

Responses to Post-Hearing Questions from the March 31, 2011 Hearing on 2012 Budget Request for the Nuclear Regulatory Commission and Department of Energy's Nuclear Energy Programs

Ticket: G20110251

1. Impact of events in Japan on nuclear industry

QUESTION 1. Given that nuclear power is and will play an important role in our energy mix, how do you think these events might impact your programs and the nuclear industry in the short term? And how – if at all – might it impact where we are heading in the long term?

ANSWER.

The NRC has launched a two-pronged review of U.S. nuclear power plant safety in the aftermath of the March 11 earthquake and tsunami and the resulting crisis at the Japanese Fukushima Daiichi nuclear power plant. The NRC established a task force, made up of current senior managers and former NRC experts with relevant experience, to conduct both short- and long-term analysis of the lessons that can be learned from the situation in Japan. The NRC will perform a systematic and methodical review, examining all available information from Japan, to see if there are changes that should be made to programs and regulations to ensure continued protection of public health and safety. An aggressive schedule has been established for the task force to provide formal updates to the Commission on the short-term effort in 30, 60 and 90 days.

As discussed in Information Notice 2011-05, dated March 18, 2011, the nuclear power industry has begun taking the following actions at each licensed reactor site:

1. verification of the capability to mitigate conditions that result from severe adverse events, including the loss of significant operational and safety systems due to natural events, fires, aircraft impact and explosions
2. verification of the capability to mitigate a total loss of electric power to a nuclear power plant
3. verification of the capability to mitigate flooding and the impact of floods on systems inside and outside the plant
4. identification of the potential for loss of equipment functions during seismic events appropriate for the site and the development of mitigating strategies to address potential vulnerabilities

NRC resident inspectors who are posted at every U.S. nuclear power plant will also support the task force's short-term effort, supplemented as necessary by experts from the agency's regional and headquarters offices. The task force will help determine if any additional NRC responses, such as Orders requiring immediate action by U.S. plants, are called for, prior to completing an in-depth investigation of the information from events in Japan. NRC inspectors are also

performing independent assessments of the adequacy of the voluntary actions, described above, that are being taken by licensees in response to the Fukushima Daiichi event and to coordinate their inspection efforts with the licensees schedule for verification of plant capabilities.

The longer-term review will inform any permanent NRC regulation changes determined to be necessary. We anticipate the task force will begin its long-term evaluation in about 90 days from when it began and will provide a report to the Commission with recommended actions within about six months later. The Commission plans to hold monthly public meetings on the status of the NRC response to the Japan earthquake and will post the meeting schedule in the NRC's public webpage. At this point, aside from the effort to identify and incorporate lessons learned and improve safety where necessary, it is still too early to tell what the long term impacts of the events in Japan will ultimately have on the direction of the U.S. nuclear industry.

2. Safety of U.S. reactors compared to Fukushima

QUESTION 2a. First, I hear disagreement over whether there was a flaw in the reactor design at Fukushima, or whether there was a systems issue – a failure to adequately protect the reactor’s auxiliary systems. What is your take on that question, Dr. Lyons and Chairman Jaczko?

ANSWER.

First, let me begin by saying that the events in Japan are still unfolding and until we the full set of details of what happened (i.e., how systems, equipment, and personnel responded) are known, it still too early to say with any level of confidence that there was a flaw in the reactor design or that there were issues of inadequate protection. What we do know, based on the information available, is that the units at Fukushima Daiichi responded to the earthquake as they were designed to respond (i.e., reactor shutdown and automatic start of emergency diesel generators upon loss of offsite power). We have also learned that the emergency power systems, with the exception of the back-up batteries, were swamped by the tsunami which exceeded the level of protection provided by the facility. Loss of the emergency power systems exacerbated the situation and as the batteries began run out, the situation continued getting worse. It has been reported that the tsunami that hit Fukushima Daiichi was in excess of the design basis tsunami for that facility. We are not aware of any indications that the design of the facility at Fukushima Daiichi was not in compliance with Japanese regulatory requirements.

