

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, DC 20555-0001

March 31, 2011

NRC INFORMATION NOTICE 2011-08: TOHOKU-TAIHEIYOU-OKI EARTHQUAKE  
EFFECTS ON JAPANESE NUCLEAR POWER  
PLANTS - FOR FUEL CYCLE FACILITIES

## **ADDRESSEES**

All licensees, applicants, and holders of a construction authorization and/or certificate issued by the U.S. Nuclear Regulatory Commission (NRC), for fuel cycle facilities including fuel manufacturing facilities, mixed oxide facilities, and uranium enrichment facilities licensed under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, "Domestic Licensing of Special Nuclear Material"; gaseous diffusion plants certified under 10 CFR Part 76, "Certification of Gaseous Diffusion Plants"; and uranium conversion/de-conversion facilities licensed under 10 CFR Part 40, "Domestic Licensing of Source Material" (i.e., Honeywell Metropolis Works).

## **PURPOSE**

The NRC is issuing this information notice (IN) to inform addressees of effects of the Tohoku-Taiheiyou-Oki earthquake on nuclear power plants in Japan. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to ensure that features and preparations necessary to withstand or respond to severe external events from natural phenomena (e.g., earthquakes, tsunami, floods, tornadoes, and hurricanes) are reasonable. The suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

## **DESCRIPTION OF CIRCUMSTANCES**

The following summary of events is based on the best information available at this time. The situation in Japan regarding recovery efforts for the Fukushima Daiichi Nuclear Power Station continues to evolve.

On March 11, 2011, the Tohoku-Taiheiyou-Oki earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and onsite power systems. Efforts to restore power to emergency equipment were hampered and impeded by damage to the surrounding areas due to the tsunami and earthquake.

Units 1, 2 and 3 were operating at the time of the earthquake. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of backup

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decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor decay heat removal could not be maintained. The operator of the plant, Tokyo Electric Power Company, injected sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure that the reactors remained shut down. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve pressure, hydrogen explosions occurred in both units and damaged the secondary containments.

Units 3 and 4 were reported to have low spent fuel pool (SFP) water levels.

Fukushima Daiichi Units 4, 5 and 6 were shut down for refueling outages at the time of the earthquake. The fuel assemblies for Unit 4 had recently been offloaded from the reactor core to the SFP. The SFPs for Units 5 and 6 appear to be intact. Emergency power is available to provide cooling water flow through the SFPs for Units 5 and 6.

The damage to Fukushima Daiichi nuclear power station appears to have been caused by initiating events beyond the design basis of the facilities.

## **BACKGROUND**

Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material," of 10 CFR Part 70 requires certain major fuel cycle facilities to perform, maintain, and annually update an integrated safety analysis that identifies controls to address potential accident sequences, both internal events and credible external events, including natural phenomena such as earthquakes, tornadoes, hurricanes, floods, and tsunamis. Certificate holders under 10 CFR Part 76 also have requirements to address the implications of such events.

## **DISCUSSION**

The events at Fukushima Daiichi remind us that highly unlikely events caused by severe natural phenomena hazards can initiate accidents of concern under 10 CFR Part 70 Subpart H, Part 76, and Part 40 and can present multiple challenges, such as recovery from loss of power and other services caused by the event. In addition, these severe events may lead to additional events, such as fires, explosions, or chemical releases that could lead to accidents of concern under 10 CFR Part 70 Subpart H or other parts of the regulations. Compliance with the regulatory requirements to prevent or mitigate regulated hazards may require that facilities be prepared, or possess equipment, to provide these safety functions despite multiple challenges and degraded or disabled resources. The degradations could include long term loss of such functions as offsite power, onsite emergency power, transportation by road or rail to access offsite resources, loss of offsite water supply, and loss of other offsite services. For events with advanced warning, plant personnel key to coping with regulated hazards may have evacuated the site, and then be unable to return. The tragic events in Japan are a reminder of the complexities and challenges of performing an ISA for scenarios resulting from such severe and widespread natural phenomena.

## PAPERWORK REDUCTION ACT STATEMENT

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## CONTACTS

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below or the appropriate Office of Nuclear Material Safety and Safeguards project manager.

**/RA/**

John Kinneman, Director  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Technical Contact: Dennis Damon, FCSS  
301-492-3126  
e-mail: [Dennis.Damon@nrc.gov](mailto:Dennis.Damon@nrc.gov)

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OFFICE	NMSS/FCSS	NMSS/FCSS	QTE	NSIR/DSP	NMSS/FCSS	NMSS/FCSS
NAME	DDamon	PJenifer	JDougherty Via-email	MLayton Via e-mail	MBailey	JKinneman
DATE	03/29/2011	03/ 25/2011	3/28/2011	04/04/2011	03/30/2011	03/31/2011

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