DHS Strategy for Improving the National Response and Recovery from an IND Attack

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Homeland Security

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Contents

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DHS Strategy for

Improving the National Response and Recovery from an IND Attack

Executive Summary

The mission of the Department of Homeland Security (DHS) includes acting as a focal point regarding natural and manmade crises and emergency planning. In support of the Department's mission, the primary mission of the Federal Emergency Management Agency (FEMA) is to reduce the loss of life and property and protect the Nation from all hazards, including natural disasters, acts of terrorism, and other man-made disasters, by leading and supporting the Nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation. Consistent with these missions, the *Nuclear/Radiological Incident Annex* to the *National Response Framework* (June 2008) sets forth DHS as the coordinating agency for all deliberate attacks involving nuclear/radiological materials, including radiological dispersal devices (RDDs) and improvised nuclear devices (INDs). The detonation of an IND would result in a complex catastrophic disaster that would severely challenge the nation's ability to effectively respond in a timely manner. The scope, severity, and complexity of the response required for an IND incident call for a highly organized and efficient management structure. Such an event will cross geographic jurisdictional boundaries and will involve multiple levels of government (federal, state, local, tribal, and territorial), as well as the private sector. While all emergencies begin as local events, it is anticipated that state and local resources would be overwhelmed by an IND and that a rapid, well coordinated federal response would be required for life-saving activities and long-term support. However, the state emergency management infrastructure is generally still expected to exist and have sufficient capacity to control response actions in its state.

In December of 2008, the DHS Deputy Secretary signed the intra-departmental Integrated Planning Guidance (IPG) for Fiscal Years (FY) 2011-2015 that identified FEMA as the departmental lead for response and recovery efforts associated with the terrorist use of an IND. Additionally, the IPG directs FEMA to develop and implement an IND Response and Recovery Program within FEMA no later than FY 2010. FEMA has developed a Management Plan for this new program, and will rely upon the acquisition management process contained in DHS Acquisition Directive 102-01to ensure that identified gaps and associated tasks will be defined to be measureable and achievable. The Capability, Objective, Resources, and Evaluative Measures (CORE) document appended to the FY11-15 IPG provides the initial list of gaps to be addressed under the program, and specifies initial metrics and performance goals to strive towards. During the extensive discussions following publication of the CORE document, the target objectives were augmented. The improved list of objectives has been incorporated into this Strategy, and will provide the basis for the subsequent Strategic Plan and other documents that will define the IND Response and Recovery program.

Building upon the guidelines contained within the *National Response Framework* (NRF) and the IPG, this DHS Strategy for Improving the National Response and Recovery from an IND Attack (IND Response Strategy identifies those capabilities needed to respond to and recover from an IND incident within the NRF and its annexes. It does not identify specific solutions for identified capability gaps, nor does it identify the agency responsible for addressing those gaps. It sets the

goals and objectives from which a DHS led national plan may be developed to address vulnerabilities and gives strategic direction in meeting the IND response and recovery mission.

The primary goal in responding to and recovering from an IND attack is to limit the total casualties resulting from such an event. The key objectives that must be achieved in order to respond to and recover from an IND incident include:

Manage the Response: The on-scene authorities will require the capability to rapidly establish situational awareness of the scope of a nuclear event, establish communications and control measures, and coordinate the large number of response assets from local, state, federal, and perhaps international contributors required for such an event. As such, they must have the ability to establish priorities and coordination measures.

Characterize the Incident: Transfer of key incident data to decision makers is crucial to facilitate rapid activation and effective utilization of emergency response operations for an IND incident. Fully coordinated agreements and protocols that utilize any and all available national assets (e.g., Interagency Modeling and Atmospheric Center (IMAAC), Federal Radiological Monitoring and Assessment Center (FRMAC), Radiological Assistance Program (RAP) teams, Radiological Emergency Response Team, and others) will be essential to rapidly acquire key incident data and generate fallout predictions. Relevant data and predictions will be transmitted to federal, state, local, tribal, and territorial officials and the public as rapidly as possible.

Mass Evacuation and In-Place Protection: This capability involves the ability to plan for, and immediately execute, the safe and effective sheltering-in-place of an at-risk population and an organized and managed evacuation of the at-risk population to areas of safe refuge.

Medical Triage: Health physics experts will be needed to help calculate health effects and educate medical responders on recognition and treatment of radiation-induced conditions. The medical community will need to estimate triage needs based upon previously agreed-upon criteria and actual onsite information, establish triage locations, provide emergency medical stabilization, prioritize patient treatment, and institute an extensive and dynamic triage plan.

Provide Casualty and Evacuee Care: The capability to provide effective care for casualties and evacuees is key to limiting the total casualties. This capability supports the identification and tracking of individuals and the provision of necessary medical, basic, environmental, and mental health care. It provides for public health and fatality management to prevent disease outbreak, and for behavioral health support.

Stabilize and Control Impacted Area: Under this capability, federal agencies will be looked upon to provide assistance to state and local governments overburdened by the sheer magnitude and breadth of the IND incident (both geographically and due to the wide spectrum of activities). Confidence in pre-existing guidance, policy, plans and agreements, which are enacted by recognized leaders within designated Incident Command Structure(s), will support efforts to stabilize and control the affected area and facilitate the saving and sustaining of life, as well as ensuring government and private functions continue or are re-established.

Perform Site Recovery and Restore Essential Functions: Restoration of critical infrastructure is crucial to local and regional recovery and may be vital to national security. Disruption of power, communications, medical care, food, housing, etc. will present obvious obstacles to ongoing response and recovery activities. Mitigating the spread of radioactive contamination, reducing the

risk of imminent hazards, and restoring essential services provided by CIKR will help in supporting both immediate life-saving activities and ongoing recovery efforts.

In addition to the seven key objectives noted above, there are cross-cutting objectives that impact more than one area of responsibility. These objectives represent actions that enable a more effective response to an IND incident. Cross-cutting objectives will require additional focus and effort, since they apply broadly across the response and recovery spectrum. These objectives include Public Information Awareness, Stakeholder Mapping and Coordination, Modeling and Decision Support, Information Exchange and Communication, Scientific Support, and Research and Development (R&D).

A nuclear detonation in a U.S. city represents one of the most catastrophic incidents that could befall our nation, causing enormous loss of life and property and severely damaging economic viability. It is incumbent upon all levels of government, as well as public and private parties within the U.S., to prepare for this incident through focused nuclear attack response planning. Proper planning and preparation could potentially save tens of thousands of lives.

DHS Strategy for

Improving the National Response and Recovery from an IND Attack

Introduction

The mission of the Department of Homeland Security (DHS) includes acting as a focal point regarding natural and manmade crises and emergency planning. In support of the Department's mission, the primary mission of the Federal Emergency Management Agency (FEMA) is to reduce the loss of life and property and protect the Nation from all hazards, including natural disasters, acts of terrorism, and other man-made disasters, by leading and supporting the Nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation. Consistent with these missions, the *Nuclear/Radiological Incident Annex* to the *National Response Framework* (June 2008) sets forth DHS as the coordinating agency for all deliberate attacks involving nuclear/radiological materials, including radiological dispersal devices (RDDs) and improvised nuclear devices (INDs).

The detonation of an IND in a major urban area would result in a complex catastrophic disaster that would severely challenge the nation's ability to effectively respond in a timely manner. While all emergencies begin as local events, it can be anticipated that state and local resources would be overwhelmed by an IND, and a rapid well-coordinated federal response with locals and states is required for life-saving activities and long-term support.

In 2008, the DHS Office of Policy Requirements Planning Team (RPT) generated the Nuclear Response and Short-Term Recovery Capability, Objective, Resources, and Evaluative Measures (CORE) document with support from the federal interagency community. This CORE document identifies desired capabilities and associated priority objectives to effectively and efficiently respond to a terrorist nuclear attack. In December of 2008, the DHS Deputy Secretary signed the Integrated Planning Guidance (IPG) for Fiscal Years (FY) 2011-2015 that identified FEMA as the Department's lead for response and recovery efforts associated with the terrorist use of an IND. The RPT's CORE document provides the basis for the DHS Integrated Planning Guidance (IPG) and this strategy. The IPG directed FEMA to initiate an IND Response and Recovery Program to:

- Develop and issue a strategy for improving the national response and recovery from an IND attack … The strategy shall include prioritizing and addressing capability gaps identified by the FY 2008 Nuclear Response and Short-term Recovery RPT; specifying intra and inter agency roles and responsibilities; identifying research and development and training needs; and addressing any conflicts that exist in current activities, plans and procedures.

- Develop and implement a dedicated IND Response and Recovery Program within FEMA no later than FY 2010.

During November 2009, the White House's National Security Staff, through the Domestic Readiness Group, created the IND Response Subordinate Interagency Planning Committee (SubIPC). The primary purpose of this new IND Response SubIPC is to clarify issues designated as policy priorities for the 2010 National Level Exercise (NLE2010) and to enhance our nation's response to an IND attack. The National Strategy for Improving the Response and Recovery from an IND Attack is an important input to this White House-driven effort, and particularly to the two working groups that have been established under this SubIPC: the Communications Working Group and the National Asset Integration Working Group.

The initial implementation of this strategy through the establishment of a dedicated IND Response and Recovery Program relies upon an assessment of current (existing) capabilities, and an analysis of the capabilities that are not yet achievable (gaps). FEMA is developing a Management Plan for this new program, and will rely upon the acquisition management process contained in DHS Acquisition Directive 102-01to ensure that identified gaps and associated tasks will be defined to be measureable and achievable. All tasks will be managed to performance-based metrics, and the initial performance metrics presented within the CORE document will support this task-based effort.

Annex A builds upon the CORE document from the FY11-15 IPG, and presents the initial Gap Analysis for IND Response and Recovery.

This strategy is predicated upon certain overarching policies. **Annex B** identifies policy implications for effective implementation of this strategy.

In 2008, the *Roadmap for Nuclear Defense Research and Development* identified national R&D priorities, as well as guidelines for Department and Agencies to develop comprehensive and mutually supportive research programs that were closely linked to operational requirements. **Annex C** presents a summary of the planned R&D efforts, addressing cross-cutting technologies and other efforts that support the establishment of critical response and recovery capabilities.

Document Purpose

Building upon the guidelines contained within the NRF and the IPG, this strategy identifies those capabilities needed to respond to and recover from an IND incident. It does not identify specific solutions for identified capability gaps nor does it identify the agency responsible for addressing those gaps. That information is more appropriately addressed within the follow-on IND Response and Recovery Program. This strategy document defines the direction of a DHS program specific to IND response, and supports decisions on prioritizing and allocating resources to address the gaps identified.

There are fifteen Emergency Support Functions (ESFs) in the *National Response Framework* (NRF) with federal coordinating departments and agencies. Within each ESF, there are numerous individual entities with roles and responsibilities for response to and recovery from an IND incident.

Federal departments and agencies must ensure coordinated actions under the NRF in order to: effectively respond to and recover from an IND incident to save and sustain lives; ensure the endurance of, and the nation's confidence in, our form of government; and restore and maintain Critical Infrastructure and Key Resources (CIKR). To that end, missions associated with Response and Recovery will include:

Respond to an IND incident.

1. Save and sustain life by supporting state, local and tribal response initiatives.
2. Provide federal assistance to state, local and tribal response, as warranted.
3. Ensure government and private functions are continued or re-established upon request.
4. Increase domestic public awareness of an IND.

Recover from an IND incident.

1. Provide federal assistance to state, local and tribal governments, as warranted.

FEMA, through the IND Response and Recovery Program, will work through the interagency process to identify gaps and overlaps within the IND response and recovery mission and will look to increase the resources within identified gap areas to improve support to state and local response and recovery efforts. This gap and overlap analysis will help foster a collaborative effort among the interagency.

Required Capabilities

The scope, severity, and complexity of the response and recovery measures required for an IND incident call for a highly organized and efficient management structure. Such an event will cross geographic and jurisdictional boundaries and will involve multiple levels of government (federal, state, local, tribal, and territorial), as well as the private sector. This strategy sets the goals and objectives in meeting the IND Response and Recovery mission. Subsequent programs and plans will outline the concept of operations for integrating and synchronizing existing federal capabilities to accomplish this mission.

An effective response can be accomplished through a set of high-level Capabilities and Objectives that were defined and described in the FY 2008 RPT CORE document. The following seven Capability sections describe the Objectives that must be achieved in order to meet IND response requirements.

- Capability 1: Manage the Response
- Capability 2: Characterize the Incident
- Capability 3: Mass Evacuation and/or In-Place Protection
- Capability 4: Medical Triage
- Capability 5: Provide Casualty and Evacuee Care
- Capability 6: Stabilize and Control Impacted Area
- Capability 7: Perform Site Cleanup and Recovery and Restore Essential Functions

In addition to these designated capabilities, FEMA has identified several cross-cutting objectives that impact more than one of these seven noted capability areas. These common objectives apply broadly across the response and recovery spectrum.

Capability 1: Manage the Response

In addition to the unified command structure that would be established in response to any large-scale catastrophic event, the authorities on-scene will require the capability to rapidly establish situational awareness of the scope of a nuclear event, establish communications and control measures, and coordinate the large number of response assets from local, state, federal, and perhaps international contributors required for such an event. As such, they must have the ability to establish priorities and coordination measures. This Capability consists of five objectives. These are described in the paragraphs that follow.

Objective 1.1 Manage Time-Critical Post-Nuclear Incident Information

Information is the manager's most valuable asset in the initial minutes of the response to an IND. Immediately following an IND incident, the authorities must have access to and be able to manage time-critical post-nuclear incident information. They require the ability to rapidly collect, assess, reconcile, and redistribute *in usable form* key information unique to a nuclear incident. This includes setting key priorities for the overall response.

The most pressing needs in the time immediately following an IND incident involve characterization of the event, and building a common operating picture that incorporates the most accurate available data on the scope of the event – numbers and locations of casualties, the location and degree of damaged areas, regions of contamination, the status of critical infrastructure components, locations and status of available response assets, and other such information required to support timely decisions regarding the response. This information must be timely and available in a form that can readily and understandably be shared with responders, as well as government officials nationally and internationally.

