpet tiles on wall.
45. Ignition of second tier.
46. Forward fire spread and thickening of smoke layer.
47. Smoke and flames out of exit at full fire developmeni
48. Conditions after experiment.

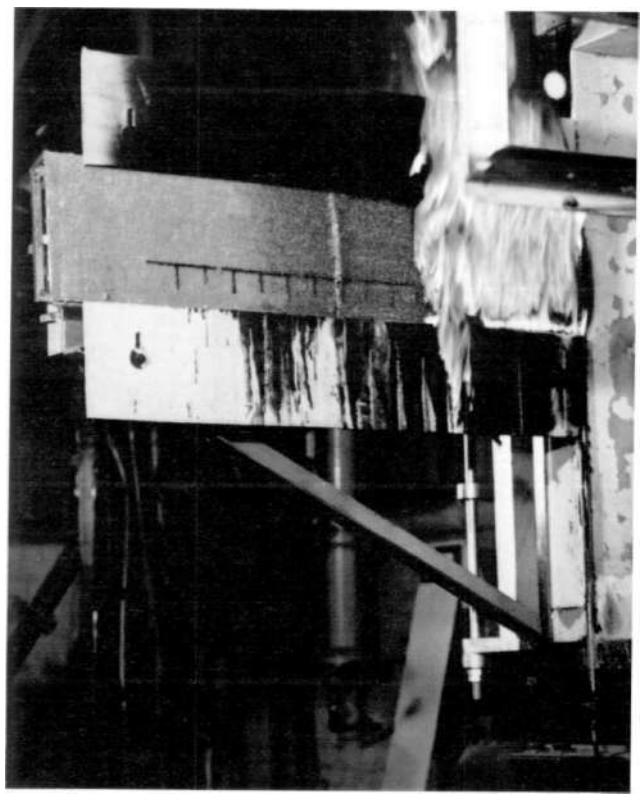


1 DD 70 ignitibility apparatus used for pilot ignition of furnishings

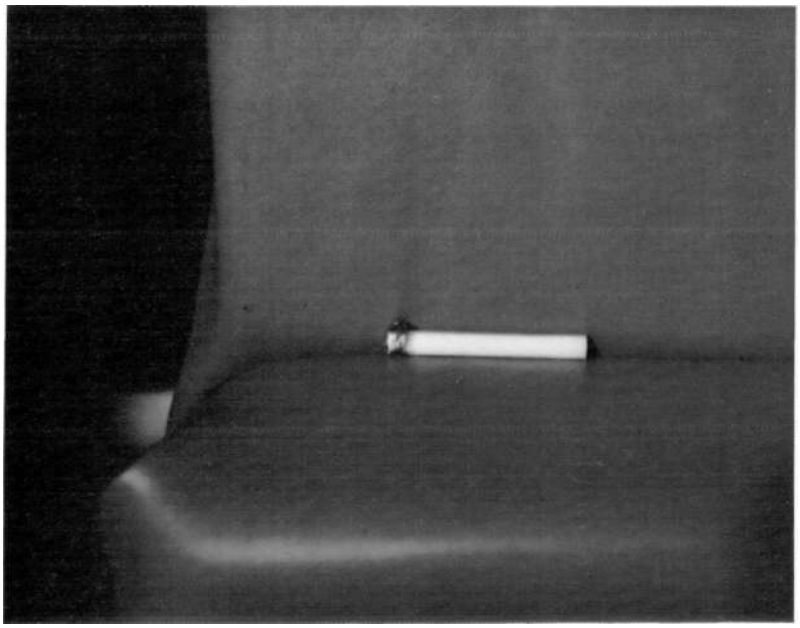


2 BS 476 Part 7 spread of flame test on Stateroom carpet tiles

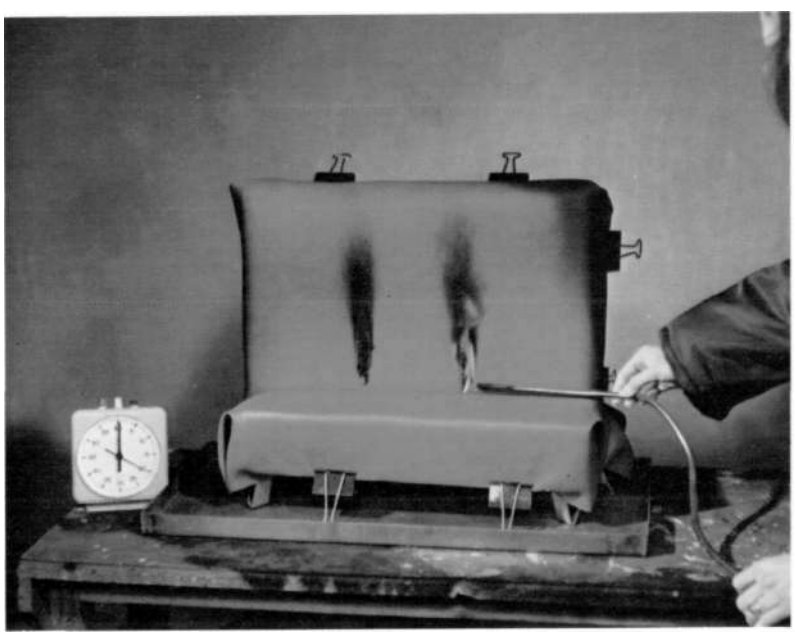
3 BS 476 Part 7 test on simulated Stateroom carpet tiles



