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(STP-06-039, May, Other, Hurricane Season)

May 4, 2006

ALL AGREEMENT AND NON-AGREEMENT STATES

**2005 HURRICANE SEASON LESSONS LEARNED TASK FORCE FINAL REPORT (STP-06-039)**

Enclosed, for your information, is the 2005 Hurricane Season Lessons Learned Task Force Final Report, dated March 30, 2006. The report contains a number of helpful recommendations on regulatory issues involving pre-storm preparation and post-storm recovery for radioactive material and reactor licensees. These recommendations are based on interviews with State Officials, U. S. Nuclear Regulatory Commission managers and staff, individuals from other Federal agencies and commercial nuclear power plants.

We appreciate the input provided by the Agreement States and the Non-Agreement States. We especially appreciate the participation on this project by Ms. Alice H. Rogers, Texas, who represented the Organization of Agreement States, Inc. and the Conference of Radiation Control Program Directors, Inc.

If you have any questions on this correspondence, please contact me or the individual named below.

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Enclosure:
As stated

# TASK FORCE REPORT

# 2005 HURRICANE SEASON

# LESSONS LEARNED

# FINAL REPORT

## March 30, 2006


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# EXECUTIVE SUMMARY

For more than 25 years, the U.S. Nuclear Regulatory Commission (NRC) has implemented improvements in its emergency preparedness and incident response programs and continues today to be vigilant in ensuring the adequate protection of public health and safety, common defense and security, and the environment before, during, and after natural or manmade emergencies. During this time, a combination of features has proven effective against severe natural phenomena. These features include robust nuclear power plant design and construction, comprehensive emergency preparedness programs and implementing procedures that improved after September 11, 2001, and well-trained staff. As the response to Hurricane Katrina and others demonstrates, the emergency preparedness capabilities and established procedures of the NRC and its licensees have proven to be effective in responding to events at licensee facilities, including natural phenomena. Senator Inhofe, Chairman of the Senate Environmental and Public Works Committee, commented very favorably on the NRC's response to Hurricane Katrina. The NRC is committed to continuous assessment and enhancement of these capabilities. The NRC has already applied insights from the response to Hurricane Katrina in preparing for and responding to Hurricanes Rita and Wilma and will further enhance coordination with the Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) to ensure effective emergency preparedness and safe and timely return to service of nuclear power plants (NPPs) and other licensed facilities when public safety can be assured.

The 2005 season was the most active hurricane season in the United States on record with the most hurricanes and the most Category 5 hurricanes. Even so, none of the commercial power plants in the path of these storms sustained any significant damage. Close coordination between the NRC and FEMA allowed the NPPs to restart in a timely manner following the passage of the storms. Radioactive sources, typically sealed and in devices, presented a different challenge—in variety and location—with less risk. The traditional focus of the regulation of radioactive sources was the protection of workers and the public from their misuse or from accidents. Security measures were also a concern, but the principal aim was to prevent petty theft or accidental loss. After the events of September 11, 2001, the NRC implemented a number of measures to improve the security of radioactive materials. The outstanding efforts of

State and Federal authorities, with the support of the NRC, provided for the safety and security of these radioactive sources during the 2005 season.

The NRC's Executive Director for Operations (EDO) directed that a task force involving all the major offices responsible for hurricane response functions conduct a lessons learned review for the 2005 hurricane season (The 2005 Hurricane Season Lessons Learned Task Force). The task force charter required the members to develop a set of lessons that can be applied to natural phenomena including topics such as the National Response Plan (NRP), radioactive materials, communications, compensatory measures, recurrence of prior lessons learned, and impact on NRC staff. In addition, the task force considered insights from the staff's development of a Lessons Learned Program while formulating its findings and recommendations. The task force members collected data from NRC Commissioners and staff, other Federal agencies, State representatives, and licensees. The primary data collection methods were structured interviews and review of other agency lessons learned reports.

Based on its review, the task force made 13 recommendations and assigned them a priority of 1, 2, or 3 (three priority 1, eight priority 2, and two priority 3). The recommendations were grouped in the areas of coordination and communications, roles and responsibilities/ management expectations, and caring for NRC employee needs. The priority 1 recommendations are as follows:

(1) The NRC should assess agency communications equipment and services associated with emergency notifications systems and recommend improvements in diversity and reliability.

(2) By May 10, 2006, the NRC should improve existing natural phenomenon response procedures for reactor and fuel facilities and materials licensees to clearly define roles and responsibilities, provide responder guidance, and to be consistent across the regional offices.

(3) By June 1, 2006, the NRC should improve consistency and apply best practices in dispatching and maintaining accountability of responders and site staff. The accountability of staff should be highly visible.

The task force members compared the lessons learned from Hurricane Andrew in 1992 to those identified in this report. One out of twelve of those Hurricane Andrew lessons learned recommendations recurred to some extent. All communication was lost at Turkey Point Nuclear Generating Station following Hurricane Andrew because of wind damage. As a result of Hurricane Andrew, the NRC arranged for portable satellite communications equipment to be available as required. Later, in response to concerns about computer problems resulting from the coming of the Year 2000 (Y2K), the NRC implemented a program of hand-held satellite communications for the resident inspectors at each reactor facility. Following Hurricane Katrina, normal communications with Waterford 3 were lost because of flooding; however, hand-held satellite communications with the licensee and the NRC staff on site were generally available.

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# LIST OF ACRONYMS

| | |
|---|---|
| DEQ | Department of Environmental Quality |
| DHS | United States Department of Homeland Security |
| DOE | United States Department of Energy |
| EDO | Executive Director for Operations |
| EOC | Emergency Operations Center |
| EP | Emergency Preparedness |
| EPA | United States Environmental Protection Agency |
| EPZ | Emergency Planning Zone |
| ESF | Emergency Support Function |
| FEMA | Federal Emergency Management Agency |
| GPS | Global Positioning System |
| HOC | Headquarters Operations Center |
| IAEA | International Atomic Energy Agency |
| IPE/IPEEE | Individual Plant Examination/Individual Plant Examination of External Events |
| IRC | Incident Response Center |
| LDEQ | Louisiana Department of Environmental Quality |
| NMSS | Office of Nuclear Material Safety and Safeguards |
| NPP | Nuclear Power Plant |
| NRC | United States Nuclear Regulatory Commission |
| NRP | National Response Plan |
| NRR | Office of Nuclear Reactor Regulation |
| NSIR | Office of Nuclear Security and Incident Response |
| OSTP | Office of State and Tribal Programs |
| RAM | Radioactive Materials |
| RCP | Radiation Control Program |
| SITREP | Situation Report |
| U.S. | United States |
| Y2K | Year 2000 |

# 1. NRC RESPONSE TO NATURAL PHENOMENA

## 1.1 Overview of Nuclear Emergency Preparedness and Response

The U.S. Nuclear Regulatory Commission's (NRC's) mission is to license and regulate the Nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment. This includes nuclear power plants (NPPs) and facilities containing licensed materials and applies during routine operations and during abnormal or emergency conditions, including natural emergencies such as hurricanes. The NRC takes an integrated approach to safety, security, and emergency preparedness (EP) in carrying out this mission. This approach, combined with the defense-in-depth strategy the NRC uses for licensing the design, construction, and operation of NPPs, provides substantial protection against severe natural phenomena, such as hurricanes and tornadoes.

The well-established capabilities and procedures of the NRC, its Federal and Agreement State partners, and its licensees proved to be effective during the 2005 hurricane season for NRC areas of responsibility. The NPPs affected by these storms were essentially undamaged. Concurrently with the disciplined approach to preparation by its nuclear reactor licensees, the NRC initiated pertinent command and control of emergency response activities early and activated the NRC Regional Incident Response Centers (IRCs) and the NRC Headquarters Operations Center (HOC) in Rockville, Maryland, as the hurricanes approached the U.S. coast, with substantial participation from all regions and senior management, including as appropriate, the Chairman. In addition, the NRC and State regulatory agencies initiated and implemented EP and response activities to account for and ensure the safety and security of radioactive materials. The States affected by hurricanes are predominantly Agreement States. These States, through formal agreements with the NRC, have regulatory authority over most radioactive sources within their States. This authority does not include reactors, large quantities of special nuclear material, or materials licensed to Federal Government agencies. The NRC coordinated extensively with the Agreement States and Federal licensees to ensure that the safety and security of risk-significant radioactive sources were maintained. Figure 1 shows a map of the Agreement States.

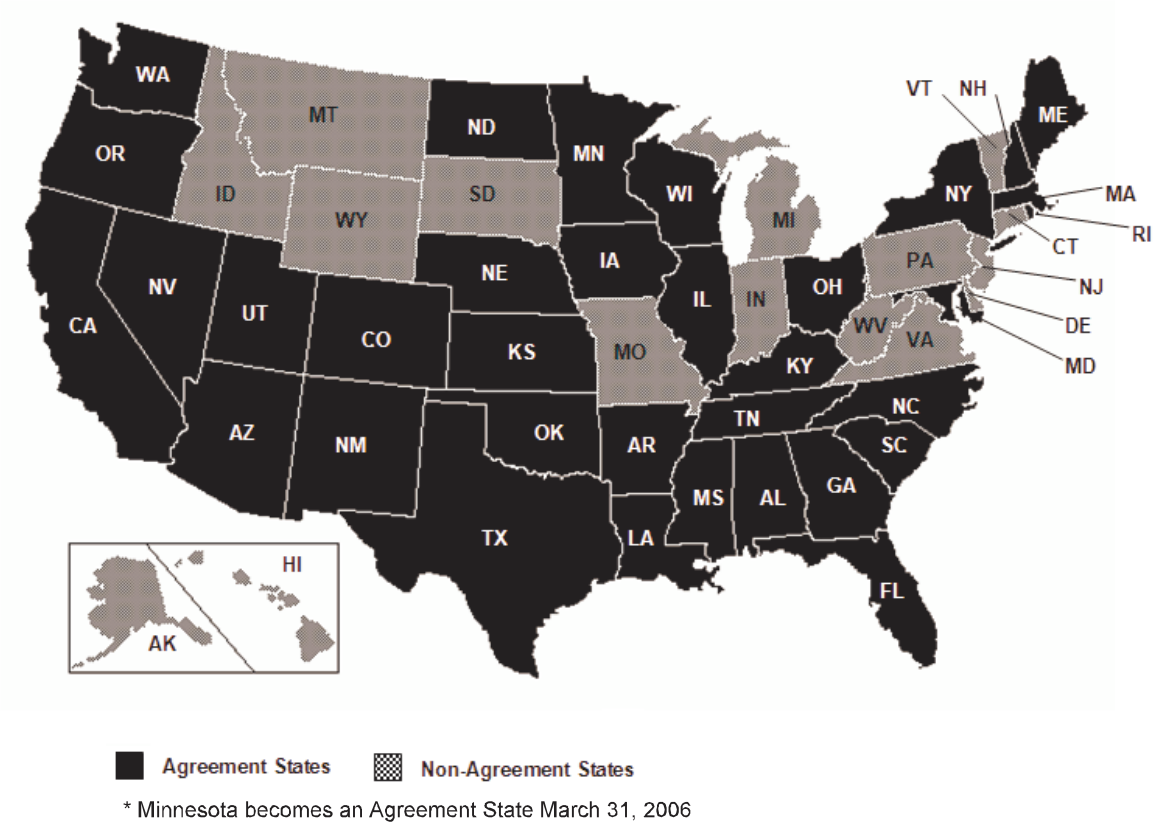


**Figure 1 Map of the Agreement States**

For NPPs, emergency planning begins with robust facility designs. NRC regulations require each NPP to be designed and constructed to withstand the effects of severe natural phenomena pertinent to the surrounding area, along with added margins of safety for even more extreme postulated events. The design of these facilities considers the combination of the effects of natural phenomena with the effects of normal and accident conditions at the plant. For example, NPPs in Florida and along the Gulf Coast are designed with capabilities to mitigate plant accidents even with the effects of hurricanes, flooding, and loss of offsite power from the electrical grid, while NPPs in California have capabilities to mitigate plant accidents even with the effects of a severe earthquake and loss of offsite power from the electrical grid. Specific measures at Waterford 3, the NPP closest to New Orleans, include protective features against flooding, such as watertight compartment doors for safety-related equipment.

