U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

# JAPAN INCIDENT RESPONSE AFTER ACTION REPORT

FOR THE FUKUSHIMA DAI-ICHI ACCIDENT

OFFICE OF NUCLEAR SECURITY AND INCIDENT RESPONSE
DIVISION OF PREPAREDNESS AND RESPONSE
DECEMBER 2011

## FOREWORD

The devastating earthquake and tsunami that struck Japan on Friday, March 11, 2011, led to what is now widely recognized as the second worst accident in the history of nuclear power. Our Operations Center operated on a 24-hour basis for more than two months to monitor events unfolding in Japan, and actions were quickly taken to ensure the continued safety of our nation's nuclear power plants. We were pressed to address new safety challenges while continuing to remain focused on our other critical responsibilities.

This was an across-the-agency effort. The work of the Operations Center and the Near-Term Japan Task Force was supported by the assistance of all NRC staff throughout the agency. Throughout the Fukushima Dai-ichi emergency, the NRC staff exhibited the highest level of dedication and professionalism, and I am tremendously proud of the outstanding job the NRC staff has done—and continues to do—in response to this event.

This "after action report" is an integral part of the NRC's commitment to continual improvement. If there are lessons to be learned from the Japan experience, we will, as always, seek to capture them. As we do so, I wanted to take this opportunity to thank you all for your continued and unwavering focus on our mission.

Gregory Jaczko

## PURPOSE

1. The title of this document is the U.S. Nuclear Regulatory Commission (NRC) Japan Incident Response After Action Report (AAR). The intent of this AAR is to document responder feedback of the response. This AAR does not make recommendations for improvements or changes to the response program. Following approval of this AAR, NSIR will address the identified issues through normal business processes.

2. For more information, please consult the following points of contact (POC):

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## SECTION 1: EVENT OVERVIEW AND RESPONSE SUMMARY

On Friday, March 11, 2011, a 9.0 magnitude earthquake off the coast of Japan triggered a devastating tsunami in the northern part of the country and set off warnings as far away as the west coast of the United States (U.S.) and South America. The earthquake and tsunami caused a crisis at the six-unit Fukushima Dai-ichi Nuclear Power Station, which resulted in explosions, core meltdowns, and radioactive offsite release.

The Diablo Canyon Power Station in San Luis Obispo County, California declared a Notification of Unusual Event at 0423 Eastern Standard Time on March 11, 2011, as a result of a tsunami warning from the National Oceanic and Atmospheric Administration (NOAA). At 1134, the Diablo Canyon licensee observed a one-to three-foot surge – a change within the normal tidal range – and reported that the surge did not impact normal plant operations.

As the crisis at the Fukushima facility escalated, the U.S. Nuclear Regulatory Commission (NRC) entered the Monitoring Mode at 0946 EST, March 11, 2011. Monitoring Mode is a heightened state of readiness for incident assessment. For situations that are not facility or region-specific (e.g., natural phenomena involving multiple licensees, multi-region electric grid incident, international incident, terrorism-related incidents), NRC Headquarters (HQ) leads the agency response and regional offices provide additional support. By the evening of March 11, 2011, the NRC established a watch bill to support 24-hour operations of the Headquarters Operations Center (HOC). The NRC response was coordinated out of the HOC at Two White Flint North, 11545 Rockville Pike, Rockville, Maryland 20852.

The NRC provided 24-hour assessment of all incoming information and coordinated event-related communications. The NRC Executive Team (ET), headed by the Chairman, led responders in the HOC. In addition, the NRC immediately organized responders to deploy to Japan. The Japan Team's advance party arrived in Tokyo on March 12, 2011; the remaining nine-member team arrived on March 16, 2011.

The NRC Chairman led the agency response, while a Deputy Executive Director for Operations (DEDO) and a rotation of senior managers alternated through the ET Director position, to coordinate NRC responders during the response. The ET frequently briefed Commission Technical Assistants (TA) and other senior NRC leadership with status updates. In addition, the ET conducted several recurring conference calls to facilitate communication of mission assignments. The NRC's top priorities during the response were:

1. To provide ongoing assessment of radiological conditions, dose predictions, and protective action recommendations for American citizens in the U.S. and Japan.
2. To provide technical assistance to the U.S. Ambassador to Japan and the Japanese Government, when requested.
3. To coordinate response activities with Federal government departments and agencies, U.S. military commands, the Institute for Nuclear Power Operations (INPO), Bechtel, General Electric Hitachi (GEH), and the International Atomic Energy Agency (IAEA).

The NRC's response to the Fukushima Dai-ichi incident occurred throughout the nine-week

period from March 11 to May 16, 2011. Approximately 415 NRC staff members participated in the response from HQ and the regional offices. The NRC exited Monitoring Mode on May 16, 2011. As of the date of this report, the NRC's Japan Team continues to provide on-going support to the Japanese government and the U.S. Embassy, both from NRC HQ and in Japan.

### Methodology for the Analysis of the Response

The Office of Nuclear Security and Incident Response (NSIR) assembled an Incident Response Lessons Learned Review Team (hereafter referred to as the Review Team) to capture lessons from the NRC's response to the Fukushima Dai-ichi event and prepare an After Action Report (AAR). The Review Team identified strengths and several areas for improvement.

As part of the after action process, the Review Team collected data from responders in a variety of formats. Responders entered concerns, suggestions, and comments into a form on WebEOC, the information management system used during the response to the events at Fukushima. After the response, the Review Team solicited feedback from each of the responders and conducted "hot wash" debriefing sessions with each of the response teams. The resulting data was analyzed and organized into the following six categories:

- NRC Mission
- Response Structure
- Procedural Issues
- Planning
- Communications
- Technological Systems

The Review Team also reviewed relevant documents from a number of different external agencies, including the IAEA, the U.S. Embassy in Japan, and the Conference of Radiation Control Program Directors.

Below are the significant strengths and areas for improvement identified by the Review Team. Section 2 and the appendices of this document discuss these findings in detail.

### Identified Strengths

The Fukushima accident was unique for the NRC because of its international nature, extended duration, and multiple source terms. Overall, the NRC's incident response program functioned successfully in this dynamic and challenging environment. Because of the incident response program's flexible design and the large number of dedicated responders, the NRC was able to provide vital services to American citizens abroad, the U.S. Ambassador in Japan, and to the government of Japan. Responders volunteered from every part of the agency and proved to be the NRC's most valuable resource. The dedication and professionalism of NRC responders and staff enabled the NRC to achieve all of its response priorities.

The Review Team identified the following strengths:

- Given the international nature of the event, the responders were very adaptive. Volunteers continued to support an effective response throughout the nine-week response period.
- The NRC organized a media and public response that accurately portrayed the NRC's role in this international incident, provided references to locations where appropriate Federal information could be obtained, and served to provide factual and accurate information to the public about radiation effects on the U.S.
- Daily conference calls with the IAEA, INPO, and a consortium of federal government and industry stakeholders greatly enhanced overall communication and coordination.

### Primary Areas for Improvement

The Review Team identified the following areas for improvement in the NRC incident response program:

- The NRC response program lacks an international response plan. Better defining lead and supporting agencies for an international response effort could result in more effective communications and coordination between the NRC and state counterparts.
- As the event progressed, competing priorities from internal and external stakeholders required significant attention from NRC senior leadership. This resulted in challenges to response continuity.
- Planning issues developed due to the protracted nature of the response. The primary areas of concern included turnover, continuity, staffing, and shift scheduling.

The intent of this AAR is to document responder feedback of the response. This AAR does not make recommendations for improvements or changes to the response program. Following approval of this AAR, NSIR will address the identified issues through normal business processes.

# SECTION 2: ANALYSIS OF OBSERVATIONS

The Review Team identified six overarching categories of observations during the after action process. The categories are NRC mission, response structure, procedural issues, logistics, communication, and technological systems. The Review Team subdivided these categories into main topic areas, each with specific observations followed by corresponding analyses.

## 2.1 NRC MISSION

### *2.1.1 Role and Mission*

**Observation:** The NRC's response role in an international event is not well defined, and the agency's mission of ensuring adequate protection of public health and safety to U.S. citizens abroad could have been better communicated to the staff throughout the event.

**Analysis:** Responders stated that they understood their roles and responsibilities with respect to the NRC's domestic mission of ensuring the health and safety of the public and protecting the environment. Some responders were comfortable with the agency's role in responding to the international event and saw a clear nexus with the agency's mission. Other responders commented, however, that they were unsure of how and why that mission applied to foreign events. Some responders believed that the NRC should not have had a significant response role and should have concluded its response activities much earlier, especially since there was little or no threat to U.S. citizens domestically. Other responders expressed concerns that the safety of U.S. citizens abroad is outside of the scope of the NRC's jurisdiction.

### *2.1.2 Federal Coordination in an International Response*

**Observation:** The NRC lacks formal guidance for integrating into the overall Federal response to an international nuclear incident.

