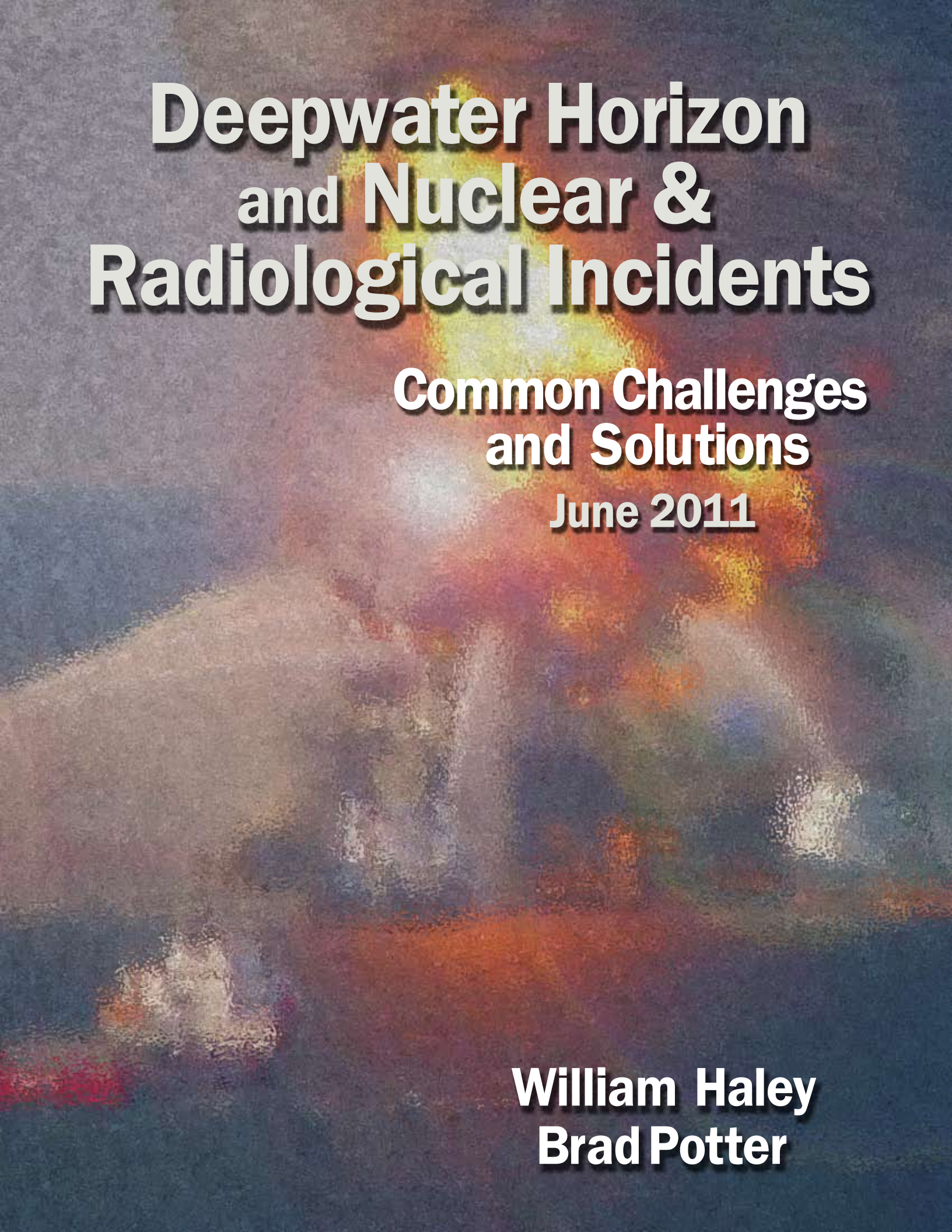
Deepwater Horizon
and Nuclear &
Radiological Incidents
Common Challenges
and Solutions
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Executive Summary

The 2010 Deepwater Horizon oil spill shares many of the same challenges associated with a radiological incident like the one considered in the Empire 09[1] exercise or even a much larger nuclear incident. By analyzing experiences during Deepwater Horizon, these challenges can be identified by the interagency in advance of a radiological or nuclear emergency and solutions made available.

