S E M I N A R

THE ECONOMIC IMPLICATIONS OF ENVIRONMENTAL PROTECTION

TORONTO, MAY 31 AND JUNE 1, 1971

# OCEAN MARINE TRANSPORTATION CRUDE OIL AND PETROLEUM PRODUCTS

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Introduction

Earlier today Harvey Clare referred briefly to the escape of oil into the sea which results from the operation of the world's tanker fleet. I will develop this subject further under the two broad categories of Accidental and Operational discharge. Due to time limitations and relative significance, I will not discuss sewage and garbage disposal or air emissions with respect to ships. If you have any questions on these matters, however, I will be pleased to attempt to answer them in the discussion period to follow.

Vugraph I - (Escape of Oil into the Sea)

The accidental discharge of oil into the sea due to groundings, collisions and other mishaps has been estimated to be approximately 100,000 tons per year at the present time. (Hudson Institute) While it is this type of discharge that receives public attention the operational escape of oil per year is much greater and is estimated currently to be

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almost one million tons per year. It should be noted that about 80% of this discharge is contributed by only about 20% of the ships in the fleet. These are the ships, categorized as "uncontrolled" on the vugraph, which do not follow certain pollution prevention operating procedures that I will refer to later.

ACCIDENTAL ESCAPE OF OIL TO SEA

Let us first examine the accidental escape of oil into the sea. While it is estimated to be only about 10% of the total, it generally occurs in concentrated form in a relatively small area and thus can present a relatively severe and immediate threat to the local environment.

Ship losses and accidents on the high seas are not a new phenomenon but have been occurring for literally hundreds of years and will, unfortunately, continue to occur as is the case in all human activities. It is the frequency of such incidents and more in particular the effects on society of these accidents that has created public interest and concern in recent years.

Vugraph II - (World Tonnage Losses)

The record of tankers, and this may be a surprise to some, has been better than all other vessels over the last seven years. The total loss ratio for tankers over the period 1964 to 1970 was slightly less than 70% of the same ratio for all other ships. The result is the same on

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either a number of ships basis or a total tonnage basis. While the tanker record has been relatively better than other ships I do not believe we can regard this performance as acceptable on an absolute basis.

Prior to the mass marine movement of cargos of pollutants, the major concerns with respect to a ship stranding, collision or loss at sea, were those held by the families of the crew and the passengers, and by the owners of the ship and the cargo. A relatively small number of people suffered damage.

The growth in the demand for oil and in the transportation by ships of this oil since World War II has given a new dimension to this matter. A large escape of oil from a stricken tanker can present an environmental threat to an entire local community. Society in total becomes involved and concerned, and an entire community is susceptible to damage.

Vugraph III - (Oil Demand and Tanker Fleet Growth)

In 1950 the free world demand for oil was approximately ten million barrels per day and the tanker fleet stood at 1400 T2 equivalents. By 1970 oil demand had grown to forty million barrels per day or 300%, while the tanker fleet grew by 650% to 10,500 T2 equivalents. By 1980

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economists foresee a doubling in oil demand (eighty million barrels per day) and it is estimated tanker tonnage will more than double to 22,000 T2 equivalents.

Coincident with this rapid growth in tanker requirements was a progressive increase in tanker size over the same period.

Vugraph IV - (Growth in Tanker Size)

In 1950 the largest tanker afloat was a 30,000 DWT ship, 575 feet long on a draft of 35 feet. By 1970 the maximum size tanker had increased by more than ten fold to a 326,000 DWT ship, 1135 feet long on a draft of 81 feet.

The rapid growth in tanker size is a reaction to a number of forces. The initial motivation was cost reduction through economies of scale. The resultant transportation savings contribute to stabilizing energy costs. Important side benefits are that traffic congestion and therefore the risks of collision and strandings in restricted waterways are lessened, as are demands for competent sea-going manpower. If size development of tankers had been arrested at the 1950 level of 30,000 DWT, industry would have to construct, man and handle in already high-density traffic lanes eight tankers for every one large crude carrier being constructed today.

By 1980 if we had stayed with today's size mix, industry would require 3,500 more units - an increase of 100% in the number of ships in the world's tanker fleet. If we built all 30,000 tonners, we would require 4,800 more units; however, if the demand increase was covered by 250,000 tonners only 600 new units would be required.