The design of a nuclear power facility is typically thought of in terms of the nuclear island (i.e., the reactor and its connected systems, including the containment buildings) and the balance of plant (i.e., secondary cooling water systems, electrical and emergency power systems, etc.). With this in mind, let me also say that even though the reactor design at Fukushima Daiichi (i.e., BWR Mark I) has operated without significant incident for many years in both the U.S. and abroad, some improvements have been required of this design in the U.S. In addition, there are differences in design of the balance of plant systems due to site-specifics and the use of different architect/engineers and constructors for these portions of the plant. The variability that occurs in the designs of the balance of plant systems at these facilities also makes it difficult to conclude that there were design flaws or inadequate protection.

QUESTION 2b.

I understand that the United States has nuclear reactors of the same “make and model” as the Fukushima Daiichi reactors – six U.S. reactors have the same reactor and secondary containment structure designs, I believe. Do our plants have the same safety risks as Fukushima, or are there regulatory differences, construction differences, and other precautions that make our plants safer?

ANSWER.

Thirty-five of the 104 operating nuclear power plants in the U.S. are boiling water reactors (BWRs), as are the reactors at Fukushima. Twenty-three of the U.S. BWRs have the same containment design (i.e., Mark I) as the Fukushima Daiichi reactors. Four of the U.S. BWRs are early designs which are similar to Fukushima Unit 1. Nineteen U.S. BWRs are similar to Fukushima Unit 3.

That being said, all U.S. nuclear power plants are built to withstand the external hazards, including earthquakes, flooding, and tsunamis, that are appropriate for its region. Even those plants that are located in areas with low and moderate seismic activity are designed for safety in the event of such a natural disaster.

The NRC is not aware of all of the differences that may exist between the reactors that are of similar design and vintage as those operated in the U.S. However, many improvements have been made to U.S. boiling water reactors (BWRs). For example, NRC Generic Letter 89-16, “Installation of a Hardened Wetwell Vent,” conveyed the importance of having a robust pathway for venting primary containment, which contains the suppression pool, in certain severe accident scenarios. In response, all BWRs with Mark I containments that didn’t have an existing strengthened or “hardened” pathway for venting directly from primary containment to the outside, made modifications to the plant consistent with the intent of the Generic Letter. This design feature permits a controlled depressurization of primary containment as well as a controlled release of radioactive materials and combustible hydrogen generated by damaged fuel, as may occur during severe accidents.

The NRC can only comment on its own regulatory approach and does not have any comments on or detailed knowledge of specific requirements in the Japanese regulatory approach. The NRC regulatory approach requires that facilities be designed to cope with a station blackout for specifically analyzed durations, include measures to control combustible gases, and include programs, procedures and equipment to maintain or restore core cooling, containment, and spent fuel cooling capabilities under circumstances associated with loss of large areas of the plant due to explosions or fire. Licensees of U.S. nuclear power plants have also implemented the use of severe accident management guidelines to respond to severe accident events. Although the reactor portions (i.e., nuclear steam supply system) are primarily the same, some differences in the design and construction of these BWR plants exist also because of site-specifics and the use of different architect/engineers and constructors.

QUESTION 2c.

What about hydrogen venting? Do our reactors have different venting systems or other precautions that would prevent the hydrogen explosions that affected some of the outer containment building at Fukushima?

ANSWER.

The NRC is not aware of all of the differences that may exist between the reactors that are of similar design and vintage as those operated in the U.S. Many improvements have been made to U.S boiling water reactors (BWRs). For example, NRC Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," conveyed the importance of having a robust pathway for venting primary containment, which contains the suppression pool, in certain severe accident scenarios. In response, all BWRs with Mark I containments that didn't have an existing strengthened or "hardened" pathway for venting directly from primary containment to the outside, made modifications to the plant consistent with the intent of the Generic Letter. This design feature permits a controlled depressurization of primary containment as well as a controlled release of radioactive materials and combustible hydrogen generated by damaged fuel, as may occur during severe accidents.

3. Cooperation with Nuclear Regulatory Commission

QUESTION 3a. What are the obstacles to effective cooperation on licensing and safety oversight between the Department of Energy the Nuclear Regulatory Commission?

ANSWER.

Given our separate and independent missions, we do not see any obstacles to effective cooperation with the Department of Energy, where possible. As I'm sure you know, the Nuclear Regulatory Commission and the Department on Energy were established by the Energy Reorganization Act of 1974. Prior to that, the functions that the newly created NRC and DOE perform were carried out by the Atomic Energy Commission (AEC). The NRC took over the regulatory functions formerly carried out by the AEC and began operations in January 1975. The NRC and DOE, as well as many other U.S. government and private entities, are cooperating to provide support to the Japanese government and the U.S. Ambassador in response to the earthquake and tsunami and the events at the Fukushima Daiichi facility.