4 Formation of flaming runnels on simulated Stateroom carpet tiles

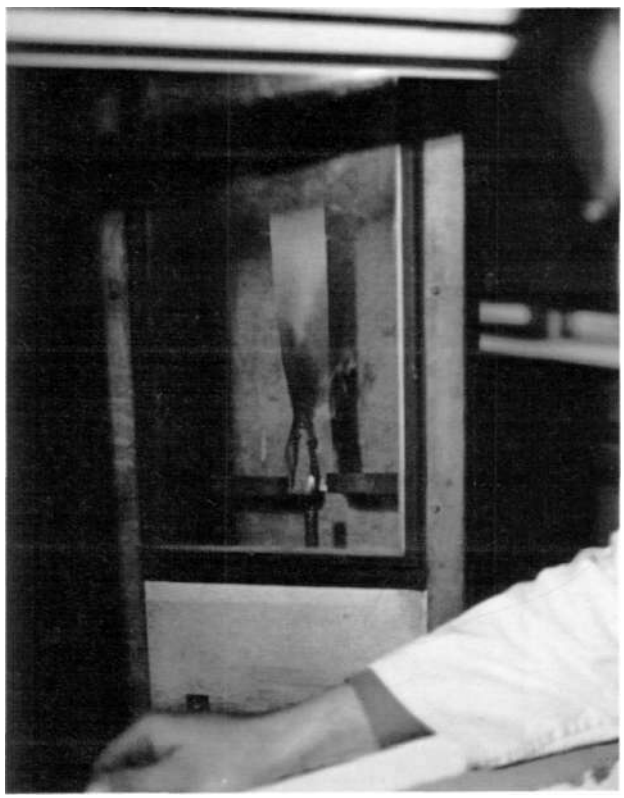


5 Cigarette ignition test on seating composite to BS 5852 (no ignition)

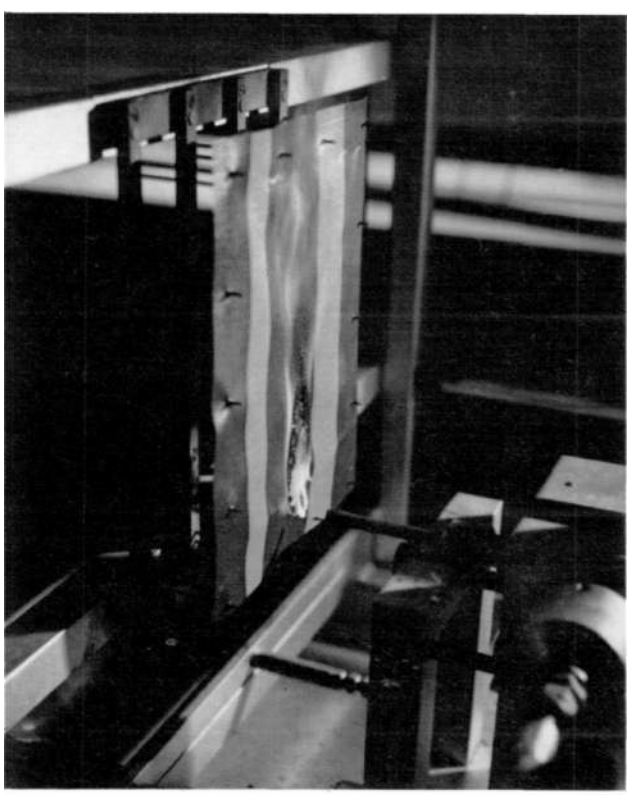


6 Gas flame ignition test on seating composite to BS 5852 (no ignition)

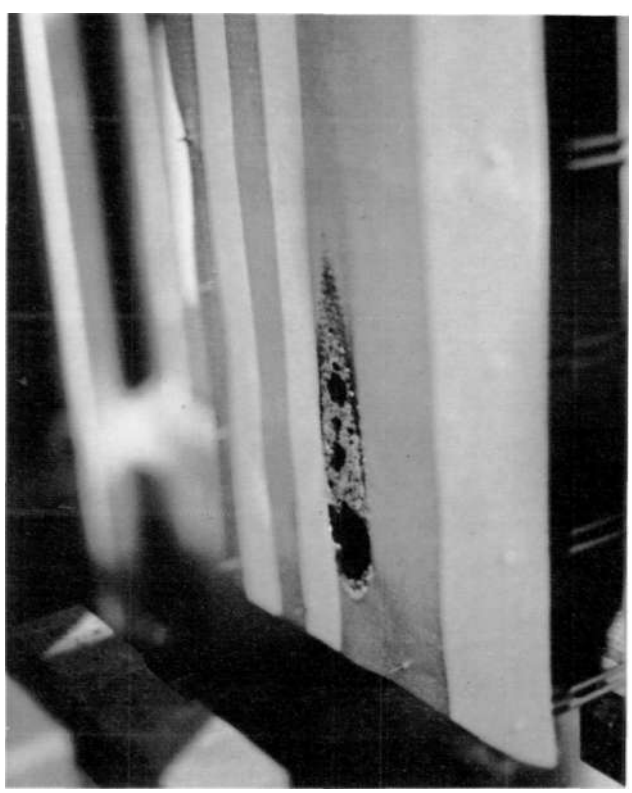
7 Ignition of test rig using source 2 of DD 58