Over the years, U.S. NPPs have experienced the direct impacts of severe natural phenomena, and their robust design and construction have enabled them to successfully withstand such events. Some of the events experienced within the past 15 years include the following:

- Hurricane Andrew, a Category 5 hurricane, the eye of which passed directly over the Turkey Point Nuclear Generating Station with sustained windspeeds of 145 miles per hour (mph) and gusts up to 175 mph (August 1992)

- onsite flooding from the Missouri River at the Cooper Nuclear Station (July 1993)

- a Fujita Tornado Damage Scale F2 tornado, which directly hit the Davis Besse Nuclear Power Station, with winds of 113 to 157 mph (June 1998)

- the shock from the magnitude 6.5 San Simeon earthquake in Paso Robles, California, at the Diablo Canyon Power Plant (December 2003)

In all of these cases, the NPPs functioned as they were designed, and adequate protection was maintained during and after the event.

NRC regulations also require NPP licensees to have in place comprehensive EP programs (e.g., dedicated emergency response facilities, systems, equipment, and staffing). Detailed site-specific emergency plans and implementing procedures provide instructions and guidelines for dealing with or responding to a variety of emergency situations, including natural phenomena such as hurricanes. These integrated emergency plans are developed in a coordinated manner between the facility licensee and State and local authorities, with oversight by the NRC and Department of Homeland Security/Federal Emergency Management Agency (DHS/FEMA). Emergency response for the sites is periodically inspected by the NRC, and emergency exercises and drills are conducted to help further prepare for a wide spectrum of emergencies, including hurricanes. During these exercises, the NRC works closely with DHS/FEMA in evaluating the acceptability of the emergency plans and response. The NRC evaluates onsite response capabilities and integration of onsite and offsite preparedness and reviews the findings that DHS/FEMA makes regarding offsite emergency planning.

The NRC has exercised its key responsibilities in coordination with DHS and other Federal agencies under the National Response Plan (NRP). In accordance with the NRP, the NRC is the coordinating agency for incidents involving facilities and/or materials licensed by the NRC or an Agreement State. Accordingly, the NRC leads the Federal-level response functions identified in the Nuclear/Radiological Incident Annex of the NRP, with support provided by the cooperating agencies, such as the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). In cooperation with its Federal partners, the NRC implemented the NRP for the major hurricanes in 2005.

The NRC Operations Center, located at its Headquarters Office in Rockville, Maryland, is continually staffed with qualified personnel who have the expertise and ability to evaluate events and alert NRC management, other Federal partners, and licensees, as necessary, to properly respond to unfolding events. Four separate IRCs are also located at the NRC's regional offices in King of Prussia, Pennsylvania; Atlanta, Georgia; Lisle, Illinois; and Arlington, Texas. These centers can be immediately staffed during normal working hours, and within approximately one hour during off hours. Over the years, the NRC has enhanced its emergency response capabilities. These include increased staffing and modernization of facilities and equipment, more frequent exercises with other Federal agencies, and increased interaction with the NRC's international partners to gain knowledge of incident response activities in other countries. The NRC is also playing an active role in enhancing incident response capabilities for radiological emergencies and incidents by conducting tabletop exercises with Federal and State emergency response organizations and outreach activities with local stakeholders. During preparation for and response to emergencies, the agency also discharges its responsibility to communicate developments to congressional delegations and State executives, as appropriate.

The NRC is capable of responding to multiple events, affecting multiple plants at the same time. This was demonstrated when the NRC was responding effectively to Hurricane Katrina while simultaneously participating in a biennial emergency exercise at the Monticello Nuclear Plant in Minnesota on August 30, 2005.

The NRC has an established hurricane response program that is implemented each year during hurricane season, from June 1 through November 30. Throughout the hurricane season, the

NRC monitors potentially hazardous weather conditions in the Atlantic and Pacific Oceans, the Caribbean Sea, and the Gulf of Mexico. For the Atlantic basin, the NRC monitors tropical storm formations developing as far away as the African coast. The NRC relies on hurricane tracking computer programs and data provided by the National Oceanic and Atmospheric Administration that provides current and projected information about developing storms and their proximity to the U.S. coastline.

## 1.2 2005 Hurricane Season

The 2005 season was the most active hurricane season in the United States on record. The 2005 season broke a number of records, including the most named storms (27), the most hurricanes (15), and the most Category 5 hurricanes (4). Table 1 lists the hurricanes for the 2005 season.

**Table 1**

**2005 Atlantic Hurricane Season**

| HURRICANE | DATES | CATEGORY AND MAXIMUM SUSTAINED WINDS | POTENTIALLY AFFECTED SITE(S) | LANDFALL LOCATIONS |
|---|---|---|---|---|
| *CINDY | Jul 3–7 | 1–75 mph | Waterford,<br>Riverbend<br>Grand Gulf, Farley | Extreme SE Louisiana |
| DENNIS | Jul 4–11 | 3–120 mph | Farley | ESE Pensacola, FL |
| **EMILY | Jul 10–21 | 5–155 mph | None | NE Mexico |
| IRENE | Aug 4–18 | 2–105 mph | Brunswick | East coast of US |
| KATRINA | Aug 23–30 | 1–75 mph<br>5–165 mph | St. Lucie, Turkey Pt.<br>Waterford,<br>Riverbend<br>Grand Gulf | Palm Beach, FL<br>SW of Biloxi, MS |
| MARIA | Sep 1–10 | 2–115 mph | Brunswick | East coast of NC |
| NATE | Sep 5–10 | 1–85 mph | None | East of Bermuda |
| OPHELIA | Sep 6–18 | 1–80 mph | Brunswick, Global | East coast of NC |
| PHILIPPE | Sep 17–24 | 1–80 mph | None | None |
| RITA | Sep 17–25 | 2–85 mph<br>5–175 mph | Turkey Point<br>Waterford<br>River Bend<br>Grand Gulf | Near Key West, FL<br>Louisiana/Texas border |
| STAN | Sep 1–5 | 1–80 mph | South Texas | Veracruz, Mexico |
| VINCE | Oct 9–11 | 1–75 mph | None | Spain |
| WILMA | Oct 15–25 | 5–160 mph | St. Lucie, Turkey Pt. | Cape Romano, FL |
| BETA | Oct 27–31 | 3–110 mph | None | Coast of Nicaragua |
| EPSILON | Nov 29–Dec 8 | 1–75 mph | None | Remained off eastern coast of United States |

*Tropical Storm Cindy was upgraded to a hurricane in the post-storm analysis.
**Hurricane Emily was upgraded to a Category 5 hurricane in the post-storm analysis.

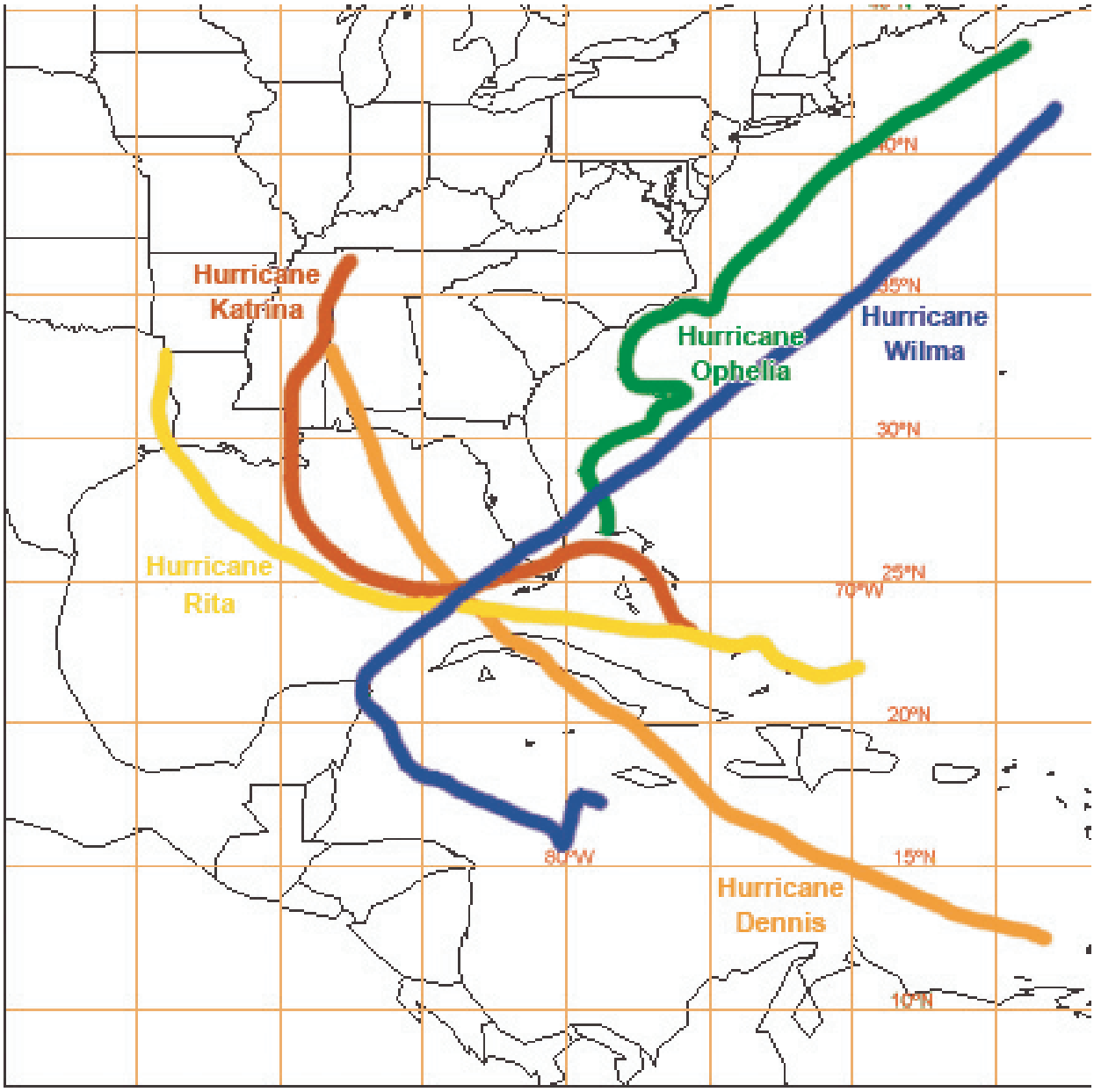


**Figure 2 Approximate Track of the Major 2005 Hurricanes Affecting the United States**

## 1.3 NRC Hurricane Response for Reactors

The NRC and its reactor licensees routinely monitor, prepare for, and respond to hurricanes using well-established procedures. Formal procedures require that each NPP take specific

action(s) under weather conditions specific to each site. For example, the Waterford 3 plant began to shut down the day before Hurricane Katrina made landfall in Louisiana, based on projected sustained windspeeds exceeding 74 mph.

At the beginning of each hurricane season, NPP licensees prepare well in advance by updating procedures and assessing their sites for readiness. For an approaching hurricane, a licensee's response would typically include identification of emergency staffing, plans for activation of emergency support facilities, testing of routine and emergency communications, equipment readiness checks, and updating of contact information with Federal, State, and local agencies.

As shown in Table 1, Hurricane Katrina was the largest storm during the 2005 season and the most damaging storm in U.S. history. The response actions taken for Hurricane Katrina illustrate the extent of the NRC's preparations for and response to a large hurricane. For Hurricane Katrina, the NRC and its licensees took aggressive and prudent steps to prepare for its impact. The NRC and NPP licensees began preparations before Katrina first made landfall in Florida on August 25, 2005. The NRC tracked the hurricane's status carefully from its inception as Tropical Depression 12 on August 24, 2005, when it was located well off the east coast of Florida. The NRC's Region II office in Atlanta, Georgia, initially tracked the storm and issued daily weather updates to alert the Commission, NRC Headquarters, and regional personnel of this storm. The NRC Region II office coordinated with the DHS/FEMA Atlanta regional office, the State of Florida, and NRC licensees, including NPPs and risk-significant radioactive materials licensees, before the storm became a hurricane and maintained communications throughout the passage of the hurricane over Florida. Two NPPs in Florida had the potential to be affected by the hurricane but were not in its direct path. The Turkey Point plant in Florida City and the Saint Lucie plant on Hutchinson Island implemented emergency preparations to ensure the facilities were fully prepared. The NRC issued status reports for these plants to keep internal and other Federal agency stakeholders informed, and the NRC's site resident inspectors monitored site conditions and implementation of the licensees' established procedures for hurricane preparations.