Establishing and Staffing a Unified Command Structure

The demands of Deepwater Horizon challenged the traditional response construct envisioned by national planning systems. The only way to overcome the immense organizational and management challenges during the spill was for the government and industry organizations involved to implement an incident management effort grounded in the National Incident Management System (NIMS) and Incident Command System (ICS). An Empire 09 radiological dispersal device (RDD) scenario would necessitate a similar structure, as would a response to an Improvised Nuclear Device (IND).

To address these challenges, the interagency should consider training and equipping additional personnel from various departments and agencies to fill specialized incident management roles during a large-scale nuclear or radiological incident. Additionally, guidance should be developed on how to flex and expand NIMS without compromising the intent of the system.

External Influences and Politics on Incident Management

The Deepwater Horizon incident was unprecedented in terms of political interest and external influences. Political involvement in resource allocation, operations, and decision-making, coupled with a lack of trained and qualified personnel to control messaging, created new incident management challenges, including deviations from traditional decision-making processes and structures. All of this stemmed from poor public access to information about the spill, which created new political issues. The same would be true during a response to a large scale radiological or nuclear incident.

A robust public and governmental affairs capability is required to address these issues. The interagency should consider holding a coordination conference and a series of working group meetings to ensure the myriad efforts addressing public affairs are clearly communicated and support one another.

Challenges Associated with Scientific and Technical Aspects of the Response

There was an unprecedented demand for scientific and technical expertise, data, and information during Deepwater Horizon. For example, there was great interest in the flow rate of oil from the wellhead, which required interpretation. Similar demands for technical data will be present during a large scale radiological incident.

During future training and exercises, the technical and scientific communities must constantly be reminded of the real pressure they will face during an actual incident. A plan for integrating additional scientific resources across the interagency should be developed. Finally, the scientific community supporting a radiological incident response should work with interagency public affairs specialists to pre-craft portions of the appropriate messages following a radiological incident.

[1] See the "Empire 09 Backgrounder" at the end of this document for additional information on this exercise.

Introduction

The Deepwater Horizon oil spill released approximately 4.9 million barrels of oil into the Gulf of Mexico over a three month period beginning in April 2010[i]. Although the National Incident Management System's Incident Command System was utilized during the response, there were immense command and coordination challenges for the unified management team never before experienced or anticipated. These challenges were compounded by unprecedented and constant demand for incident information by government executives and external entities (including the media) and the extraordinary scientific and technical challenges. Nuclear and radiological emergencies, including terrorist acts, will present similar challenges for those managing the response to the incident.

This paper outlines three challenges the unified management team of the Deepwater Horizon faced with relevance to radiological or nuclear incident response. Parallels are drawn between Deepwater Horizon and a radiological incident, specifically the Empire 09 exercise scenario, to highlight the incident management complexities and some of the lessons learned applicable to the interagency.[2] The three primary challenge areas include:

1) Establishing and staffing a unified command and coordination structure to manage the entire incident
2) The role of external influences and politics on incident management
3) The challenges associated with scientific and technical aspects of the response

[2] The Empire 09 exercise, conducted in June, 2009, tested the Federal, state, and local response to a terrorist detonation of two radiological dispersal devices (RDDs) in an urban environment.

Command & Coordination Challenges

The demands of the Deepwater Horizon incident challenged the traditional response construct envisioned in the National Contingency Plan (NCP), the National Incident Management System (NIMS), and the National Response Framework (NRF). At the peak of the response, an enormous command and coordination structure was established to manage the incident. The only way to overcome the immense organization and management challenges was for government agencies and industry organizations involved to implement a unified, coordinated, flexible, and adaptable incident management effort grounded in the NIMS and Incident Command System (ICS). The magnitude of the Deepwater Horizon incident necessitated establishing a multi-layered organizational structure with commensurate delegation of responsibilities. A real world Empire 09 RDD scenario would necessitate the same structure.