8 BS 3119 test on roller blind material showing extent of damage

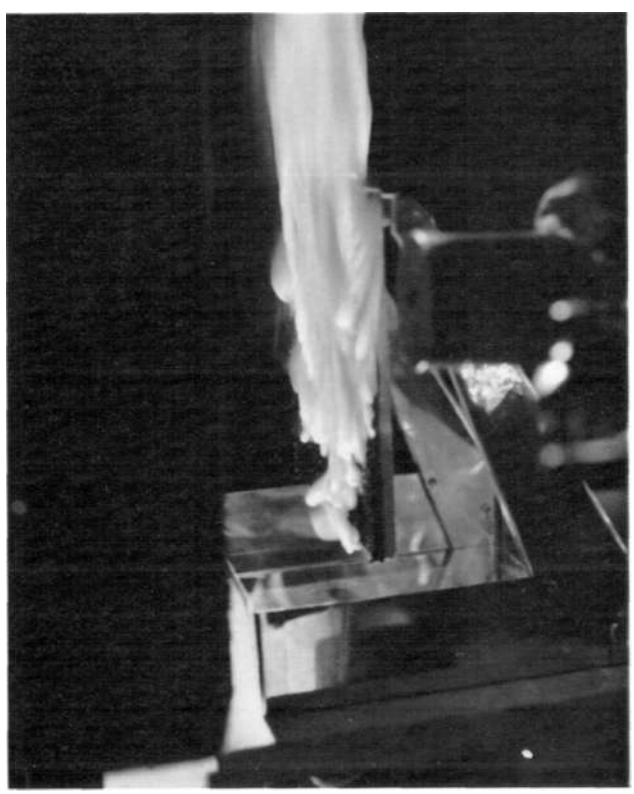


9 BS 5458 test on roller blind material

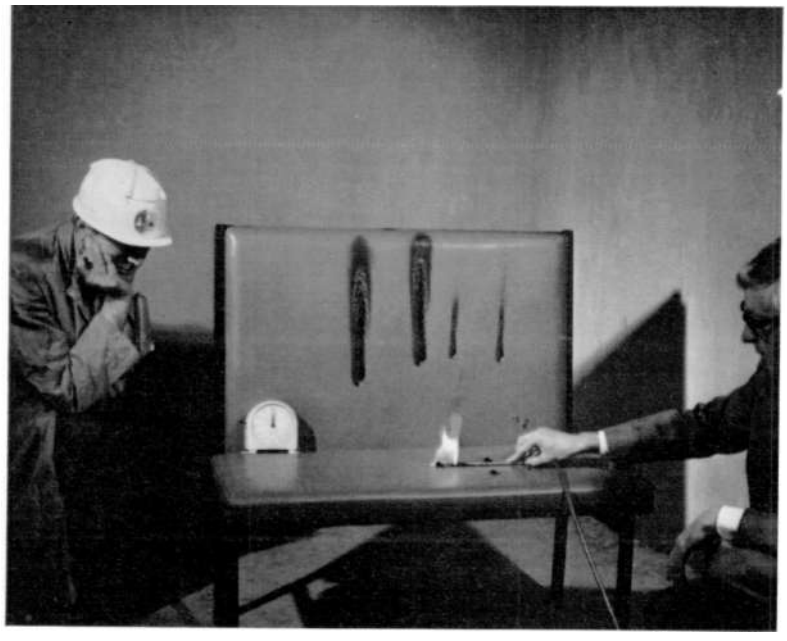


10 Limit of damage to roller blind material

11 Radiant panel used in tests on ignition and rate of burning of carpet tiles

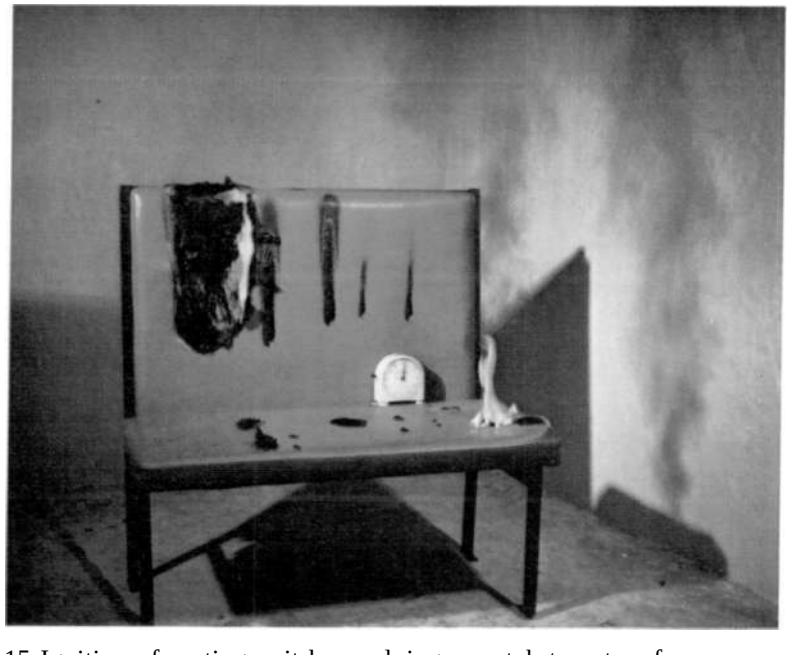


12 Burning and flaming runnels on wall carpet tile sample irradiated at 2 W/cm^2



13 DD 58 ignition source on seating unit (no sustained ignition)

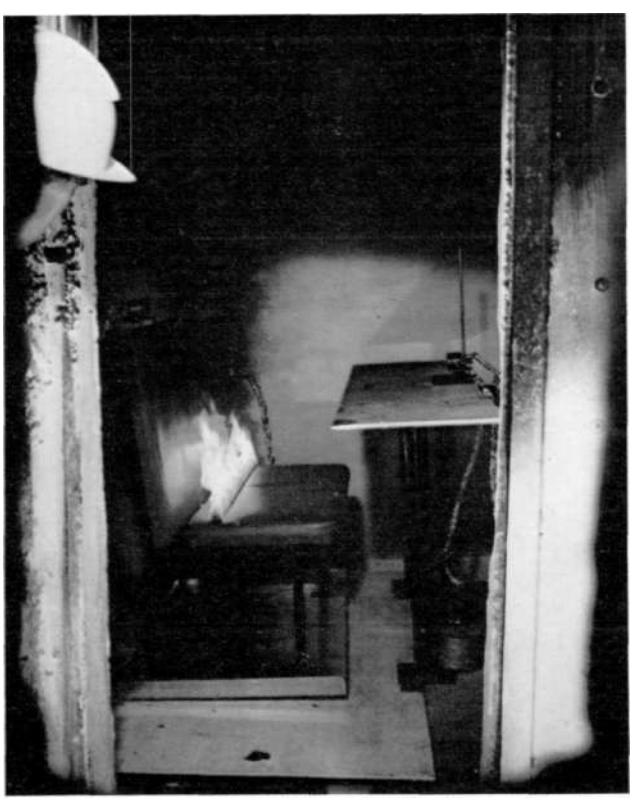
14 Larger source resulting in ignition



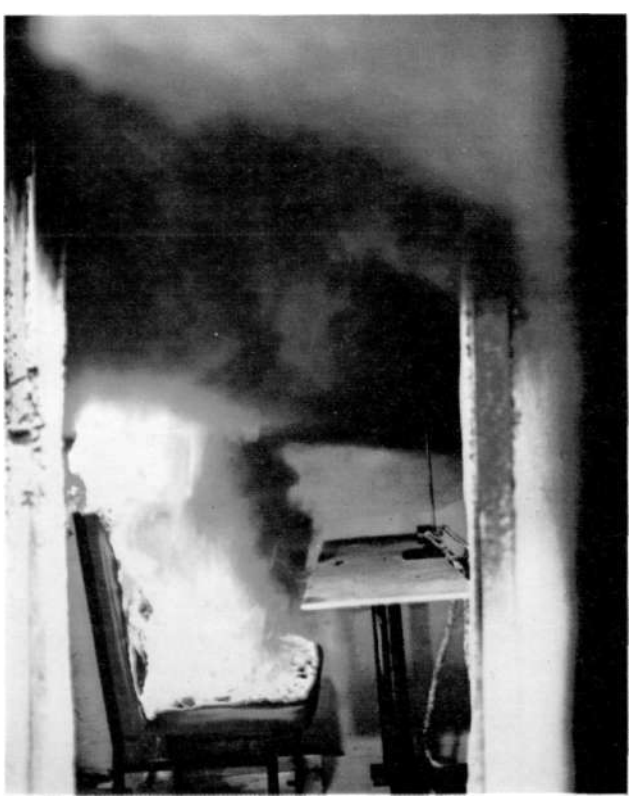
15 Ignition of seating unit by applying a match to cut surface