When the storm passed west of longitude W87 on August 27, 2005, the NRC's Region IV office in Arlington, Texas, assumed the lead and monitored Hurricane Katrina as it moved into the Gulf of Mexico. The NRC Region IV IRC coordinated with Louisiana and Mississippi State officials, and on August 28, 2005, an NRC State/Federal Liaison Officer was dispatched to the

FEMA regional office in Denton, Texas. In accordance with the NRC's Incident Response Program, the Chairman of the NRC and NRC senior staff led the agency's response to Hurricane Katrina in both Headquarters and Region IV. Before Hurricane Katrina's arrival along the Gulf Coast States, the NRC staffed its HOC and Region IV IRC with experts to prepare for any unforeseen circumstances, and NRC Region IV dispatched additional inspection staff to augment the NRC resident inspectors assigned to NPPs in Louisiana and Mississippi.

The Grand Gulf plant in Port Gibson, Mississippi, the River Bend plant in Saint Francisville, Louisiana, and the Waterford 3 plant in Killona, Louisiana, were more affected by Hurricane Katrina than the plants located in Florida. Before, during, and after the storm's passage, the NRC closely monitored onsite and offsite activities at each of these sites by maintaining staff in NRC's HOC, in the Region IV IRC, and at the sites. The NRC communicated frequently with Federal partners and provided periodic status reports to DHS. The NRC held routine conference calls with the State of Louisiana and the parishes surrounding the Waterford 3 site and supported the State of Louisiana's Emergency Operations Center (EOC) in Baton Rouge. The NRC provided status information on the conditions and the operational status of NPPs and risk-significant materials facilities in the States of Louisiana and Mississippi for the Federal Joint Field Office, which was established following the DHS declaration of an Incident of National Significance for Hurricane Katrina on August 30, 2005.

All three NPPs sustained no significant damage from the hurricane. However, land-line and cellular communications with the Waterford 3 site were lost because of flooding, electrical outages, and wind damage in the New Orleans area. In addition, offsite power was lost because of instability in the regional electrical grid. In response to the loss of offsite power, electrical power for key safety systems for the Waterford 3 plant was supplied automatically by the plant's standby diesel generators. Prior to the hurricane, the licensee for the Waterford 3 facility obtained two additional diesel generators to supplement the installed units and placed them on site. One of these units was connected following the storm to provide power to nonessential systems. To address the loss of land-line communication, extra land lines were installed and satellite communications equipment was employed for communication following the hurricane's passage at this site. Backup satellite communications equipment was employed by NRC staff at the site to ensure communications between the Waterford 3 site and the Region IV offices to monitor plant conditions and recovery efforts.

Before the restart of the Waterford 3 plant, the NRC staff (including support staff from Headquarters and the regions) independently verified that key plant systems and structures were able to support safe operations at the plant, and in cooperation with DHS/FEMA, the NRC confirmed that the offsite infrastructure was adequate to support plant operations. An NRC regional team evaluated onsite EP and the readiness of the plant for restart. Also, the NRC participated in the DHS/FEMA Disaster Initiated Review Team for the offsite assessment of the Waterford 3 site by reviewing and evaluating offsite EP and response capabilities. After successful completion of these evaluations, the NRC notified the licensee that it had no objection to restart on September 9, 2005, and the Waterford 3 power plant resumed operation, supplying electricity to support recovery of the regional infrastructure.

A number of early lessons were learned during Hurricane Katrina, particularly involving internal and external communication processes such as daily status reports for the Commission, early telephone communications on storm track and strength, and daily DHS situation reports. These improvements were applied to later storms in the season such as Hurricanes Rita and Wilma.

## 1.4 NRC and Agreement State Hurricane Response for Radioactive Material Control

The traditional focus of the regulation of radioactive materials was the protection of workers and the public from the misuse of these materials or from accidents. Security measures were also a concern, but the principal aim was preventing petty theft or accidental loss. The events of September 11, 2001, however, changed the way in which the NRC ensures protection of the public from hazards associated with radioactive sources because of concerns over malevolent use. The NRC and the Agreement States share the regulatory oversight responsibilities for ensuring the safety and security of radioactive materials in the region affected by natural phenomena. For example, the Agreement States of Louisiana, Mississippi, and Alabama, the States most affected by Hurricane Katrina, have regulatory authority over approximately 98 percent of the total number of radioactive materials licensees located within their borders. The NRC has jurisdiction over the remainder, which includes Federal facilities such as veterans hospitals and the U.S. military.

The majority of the NRC and Agreement State licensed material is in the form of sealed

sources. Devices containing sources of the greatest concern because of their radiological risk are designated as Category 1 or 2 in the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources and are referred to in this report as risk-significant sources. Such sources are designed and manufactured in accordance with strict NRC regulatory requirements. These risk-significant sources are subject to strict export-import controls, effective January 1, 2006. They are also listed in an interim NRC database, which will be succeeded by a cradle-to-grave National Source Tracking System in late 2007. These provisions are consistent with the U.S. commitment to the IAEA Code and with provisions in the Energy Policy Act of 2005. To ensure that the source is designed to meet or exceed standards as specified in the regulatory requirements, the NRC or Agreement State must review and approve the manufacturers' applications to manufacture sealed sources and/or devices. Typically, these sources are doubly encapsulated in stainless steel and are manufactured to withstand accidental conditions such as water immersion, fire, and dropping/crushing. When not in use, the sources are stored in a shielded configuration to ensure the safety of the general public and workers.

During the immediate and prolonged recovery from Hurricane Katrina, large areas of Louisiana and Mississippi were abandoned. Buildings that were used for authorized activities under NRC and Agreement State licenses would not be reoccupied for days to weeks. Security and other controls that relied on human surveillance and action to ensure safety were called into question. The NRC worked closely with Agreement States and its own materials licensees (Federal facilities) in those States to monitor the safety and security of risk-significant radioactive sources during the recovery from Hurricane Katrina. The NRC contacted its licensees who possessed Category 1 and Category 2 sources in the affected States to obtain additional information on the status and security of risk-significant materials listed in the existing database. This database included information on licensees regulated by the NRC, Louisiana, Alabama, and Mississippi, which was updated daily as recovery efforts continued. Working with the Agreement States, the NRC was successful in obtaining current information regarding the control and status of risk-significant radioactive materials. In addition, the NRC provided current information for situation reports (SITREPs) required by DHS regarding the status of these risk-significant radioactive sources.

The NRC also discussed the availability of resources for assisting in recovery efforts with its

Federal partners, including the Centers for Disease Control, DOE, EPA, FEMA, and the U.S. Army Corps of Engineers. The NRC also assisted Louisiana with its request for use of the DOE Aerial Monitoring System to detect any misplaced or missing risk-significant radioactive sources. On September 13, 2005, the NRC sent staff to the Louisiana Department of Environmental Quality (LDEQ) for an extended period to enhance communications and assist in the recovery of Category 1 and 2 sources in Louisiana. On September 26, 2005, the NRC sent additional staff to Baton Rouge and Lafayette, Louisiana.

Again, a number of early lessons were learned during Hurricane Katrina in the materials arena, particularly involving reporting the status of risk-significant materials. These improvements were applied to later storms in the season such as Hurricanes Rita and Wilma.

### 1.5 NRC Hurricane Response to Fuel Facilities

The NRC also regulates a number of nuclear fuel facilities. None of these facilities were affected by Hurricane Katrina. The NRC hurricane response program addresses all of these facilities. For example, one of the facilities, Global Nuclear Fuels in Wilmington, North Carolina, had the potential to be affected by Hurricane Ophelia. In this case, the NRC Region II office in Atlanta, Georgia, contacted the licensee before and after the storm to ensure radioactive materials were safely and securely contained.

# 2. NRC TASK FORCE ACTIVITIES

On November 4, 2005, the Executive Director for Operations directed that a task force involving all the major offices responsible for hurricane response functions conduct a lessons learned review for the 2005 hurricane season. The task force charter requires the members to develop a set of lessons that can be applied to natural phenomena and include topics such as the NRP, risk-significant radioactive materials, communications, compensatory measures, and recurrence of prior lessons learned. One area of emphasis was the well being of NRC responders. The tasking memorandum and the charter are included as Appendix A. In addition, the task force was asked to develop its findings in accordance with the agency's new lessons learned process. The task force members collected data from NRC Commissioners, managers, and staff; DHS responders; State representatives; and licensees. The primary data collection methods were structured interviews and review of other agency lessons learned documents.

Task force members conducted telephone interviews, using a structured questionnaire, with Radiation Control Program (RCP) staff from 14 Agreement States and the Commonwealth of Puerto Rico. Valuable information was obtained on their preparations for and response to hurricanes and other natural phenomena. Program staff recommended contacting licensees in the projected path of a storm both before and after landfall. They expressed concern about maintaining reliable communications with licensees and other agencies. RCP staff recommended establishing a Global Positioning System (GPS) database with the exact location of use for licensed radioactive material. They viewed the NRC's support role as consultative, but most States would request direct NRC assistance, if needed. The task force also received suggestions on establishing a single point of contact within the NRC to avoid multiple requests for similar information. RCP staff members shared their experiences regarding support for their first responders. Their staff traveled in pairs, refueled response vehicles at State transportation depots, and carried extra batteries for cell phones and radiation survey instruments. RCP staff mentioned that they could obtain assistance from State universities and other State agencies in assessing radiation hazards and securing risk-significant radioactive sources or devices. The questionnaire and the results of the interviews are included as Appendices B and C, respectively.

Task force staff interviewed many NRC employees who were directly affected by the hurricane response effort. The task force developed three separate questionnaires to interview NRC personnel, including the NPP resident inspector staff, the replacement inspectors dispatched from the regional offices to the sites, and the NRC personnel dispatched to the State facilities. The interviews focused on getting firsthand feedback on topics ranging from administration in the recovery effort to the well-being and care of NRC employees. Overall, the interviews indicated that there was a general improvement in the support of NRC personnel responding to the hurricane(s) when compared to previous hurricane seasons. However, several opportunities for additional improvement were identified.

A member of the task force interviewed DHS/FEMA personnel from FEMA Regions IV and VI (Hurricane Wilma and Hurricane Katrina) who were part of the restart effort. These individuals assessed the offsite response organizations' infrastructure capabilities to respond to a classified emergency event in order to permit restart of the affected nuclear facilities, St. Lucie and Waterford 3. Overall, the interview results showed that the support of the DHS/FEMA assessment by NRC regional state liaison officers was well received and beneficial.

Task force staff participated in an Energy Leadership Forum sponsored by DOE in Tunica, Mississippi, on January 19 and 20, 2006. This forum provided an opportunity to learn from the experiences of industries in the energy and other sectors in responding to Hurricanes Katrina and Rita. The key items from the forum applicable to NRC response were the interconnected nature of electrical power, communications, and fuel supply. Also of significant note was the complete devastation of the infrastructure which normally supports travelers. One oil company speaker commented about the "expeditionary" nature of traveling in the wake of Hurricane Katrina—if you did not carry it (food, water, shelter) with you, you did not have it at all.