Unified Incident Command

At the height of the Deepwater Horizon response, more than 48,000 responders, 8,000 vessels, and 120 aircraft were deployed to the incident.[ii] The magnitude of the response and the geographic area affected required establishing six Incident Command Posts (ICP), which each reported to the Unified Area Command. Four of the ICPs had geographic Areas of Responsibility (AOR) and the other two were functional.[iii] The ICP in Houma, Louisiana was alone staffed with 1,700 people to manage and provide support for approximately 25,000 responders operating in Louisiana.[iv] To ensure effective span-of-control, responders employed creative organizational concepts to manage operations. These included establishing operational Branches, which normally would be smaller organizations, but in this case sometimes resembled traditional ICPs with up to 3,000 responders working in specific geographic area.[v] This delegation of authority to the Branches was unprecedented in a large, national response. The successful implementation of this Branch Planning required each Branch to possess the necessary incident management, response, and technical expertise typically resident within the ICP.

A similar, though less complex, Incident Command Post network was established during the Empire 2009 exercise. A few hours after the exercise RDD detonations, New York established an ICP in Albany to manage the incident.[vi] The area of responsibility for this ICP was intended to be all of the affected areas within New York. A separate ICP was established in Vermont to address the affected areas in that state. The idea that one ICP could adequately manage all of the incident effects in New York was an exercise artificiality. Based on how New York officials stated they would organize and manage the incident outside of exercise constraints, and based on observations from the Deepwater Horizon incident, the command and coordination structure would likely have included multiple ICPs established in New York all reporting to one Area Command (See Figure 1.1). Even though only two New York counties participated in the exercise, in reality, more than two counties would have been involved in the incident, even if they were only indirectly or only presumably affected. Moreover, recognizing decision-making for response operations in each of the jurisdictions would need to be delegated to the lowest possible level, it is unrealistic emergency decision-makers would leave their jurisdictions to

participate in a remote Unified Command. Instead, they would develop county-specific action plans through one of the ICPs, a process which would require Federal assets to provide technical and scientific input at the local level.

Complicating incident response to these types of large scale incidents, local authorities expect a single Federal government authority in their community to have the ability to respond to immediate operational needs as well as the needs of the local authorities.[vii] Federal interaction with only the state is not acceptable. In order to accommodate timely response to local needs during the Deepwater Horizon response, decision-making authority was delegated to the lowest level practical, the geographic Incident Commands. It was further delegated to field elements (the Branches) to permit timely response to oil affecting remote, sensitive, high priority, and difficult to reach areas. A similar delegation of decision-making authority would occur during an RDD incident, with a requirement for Federal decision-makers to be integrated at all levels of the response.

Unlike an oil spill, more than the shoreline would be directly affected by the technical hazard in a radiological incident; a large geographic area could be contaminated by a hazard not as easily detected as oil and presenting potentially significant health hazards. During the Deepwater response, some Louisiana parishes with directly contaminated shorelines had 3,000 responders.[viii] This suggests the Empire 2009 scenario would require a significantly greater number of responders operating in the counties most susceptible to the radiation hazard. An effective way to organize would be to establish county Incident Command Posts or regional Incident Command Posts with county specific operational Branches, similar to the geographic command posts used during Deepwater Horizon. Such an arrangement could prevent the swelling of responders at only a single ICP, which would far outstretch span-of-control appropriate for planning and logistics. Moreover, it would help ensure these resources were staffing a network of ICPs and Branches in areas most needing them.