16 Ignition

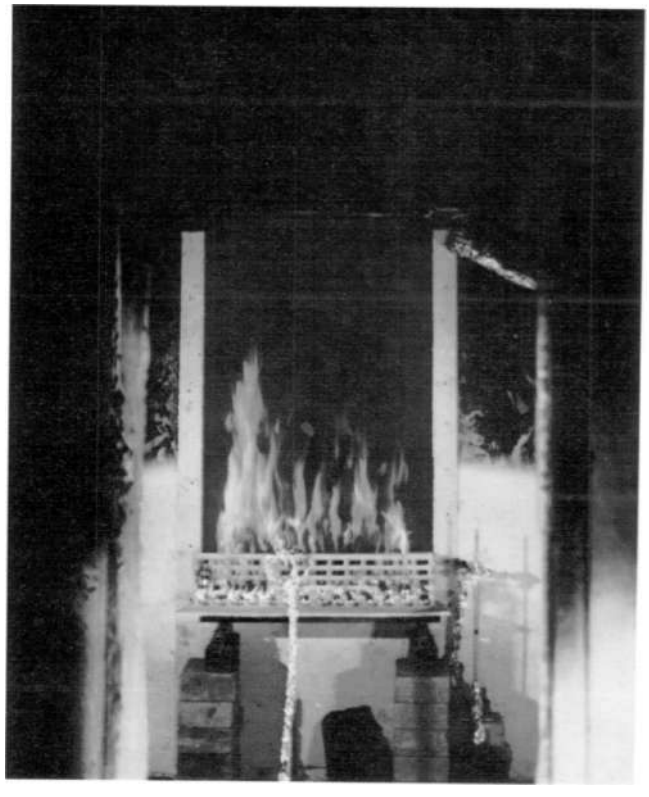
17 Complete involvement



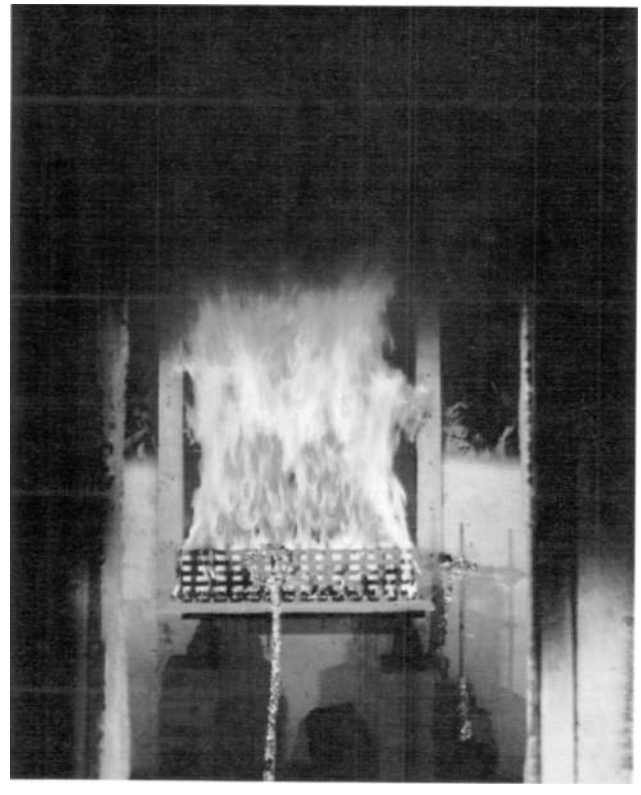
18 Ignition



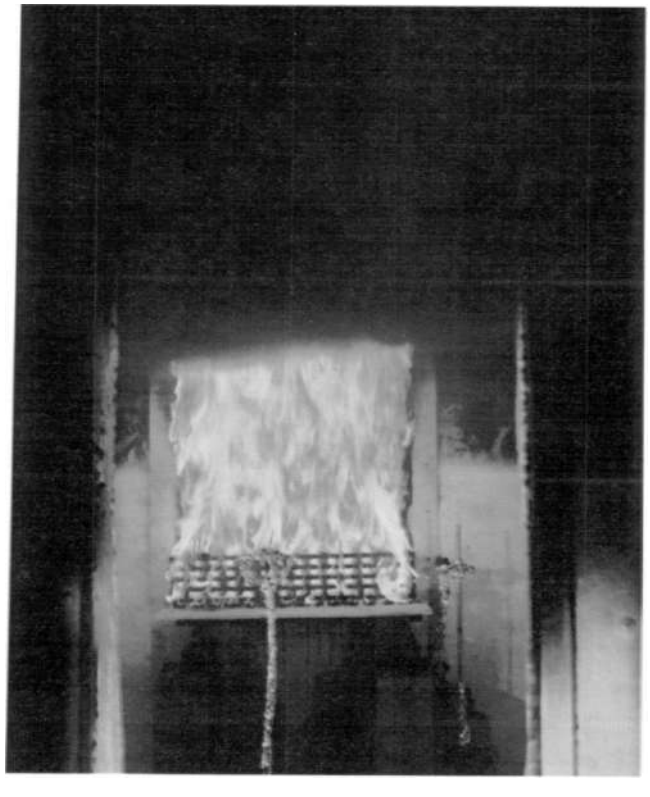
19 Complete involvement



20 Tiles not involved

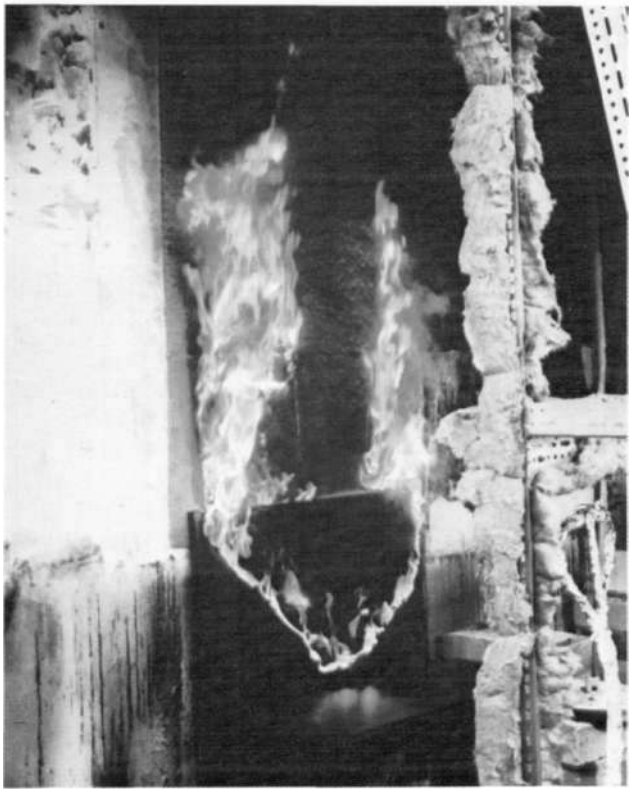


21 Tiles involved



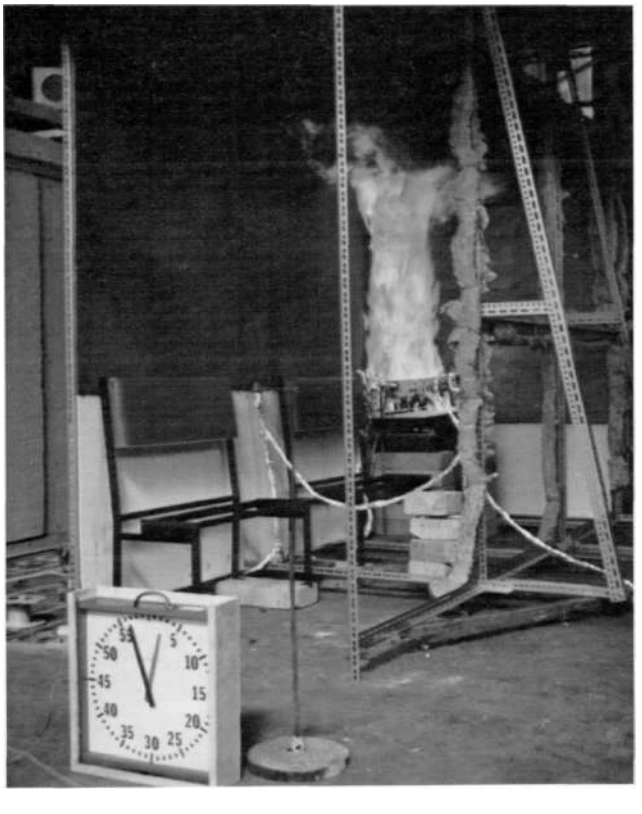