Staff interviewed employees of Entergy, the licensee for the Waterford 3 NPP near New Orleans. Entergy management was complimentary toward the responders to the site and the actions the agency took to provide authority to the licensee to restart the facility following Hurricane Katrina. Of particular note was the fact that the inspector sent to supplement the

resident inspectors was a previous resident inspector at Waterford 3 and hence was familiar with both the site and operations. The licensee did not apply any of the compensatory measures required in recent security orders because the impact of Hurricane Katrina on the site was such that those measures were not necessary. The licensee stated that if damage had been more extensive, then those measures would have been applied. However, the licensee did pre-stage two large emergency diesel generators on site in advance of the storm. One of these was connected to nonsafety-related loads after the passage of the storm. The licensee's installed safety-related emergency diesel generators operated as required until offsite power was reliably established. One oil pipeline executive at the Energy Leadership Forum commented that large emergency diesel generators were in very short supply following Hurricanes Katrina and Rita.

In accordance with the charter, the task force also reviewed internal lessons learned documents from various offices and assessed which of those items warranted consideration in this report. Again in accordance with the charter, the task force also reviewed a report on flooding of Le Blayais power plant in France on December 27, 1999, which was suggested by one of the interviewees as a beneficial source of information.

# 3. RECOMMENDATIONS

The task force established a series of recommendations which were characterized as having a priority of 1, 2 or 3. A Priority 1 item represents an issue which, if not resolved, will adversely impact the agency's ability to respond to future events. A Priority 2 item represents an issue which will provide significant benefit to the agency's response to future events. A Priority 3 item represents an issue which will provide some benefit to the agency's response to future events. A total of 13 recommendations were identified:

**Recommendation 1** (Priority 1): The NRC should assess agency communications equipment and services associated with emergency notifications systems and recommend improvements in diversity and reliability.

**Recommendation 2** (Priority 2): The NRC should coordinate with other Federal agencies to determine, as reasonable, each agency's information needs during response to natural phenomena and develop appropriate communications protocols. These requirements should be identified by May 1, 2006.

**Recommendation 3** (Priority 2): By June 1, 2006, NRC procedures for routine or periodic communications (both agency internal and those with external organizations) during response activities should be streamlined to improve efficiency and reduce unnecessary burden.

**Recommendation 4** (Priority 2): The NRC should develop improved tools to enable more effective communications of plant design information and agency response processes. These tools should be made available in advance of the 2006 hurricane season for susceptible facilities (before June 2006).

**Recommendation 5** (Priority 2): The NRC should utilize the information from the evacuations following Hurricanes Katrina and Rita and assess the impacts on the agency's emergency preparedness program.

**Recommendation 6** (Priority 2): By June 1, 2006, the NRC should identify NRC and other personnel available for potential assistance in the field after major events involving nuclear materials.

**Recommendation 7** (Priority 2): The NRC should assess the cost benefit of building on the interim database and the National Source Tracking System to include information on the location of sources (such as latitude and longitude) to enhance response to natural phenomena or other events.

**Recommendation 8** (Priority 3): The NRC should develop and implement processes to efficiently address emergent risk-significant materials license amendments or requests for technical assistance to Agreement States and other agencies following natural phenomena or other emergencies.

**Recommendation 9** (Priority 3): The NRC should transfer NRC oversight of the Mississippi program for oversight of radioactive materials licensees to NRC Region IV in order to minimize the NRC interface burden on the State of Mississippi.

**Recommendation 10** (Priority 1): By May 10, 2006, the NRC should improve existing natural phenomenon response procedures for reactor and fuel facilities and materials licensees to clearly define roles and responsibilities, provide responder guidance, and to be consistent across the regional offices.

**Recommendation 11** (Priority 2): The NRC should form a working group in accordance with Management Directive 5.3 with the Organization of Agreement States and the Conference of Radiation Control Program Directors as appropriate to describe the expectations of NRC and State Radiation Control Program oversight of risk-significant radioactive material licensees in preparation for and/or response to natural phenomena. The results of the working group should incorporated into the NRC's natural phenomenon response procedures to define those activities necessary to ensure adequate regulatory oversight of risk-significant radioactive materials licensees located in Agreement and non-Agreement States (including Puerto Rico and U.S. territories).

**Recommendation 12** (Priority 2): After development and enhancement of NRC procedures for response to natural phenomena, NRC staff and management should be trained on the procedures before June 1, 2006. Consideration should be given to establishing seasonal refresher training requirements and requiring training on these procedures in NRC staff qualification guides.

**Recommendation 13** (Priority 1): By June 1, 2006, the NRC should improve consistency and apply best practices in dispatching and maintaining accountability of responders and site staff. The accountability of staff should be highly visible.

# 4. SUPPORTING OBSERVATIONS

This section includes a series of observations which support the recommendations. They are grouped into three categories—coordination and communications, roles and responsibilities/ management expectations, and caring for NRC employee needs. Each observation includes an examples/discussion section to further illustrate the item. For ease of reference, the task force recommendations are included at the head of each supporting observation(s).

## 4.1 Coordination and Communications

**Recommendation 1** (Priority 1):

> The NRC should assess agency communications equipment and services associated with emergency notifications systems and recommend improvements in diversity and reliability.

Observation:

> Communications following a major natural disaster were not sufficiently diverse and reliable.

Examples/Discussion:

> Following the flooding in New Orleans, all normal (land-line) telephone communications with Waterford 3 were lost. The licensee and the resident inspectors used satellite telephones to contact the NRC, but these telephones do not work well in heavy cloud cover and the operator has to go outside to use them.
>
> Normal cellular telephones were not reliably available following Hurricane Katrina because either towers were damaged or power towers were unavailable. However, some telephones in “radio mode” were functioning. Text messaging and email were

also functioning somewhat effectively.

**Recommendation 2** (Priority 2):

The NRC should coordinate with other Federal agencies to determine, as reasonable, each agency's information needs during response to natural phenomena and develop appropriate communications protocols. These requirements should be identified by May 1, 2006.

Observation:

NRC procedures and practices do not specifically address coordination and communication of risk-significant radioactive materials issues with other Federal agencies (during preparations or during response). Communication roles between States, the NRC, and DHS on radioactive materials issues are not well defined.

Examples/Discussion:

IAEA Category 1 and 2 radioactive materials table updates were requested frequently, and some agencies that received the tables did not understand the information. There were problems with the information flow regarding the updates to the tables; information was passed from Agreement States to Office of Nuclear Security and Incident Response (NSIR) to DHS and was not consistently coordinated with the Office of State and Tribal Programs (OSTP). There were instances when DHS directly obtained updated source information from the State EOCs.

NRC staff prepared an NRC/DHS Joint Information Bulletin, "Assessment of Security of Radioactive Sources in the Hurricane Affected Areas" to better inform responders to potential hazards. However, the bulletin was never issued by DHS because NRC staff did not follow the appropriate procedures for issuing the bulletin.

NRC staff was unclear on the requirements and methods for communicating information on risk-significant radioactive sources to the various Emergency Support

Function (ESF) groups. The NRP contains 15 ESF annexes (for example, ESF 10, Oil and Hazardous Materials Response).

**Recommendation 3** (Priority 2):

By June 1, 2006, NRC procedures for routine or periodic communications (both agency internal and those with external organizations) during response activities should be streamlined to improve efficiency and reduce unnecessary burden.

Observation:

Agreement States initially had to deal with multiple NRC contacts, and NRC communications with Agreement States were not well coordinated.

Examples/Discussion:

State RCP managers indicated that just before and immediately after the storms, different NRC callers contacted them with some redundant questions. The State officials indicated that it was not always clear what the NRC would do with some of the requested information. The NRC regional offices actively stressed single NRC contact points, but States still felt strongly that they had to spend too much time answering NRC questions.

Mississippi State authorities report to NRC Region IV for reactor issues but to NRC Region I for radioactive materials matters. (Currently for Mississippi, NRC Region I is responsible for oversight of the State's radioactive material program and licensed materials, NRC Region II is responsible for State/Federal interface, and NRC Region IV is responsible for oversight of commercial NPPs.) NRC oversight and coordination of materials issues in Mississippi for Katrina/Rita were handled in the Region IV office to simplify communications.

Observation:

NRC management and numerous external stakeholders desired updated information on the status of risk-significant radioactive materials at the same interval as reactor updates. These requests were burdensome on the States and staff, and collection and communication of this information were inefficient. Responding to NRC requests for information/status required States to use limited resources diverted from other response activities, sometimes with uncertain value for the information communicated.

Examples/Discussion:

Radiation hazards/concerns have to be balanced with other needs following a serious event. Although the State radiation programs recognize the need to focus on preparation and response, sometimes other needs take precedence. During initial post-storm activities, LDEQ staff and resources were directed strictly to lifesaving actions.

Observation:

There were not consistent expectations regarding content and periodicity of briefings between the NRC and the licensees. NRC communications were not always well coordinated among offices within the NRC. Some information status requests from the NRC Region IRC led to an unnecessary burden on the licensee and NRC responders.

Examples/Discussion:

Some NRC responders questioned the need for 15-minute status updates or for continuous communication during a Category 1 hurricane. This affected the site inspectors' ability to perform more important tasks.

Some staff members expressed concerns that, in some cases, IRC management unnecessarily directed that 24/7 staffing was needed on the reactor safety counterpart link while there were only two NRC responders at a reactor site. In

extreme cases, this caused the NRC responders to work around the clock without sleep.

Both NRC Headquarters and the region would request similar information from different licensee personnel. This resulted in an additional burden on both NRC and licensee personnel. NRC responders noted that NRC Headquarters personnel requested updates directly from the licensee when the responder was working on gathering information to provide an update at the next briefing.

**Recommendation 4** (Priority 2):

The NRC should develop improved tools to enable more effective communications of plant design information and agency response processes. These tools should be made available in advance of the 2006 hurricane season for susceptible facilities (before June 2006).

Observation:

Concise descriptions of basic reactor site design-basis information related to natural phenomena (hurricanes, flooding, earthquakes, and tornadoes) were not readily available to NRC responders and managers.

Examples/Discussion:

NRC staff had difficulty explaining to external stakeholders the design-basis information for windspeed and flooding for Waterford 3 (e.g., different windspeed limits for straight line and rotational winds).

**Recommendation 5** (Priority 2):

The NRC should utilize the information from the evacuations following Hurricanes Katrina and Rita and assess the impacts on the agency's emergency preparedness

program.

Observation:

Several major evacuations were conducted during the 2005 hurricane season. Additional information from these evacuations should be available for the NRC to review and consider the impact on EP planning.

Examples/Discussion:

Some reports have indicated that the time taken for the evacuation of Houston following Hurricane Rita exceeded the assumed evacuation times in earlier analyses.

**Recommendation 6** (Priority 2):

By June 1, 2006, the NRC should identify NRC and other personnel available for potential assistance in the field after major events involving nuclear materials.

Observation:

The NRC does not have a listing of health physics consultants' availability and capabilities to assist in the event of a large-scale emergency.

Examples/Discussion:

The NRC compiled a listing of health physics consultants' availability and capabilities during Hurricane Katrina to ensure the NRC would be able to provide adequate resources to assist the States if needed.

In the response to Hurricanes Katrina and Rita, several States assisted other States

and made additional offers to assist. Other States offered support for post-event recovery in advance of and in response to the storm (Southern States Radiological Mutual Assistance Compact).

**Recommendation 7** (Priority 2):

The NRC should assess the cost benefit of building on the interim database and the National Source Tracking System to include information on the location of sources (such as latitude and longitude) to enhance response to natural phenomena or other events.

Observation:

Although the listings of licensees with Category 1 and 2 radioactive sources provided some benefits in prioritizing response actions, the lists were not immediately available, did not initially match the States' lists, and did not contain detailed information on location of sources. Instead, the interim data source included street addresses and town locations, which do not translate effectively into geographic mapping tools.

Examples/Discussion:

Listings of licensees with Category 1 and 2 radioactive sources were prepared and updated after landfall of Hurricane Katrina based on the NRC's interim database. These lists are used to focus the attention of the NRC and other organizations on the status of security and control of the risk-significant radioactive sources. However, these lists were not as accurate as initially expected, and some licensees on the list did not (at least initially) coincide with the States' lists.

Observation:

The latitude and longitude of risk-significant radioactive materials locations would be useful to the NRC and Agreement States when considering preparation and/or response activities after an event. This information could be especially useful in a significant event when street signs and buildings are destroyed.

Examples/Discussion:

In some States, GPS coordinates are used or are going to be used to determine the exact location of licensees in affected areas. States indicated a desire to have geographical information but have been constrained in collecting this information by resource limitations.