**Analysis:** Some responders were unsure of how the NRC integrates into the Federal response plan for international events. The NRC initiated assistance at the request of the U.S. Embassy in Japan and, consequently, became the lead for several aspects of the Federal response. Many agencies and external stakeholders contacted the NRC for information; however, some NRC responders did not know if they were permitted to share information.

The National Response Framework (NRF) does not outline lead and supporting agencies for international incidents. As a result, the NRC did not have established guidance or processes to facilitate a lead role in an international Federal response. This led to confusion about the NRC's role in coordinating with other agencies, such as the IAEA, the Environmental Protection Agency (EPA), the Department of Energy (DOE), and the U.S. Agency for International Development (USAID).

The NRC's Japan Team understood that USAID was in charge of humanitarian efforts, but were not certain of roles of other agencies. Responders did not know how to best interface with other agencies and were unsure of what information could be shared with foreign regulators. Japan Team responders also acknowledged that there was the potential to be overly conservative. Specifically, some responders were unsure if they

could or should share information obtained from the U.S. Boiling Water Reactor Owners Group with the Japanese Government and industry.

## 2.2 RESPONSE STRUCTURE

### *2.2.1 Task Management*

**Observation:** The absence of a formal task management process led to difficulty in tracking and prioritizing tasks. The existing informal process also lacks a means for assigning tasks to various NRC line organizations.

**Analysis:** During the response, the process for tracking tasks could have been more consistent and better managed. The current process appropriately captures tasks originating from the ET and not from external entities, but there is no central process that ensured all tasks went through the ET. This lack of a central processing mechanism confused the assignment of resources and the prioritization of tasks. This occasionally led to unnecessary delays for priority tasks when working on tangential support functions.

Responders also noted that there was no protocol for adequately transitioning long-term actions to NRC line organizations during the initial response phases. A long-term task management system was developed later in the response. This system allowed the HOC to task line organizations with a longer-term project or action requiring significant staff resources.

**Observation**: The WebEOC Task Tracker was beneficial to capture assigned mission tasks, but the limited usability of the software resulted in ineffective use of the tool.

**Analysis:** Responders indicated that using Task Tracker during the response provided a mechanism for capturing many different response tasks. However, due to software and training issues, it was challenging for responders to track the assignment, status and completion of tasks. Not only was it difficult to hold individuals accountable for the work they had been assigned, but responders also were unknowingly working on the same tasks or reworking tasks that had already been completed, leading to confusion and an inefficient use of staff time.

### *2.2.2 Leadership Continuity*

**Observation:** The response structure is not designed to establish long-term command and control or long-term continuity of leadership.

**Analysis:** The NRC Chairman led the agency throughout the response. During the early phase of the response, a DEDO and three other senior NRC managers alternated through the ET Director position, providing leadership to the ET. As the response period lengthened, the ET increased the number of individuals rotating through the ET Director position, which disrupted the continuity of leadership. Responders expressed concerns that there was a lack of communication of the standing orders between ET Directors during shift turnover, and that the ET sometimes did not effectively communicate to the other response teams the rationale for changes to tasks and orders from the previous shift. Several responders commented that the goals, priorities, and the methodology of

the response changed every shift. An ET Director would assign tasks during one shift, and the Director on the subsequent shift would negate or cancel the tasks, only to have the next ET Director reinstate them. In an attempt to improve communication between shifts, the Chairman requested status updates during each shift turnover so the departing shift provided the update with the oncoming shift in attendance.

### *2.2.3 Shift Turnover/Continuity*

**Observation:** Individual Response Team Directors did not consistently conduct turnover briefings which complicated shift continuity and task completion.

**Analysis:** The inconsistency of shift turnover briefings led to deficient communications between shifts. Some Team Directors conducted 15-minute briefings at the beginning of every shift, relaying pertinent information to the oncoming shift, such as status updates, action items, and priorities of work; other Directors did not. The Chairman and other responders expressed concern that knowledge transfer from one shift to another was not adequate, despite the availability of WebEOC functions designed to facilitate knowledge transfer at turnover. Other responders voiced frustration over action items assigned to the relieving shift that were never completed.

**Observation:** The lack of a consistent response roster composed of watch standers challenged daily knowledge transfer and shift continuity.

**Analysis:** Responders stated that positions were often filled by multiple individuals on consecutive days rather than consistently staffing the shifts with the same individuals for several days in a row. This contributed to a lack of situational awareness by responders who were forced to re-learn current priorities and tasks at the start of each shift.

### *2.2.4 Protracted and Multi-Unit Events*

**Observation:** The NRC's incident response program does not train or exercise responders for protracted or multi-unit events.

**Analysis:** The scale of the Japan event response was more complicated than most responders had ever experienced. Responders identified many issues that arose because the event included multiple units and response lasted for weeks instead of hours or days. The current training program and response exercises do not incorporate long-term or multi-unit scenarios. Typical drills last several hours, involve one shift of responders, and are predictably formatted. The current training platform is not sufficient to prepare responders for protracted, multi-unit events.

### *2.2.5 Expertise and Training*

**Observation:** The HOC used trained volunteer responders to fill team positions. As the response period lengthened, it became necessary to use untrained volunteers to supplement the response teams. Untrained responders lacked the necessary response training and knowledge of HOC operations, and even trained responders recognized a need for more drills with an increased focus on HOC procedures and tools.

**Analysis:** As the response extended into months, the HOC required more personnel resources to respond to the incident than were available from the pool of trained responders. The HOC filled voids in trained response team positions with untrained volunteers during the response to meet the need. Some volunteers lacked essential training and possessed little understanding of HOC operations. Many attempted to use training materials before their shifts but had difficulty locating the documents. To address the knowledge gap, volunteers were provided "on-the-job" training. They shadowed trained responders, which burdened the trained responders and prevented them from concentrating fully on their primary responsibilities.

Many trained responders noted that their lack of event response experience (actual or drill) presented a challenge during the response. Trained responders expressed a desire for more drills that have a greater focus on the use of various software packages, procedures, and other tools. Several experienced responders noted that they acquired their incident management experience and skills through their work in the nuclear industry or their military careers, and not through the training they received at the NRC. Additionally, many responders indicated that they lacked the refresher training necessary to perform some of their response duties immediately upon reporting to a shift.

### *2.2.6 Roster of Subject Matter Experts*

**Observation:** Subject Matter Experts (SME) were a valuable resource throughout the response, not only supporting internal objectives, but also supporting other Federal stakeholders. However, during the response, responders were not readily able to access an agency-wide SME database.

**Analysis:** During the response, the HOC needed technical experts in specialized areas to support the NRC's response mission. HOC responders had difficulty identifying individuals with the requisite subject matter expertise. Many SMEs were identified and contacted as a result of personal relationships with HOC responders. Most responders were unaware that the Headquarters Operations Officers (HOOs) maintain a SME list. Additionally, many responders were unaware of the Strategic Workforce Planning database, which serves a similar purpose as the SME list, but is not maintained. The responders who were aware of the database noted that the site is difficult to locate, and the "Find an Expert" database is restricted to managers and supervisors.

### *2.2.7 Conflicts with Regular Duties*

**Observation:** Many responders who volunteered for response duty were also expected by their supervisor to continue their normal work duties. Response team leaders had no direct control over the voluntary responders' schedules or the duration of their service.

**Analysis:** Because non-response-related work tasks continued to require attention, many responders had to complete their normal duties. As a result, many responders worked very long hours for multiple days. Some responders withdrew from response activities or reduced their availability due to regular workloads.

Since the responders were participating voluntarily, response team coordinators did not have direct control over the work schedule of the responders on their teams. This led to

inconsistent shift lengths, added work load on team coordinators, and diminished continuity between shifts.

### *2.2.8 Team Management/Team Mission*

**Observation:** The NRC's lack of international response experience, coupled with limited team cross-training, caused uncertainties and confusion among the responders regarding their team-specific mission assignments and the roles of other teams.

**Analysis:** Many responders expressed concerns about the lack of a well-defined, team-specific mission in the context of an international response. Responders noted that the ET, other NRC response teams, and external stakeholders often misunderstood the roles and capabilities of the teams. As a result, many responders were unsure how their individual role within their team helped to facilitate the NRC's overall response effort. Responders understood the necessity to adapt to dynamic response conditions, but many became overwhelmed with requests to perform functions that were administrative, time-sensitive, or associated with a different team's responsibilities.

### *2.2.9 International Response Considerations*

**Observation:** The NRC incident response program lacks a comprehensive international structure.

**Analysis:** The international nature of this incident created complications that would likely not have been present during a domestic response.

Information Sharing: Since information primarily flowed through government channels, receiving direct communications or confirmatory reports from the Japanese or Tokyo Electric Power Company (TEPCO) was difficult.

Language Barrier: The language barrier between the Japanese and the NRC was challenging and presented complications. Responders observed that some translators reduced long conversations into a few sentences, which generated concern that information was being lost.

NRC responders in Japan valued their interactions with translators. However, hiring translators was costly, and managing translator time became an additional job task. Translators scheduled time for meetings, but did not allot time to assist in translating printed documents. Translators also varied in their ability to handle technical information. Some responders held briefings with translators before meetings, teaching them basic terms and telling them what to expect. This was beneficial in preparing the translators for technical terminology they might encounter during the course of the meeting.