As the response to the event continues, there will be a need to maintain and disseminate critical information. Periodic status reports involving all the aforementioned key data elements will support decisions regarding resource allocations and response priorities.

Objective 1.2 Provide Emergency Public Information

A robust public awareness campaign is a critical element to the successful management of an IND incident, both prior to and following a burst. The necessity of a pre-event campaign is largely due to three factors:

- An IND is a singular threat; however the incident itself involves multiple hazards including: fire, radiation, blast and mechanical injuries.
- There are many misperceptions regarding the IND threat, including confusion with traditional thermal nuclear weaponry and the no-notice probability of an IND.
- The limited ability to quickly establish communications with the public post-incident when protective actions are most critical.

Due to the complexity of the incident, it is highly probable that during the initial minutes following an IND detonation, when the proper public response is essential to increasing the chances of survivability, the public may only be able to rely on information and training received pre-incident.

In addition to a robust public awareness campaign, accurate and transparent post-incident messaging is critical to maintaining the public's trust in a time of crisis and rapidly changing conditions. Since hazards are expected to be dynamic over the course of the event, the public needs to be updated on the status of thermal, radiological, chemical, and other hazard predictions and assessments in accordance with the Nuclear Incident Communications Plan. This capability entails the enhancement of the government's capability to provide the public and responders with the following: accurate situational awareness; shelter-in-place or evacuation guidance; information on the appropriate protective actions, community reception centers, medical facilities, and family reunification; and preparedness information to the unaffected population. Information will eventually need to include topics such as food safety, transportation issues, and the anticipated impact of the incident on every other state in the country. As noted in the *Nuclear Incident*

Communication Planning – Final Report (dated March 15, 2009, prepared for the DHS Office of Health Affairs), a multi-component approach is necessary to facilitate public communication following an IND incident in the United States. The needs of key stakeholder groups (the public, state officials, national leadership, and first responders) form the basis for the IND public communication strategy.

The Domestic Communications Strategy (DCS) developed and maintained by the DHS Office of Public Affairs (OPA), will be activated for an IND incident. The DCS is a dynamic, evolving strategy that includes federal department and agency options and actions that can be quickly employed as a result of a credible threat or detonation. The White House Office of Communications reviews and approves its content and provides strategic direction during its employment. This public information strategy not only takes key communications assumptions into account, but also supports counterterrorism objectives. The DCS is intended for the United States domestic audience, but its execution is coordinated and shared with federal partners to ensure consistency with international efforts. The strategy is adaptable and can be adjusted as necessary to support emergency planning efforts, particularly during the pre-incident phase.

While communicating complex information in response to an event in ways that reach the broadest possible audiences – including special populations – enhances the government's response capabilities and inspires public trust, pre-incident public information is vital to overcome wide-ranging misperceptions about survival from an IND incident and what to do following a detonation. Initial public information needs to address the immediate measures available to individuals to minimize their exposure to radiation hazards. Depending on their physical location, continual information regarding sheltering in place versus self-evacuation will be required, in an understandable format, particularly in the fluid, stressful, and dynamic conditions following an IND incident.

Objective 1.3 Establish Unique Post-Nuclear Elements of Incident Command

The onsite incident manager will be required to direct and control the incident by establishing a system to organize and integrate a range of resources within a common organizational structure for effective and coordinated management of the incident. This will be predicated upon the proven tenets of Unified Command found in the National Incident Management System (NIMS), but the scope of the incident and a range of additional resources needed to support the IND response will call for an extraordinary span of control and attention to detail. Identification of these resources and implementation of relevant control measures must be accomplished and rehearsed in advance of an IND incident.

Objective 1.4 Establish Emergency Communications in Post-Nuclear Environment

The immediate effects of an IND burst – the blast, thermal effects, and electromagnetic pulse (EMP) – may disrupt much of the communications capabilities that the public and first responders rely upon.[1] Power lines, cell towers, microwave antennas, and other communications infrastructure may be damaged or destroyed in the vicinity of the burst. Effective response to an IND requires the capability to provide reliable, coordinated communications to include secure and non-secure data, video, and voice among and across levels of the response community. This will support the actions

[1] An EMP, which is a high-voltage surge that poses no direct health threat, can impact electronic components that it reaches and seriously hamper communications and disrupt computer equipment, controls systems, and other electronic devices, both in the vicinity of the IND burst and potentially at much longer distances through induced electrical currents in conducting materials (e.g., pipes and wires).

of initial responders on scene and support the public information messaging described previously. For example, the Homeland Security Council's *Planning Guidance for Response to a Nuclear Detonation* states that the best initial action for private citizens immediately following a nuclear explosion is to take shelter in the nearest building or structure and listen for instructions from authorities. This will only be effective if a communication capability exists to get the word out to the public in their shelters.

Establishing initial tactical communications for responders will be a high priority; followed by voice and data radio communications across the region; and other key communications components required to manage the response, provide key public safety information to the general public, and report to higher levels of government. All these elements must be coordinated and integrated under an overall Nuclear Incident Communications Plan.

Objective 1.5 Support Safe Worker Entry and Operations in Post-Nuclear Environment

The extreme radiation environment, extensive physical damage, and downwind hazards due to fallout all contribute to the difficulty of responding to an IND incident. A key capability will be to provide the protocols, equipment, information, and expertise to operate within acceptable safety constraints in a hazardous environment. This includes immediate information regarding the physical extent and severity of the radiological hazard, as well as information regarding secondary hazards such as fires, unsound structures, and hazardous chemicals. Hazard avoidance is the best practice, but the need to extract victims and restore key functions will necessitate operations in a contaminated environment. Emergency Worker Guides and Hazardous Waste Operations and Emergency Response (HAZWOPER) procedures are a starting point, but application of these guidelines for effective response and recovery requires the ability to collect and disseminate relevant information to responders and workers and the ability to identify and track the extent of exposure for workers on-scene. Educating the responders and decision makers on the increased risk of radiation-induced cancer compared to the background risk, and on the time course for its development, can help establish protective action plans. Ideally, personal protective equipment and medical prophylaxis measures should be developed and made available to all workers and responders, further enhancing their ability to perform their mission without becoming casualties themselves.

Capability 2: Characterize the Incident

In the aftermath of an IND detonation, transfer of key incident data to decision makers is crucial to facilitate rapid activation and effective utilization of emergency response operations. Fully coordinated agreements and protocols that utilize any and all available national assets (e.g., Interagency Modeling and Atmospheric Center (IMAAC), Federal Radiological Monitoring and Assessment Center (FRMAC), regional DOE Radiological Assistance Program (RAP) teams, Environmental Protection Agency Radiological Emergency Response Team, Nuclear Incident Response Teams (NIRT) and others) will be essential to rapidly acquire key incident data and generate fallout predictions. Relevant data and predictions will be transmitted to federal, state and local officials and the public as rapidly as possible. Emergency response personnel, including public affairs specialists, need to understand and have access to plume maps. A lack of either information or understanding can lead to ineffective, inappropriate, or even detrimental actions during an incident.

Baseline planning, exercising, and training of local, state, and federal assets will properly integrate assets and enable the execution of a time-phased approach to incident assessment that remains crucial for public protection considerations and the assessment of CIKR. The characterization of Light Damage, Moderate Damage, No-Go, and Dangerous Fallout zones[2] by key incident parameters such as degrees of broken glass, structural damage, rubble, stalled and crashed automobiles, fires, utility and water infrastructure damage, and elevated radiation levels will be vital for implementing informed protective action decisions. As part of this strategy, four objectives necessary for complete incident characterization have been identified – from initial assessment of the size and precise location of the IND through post-event assessments).

Objective 2.1 Establish Key Incident Parameters and Make Predictions

This objective emphasizes the need for rapid acquisition of critical incident data and information to facilitate shelter or evacuation decisions and construct initial damage and hazard assessments. Pre-incident, yield-based models will be overlaid onto incident sites when little specific information is known. Upon confirmation that an IND detonation has occurred (and determination of the location of the burst), yield estimates will be used to begin modeling the expected effects. Ambient meteorology, tracking of the fireball, fallout deposition, and dose estimates, as well as available data from onsite monitoring teams, will feed into existing models to assist decision makers in making time-critical, life-saving decisions.

Early incident characterization will largely fall to local responders. Therefore, planning, training and exercising the rapid transmission of field data from local responders to federal assets will play a key role in this objective. In-place communications must ensure that key, time-sensitive nuclear yield and fallout data reaches appropriate Command entities. The information must be in a format that is not only compatible with existing communication and data exchange networks, but is readily understandable to the recipient. A seamless communication capability between relevant departments and agencies with the onsite incident command structure will further enhance the life-saving capabilities onsite.

Objective 2.2 Determine Hazards to People

Information on hazards in the affected area is crucial to aid in determination of potential threats to citizens and responders from fire, hazardous materials, radioactive contamination, and structural failures. While predictions for radiological hazards in the affected area resulting from the burst can be available within minutes, pre-incident identification of locations and quantities of pre-existing hazardous materials are needed to aid in assessment of compounding risks for fire and chemical dangers in the affected area. To assure adequate public protection and evacuation or sheltering recommendations, physical confirmation of the radiation hazards in the affected area will be needed within hours following an incident. Information regarding the number, location, and severity of fires will need to be collected quickly for dissemination to the public.

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[2] These zones are defined in the *Planning Guidance for Response to a Nuclear Detonation* as follows:
- Light Damage: characterized by broken windows and easily managed injuries
- Moderate Damage: characterized by significant building damage, rubble, downed utility poles, overturned automobiles, fires, and serious injuries
- No Go: characterized by completely destroyed infrastructure and radiation levels resulting in unlikely survival of victims
- Dangerous Fallout: the area covered by fallout that impacts responder life-saving operations and/or has acute radiation injury potential to the population

Objective 2.3 Assess Effects and Damage; Ascertain Functionality of CIKR

Determination of damage to CIKR will be required to facilitate safe responder operations, safe and expeditious shelter and evacuation, and proper site stabilization efforts. Status of the following CIKR elements will be needed following an incident to save and sustain life:

- Local/regional transportation systems (roads, bridges, rails, subways/tunnels, airports, harbors)
- Healthcare and public health facilities
- Communications and information technology infrastructure
- Local/regional energy systems (oil, gas and electric power)
- Local/regional water systems (drinking water and wastewater)
- Building structural damage

This objective comprises integration of the CIKR emergency status into the incident commander's situational awareness, to include a mechanism for integrating private sector owners' or entities' data; exercises with federal, state, local, tribal, and territorial or private sector managers that directly evaluate functionality of CIKR in the aftermath of an IND incident and provide insights on the likely impact on response operations at this scale; real-time collection and storage of situational data for local, regional, state, and national assets; and the execution of plans and agreements for rapid status evaluation and data transmission between federal, state, local, tribal, and territorial agencies. Sensor and aerial capabilities will be integral for rapid assessment of CIKR status, and the real-time transmission of that data remains critical for the decision makers to pass along essential information to relevant federal departments and agencies as well as state and local officials and the public.

Objective 2.4 Characterize Fallout Particles and Distribution in the Environment

Characterization of the distribution and magnitude of fallout contamination will be essential for assessment of potential impacts to human health and the environment and to facilitate decontamination activities. Key analytical procedures are in place to assist in this effort. Pre-event analysis should be augmented with field sampling and modeling capabilities to improve national capabilities and enhance life-saving capabilities.

Capability 3: Mass Evacuation and In-Place Protection

This capability involves the ability to plan for, and immediately execute, the safe and effective sheltering-in-place of an at-risk population and an organized and managed evacuation of the at-risk population to areas of safe refuge.

Due to the resultant threat from radioactive contamination and fallout, one of the most effective ways to reduce the casualties from a nuclear explosion is through planning and rapid implementation of an effective shelter and/or evacuation strategy.

There are two principal actions that may be taken to protect the public from fallout: taking shelter and/or evacuation. These protective actions may be self-executed by informed members of the public or they may be communicated and orchestrated by response officials during the incident.

Federal support to state and local planning efforts in this scenario includes the provision of sound science to support local pre-incident planning efforts, the issuance of pre-incident federal guidance

to assist in the planning effort, and grants to help prepare evacuation plans which include the development of evacuation routes, the purchase and stockpiling of necessary supplies and shelters, and the exercising of these plans.

As part of this strategy, four objectives necessary for effective mass evacuation and in-place protection have been identified.

Objective 3.1 Search and Rescue

The number of victims and survivors of a nuclear detonation will likely exceed the large numbers seen in Hurricane Katrina or the Haitian Earthquake, and many people will be in contaminated or blast-damaged areas that will represent a significant technical challenge to responders. Some survivors will also be in fallout areas that can represent a significant obstacle to search and rescue efforts in the first few days following a burst.

Pre-designated priorities and the accomplishment of well-coordinated Urban Search & Rescue (US&R) and civil Search and Rescue (SAR) efforts and the delivery of proper medical attention are essential to maximizing the number of lives saved. Search and rescue, fire, and others performing life-saving services with specialized training and equipment to enable them to rapidly identify unsafe structures and to work in the contaminated environment enhances their overall life-saving capabilities in the Light Damage and Moderate Damage zones.

FEMA serves as the ESF #9 (Search and Rescue) coordinating agency, serves as the primary agency for urban search and rescue under ESF #9, and operates the Urban Search and Rescue Response System. The USCG serves as the primary agency for waterborne search and rescue under ESF #9. As such, it will be critical for DHS to coordinate with interagency partners, particularly DoD and DOI/NPS during search and rescue operations.

Objective 3.2 Organize and Manage Evacuation

With no likely advance warning of an IND attack and incomplete, imperfect, and potentially contradictory information coming from the scene; decision makers will have little or no time to wait for additional or better information to affect the safety of our citizens. Since the best initial action immediately following a nuclear explosion is to take shelter in the nearest building or structure and listen for instructions from authorities, decision makers must endeavor to ensure that pre-event training and guidance to this effect is understood by the public.