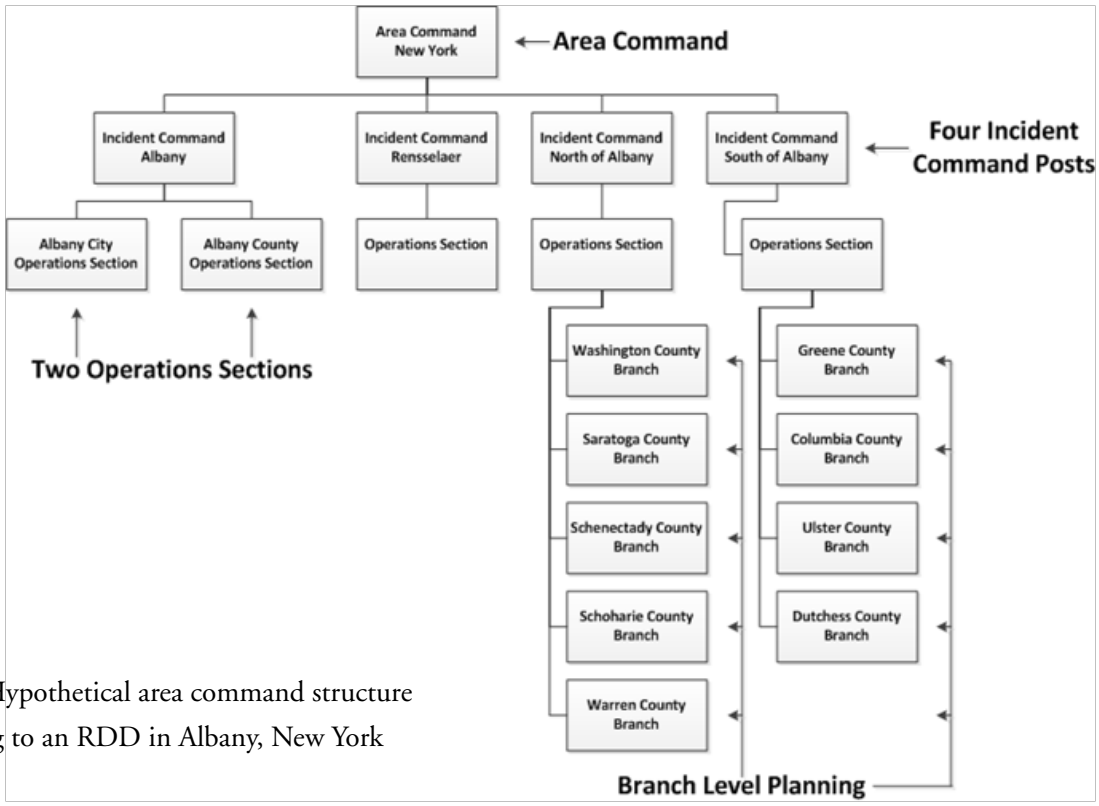

Figure 1.1 – Hypothetical area command structure for responding to an RDD in Albany, New York

Unified Area Command

A Unified Area Command was established in Louisiana for the entire Deepwater Horizon incident. Area Command is a component of ICS intended for managing large, complex incidents requiring multiple Incident Command Posts.[ix] The Area Command organization itself is typically small, but the Unified Area Command for Deepwater Horizon swelled to over 600 people.[x] The Unified Area Command had strategic management responsibility. It set overall response priorities, objectives, and strategies consistent with direction from the National Incident Commander; allocated resources according to priorities; and ensured the incident was properly managed so objectives were met and strategies were followed. During an incident like Empire 09, a Unified Area Command with adequate representation and staffing would be a necessity.

National Incident Command

In the second week of the Deepwater Horizon response, a National Incident Commander[3](NIC), Admiral Thad Allen, was named and a robust support team was established at USCG Headquarters in Washington, DC. The NIC organization included an Interagency Solutions Group, which collaborated between government agencies to develop strategies to support the response and to deconflict competing organizational goals, directives, and policies. The National Incident Commander and NIC support team primarily functioned as a national coordination and communications center to deal with national-level political and media inquiries. In place of a National Incident Commander, consistent with current doctrine, a Joint Field Office (JFO) would be established in each affected state during a major nuclear or radiological incident.[4] The JFO has similar coordination responsibilities as the NIC with extra emphasis on coordinating Federal assistance to State governments.