The language translation capabilities of the HOC were also insufficient. Responders noted that some NRC staff members located at HQ speak Japanese fluently, but were unavailable during the response.

Travel: The international nature of the event created logistical challenges for the responders in Japan. The NRC was unfamiliar with using an external agency to coordinate travel for their personnel. More expensive commercial flights were preferred

over military flights due to fewer stops and less flight time. Travel within Japan posed challenges as well. Initially, responders traveled by way of Embassy sedans, but Embassy vehicles were not available for subsequent teams, who used taxi services for transportation.

Initially there was no deployment or return checklist available for the Japan Teams, though responders developed one during the response. Japan Team members also expressed a desire for a central location (i.e., a blog or SharePoint site) where they could post and receive information on international logistical issues such as power adapters, food, and clothing. In addition, acquiring expedited passports and visas was challenging.

Logistics: Currently, there is no logistics support team to perform support functions related to deployment and re-deployment of responders deploying to remote or overseas locations.

NRC HQ does not have the capability to provide whole body bioassays to deploying staff, as they are normally the responsibility of domestic licensees. Responders coordinated with the Naval Dosimetry Center at Bethesda Naval Hospital to provide whole body counts.

Furthermore, since Management Directive (MD) 10.132 does not currently provide guidance on radiation monitoring for returning personnel, there was confusion regarding radiation monitoring for Japan Team detailees who were returning to their normal duty stations.

Technical Issues: Most Japan Team responders encountered technological issues with electronic file compatibility, NRC local area network (LAN) access, and NRC information technology policy restrictions. Responders were able to resolve most issues during the response through coordination with USAID and the U.S. Embassy in Japan, and by using personal computers. Appendix G details these issues.

## 2.3 PROCEDURAL ISSUES

### *2.3.1 Records*

**Observation:** Response teams had an insufficient protocol for recordkeeping, leading to inefficient information management. This caused duplicative efforts, limited capture of lessons-learned documentation, and inefficient management of requests for information.

**Analysis:** Some responders expressed difficulty in managing the large volume of paper and electronic documentation produced during the response. Responders consistently noted that they were not aware of a standardized procedure or protocol for managing the large number of files that each shift produced. Because there was no established protocol for file names, folders, or overall file organization for saving information on the shared drive, responders saved documents in various locations on an ad hoc basis, which required considerable effort to locate and consolidate. Consequently, shifts often worked independently of each other, using multiple versions of the same or similar documents. In addition, the HOC had no central storage method or space for the paper documents created. Tabletops set aside for paper storage quickly became inundated

with large piles of unorganized documents. Responders commented that important documentation created during a shift routinely "disappeared" by their next shift. Additionally, there was no process for shift management review and approval of official chronologies and logs.

Some responders noted that external communications with interagency partners were not sufficiently documented in response records. Because this was not a domestic event, a large number of external decision-makers were involved with NRC's actions and providing essential information. However, there was no integrated method for recording this external input.

File organization and storage limitations presented problems with e-mail as well. Many responders were unsure where to file or send e-mails in order to facilitate easy retrieval later should Freedom of Information Act (FOIA) requests be received. As a result, multiple copies of the same e-mails were stored in many different locations, making the retrieval and consolidation of e-mails very cumbersome.

### *2.3.2 Freedom of Information Act Requests*

**Observation:** During the response, the NRC received a large number of FOIA requests. This caused already limited resources to be re-directed to mandatory FOIA work rather than incident response activities.

**Analysis:** The NRC received over 30 FOIA requests related to the Japan event. While the FOIA Response Account that was created during the response was helpful, responders had difficulty locating relevant documents due to overall recordkeeping inefficiencies. In addition to the collection and review of hard copy documents, transcription and analysis of recorded telephone lines in the HOC was also necessary. The cost and time needed to facilitate prompt and thorough processing of the FOIA requests remains challenging. Preliminary calculations suggest that processing all the requests from this incident will require a significant investment of time and funds, measured in years and millions of dollars. Responders expressed concerns that the current document management practices will complicate future FOIA requests, and that the NRC must do more to plan for FOIA requests of this nature in order to reduce the strain on staff resources.

### *2.3.3 Reports/Procedures*

**Observation:** Most response procedures and protocols are not adequate for protracted, multi-unit or international events. Additionally, no process currently exists to formalize ad hoc protocols throughout the response.

**Analysis:** Responders commented that there were no NRC response procedures for addressing international events, and many of the established procedures used in the HOC were not adequate to handle the magnitude of the Japan response effort. Technical teams also noted that the lack of a standardized form for submitting routine input on dose projections, by both the Protective Measures Team (PMT) and the Reactor Safety Team (RST), created confusion about the basis of RST projections during the event. Responders also stated that certain reports, including the Situation

Report (SITREP) and the one-page briefing sheet, became very useful in keeping NRC responders and other agencies informed.

Overall, responders made numerous comments that collectively indicate a need for an expansion of procedures in areas such as standardized shift turnover, response for protracted events (domestic and international), standardization of reports, document version control, storage and documentation of Radiological Assessment System for Consequence Analysis (RASCAL) runs, and other file management protocols.

## 2.4 PLANNING

### *2.4.1 Staffing/Scheduling*

**Observation:** The voluntary nature of the current response program presented many challenges in supplying fully qualified responders to staff the HOC for the duration of the response. As the response lengthened, many issues related to staffing and scheduling surfaced, including the inadequacy of the four-deep team roster, length of shifts, miscommunication of schedule changes and availability, and inconsistent scheduling methods.

**Analysis:** It was difficult to staff the HOC throughout the response. Team rosters currently have at least four personnel qualified for each position. There were occasions when none of the four individuals listed on the team roster were available. Because response participation is largely voluntary, it was difficult to require responders to fill their positions on the watch bill. In order to fill open positions, the HOC employed volunteers who lacked HOC experience or training.

Other issues stemmed from the scheduling process, including inconsistencies in the way individual teams scheduled personnel. Some teams managed their own staffing roster, while the Executive Support Team (EST) managed the rosters of other teams. Occasionally, teams had two different rosters—one managed by the EST and the other managed by the team. In some instances, teams used sign-up sheets to fill rosters. The posting of these sign-up sheets was irregular and in uncommon areas. Responders could not agree on the best way to publish the schedule (daily, weekly, or pay-period.)

The process for contacting experienced responders was also problematic. Several responders commented that they received a call from the HOC at the beginning of the response, but were unable to report at that time. Those responders never received a subsequent call, and assumed that the HOC did not have a need for them. Others reported that they never received an official request to report to the HOC.

Responders voiced concerns over miscommunications surrounding changes to schedules and responder availability. Responders reported showing up for a shift, only to find another responder had removed their name from the list. Some volunteers who desired to end their involvement in the response received repeated calls to respond to the HOC. In contrast, many personnel who were HOC-trained, available, and willing to respond, never received a call to respond. Responders also noted that the HOC did not update the responder list regularly, or share it with appropriate personnel.

Responders made several comments regarding shift length. During the response, shifts were eight hours in length and not always on consecutive days. Many responders commented that 12-hour shifts might reduce problems with shift turnover by reducing the number of turnovers per day. Conversely, some responders had concerns about 12-hour shifts. The length of some responders' commutes, combined with a 12-hour shift, would reduce available rest time between shifts, thus possibly creating fitness for duty issues. Responders expressed a willingness to work longer shifts for an initial response, but would prefer a more normalized schedule after the first few days of a response.

### *2.4.2 Human Limitations and Human Capital*

**Observation:** The limited size of the qualified responder pool, coupled with the length and complexity of the event, led to fatigue and stress issues.

**Analysis:** Responders highlighted several human factor issues, including availability of necessary expertise, fatigue, and stress management, and identified many factors that could impact the quality of their decisions. Some areas that caused stress included the overwhelming nature of the event itself, sometimes ambiguous information and tasks, lack of documentation or rationale for previous decisions, irregularity of shift operations, and working with volunteers unfamiliar with HOC protocols. Responders stated that they were often unfocused because of unnecessary distractions, including nearby conference calls and unidentified personnel on the floor. These factors, exacerbated by increasing fatigue, resulted in high levels of stress.

Responders also reported that they worked many alternating day and night shifts. In addition to their HOC shifts, many responders had normal work tasks to complete. Long work hours and sleeplessness increased responder fatigue. As the response continued, cumulative fatigue became more of an issue and significantly increased responder stress levels.

In addition to fatigue, irregularities in procedures and practices compounded stress. Several responders stated that having Commission TA briefings at the beginning of their shift gave them little time to prepare. Scheduling issues, intense job demands, and personnel compatibility issues played a role in elevated stress levels as well. When a responder's inability to handle the stress of the response interfered with their ability to carry out their job function, there were limited options to remedy the situation, as replacement responders were not readily available.