**Recommendation 8** (Priority 3):

The NRC should develop and implement processes to efficiently address emergent risk-significant materials license amendments or requests for technical assistance to Agreement States and other agencies following natural phenomena or other emergencies.

Observation:

There is no established NRC process to efficiently and rapidly respond to emergent risk-significant materials license amendments or requests for technical assistance to Agreement States and other agencies.

Examples/Discussion:

After storms and flooding abated, licensees requested information regarding the possibility of temporarily storing risk-significant radioactive material in commercial storage facilities in order to support renovation and/or repairs. In emergencies, manufacturers and universities have been used to store sources or devices until a

final licensed destination is identified. However, such transfer or relocation of sources would require a license amendment to properly authorize the emergent action. Inability to respond to such amendment requests could unnecessarily delay the transfer.

**Recommendation 9** (Priority 3):

The NRC should transfer NRC oversight of the Mississippi program for oversight of radioactive materials licensees to NRC Region IV in order to minimize the NRC interface burden on the State of Mississippi.

For background information see the observations for Recommendation 3.

## 4.2 Roles and Responsibilities/Management Expectations

**Recommendation 10** (Priority 1):

By May 10, 2006, the NRC should improve existing natural phenomenon response procedures for reactor and fuel facilities and materials licensees to clearly define roles and responsibilities, provide responder guidance, and to be consistent across the regional offices.

Observation:

Roles and management expectations are not clear for NRC responders to a hurricane. The roles of responders are not clearly defined in the hurricane response procedures. Procedures do not clearly set forth basic practices such as the proper chain-of-command, or details such as the process for periodic information updates. (Responders, as used in this report, include all NRC staff who respond to the event, including to the reactor site, to the regional IRC or HOC, and to the State Emergency

Response Center facilities).

Examples/Discussion:

Existing procedures for NRC response to natural disasters are not standardized between the regions and Headquarters.

Some NRC staff members were unsure of their role during a hurricane; that is, whether their role is to assist the licensee or to remain in the inspection mode. Some staff members felt that they should have been better informed of their responsibilities in advance of arriving at sites/facilities. Responders indicated that expectations from a regional IRC changed following a shift change with different personnel. On one occasion, responders were directed to remain at the site for several days even though the hurricane had passed and the licensee had already terminated from a response mode.

In advance of and subsequent to Hurricane Katrina's landfall, there were periods in which (during off-normal hours) regional IRC personnel had difficulty answering questions related to the safety and security of risk-significant radioactive materials.

Observation:

No formal process exists for selecting, dispatching, providing relief personnel, or coordinating the return of NRC responders.

Examples/Discussion:

The selection of volunteer responders is perceived by some staff to be largely based upon past knowledge of the experience and qualifications of individual NRC staff members. Some responders indicated that the same individuals seem to be repeatedly relied upon to respond when others may be available, qualified, and ready to respond. Upon departing for the plant site, some responders were not aware of

the duration their services would be needed, nor if relief was being considered.

**Recommendation 11** (Priority 2):

The NRC should form a working group in accordance with Management Directive 5.3 with the Organization of Agreement States and the Conference of Radiation Control Program Directors as appropriate to describe the expectations of NRC and State Radiation Control Program oversight of risk-significant radioactive material licensees in preparation for and/or response to natural phenomena. The results of the working group should incorporated into the NRC's natural phenomenon response procedures to define those activities necessary to ensure adequate regulatory oversight of risk-significant radioactive materials licensees located in Agreement and non-Agreement States (including Puerto Rico and U.S. territories).

Observation:

The NRC does not have an established process/procedure to determine if risk-significant radioactive material is safely secured following a natural event. Potential loss of security or control of risk-significant materials is not clearly highlighted as a key factor in determining regulatory response to natural phenomena.

Examples/Discussion:

Regulatory expectations for security and control of risk-significant radioactive materials by licensees during and in the wake of catastrophic natural phenomena are not clear. One example is that it is not clear what facilities affected by the Increased Controls Orders are expected to do if they cannot meet requirements because of conditions beyond their control such as loss of electrical power.

Some Agreement States request (and some apparently now require) their licensees to provide a radioactive material status update within 48 hours after the storm passes. Some States make post-event calls after events in areas where radioactive

material is licensed (when pre-event notification is not practical, such as in the case of tornadoes and earthquakes).

Observation:

NRC natural phenomena procedures do not sufficiently address oversight of the actions of risk-significant radioactive materials licensees (both NRC and Agreement State licensees). NRC procedures do not address consideration of actions such as notification of NRC risk-significant radioactive materials licensees in advance of an impending event or verification that Agreement States have contacted their risk-significant materials licensees.

Examples/Discussion:

Some States have been effective in notifying licensees possessing risk-significant radioactive material in advance of an impending storm, instructing them to secure sources/devices before evacuation and requesting the licensees to contact the State with radioactive materials status after the event. Several States contact all licensees and ask them to consider security and control and question whether they can (or need to) move radioactive materials to a safer area. They also verify contact phone numbers/communications methods for post-event followup.

Observation:

Regarding response to radioactive materials incidents, it is not clear if/when NRC staff should be considered as serving in “first responder” roles. Although NRC staff members have been effective in liaison, communications support, and other assistance roles related to radioactive materials events, current procedures do not sufficiently address numerous potential issues associated with NRC staff serving as first responders. This issue is a concern for non-Agreement and Agreement State scenarios.

Examples/Discussion:

During preparation to send NRC staff to Louisiana, there were questions regarding hazard training, inoculations, self-contained breathing apparatus certification, and other details for NRC staff before dispatching to assist the RCP.

**Recommendation 12** (Priority 2):

After development and enhancement of NRC procedures for response to natural phenomena, NRC staff and management should be trained on the procedures before June 1, 2006. Consideration should be given to establishing seasonal refresher training requirements and requiring training on these procedures in NRC staff qualification guides.

Observation:

NRC responders are not as prepared as they should be for responding to natural disaster events.

Examples/Discussion:

NRC responders are not always familiar with the plant site and its surroundings. Since some responders did not know in advance that they would be called to a particular site, they had no opportunity to adequately acquire information on the basic design, location, and surrounding area of the plant site. This led to a sense of unfamiliarity and required responders to gain basic knowledge before fully executing their response duties. When staff were knowledgeable, as in the case of a responder to Waterford 3 who was a previous resident inspector for that facility, this greatly assisted the NRC's response in that the individual was familiar with licensee procedures. This also minimized the burden on the licensee of answering questions during a busy time.

Some NRC responders arrived at a plant site needing to be badged for access. The

licensee was requested to call in security personnel to accommodate the badging of NRC response personnel. This imposed a burden on these licensee employees who had to leave their families during the response to the natural disaster event.

## 4.3 Caring for NRC Employee Needs

**Recommendation 13** (Priority 1):

By June 1, 2006, the NRC should improve consistency and apply best practices in dispatching and maintaining accountability of responders and site staff. The accountability of staff should be highly visible.

Observation:

Agency processes do not provide a consistent, reliable process of checking on the welfare of affected staff. A process to allow 24-hour communications with redundant means (e.g., telephone, text message, email) would improve communications reliability. In situations with advance warning, relocation of staff should be considered. The daily situation report should include information on affected staff.

Examples/Discussion:

The NRC routinely supplements resident staff in advance of a hurricane to allow those staff members to focus on their families' welfare. Regional managers normally contact staff in advance of a hurricane to identify whether they were intending to evacuate. Managers then attempted to keep in contact with affected staff but sometimes experienced gaps in their ability to communicate. These gaps led to concerns about staff welfare and some misinformation as to management actions.

Observation:

Agency processes do not provide a consistent level of guidance for staff on personal safety.

Examples/Discussion:

For many of the inspectors dispatched to the affected power reactor sites, regional management and staff conducted a predeployment briefing on personal safety as the highest priority, equipment needs, family welfare, and communications. However, not all responders received such a briefing. A consistent process across the agency would improve responders' safety.

The conditions for Hurricane Katrina were severe. The task force found examples of NRC management giving very clear direction that employees should not proceed if they felt they were in danger. Task force members were also aware of examples in

previous seasons of NRC management supporting employees who stopped because they felt conditions were dangerous. Even so, some NRC responders expressed concern about being asked to respond to the site when the roads were deemed unsafe by the local authorities due to downed trees and electric lines and flooding. It appears that this is an issue that requires constant reminders to staff to balance their desire to support the mission of the agency with the need to maintain personal safety. Some responders felt that such travel should be closely monitored, tracked, and reported by the IRC as a very high priority.

Observation:

Numerous problems were encountered by responders in the area of logistical support, including travel regulations, time and attendance, and supplies. These problems deflated the morale of some of the responders who volunteered but felt they did not receive strong logistical support.

Examples/Discussion:

The normal administrative processes designed primarily for NRC employees in an official setting (e.g., travel, time and attendance) do not adequately address responder needs during emergency conditions when responders are dispatched quickly and work extended hours. Some responders found themselves in a difficult position trying to get fully reimbursed for pay and travel-related expenses.

# 5. REVIEW OF HURRICANE ANDREW REPORT

Task force members conducted a review of the report, “Effect of Hurricane Andrew on the Turkey Point Nuclear Generating Station on August 24, 1992,” and identified which, if any, items recurred from that major storm. This re-review offered an opportunity to evaluate how effectively the NRC had implemented enhancements based on the prior lessons learned. It also explained the extent to which any problems identified in response to the hurricanes of 2005 could be attributed to recurrence of problems identified in 1992.

## 5.1 Description of the Storm

On August 24, 1992, Hurricane Andrew, a Category 5 hurricane, made landfall in south Florida and caused extensive onsite and offsite damage at Turkey Point Nuclear Generating Station without threatening the public health and safety. Turkey Point experienced sustained winds of 145 mph and gusts of at least 175 mph. A joint team from the NRC and the Institute of Nuclear Power Operations reviewed the damage that the hurricane caused the nuclear units and the utility’s actions to prepare for the storm and recover from it, and compiled lessons that might benefit other nuclear reactor facilities.

The nuclear portion of the plant contained within Class I structures is designed to withstand these wind velocities and suffered no damage from the hurricane except for minor water intrusion and some damage to insulation and paint. These Class I structures, systems, and components were designed and constructed to withstand the storm without damage. Turkey Point’s operation of emergency diesel generators and normal cooling systems to sustain the plant in a safe-shutdown mode during Hurricane Andrew confirmed these capabilities.

Prior to the storm, on August 23, 1992, the licensee shut down both reactors and placed them in the “hot standby” condition (approximately 300 EF) as required by the plant emergency procedures. The plant lost all offsite power during the storm and for over five days after the storm. Emergency diesel generators automatically picked up safety-related loads and maintained the plant in a safe condition during the recovery until offsite power was restored on August 30. All offsite communications were lost during the storm for about four hours, and the access roads to the plant were blocked with trees, utility poles, and other

debris. Helicopters and portable communications equipment were used to sustain the plant until the access road and more permanent communications were restored on August 25.

The hurricane caused some damage to the non-nuclear Class III structures, systems, and components, which are designed to withstand 120-mph winds. Most of the damage occurred when the 100,000-gallon water tower collapsed, destroying a raw water tank and portions of the fire protection system piping, and disrupting the city water system supply to the site. Electrical service and instrumentation associated with this equipment were also destroyed, rendering the fire protection system inoperable. Temporary fire protection compensatory measures were instituted.

The security system sustained extensive damage to equipment such as lighting, cameras, intrusion detection equipment, protective area fencing, and the entrance building. The licensee implemented compensatory measures.

The hurricane also caused extensive damage throughout the 10-mile emergency planning zone (EPZ) around the plant. On September 28, 1992, the NRC staff reviewed the licensee's conclusion that the onsite restoration activities were complete and that it was ready to restart Unit 4. The NRC staff concurred with the licensee, who then commenced startup and attained 30 percent power. On October 1, 1992, the licensee shut down Unit 4, at the request of the NRC, after FEMA identified the need to evaluate the status of emergency planning in the area around the site. Unit 4 achieved cold shutdown on October 2, 1992. FEMA completed an interim assessment of offsite EP capabilities on October 23, 1992. Unit 4 restarted on October 24, 1992.