In the Energy Policy Act of 2005, Congress directed the DOE and the NRC to develop a licensing strategy supporting the Next Generation Nuclear Plant (NGNP) program, including research and development activities needed to demonstrate the safety of the proposed reactor. The strategy described in an August 2008 report to Congress described a risk-informed, performance-based approach to develop a combined license application pursuant to NRC's regulations in 10 CFR Part 52. As this strategy is executed, DOE and NRC staffs routinely discuss project activities, plans, and correspondence associated with the NGNP project to ensure consistent understanding of project activities and status, and to ensure alignment of respective agency activities.

In cases where NRC licensing and/or oversight of DOE facilities is sought, these types of cooperative arrangements involve policy level discussions at the Commission and may also involve legislation, as in the case of the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site in Aiken, SC. Another example of cooperative effort between the NRC and the DOE is the Department of Homeland Security National Response Framework, Nuclear/Radiological Incident Annex, which defines the roles and responsibilities of several government agencies in response to incidents involving release of radioactive materials.

QUESTION 3b. What is being done to remove these obstacles?

ANSWER.

As previously stated, we do not see any obstacles to effective cooperation with the DOE.

6. NRC Actions related to Japan

QUESTION 6a. Chairman Jaczko, what is the NRC doing to support efforts in Japan to stabilize and secure the damaged nuclear plants?

ANSWER.

The NRC has taken a number of actions:

1. Since the beginning of the event, the NRC has continuously manned its Operations Center in Rockville, MD in order to gather and examine all available information as part of the effort to analyze the event and understand its implications both for Japan and the United States.
2. A team of 11 officials from the NRC with expertise in boiling water nuclear reactors have deployed to Japan as part of a U.S. International Agency for International Development (USAID) team. This team continues to be refreshed
3. The NRC has spoken with its counterpart agency in Japan, offering the assistance of U.S. technical experts.
4. The NRC is coordinating its actions with other Federal agencies as part of the U.S. government response.

The entire federal family is responding to this event. The NRC is closely coordinating its efforts with the White House, DOE, DOD, USAID, and others. The U.S. government is providing whatever support requested by the Japanese government. Some U.S. agencies are involved in monitoring and assessing radiation including EPA, DOE, and NRC. The NRC has been working through the U.S. Ambassador as focal point for Japanese requests for equipment needed to cool the reactor fuel. This includes such things as pumps, fire hoses, portable generators, and diesel fuel. The NRC is also coordinating with General Electric, which has plant design specifications, to ensure any equipment provided will be capable of meeting the needs of the Japanese.

QUESTION 6b.

The NRC announced last week the formation of a task force to conduct both a short- and long-term analysis of the lessons we can learn from the events in Japan. Realizing that we don't yet have all the information on Japan or the task-force's recommendations, what types of short-term changes to your regulatory framework do you think are possible? What about long-term changes?

ANSWER.

Well, just as you said, we don't yet have the full details on the events in Japan or the task force's recommendations, so it is difficult to speculate on the results of the task force's efforts. As you know, several briefings have been tentatively scheduled with the Commission to discuss status NRC efforts in response to the events in Japan, including briefings by the task force (e.g., April 25, May 9, June 13, etc.). Some short-term actions that may be possible include the issuance of additional information notices, other generic communications, inspection procedures, or licensing review guidance. Long-term actions may include issuance of additional generic communications, licensing review guidance, orders, proposed rulemakings, etc. All these things are in the realm of possibility, however, I must stress that it is still too early to speculate with any sense of certainty what the outcomes. What is certain, though, is that this agency will continue to ensure the health and safety of the public and the environment and that whatever the results of the task forces efforts, the health and safety of the public and environment will be maintained or enhanced.

QUESTION 6c.

Will the NRC continue processing existing license applications while the task force conducts its analysis?

ANSWER.