An immediate priority of emergency managers will be to adapt pre-existing large scale evacuation plans to on-the-ground realities in order to facilitate the evacuation of populations designated as early evacuation priorities. As situational awareness increases and evacuation routes are refined, additional groups and areas will be identified for evacuation support. Informing and managing large numbers of evacuees will be a monumental task.

Objective 3.3 Monitor and/or Decontaminate Population

Population monitoring is the ability to determine if people have been internally or externally contaminated. Decontamination includes techniques to remove contaminated clothing and personal effects, showering, and administering drugs (chelating or decorporating agents) for internal contamination. Both of these are crucial components of mass evacuation. Given the extent of the fallout area from an IND, this capability may likely be required for millions in the affected area. Rapid monitoring and decontamination are essential for success since most of the population's

exposure to harmful radiation occurs in the first hours following the event. Registration and tracking systems for survivors will be required. Special considerations and treatment for those responders engaged in activities in the Dangerous Fallout, Light Damage, Moderate Damage, and even No-Go zones are required in order to ensure continued performance of life-saving capabilities and other mission essential tasks in those areas.

Objective 3.4 Provide Essential Human Needs

In the aftermath of an IND incident, essential provisions of clothing, food, water, and shelter will be required for large numbers of survivors. State and local governments generally retain the principal responsibility for meeting mass care and other needs in responding to a disaster; however, governments largely carry out this responsibility by relying on the services provided by voluntary organizations. Pre-positioned supplies and fuel for emergency responders conducting life-saving operations and a reinforced capability to quickly draw upon additional resources as demands grow will have a significant impact on this objective.

Volunteer organizations (such as the American Red Cross) have long supported local, state, and federal government responses to disasters. Pre-event planning should identify such organizations and incorporate their services as appropriate.

Capability 4: Medical Triage

Following an IND incident, casualties from blast effects, thermal radiation, and ionizing radiation will completely overwhelm local medical response. Health physics experts will be needed to help predict health effects and educate medical responders on recognition and treatment of radiation-induced conditions. The medical community will need to estimate triage needs based upon previously agreed-upon criteria and actual onsite information, establish triage locations, provide emergency medical stabilization, prioritize patient treatment, and institute an extensive and dynamic triage plan.

Effective anticipation of the medical needs following an IND incident and operational planning for efficient management of those needs is essential. Pre-incident identification of available assets and the corresponding resource deficiencies in the affected area will be fundamental to saving lives. The initial medical needs will be include extensive biodosimetry and bioassay resources, as well as a common operating picture for the current federal, state, local, tribal, and territorial capabilities. After the current capabilities and needs have been fully identified, the national response community should activate in-place plans for large-scale medical triage of blast, thermal, and radiological effects. The laboratory community does the same for the national biodosimetry/bioassay program.

Three objectives for medical response and triage have been identified.

Objective 4.1 Predict Health Effects; Estimate Triage Needs, Locations, and Required Assets

Following an IND detonation, health effects will be widespread and varied. Assessment of the initial population health effects and mobilization of surge medical treatment for mass-casualty triage is complex, and unless carefully planned, are rarely-rehearsed endeavors for incidents of this magnitude. Pre-incident identification and advertisement of probable triage locations will ease the post-event chaos, as will effective operational planning. As the event unfolds, it will be imperative

to estimate the types and quantities of gross medical effects and provide this information to responders to rapidly mobilize appropriate medical support personnel.

While adequate triage concepts of operation exist, all parties must adhere to them in order to ensure a common operating scheme for the medical response and fairness to victims. In-place plans must include guidance regarding large-scale medical response activities to an IND:

- Mass triage prioritization decisions
- Priorities for accomplishing palliative care
- Amount, type, and placement of pre-positioned medical treatment
- Credentialing of medical and support responders
- Releasing medical countermeasures
- Estimating medical transportation needs
- Public emergency declarations[3]
- Process for seeking waivers of certain legal requirements
  - Emergency use authorizations[4]

Objective 4.2 Establish Triage Sites and Provide Emergency Medical Stabilization

Following an IND incident, implementation of triage plans will be crucial for effective treatment of burns, physical trauma, blood loss, infection, shock, and acute radiation effects. Triage sites should be determined and conveyed to medical personnel. As event conditions unfold, the initial triage plan will require regular updates. Expected effects will vary spatially, requiring specialized treatment plans for different patient groups relative to the incident site(s). At some point, patients will require movement to specialized treatment locations for effective management of like conditions. Personnel with specialized training for recognizing and handling expected effects and decision making for mass casualty care following a nuclear incident must train and participate in pre-event exercises with first responders to increase life-saving capabilities.

Objective 4.3 Evaluate Radiation Exposure of Patients

Estimation of patient radiation exposure will require rapid assessment of incident conditions. Information regarding expected effects should be provided to mobilize biodosimetry/bioassay assets. Following the incident, implementation of an initial sample collection and biodosimetry/bioassay strategy will be required to evaluate radiation exposure in individual patients. As the incident unfolds, the magnitude of required biodosimetry/bioassay efforts will require augmentation of assets.

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[3] Federal law sets forth the conditions, precedent, and authorities for making such a declaration (see 42 U.S.C. 247d). The Secretary of HHS has broad discretion to determine whether an event meets one of the two criteria set forth in 42 USC 247d and to determine the particular public health officials in HHS or outside HHS to consult about a specific declaration. Unlike a Stafford Act declaration, the Secretary of HHS does not need to wait for a state request in order to make a public health emergency declaration. The HHS Office of Intergovernmental Affairs, Office of ASPR, HHS Centers for Medicare and Medicaid Services (CMS), and other relevant HHS components work closely during emergencies to evaluate whether a public health emergency declaration is necessary.

[4] Federal law sets forth the conditions, precedent, and authorities for authorizing the introduction into interstate commerce of a drug, device, or biological product intended for use in an actual or potential emergency (an emergency use authorization) (21 U.S.C. § 360bbb-3(b)).

The biodosimetry/bioassay capability will need to be sustained to collect and analyze samples for an extended period of time post-incident.

Pre-incident planning for the implementation, activation, and documentation of a nationwide biodosimetry/bioassay capability will include prioritization criteria and a list of available resources for evaluation of mass radiation exposure. Coordination among federal, international, and private laboratory assets must occur to facilitate proper integration of available assets and ensure the consistency of laboratory procedures and biodosimetry methods. Following an IND incident, internal and external dosimetry of responders and individual patients will be necessary to capture the radiation health effects and to implement the proper immediate and long-term patient management decisions. An in-place pre-event plan will facilitate the management of biodosimetry sample tracking, handling, and the reporting of results.

Capability 5: Provide Casualty/Evacuee Care

The first goal in responding to and recovering from an IND attack is to limit the total casualties resulting from such an event. Key to this goal is provision of effective care for casualties and evacuees. This capability supports the identification and tracking of individuals and the provision of necessary medical, basic, environmental, and mental health care. It provides for public health and fatality management to prevent disease outbreak and for behavioral health support.

Four specific objectives have been identified that constitute effective casualty/evacuee care.

Objective 5.1 Register, Process, and Track Individuals

One key element is the need for electronic "patient tracking systems" as a means to improve emergency response and preparedness capabilities by capturing and distributing patient information to various stakeholders (within the legalities of the Health Insurance Portability and Accountability Act of 1996), such as emergency managers and local hospitals, throughout the system of care from the incident. These monitoring strategies for casualties are anticipated to be long term, since some adverse effects of radiation exposure involve long-term physiological effects.

Population monitoring of a suitable scope and scale to accommodate such a disaster will be required within just a few hours from IND detonation, with an emphasis on operating within a contaminated environment and caring for a population with radiation exposure, burns, and or blunt trauma injuries. Authorities will require access to registries and locator databases used to contact and track the affected population who require short-term and long-term medical monitoring, evacuation and shelter assignments.

Objective 5.2 Provide Medical and Specialized Medical Care (Hospitalization)

Due to the number of anticipated casualties, and the extensive trauma, burn, and radiation exposure injuries involved, increased survival will necessitate deployment of medical, surgical, burn and other treatment assets to the location of the mass casualties for several weeks. At the same time, evacuation to distant care facilities around the entire nation will be necessary to distribute the large number of injured to support facilities that cannot readily be relocated to the site of the incident. A component of the commander's immediate situational awareness requirement will be to obtain "bed counts" for available medical treatment facilities, locally and within evacuation distance. Potentially specialized assets for evacuation of burn and trauma patients will be required. Redistribution of

patients will be called for in some cases, i.e., receiving hospitals may be requested to receive patients, despite fear of cross contamination.

Expected health effects and impacts on the general population following an IND detonation must well–characterized in order to support decisions regarding allocation of medical resources, facilities, and support staff. This implies a need for effective risk assessment modeling tailored to an IND incident in an urban/city, ready for rapid application following the disaster. In addition, massive amounts of biodosimetry samples will be collected and will require laboratory analysis.

In the initial response phase, medical care, management, and intervention capabilities for possibly hundreds of thousands of casualties will be needed.

In anticipation of the above medical care measures, healthcare professionals need training in management of victims of radiation as well as handling of surge populations of patients. It is recognized that a scarce resources environment will require different standards of care in a mass casualty event. Beds, medicines, and equipment and supplies must be cached in useful, deployable ways with a mechanism to efficiently dispatch for use following a detonation.

Objective 5.3 Provide Public Health and Behavioral Health Services

Experts believe that the psychological impact of an IND incident could be the most difficult aspect of the response. Real or perceived exposure to radiation after an IND incident could cause mass fear and panic because radiation is invisible, odorless, and largely unknown or misunderstood. The invisibility of radiation may be the most terrifying aspect of the IND. Many people do not understand the physical consequences of radiation exposure and may become concerned with the limited availability of and uncertainty about the effectiveness of decontamination procedures, possible prophylactic measures and treatments. The behavioral responses of individuals and groups immediately after an IND incident may complicate or impede emergency response operations. In addition, an IND attack could generate a large number of psychological stress casualties as well as individuals with long-term psychological effects such as phobias, depression, or post-traumatic stress disorder.

Effective early intervention of behavioral health services following an IND incident requires careful facilitation and the conduct of screening and needs assessments for individuals, groups, and populations. Tools are needed to support social and psychological needs, to include a systematic method for assessing mental, behavioral and physical health needs of impacted communities. Early interventions should be delivered as needed in a manner acceptable to the survivors of the incident and in keeping with best available practices associated with psychological intervention following a mass violence incident such as an IND detonation. Many survivors will experience some symptoms in the immediate aftermath of the IND incident, but these symptoms are not necessarily cause for long-term follow-up, since most will eventually remit.

Objective 5.4 Provide Fatality Management

An IND detonation will create a large number of fatalities. Fatality management will be complicated by the presence of radioactive contamination. Proper management will require procedures for dealing with contaminated remains and personal effects, including facilities for temporarily storage, means to identify and track the remains (effective recordkeeping), and the means to transport them without spreading contamination.

Capability 6: Stabilize and Control the Impacted Area

Dependent on weather, fallout contamination could extend hundreds of miles downwind and include thousands of square miles, with significant casualties developing over several days to weeks. This includes areas extending well beyond the immediate danger zones near ground zero. In all these areas, measures will be needed to protect access and egress for public safety personnel, for protection of CIKR, and for designated areas (camps, decontamination centers, medical treatment facilities, storage areas, etc.).

Under this capability, federal agencies will be looked upon to provide assistance to state and local Governments overburdened by the sheer magnitude of the IND incident and the breadth (both geographically and due to the wide spectrum of activities) impacted by the IND. Confidence in pre-existing guidance, policy, plans and agreements will support efforts to stabilize and control the impacted area and facilitate saving and sustaining of life and ensure government and private functions continue or are re-established for the purposes of the overall mission.

Objective 6.1 Extinguish Fires Initiated by the Blast and in Contaminated Areas Downrange

One of the primary threats to survivors of the initial blast will be fires caused by the thermal energy of the IND, building fires caused by collapse of structures and ruptures of gas lines and similar effects. Rubbled buildings will provide a great quantity of potential fuel for such fires. The IND response will require focused local efforts to extinguish fires initiated by the blast and in contaminated areas downrange in accordance with existing Compacts and Agreements.

Objective 6.2 Stabilize utilities and Structures That Affect Initial Evacuation Routes

The most immediate need will be to stabilize utilities and structures in the impacted area which affect initial evacuation routes for initial response operations. The response will require establishment of routes into or out of the impacted area and the restoration of localized utilities for emergency responders' needs.

A key requirement is the need for pre-coordinated, pre-approved plans and guidance to facilitate efforts at stabilizing the infrastructure in the immediate impact area and provide a basis to assist in the recovery of basic utilities and services in the impacted area in the days and weeks following the event.

Objective 6.3 Provide Public Safety and Security in the Vicinity of the Blast Area and in the Overall Federally Declared Disaster Area

As was witnessed in previous major disasters (such as Hurricane Katrina), there is a need for security and public safety measures in the vicinity of the blast area as well as in the overall federally declared disaster area. In order to protect responders in the course of their duties and private citizens as they are evacuated, extensive measures will be required, including the augmentation of local onsite efforts with federal assets as needed.

Capability 7: Perform Site Cleanup and Recovery and Restore Essential Functions

Restoration of critical infrastructure is a key to local and regional recovery and will be vital to national security. Disruption of power, communications, medical care, food, housing, and other services presents obvious obstacles to ongoing response and recovery activities. Mitigating the

spread of radioactive contamination, reducing the risk of imminent hazards, and restoring essential services provided by CIKR will help in supporting both immediate life-saving activities and ongoing recovery.

After the immediate hazards have been addressed, radioactive fallout will still cover the impacted city, nearby environs, and additional thousands of square miles. Thus, the devastation of a nuclear attack on a city will persist for years to come, denying state and local governments critical economic resources, impeding transportation and commerce, bankrupting private firms, and potentially leaving millions homeless. Responders will carry out decontamination of infrastructure such as power stations, water treatment facilities, hospitals, rail and highways; commercial and residential areas; and decontamination or mitigation of agricultural resources. An intense public effort will be required to prioritize and expeditiously remediate infrastructure, buildings and lands. Expert-guided public discussion will help determine the acceptable level of decontamination.