## 5.2 Lessons Learned/Findings

The Hurricane Andrew report identified six findings:

**(1)** **Adequacy of timing of plant shutdown in anticipation of a hurricane.** Starting a plant shutdown strictly in accordance with the licensee commitments could have resulted in the plant being in the midst of a dual-unit shutdown when offsite power was lost. The licensee commitments in response to the station blackout rule require

the licensee only to commence shutdown at least two hours before the onset of hurricane force winds. In addition, important equipment is located outside and would not have been accessible during a hurricane.

(2) **Adequacy of licensee offsite communications for natural disasters.** Offsite communications were lost during the storm because of a common vulnerability to wind damage. All offsite communications were lost for about four hours during the storm, and reliable communications were not restored for about 24 hours following the storm. A temporary satellite communications system provided by the NRC aided recovery efforts considerably and would have been more beneficial if it had been on site before the storm.

(3) **Adequacy of compensatory measures for equipment or facilities not designed for a hurricane.** A number of important systems, structures, or facilities for security, emergency response, effluent monitoring and disposal, and low-level waste storage were not designed for hurricane-force winds. The licensee's emergency plan considered the loss of these systems, structures, or facilities and contained contingency measures. However, because of damage to the plant stack and associated ductwork and monitoring equipment, a major radiological release path could not have been monitored if it had been necessary to do so.

(4) **Early preparations for hurricane.** Turkey Point benefited greatly from the prior hurricane experience of the plant staff and extensive planning done in preparing and implementing the associated Emergency Plan Implementing Procedure. Using the control room simulator to train operators immediately before the storm enabled the operators to be more alert to any likely plant transients.

(5) **Impact of nonsafety equipment on important equipment.** During the storm, failed nonsafety-grade equipment damaged certain important equipment. For example, the high water tank collapsed onto the fire water system, rendering the fire protection system inoperable.

(6) **Impact on Offsite Emergency Preparedness.** The unprecedented destruction within the Turkey Point 10-mile emergency planning zone (EPZ) gave FEMA concern about the possible impact on the offsite EP infrastructure and on the population in the EPZ. Accordingly, at the request of the NRC, the licensee interrupted its restart of Unit 4, which then remained shutdown until FEMA could complete its offsite preparedness review. Several factors contributed to a flawed restart approval process, including poor internal and external communications and coordination, the lack of a formal restart process with attendant procedures and checklists, the lack of management and staff focus on the offsite EP issues, and inadequate training and knowledge of the role of and relationship with FEMA.

## 5.3 Review of Recommendations for Recurrence

The task force members reviewed the lessons learned from Hurricane Andrew and compared them to the lessons identified in this report. The following Table 2 shows which of the items recurred based on that comparison.

**Table 2**

**Comparison of Hurricane Andrew Lessons Learned**

**With the 2005 Hurricane Season**

| RECOMMENDATION | RECURRENCE DURING 2005 HURRICANE SEASON |
|---|---|
| 1. Adequacy of Timing Plant Shutdown in Anticipation of Hurricane | |
| a. Review the existing regulatory guidance and commitments made by all affected licensees related to timing of a facility shutdown in anticipation of hurricane force winds. Revise the guidance and obtain revised commitments as may be needed. | Did not recur; plant shutdown commenced sufficiently in advance of severe weather. |
| 2. Adequacy of Licensee Offsite Communications for Natural Disasters within the Plant Design Basis | |
| 2.a Review the existing regulatory guidance and requirements related to normal and backup offsite communications system design capabilities for hurricanes. Based on this review, consider the adequacy of the guidance for other external events. Issue revised guidance or requirements as needed. | Loss of normal communications did recur because of flooding and loss of offsite power rather than wind damage. Nevertheless, the NRC maintained communications with Waterford 3 through satellite communications. |
| 2.b Evaluate the need for the NRC to preposition a temporary satellite communications system or other suitable communications at sites in advance of a hurricane. Based on this review, consider the applicability to other external events. If appropriate, develop and implement such a capability. | Did not recur, but portable satellite communications were not as robust as desired. |
| 3. Adequacy of Compensatory Measures and Design of Equipment or Facilities Not Designed for Hurricane | |

| RECOMMENDATION | RECURRENCE DURING 2005 HURRICANE SEASON |
|---|---|
| 3.a Reexamine the need for guidance for preplanned compensatory actions for important equipment and facilities not designed for a hurricane. Issue guidance as appropriate. | Did not recur. |
| 3.b Reexamine the need for guidance for preplanned compensatory actions for important equipment and facilities not designed for other severe external events. Issue guidance as appropriate. | Did not recur. |
| 3.c Consider the need for additional guidance or requirements to assure low-level radioactive waste stored on site is adequately protected from dispersal by severe external events. Issue revised guidance or requirements as may be needed. | Did not recur. |
| 3.d Review the existing regulatory guidance related to major release paths and monitoring equipment to determine if equipment should be designed to Class I criteria. Issue revised guidance or requirements as may be needed. | Did not recur. |
| 4. Adequacy of NRC Guidance for Reviewing Licensee Preparation and Response to Natural Disasters and Industry Preplanned Support | |
| 4.a Consider the need for development of additional guidance for review of licensee preparations for a predicted hurricane. Develop and issue staff guidance as appropriate. | Did not recur. |
| 4.b Consider the need for development of guidance for review of licensee preplanning for response to other external events. Develop and issue staff guidance as appropriate. | Did not recur. |

| RECOMMENDATION | RECURRENCE DURING 2005 HURRICANE SEASON |
|---|---|
| 4.c Coordinate with industry in consideration of preplanned measures to supplement individual utility resources to maintain adequate staffing and critical supplies immediately following a severe external event. | Did not recur. |
| 5. Adequacy of Examination of the Impact of Nonsafety Equipment on Important Equipment during External Events | |
| a. Consider, as part of the IPE/IPEEE, the need for reexamination of the potential impact of nonsafety-grade equipment on safety-grade and other important equipment for severe external events. | Did not recur. |
| 6. Impact on Offsite Emergency Preparedness | |
| a. Review the regulatory process for review and approval of plant restart following shutdown due to significant events. | Did not recur. |

One out of twelve of the Hurricane Andrew lessons learned recommendations recurred to some extent. All communication was lost at Turkey Point following Hurricane Andrew because of wind damage. As a result of Hurricane Andrew, the NRC arranged for portable satellite communications equipment to be available as required. In 1999, in response to concerns over Y2K, the NRC implemented a program of hand-held satellite communications for the resident inspectors at each reactor facility. Following Hurricane Katrina, normal communications with Waterford 3 were lost because of flooding; however, hand-held satellite communications with the licensee and the NRC staff on site were generally available.

# APPENDIX A

# TASK FORCE CHARTER

## A.1 Memo re 2005 Hurricane Season Lessons Learned Task Force and Charter

November 4, 2005

MEMORANDUM TO: Melvyn N. Leach, Director
Incident Response Directorate
Division of Preparedness and Response
Office of Nuclear Security and Incident Response

FROM: Luis A. Reyes ***/RA Martin J. Virgilio Acting For/***
Executive Director for Operations

SUBJECT: 2005 HURRICANE SEASON LESSONS LEARNED TASK FORCE AND CHARTER

The purpose of this memorandum is to assign you to lead the inter-office task force to find and assess lessons learned from the 2005 hurricane season. Although the agency's response to the many hurricanes this season has been commendable, it is appropriate that we look for ways to learn from these experiences and apply them in the future. The objective of this Lessons Learned Task Force is to conduct a review of Nuclear Regulatory Commission (NRC), State, and licensee preparations for and response to the hurricanes in order to identify and recommend areas of improvement. You should take advantage of the hurricane lessons-learned review efforts that have already been initiated as described in Attachment 1.

The charter (Attachment 2) was developed to define the objective, scope, expected products, schedule, staffing and senior management interface. The scope of the task effort will include, but not be limited to, the following: 1) issues related to implementation of the National Response Plan; 2) the impact of natural phenomena incidents on radioactive materials licensed by the NRC or Agreement States; 3) communications capabilities among the NRC, States, and licensees during and after natural phenomena incidents; and 4) consideration of applying the compensatory measures approach regarding readily available assets/resources to respond to natural phenomena incidents.

The team should expeditiously seek the participation of one or more State representatives to aid in this lessons learned review. The Office of State and Tribal Programs should facilitate this participation by working through the Conference of Radiation Control Program Directors and/or the Organization of Agreement States as appropriate.

I am assigning Mr. Leonard Wert as the Deputy Team Leader. Mr. Wert should focus his efforts on identifying and recommending any needed improvements on the preparation for and response to natural phenomena incidents on radioactive materials licensed by the NRC or Agreement States. Other staff selected as team members are identified in the charter.

As the task force leader, you will report to the Deputy Executive Director for Reactor and Preparedness Programs (DEDR). If you identify concerns or issues that may need to be promptly addressed, you should promptly communicate and coordinate these with the responsible program office.

The task force will periodically brief the DEDR and other senior managers regarding the progress of the task force. The task force will provide its observations, conclusions, and recommendations in the form of a written report consistent with the guidance provided in the charter. The team's recommendations will be considered for entry into the agency's new corrective action program for significant lessons learned as part of the piloting of that program.

Attachments: As stated (2)

## A.2 Attachment 1 - Memo re 2005 Hurricane Season Lessons Learned Task Force and Charter

October 6, 2005

MEMORANDUM TO: Office Deputy Directors and Deputy Regional Administrators
(See Attached List)

FROM: Eric J. Leeds, Director**/RA/**
Division of Preparedness and Response
Office of Nuclear Security and Incident Response

SUBJECT: CAPTURE OF ISSUES REGARDING AGENCY RESPONSE TO HURRICANES KATRINA AND RITA

While Hurricanes Katrina and Rita were terrible natural disasters, they provided excellent opportunities to test the agency's incident response procedures and equipment. I would like to solicit your assistance in capturing issues that arose during your response to the hurricanes.

As you review the NRC's response to the hurricanes, I request that you consider the following questions:

(1) What specific issues did you encounter?

(2) Were you able to find a solution to the issue?
  (a) Was your solution temporary or permanent?
  (b) Do you think that this solution may be applicable to other Regions or Headquarters?

(3) Does this issue require an agency-wide followup action to resolve completely?

(4) What enhancements could be made to the NRC's incident response procedures or equipment to prevent similar issues from arising in the future?

(5) Did you identify any significant weaknesses in licensee response that should be addressed by NRC (e.g., generic correspondence, new requirements, etc.)?

(6) Did you observe any "best practices" by licensees or other agencies that could be implemented by the NRC?

In addition, please identify whether your Office or Region can resolve this issue independently or whether coordination with another Office or Region will be required. I request your input by October 30, 2005, so that my staff can promptly begin conducting an overall review of the issues and potential solutions.

CONTACT: Peter R. Wilson, DPR/NSIR
301-415-8743

cc: W. Kane, EDO
M. Virgilio, EDO
J. Silber, EDO

Attachment 1

## A.3 Attachment 2 - Memo re 2005 Hurricane Season Lessons Learned Task Force and Charter

**CHARTER**

**FOR THE**

**2005 HURRICANE SEASON**

**LESSONS LEARNED TASK FORCE**

Objective

The objective of this Lessons Learned Task Force is to review NRC, licensee, and State preparations for and response to this year's hurricanes in order to identify and recommend areas of improvement where these activities were related to the discharge of responsibilities under the Atomic Energy Act. The task force should also consider how the preparation and response to other natural phenomena could be improved by thinking broadly about the lessons collected.

Scope

The task force should address the following areas:

1. National Response Plan

   - Identify and recommend any needed improvements regarding the integration of NRC incident preparation and response activities within the structure and processes of the National Response Plan, including the Emergency Support Functions.

   - Identify and recommend any needed improvements regarding the NRC's incident-related coordination and communication with other Federal, State, and local agencies pertaining to incidents with the potential to render critical communication infrastructure inoperable.