22 Fire at maximum

23 Tiles not involved

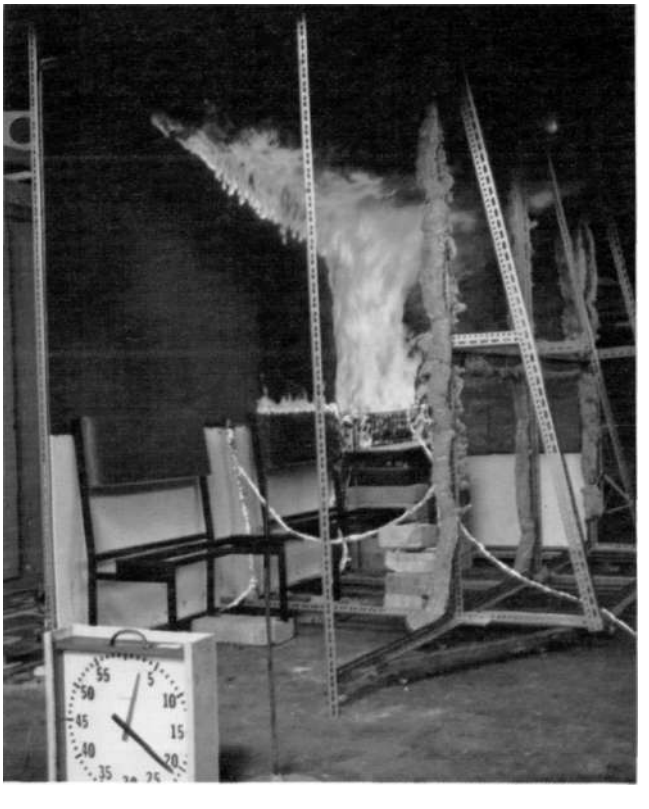


24 First involvement of carpet tiles

25 Fire at maximum



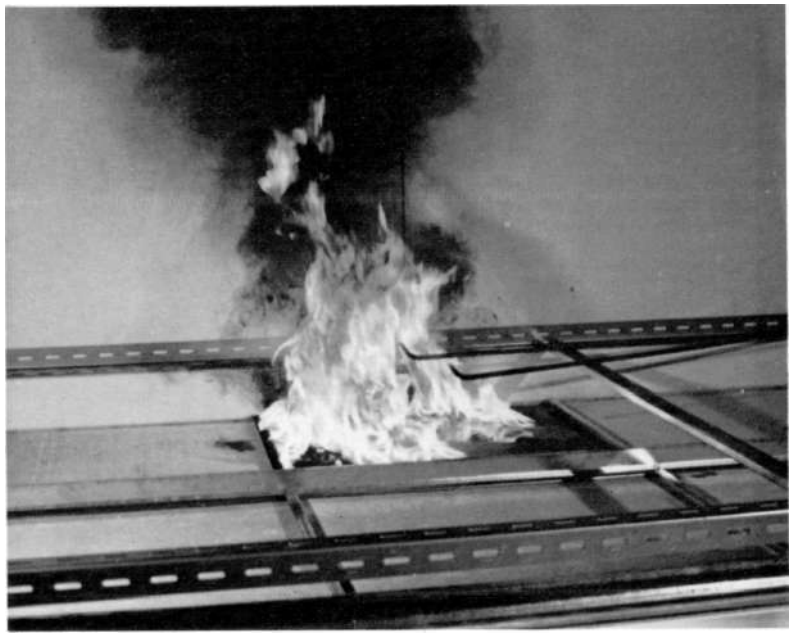
26 First involvement of tiles



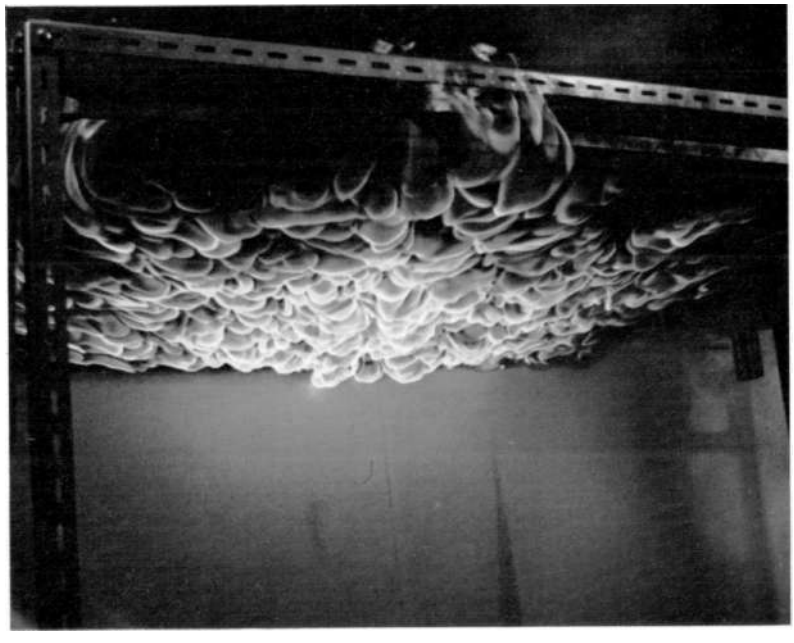
27 First involvement of adjacent seating unit