Objective 7.1 Manage Environmental Hazards in Impacted Area and in Contaminated Areas Downwind

A critical component of site recovery and restoration of essential functions includes characterization of the incident (see Capability 2). Characterization, along with certain pre-set parameters, will determine the impact to the area and address several key requirements, including: identifying hazard levels for workers to restore infrastructure, identifying the type of decontamination techniques needed to bring hazards to an acceptable level, and minimizing the spread of contamination. Methods for identifying sites for temporary staging and final long-term contaminated waste disposal are very important and have proven problematic in previous large-scale events. Waste volumes generated by an IND incident are likely to be significantly larger than the typical annual volumes of radioactive waste generated nationally and will challenge existing disposal capabilities. Waste characterization, treatment, packaging, and transportation will also present significant challenges. Policies and procedures for handling bio and hazardous wastes will include dealing with contaminated fatalities and morgues. Procedures for identifying staging areas for both clean and contaminated equipment and personnel must all be in place, trained, and exercised. Plans will include all modes of managing environmental hazards, such as minimizing the spread of contaminated materials, washing down buildings, and controlling runoff.

Objective 7.2 Perform Gross Decontamination of Critical Infrastructure and Key Resources

This objective calls for the reduction of the level of radioactive contamination and other imminent hazards to acceptable levels of risk which allows CIKR, real property and personal property to be used to support the response and recovery operations. It is recognized that capabilities to accomplish wide-area urban decontamination are limited, which could lead to disruptive, slow, and costly recovery. An affected area, or some portion of it, could be razed or simply abandoned for an extended period of time. The knowledge for decontamination after an IND is limited because of lack of information about the nature of fallout and its interactions in the environment. However, there will be a need for "targeted decontamination" of critical infrastructure (see Capability 6).

Objective 7.3 Perform Restoration of CIKR

During an IND incident, it is expected that there will be increased demand on the infrastructure and services both near the incident site and outside of the incident due to evacuated and displaced populations. There will be an immediate need to identify essential CIKR that is available to support

life-saving activities. Because of mass evacuations, jurisdictions in the vicinity of the incident site will likely experience high demands on infrastructure and services for an extended period of time, creating further difficulty with prioritizing the response to restore CIKR.

Cross-Cutting Objectives

In the descriptions of the required capabilities above, some cross-cutting elements are evident that impact more than one area. These common threads comprise a set of required actions that enable a more effective response to an IND incident. These require additional focus and effort, since they apply broadly across the response and recovery spectrum. These cross-cutting objectives include the following:

Objective CC.1 Public Information Awareness

A well-defined public information awareness campaign is required prior to an IND incident. This campaign includes all public awareness tools and information products that would be required by the public both prior to and directly following an IND incident. These tools and products would be used to raise awareness of IND preparedness and provide in-depth information to the public on how to prepare for and respond to an IND detonation. This campaign and products also need to provide detailed protective action recommendations to the public. Pre-event information materials should provide consistent, detailed, scientifically-based information to the public on how to prepare and respond, as well as instructions for where to locate additional information. Tools and products should also provide guidance to special needs populations including, but not limited to, the elderly, the physically challenged, non-English-speaking individuals, schools, businesses and pet owners. Pre-event education can be used to build partnerships between the public and federal, state and local governments.

Objective CC.2 Stakeholder Mapping and Coordination

The roles and responsibilities of all DHS intra-agency and interagency partners in the IND response and recovery effort must be identified, synchronized, and documented within a time-phased operational plan. Effective coordination measures between federal entities and state and local stakeholders must be identified, implemented, rehearsed and exercised. A standard lexicon will be in place as well.

Objective CC.3 Modeling and Decision Support

Advanced modeling and decision making, risk communications, consequence management, and decontamination assessment must be integrated into planning support, and modeling results must be folded into operational plans.

All protective action policy guidance will be articulated by the White House, and all protective action guidelines (PAGs) will be promulgated by both the EPA and the FDA, to include those PAGs needed in support of decision making associated with public and first responder safety, urban shelter in place, evacuation, and medical intervention.

Objective CC.4 Information Exchange and Communications

All seven of the required capabilities are undergirded by the need for timely, accurate information and data exchange. Time-critical, life-saving decisions are made based on the best available data, so decision makers require immediate access to relevant information. Because of the extent of damage

caused by an IND incident, normal communications infrastructure is likely to be disrupted. It is essential that appropriate public messaging be made prior to an event, that tactical (responder) communications be established as soon as possible after a burst, and that public safety messaging continues throughout the response and recovery phases. The March 15, 2009, *Nuclear Incident Communication Planning-Final Report*, which was prepared for the DHS Office of Health Affairs by the Homeland Security Institute, recommends that messages be tailored by pertinent federal, state, local, tribal, and territorial stakeholders for specific target audiences, to include affected communities, special needs populations, schools and businesses. The messaging must include public safety guidelines, sheltering information, risk communication, and evacuation techniques and strategies. Information regarding the relative risk and time course of radiation-induced cancer compared to lifetime background will help planners, responders, and victims understand the recommendations for sheltering, evacuation, medical needs and long-term follow-up.

Communications networks are required on-scene (both for responders and to the public), to the state and regional authorities, and to the national authorities. This will include both voice and data exchange capabilities.

Objective CC.5 Logistics

The enormity of the expected needs and the unique radiation and fallout aspects of an IND incident will quickly outstrip the planning and committed resources intended to save and sustain lives in other disaster scenarios. A well-coordinated effort that builds upon existing plans and policies will be required to get necessary supplies and services into and out of the impacted area in support of each of the required capabilities.

Objective CC.6 Scientific Support and R&D

Near-term capability gaps must be identified and appropriate resources allocated to address those needs requiring material solutions or related research efforts. A risk-based process is needed to continually re-evaluate requirements, and to revise R&D objectives to meet newly-defined needs in a timely fashion.

Coordination and Implementation

All the capabilities discussed under this strategy require extensive involvement across federal departments and agencies, and across the full spectrum of federal, state, local, tribal, and territorial governments. While the NIMS concept of Unified Command is well-established for major incident response, the sheer scope of an IND incident will require additional pre-event coordination, and will impose additional difficulties on the Unified Command structure during the course of response to and recovery from an IND incident.

For an IND incident, local and state responders will have the initial responsibilities on-scene, but are likely to be overwhelmed by an IND. A rapid, well coordinated federal response is required for life-saving activities and long-term support. The state emergency management infrastructure generally is still expected to exist and have sufficient capacity to control response actions in its state.

Homeland Security Presidential Directive (HSPD) -5 states that the Secretary of Homeland Security "shall ensure that, as appropriate, information related to domestic incidents is gathered and provided to the public." The DHS National Joint Information Center (NJIC) serves as the federal incident communications coordination center during incidents requiring a coordinated federal response. The

NJIC coordinates with and supports the White House Office of Communications, the Secretary of Homeland Security, the National Operations Center (NOC), Crisis Action Teams (CAT), the Incident Management Planning Team, the National Response Coordination Center (NRCC), the National Infrastructure Coordinating Center (NICC), Federal Coordinating Officers (FCOs), Joint Field Offices (JFOs), and Emergency Support Function (ESF)-15 staff. The DHS NJIC also coordinates directly with the Office of the Secretary of Defense and the DHS Office of Public Affairs (OPA) for domestic homeland security incidents.

FEMA is tasked under a number of existing federal guidelines and authorities to provide necessary planning and coordination for IND response and recovery. This planning and coordination will be conducted consistent with the NRF and its *Nuclear/Radiological Incident Annex*, and the National Infrastructure Protection Plan (NIPP).

FEMA coordinates response support from across the federal government and certain non-governmental organizations by calling up, as needed, one or more ESFs. The ESFs provide the structure for coordinating federal interagency support for a federal response to an incident. They are mechanisms for grouping functions most frequently used to provide federal support to states and federal-to-federal support, both for declared disasters and emergencies under the Stafford Act and for non-Stafford Act incidents.

The Incident Command System provides for the flexibility to assign ESF and other stakeholder resources according to their capabilities, taskings, and requirements to augment and support the other sections of the JFO/Regional Response Coordination Center (RRCC) or NRCC in order to respond to incidents in a more collaborative and cross-cutting manner.

While ESFs are typically assigned to a specific section at the NRCC or in the JFO/RRCC for management purposes, resources may be assigned anywhere within the Unified Coordination structure. Regardless of the section in which an ESF may reside, that entity works in conjunction with other JFO sections to ensure that appropriate planning and execution of missions occur.

Strategy Update

This Strategy will be reassessed during FY 2011, and revised accordingly. At that time, the Strategy will incorporate both policy recommendations, as defined in coordination with DHS Policy and other DHS stakeholders, and enhanced interagency inputs that have been identified and developed in the interim.

Conclusion

A nuclear detonation in a US city represents one of the most catastrophic incidents that could befall our nation, causing enormous loss of life and property and severely damaging economic viability. It is incumbent upon all levels of government, as well as public and private parties within the US, to prepare for this incident through focused nuclear attack response planning. Proper planning and preparation could result in life-saving on the order of tens of thousands of lives.

This Strategy represents an integrated approach to Response to and Recovery from an IND incident in a major urban area. It defines the direction of a DHS-led national program specific to IND response, and supports and informs initial decisions on prioritizing and allocating resources to enhance gaps in our existing capability to implement the response measures identified herein.

Annexes

Annex A: Gaps and Analysis
Annex B: Policy Direction and Issues
Annex C: Research and Development

Annex A: Gaps and Analysis

Gaps in Capability 1: Manage the Response

Rapid sheltering of the public exposed to the path of fallout could save hundreds of thousands of lives. To accomplish this, the affected public needs to be educated on immediately protecting themselves to avoid exposure to lethal levels of radiation. Although atmospheric dispersion models can provide predictions of downwind consequences given a known set of input parameters such as cloud height, chemistry, and particle size distribution; these parameters are not currently known for a ground level, low-yield nuclear detonation in a modern urban environment. Another major gap is that the doctrine, plans, and policies needed to harness these predictions is lacking. Currently, there is no strategy for notifying the public in real time of recommendations on shelter or evacuation priorities. Response management requires communication and logistical support, however, the extent of disruption from IND effects (such as blast and the electromagnetic pulse) are currently unknown.

Provide Emergency Public Information

- *Doctrine/Plans.* Some strategies are in place, but are incomplete. There is a need for:
  - National strategies for public information and communications
  - A strategy for establishing and ensuring effective information flow to the public
  - A strategy to counter inaccurate or spurious information from unauthorized sources
- *Training.* No validated public information program exists. There is a need for:
  - A validated public information program
  - Training and exercises for delivery of protective information
  - A First Responder outreach program
- *Regulations/Authorities/Grants/Standards*. Public alert (e.g., Emergency Alert System) standards are a shortfall. Some product and information standards exist, but are inadequate. There is a need for:
  - Information and training grants
  - Public alert standards
  - Information product standards
  - Public Information Officer Certification
- *Research and Development*. Pre-event analysis of potential effects must be performed to determine optimum shelter and evacuation strategies for a variety of yields and urban conditions.
  - Ground shock and blast effects on evacuation planning, especially for protected alternative evacuation routes (e.g., subway systems and underground pathways)

- Fire initiation and spread, fire fighting capability
- Fallout characteristics; physical properties and radiation levels
- Fallout pattern analysis
- Evaluation of modern structures for fallout exposure protection

Establish Emergency Communications in a Post-Nuclear Environment

- *Doctrine/Plans.* Some strategies are in place, but incomplete. There is a need for:
  - Integrated Emergency Communications Plans
- *Materiel.* Existing systems can provide interoperability, but have limited ability to handle classified information. There is a need for:
  - Interoperable communications equipment capable of handling both classified and unclassified information hardened against a nuclear attack
- *Organization.* The DHS National Joint Information Center (NJIC) serves as the federal incident communications coordination center during incidents requiring a coordinated federal response. It is staffed by experienced incident communications response personnel and rapidly mobilizes to coordinate the federal external communications effort. There is a need for:
  - Formal policies establishing radiological subject matter experts to support the NJIC
  - A policy on the public dissemination of plume products
- *Leadership.* Government Emergency Telecommunications Service (GETS) provides priority service over land-based telephone lines, but it does not apply to radio or broadband "frequency bands." There is a need to:
  - Generate a communications plan that will establish frequency assignments and adjudication process
- *Regulations/Authorities/Grants/Standards.* Public alert (e.g., Emergency Alert System) standards are a shortfall. Some information product standards exist but are inadequate. Physical connectivity issues between how Integrated Public Alert and Warning System (IPAWS) and similar programs can interconnect with different technologies. There is a need for:
  - Public alert standards
  - Information Product Standards
  - Radio frequency allocation
  - Internet alert notification standards
- *Research and Development*. Analysis of how blast and electromagnetic pulse will effect local and regional communications needs to be performed. Understanding the range of these effects on public and responder communication methods will be key information needed for response planning. Needs include:

- EMP and blast effects on communication capabilities (both responder and public)

Gaps in Capability 2: Characterize the Incident

Rapid characterization of the incident is required to provide critical situational awareness to federal, state, local, tribal, and territorial decision makers. Success requires both pre-incident analysis and tools and capabilities to ensure rapid collection and use of information.