While admittedly one 250,000 tonner represents a greater pollution threat than one smaller vessel, it is my, and my marine industry associates, belief that the total sea and port pollution risk is significantly less with fewer but larger ships, handled by offshore terminals, than with a substantially greater number of smaller ships handled in congested harbours.

The regulation and control of deep sea shipping has always been on an international agreement basis and I believe this will continue to be the case. Unilateral action by one country, without support from others, is just not effective.

While it may be a widely held belief that there is little or no regulation of ocean shipping, such is not the case.

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Vugraph V - (International Regulations and Standards)

All of the major ship-owning countries of the world have ratified international conventions dealing with:

(i) safety of life at sea (SOLAS) which includes the international rules of the road;

(ii) safe loadlines;

(iii) prevention of the pollution of the seas by oil.

At an international meeting in Brussels in November of 1969, two new conventions dealing specifically with oil pollution were drafted and adopted. These are:

(A) the Civil Liability Convention, which provides for shipowner liability for damages in the event of a spill of $134 per GRT up to $14,000,000. Shipowner insurance for this liability is required.

(B) The Public Law Convention which gives national governments the right to take action if threatened by pollution from a stricken tanker outside its national waters.

Currently under consideration for new conventions or revisions to existing ones are such matters as mandatory shipping lanes, international certificates of competence for ships' officers, size of cargo tanks in tankers and a cargo-owner supported fund to supplement the shipowner's liability under the Civil Liability Convention previously mentioned.

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In addition to international conventions the vast majority of shipowners have their ships certified for seaworthiness by one of the recognized classification societies, such as Lloyd's Register of Shipping or the American Bureau of Shipping. This is a general insurance and chartering requirement. All Esso charter parties for ocean-going tankers require that the shipowner maintain his ship in the highest classification of a specified and recognized classification society.

Due to the need for financial protection from damage due to oil spills and because ratification of international conventions can be a rather lengthy process, the major oil companies and tanker owners in the world have established two voluntary insurance plans.

Vugraph VI - (Financial Protection)

In 1969 a plan referred to as TOVALOP (Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution) was established. This provides for financial protection to national governments of $100 per GRT up to ten million dollars. Currently over 80% of the free world's commercial tanker tonnage is entered in TOVALOP.

Early this year the major oil companies of the world announced a plan, supplemental to TOVALOP, named CRISTAL (Contract Regarding an Interim Supplement to Tanker

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Liability for Oil Pollution) which will provide up to a total of thirty million dollars protection to national governments and the public from damage due to oil spills. This fund will be supported by payments from cargo owners and currently over 80% of the free worlds movement of persistent oils is covered under this plan.

These two voluntary plans will, of course, not be necessary when and if the Civil Liability convention and the proposed Cargo Owners Fund convention are ratified.

To provide more effective communication between the oil industry, governments and international legal bodies, the major oil companies established in 1970 an organization named the Oil Companies International Marine Forum. This group is currently working closely with IMCO (Inter-Governmental Marine Consultative Organization), a United Nations agency which coordinates international action with respect to marine matters and drafts proposed international conventions. I am pleased to state that the oil companies' forum has received strong support from the Canadian Government delegation at IMCO.

Before I conclude my formal remarks on the accidental escape of oil I would like to review briefly

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some of the activities undertaken by Esso with respect to safer navigation of tankers.

In 1967, Esso established at a lake in the French Alps, near Grenoble, a tanker navigation school for masters, pilots and other navigating officers. This school is available to all shipowners and pilotage authorities. At the facility, in addition to classroom training and discussions, the students are given training in handling scale models of ocean tankers. The masters and first mates of the two ocean-going ships operated by Imperial Oil Limited have completed the course at Grenoble.

At the present time, three collision avoidance systems are under evaluation on three Esso tankers. With these evaluations and other research being conducted by Esso, we believe the whole process of ship navigation can be greatly improved by the introduction of a modern systems approach to the function along with the new hardware.

As a supplement to the Grenoble training, plans are currently being developed for the attendance in 1971 of Esso masters at a big ship simulator course at Delft, Holland. This facility is supported by the Dutch government and the activity is a good example of joint industry/ government recognition of a need and effective cooperation.