Many of the errors associated with compensating staff response for response work have yet to be resolved. Bi-weekly overtime pay caps were lifted for responders; however, the annual limit remained. Currently, responders will not be compensated for hours worked after the annual cap is reached. Some responders expressed concerns that some of the most experienced responders had to choose whether to work without compensation or discontinue their contributions to the response.

### *2.4.3 Equipment*

**Observation:** The Japan Team dispatched from HQ had difficulty securing the necessary emergency response equipment since most equipment is provided for region-based site

teams. Regional offices had concerns about replacement and reimbursement of equipment used during the response.

**Analysis:** Responders from HQ expressed concern that dosimetry, respirators, KI, and other necessary equipment for this emergency response were not readily available. Distribution of dosimetry, normally a function of the Office of Nuclear Reactor Regulation (NRR) and the regional offices, was not available for HQ responders who were immediately dispatched to Japan.

The regional offices were unclear as to who would provide the stock replacement funds for the many consumables that were provided during the response. The Regions were also concerned that the equipment provided might be damaged or lost. The Japan Team also noted that additional procedures and guidance was necessary for education and direction on NRC use of KI.

### *2.4.4 Facilities*

**Observation:** The responders identified many operational improvements during the response that should enhance the operations center facility currently under construction at Three White Flint North.

**Analysis:** Overall, the HOC functioned well for response; nonetheless, the following facility-related concerns were raised:

Work Spaces: Overall, work space in the HOC was crowded. Because of the limited space, team members were not always able to co-locate. As a result, responders had difficulty collaborating on work assignments. Other teams voiced similar concerns that the HOC layout was not conducive to working with others and huddle rooms were not available. Paper documents became difficult to manage because workspaces were not large enough to accommodate the documents and no organizational method existed for filing documents. In addition, responders noted that seating arrangements implied authority of a position that was not always accurate, leading to some confusion about roles and responsibilities. Further, responders voiced concerns about objects under desks and tables, such as cables and low hanging keyboard trays.

Food: Responders voiced concerns that there were limited food options available during the response. The lack of refrigerator space for the storage of meals amplified the concerns. The HOC made requests to open the cafeteria for extended hours, but cafeteria operators were unable to support this request. Responders commented that there was not an available food delivery menu book or a sufficient supply of vending machine food.

Signage to the HOC: The Two White Flint Complex has limited signage for directing personnel to the HOC. Liaisons from other agencies had difficulty entering the building and finding their way to the HOC, especially after hours.

Contract Staff: The need for Office of Administration contract personnel in the HOC (janitorial staff, drivers, etc.) diminished throughout the response, but the HOC did not communicate their reduced needs in a timely fashion.

### *2.4.5 Security*

**Observation:** The Japan Team established and maintained communications with the HOC; however, secure communications capabilities were limited because of the unavailability of secure equipment on-site and requisite information access of ET members.

**Analysis:** Outlined below are several security issues encountered during the response:

Secure Communications: There was no secure field communications equipment available for the Japan Team, forcing team members to use Embassy facilities. Additionally, ET members could not discuss certain information with the Japan Team because some ET members lacked the proper clearance access. During the response, responders had limited access to secure networks due to the long approval time for obtaining access credentials.

Secure Document Storage: Response teams required ready access to secure documents during the response. Responders were unaware of a designated secure document storage location within the HOC, causing the HOO secure area to become the de facto storage area.

Notification of Available Classified Information: There was no formal method for notifying Team Directors when classified information was available for review. Responders had to consult the HOOs daily to ensure they had not missed any classified information.

Document Disposal: There was no readily-available receptacle for disposing Official Use Only (OUO) information.

## 2.5 COMMUNICATIONS

### *2.5.1 Internal Communications*

**Observation:** Responders identified several challenges with inter-team communications.

**Analysis:** Responders provided comments on the issues that helped and hindered their communications. Responders noted that shifts operated more effectively when senior responders held a briefing within the first 30 minutes of the start of shift to update responders with new information and high-priority tasks.

Miscommunications arose when responders attempted to communicate the status of tasks and provide justification for decisions. Documentation and communication of key decisions was inadequate, contributing to parallel work on similar or contradictory projects. Additionally, subsequent management often countermanded previous instructions, confusing responders.

### *2.5.2 Interagency Communications*

**Observation:** Interagency liaisons were effective in serving in the HOC and provided an added level of interagency coordination and communication. However, formal protocols and interagency agreements related to roles of external liaisons in the HOC during an international response do not exist.

**Analysis:** The NRC granted HOC access to liaison staff from other agencies in an attempt to enhance interagency communications and coordination. This assisted in furthering interagency coordination, but some responders did not understand the role the liaisons played in the response, or the level of information access they should have been given while in the HOC. In addition, it was difficult for NRC responders to identify individuals from other agencies, as they were not wearing badges that clearly denoted their name and agency affiliation.

While the ET normally processed information requests within the HOC, individuals outside the agency requested information through their liaisons or directly from the response teams and circumvented the established information dissemination process. Responders were unsure what agencies had a "need-to-know" for particular information. Informal telephone and e-mail communications became a problem for responders, as most external requests were not managed through the task tracking system. Responders were not certain how to prioritize these requests, or how to verify the affiliation of the requestor.

Responders raised some concerns regarding the NRC's interface with Department of Defense (DOD), specifically DOD facilities within Emergency Planning Zones (EPZ). Many responders were not accustomed to coordinating with the DOD command structure.

**Observation:** Daily conference calls with international and industry partners greatly enhanced overall communications and mission priorities; however, there were no formalized protocols establishing the purpose of calls, the level of information that could be shared, and the entity or position that should have led the calls.

**Analysis:** Although not part of any procedure or protocol, the HOC contacted industry partners and international allies to establish daily conference calls. The HOC regularly held calls with international partners (United Kingdom, Canada, France, and Germany), as well as with INPO and a consortium of government and industry stakeholders. The conference calls provided a general overview and update on the conditions in Japan and the progress of U.S. response efforts. The calls were very effective in discussing follow-up of action items and planning for future support requests. Responders did note, however, that the consortium calls did not have a single point of contact (POC) who had ownership of the call or was responsible for tracking follow-up actions.

### 2.5.3 Public Communications

**Observation:** The use of scientific figures and numbers in public messaging by the NRC was confusing in context when conveyed to the public.

**Analysis:** Responders commented that using scientific figures and numbers did little to calm the fears of the public. In addition, the NRC did not have any visual aids to clearly explain what was occurring during the accident. Responders stated that the NRC blog was helpful in getting reliable data to the public.

**Observation:** The influx of calls to the NRC regional offices from the public created a significant distraction to the response.

**Analysis:** In the weeks following the reactor accidents at Fukushima, the HOOs and the regional offices fielded a large number of calls from concerned citizens. There is no established process for handling a large volume of public calls to the Operations Center. Currently, the only toll-free number on the NRC website for members of the concerned public is the "safety hotline," which is intended as a portal for persons wishing to report safety concerns about licensed U.S. facilities. The safety hotline detects the telephone exchange from which a call originates and routes the call to the nearest regional office. In this case, most calls originated from the west coast and were routed to the Region IV allegations staff. The volume of calls (nearly 300 in the first week alone) to Region IV effectively rendered the safety hotline unavailable to callers with concerns about U.S. nuclear facilities. Mostly, callers wished to provide ideas about how to help the Japanese, or had concerns about their immediate safety. The Region IV staff developed a useful "frequently asked questions" guide that they subsequently shared with other program offices and distributed to the entire NRC in the Operating Experience Branch (IOEB) Clearinghouse Summary on March 17, 2011.

### 2.5.4 State/Regional Communications

**Observation:** The international nature of the event challenged communication efforts with State and regional stakeholders.

**Analysis:** Several States expressed frustration over the lack of coordination and information sharing between the Federal government and the States. States expressed concern that there was not a single, reliable source of information from which State agencies and governments could get information, data, plant status, or public information during the first days and weeks of the accident. Further detail regarding state communication issues can be found in a letter written by the Conference of Radiation Control Program Directors to the NRC under ADAMS accession number ML113470662.

Overall, NRC responders commented that they were unsure of what information was appropriate to share with the States and had difficulty determining their "need-to-know." This concern was equally applicable to external stakeholders as well.

### 2.5.5 Technical Communications

**Observation:** Technical communication was not consistent and was often confusing.

**Analysis:** The mixed use of metric and English units complicated the messages released by the NRC and the U.S. Government. There was a disconnect between international reports and NRC statements, specifically in the matter of units. Frequently, dose-related information in the news was in the International System of Units, while all NRC calculations were in English units. Many responders were concerned that this burdened the public with comparing measurements in two different sets of units.

## 2.6 TECHNOLOGY

### *2.6.1 RASCAL*

**Observation:** The modeling provided by RASCAL throughout most of the response was valuable; however, the program does not support the creation of a single impact plot from multiple source terms nor does it provide an impact perspective at distances greater than 50 miles. In addition, RASCAL only has a maximum calculation period (release duration) of 48 hours.