Establish Key Incident Parameters and Make Predictions

- *Doctrine/Plans.* There is a lack of communication plans to enable key nuclear data getting to appropriate Command entities. There is a lack of procedure for transmitting field corroboration data to the appropriate Command entities. There is a need for:
  - A policy on the rapid communication of time-sensitive nuclear yield and fallout information among departments and agencies
  - A well-communicated plan among federal, state, local, and private entities for measurement of required data, and transmission of integrated field data to state and federal assets that need it
  - Coordination of the environmental monitoring data for radiological (FRMAC lead at federal level) and non-radiological constituents (EPA lead at federal level) to provide a common operating picture
- *Personnel*. Insufficient number of qualified people available for key parameters, field corroboration and field confirmation (DOE, EPA teams, CSTs, S/L assets)
- *Materiel*. While satellite and IMAAC assets are good, equipment for effective field corroboration is inadequate.
- *Training.* Federal agencies have some personnel who are relatively well-trained and exercised. However, IND response is difficult to prepare for, especially at the state and local levels. There is a need for:
  - Integrated regional interagency exercises
  - Training, simulation, and exercises for acquisition, analysis, and sharing of nuclear incident information in a crisis
- *Research and Development*. The capability to rapidly acquire key incident data and generate blast and fallout predictions in an urban setting requires both rapid collection and integration of post-incident data, combined with pre-event analysis of potential observable effects and fallout characteristics. There is a need for:
  - Evaluation of modern structures for blast, thermal, and prompt (initial) radiation effects and protection
  - Impacts on current communication capabilities and infrastructure
  - Fallout characteristics; physical properties and radiation levels
  - Fallout pattern analysis

- Evaluation of modern structures for fallout exposure protection
- Technology to rapidly assess damage and hazard zones
- Robust data communication capability in damaged infrastructure areas
- Improved accuracy of models based upon incorporating detailed site information

Determine Hazards to People

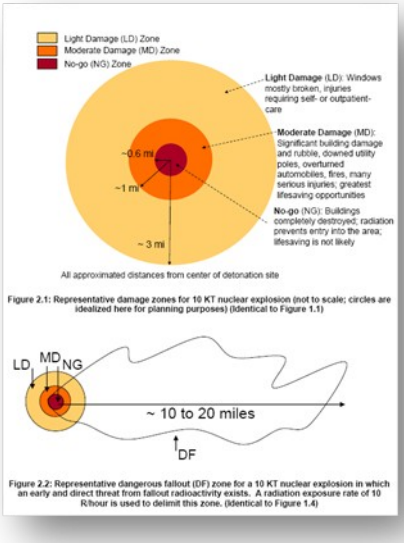
- *Doctrine/Plans.* Plans and procedures do not exist to rapidly assess hazards across the impacted zone. There is a need for:
  - Effective communication of plans to obtain and transmit hazard information for prediction generation among the IMAAC, FRMAC, and federal, state, local, tribal, and territorial responders
- *Training*. Additional training and exercises are needed to deal with scope of the incident
- *Organization*. Need better integration with DoD assets and state and local assets
- *Research and Development*. Pre-event analysis of potential effects must be performed to determine potential hazards the public might face for a variety of yields and urban conditions. This includes not only the nuclear detonation hazards, but also secondary hazards that may be generated by fire or hazardous material releases. There is need for additional research on:
  - Blast and thermal effects for generating delayed building collapse, physical hazards for rescuers and evacuees, and hazardous material releases in the urban environment
  - Fire initiation and spread, fire fighting capability, generation of hazardous smoke
  - Fallout characteristics; physical properties and radiation levels
  - Fallout pattern analysis
  - Optimization of external decontamination, including wet versus dry, based on types of materials
  - Tools for remote detection and analysis of hazards in inaccessible areas

Assess Effects and Damage; Ascertain Functionality of CIKR

- *Doctrine/Plans.* Plans for integration of CIKR emergency status are not complete or adequate. There is a need for:
  - Plans and agreements among federal, state, local, tribal, and territorial agencies and industry partners to accomplish rapid CIKR status evaluation and to transmit data and information
  - Policies for implementing protocols for passage of proprietary information and classified information as appropriate
- *Organization.* Organizational mechanism for integration of response with private-sector owners or entities. There is a need for:

- Coordination of assets and Incident Command to collect and analyze CIKR data and information
- Clearly identified fusion center which utilizes national and locally collected data to provide logistical and safety roadmaps for responders

- *Materiel.* Comprehensive real-time collection and data basing for situational awareness has not been achieved. There is a need for:
  - Sensor and aerial measurement and observation technologies to rapidly assess the status of CIKR
  - Real-time transmission of data and information
- *Training*. Few exercises directly evaluate functionality of CIKR and impact on response operations at this scale.
- *Research and Development*. Critical Infrastructure and Key Resources are important for effective response and for national safety and security. The nature of an IND detonation may create long range cascading infrastructure failures in addition to the direct effects on local CIKR. Detailed pre-event analysis is required for a variety of yields and locations to determine likely long range infrastructure effects.
  - EMP and blast effects and impact on local and regional CIKR
  - Evaluate potential long rang (cascading or interconnected) effects to CIKR from an IND Detonation



Note: Additional interagency gaps and research needs for this subject area have been identified at the end of this appendix.

Gaps in Capability 3: Mass Evacuation and/or In-Place Protection

The blast from a nuclear explosion will potentially result in large areas of significant building damage and may resemble severe earthquake or hurricane effects. Additionally, the radioactive fallout will affect downwind areas (including some of the blast areas) and can result in deadly radiation exposures to people outdoors in the first minutes to hours after the detonation. Taking appropriate shelter from the fallout will greatly reduce exposure and could save tens to hundreds of thousands of lives.

The most critical lifesaving action for both the public and first responders is to seek adequate shelter for at least the first hour. The public must be educated to resist the desire to flee the area. A much higher degree of coordination is required to mount successful evacuation and rescue activities, support public decontamination, transportation, and basic mass care.

Make Time-Phased Determination on Shelter-in-Place vs. Evacuation

- *Doctrine/Plans.* Existing plans are not adequate to meet the requirements of an IND incident. There is a need for:
    - Strategy and policy establishing criteria for shelter vs. evacuation decisions appropriate for a rapidly changing environment
    - Community-specific analysis of shelter and evacuation strategies and planning
- *Organization.* Although numerous plans exist for the different jurisdictions, they vary widely in scope and completeness. There is a need for:
    - Integrated organizational structure to make shelter-in-place vs. evacuation decisions
    - Organizational structure to identify and manage local and regional public shelters
- *Research and Development*. As in "Manage the Event," a pre-event analysis of likely scenarios can help determine optimum shelter and evacuation strategies for a variety of yields and urban conditions. The types of research required are:
    - Ground shock and blast effects on evacuation planning, especially for protected alternative evacuation routes (e.g., subway systems and underground pathways)
    - Fire initiation and spread, fire fighting capability
    - Fallout characteristics; physical properties and radiation levels
    - Fallout pattern analysis
    - Evaluation of modern structures for fallout exposure protection

Perform Search and Rescue

- *Doctrine/Plans.* Existing plans are not adequate to meet the requirements of an IND incident. There is a need for:
    - Large event, multiple resource integration planning
    - Evaluation of the nature and extent of hazards and blast damage that Search and Rescue teams will need to function in
- *Materiel.* On-going efforts to maintain pace with new technology and replacement of outdated PPE, monitoring, and decontamination equipment. There is a need for:
    - PPE and dose control tools adequate for surge and additional equipment for extended operations
- *Research and Development*. Urban Search and Rescue capability is a highly technical and limited resource. Pre-event analysis is required to inform and optimize this response capability to ensure they maintain their safety and focus on areas where they can provide the greatest benefit. There is a need for additional research on:
    - Blast and thermal effects that generate delayed building collapse, physical hazards for rescuers and evacuees, and hazardous material releases in the urban environment
    - Fire initiation and spread, fire fighting capability, generation of hazardous smoke

- Fallout characteristics; physical properties and radiation levels
- Fallout pattern analysis
- Expected injury types and location of injured
- Point of Contact high-throughput triage tools and an established Radiation Laboratory Network to assess internal contamination and radiation exposure

Organize and Manage Evacuation

- *Doctrine/Plans.* The mass evacuation annex and supplement are adequate. Personnel, monitoring, and methods are not adequate. There is a need for:
  - Guidance on managing large numbers of potentially fallout-contaminated individuals
  - Acceptable personnel monitoring levels to be defined
  - Acceptable monitoring capabilities and methods to be defined
  - Establish appropriate decontamination techniques and requirements
- *Materiel.* The requirements to monitor, track, and decontaminate large numbers of people have not been identified. There is a need for:
  - Mass transportation vehicles
  - IT systems for evacuee tracking
  - Decontamination supplies
  - Personnel contamination monitoring equipment
- *Research and Development*. Current analysis indicates that fallout will likely arrive too quickly to avoid, and early adequate shelter followed by ***informed, delayed evacuation*** is the preferred strategy. This will result in large number of victims (potentially millions) sheltered in potentially hazardous areas that will need guidance and evacuation support. Pre-event analysis of optimized evacuation strategies and methods for a variety of urban areas can help inform general post-event evacuation strategies. Understanding potential competing hazards such as fire or toxic material releases will also be a critical component. Additional research is needed for:
  - Ground shock and blast effects on alternative evacuation routes (e.g., subway systems and underground pathways)
  - Fire initiation and spread, fire fighting capability
  - Effects on current communication capabilities and other CIKR
  - Fallout characteristics; physical properties and radiation levels
  - Fallout pattern analysis
  - Evaluation of modern structures for fallout exposure protection
  - Decontamination technologies and methodologies

- CIKR rapid return to service methods
- Personnel decontamination issues and methods
- Technology to rapidly assess damage and hazard zones
- Location of injured and extraction considerations
- Psychological effects on, and anticipated response of both the public and first responders

Provide Essential Basic Care

- *Doctrine/Plans.* Plans are in place for providing basic human needs as it is a robust capability in the United States. However, few jurisdictions have planned for extraordinarily large mass care operations. There is a need for:
  - Doctrine and plans to be developed and refined for more robust repatriation, along with best practices and its standards or allowances (e.g., intact utilities)
- Organization. An organization for basic care exists and is adequate. The country has a very robust and experienced system of providing basic mass care and shelter. There is a need for:
  - The ability of the evacuation network to reverse flow to support repatriation
  - A good organization and understanding by assets to simplify and enhance this capability
- *Research and Development*. Current doctrine requires that all victims be decontaminated before entering support shelters, but this may not be practical or necessary for large numbers of evacuees who will need immediate support. Analysis of contamination levels, monitoring methods, health impacts from alternate strategies needs to be performed.
  - Personnel decontamination issues and methods
  - Psychological effects on, and anticipated response of, both the public and first responders

Gaps in Capability 4: Medical Triage

In the wake of an IND detonation, up to hundreds of thousands of victims will require rapid medical treatment for blast, flying glass, and radiation injuries. Maximizing the number of lives saved will require an immediate interagency response, and an effective triage strategy that focuses treatment on those who can be saved, and provides palliative care to those who cannot. Currently well-established, executable procedures and protocols for interagency medical response and triage after an IND detonation do not exist. Current capabilities can only handle a few radiation injuries at any one time. Lack of lab capacity exists for biodosimetry and radiobioassay for radionuclides.

Predict Health Effects, Estimate Triage Needs and Locations, and Required Assets

- *Doctrine/Plans.* While modeling capabilities exist with analytical tools to predict health effects, improvements can always be made. Triage concepts of operation exist and are adequate; however they must be conveyed to appropriate participants so all use a common operating scheme. There is a need for:
    - Base triage plan for a nuclear incident including policies for mass triage priority decisions
    - Policy for priorities for accomplishing palliative care
    - Policy for amount, type, and placement of pre-positioned medical treatments
    - Policy for credentialing of medical and support responders
    - Policies for releasing medical countermeasures
    - Predictions regarding transportation requirements
- *Research and Development.* Medical response planning requires an understanding of the type, number, and geographic distribution of potential injuries.
    - Expected injury type (e.g., burn, radiation exposure, and blast effects) and medical countermeasure
    - IND effects on local healthcare infrastructure (evaluation of modern structures for blast, thermal, and prompt (initial) radiation effects and protection)
    - Location of injured and extraction considerations
    - Personnel decontamination issues and methods
    - Psychological effects on, and anticipated response of the public

Establish Triage Sites and Provide Emergency Medical Stabilization

- *Doctrine/Plans.* While many of these capabilities exist piecemeal such as ESF#8 playbook, and doctrine and guidance for specific response components, these are not completely integrated and not evolved for a cross-governmental response. There is a need for:
    - A base triage plan that establishes: priorities for stabilization, survivability and specialized care methodology, palliative care, treat-in-place, transportation, and surge capabilities; recognizing this will be a scarce resources setting (Alternate Standards of Care – Agency for Healthcare Research and Quality (AHRQ), Surge Care - AHRQ "RTR" medical system)
- *Training.* Training does not exist and is required to support decision making in a nuclear detonation as it pertains to triage placement and allocation of scarce resources. There is a need for:
    - Specialized training for recognizing and handling radiation and combined-effects-injured patients, and decision making for mass casualty care

- Exercises for responders

- *Leadership.* The leadership has a strategic understanding of appropriate application of authorities and decisions; however there are gaps in strategic decisions for the medical response system. There is a need for:
  - The appropriate plans and procedures to ensure the declaration of a public health emergency
  - The provision waivers of legal requirements
  - Emergency use authorizations
  - Policy guidance for management of mass casualty and for communications plans

- *Research and Development*. The capability to provide medical prognosis, disposition, medical management requirements, and perform medical stabilization through the development and implementation of executable procedures and protocols for interagency medical response and triage.
  - Expected injury type (e.g., burn, radiation exposure, and blast effects) and medical countermeasure
  - Triage tools to determine potential radiation exposure
  - Improved medical countermeasures for radiation exposure and combined injury
  - IND effects on local healthcare infrastructure (evaluation of modern structures for blast, thermal, and initial radiation effects and protection)
  - CIKR rapid return to service methods
  - Location of injured and extraction considerations
  - Personnel decontamination issues and methods
  - Psychological effects on, and anticipated response of the public

Evaluate Radiation Exposure of Patients

- *Doctrine/Plans.* Dosimetry is necessary to capture the health effects of radiation and to guide decision making for patient management both immediate and long-term. There is no doctrine to support this need. There is a need for a:
  - Strategic plan to implement and activate biodosimetry/bioassay capability to handle surge nationwide and internationally
  - Strategy for biodosimetry/bioassay for predicted exposure population and identify requirements for short- and long-term evaluations
  - Policy for priorities, and resourcing for evaluation and radiation exposure
  - Operational and logistical plan to manage biodosimetry sample handling and reporting

- *Organization.* While a few boutique capabilities exist for small radiological incidents, a more robust system is needed to meet requirements of an IND incident, to include:
    - An organization to accomplish assessment and tracking of patients exposed to radiation, including CDC laboratory response network, DoD, DOE (with the Radiation Emergency Assistance Center/Training Site [REAC/TS]), and international partners
- *Leadership.* Leadership should provide strategic guidance and support for physical dosimetry/biodosimetry and engage a network to provide this capability. There is a need for:
    - Direction on establishing guidelines for establishing laboratory procedures
    - Guidance on organizational leadership for collection and analysis and reporting of samples
- *Regulations/Authorities/Grants/Standards.* Funding and legislative backing would enhance the efforts to create this system. Grants are a vital component of enabling laboratories to afford upkeep and maintenance of certifications and equipment. There is a need for:
    - Funding to support establishment and maintenance of biodosimetry capabilities
    - Agreements on standards for biodosimetry
    - Funding for initial and continued training
- *Research and Development*. Medical evaluation and treatment of radiation exposure is limited. Research on new techniques or improvements in the speed and capacity of current capabilities are important research areas.
    - Expected injury type (e.g., burn, radiation exposure, and blast effects) and medical countermeasure
    - Triage tools to determine potential radiation exposure
    - Improved medical countermeasures for radiation exposure and combined injury

Note: Additional interagency gaps and research needs for this subject area have been identified at the end of this appendix.

