

**Statement of Peter Lyons**  
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**Before the**  
**Subcommittee on Energy and Water Development, and Related Agencies**  
**Committee on Appropriations**  
**U.S. Senate**

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Chairman Feinstein, Ranking Member Alexander, and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the nuclear accident situation in Japan and the Department of Energy's (DOE) response.

Let me briefly recap our current understanding of events at the Fukushima-Daiichi nuclear power plant with its six nuclear reactors, albeit with many gaps in our knowledge. When the earthquake on March 11 struck, the three operating reactors (Units 1, 2, and 3) shut down in accordance with operating procedures. Backup diesel generators started per procedures to keep the water pumps and instrumentation operational. But when the earthquake-generated tsunami struck, those backup power generators were damaged.

Units 1, 2, and 3 used battery power to continue to run their cooling pumps until the batteries were drained or the pumps failed. As the reactor cores heated from radioactive decay, steam was produced. The pressure buildup from that steam required venting, which released some radioactive materials. It also lowered the water level in the three reactor pressure vessels, reducing the cooling of the core. It appears that all three reactor cores are damaged to unknown extents. Additionally, as the fuel rod temperature increased, a reaction took place between the zirconium fuel cladding and the water in the pressure vessel, producing hydrogen. This hydrogen was vented along with the steam and may have ignited at all three reactors. Substantial explosive damage is visible at Units 1 and 3, presumably from these explosions. An explosion may have damaged the containment structure at Unit 2. Fission products have been released through these processes. Once pumper units were brought in, seawater cooling was used for many days until fresh water supplies were available.

Water levels at the spent fuel pools are also of concern with some reports that at least one was empty for some time. Depending on the condition of the pools and the age of the fuel in the pool, the cladding of the used fuel could ignite. Such a zirconium fire would be very difficult to extinguish and could potentially lead to significant releases. Seawater was also used to cool spent fuel pools, until fresh water supplies were obtained.

Current information suggests that the plants are in a slow recovery from the accident. Long term cooling of the reactors and pools is essential during this period. A massive cleanup operation remains for the future.

To assist in the United States' response, National Nuclear Security Administration's (NNSA) Nuclear Incident Team (NIT) Operations Center was promptly activated and has been

continuously staffed by NNSA and Office of Nuclear Energy personnel since the accident. The focus of all DOE activities, led by the Operations Center, has been to understand the accident progression and offer advice and assistance to the Japanese officials who have the direct responsibility to manage the accident recovery.

The DOE has deployed about 40 people and more than 17,000 pounds of equipment to Japan, including NNSA's Aerial Measuring System (AMS) and Consequence Management Response Teams. The Response Teams on the ground are utilizing their unique skills, expertise and equipment to help assess, survey, monitor and sample ground areas for radiation. Since arriving in Japan, the AMS team has collected and analyzed data gathered from more than 40 hours of flights aboard Department of Defense fixed wing and helicopter platforms. Sampling of airborne radiological material, coupled with spectroscopic measurements by the DOE team, have helped to determine that virtually all the material studied to date is consistent with releases from operating reactors, not the used fuel in the pools from which short-lived radioactive materials have already decayed.

The AMS measures radiological contamination on the ground deposited from transit of any release plumes. We are sharing the results of these measurements with Japanese officials. In addition, AMS data are available on the DOE web site.

As of March 19, 2011, all AMS measurements beyond 2.5 miles from the reactor were below 30 millirem per hour. Elevated readings have been observed within about 25 miles of the Fukushima-Daiichi Nuclear Power Plant and a distinctive pattern to the ground deposition is readily observable with an area of higher contamination extending to the northwest of the plant. The AMS was grounded by weather for several days and flew again on March 24. The new data are consistent with reduced levels of radiation compared to the earlier measurements and show no evidence of significant new releases between March 19 and 24.

In addition, NNSA has been performing in-country and long distance modeling of potential plume movement using the National Atmospheric Release Advisory Capability (NARAC) at Lawrence Livermore National Laboratory. The Nuclear Regulatory Commission supplies the hypothetical source terms for these NARAC calculations.

The Office of Nuclear Energy has established a Nuclear Energy Response Team (NERT). The purpose of this team is threefold:

- Provide expert analysis on reactor conditions to DOE leadership from reported information and investigate discrepancies or conflicting reports.
- Support the NIT Operations Center with analysis or additional information as needed.
- Coordinate analysis activities at the DOE National Laboratories in support of the above.

The NERT consists of eight sub-teams organized by major systems of the reactor (e.g. cooling, electrical power, reactor vessel) that meets twice daily.

The Office of Nuclear Energy has staff in Japan working directly with NRC's staff in Japan and with the Japanese agencies and industry. We also have a representative at the NRC operations

center in Rockville. The Office of Nuclear Energy is also in contact with the GE-Hitachi command centers.

DOE and NRC have worked with the Institute for Nuclear Power Operations (INPO) and the Nuclear Energy Institute (NEI) to encourage formation of an industry assistance team. INPO is now leading this industry team, deployed both in Japan and at INPO headquarters in Atlanta. Members of the NERT are in regular contact with the INPO teams.

In addition, Secretary Chu and White House Science and Technology Advisor John Holdren have jointly set up an informal group of experts on reactor safety and accident mitigation from inside and outside the government. The group has a daily teleconference in which the newest information is discussed and the individual members convey their thoughts about the most promising approaches to the Secretary and Dr. Holdren.

Beyond our response to the accident, the research, development, and deployment programs of the Office of Nuclear Energy are highly relevant to future decisions about the potential options for nuclear power in the United States. Our proposed Small Modular Reactor program will explore designs that offer safety advantages through extensive use of passive systems. We are also conducting research and development into high temperature gas reactor designs that offer inherent safety features. The Light Water Reactor Sustainability program is exploring whether the lifetime of operating reactors can be extended with no compromise in safety.

The Office of Nuclear Energy also performs research on fuel cycles. We are conducting R&D into a broad range of options for the nation's fuel cycle with careful attention to safety, environmental protection, and nonproliferation. In addition, our cross-cutting research into areas like advanced materials and instrumentation is exploring technologies that could enable future safety enhancements, like fuel claddings that cannot generate hydrogen in an accident or fuels that are virtually impossible to melt. And the new Modeling and Simulation Hub, based at the Oak Ridge National Laboratory, will provide new capabilities to the nuclear industry, capabilities that can be used to assess and improve the safety of existing reactors.

I fully concur with the statement made by Deputy Secretary Poneman at a White House briefing on March 14 that: "We view nuclear energy as a very important component to the overall portfolio we are trying to build for a clean energy future." The programs of the Office of Nuclear Energy are focused on assuring that the option for safe nuclear power remains open to the nation.

In conclusion, the earthquake and resulting tsunami have visited tremendous devastation on Japan. Those of us at the DOE are making every effort to assist the Japanese people in their time of need.