Staffing

The demand for qualified individuals to fill incident management roles in both the Area and Incident Commands over the long-duration of the Deepwater Horizon incident placed an incredible burden on the departments, agencies, and private sector companies involved. The Coast Guard did not have the depth of qualified individuals needed to effectively staff an incident management organization of the magnitude required.[xi] Moreover, not enough planning was conducted during the response to ensure personnel were replaced as needed or new, qualified personnel were ordered.[xii] In July, before the well was capped, the NIC organization approached other Federal agencies to determine if they could send additional incident management personnel to the incident. Many agencies were already assigning personnel and other agencies, which had not been previously involved, were developing plans to mobilize personnel.[xiii] When the well was capped, the need for personnel diminished; however, the dire demand demonstrated a burden certain to exist during a radiological incident.

The Coast Guard, which uses ICS in their day to day operations, noted their incident management capabilities are configured for "normal" incidents and Deepwater Horizon exceeded their preparation.[xiv] For large emergencies, the

[3] The role National Incident Commander (NIC) is defined in the National Contingency Plan and is used exclusively in a "Spill of National Significance" in a coastal zone. There is no defined NIC authority in the National Incident Management System or the National Response Framework for any other incident, including a radiological incident.

[4] This is consistent with guidelines set forth in the National Response Framework.

incident management staffs need to be the best, most qualified personnel in an agency. During Deepwater Horizon, positions were too often filled with under-trained, under-qualified individuals. The size of a radiological incident like Empire 2009 would create immense staffing challenges. As experienced during Deepwater Horizon, the demand for qualified individuals to fill incident management roles over a long period of time would place a burden on the organizations involved. Filling key incident management positions with untrained and unqualified individuals would have negative externalities on the overall response.

There was also high demand, and subsequent shortage, of scientific and technical personnel, who were invaluable in the Command Posts at all levels of the response during Deepwater Horizon.[xv] The demand for scientific and technical personnel during a radiological incident may completely drain an already limited resource base. Even though exercises like Empire 09 do not replicate the true scope and related staffing demands of the scenario being exercised, in recent years, many Federal organizations experienced notable staffing shortages operating in national-level exercises replicating a large-scale response; these would only be magnified during a real world incident.

External Influences & Resulting Challenges

The Deepwater Horizon incident was unprecedented in terms of political interest and external influences. The complexities added by politics and external influences were quite often more challenging than the operational issues faced by responders. In particular, political involvement in resource allocation, operations, and decision-making, coupled with a lack of trained and qualified personnel to control messaging, created new incident management challenges, including deviations from traditional incident management decision-making processes and structures. The same would be true during a response to a large scale radiological incident.

Political Involvement in Resource Allocation and Operations

By the end of May 2010, polls showed 60% of adults thought the government was doing a poor job of responding to the Deepwater Horizon oil spill.[xvi] Much of the public opinion was shaped by comments in the media from individuals not officially associated with the response and politicians with different priorities than those of the incident commanders. These opinions placed new pressures on incident managers. The management of a radiological incident like the Empire 09 scenario would be subject to similar political and external influences. Limited understanding of a radiological hazard could quickly fuel public fear and lead to a poor public perception of response efforts. If the government as a whole cannot provide timely, accurate, and clear messaging, those seeking information will get it from other, potentially less reliable, sources.

In Deepwater Horizon, state and local politicians felt they were being deprived of necessary resources despite there being no operational need for the resources they requested. As a result, due to political pressures, additional resources not required were pushed to the incident. At the end of May 2010, President Obama announced he would triple the Federal manpower and resources responding to the spill despite a lack of demand from professionals managing the incident for the types of resources provided. Additional trained incident management personnel were needed, not what was made available.[xvii] Adding these extra resources to the incident in response to public perception and political necessity rather than operational needs resulted in resources being "pushed" to the incident rather than being targeted in an efficient way. This was not the most effective use of an already depleted resource base in a lengthy response. It added significant logistical demands, which detracted from the operational efforts. The top-down push of resources restricted the ability of the incident management organization to assign, supervise, equip, and support the new resources.