2. Radioactive Materials

   - Identify and recommend any needed improvements regarding the preparations and response activities by the NRC, States and local governments, and materials licensees for natural phenomena related incidents, including the impact of a sustained loss of electrical power.

3. Communications

   - Evaluate the adequacy of primary and alternate/backup communications capabilities between the NRC, other government organizations, and licensees, both reactors and materials, pertaining to natural phenomena incidents and other incidents with potential to render critical communication infrastructure inoperable.

4. Compensatory Measures

- Review and record those actions taken by reactor licensees to prepare for or respond to hurricanes that used readily available assets or resources, including those that may have been required by post September 11, 2001, security orders.

5. Other Areas

- Evaluate the other lessons learned from Hurricanes Katrina and Rita that may be provided in response to Attachment 1 and recommend any needed improvements.

- Review the lessons learned from Hurricane Andrew and other major natural phenomena events selected by the task force, and report if any issues recurred.

- Review the impact the major hurricanes had on the well-being of NRC employees in the storm damaged areas and recommend any needed improvements.

The scope of subjects considered by the task force should not necessarily be limited to those noted above. The Deputy Executive Director for Reactor and Preparedness Programs (DEDR) should approve any significant deviation from the charter.

Expected Product and Schedule

The task force should provide a lessons learned report with recommendations for areas for improvement by February 3, 2006. The final report should include a summary of the event and a short description of each major lessons learned. Recommendations should be grouped based on their importance (high, medium, and low) and linked to a specific lesson where appropriate.

Staffing

| | |
|---|---|
| Team Leader: | Melvyn N. Leach, NSIR |
| Deputy Team Leader: | Leonard D. Wert, Jr., RIV |
| Administrative Assistant: | Sally A. Billings, NSIR |
| Team Members: | Richard A. Laura, NRR<br>Anthony C. McMurtray, NSIR<br>Gregory K. Morell, NMSS (IMNS)<br>Lloyd A. Bolling, STP<br>Todd J. Jackson, Region I<br>James W. Hufham, Region II<br>Linda L. McLean, Region IV |

Other staff members may be consulted on a part-time basis.

Senior Management Interface

The task force will report to the DEDR and will periodically brief senior management (Executive Director for Operations, Office Directors, Regional Administrators, or their designees), as needed, on the status of the effort and provide early identification of significant findings. In addition, the task force will regularly interface with the cognizant OEDO staff to keep them abreast of progress.

# APPENDIX B

# 2005 HURRICANES LESSONS LEARNED QUESTIONNAIRE

# 2005 HURRICANES LESSONS LEARNED QUESTIONNAIRE

The task force compiled a list of questions to solicit feedback and input from the State Radiation Control Programs regarding potential enhancements to the oversight of radioactive materials. The task force developed these questions based on initial feedback provided by involved State Radiation Control Programs, comments collected during the response, and discussions with NRC management.

What did work - any specific success stories?

What did not work?

How did NRC do?

Could NRC have better supported you? How?

Do you have written procedures for dealing with natural phenomena? What is the content of the procedures? Did you implement them? Did they work?

Do you think that the appropriate priority was placed on the security and safety of radioactive materials in the aftermath of the storms?

What do you think of the use of the Category 1 & 2 source list? Did this match your priorities? Were any problems caused by use of this list?

Did the State organization and leaders place an appropriate priority on nuclear materials aspects after the hurricanes? Were you required to divert attention away from confirmation of nuclear materials to complete other tasks?

What would you do differently for the next hurricane? Are you proposing any changes to your procedures/processes as a result of the hurricane experiences? Should enhancements in licensee/state actions, (e.g., secure materials, take out if reasonable, and contact regulators afterwards) be license conditions or regulations?

Do you have any ideas or suggestions to deal with natural phenomena that occur without any warning, (i.e., earthquakes, tornados, etc.)?

<u>Other potential discussion topics for calls</u>:

Should perhaps some consideration be given to “safe havens” for sources, (e.g., large manufacturers and distributors out of harms way could store and provide security for sources for licensees that have to leave?

What should hospitals do with typical radioactive waste during preparations? (Refer to EN on Iodine waste lost during flooding in Katrina/Rita....)

# APPENDIX C

# 2005 AGREEMENT STATE INTERVIEW DATA

# 2005 AGREEMENT STATE INTERVIEW DATA

Response From Alabama

*1. In advance of a storm, the staff typically contacts all licensees to discuss securing sources (such as not leaving gauges in trailers or at construction sites), and locking them up if necessary to abandon facilities. The staff also assures that licensees know how to contact state radiation control authorities. Afterwards, the staff contacts those licensees who have not called in a status report.*

*2. Procedures are in-place (not written). Other States are contacted in advance of a storm and offered support for post-event recovery, as conditions permit.*

*3. The staff stated that there was no need for NRC at the State EOC. The State would call on Southern States Radiological Mutual Assistance Compact first. (The State Office of Radiation Control staff would not typically be at the EOC.)*

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Response From California

*1. The predominant natural events in California are earthquakes and forest/brush fires.*

*2. Contact with licensees in a specific disaster area is generally made through the regional offices.*

*3. There is usually no warning for earthquakes, but in the case of forest/brush fires the Radiation Control Program (RCP) utilizes satellite imaging and photography to follow the progress of a fire. Licensees can then be notified.*

*4. GPS is used to determine the exact location of individual licensees in affected areas. The RCP is considering a plan to place all Radioactive Materials (RAM) licensees on a GPS database.*

*5. In emergencies, manufacturers and universities have been used to store sources or devices until a final licensed destination is identified.*

*6. State universities occasionally respond to radiological events at the request of the RCP.*

*7. Post-emergency, the RCP staff contacts licensees in a known event area.*

*8. Federal radiological assistance was not needed as a result of recent fires or earthquakes.*

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Response From Florida

*1. Florida's practice is to email high-risk licensees before a hurricane makes landfall and request that they respond within 48-hours post-storm to provide a status on their facility. Licensees are instructed to store and lockup radioactive sources and devices prior to evacuation.*

*2. The RCP prepares its own facilities for a direct hit. Papers and books are secured in locked cabinets and the cabinets are moved as needed. Flooding has not traditionally been a problem; however, windows can get blown-out and driving rain can cause facility damage.*

*3. The RCP has a plan to relocate its main or regional offices during emergencies, both temporarily (up to one week) and longer term (up to one month).*

*4. During emergency response, RCP personnel are contacted via an emergency call-down list. Experience has shown that the supervisor should contact the staff and the staff should attempt to contact their supervisor.*

*5. RCP personnel are instructed to avoid regular gas stations and to fuel State cars and*

*trucks at State highway motor pool facilities.  Power outages affect gas stations.*

*6. RCP personnel are deployed in pairs so that one team member can drive while the other navigates. The RCP is divided into regions and staff are well familiar with their region.*

*7. Equipment, (e.g., radios, mobile phones, radiation detectors) should have extra batteries.*

*8. Hotel reservations should be made as soon as possible after a decision to deploy is made.*

*9. Communications are affected by power outages.*

*10. Licensees are responsible for moving sources and devices (not the RCP).*

*11. For nuclear power plants to operate in Florida, the offsite monitoring system and the State Environmental Radiation Laboratory must be online and running. The RCP has a supply of spare parts for their offsite monitors. The State Lab has an available backup electric generator.*

*12. The RCP reported that requests for help from the NRC would generally be consultative rather than direct assistance.*

*13. There has been some discussion in-State regarding possible rulemaking to require specific and general licensees to contact the RCP post-storm. Exactly how soon post-storm and what action would be taken for failure to notify is being debated.*

*14. Since Florida is a topical/sub-tropical region, the RCP staff noted that insect repellent is a must for inspections conducted outdoors.*

*15. A decision-making group of State emergency officials averted a potential problem when several radiopharmacies requested a special exception to a fuel ban so that they could deliver products to medical facilities. The State officials contacted area medical facilities, determined that they were not open or in operation, and the special exception was denied.*

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Response From Georgia

*1. The State Program is considering whether licensees should be required to make storm preparations, make post-storm contact, etc. The State of Georgia generally prefers to address these issues through rulemaking instead of license conditions, as rules are more effective and easier to implement and enforce.*

*2. In an emergency, the State prefers to contact and track all radioactive material licensees in the affected areas. The State considers concentrating only on Category 1 & 2 sources to be inadequate. Facilities with Category 1 & 2 sources may actually be more robust for storms, with other materials more vulnerable to damage.*

*3. Hospitals (and others) could prepare radioactive waste in advance of storms to prevent it from being impacted by flooding (e.g. move to higher floors, watertight containers, etc.).*

*4. The State staff does see a benefit to the NRC sending a representative in advance to the Radiation Control Agency Operations Center. (This may be at a location other than the state EOC.)*

*5. The State staff indicated that "safe havens" for sources sounds like a good concept, although logistically could be very difficult to do.*

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Response From Illinois

*1. Advance notice is not usually possible for many natural events (tornado or severe storm).*

*2. The State's staff checks the license database and contacts licensees in affected areas, post-storm.*

*3. The State's staff found that email works well even when phones are disabled. Many evacuation shelters have Internet capability.*



*4. The State staff indicated that License Conditions requiring licensees to contact the Radiation Control Program would be helpful.*

*5. State emergency procedures provide for satellite telephones for the Program's emergency response vehicles.*

*6. The State's Incident Response Plan covers nuclear power plants, significant materials licensees, and also other materials licensees. There is 24-hour staff coverage utilizing the resources of the division and other State agencies.*

*7. The State is completing a two-year effort to establish a GPS database with the exact location of use for radioactive material possessed by each licensee.*

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Response From Iowa

*1. The State has an general disaster plan, but it is not specific to radioactive materials.*

*2. The RCP is very active in participating in nuclear power plant drills and in training county first responders, State-wide.*

*3. The State has a cadre of qualified radiation personnel from the State universities to backup the RCP staff in a disaster.*

*4. Tornado warnings are not very reliable, so advance notice to licensees is not practical. Post-storm calls are made when a tornado touches down in an area where radioactive material is licensed.*

*5. The RCP views the NRC's roles as consultative; however, they would call upon NRC for direct help, if needed.*

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Response From Louisiana

*1. The Louisiana Radiation Control Program resides within the State Department of Environmental Quality (DEQ). During the initial phase of the Katrina Hurricane and flooding, State DEQ vehicles, boats, aircraft, and personnel were directed strictly to lifesaving activities.*

*2. The State staff indicated that the NRC Staff sent to Louisiana were a great help and were very much appreciated. The NRC staff served as liaisons to and between Federal agencies, thus freeing up State personnel for direct response to licensees and citizens. NRC staff also provided a sounding-board for questions such as the issue on burning large numbers of Am-241 smoke detectors along with other debris.*

*3. The State staff recommended that NRC should immediately reserve hotel rooms in anticipation of sending staff to within 100 miles of a disaster zone. Pre-arrangement with a hotel chain might also be a good idea.*

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Response From Mississippi

What did work - any specific success stories?

*After the hurricane, one team was sent to the field and one team remained behind to attempt to communicate with the licensees. That worked well, (e.g., they were able to narrow down the where the field team should go first).*

*The State called corporate offices that were located out of the affected area. Some of the licensees had satellite phones that help with communications. Mississippi also has satellite phones. Two large licensees had helicopters out after the storm and reported back to the State on the conditions of the facility and sent photographs. One licensee has a hurricane bunker and keeps some staff on site during the hurricanes.*

*The State recommends providing some other type of identification for the inspectors (e.g., a shirt or jacket with the Department's logo and name. This should help in getting access into restricted areas and would also identify them as State or Federal workers, not looters, (i.e., like a FEMA hat or jacket).*

What did not work? *Communications with licensees. Single point of contact with NRC for communications*.

How did NRC do? *Inaccurate information was apparently sent from DHS about the status of the State's actions. That information was provided to Mississippi's Governor*.