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OPERATIONAL ESCAPE OF OIL TO SEA

I wish now to turn to the second major reason for oil escape into the sea from ships: i.e. operational discharge. This discharge results primarily from the need on the empty leg of a tanker voyage to take on water ballast. The ballast is carried in some of the ships' cargo tanks and the water therefore becomes contaminated from oil residue and clingage in these tanks. Upon arrival at the loading port it is necessary to discharge the oily ballast. With careful handling and planned tank washings during the ballast voyage this operational discharge can however be greatly reduced. This procedure, which was adopted by the oil industry seven years ago, is commonly referred to as "Load On Top". With proper settling and separation procedures it is possible to arrive at the loading port with only a small volume of high oil concentration slops and with the balance of the ballast clean water. The high concentration slops are retained on board and cargo loaded on top of them, hence the term "Load On Top".

Vugraph VII - (Operational Escape)

If the oil industry had not introduced this procedure it is estimated that the operational discharge of oil into the sea would today be approximately

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4,300,000 tons. With approximately 80% of the world's tanker fleet following the "Load On Top" procedure, the actual operational discharge is estimated today at 950,000 tons. Of this total, the tankers employing "Load On Top" contribute about 200,000 tons. With no changes in the present operating practices of the world's tanker fleet, it is estimated that the total operational escape of oil into the sea would be 2,000,000 tons by 1980.

Overlay VII - (Corrective Measures)

There are, however, corrective measures that can be taken.

(A) The universal adoption by tanker operators of "Load On Top" might reduce this 2,000,000 ton figure to as low as 200,000 tons. Better sensing and control devices on board would probably be required and it is estimated these would require an investment of 715 million dollars. This lower level of discharge will be required to meet the standards of the 1969 amendments to the International Convention on the Prevention of the Pollution of the Seas by Oil. I referred briefly to this convention previously.

The drawbacks to this approach to the problem are as follows:

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(i) The required ship-board control, sensing and separator devices currently available have serious limitations. Improved equipment in this field is the continuing subject of research by Esso and the industry.

(ii) The procedure requires rigid operating practices and the monitoring of performance is difficult.

(iii) On short voyages adequate time is not available for proper separation of oil and water.

(B) Another means of reducing the operational escape would be installation of shore ballast handling facilities at all loading ports. This is the procedure followed at most of the Venezeulan and Caribbean loading ports where much of eastern Canada's requirements originate. It is also the procedure we in Imperial follow in our Great Lakes and coastal marine operations.

The operational discharge, it is estimated, could be reduced to 25,000 tons. The discharge would stem in this case not from the tanker but from the dirty ballast handling shore facility. The required investment in shore facilities to accomplish this is estimated to be one billion, 600 million dollars.

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The major reservation with respect to this approach is that it tends to localize the discharge and this could meet with local jurisdictional problems and objections.

(C) A third approach, and by far the most costly, would be to provide for segregated ballast systems on all new tankers constructed after 1976. Free world shipyards are fully booked through 1974 with additional commitments into 1975 and 1976. Of the total forecast required 1980 tanker tonnage it is estimated that 41% will be delivered after 1976. Even with segregated ballast systems, such vessels will periodically need to clean cargo tanks for drydocking and other operating reasons. The slop oil from these operations would amount to 8,000 tons per year and would have to be disposed of at sea unless shore facilities were provided. The additional investment for the newbuildings after 1976, to achieve this result, would be 2 billion, 700 million dollars.

The pre-1976 fleet would not be provided with segregated ballast facilities and would have to rely on other means to minimize discharge of oil into the sea. If these ships met the revised 1969

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standards through the "Load On Top" procedure, their annual discharge would be about 120,000 tons.

The total operational escape for this approach would then be 128,000 tons per year.

(D) It may well be that a combination of the three separate systems I have discussed up to this point will prove to be the most practical and effective means of reducing the operational discharge of oil to an acceptable level. For example, on some long voyages the "Load On Top" system may be most effective. In cases of shorter movements, treatment of ballast ashore may be the best solution.

In the example I have chosen it is assumed that 75% of tanker loadings in 1980 are long haul voyages where "Load On Top" procedures would be followed and an annual discharge of 150,000 tons would result. This would meet the new revised 1969 standards. The remaining 25% of the tanker loadings are assumed to be on short voyages where all ballast would be put ashore for treatment. The shore facilities would discharge about 6,000 tons per year.