Similarly, during the Empire 09 exercise, Rensselaer County, situated adjacent to the incident site in Albany County, felt much of the initial Federal response was focused on Albany County and the needs of Rensselaer were being neglected. Rensselaer County's concerns did not have a larger, more negative influence on the response during the exercise given limited time during the exercise. However, there would be limited opportunities during a real-world incident to correct these perceptions before pressure mounted and, as in the Deepwater case, led to local elected officials using the media as a platform to criticize the response efforts, place artificial demands on the response, and cause additional resource allocation challenges.

During Deepwater Horizon, oil containment boom became one of the most visible manifestations of state and local dissatisfaction with the Federal response efforts, and its presence became a symbol of how responsive the government was to local communities.[xviii] As a result, responders began deploying boom everywhere possible even though technical experts suggested it was not an effective operational strategy. Each state and local jurisdiction wanted as much or more boom than the others. As a result, responders had to measure "feet of boom deployed", a measurement requiring considerable time to compile but providing very little value in evaluating the effectiveness of the response.[xix] Boom was distributed according to political imperatives, not operational needs. Operational decisions became politically motivated and the politics of the spill were more complex than the spill itself. In the case of a radiological incident like Empire 09, some jurisdictions may also request radiological monitoring resources out of a perceived radiological hazard regardless of its validity. The Federal government may not be able to deny these requests and may have to allocate some critical resources to validate natural, background levels of radiation. In short, resources may be allocated based on political, not operational demands.

Political Involvement in Decision-Making

During Deepwater Horizon, political involvement at the highest levels occurred when principals from agencies participated in meetings and decision processes in ways never envisioned under the National Incident Management System and other response plans. This sometimes delayed decisions for political reasons. NIMS states elected and appointed officials generally do not work at the incident level but instead provide input on policy, direction, and authority to their designated Incident Commander. At the Unified Commands, states were represented by pre-designated State On-Scene Coordinators (SOSC). At various points during the incident, governors of some affected Gulf Coast states declared themselves the SOSC.[xx] When this occurred, nobody else had the authority to speak for the state, so all decisions had to flow through a governor's office, which weren't at the incident site. This significantly slowed decision-making.

This circumvention of structure and process made it unclear to the public and responders who actually had authority over some of the key decisions and this consequently sowed criticism. Much of the advanced planning work was suddenly being carried out by political appointees and elected officials who had not been involved in prior planning efforts and who had limited knowledge of basic emergency and incident management processes and principles. Moreover, much of the incident management structure is intended to push issues down to the local level at which they can be addressed. Having strong agency heads and political participation tended to elevate, and slow, decisions that otherwise might have been addressed more quickly at a local level.

A similar political challenge occurred during Empire 09. The New York State Multi-Agency Coordination (MAC) Group decided they would be responsible for making evacuation decisions. Taking this decision out of the hands of Incident Commanders resulted in delayed decision-making that could have resulted in an undesirable and avoidable public health hazard. The Incident Commanders at the Unified Command in Albany were not delegated the authority to make evacuation decisions. At one point, due to the delay in making these decisions at the MAC Group, the Unified Command made evacuation decisions outside of their delegated authority and were subsequently admonished.

Another example of political involvement in decision-making revolves around advisory teams. The Advisory Team for Food, Health, and the Environment, a group defined in the National Response Framework, plays a critical role in assisting state and local jurisdictions make informed decisions related to public protection from a radiological hazard. Because of the high-profile of the decisions during the Deepwater Horizon response, entities similar to the Advisory Team had authorities usurped and were replaced by elected and appointed officials who did not have expertise in the hazard. There is no reason why this same phenomenon would not exist during a radiological incident like Empire 09. Elected and appointed officials will want to be the ones responsible for making key decisions about which they are unfamiliar. This may result in a slow decision-making process and cause ill-informed decisions if not properly addressed in the incident management organization.

Scientific & Technical Challenges

There was an unprecedented demand for scientific and technical expertise, data, and information during the Deepwater Horizon incident. In particular, there was great interest in the flow rate of oil from the wellhead and the amount of oil in the Gulf. Similar demands for data focused on very technical issues will be present while responding to a radiological incident.