**Analysis:** RASCAL was designed for a single-unit domestic nuclear power plant incident of more limited duration. Some PMT responders were initially unaware of the underlying limitations of the RASCAL code when the PMT applied it to the international multi-unit, multi-spent fuel pool incident.

The lack of understanding of internal RASCAL code assumptions limited the responders' ability to interpret results and make subsequent recommendations. Both longer-term and multiple unit modeling capabilities existed and were functional at the National Atmospheric Release Advisory Center (NARAC) which regularly supports the NRC during HQ exercises. RASCAL's limitations did not significantly limit the production of NARAC impact plots, although it did slow the process. RASCAL was limited in its ability to simulate a delayed release of the source term for more than 48 hours after reactor shutdown.

Most dose assessors centrally stored individual RASCAL runs on the shared drive as directed by procedure. Some had difficulty locating specific runs and files, particularly because opening and re-saving cases changes the file date. Before PMT constructed a tracking table approximately one week into the response, the extent of RASCAL runs already performed was not readily clear to all responders.

### *2.6.2 WebEOC®*

**Observation:** WebEOC proved to be an essential and useful tool during the response; however, the full functionality and capabilities of WebEOC were not used.

**Analysis:** WebEOC is a web-enabled, crisis-information management system used to provide secure, real-time information sharing to help managers make sound decisions quickly. This software system provides many communications and archival functions to support the HOC. While there are many tools available within WebEOC, the three most commonly discussed among responders were the Logs, Chronology, and Task Tracker functions.

Since responders did not fully understand some functions provided by WebEOC, the software was generally under-utilized. This slowed communications for those who were searching WebEOC for information that was not there. Responders attributed some of the shift turnover communications problems to the lack of WebEOC use.

Responders also expressed concern that Team Directors were requiring written reports instead of utilizing the electronic functions of WebEOC. Responders also reported several usability concerns which may have also encouraged workers to use alternate means of communications. Searching, editing entries, adding attachments, and formatting were commonly reported concerns.

Among responders, there was a general confusion regarding the differences between Logs and Chronology. Many users felt that the two were redundant. The amount of appropriate information to enter into the Logs or Chronology was not clear to many users. Additionally, there were no processes for management review or approval of information entered into the Logs or Chronology.

The Task Tracker was widely used throughout the response. Identified deficiencies with the Task Tracker included the inability to sort by team, priority, requestor, or date. Users found monitoring the status of tasks and searching through tasks difficult during a long event. The default settings and the 12-hour limits were not appropriate for a protracted event, making the program more difficult to use.

Portability was a major concern for job tasks that required mobility. Responders often entered information for the Chronology and Log in notebooks, rather than in WebEOC, because the notebook could be carried from location to location. This was not ideal because it made sharing this information with others more difficult and increased the likelihood that the information would be completely lost if the notebook were to be misplaced.

Early on-site Japan responders did not know about the existence of the WebEOC system. As a result, the responders could not transmit information to HQ through WebEOC until weeks after they arrived in Japan. However, the final wave of responders in Japan had training on the use of WebEOC, which they found helpful.

### *2.6.3 General Technology Issues*

**Observation:** The technical support provided in the HOC was exceptional. Although technical issues arose, responders quickly rectified them.

**Analysis:** Overall, responders were very satisfied with the level of technical support received in the HOC. Responders identified several areas that fell into the following general technology areas:

Laptops and Computers: The laptops provided during the response were very useful. However, because laptops are not officially part of the response program, they were not always available. Some laptops had issues with software updates and connectivity to printers and other systems that had to be resolved. Also, the computers at the ET table allowed connectivity and productivity throughout the day, but required additional setup and training for use.

ADAMS: ADAMS software is not installed on all HOC workstations, which made it difficult for responders to access and print agency documents needed throughout the response.

Credentials: Volunteers without prior HOC experience required login credentials when reporting for their initial shifts. Technical support staff members were very responsive establishing accounts for the responders, but this also created a distraction from other duties. Experienced responders noted that there were no “desktop reference guides” to assist in accessing the systems.

Workstations: Responders agreed that workstation space was effective overall and met the needs of a short-term response. However, many responders noted that computer monitors were too small to allow viewing of certain documents, and other responders indicated they would prefer two monitors at their workstations.

Recorded Lines: The phones with recorded lines caused confusion in the HOC. There is currently no clearly defined policy or practice for use of recorded phone lines.

E-mail Accounts: Complications with the e-mail system — including size limits for attachments, HOC account names, and difficulty locating and retrieving previous communications — contributed to confusion and miscommunications. Responders regularly monitored the HOC e-mail accounts, but the HOC e-mail addresses only indicated computer station identification and did not indicate names or job titles of individuals. As a result, responders unknowingly sent e-mails to incorrect recipients. Responders incorporated several strategies to work around the e-mail labeling problem, one of which was relying on their personal NRC e-mail accounts. This strategy created a temporary solution but posed subsequent challenges surrounding shift turnovers, security, and information continuity.

# APPENDIX A: EXECUTIVE TEAM

## Executive Team Mission:

The Executive Team, under leadership of the NRC Chairman, ensures that the NRC supports and assists external decision-making to assure that risk to the public is minimized and ensures effective communication and coordination with all response stakeholders – including the licensee, other Federal departments/agencies, Congress, media, et al. The ET determines, through briefings from response Team Directors, the status of both external and internal activities, and what actions are necessary to support incident response efforts.

## Narrative of Response:

Due to the unique nature and circumstances of this event, the ET assumed a slightly modified role than that stated above. Once the lead for monitoring of the event shifted from Region IV to Headquarters (HQ), after the threat of a tsunami affecting the west coast of the United States (U.S.) had passed, the ET's role centered primarily on communications. As the crisis at the Fukushima Dai-ichi nuclear plant site escalated, the ET broadened its role to include assisting the U.S. Embassy in Japan in its efforts to protect American citizens and initiating the offer of NRC assistance to the Japanese Government. ;

## Best Practices/New Procedures:

1. Initially, the volume of conference calls (approximately 15 calls per day) and other requirements overwhelmed the ET. Eventually the responsibility for monitoring and participating in these calls was delegated to other response teams in order for the ET to devote more time to other response tasks and responsibilities.

2. Because of the high-volume of external communications and correspondence, access to e-mail and local area network (LAN) accounts at the ET table enabled ET members to maintain awareness of information and guidance.

## Challenges:

1. The response structure does not establish long-term command and control or continuity of leadership. Responders expressed concerns that there was a lack of communication of the standing orders between ET Directors during shift turnover. There could have been better communications to the other response teams for changes to tasks and orders from the previous shift.

# APPENDIX B: PROTECTIVE MEASURES TEAM

## Protective Measures Team Mission:

The overall mission of the Protective Measures Team (PMT) is to perform independent assessments of a licensee's protective action recommendations, provide the ET with confirmation that State protective action decisions are adequate to protect public health and safety, and supply and review information for NRC public announcements. When fully staffed, the PMT consists of approximately 16 response specialists who manage protective measures functions including dose assessment, communications, assessment of impact areas, and inter-agency coordination.

## Narrative of Response:

The PMT staffed between six to eight response positions during the first few days of the event. The on-shift responders included two Dose Assessors, a Radiological Assessment Assistant Director (RAAD), a Protective Actions Assistant Director (PAAD), and a Coordinator. Geographical Information Systems (GIS) and Meteorologist positions were also staffed early in the response.

As more accurate and timely monitoring and engineering data became available throughout the event, the PMT continuously reassessed and refined dose projections and source terms. The team participated in numerous conference calls with the Department of Energy (DOE), the National Atmospheric Release Advisory Center (NARAC), and other Federal agencies, and held periodic conference calls with the Japan Team at the U.S. Embassy in Tokyo. The PMT also addressed requests from the U.S. Ambassador to Japan and other dignitaries.

The PMT monitored news-media coverage of the event and other sources of information. This included the DOE Consequence Management Web files, which grew as DOE collected measurement data in Japan. Information from the Tokyo Electric Power Company (TEPCO) and Japanese Ministry of Education, Sports, Culture, Science and Technology (MEXT) became abundant sources of data. At every opportunity to re-evaluate, PMT conducted re-assessments of potential impacts on public health and safety domestically and abroad.

## Best Practices/New Procedures:

1. The PMT focused on assessments and continually released new projections. The team was able to optimize its response, even without applicable procedures, by keeping public health and safety as a priority and finding ways to obtain the best understanding of the current and evolving situation.
2. The PMT used WebEOC effectively to track tasks assigned to the team, manage a flowing chronology, provide graphics and assessment results, and communicate with other response teams.

## Challenges:

1. The international nature of the event limited the applicability of existing PMT procedures.

2. Information shared by the Japanese required much longer assessment periods due to necessary language translation, particularly at the beginning of the response.

3. The design of Radiological Assessment System for Consequence Analysis (RASCAL) enabled assessment of one reactor at a time. Attempting to model several reactors and spent fuel pools simultaneously presented a challenge which the team overcame by modeling separate units and having NARAC add the activities into one release scenario. Other RASCAL limitations included a 48-hour dose calculation interval, an ad hoc approach to defining percentage of fuel melt, a 48-hour period during which deposition could decay, a spent fuel module limited to one batch of fuel, no original saved case protection, and no RASCAL operator identification.