For this example the total annual discharge would be approximately 156,000 tons and the investment required

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would be 400 million dollars.

Clearly the situation is a possible serious threat to the world's environment. More research is required into the fate of oil in the sea and its effect on the ecology. Such a study has been commissioned by the oil industry.

In the shorter term, universal ratification of the revised 1969 international standards and the attainment of their target (100,000 tons in 1971, 200,000 tons in 1980) through the widest possible use of conventional "Load On Top" procedures will accomplish the greatest reduction in the operational discharge of oil into the sea by tankers, in the shortest time.

SUMMARY

Vugraph VIII - (Oil Industry Actions)

To conclude I would like to review in summary the actions taken over the last seven years by Esso and the other major oil companies to reduce and combat the effects of the escape of oil into the sea.

With respect to operational discharges, Esso and the other major oil companies introduced the "Load On Top" procedure for owned and chartered ships in 1964. Research and testing of improved sensing and control devices has been

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and continues to be carried out by Esso and the industry. Other methods of reducing the level of discharge, as I discussed in some detail, are under study.

To reduce the frequency of tanker accidents and the resulting oil spills, Esso took the lead by establishing a tanker navigation school at Grenoble in 1967. Improved navigational equipment and systems are under development and test by Esso at the present time. To supplement the officer training provided at Grenoble, a group of Esso masters will take and evaluate a big ship simulator course at Delft, Holland in 1971.

To provide necessary financial protection to governments and the public, the oil industry on a voluntary basis established in 1969 TOVALOP and in 1971 CRISTAL, two insurance plans that provide together up to thirty million dollars protection one ship, one incident.

To assist in and accelerate the drafting and ratification of progressive, effective international maritime conventions the major oil companies formed in 1970 the Oil Companies International Marine Forum. This group is actively engaged today with IMCO in formulating improved international standards.

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Marine research on a broad front has and is being conducted by Esso "in house", with industry and with governments to meet the environmental needs of modern society. The challenges to the oil industry in the field of marine transportation are substantial but I believe we can and will meet them. Indeed, considerable progress has already been made, as I have outlined today.

RSG/pf
May 26, 1971

# OCEAN MARINE TRANSPORTATION

## CRUDE OIL AND PETROLEUM PRODUCTS

### PURPOSE OF PRESENTATION

- IDENTIFY ORIGIN AND MAGNITUDE OF THE ESCAPE OF OIL INTO THE SEA FROM THE WORLD'S TANKER FLEET
- DISCUSS THE CAUSES OF SUCH ESCAPE OF OIL
- IDENTIFY STEPS TAKEN AND UNDER DEVELOPMENT TO CORRECT THE SITUATION

## OCEAN MARINE TRANSPORTATION

## CRUDE OIL AND PETROLEUM PRODUCTS

## ENVIRONMENTAL PROTECTION

| ESCAPE OF OIL INTO THE SEA | | ESTIMATED AMOUNT PER YEAR - TONS |
|---|---|---|
| (A) ACCIDENTAL | | 100,000 |
| (B) OPERATIONAL - | CONTROLLED TANKERS | 200,000 |
| | UNCONTROLLED TANKERS | 750,000 |
| | TOTAL | 950,000 |
| (C) TOTAL | | 1,050,000 |

## TOTAL WORLD SHIP LOSSES

| | TANKERS | | ALL OTHER VESSELS | |
|---|---|---|---|---|
| | % OF NO. | % OF TONNAGE | % OF NO. | % OF TONNAGE |
| 1964 | 0.18 | 0.11 | 0.54 | 0.42 |
| 1965 | 0.32 | 0.25 | 0.68 | 0.54 |
| 1966 | 0.41 | 0.37 | 0.67 | 0.57 |
| 1967 | 0.43 | 0.29 | 0.66 | 0.49 |
| 1968 | 0.44 | 0.26 | 0.61 | 0.40 |
| 1969 | 0.42 | 0.45 | 0.55 | 0.36 |
| 1970 | 0.47 | 0.28 | 0.54 | 0.34 |
| AVERAGE 1964/1970 | 0.39 | 0.30 | 0.61 | 0.44 |