28 Involvement of second seating unit (Note flaming runnels on wall tiles)

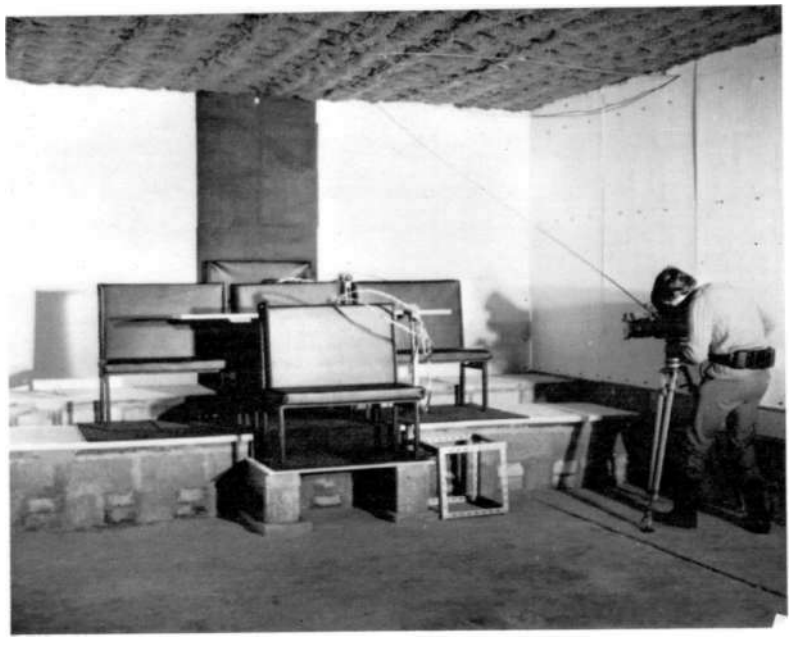
29 Simulated Stateroom tiles for comparison