4. PMT responders had difficulty collaborating with and receiving requested information from external organizations.

5. PMT meteorologists experienced unique challenges during the response due to the international nature of this incident. The meteorologists lacked on-site meteorological data and the ability to observe stations near Fukushima Dai-ichi. They also had to identify the resources and limitations of the Japan Meteorological Agency and other sources of data, such as military installations, and commercial Web sites. The wind speed data set was critical to calculations and was difficult to obtain in the correct format.

# APPENDIX C: REACTOR SAFETY TEAM

## Reactor Safety Team Mission:

The mission of the Reactor Safety Team (RST) is to perform an independent assessment of facility conditions to provide the ET and PMT a clear understanding of the significance of the event and the possible sequence of future events. The RST advises the ET and PMT on any plant condition that could affect public health and safety or threaten the environment. To support their assessments, the RST utilizes the Emergency Response Data System (ERDS) to display real-time plant parameters and communicates with licensee communicators, NRC Resident Inspectors, and with NRC regional counterparts. When fully staffed, the RST consists of approximately 18 specialists and engineers with a wide range of technical expertise and communications skills, and is able to perform complex analyses.

## Narrative of Response:

There were approximately six staff members assigned to the RST for the first month of the response, including the Team Director, Severe Accident Analyst and Boiling Water Reactor Expert, Chronologist, and Coordinator. As the response was scaled back, the Coordinator and Communicator stood down. The main mission of the RST during the response was to support the Japan Team and to coordinate with other technical assessment experts throughout the U.S. Government and U.S. nuclear industry to provide recommendations to be presented to Japanese authorities through the U.S. Embassy in Japan.

## Best Practices/New Procedures:

1. The NRC's Response Technical Manual provided very useful reference information regarding core damage prediction, recognition, and confirmation.
2. The RST's event status display board was an excellent product for maintaining the status of the six Fukushima reactors, containments, and spent fuel pools.
3. Effective cross-training of experienced RST members allowed for diverse skill sets across the team. Also, the RST established a protracted response protocol whereby incoming RST members would shadow an experienced responder on their assigned shift.

## Challenges:

1. The RST was responsible for coordinating the technical review and obtaining input from a consortium of government and nuclear industry entities. Preparing for the consortium and international calls required a significant amount of time, which detracted from analyzing the conditions at the plant and making informed recommendations. The level of effort needed to facilitate the calls warranted additional staff members.
2. Several RST members were not available to support prolonged shift work due to special assignments related to Japan. Additionally, personal issues and/or work demands arose that prevented team member participation in more than one or two shifts per week. This

led to an inefficient team work flow and the need to regularly initiate and train new RST members.

3. Many of the key tools the RST typically employs in response efforts were not applicable due to the international nature of the response. Since the response involved a non-U.S. facility, current plant specific information was not available to the RST via normal means. Responders were not able to use NRC resident inspectors for gathering information. E-library reference material (drawings, photos, procedures, emergency plans, etc.) did not apply, although responders used E-library to locate information on U.S. facilities with features similar to the plants in Fukushima. However, responders noted that it was difficult to locate documents readily in E-library in part because the labeling convention of documents in E-library is not user-friendly. Searching through E-library to find drawings and procedures of similar facilities consumed time and resources.
4. The Response Program Manager (RPM), responsible for organizing and training the team, had many competing responsibilities during the response effort. Once it became clear that shift work would be extended for a long period, the RPM did not shift focus from response actions to planning actions, such as RST watch bills, training RST members, standardizing RST turnovers, document management, and communications protocols.
5. When the response was scaled back, some teams eliminated positions which hampered RST communications. The number of e-mails being sent to the primary RST e-mail address (RST Coordinator) was extremely large. When that position was no longer assigned, the tracking, prioritizing and distributing incoming information resulted in lost information and other communication related shortcomings.

# APPENDIX D: LIAISON TEAM

## Liaison Team Mission:

The mission of the Liaison Team (LT) is to support the decision making, external coordination, and communication needs of the ET; communicate and coordinate effectively with Federal, State, International and Congressional stakeholders; and support the mission-critical functions of peer organizations and teams. When fully staffed, the LT consists of approximately 12 response specialists who manage liaison functions with Federal, State, local, Congressional and international partners of the NRC.

## Narrative of Response:

The LT began staffing on March 11, 2011. The LT filled all positions, with the exception of the Deputy Director and Technical Advisor positions. The LT communicated with external stakeholders about the NRC's involvement in the response. The team helped to coordinate communications and data exchange with other agencies and provided this data to other NRC response teams. The LT produced a daily NRC Status Update and a spreadsheet of the HOC's daily conference calls. After the U.S. Agency for International Development (USAID) mission in Japan ended, the LT also coordinated much of the travel to Japan for the Japan Team.

The NRC's Interagency Response Team (IRT), embedded with the USAID Response Management Team in Washington, DC, served as NRC's representative for aspects of interagency coordination and communication.

By the second week of the response, the LT received assistance in the form of on-site liaison staff from DOE, the Federal Emergency Management Agency (FEMA), and the Department of State (DOS), the latter of which provided an interpreter. All three agencies provided their liaisons on a 24/7 basis, or as needed.

## Best Practices/New Procedures:

1. The cross-training conducted throughout the HOC allowed many LT members to cover open positions on other teams during the response, and allowed individuals from the Safeguards Team to assist the LT with staffing. This cross-training process created more depth and capability within the LT.
2. DOS, FEMA, and DOE provided liaison staff to the LT room to assist in the coordination of response efforts.
3. The creation of a traveler's checklist for the Japan Team was a useful outcome of this response. The checklist helped manage the various requirements needed for travelers to complete before and after their trip.

## Challenges:

1. LT procedures do not provide sufficient guidance for coordination and communication, including a detailed framework for staffing an IRT. IRT response procedures call for sending IRT members to represent NRC interests at the Department of Homeland Security (DHS) National Operations Center (NOC) and the FEMA National Response Coordination Center (NRCC). For this international event, these operations centers did not activate. Instead, the LT maintained a 24-hour liaison presence at the USAID for over a month. The USAID office had not been identified previously in IRT response procedures; therefore, turnover procedures, network password accounts, and other protocols were absent. Additionally, no process exists for routinely providing information updates to IRT members. As a result, IRT members had difficulty staying informed of the NRC's current priorities, goals and upcoming activities.
2. During the international response, several States called the LT or spoke frequently with NRC Regional State Liaison Officers (RSLOs) to obtain event information. Responders were unsure what information they were able to share with Governor-appointed State Liaison Officers, State Radiation Control Program Directors, and U.S. Territories, or if information could be shared electronically. This also applied to the IRT and the sharing of information to interagency partners.
3. Near the end of the response, the LT was assigned the task of producing the daily, six-page NRC Status Update. At the end of each shift, every team prepared a summary describing what the team accomplished and what challenges were encountered. Many of the teams carried over items on their summaries for weeks at a time, which led to confusion about which items were actually current, thus complicating the creation of the Status Update.
4. Certain assigned roles of the Executive Briefing Team (EBT) overlapped with those of the LT, causing confusion between the teams.
5. The ET requested that the LT frequently check the International Atomic Energy Agency (IAEA) Emergency Notification and Assistance Convention (ENAC) Web site to see if IAEA had additional technical information on Fukushima plant status. No members of the LT had access to IAEA websites, including ENAC. Therefore, the LT had to request access through the Headquarters Operations Officers (HOO).
6. There is currently no high-level milestone/priority/major issues board displaying objectives for each shift where response teams can continuously provide updates.
7. The Homeland Security Information Network (HSIN) is a DHS information sharing platform designed to provide all credentialed responders at the Federal, State, and local levels with a common operating picture. Some LT members did not have access to HSIN, which restricted their ability to view what other Federal, State, and local governments and agencies were posting for event status information.

## APPENDIX E: EXECUTIVE SUPPORT TEAM

### Executive Support Team Mission:

The mission of the Executive Support Team (EST) is to provide overall administrative and technical support to the ET and other response teams. The EST prepares, reviews, and displays ET products, such as the ET Chronology, Significant Events Board, ET Task Tracking, HQ Team Priorities, and Team Status Displays. The EST ensures all operational support and logistical needs are provided to the HQ response teams. The EST maintains and distributes ET products to the appropriate stakeholders, and supports the communication and information exchange of the ET. When fully staffed, the EST consists of approximately 12 specialists with a wide-range of skills including administrative, technical, communications, and response program expertise.

### Narrative of Response:

As the crisis at the Fukushima Dai-ichi nuclear plant escalated, and the lead for monitoring shifted from Region IV to HQ, the EST began filling key positions, such as the EST Status Officer and EST Chronologist, to support the response efforts. Within two days of the event, the EST was fully staffed. Due to the unique nature of the Japan response, leadership modified some of EST roles and responsibilities to meet the unusual challenges of this event response.