SOURCE: LLOYD'S REGISTER OF SHIPPING

VESSELS OVER 500 GRT

# FREE WORLD OIL DEMAND

# AND

# TANKER FLEET

| | DEMAND MMB/CD | TANKER FLEET T2 EQUIVALENT |
|---|---|---|
| 1950 | 10 | 1400 |
| 1960 | 20 | 3800 |
| 1970 | 40 | 10500 |
| 1980 ESTIMATED | 80 | 22000 |

## GROWTH IN TANKER SIZE

| | MAXIMUM SIZE TANKER | | |
|---|---|---|---|
| | DWT | LENGTH | DRAFT |
| 1950 | 30,000 | 575 | 35 |
| 1960 | 110,000 | 900 | 50 |
| 1966 | 200,000 | 1050 | 63 |
| 1970 | 326,000 | 1135 | 81 |
| ON ORDER | 477,000 | 1245 | 92 |

# OCEAN SHIPPING

## INTERNATIONAL REGULATIONS AND STANDARDS

### (A) INTERNATIONAL CONVENTIONS

| | | |
|---|---|---|
| RATIFIED | : | SAFETY OF LIFE AT SEA (SOLAS) |
| | | LOADLINE |
| | | PREVENTION OF THE POLLUTION OF THE SEAS BY OIL |
| ADOPTED BY CONVENTION | : | CIVIL LIABILITY (FOR OIL SPILLS) |
| | | PUBLIC LAW |
| UNDER CONSIDERATION | : | MANDATORY ROUTINGS |
| | | INTERNATIONAL CERTIFICATES OF COMPETENCE (SHIPS OFFICERS) |
| | | SIZE OF CARGO TANKS |
| | | CARGO OWNER FUND (SUPPLEMENT TO CIVIL LIABILITY) |

### (B) CLASSIFICATION SOCIETIES

| | | |
|---|---|---|
| e.g. LLOYDS, ABS | : | ATTEST TO SEAWORTHINESS OF SHIPS |

# FINANCIAL PROTECTION

# FROM DAMAGE FROM OIL SPILLS

## VOLUNTARY PLANS PUT INTO EFFECT

## BY SHIPOWNERS AND MAJOR OIL COMPANIES

**T O V A L O P**

PROVIDED BY SHIPOWNER

COVERAGE : $100 PER GRT UP TO $10,000,000 PER INCIDENT

**C R I S T A L**

PROVIDED BY CARGO OWNER

COVERAGE : UP TO A TOTAL OF $30,000,000 PER INCIDENT

TOVALOP AND OTHER LEGAL LIABILITIES DEDUCTED

# OPERATIONAL ESCAPE

# OF OIL INTO SEA

| | ANNUAL TONS |
|---|---|
| **CURRENT SITUATION** | |
| TODAY, WITHOUT "LOAD ON TOP" | 4,300,000 |
| ESTIMATED ACTUAL TODAY | 950,000 |
| ESTIMATED BY 1980 WITH NO CHANGES | 2,000,000 |

# S U M M A R Y

## OIL INDUSTRY ACTIONS

## RE ESCAPE OF OIL FROM SHIPS

| | | |
|---|---|---|
| OPERATIONAL DISCHARGE | : | "LOAD ON TOP". ESSO OWNED AND CHARTERED SHIPS. 1964 |
| | | OTHER MEANS UNDER STUDY. |
| SAFE NAVIGATION | : | TANKER NAVIGATION SCHOOL, GRENOBLE. ESTABLISHED BY ESSO 1967. |
| | | EVALUATION OF COLLISION AVOIDANCE SYSTEMS - ESSO 1970/71 |
| | | SIMULATOR TRAINING, DELFT, HOLLAND. ESSO 1971. |
| FINANCIAL PROTECTION | : | TOVALOP UP TO $10,000,000. ESTABLISHED 1969. |
| | | CRISTAL UP TO A TOTAL OF $30,000,000. ESTABLISHED 1971 |
| OIL COMPANIES INTERNATIONAL MARINE FORUM (OCIMF) | : | ESTABLISHED 1970 TO ADVISE AND ASSIST RE INTERNATIONAL CONVENTIONS AND REGULATIONS. |
| MARINE RESEARCH PROGRAMS | : | WITHIN ESSO |
| | | WITH INDUSTRY |
| | | WITH GOVERNMENTS |