Gaps in Capability 5: Provide Casualty and Evacuee Care

The sheer number (potentially millions) of evacuees alone creates a significant capability gap. Additionally, the unique needs of the evacuation population concerning issues such as contamination and psychological trauma require significant response planning and capability development.

Register, Process, and Track Individuals

It is recognized that extensive resources will be required and that some state and local databases and registries may not be compatible with each other or with federal systems. Federal agencies, specifically the CDC and the Agency for Toxic Substances and Disease Registry (ATSDR), will provide assistance in establishing, coordinating, and maintaining this registry. Non-federal tracking systems will require standards so that data can be shared across the many jurisdictions and centers likely to be involved in a nuclear detonation response. In addition, FEMA has the National Emergency Family Registry Locator System (NEFRLS) and offers a mechanism for voluntary registration of displaced people over the Internet or by phone. The system allows displaced persons to register in a national database, family members and friends to search for displaced persons, and facilitate communications between displaced persons and their family and friends. FEMA has also engaged the National Emergency Child Locator Center, managed by the National Center for Missing and Exploited Children, to help federal, state, local and tribal governments and law enforcement agencies to track and locate children aged 21 and younger who have become separated from their parents or guardians.

- *Doctrine/Plans.* While there are isolated pockets of capabilities in these areas, there is no plan or doctrine to support a single electronic registration and tracking system (eRTS). There is a need for an:
    - Interagency concept of operations for implementation and use of patient tracking and registration and specifically eRTS
- *Organization.* There is no comprehensive, coordinated organizational alignment across federal, state, local, tribal, and territorial levels. There is a need for:
    - Interagency partners invested in evacuation and patient care to work with state and local governments and responders who will use this system to coordinate development and integration with private sector tracking system developers
- *Research and Development***.** The capability to identify and track persons for the provision of the necessary medical, basic, environmental, and mental health care. This includes understanding of:
    - Expected casualty quantity and type (e.g., burn, radiation exposure, and blast effects)
    - IND effects on local healthcare infrastructure
    - Psychological effects on, and anticipated response of the public

Provide Medical and Specialized Medical Care (Hospitalization)

Much like Hurricane Katrina, responders will have to operate in an environment where several large hospitals will be totally destroyed while many others will be rendered inoperable and nearly all smaller health care facilities will be shut down or overwhelmed. Many state and local public health and medical assets will be overwhelmed by these conditions, placing an even greater responsibility on federally deployed personnel. While the death toll will be high, there is an opportunity to save tens or hundreds of thousands of injured victims with appropriate mitigation and treatment strategies.

- *Doctrine/Plans.* Public messaging is inadequate. There must be a robust behavioral health system available to activate immediately. There is a need to:
    - Develop all levels of CONOPS for stabilization, triage, transport, evacuation, and definitive medical care that is fully integrated across jurisdiction and models of response (see RTR system)
- *Organization.* The current organization does not support the anticipated magnitude of the requirements. There is a need for:
    - Networks, such as the Radiation Injury Treatment Network (RITN) and the National Disaster Medical System (NDMS), to establish relationships that will define expectations and increase surge capacity, efficiency of response, and patient movement and care in such an incident
    - National networks with specialized capabilities and surge capacity (300K-500K)
    - Laboratory networks with capabilities to support needs for biodosimetry (300K-500K patients)
- *Research and Development*. Pre-event analysis of likely hazard areas will help identify where and when it is safe to deploy local medical care capabilities and how many victims may be expected. There is a need to understand:
    - Expected casualty quantity and type (e.g., burn, radiation exposure, and blast effects)
    - Fallout characteristics; physical properties and radiation levels
    - Fallout pattern analysis
    - IND effects on local healthcare infrastructure
    - Psychological effects on, and anticipated response of the public

Provide Public Health and Behavioral Health Services

During the TOPOFF 4 exercise, it was noted that state and local governments are unfamiliar with federal disaster mental health operations and disaster surge capability. Participants unanimously agreed that an RDD attack would require different approaches than responses to any other type of disaster. Although there are many disaster mental health programs in place, they are underutilized because agencies and governments are unaware of their existence. Representatives from states and agencies also saw public messaging as key to addressing disaster mental health issues. Conveying guidance and information to the public and explaining the government's response to the attacks should reassure citizens that authorities are in control of the situation, reducing the psychological impact.

- *Doctrine/Plans.* There is guidance for handling bodies; however there is no guidance for overall fatality management. There is a need for tiers of providers and surge capabilities for mobilization or surge response for:
    - All hazards and types of behavioral and mental health services required by a diverse population

    - Services required by decedents' families or missing persons

- *Organization.* There is a traditional organization during peacetime, but nothing in place for the scope of an IND incident. Currently, limited capability exists via Disaster Mortuary Operational Response Teams (DMORTS) and DoD assets. There is a need for:
    - Networks to provide the best capability for this requirement
    - Federally-led efforts to establish cohorts of providers and experts to manage the needs of a diverse population
    - Remediation of bodies will require organization between pickup, identification, decontamination, and final disposition
- *Leadership.* Leadership has not broached this issue. There is a huge information sharing gap. There is a need for:
    - Leadership to provide direction and communication to the public and responders on body handling, identification, and the meeting of religious requirements in the context of a nuclear detonation
    - Plans to aid leadership in reducing mental health requirements by providing informative and clear messages to the public
- *Research and Development*. The regional and national psychological impact of nuclear terrorist attack is currently expected to be extensive and severe. Research to better understand and mitigate this impact can have a significant influence on national resilience.
    - Psychological effects on, and anticipated response of the public

Gaps in Capability 6: Stabilize and Control the Impacted Area

Extinguish Fires Initiated by the Blast and in Contaminated Areas Downrange

- *Doctrine/Plans.* Several plans exist, but they are not necessarily linked and demonstrate little to no synergy. Current plans lack operational certitude. There is no definition of roles and responsibilities. There is a need for:
    - Plans integrating and prioritizing federal, state, local, tribal, and territorial resources for fire fighting and decontamination operations and the management of radioactive waste
    - Plans for assessing firestorm potential
    - Regional/state mutual-aid agreements and partnerships (Emergency Management Assistance Compact [EMAC])
- *Leadership.* There are some current plans and directives in place. However, there is a need for:
    - Policy addressing private sector issues related to prioritization decisions

- *Regulations/Authorities/Grants/Standards.* Federal grants do exist, but they are inadequate. There is a legal basis for state and local activities, but it has never been tested or exercised to any great extent. There is no uniformity with data standards. There is a need for:
    - Federal grants to help develop state and local requirements in support of these activities, to include but not limited to concept development, equipment, training, and exercises
    - Data standards for modeling and assessment products
- *Research and Development*. Firestorms caused a significant amount of the damage in Hiroshima and Nagasaki. Although a significant number of fires are expected from a low yield, ground level detonation in a modern urban environment, the speed at which these might coalesce into a mass fire or fire storm is unknown. Different firefighting techniques and planning are required depending on the fire type.
    - Fire initiation and spread
    - IND effects on local healthcare infrastructure (water pressure and distribution systems in particular)

Stabilize Utilities and Structures in the Immediate Blast Area that Impact Initial Evacuation Routes for Initial Response Operations

- *Doctrine/Plans.* Plans to integrate stabilization activities do not exist. There is a need for:
    - Plans to provide guidance on stabilization and demolition
    - Integration of federal, state, local, tribal, and territorial resources
- *Leadership.* There are current plans and directives in place. However, there is a need for:
    - Plans addressing private sector issues related to standards and prioritization decisions
- *Regulations/Authorities/Grants/Standards.* There are no basic universal standards for civil engineering. There is a need for:
    - Formalized and accepted civil engineering standards and prioritization methodology to facilitate stabilization efforts
    - Federal grants to help develop state and local requirements in support of these activities, to include but not limited to concept development, equipment, training, and exercises
    - Authorities to act on priorities if different from standard operations
- *Research and Development*. Effects analysis to support the development of pre-coordinated pre-approved plans and guidance for stabilizing the infrastructure in the immediate impact area and provide a basis to assist in the recovery of basic utilities and services in the impacted area is needed. There is a need for:

- Evaluation of modern structures for blast, thermal, and initial radiation effects and protection
- Ground shock and blast effects on alternative evacuation routes (e.g., subway systems and underground pathways)
- Fire initiation and spread, fire fighting capability
- Effects on current communication capabilities and infrastructure
- Fallout characteristics; physical properties and radiation levels
- Evaluation of modern structures for fallout exposure protection
- Decontamination technologies and methodologies
- CIKR rapid return to service methods
- Technology to rapidly assess damage and hazard zones
- Improve accuracy of models based upon incorporating detailed site information
- Psychological effects on, and anticipated response of the public

Provide Public Safety and Security in Vicinity of the Blast Area as well as in the Overall Federally Declared Disaster Area

- *Doctrine/Plans.* There are current but inadequate plans for site security. There is a need for:
  - Policy on method for ensuring public safety and security
  - Plans for integrating federal, state, local, tribal, and territorial resources
  - Plans for addressing public and private sector issues related to implementation of security measures
- *Regulations/Authorities/Grants/Standards.* Eminent domain is an issue. Some regulations exist but they are not adequate and might have to be revised. There is a need for:
  - Federal grants to develop state and local capabilities in support of public safety and security activities to include, but not limited to concept development, equipment, training, and exercises
- *Research and Development*. Pre-event analysis of potential effects must be performed to determine appropriate security boundaries, and security personnel actions should be developed for a variety of yields and urban conditions. This includes:
  - Fire initiation and spread, fire fighting capability
  - Fallout characteristics; physical properties and radiation levels
  - Fallout pattern analysis

Gaps in Capability 7: Perform Site Recovery and Restore Essential Functions

In order to provide a safe environment for emergency responders and minimize unnecessary radiation doses and risks to life, appropriately targeted decontamination and fallout management procedures and protocols are needed for people, structures and the incident scene. In addition, procedures and systems for tracking and monitoring people's contamination status are needed to target decontamination and to prevent recontamination. These procedures, protocols, technologies and systems would have to be deployed in the hours immediately following the incident; however, they do not currently exist.

Manage Environmental Hazards in Immediate Blast Area and in Contaminated Areas Downwind

- *Doctrine/Plans.* Different environmental mitigation resources exist, but not all are sufficient. There is minimal focus on IND. There is a need for:
    - NRF NRIA to be made consistent with support ESF structure for response
    - Pre-scripted mission assignments for nuclear response assets
    - OSHA Guidelines
    - Harmonized federal requirements for emergency worker safety in a hazardous materials environment
    - Policy for establishing priorities
    - Plans for implementing engineering controls for mitigating hazards
- *Organization.* There is a need for:
    - Integrated organizational structure within the NIMS framework and agreements across federal, state, local, tribal, and territorial governments and the private sector
- *Research and Development*. Pre-event analysis of potential effects must be performed to determine potential hazards responders might face for a variety of yields and urban conditions. This includes not only the nuclear detonation hazards, but also secondary hazards that may be generated by fire or hazardous material releases. There will be a need for predetermined rapid, targeted site decontamination capabilities that will need to be developed based on the following.
    - Blast and thermal effects for generating delayed building collapse, physical hazards for rescuers and evacuees, and hazardous material releases in the urban environment
    - Fire initiation and spread, fire fighting capability, generation of hazardous smoke
    - Fallout characteristics; physical properties and radiation levels
    - Fallout pattern analysis

- Tools for remote detection and analysis of hazards in inaccessible areas

Perform Gross Decontamination of Critical Infrastructure and Key Resources

- *Doctrine/Plans.* There is a need for:
  - NRF NRIA to be made consistent with support ESF structure for response.
  - Pre-scripted mission assignments for nuclear response assets
  - OSHA Guidelines
  - Harmonized federal requirements for emergency worker safety in a hazardous materials environment
  - Plans for decontamination activities
- *Organization.* There is a need for:
  - Critical Infrastructure Annex Private Sector Liaison in the NRF
  - Integrated organizational structure and agreements across federal, state, local, tribal, and territorial governments and the private sector (18 CIKR)
  - Private sector-specific leaders with knowledgeable skills to decontaminate CIKR and assist with on the spot decisions regarding worker health and safety and environmental quality in a post-nuclear environment
- *Research and Development*. The capability to mitigate the spread of radioactive contamination, reduce the risk of imminent hazards and restore essential services provided by critical infrastructure and key resources.
  - Fallout Characteristics; physical properties, dissemination, and radiation levels.
  - Decontamination technologies and methodologies
  - CIKR rapid return to service methods
  - Psychological effects on, and anticipated response of the public

Perform Restoration of Critical Infrastructure and Key Resources

- *Doctrine/Plans.* There is a need for:
  - NRF NRIA to be made consistent with support ESF structure for response
  - Pre-scripted mission assignments for nuclear response assets
  - OSHA Guidelines
  - Harmonized federal requirements for emergency worker safety in a hazardous materials environment
  - Plans for restoring CIKR functions
- *Organization.* There is a need for:

- Integrated organizational structure and agreements across federal, state, local, tribal, and territorial governments and the private sector (18 CIKR)

- *Research and Development*. Determining the most appropriate decontamination process require research in the following areas:
  - Fallout Characteristics; physical properties, dissemination, and radiation levels
  - Decontamination technologies / methodologies

IND Response and Recovery Gaps Identified Outside of the RPT Process

Characterize Fallout Particles and Distribution in the Environment

Capability Gaps identified in the Nuclear Defense R&D Roadmap

In post-detonation, the current capability for ground fallout collection has been tested in the field and is still being improved. The capability for airborne sampling of particulates is scientifically well developed and exercised, but lacks operational resources. The DOE Aerial Measuring System (AMS), EPA's Airborne Spectral Photometric Environmental Collection Technology (ASPECT) aircraft, and the DTRA Multiplatform System (MPS) conduct radiation field mapping for consequence management, search, and sample collection planning. To fully meet the demands of response and recovery key mission objectives, a number of capabilities are needed.