### Best Practices/New Procedures:

1. The Executive Briefing Team (EBT) was helpful during the response, although the team structure is not currently formalized. EBT procedures, the Situation Report (SITREP) template, the one-page briefing template, the go-book template, and the resources list developed during the response were all very useful.

2. During the response, the EST developed a procedure for assigning protracted tasks to line organizations within the agency. The EST used this process effectively during the final stages of the response.

### Challenges:

1. Responders inconsistently used the established process for tracking tasks within the Task Tracker in WebEOC. This created additional work for the ET and EST by having two status assignments and tasks (one created by manually obtaining the needed input and the other created using the automated system). This also contributed to issues associated with the lack of team continuity and incomplete turnover between shifts.

2. Responders' knowledge of the roles and responsibilities of the EST was limited. Due to the large administrative burden associated with this response, the EST was overwhelmed with tasks.

3. The process for creating and filling an ongoing response watch bill was ineffective and the team responsibilities for completion of the document were not well-defined.

## APPENDIX F: HEADQUARTERS OPERATIONS OFFICERS

### Headquarters Operations Officer Mission:

The mission of the HOOs and Headquarters Emergency Response Officers (HERO) is to staff the HOC 24 hours-a-day, 365 days-a-year. The HOO and HERO receive incident information and emergency declaration notifications at the HOC from NRC licensees, agreement States, Government agencies and private entities, and perform an initial assessment of the safety significance of each report. The HOO and HERO immediately notify appropriate NRC officials at the onset of an incident or emergency in case a decision to escalate the NRC response mode is necessary. In addition to internal notifications, the HOO and HERO notify other Federal organizations and, if appropriate, licensees, and local, State, and Tribal organizations. When the HOC is activated, the HOO and HERO assemble teams of specialists and directors to evaluate incident information and to assess the potential impact of the incident or emergency.

### Narrative of Response:

The activities associated with the events in Japan fully exercised HOO/HERO personnel and equipment capacities. As expected, activities increased in the first few days and remained constant in the weeks that followed. Over a month passed before the normal complement of one HOO and one HERO were able to handle the volume of activity without additional support. During normal business hours, the NRC stationed a third qualified HOO/HERO in the HOO area to share the workload. During non-business hours, when the HOO and HERO normally complete routine administrative work, the two watch officers on duty were fully engaged in the Japan response. The HOOs delegated some routine administrative work to the Operations Officers in other Regions. Region IV staffed its Incident Response Center (IRC) to assist with public inquiry calls. The HOOs used the Avaya® conferencing system as well as the Communicator's Automated Notification System extensively, which assisted in the management of the many daily conference calls. In addition to supporting the events in Japan, the HOC continued to receive event notifications from U.S. licensed facilities. This included nine emergency classifications while the NRC was in Monitoring Mode.

### Best Practices/New Procedures:

1. ROOs obtained daily plant status, prepared the Executive Director for Operations (EDO) briefing package, and conducted other routine administrative tasks normally executed by the HOOs. This allowed the HOOs to remain fully engaged with the Japan response, while simultaneously allowing the ROOs to gain greater proficiency in HOO activities.
2. The NRC assigned a third HOO/HERO during the day to help distribute the workload of HOO/HERO duties. While the HOO/HEROs were engaged in Japan activities, the third HOO/HERO was available to handle reports associated with domestic events.
3. The HOOs developed a contact information list for other responding agencies. The consolidated list proved useful to the LT and was helpful during turnovers.

### Challenges:

1. Coordinating conference calls for the response teams was difficult and time consuming. During some of the most hectic days of the response, the HOOs were supporting over 25 conference reservations each day.
2. Inquiries from the public challenged the HOOs and HEROs. Regional Operations Officers (ROO) assisted with fielding these calls, and the Office of Public Affairs (OPA) set up an e-mail account which citizens could use to send their recommendations and inquiries.

# APPENDIX G: JAPAN TEAM

## Japan Team Mission:

The mission of a Site Team in a domestic event is to aid in the assessment of a licensee's actions in mitigating the adverse consequences of an incident. This NRC region-based team also assists in confirming licensee recommendations and helping the State to develop protective action decisions. The NRC dispatched a Japan Team comprised of NRC HQ and regional staff that performed functions similar to a Site Team. These functions typically included communicating with onsite response stakeholders, leading the NRC response activities onsite, and assessing the actions of the plant owner/operator.

## Narrative of Response:

Immediately following the incident, the NRC dispatched a team of reactor experts, international affairs staffers and senior managers to the U.S. Embassy in Japan. Serving as part of a USAID disaster assistance response team, the NRC team was sent to Tokyo to provide assistance as requested by the Japanese government.

The mission of the NRC's Japan Team was to conduct activities needed to understand the status of efforts to safely shut down the Japanese reactors, better understand the potential impact of any radioactive releases on people and the environment, provide technical advice and support through the U.S. Ambassador to the Japanese government, and draw on NRC-HQ expertise for any other additional technical requirements. The team was in communication with the Japanese regulator, the U.S. Embassy, NRC HQ, and other domestic and international stakeholders throughout the response.

## Best Practices/New Procedures:

1. Interactions with USAID worked very well during the response. USAID readily provided resources to fund necessities such as conference rooms, copiers, and fax machines.

2. The Japan Team found it very helpful when the NRC HOC scheduled videoconferences and calls during working hours in Japan.

## Challenges:

1. The NRC had not trained responders on international deployment. Responders stated that they used the first few days of their time in Japan determining what they needed to know.
2. In Japan, there were a number of U.S. agencies assisting in the response such as the U.S. Embassy, Department of Defense (DOD), DOE, and USAID. Some Japan Team members were not aware of the roles or responsibilities of the various agencies or which agencies were the appropriate resources for certain information.
3. The Japan Team was also unsure of what information and documents they were permitted to share outside the organization. Many of the international agencies

requested copies of NRC documents, but the NRC did not release them. The Japan Teams commented that there was no information clearinghouse established to approve information for release or develop a non-disclosure agreement.

4. Responders in Japan reported numerous issues regarding technological resources used in Japan, as there was no onsite NRC technical support to assist responders. Responders reported numerous issues with BlackBerries® not receiving e-mails or not working until late in the response. There were also significant computer-related issues. NRC laptops at the Embassy functioned at extremely slow speeds, especially when downloading and transferring files. Embassy technical support staff tried to assist but were often unsuccessful due to NRC computer security and credentialing features. The Japan Team staff resorted to using their personal computers with wireless modems since they performed at faster speeds. However, the potential security issues presented by this approach concerned Embassy officials. Other technical complications included the lack of a multipage scanner (which hindered responders' ability to send information back to HQ) and the inability to view certain files provided by foreign agencies.
5. Language translation services were provided at meetings, but services for written documents was more limited due to the time required to translate a document, the high demand for translators, and the associated costs.

# APPENDIX H: PUBLIC AFFAIRS

## Office of Public Affairs Mission:

OPA provides the public and news media clear, accurate, and complete information about NRC programs, policy decisions, and activities, primarily by issuing news releases, fact sheets, and brochures. The office follows news coverage of the agency and responds to media and public inquiries. Should a serious event occur involving an NRC licensee, OPA would provide immediate crisis communication support, including, if appropriate, implementing the Emergency Event Web page.

## Narrative of Response:

OPA began staffing the HOC on Friday, March 11, 2011, and disseminated the first of many press releases and blog posts that day. Initial talking points and Questions and Answers (Q&A) were also created and disseminated via WebEOC.

OPA continued staffing the Japanese response with 24-hour coverage for several months using a modified Incident Command System. Regional OPA staff members handled local/regional media inquires and several traveled to HQ to provide overnight OPA HQ coverage. OPA also used more than a dozen employees from around the agency to augment the staff and allow OPA to respond to hundreds of media and public requests for information. Two public affairs staffers from FEMA also supported NRC's response efforts for several days.

The OPA Director accompanied the Chairman to the White House and to Congress, and arranged multiple briefings for the White House press corps while designated media briefers gave phone interviews to domestic and international media. A first-ever Public Inquiry Desk was created and staffed with individuals from an "Adjunct Public Affairs Officers" list and others. Responders staffing the desk answered phone and e-mail inquiries for extended daily hours and on weekends for several months. A special Japan page was created on the Web site to make it easier for the public to obtain Japan-specific information, including press releases, Q&As, backgrounders and fact sheets, and links to the blog posts. Media coverage of the NRC's role in the Japan response and the correlation of the Japanese incident to safety at U.S. nuclear power plants was significant. OPA monitored the news media and provided extensive reports on press coverage and published those reports on the NRC Intranet.

Throughout the response, OPA was in continuous communication with members of the ET, LT, PMT, and RST in order to obtain and disseminate information. OPA also was in contact with the White House, DHS, the Department of Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC), and other relevant federal agencies, and worked with the NRC State liaison desk to provide information to State officials.

### Best Practices/New Procedures:

1. This was the first opportunity for OPA to use social media during a crisis situation. OPA staff continuously updated the NRC blog. This blog received more than 5,000 views per day.