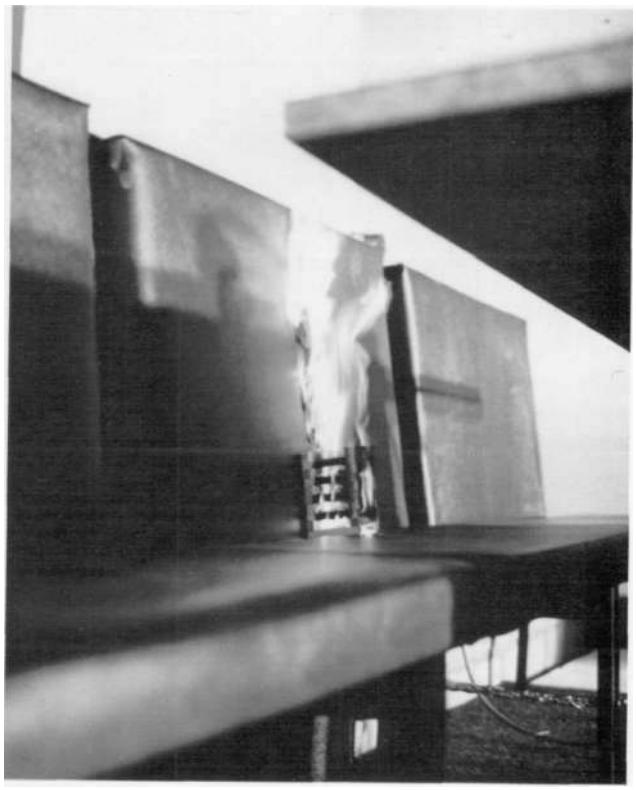
30 Paraffin burning on top



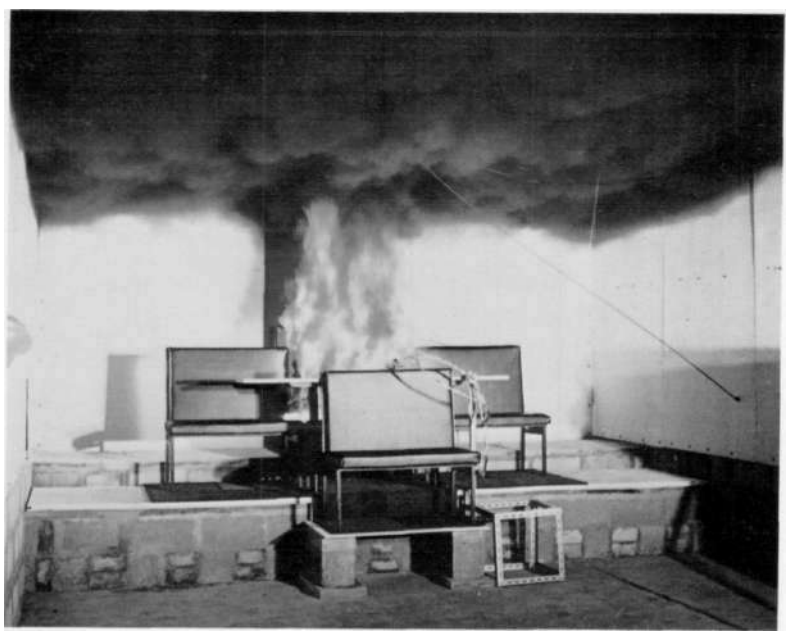
31 Flaming vapours underneath



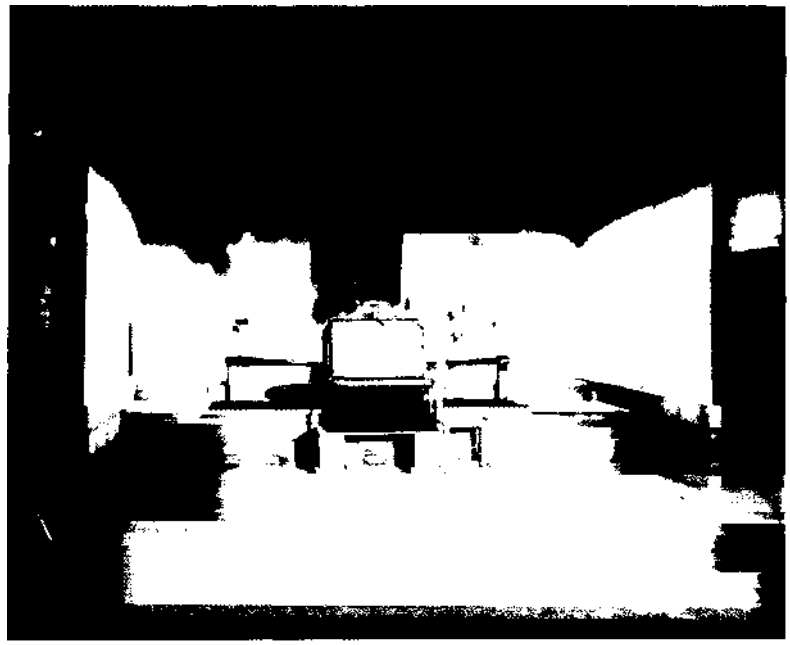
32 Arrangement of furnishings



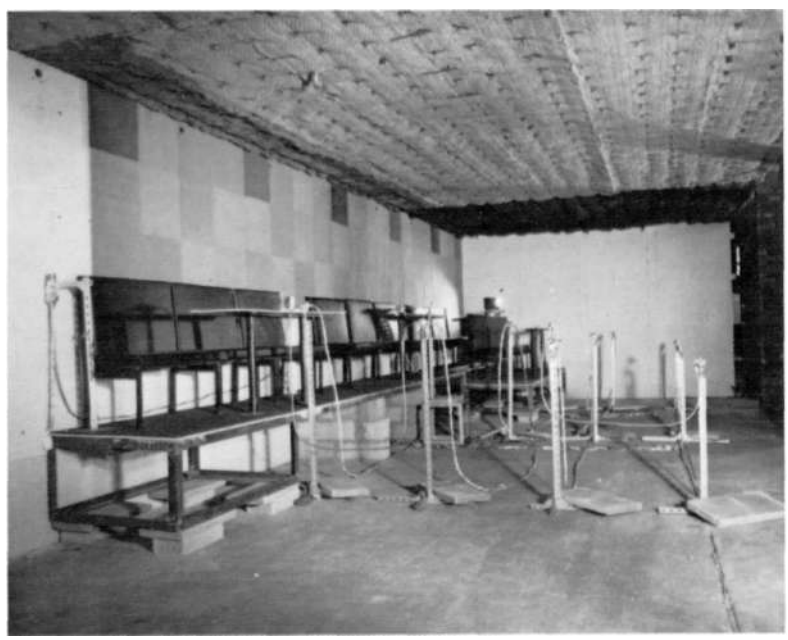
33 Involvement of back of seating unit



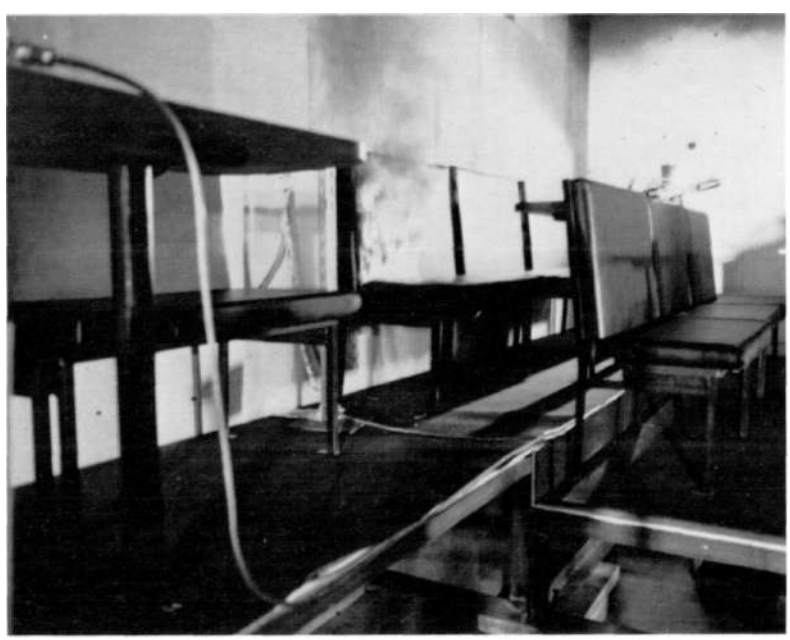
34 Full involvement of first seating unit



35 Lateral fire spread along seat



36 Experimental arrangement



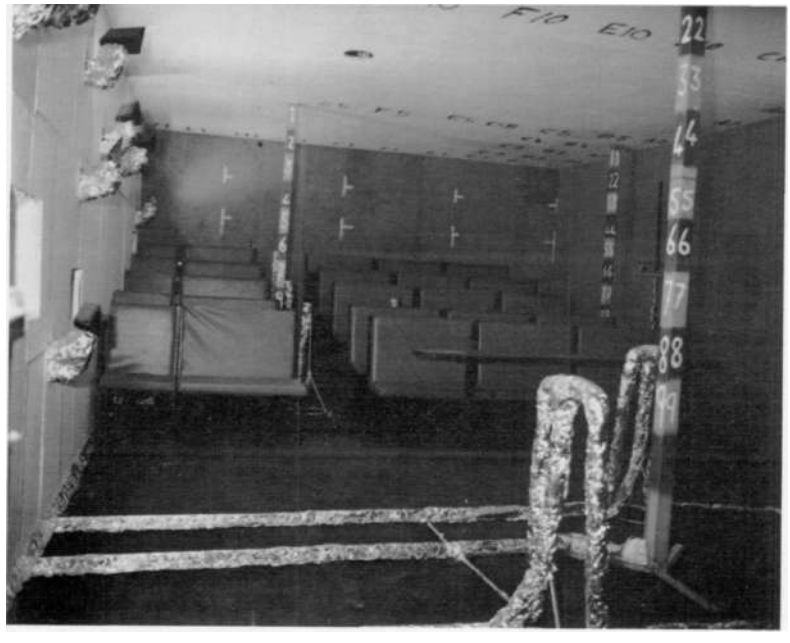
37 Involvement of back of first seating unit