- Scientifically-based protective and response action recommendations
- Guidance and tools to establish capabilities for responder entry, victim extraction, and incident stabilization
- Prompt collections require ground-based monitoring systems to complement existing national technical means
- Rapid characterization of an incident site and contaminated critical infrastructure (e.g., outdoor and indoor environments of critical infrastructure)

The following are gaps in addition to those presented in the RPT CORE document, identified by the Federal Interagency during the development of this strategy document, to be included in order to enhance the life-saving function of this capability:

As recognized by the Senate Committee on Homeland Security and Governmental Affairs and provided by HHS for insertion into this strategy document, there is a clear need for a Radiation Laboratory Network (Rad-LN). A business plan has been developed and refined by a multi-agency working group but has yet to receive funding. The four primary objectives of RAD-LN are:

- National coordination of expertise, triage protocols, field assessment techniques, and laboratory analysis necessary to determine proper victim treatment after a radiological or nuclear event, including coordination and collaboration with international partners

- Coordination of surge hematology capacity with the CDC Laboratory Response Network (CDC-LRN). Develop supplemental resources for states and regions for hematological surge capacity, as required

- Establish a laboratory network to perform the analyses which will coordinate and expand our existing capabilities and establish new capacity, conduct cytogenetic analysis, conduct radio-bioassay analysis, standardize operating procedures and data sharing, optimize the use of Artificial Intelligence and computer technology, utilize a cost effective business model to maintain national capability, and integrate national capability with our international partners

- Integrate innovative and new, high throughput biodosimetry techniques such as allowing collaboration with research and development teams and our academic partners.

Additionally there are seven components essential to RAD-LN:

- Radiobioassay- that will consist of chemical analysis and spectroscopic analysis (in some instances). This might include high throughput health physics labs like NIH

- Cytogenetic biodosimetry- including sample processing and reading

- Hematology- complete blood counts, and lots of them, possibly 100,000 per day

- Optimizing and improving existing techniques- automation of sample processing and image acquisition and analysis, Artificial Intelligence and comparison of extant approaches with new methods

- Surge capacity- for radiobioassay and biodosimetry

- Oversight committee and standardization (ISO standards, CLIA labs, etc), including periodic exercising of the core and satellite labs

- International collaboration- this could provide huge surge capacity and savings

- Research- truly new technology and biodosimetry methodology

- This plan must take into account emerging technology, networking within North America and partnering with other countries, such as the Global Health Security Initiative, WHO, IAEA and others

There are specific issues the finite number of radioanalytical laboratories will face in such an incident, including:

- Struggle to analyze mixed fission products, particularly mid- and longer-lived mixed fission products

- Fission products not listed in routinely used gamma libraries of these laboratories

- Proficiency testing programs discontinued

- Lack of calibration standards

- Training and others

Annex B: Policy Direction and Issues

Policy issues related to the Department's strategy for response to an IND attack exist at two basic levels of analysis. The first is *strategic* level decisions. At the second level are *operational* policies required to facilitate and/or enact the decisions made by elected leaders and decision makers.

The DHS Strategy for Improving the Response and Recovery from an IND Attack defines the direction that DHS and FEMA shall pursue in preparing a federal response to an IND attack on the homeland. It applies existing policies and decisions and provides operational guidance and direction to DHS components charged with implementing the overall strategy. It acknowledges the vulnerabilities and gaps identified in existing plans and documents, as well as those offered in Annex A, and offers a DHS-led course of action to address them.

There are unfolding opportunities that will enable the Department to address anticipated incident-driven conditions and influence decisions that will improve the government's ability to rapidly respond to and recover from an IND attack. In the near future, these opportunities include:

- Homeland Security Presidential Directive-8 (HSPD-8) revision. Of particular policy relevance to this Strategy, HSPD-8 established a capabilities-based approach to preparedness for all homeland security mission areas (prevention, protection, response, and recovery), and presented as one of the national priorities the strengthening of CBRNE detection, response, and decontamination capabilities. The HSPD-8 revision process will present unique and timely opportunities to address a number of policy issues derived from the CORE document, this Strategy document, as well as from NLE 2010 after-action reports and associated lessons learned.
- Nuclear/Radiological Incident Annex (NRIA) to the National Response Framework (NRF) revision. This annex primarily focuses on describing the policies and associated responsibilities of federal departments and agencies governing the immediate response and short-term recovery activities for incidents that may occur on government-owned or licensed facilities and private property associated with nuclear utilities, or other licensed and prescribed facilities and sites.
- In support of NLE 2010, the Domestic Readiness Group has recently granted interim approval to draft version 10 of the *Federal Interagency Improvised Nuclear Device Concept Plan* (IND CONPLAN). While this CONPLAN is consistent with established policies and does not create additional policy requirements, the development process has brought up capability gaps and policy issues and that will support the maturation of this Strategy during the FY 2010 "strategy update". NLE 2010 after-action reports and associated lessons learned will also contribute to the strategy update.

In addition, a number of IND response and recovery policy questions were initially raised during the development of the CORE document by the DHS Requirements Planning team (RPT) and expanded upon during the development of this strategy. These issues offer DHS and FEMA the opportunity to formulate assumptions and decisions that will facilitate the development of plans, the allocation of resources, and the undertaking of training exercises to mitigate the impacts of an attack and augment recovery operations. In no particular order, the following topics have evoked discussions and calls

for policy decisions in the past. By focusing our efforts on establishing a pre-determined baseline from which all departments and agencies could work from, we would enhance a future coordinated interagency effort to plan for this contingency.

An overarching *Emergency Communications Plan* can clarify the messaging for both the public and local authorities regarding how to prepare for an event on the scale of an IND. This plan should cover the roles and missions of federal, state, local, tribal, and territorial entities who would be involved in IND response and recovery, guidelines for identifying sheltering options in an urban area, guidelines for when sheltering in place is appropriate and when an individual should evacuate to a safer location, and most importantly, how a region may establish and maintain effective emergency communications during an IND incident. What information can (and should) be shared with local officials, and conversely, what information can (and should) be shared with international partners and allies? Such a plan should guard against the release of spurious information, while emphasizing the need for the release of timely, accurate information that might save countless lives.

The Communications Plan presupposes the existence of a set of criteria that enables appropriate shelter vs. evacuation decisions in a rapidly changing environment along with priorities for evaluating radiation exposure guidelines.

There is a need for clear and effective *standards* for a variety of important areas, including decontamination of people, equipment, and critical infrastructure facilities. As described in this Strategy, there is a need to re-establish key support functions as soon as possible following an IND incident. That will require selective decontamination measures, but a policy determination is required regarding the degree of decontamination that is acceptable to allow these functions to be re-established. Some guidance for CIKR decontamination levels during the Intermediate Phase of a radiological response has been developed in the Operational Guidelines, although they were developed specifically for RDD response. Similarly, as the many anticipated victims are extracted, treated, and evacuated for more extensive medical care, how much decontamination is enough? Another area involving standards is the question of dose rates for responders, medical personnel, support personnel, and others who are necessary for effective response and recovery, but who might not now be covered under existing Protective Action Guidance.

The *private sector* will play an invaluable role in effective IND response and recovery. However, agreements need to be established ahead of time, and exercised often, if there is to be a seamless integration of government and private sector resources. Mutual Aid Agreements, MOUs, MOAs, and other such pre-negotiated agreements can substantially improve the ability of a jurisdiction to recover from an IND incident, while not relying on technology development or extensive hardware investments.

Much of the impact of a nuclear device involves blast (structural) damage coupled with radioactive contamination. Resources to clear and manage large amounts of radioactively contaminated debris will be limited, and impacted jurisdictions will need a location where such contaminated materials can be safety transported and stored. In the aftermath of the attacks of 9/11, a huge effort was required to recover personal effects and traces of victims from the mountains of material removed from the site of the World Trade Center. The aftermath of an IND would dwarf that effort, and must be planned carefully in advance. In addition, decision makers will need assistance in weighing the

emotional need to recover personal effects and victims' remains against the potential risk to responders from radiation exposure during the recovery effort.

The massive medical response that will be required for responding to and recovering from an IND incident will call for large amounts of medical supplies and resources. *Prepositioning* of supplies, identification of available medical facilities, and even identification of facilities that could be converted to medical treatment centers all call for policy decisions, not technology development.

Medical treatment will involve both trauma patients and victims of radiation exposure. The latter will require massive efforts at personal dosimetry and biodosimetry measures to guide the medical treatment. Assessing longer-term health issues across populations within both the prompt and plume affected areas will also be required. Establishment of an individual radiation dose tracking program over time may require national-level policy discussions.

In addition, we will need a plan that establishes priorities for stabilization, survivability and specialized care methodology, palliative care, treat-in-place; transportation, surge capabilities and fatalities management. Although the federal government possesses some operational capabilities to support mission areas such as medical care, monitoring, and decontamination, these capabilities do not exist on the scale required to effectively respond to an event of this magnitude.

Furthermore, in an event of this magnitude, multiple mission areas are likely to simultaneously require access to common assets, thereby exacerbating already conflicting demands on scarce resources over the spectrum of response priorities. Because of the coordination, logistics, and transportation requirements to deploy these federal assets during the critical first hours to days, it is unlikely that substantial federal assets could be in place on the ground in less than 48 to 72 hours, which is a critical period for saving lives. It is recognized that in such an event, state and local authorities will have primary responsibility for response and their capacity to effectively respond is likely to be quickly overwhelmed.

Annex C: Research and Development

Addressing the Need

Effective response to and recovery from an IND incident requires scientifically informed planning at all levels of government and tools to rapidly and effectively communicate guidance to the public, perform victim care, and mitigate consequences. In an IND incident, the ability to make good decisions quickly and to act decisively and appropriately in the first minutes and hours after an attack will make an enormous difference in saving lives and mitigating the overall impact of the event. Although a large number of casualties will be unavoidable, tens of thousands of lives might be saved through properly implemented emergency and medical response actions and which will more quickly place us on the path to recovery. The timeframe for effective response-related action is extremely short. Thus developing plans, preparing, training, and exercising the responders and decision makers are crucial to the national well being in the event of an IND attack.

Previous OMB budget priorities[5,6] placed an emphasis on R&D to better "understand and mitigate the social and economic effects of a domestic nuclear explosion, including better tools to treat the injured and means for rapidly assessing damage." The current OMB/OSTP budget priorities[7], *Science and Technology Priorities for the FY 2011 Budget*, continues to value "technologies needed to protect our troops, citizens, and national interests" which FEMA, on behalf of DHS, will accomplish by improving public and first responders awareness on IND response issues through applied research and studies at universities, national laboratories, and research centers using an open innovation model of collaboration.

Addressing the Shortfall

Previous nuclear weapon tests and research focused on strategic thermonuclear war scenarios with high yield weapons detonated at optimal heights to maximize prompt effects. The development of sound response guidance requires a deeper understanding of the effects of a ground level, low yield nuclear detonation in a modern US city. Supporting scientific analysis is needed to determine fallout characteristics, such as physical properties and radiation levels, which are needed to evaluate public shelter and evacuation strategies, population decontamination requirements, and response actions. There is insufficient information on the magnitude and interaction of the electromagnetic pulse with modern electronics which are vital for public and responder communication. Fire initiation and spread along with blast effects on modern buildings are also areas of significant speculation.

Studies and response guidance on the appropriate actions to take after a nuclear detonation offer conflicting advice. For example, the recommendations of the Department of Homeland Security's *Ready.gov*, which are consistent with the recommendations of the National Academy of Sciences

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[5] OMB/OSTP, FY 2008 Administration Research and Development Budget Priorities, June 2006.

[6] OMB/OSTP, FY 2009 Administration Research and Development Budget Priorities, August 2007.

[7] OMB/OSTP, Science and Technology Priorities for the FY 2011 Budget, August 2009.

and the interagency planning guidance[8] [9], were recently criticized by the Federation of American Scientists[10] because of conflicting recommendations with a RAND study[11] [12].

The R&D Path Forward

In order to achieve broad interagency R&D collaboration FEMA has taken on the co-chairmanship of the Response and Recovery Working Group (RRWG) of the Nuclear Defense Research and Development (NDRD) Subcommittee, a group chartered by the National Science and Technology Council (NSTC) and its Committee on Homeland and National Security. This subcommittee reviews research activities across the federal government and produces the *Roadmap for Nuclear Defense Research and Development.* In 2008, this *Roadmap* identified national R&D priorities and guidelines for departments and agencies to develop comprehensive and mutually supportive research programs that were closely linked to operational requirements. It included suggested actions and completion dates.