Could NRC have better supported you? How? *They did not need help. However, they liked the single point of contact with NRC.*

Do you have written procedures for dealing with natural phenomena? What is the content of the procedures? Did you implement them? Did they work? *The State has a radiological emergency plan for all natural disasters. They are not sure what is in it regarding radioactive material. They did not use it.*

What do you think of the use of the Category 1 & 2 source list? Did this match your priorities? Were there any problems caused by use of this list? *They thought that using the list was a good way to start. They were able to concentrate on higher priority licensees*.

Did the State organization and leaders place an appropriate priority on nuclear materials aspects after the hurricanes? Were you required to divert attention away from confirmation of nuclear materials to complete other tasks? *The State had their x-ray staff from the health department provide additional help; therefore, it did not affect activities of the radiological materials inspectors.*

What would you do differently for the next hurricane? Are you proposing any changes to your procedures/processes as a result of the hurricane experiences? Should enhancements in licensee/state actions, (e.g., secure materials, take out if reasonable, and contact

regulators afterwards) be incorporated as license conditions or regulations? *The State is planning on meeting with the larger licensees to discuss notifications, communications, security of sources, (e.g., large fixed gauges). They will be doing this before the next hurricane season*.

Do you have any ideas or suggestions to deal with natural phenomena that occur without any warning, (i.e., earthquakes, tornados, etc.)? *After a tornado, the State pulls the list of licensees potentially impacted and contacts them if possible*.

Should some consideration be given to "safe havens" for sources, (e.g., large manufacturers and distributors out of harms way could store and provide security for sources for licensees that have to leave)? *Believes that safe havens might be a good idea.*

Should there be an NRC representative sent to the State EOCs in advance of approaching natural phenomena. *May be a good idea.*

Should a natural phenomenon without any reports or worries about looting prompt the same level of actions for source security? *Would do the same*.

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<u>Response From New Hampshire</u>

*1. State staff reported that Northeastern New Hampshire experienced severe flooding in mid to late September 2005. The flooding occurred rapidly and no preparation was possible. After initial reports of flooding, calls were made to the Radiation Safety Officers of licensees known to be in the general area of the floods. All facilities reported no damage*.

*2. The State staff has decided to enter the exact location of each RAM licensee in their GPS database. During the next year, State inspectors will visit each RAM licensee facility to obtain the exact location of use for licensed radioactive material.*

*3. The State of New Hampshire has a general emergency or disaster plan.*

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Response From New York City

*The State staff reported that in the immediate aftermath of the 9/11 event, basic communication systems such as cellular towers, land-line telephones, cell phones, and the internet failed.*

*The Radiation Control Program deployed 800 mHz emergency frequency radios to key emergency response staff throughout the agency. These radios allowed the staff to monitor New York City's Office of Emergency Management and to communicate with the Department of Health's Transportation Police and Bureau of Emergency Management. A cache of these radios is charging at all times and they are strategically dispersed the Department*.

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Response From North Carolina

*1. The State staff contacts licensees in advance of oncoming storms, while there is time for preparations. The staff contacts all licensees, asks them to consider security, whether they can (or need to) move materials to a safer area, what actions they do plan to take, and request they contact the state post-event to confirm their status. The emphasis is on calling in advance because it is assumed there will be competing, and higher, priorities facing people during and after the event.*

*2. The State staff indicated that requirements that licensees report preparations, make contact post-event are not viable, won't solve problem. They questioned how this would be enforced? The State staff believes that advance contact is more important.*

*3. The State staff reported that it was helpful for the NRC's Regional State Liaison Officer to make contact with the State in advance, to discuss preparations and provide assistance as possible.*

*4. The State staff indicated that would not want to limit the in-advance calls to only Cat 1 or 2 sources list. Concern is perception of neglecting any RAM, and they want to reach out and contact every licensee. They also feel that limiting calls to the Catagory 1 & 2 lists may be too confusing to implement well, and is definitely too confusing to explain to the public as a justification for not calling some radioactive materials licensees.*

*5. Regarding ability to locate licensee facilities post disaster, the State Radiation Control Program has GPS coordinates for hospitals and some other licensees. This information was obtained through another agency's efforts. The State staff considered obtaining the GPS locations for all of its licensees, however these plans are currently on hold due to resource constraints.*

*6. The State staff considered the need to track/prepare in advance of other storms besides hurricanes, (e.g., northeasters). The State has experienced significant flooding events from fall storms. They believe that this may apply in other regions for seasonal events like wildfires, ice storms, and mudslides.*

*7. It is important that the state radiation regulatory group focus on preparations/response for RAM licensees. Other public health agencies post-event will be focusing on other public health issues, (i.e., mosquito control (disease vector), water, food, and shelter, etc.). The State staff feels that prioritization of RAM issues has been appropriate in their interactions with NRC.*

*After Hurricane Floyd, focus shifted away from enforcement post-event, toward asking "What can we do to help licensees get up and running to keep materials safe?". The State staff will try to not interfere while licensees are dealing with human needs and issues that are more pressing. The State staff feels that it is not likely that radioactive materials issues will be as immediately hazardous to public health as the other problems to be faced.*

*8. The State staff was not diverted from advance calling of licensees. All resources were devoted to making contacts, so any requests for information, from NRC or others, would have significant impact.*

*9. The State staff indicated that when Hurricane Fran hit Raleigh in 1996, it destroyed a number of State offices, including the Radiation Control Program's offices. Plans were then developed to assure business functions could be continued, such as records retrieval.*

*10. The State staff considered what should be in place to address events that provide no advance notice. They indicated the need to plan as thoroughly as possible since the important in-advance contacts cannot happen. They also recommended assuring that basic business processes of a regulatory agency can continue (records, useable backup location), and providing as much redundancy in communications capability as possible (communications are always a problem).*

*11. The State staff indicated that requirements for licensees to report preparations and make contact post-event are not viable and won't solve the problem. The State staff questioned how this would be enforced. They believe that advance contact is more important.*

*12. The State staff reported that radioactive waste is not considered more of a problem than other radioactive materials, and licensees are asked to look at their overall readiness in advance of a hurricane. Radioactive waste is not viewed as critical overall, considering that other wastes (chemical or biological) will likely be of more pressing concern.*

*13. The State staff feels that it is not necessary for NRC to send a representative to the State EOC in advance of a hurricane. They questioned how it would work when a storm moves along the coast of many states, hangs out at sea for a few days, then hits unpredictably. They believe that it would be more useful to assume that an NRC representative would be welcome in the State EOC post-event, unless the State specifically says "no" to the offer. If unable to communicate with the State post-event, assume the NRC representative will be wanted in the EOC.*

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Response From Oklahoma

*The State's experience has generally been with tornadoes*.

What did work - any specific success stories? *Nothing to add*.

What did not work? *During a tornado several Generally Licensed devices were blown down and out of the facility's control.*

How did NRC do? *NRC has been very supportive.*

Do you have written procedures for dealing with natural phenomena? What is the content of the procedures? Did you implement them? Did they work? *The State has a State emergency plan that is oriented towards guidance to first responders. There is a brief section on radioactive material, (e.g., who to call, what to do, etc.) For tornados the problems are not as extensive. Usually there is a narrow path of destruction. Oklahoma calls licensees in affected areas (after the tornado). Generally, very few licensees are impacted.*
Do you have any ideas or suggestions to deal with natural phenomena that occur without any warning, (i.e., earthquakes, tornados, etc.)? *During disasters, access to affected areas is usually limited to first responders. Inspectors have been denied entry into the areas (e.g., Murrah Building). The State may try to get prior authorization for their staff's access.*

Oklahoma provided some information on the Southern States Agreement for Mutual State Radiological Assistance. The purpose of the agreement is to provide a cooperative mechanism within the southern region for mutual assistance in responding to radiation incidents upon request by any party to the agreement.

Should some consideration be given to "safe havens" for sources, (e.g., large manufacturers and distributors out of harms way could store and provide security for sources for licensees that have to leave)? *No need for safe havens for tornados since they come without warning.*

Should there be an NRC representative sent to the State EOCs in advance of approaching natural phenomena? *Not good for tornados.*

Should a natural phenomenon without any reports or worries about looting prompt the same level of actions for source security? *Yes*

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Response From South Carolina

*1. The State staff indicated that they contact all licensees in-advance of the storm hitting to discuss preparations and to notify them of the need to secure radioactive sources.*

*2. The State staff reported that rather than using the Cat 1 & 2 list, they work with those facilities now required to have an emergency plan.*

*3. The State staff indicated that GPS coordinates for vulnerable facilities would be helpful. Currently not all are available. The State wants to do this.*

*4. The State staff reported that an NRC representative would not likely be useful at the State EOC: The Radiation Control Agency does not normally staff the State EOC during storms. They indicated that there might be some circumstances when an NRC representative could be useful at the Radiation Control Agency Operations Center, but not likely.*

*5. The State staff indicated that for facilities affected by the Increased Controls, they would need to verify in advance of a storm that security controls will be maintained.*

*6. The State staff reported that for advance preparations/planning, there is a need to identify facilities located in vulnerable areas, (i.e., flood zones) and focus on them.*

*7. The State staff indicated that "safe havens" for sources would be a logistical nightmare - not a good idea.*
**********

Response From Texas

What did work - any specific success stories?

*Due to lessons learned from Katrina, the State was prepared for Rita. Texas contacted all Category 1 & 2 licensees prior to landfall and requested that they contact the agency post-storm to provide a status on their facility. Licensees were also instructed to store and lockup sources and devices prior to evacuation. The State is planning to add a license condition requiring the above.*

What did not work? *Contacting the licensee prior to the storm*.

How did NRC do? *OK, but Texas did not need assistance.*

Do you have written procedures for dealing with natural phenomena? What is the content of the procedures? Did you implement them? Did they work? *The State of Texas has an Emergency Operations Plan that includes radioactive material and other hazardous materials.*

Do you think that the appropriate priority was placed on the security and safety of radioactive materials in the aftermath of the storms? *The State staff indicated that the appropriate priority was used*.

What do you think of the use of the Category 1 & 2 source list? Did this match your priorities? Were there any problems caused by the use of this list? *The State staff thought the list was good and used the list for setting priorities.*

Did the State organization and leaders place an appropriate priority on nuclear materials aspects after the hurricanes, (i.e., were you required to divert attention away from confirmation of nuclear materials to complete other tasks?)? *The State staff indicated that the appropriate priority was used*.

What would you do differently for the next hurricane? Are you proposing any changes to your procedures/processes as a result of the hurricane experiences? Should enhancements

in licensee/state actions, (e.g., secure materials, take out if reasonable, and contact regulators afterwards) be license conditions or regulations? *The State staff will probably issue a license condition requiring status reports before and after a storm.*

Should some consideration be given to "safe havens" for sources, (e.g., large manufacturers and distributors out of harms way could store and provide security for sources for licensees that have to leave)? *The State staff does not think safe havens are needed.*

Should there be an NRC representative sent to the State EOCs in advance of approaching natural phenomena. *The State staff feels that the EOC is too small to accommodate additional people.*

Should a natural phenomenon without any reports or worries about looting prompt the same level of actions for source security? *The State staff indicated that the main concern is the security of the sources no matter what the circumstances.*

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<u>Response from Puerto Rico</u>

*(Note: Byproduct materials licenses in Puerto Rico are NRC licensees. However, Puerto Rico does license material not covered by NRC and has had significant experiences with hurricanes. The task force spoke with the Director of the Radiation Control Program.)*

*Most commercial construction in Puerto Rico is concrete with aluminum windows, so these are relatively hurricane resistant compared with wooden framed structures. Wind damage does not seem to be a common problem. The Director thought this was a significant factor explaining why they have not had any sources/material lost due to floods or wind damage, that he knows of.*

*Puerto Rico requires licensees to have emergency procedures that are expected to cover a range of issues, including loss or theft. Sources are required to be locked up, and are expected to be protected from flooding by not being stored in basements or on the floor, but instead off the floor, in cabinets, or on tables.*

*The director would expect a licensee having a problem to contact his office. If it was an NRC licensee, he would expect them to call him and he would contact NRC.*

*The Director felt the NRC has been responsive in the past, and had no suggestions on changing the way business is conducted.*

*As a final comment, the Director noted that, since the last big hurricane, it is his impression that many more individuals are buying generators and installing water storage tanks at their homes to be better prepared.*