38 Fire spread up wall tiles and smoke production

39 Lateral spread over wall tiles showing flaming runnels

40 Lateral fire spread over second seat

41 Fully developed fire



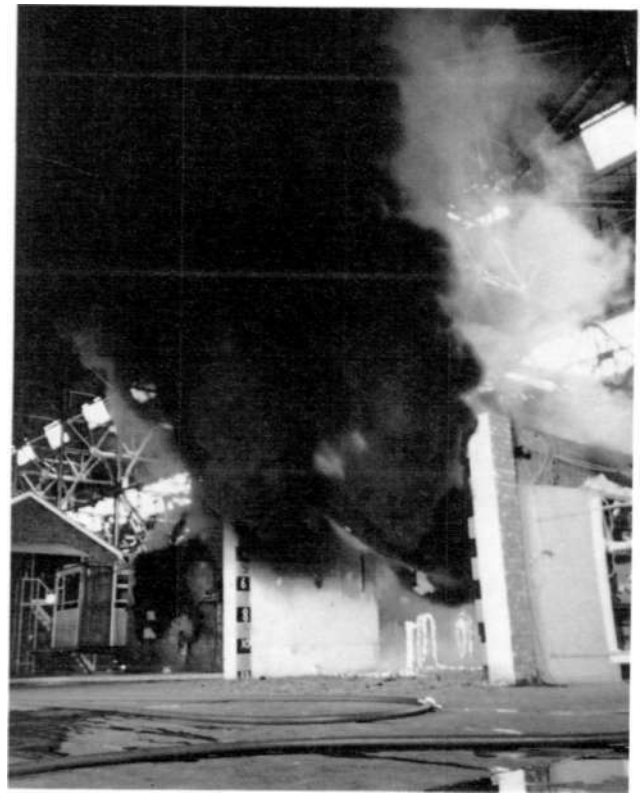
42 Arrangement of furnishings

43 Newspaper ignition source

44 Involvement of rear tier and carpet tiles on wall

45 Ignition of second tier

46 Forward fire spread and thickening of smoke layer



47 Smoke and flames out of exit at full fire development

48 Conditions after experiment

APPENDIX 15

Plans

APPENDIX 16

Results of Flammability Tests on Standard Production Qualities

Appendix 16

E. Illingworth & Co. (Bradford) Ltd.

Results of Flammability tests on Standard Production Qualities

The following products have been tested in accordance with BS 4790:1972 'Hot Metal Nut Test'. The recommended Grades for these tests when labelled in accordance with BS 5287:1976 are as follows:—

Char Radius
0-35 mm low radius of effects of ignition.
40—75mm medium radius of effects of ignition.
80mm and over high radius of effects of ignition.

VILLATEX ULTRA	Less than 35 mm radius of char
VILLATEX SUPERNOVA	„ „ „ „ „ „
CHECKERTEX NOVA	„ „ „ „ „ „
FAIR 'N' SQUARE	„ „ „ „ „ „
STATESMAN PIECE GOODS	„ „ „ „ „ „
STATESMAN TILES	„ „ „ „ „ „
NYLFLOOR'2000'	„ „ „ „ „ „
NYLFLOOR'3000'	„ „ „ „ „ „
ATHELSTONE	„ „ „ „ „ „
PEMBRIDGE	„ „ „ „ „ „
PALADIN	„ „ „ „ „ „
CHANCELLOR	„ „ „ „ „ „
STATEROOM	„ „ „ „ „ „

All the above products were also tested in accordance with 'Methenamine Pill Test' with a PASS result.

^

APPENDIX 17

Alphabetical List of Victims

Appendix 17

Alphabetical List of Victims

Michael Barrett, 28 Streamville Road, Raheny, Dublin 5.
Richard Bennett, 5 Cromcastle Court, Coolock, Dublin 5.
Carol Bissett, 38 O'Rahilly House, Ringsend, Dublin 4.
James Buckley, 44 Clanree Road, Donnycarney, Dublin 5.
Paula Byrne, 26 St. Brendan's Park, Coolock, Dublin 5.
Caroline Carey, 18 Kilbarron Road, Coolock, Dublin 5.
John Colgan, 54 Pine Grove Park, Swords, Co. Dublin.
Jacqueline Croker, 50 Dundaniel Road, Kilmore West, Dublin 5.
Liam Dunne, 5 Bunratty Avenue, Coolock, Dublin 5.
Michael Farrell, 1 Castletimon Park, Coolock, Dublin 5.
David Flood, 58 Coolgreena Road, Beaumont, Dublin 9.
Thelma Frazer, 64 O'Connell Gardens, Bath Avenue, Sandymount, Dublin 4.
Michael French, 2 Bunratty Drive, Coolock, Dublin 5.

Josephine Glen, 24 Clonshaugh Avenue, Dublin 5.
Michael Griffiths, 6 Kilbarron Road, Kilmore Road, Dublin 5.
Robert Hillick, 54G Brian Park, Twinbrook Estate, Belfast.
Brian Hobbs, 22 Yellow Road, Whitehall, Dublin 9.
Eugene Hogan, 4 Kilmore Drive, Artane, Dublin 5.
Murtagh Kavanagh, 13 Millbrook Drive, Coolock, Dublin 5.
Martina Keegan, 37 Greencastle Crescent, Coolock, Dublin 5.
Mary Keegan, 37 Greencastle Crescent, Coolock, Dublin 5.
Robert Kelly, 18 Edenmore Crescent, Raheny, Dublin 5.
Mary Kennedy, 182 Millbrook Avenue, Kilbarrack, Dublin 5.
Mary Kenny, 24 Macroom Road, Coolock, Dublin 5.

Margaret Kiernan, 11 Coolock Avenue, Coolock, Dublin 5.
Sandra Lawless, 95 Ferrycarrig Road, Coolock, Dublin 5.
Francis Lawlor, 52 Cappagh Drive, Finglas, Dublin 11.
Maureen Lawlor, 52 Cappagh Drive, Finglas, Dublin 11.
Paula Lewis, 27 Macroom Avenue, Coolock, Dublin 5.
Eamon Loughman, 12 Ardmore Drive, Beaumont, Dublin 9.
George McDermott, 42 Edenmore Crescent, Raheny, Dublin 5.
Marcella McDermott, 42 Edenmore Crescent, Raheny, Dublin 5.
William McDermott, 42 Edenmore Crescent, Raheny, Dublin 5.
Julie McDonnell, 36 Dundaniel Road, Coolock, Dublin 5.
Teresa McDonnell, 40 Collin's Avenue East, Donnycarney, Dublin 5.
Gerard McGrath, 31 Chanel Grove, Coolock, Dublin 5.
Caroline McHugh, 172 Ardlea Road, Artane, Dublin 5.
Donna Mahon, 19 Edenmore Drive, Raheny, Dublin 5.
Helena Mangan, 19 Macroom Road, Coolock, Dublin 5.
James Millar, 13 Juniper Park, Twinbrook Estate, Belfast.
Susan Morgan, Nazareth House, Malahide Road, Dublin 5 and Derry.
David Morton, 27 Montrose Drive, Artane, Dublin 5.
Kathleen Muldoon, Ballyhist, Carnaross, Kells, Co. Meath.
George O'Connor, 24 Clonshaugh Close, Coolock, Dublin 5.
Brendan O'Meara, 3 Coolock Village, Dublin 5.
John Stout, 61 Ferrycarrig Drive, Coolock,Dublin 5.
Margaret Thornton, 47 Dunne Street Flats, Dublin 8.
Paul Wade, 101 Ardcollum Avenue, Artane, Dublin 5.

Wt. 134832. 2,500. 9/82. Cahill. (1581). G.Spl.