Also in 2008, the DHS Office of Policy Requirements Planning Team (RPT) generated the Nuclear Response and Short-Term Recovery Capability, Objective, Resources, and Evaluative Measures (CORE) document with support from the Federal Interagency. This CORE document identified desired capabilities and associated priorities to effectively and efficiently respond to a nuclear incident. The RPT's CORE document provided the basis for the DHS Integrated Planning Guidance (IPG) for FY2011-15 and this strategy, and provided additional inputs to consider for potential R&D requirements.

FEMA's IND Response and Recovery Program is currently working to address these identified high priority research and technology needs for capability development through collaboration with interagency and DHS Research, Development, Test, and Evaluation (RDT&E) partners such as the Domestic Nuclear Detection Office, the Science and Technology Directorate (S&T), and the Office of Health Affairs. As such, the path forward depicts the capability enhancements derived from the DHS CORE and the *Roadmap* documents which produced ten priority enhancements where R&D support is needed. FEMA re-examined them and consolidated recurring themes and requirements into a list of six overarching requirement areas for R&D with proposed research methods and focus areas in order to address the most pressing R&D needs as rapidly as possible.

Priority capability enhancements require supporting research and development:

Annex A listed key gaps and analysis that would need to be addressed in order to develop the required capabilities. Specific Research and Development recommendations were provided in that section, which helped generate the following list of research and development focus areas.

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[8] National Academy of Sciences, 2005, Nuclear Attack, factsheet created for News and Terrorism: Communicating in a Crisis.

[9] Homeland Security Council Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats, *Planning Guidance for Response to a Nuclear Detonation*. Office of Science and Technology Policy, Executive Office of the President (www.ostp.gov), January 16, 2009.

[10] Federation of American Scientist, 2006, Analysis of Ready.gov. Available online: http://www.fas.org/reallyready/analysis.html.

[11] Davis, L., LaTourrette, T., Mosher, D.E., Dais, L.M., & Howell, D.R., 2003, Individual Preparedness and Response to Chemical, Radiological, Nuclear, and Biological Terrorist Attacks [Electronic version]. Arlington, Virginia: RAND Corporation.

[12] Orient, J., May 2005, Unready.gov. Civil Defense Perspectives, 21(4). Retrieved June 23, 2006, from http://www.oism.org/cdp/may2005.html.

The following paragraphs summarize the overarching research requirement areas derived from the RPT CORE documents[13], the Nuclear Defense R&D Roadmap[14], and other analysis.

Consolidated Supporting Research Requirements List

1. **Prompt Effects Research Areas**
    a. Evaluation of modern structures for blast, thermal, and prompt (initial) radiation effects and protection
    b. Ground shock and blast effects on CIKR, including hospitals, alternative evacuation routes (e.g., subway systems and underground pathways), water systems for fire fighting, and communication capabilities.
    c. Fire initiation and spread, fire fighting capability
2. **Electromagnetic Pulse (EMP) Research Areas**
    d. Effects on current communication capabilities and infrastructure
    e. Technology development for IND effect resilience (both blast and EMP)
3. **Fallout Research Areas**
    a. Fallout characteristics; physical properties and radiation levels
    b. Fallout pattern analysis
    c. Evaluation of modern structures for fallout exposure protection
4. **Situational Assessment Research Areas**
    a. Technology to rapidly assess damage and hazard zones
    b. Improve accuracy of models based upon incorporating detailed site information
5. **Research on Medical Response and Evacuee Care**
    a. Expected injury type (e.g., burn, radiation exposure, and blast effects) and medical countermeasure
    b. Location of injured and extraction considerations
    c. Triage tools to determine potential radiation exposure
    d. Personnel decontamination issues and methods
    e. Psychological effects on, and anticipated response of the public
6. **Recovery and Restoration Research Areas**
    a. Decontamination technologies and methodologies
    b. CIKR rapid return to service methods

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[13] Department of Homeland Security Integrated Planning Guidance for FY11-15.

[14] Office of Science and Technology Policy, 2008, Nuclear Defense Research and Development Roadmap Fiscal Years 2010-2014; available at http://www.ostp.gov.

Proposed Research Methods and Focus Areas

1. **Prompt Effect Research Areas** were important to all seven critical capability areas: manage the response, characterize the incident, mass evacuation and/or in-place protection, medical triage, provide casualty and evacuee care, stabilize and control impacted area, and perform site recovery and restore essential functions.

   a) Evaluate modern structures for blast, thermal, and prompt (initial) radiation effects and protection.

      - Perform a detailed analysis on how a ground-level, low-yield detonation interacts with the modern urban environment to mitigate or enhance blast, thermal, or prompt radiation effects. This includes urban canyon effects on blast wave propagation and thermal and radiation streaming.
      - Estimate the impacts of a nuclear detonation in a modern urban environment including the generation of physical hazards for rescuers and the public, hazardous material releases in the urban environment, and impacts on human health.
      - Perform an analysis on impacts from a variety of yields and urban environment types to enable the development of universal guidelines.
      - Determine how modern structures respond to nuclear blast and thermal effects. Determine the IND impact changes from city-to-city variation (e.g. Los Angeles vs. Houston vs. New York City)

   b) Determine impacts on CIKR, including access routes and evacuation corridors (to include alternative evacuation routes – e.g. subway), blast effects on shelters, public health infrastructure, water; power, and communication and the impact characteristics of urban environments have on planning and decision making.

   c) Evaluate fire initiation and spread to determine if fires generated from the detonation might coalesce into a mass fire or fire storm, as these events have significantly different requirements for mitigation. Another important element is the understanding of how the detonation will affect fire fighting capabilities such as water supply and movement of response capability.

2. **Electromagnetic Pulse (EMP) Research Areas** were important to three of the critical capability areas: manage the response, characterize the incident, and mass evacuation and/or in-place protection.

   a) Examine the effects on current communication capabilities and infrastructure

      - Determine Electromagnetic Pulse (EMP) impacts on first-responder communication equipment.
      - Determine Electromagnetic Pulse (EMP) impacts on the emergency broadcast system and the ability to communicate to the public in the affected areas.

   b) Develop technology for IND effect resilience (both blast and EMP).

3. **Fallout Research Areas** were important to all seven critical capability areas: manage the response, characterize the incident, mass evacuation and/or in-place protection, medical triage, provide casualty and evacuee care, stabilize and control impacted area, and perform site recovery and restore essential functions.

   a) Examine fallout characteristics, physical properties and radiation levels.

      - Assess ground level, low yield, urban environment changes on fireball behavior, rise times and heights, and fallout cloud appearance and movement.
      - Characterize urban nuclear explosion fallout (fallout mass, particle information and size distribution, and radionuclide information).

   b) Analyze fallout pattern to identify principle potential patterns (including direction, length, and shape) to inform response planning.

   c) Evaluate modern structures for fallout exposure protection.

      - Evaluate efficacy of urban sheltering and evacuation decision-making parameters, to include the following: shielding factors associated with urban shelter structures, safety of shelter options, optimizing sheltering versus evacuation or deferred evacuation, and characterizing population sustainment issues in shelters.

4. **Situational Assessment Research Areas** were important to four critical capability areas: manage the response; characterize the incident; mass evacuation and/or in-place protection; and stabilize and control impacted area.

   a) Develop technology to rapidly assess damage and hazard zones

      - In order to mount an effective response, leaders need to be able to quickly assess the situation. Tools need to be developed to rapidly acquire data for damage assessment (e.g. damage to buildings, impact to communication systems, and impact to transportation and evacuation routes) and radiological conditions. The ultimate objective is to have real-time data collection, analysis and availability of data to response leaders.
      - Develop communication networks for transferring and sharing large data file information between local responders, deployed field teams and national response centers. Rapidly deployable field communications equipment has bandwidth restrictions that can impact emergency response data sharing, especially in a post-detonation environment when communications are already stressed. Reliable modes of communications need to be developed and distributed.
      - Develop technologies to rapidly characterize an incident site and contaminated critical infrastructure/key resources (CIKR) to support emergency field operations, and function and operation of CIKR.
      - Develop local and national capability to rapidly assess consequences to public safety and the environment. Most radiation detection equipment currently in use is based upon routine radiation measurement needs for industry-related radiation safety. Scientific effort is needed to evaluate the applicability and most efficient use of this type of radiation

detection equipment for IND response needs. Scientific effort is also needed to evaluate and develop new technologies for radiation detection and measurement during an IND response.

b) Improve accuracy of models based upon incorporating detailed site information

- Develop higher fidelity models of various standard building classes to assess the protection factors afforded against radioactive fallout. Improve the ability to model rubbeling and other blast damage effects in an urban environment with specific urban area geographies. Incorporate more realistic population demographics and time evolution of population densities.

5. **Research on Medical Response and Evacuee Care** were vital to three critical capability areas: mass evacuation and/or in-place protection, medical triage, and provide casualty and evacuee care:

a) Estimate expected injury types and medical countermeasure.

- A key medical planning element is an estimate of the total number and type of injuries that may be encountered. This will need to be developed for a variety of yields and urban types to bound the potential range of effects and requires modeling that includes calculating the effects to people inside various structures.

b) Locate injured and consider extractions.

- Planning deployment of rescue and triage resources requires estimates of where viable victims can be found and extraction considerations

c) Develop or acquire triage tools to determine potential radiation exposure.

- Develop and improve the capability for triage of very large numbers of casualties, allocation of prompt therapeutics (e.g., severe physical injuries and radiation exposure), accurate field biodosimetry, and mass casualty care and management. The current capability can only handle a few radiation injuries at any one time.
- Develop and make available improved therapeutics and diagnostics for radiation injury, including combined injuries. Develop and test a capability for triaging and sorting large numbers of casualties, allocating prompt therapeutics (e.g., for severe physical injuries and radiation exposure), getting accurate field biodosimetry, and caring for and managing mass casualties.

d) Address personnel decontamination issues and methods.

- Technologies for definitive dose assessment are labor intensive and have low throughput. Population monitoring techniques and rapid bioassay and biodosimetric capability for accurate dose assessment for large numbers of people are needed to replace reliance on prodromal symptomology or lengthy dose reconstruction.
- Develop long-term medical care and management capabilities, including population monitoring. Given the huge number of individuals an IND will affect, the ability to provide long-term care will be essential in saving lives and maintaining public health. Long-term care will require population monitoring (for decades) of those exposed to

radiation for potential latent diseases and psychological issues. They will also need shorter-term care for burns and injuries. Research is needed to characterize the expected health impacts on a post-IND population. Long-term patient care and monitoring strategies must also be developed.

e) Address the psychological effects on, and anticipated response of the public.

- Develop an empirically-based risk communication program for key decision makers. Countering detrimental social behavioral responses and assuring that the message transmitted by government officials is received and understood will require social research and testing of message content, delivery, comprehension, and appropriate response.
- Develop tools for assessment of social and psychological needs. There are no nationwide mechanisms in place for the immediate assessment of social and psychological harms and needs following a nuclear event. Data are likely to be anecdotal, collected by emergency workers whose focus and duties are other than the collection of such data, and gleaned from the media. A systematic method for assessing mental, behavioral, and physical health needs of impacted communities would enhance federal, state, tribal, and local planning and response activities. It would enable realignments of service provision as real-time data about needs emerge. It also would provide a rigorous platform for studying disaster- and terror-exposed populations that could be used to enhance preparedness and mitigation activities.

6. **Recovery and Restoration Research Areas** are required to support three critical capability areas: provide casualty and evacuee care, stabilize and control impacted area, and perform site recovery and restore essential functions.

a) Develop decontamination technologies and methodologies.

- Develop tools and technologies to rapidly restore critical infrastructure, along with a focus on efficient and effective long-term remediation and recovery.
- Develop capability to decontaminate critical infrastructure (e.g., transportation, power, water, sanitation, communications, public health, and essential government services).
    - Perform wide-area urban decontamination for permanent recovery and normal land use (e.g., high-value structures, businesses, residences, parks, and waterways). A critical early need after an IND incident is to restore infrastructure elements that support response activities along with public services. Gross decontamination and waste management techniques will aid rapid infrastructure recovery. Full recovery requires the meticulous decontamination of buildings and urban areas so they can be reoccupied. Technologies and guidance are needed to remove radioactive materials from urban infrastructure, businesses, and residences. Soils and surface water systems must be remediated. High-throughput laboratory analytical processes are required. Failure to effectively decontaminate and recover contaminated buildings and lands will result in razing or abandonment of the affected area. This priority should include research into

resilient building construction technology and pretreatments for high-value structures to aid decontamination efforts.

- Develop processes, guidelines, procedures, and tools for decontamination and cleanup (e.g., urban areas, businesses, residences (outdoor/indoor), rural assets) for long-term recovery of normal function.
- Develop processes, procedures, and tools to accomplish effective and efficient contaminated debris removal, management and disposal.

b) CIKR rapid return to service methods

- Develop processes, procedures, and tools to contain contaminants and control contaminant migration (including all migration vectors for contaminants such as water, re-suspension, people, and vehicles) in the immediate aftermath of an incident.

Research and Development

Currently research and development efforts related to a nuclear detonation focus on detonation prevention or forensics (Department of Homeland Security), medical countermeasures (Health and Human Services), Nuclear Incident Response Team improvements (Department of Energy), or long-term environmental decontamination (Environmental Protection Agency). The FY 2011 President's Budget added response and recovery as a priority funding area within DHS.

The fiscal year 2011 budget request proposes moving the Transformational & Applied Research Directorate from DNDO to S&T, effectively reconsolidating the research and development portfolio. Additionally, the FY 2011 budget requests $10 million for radiological and nuclear response and recovery research and development. FEMA and S&T are in the process of determining the highest priority response and recovery capability needs and developing the research programs to deliver those capabilities within available funds.