The NRC will continue to process existing applications for new licenses and license renewal applications in accordance with the schedules that have been established. The NRC continues to believe that its regulatory framework and requirements provide for a rigorous and comprehensive license review process that examines the full extent of siting, system design and operations of nuclear power plants. The recommendations of the NRC's task force that was established to examine lessons learned from the events in Japan will certainly be taken into account in the performance of the NRC's review of these applications, as appropriate. Further, the NRC has the necessary regulatory tools to require changes to existing licenses or applications for certification should the agency determine that changes are necessary.

QUESTION 6d. How will the task force's timeline of 90 days for its short-term analysis and approximately six months for its long-term recommendations impact existing license applications?

ANSWER.

The timelines for the task force analyses and recommendations will not have any immediate effect on the review of existing license applications. The NRC will continue to process existing applications for new licenses and license renewal applications in accordance with the schedules that have been established. The NRC continues to believe that its regulatory framework and requirements provide for a rigorous and comprehensive license review process that examines the full extent of siting, system design and operations of nuclear power plants. The recommendations of the NRC's task force that was established to examine lessons learned from the events in Japan will certainly be taken into account in the performance of the NRC's review of these applications, as appropriate. Further, the NRC has the necessary regulatory tools to require changes to existing licenses or applications for certification should the agency determine that changes are necessary. For example, any new requirements that may result from the task force's recommendations could be implemented in accordance with existing agency policies that may involve rulemaking or backfitting.

7. Review of existing facilities

QUESTION 7a. What is the scope of this review? Are enrichment facilities, waste repositories, spent fuel pools, and non-commercial reactors all included?

ANSWER.

The near-term review by the task force established by the Commission will focus on identifying potential or preliminary near term/immediate operational or regulatory issues affecting domestic operating power reactors of all designs, including their spent fuel pools, in areas such as protection against earthquake, tsunami, flooding, hurricanes; station blackout and a degraded ability to restore power; severe accident mitigation; emergency preparedness; and combustible gas control. The longer-term review would begin as soon as the NRC has sufficient technical information from the events in Japan, including specific information on the sequence of events and status of equipment during the duration of the event. The task force will evaluate all technical and policy issues related to the event to identify potential research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by the NRC. The applicability of lessons learned to non-operating reactor and non-reactor facilities would also be explored.

QUESTION 7b.

Do you expect that applications for reactor extensions or power uprates will be slowed because of this review? What about new reactor licenses?

ANSWER.

The NRC will continue to process existing applications for new licenses and license renewal applications in accordance with the schedules that have been established. The NRC continues to believe that its regulatory framework and requirements provide for a rigorous and comprehensive license review process that examines the full extent of siting, system design and operations of nuclear power plants. The recommendations of the NRC's task force that was established to examine lessons learned from the events in Japan will certainly be taken into account in the performance of the NRC's review of these applications, as appropriate. Further, the NRC has the necessary regulatory tools to require changes to existing licenses or applications for certification should the agency determine that changes are necessary.

QUESTION 7c.

How long will it take for you to complete this review? Will the Task Force's anticipated timeframe of six months for its long-term analysis conclude the review?

ANSWER.

As noted in the staff requirements memorandum that established the task force, the Commission expects the near-term review to last approximately 90 days. The Commission has requested status briefings from the task force about every 30 days, with the final briefing providing a culmination of the near-term review. The longer-term review should begin as soon as the NRC has sufficient technical information from the events in Japan with the goal of no later than completion of the 90-day near term report. We envision that the longer-term review could last up to 6 months. Based on the results of the long-term review, there could be additional analysis and research recommended. It also depends on exactly what we learn regarding the full details of what happened to those reactors in Japan. If you look historically at what the NRC did in response to TMI, the review and analysis effort lasted for an extended period of time and has repercussions even unto today. So, I would say that it is too early to tell whether this approximate 6-month effort would conclude the review. One could say that the completion of the 6-month review effort might be considered the end of the beginning of long, deliberate, comprehensive safety review.

QUESTION 7d.

How much funding do you expect this review to cost, and do you expect the 2012 request will need to change in order to accommodate it?

ANSWER.

The task force's work is being accomplished in FY11 with some of the work extending out into FY12. Any adjustments that would need to be made in FY12 and beyond can only be determined after the task force completes its work and its recommendations are acted upon by the Commission. At this point in time, with the task force having only been convened for a few weeks and without the first status briefing or any interim recommendations before us, we believe that it is still too early to estimate the level of funding necessary to complete this thorough review.