Flow Rate & Source Term Estimates

During Deepwater Horizon, the Federal government's widely changing estimates about the amount of oil flowing into the Gulf of Mexico were the source of significant controversy and eventually undermined public confidence in the Federal government's response to the spill.[xxi] As noted by the presidentially established Oil Spill Commission, the Federal government created the impression it was either not fully competent to handle the spill or not fully candid with the public about the scope of the problem. This was further compounded by the estimates from non-governmental experts in the scientific community and academia who produced significantly higher flow estimates than official government numbers. Loss of public trust and confidence is a significant problem fueling public fears, which in turn hinders response efforts, as in the Deepwater Horizon case.

The leaking well's flow rate instantly became a crucial question, but an answer remained elusive for most of the response. Despite technical challenges calculating an accurate flow rate, including limited expertise in this field and not much practical experience actually doing it, the public still expected an answer. Congress was so interested it held hearings on May 19th, 2010.[xxii] As more data became available, official flow rate estimates steadily climbed. In driving operations, responders used worst-case scenario figures, which far exceeded the estimates and actual flow rate.[xxiii] Despite the availability of these worst-case scenario figures and their being used for operational planning, these figures were never disclosed to the public. In hindsight, releasing more information to the public rather than less could have combated the declining public confidence. Such information releases would be vital during a radiological incident.

On May 19th, 2010, the NIC created an inter-agency Flow Rate Technical Group as part of the Interagency Solutions Group and tasked them with developing the official flow rate estimates.[xxiv] The group enlisted both government and non-government scientists with applicable expertise and experience. The group was slow to release its first estimate and was criticized for its failure to disclose enough information to enable other experts to assess the group's methodologies and findings. If more of the group's data had been made public, its estimates may have evolved more rapidly with input from the broader scientific community. Similar challenges would exist in a radiological incident scenario like Empire 09. The Empire 09 scenario was highly technical and scientific and the management of the incident would be compounded by these same factors. There would be great interest in the extent of contamination, and this would require the release of timely and accurate information to avoid second guessing and external criticism.

Measuring and characterizing the levels of radiological contamination in a scenario like Empire 09 will be a challenge not widely understood by the public. There will be demands for immediate answers on the extent of radiological contamination; however, gathering and assessing this data will take time. Much the same way the public and politicians demanded immediate and accurate estimates on the amount of oil leaking into the Gulf, there will be demands for

immediate and accurate estimates on the extent of radiological contamination in the Empire 09 scenario. These demands will be augmented by the potential threat to health and safety posed by the hazard.

In the absence of timely information, the media will turn to non-governmental and academic experts who will provide their own estimates on the extent of contamination and commentary on the government's response. The government will need to have an accurate and defendable estimate on the extent of contamination using commonly accepted and understood methods. Much like the establishment of the Technical Flow Rate Group during Deepwater Horizon, additional scientific groups may be established to confirm data gathered and analyzed by technical experts.

Way Forward

Command & Coordination Challenges

The interagency should consider training and equipping additional personal from various departments and agencies to fill specialized incident management roles during a large-scale nuclear or radiological incident. At a minimum, these training efforts should include advanced systems-level ICS training for all response personnel and advanced position-specific training should be provided for key incident management functional areas such as operations, planning, logistics, and safety. The interagency should discuss training technical experts from across the interagency in specialized incident management roles, which allow them to effectively provide scientific and technical advice to an incident management organization.

The ways that NIMS and ICS were flexed on the Deepwater Horizon should be examined for applicability during other catastrophic incidents, including nuclear and radiological incidents. Guidance should be developed on how to flex and expand NIMS to meet the needs of a catastrophic incident without compromising the intent of the system and compounding the problem. This guidance should address Incident Command issues as well as Multi-Agency Coordination and Public Information.

External Influences & Resulting Challenges

Key to dealing with political and external influence issues will be a robust public and governmental affairs capability. Such a capability needs to be prepared to address incident concerns before public perception turns negative and drives political leaders into overly influencing the response in a way that has potential to slow it. The interagency should consider holding a coordination conference and a series of working group meetings to ensure the myriad efforts addressing public affairs are clearly communicated and support one another. These efforts should be integrated with and build on the work of the Whole Community Communications Working Group and the FEMA CBNRE Branch-led Nuclear and Radiological Communications Working Group.