2. The Public Inquiry Desk served a vital function in providing accurate communications to a concerned public, channeling public inquiries into a central location, and providing feedback to OPA about public concerns that could be addressed via various communications tools.

3. Before the response, OPA had developed a basic outline for a Public Inquiry Desk with a possible roster of staff as part of their crisis communications strategy. However, it had never been tested or fully institutionalized as an NRC emergency function. During the response, OPA stood up the desk and staffed it with volunteers from throughout the agency, using notes created by OPA. Throughout the response, it became clear that the desk served a very important, but time-consuming function.

### Significant Challenges:

1. OPA did not have the resources to staff the Public Inquiry Desk themselves.
2. OPA has recognized the need to augment its staff in times of crisis and has an "adjunct public affairs" roster of individuals and technical briefers who agree to support OPA during incidents. During the response to Japan, the importance of these rosters became clear. Currently, OPA's rosters are limited and do not include technical briefers, nuclear power or material experts, or health physicists.

## APPENDIX I: BEST PRACTICES

The following feedback from responders covers the best practices – actions taken which were most valuable in generating an effective response. This section highlights both established procedures that produced positive results, as well as improvised procedures that might be applied to future responses.

- **The responders' flexibility and dedication was essential to provide vital services throughout the response.** Although the agency does not train for protracted international events, volunteer responders adapted to the situation and continuously staffed a 24-hour watch bill for nine weeks. This enabled the agency to perform a vital role to ensure adequate protection of public health and safety.

- **Daily conference calls were an effective method to communicate and exchange information with stakeholders outside of the agency.** The NRC regularly scheduled conference calls with other Federal agencies, industry, and the international community to share the latest information between key decision makers and exchange ideas.

- **A timeline of all conference calls resolved many coordination and scheduling issues.** The HOC compiled a list of all conference calls with call instructions and the purpose of calls on WebEOC. This improved coordination among teams and ensured all teams were appropriately informed of daily events.

- **Bi-lingual meetings in Japan were more effective when translators were pre-briefed on relevant terms and technical phrases.** Pre-briefings with translators allowed those translators who lacked a comprehensive scientific background to gain advance familiarity with discussion topics.

- **Turnover briefings provided effective knowledge transfer and shift continuity.** The ET led a 15-minute briefing that efficiently and effectively communicated future priorities and past events, maintaining information continuity between shifts.

- **It was helpful for new responders to shadow more seasoned responders for several hours prior to their assigned shift.** While this occasionally created distractions, this practice helped to ensure that new responders acquired basic knowledge of skills and processes when they lacked the necessary qualifications or expertise. Response teams found cross training to be relatively simple, and once a new skill was obtained, that team member could then train his or her relief on the new task. Additionally, this process was an efficient method for increasing bench strength.

- **The HOC used SITREPs and one-page briefing reports as an effective tool for information sharing.** SITREPS and one-page briefing reports kept stakeholders aware of the latest information. The NRC received positive feedback on the SITREPS from other Federal agencies.

- **The EST effectively managed responder parking at HQ.** The Office of Administration was successful in managing and coordinating continuous parking access for responders.

In particular, NRC created temporary parking permits specifically for the event. Providing parking spaces for responders gave them the flexibility to drive to the HOC at any time when other transportation methods were not available or feasible.

- **The travel checklist for responders traveling abroad was very helpful.** An itemized checklist that merged all the significant issues regarding medical/security/travel/logistics served as a simple tool to relieve the hassle of short-notice foreign travel.

- **The Multiple Event Status Display Board efficiently organized information for the six units at Fukushima Dai-ichi.** Response teams found the status board particularly useful for maintaining awareness of the status of all six Fukushima reactors, containments, and spent fuel pools.

- **Interagency liaisons within the HOC were valuable resources.** These liaisons provided an added level of interagency communication and coordination, significantly improving the transfer of vital information. Specifically, liaison staff from DOS, DOE, and FEMA proved essential for the coordination of the government response.

- **Early interface with U.S. licensees and private industry facilitated collaboration during the response.** This collaboration provided the Japan Team and the ET important information regarding similar reactors, operator expertise, and mitigation strategies.

- **Posting important data constants for computational analysis (e.g., RASCAL) assisted in minimizing duplicative efforts.** Much of the data generated during the response was dynamic. Multiple sources of information and figures made the development of accurate recommendations difficult. However, there was agreement on some figures that would not change, such as, Global Positioning System (GPS) coordinates of reactors, number of fuel rods, etc. This information was posted permanently in the HOC, preventing responders from repeatedly having to search for known constants.

- **WebEOC was a useful asset during the response.** Use of the WebEOC turnover checklist facilitated turnover and communication. Furthermore, teams used WebEOC as a tool to track tasks, keep a flowing chronology, and provide graphics.

- **Laptops and other devices provided a mobile capability for the responders.** The portability of laptops and other mobile devices assisted the response teams in completing their tasks during the busy days of the event when responders were constantly changing locations.

- **Tagging and dating sources of information made referencing the original source documents easier.** During the response, information flowed into the HOC from varying sources; labeling the date and source of information allowed responders to quickly reference original source documents.

- **Region IV developed useful guidelines on how to answer frequently asked questions from the public.** After a few days of taking public calls, responders realized that most queries could be categorized under thirteen topics ranging from dangers within U.S. to proposals for assistance related to the Japan event. Responders created guidelines for how to answer these recurring questions and subsequently distributed this information to the entire NRC via the Operating Experience Branch (IOEB) Clearinghouse Summary. These guidelines were an effective starting point for efficiently handling a large volume of calls.

- **The creation of a long term tracking system facilitated the assignment of tasks that required multiple shifts to complete.** This system, developed during the later phases of the response, allowed the HOC to task NRC line organizations with longer-term projects or actions.

## APPENDIX J: ACRONYMS

| Acronym | Definition |
|---|---|
| **AAR** | After Action Report |
| **ADAMS** | Agency-Wide Documents Access and Management System |
| **CDC** | Centers for Disease Control and Prevention |
| **DEDO** | Deputy Executive Director for Operations |
| **DHS** | U.S. Department of Homeland Security |
| **DOD** | U.S. Department of Defense |
| **DOE** | U.S. Department of Energy |
| **DOS** | U.S. Department of State |
| **EBT** | Executive Briefing Team |
| **EDO** | Executive Director for Operations |
| **ENAC** | Emergency Notification and Assistance Convention |
| **EPA** | U.S. Environmental Protection Agency |
| **EPZ** | Emergency Planning Zone |
| **ERDS** | Emergency Response Data System |
| **EST** | Executive Support Team |
| **ET** | Executive Team |
| **FEMA** | Federal Emergency Management Agency |
| **FOIA** | Freedom of Information Act |
| **GEH** | General Electric Hitachi |
| **GIS** | Geographical Information Systems |
| **GPS** | Global Positioning System |
| **HERO** | Headquarters Emergency Response Officer |
| **HHS** | U.S. Department of Health and Human Services |
| **HOC** | Headquarters Operations Center |
| **HOO** | Headquarters Operations Officer |
| **HQ** | Headquarters |
| **HSIN** | Homeland Security Information Network |
| **IAEA** | International Atomic Energy Agency |
| **IOEB** | Operating Experience Branch, Office of Nuclear Reactor Regulation, U.S.NRC |
| **INPO** | Institute for Nuclear Power Operations |
| **IRC** | Incident Response Center |
| **IRT** | Interagency Response Team |
| **KI** | Potassium Iodide |
| **LAN** | Local Area Network |
| **LT** | Liaison Team |
| **MD** | Management Directive |
| **MEXT** | Japanese Ministry of Education, Sports, Culture, Science and Technology |
| **NARAC** | National Atmospheric Release Advisory Center |
| **NOAA** | National Oceanic and Atmospheric Administration |
| **NOC** | National Operations Center |
| **NRC** | U.S. Nuclear Regulatory Commission |

| Acronym | Definition |
|---|---|
| **NRCC** | National Response Coordination Center |
| **NRF** | National Response Framework |
| **NRR** | Office of Nuclear Reactor Regulation, U.S.NRC |
| **NSIR** | Office of Nuclear Security and Incident Response, U.S.NRC |
| **OPA** | Office of Public Affairs, U.S. NRC |
| **OUO** | Official Use Only |
| **PACOM** | Pacific Command, U.S., DOD |
| **PAAD** | Protective Actions Assistant Director |
| **PMT** | Protective Measures Team |
| **POC** | Point of Contact |
| **Q&A** | Question and Answer |
| **RAAD** | Radiological Assessment Assistant Director |
| **RASCAL** | Radiological Assessment System for Consequence Analysis |
| **ROO** | Regional Operations Officer |
| **RPM** | Response Program Manager |
| **RSLO** | Regional State Liaison Officer |
| **RST** | Reactor Safety Team |
| **SITREP** | Situation Report |
| **SME** | Subject Matter Expert |
| **TA** | Technical Assistants |
| **TEPCO** | Tokyo Electric Power Company |
| **U.S.** | United States |
| **USAID** | U.S. Agency for International Development |


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