Scientific & Technical Challenges

The nature of challenges associated with Deepwater Horizon suggests the demand for informed technical and scientific information during the response to a radiological incident will be significant. The interagency should consider several actions. First, during future training and exercises, the technical and scientific communities must be constantly reminded of the real pressure they will face during an actual incident. Moreover, to build capacity, a plan for integrating additional scientific resources across the interagency should be developed. This plan should include metrics that describe training and qualification standards and the required number of scientists needed during an incident. State and local government departments should also be approached to augment this plan. Finally, the scientific community supporting response to a radiological event should work with interagency public affairs specialists to pre-craft portions of the appropriate messages following a radiological incident and set realistic expectations.

Japan Nuclear Incident Lessons Learned

The U.S. Government (USG) coordinated a robust interagency response to the Fukushima Daiichi Nuclear Power Plant incident resulting from the March 11, 2011 earthquake and tsunami in Japan. The response provided an opportunity for USG radiological response assets to operate outside of an exercise environment. There were a considerable number of lessons learned from the response that continue to be collected and should be explored in further detail. In fact, the response in Japan highlights several themes suggested in this paper and its analysis will help formulate corrective actions rooted in lessons learned.

Background Empire 09

Empire 2009 was a U.S. Department of Energy/National Nuclear Security Administration sponsored Full-Scale Exercise (FSE) in June 2009. The purpose of Empire 09 was to demonstrate effective management of the response to a domestic RDD incident in an urban environment. Exercise objectives included:

- Assess the ability of Federal, State, and local organizations to communicate and coordinate resources and response efforts within a unified response
- Assess the ability of FRMAC to integrate with the established State and local response structure

The exercise scenario was a terrorist attack in downtown Albany, NY involving a notional explosion with release of radiological material. The nature of the released required responders and technical experts to, among other things:

- Evaluate the immediate impact on public health
- Assess the extent and magnitude of the release on potentially affected populations
- Take actions to prevent further spread of radiological materials
- Restore critical infrastructure and key resources

In order to accomplish this in a unified manner, responders had to establish an organizational structure equipped to handle a multi-agency, multi-discipline response and adhere to common incident management principles.

[i] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, "Deepwater: The Gulf Oil Disaster and the Future of Offshore Drilling Report to the President", January 2011, 167.

[ii] Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[iii] Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[iv] Interview with responder from Deepwater Horizon, Houma Unified Command, Louisiana, July 7. 2010.

[v] Interview with responder from Deepwater Horizon, Houma Unified Command, Louisiana, July 7. 2010.

[vi] "Empire 2009 Interagency After Action Report", January 8, 2010, 23.

[vii] "National Incident Commander Strategic Implementation", September 28 2010, Version 5.0, 23.

[viii] Interview with responder from Deepwater Horizon, Houma Unified Command, Louisiana, July 7. 2010.

[ix] "National Incident Management System", December 2008, 62.

[x]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xi]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xii]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xiii]Oil Spill Commission, "Decision-Making within the Unified Command", 8.

[xiv]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xv]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xvi]Oil Spill Commission, "Decision-Making within the Unified Command", 7.

[xvii]Interview with responder from Deepwater Horizon, Area Command, Louisiana, September 9. 2010.

[xviii]Oil Spill Commission, "Decision-Making within the Unified Command", 20.

[xix]Oil Spill Commission, "Decision-Making within the Unified Command", 22.

[xx]Oil Spill Commission, "Decision-Making within the Unified Command", 17.

[xxi]National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, "The Amount and Fate of the Oil", 1.

[xxii]Oil Spill Commission, "The Amount and Fate of the Oil", 7.

[xxiii]Oil Spill Commission, "The Amount and Fate of the Oil", 8.

[xxiv]Oil Spill Commission, "The Amount and Fate of the Oil", 11.