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Adrian P. Heymer
Senior Director
Strategic Programs
Nuclear Generation Division

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September 26, 2011

Ms. Cindy K. Bladey
Chief, Rules, Announcements and Directives Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

**Subject:** Nuclear Industry Input on the Approach to, and Prioritization of, NRC Actions Associated with the Fukushima Daiichi Accident; Docket Number NRC-2011-0196

**Project Number: 689**

Dear Ms. Bladey:

The Nuclear Energy Institute[1] appreciates the opportunity to follow-up the September 21, 2011 public meeting between NRC senior management and representatives of the industry's Fukushima Response Steering Committee. The purpose of this letter is to provide input on the approach to, and prioritization of, NRC actions associated with the Fukushima Daiichi accident, especially in light of the industry actions taken to date following the accident.

The industry agrees that there are important lessons to be learned and implemented from the Fukushima Daiichi accident. As described at the September 21 meeting, the industry has developed a strategic plan, *The Way Forward*, to manage its response to the Fukushima crisis; a copy is attached. The plan emphasizes the importance of maintaining the high safety performance of the 104 operating reactors and covers the development and implementation of lessons learned from Fukushima, research and development, technical support, international cooperation, communications, emergency planning and preparedness, training, and regulatory interactions and response.

Following the accident at Fukushima Daiichi, the nuclear industry took immediate actions in the areas needing attention based on the earliest lessons learned. These actions were discussed by industry representatives on September 21. As more is learned, the industry will not hesitate to take additional actions.

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[1] NEI is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and entities involved in the nuclear energy industry.

1776 I Street, NW | Suite 400 | Washington, DC | 20006-3708 | P: 202.739.8094 | F: 202.533.0147 | aph@nei.org | www.nei.org

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Template = ADM-013

Add = Michael Dudek (MID)
Michael Levine (MHL)
Kevin Witt (KMW)
Brian Green (BDG1)

**Actions Should Match Information Available**

History—especially the NRC and industry experience following the 1979 accident at Three Mile Island—teaches the importance of first understanding what happened, defining the problem to be solved, and then taking an action. This reduces the likelihood of missing what is truly important to safety and rework. As discussed at the September 21 meeting, the industry is developing a timeline—in conjunction with the Tokyo Electric Power Company—of the events at Fukushima Daiichi. This is expected to be completed by early November 2011. It is our intent to share the timeline with the NRC. It is important that the NRC, the industry and the public have a common understanding of the progression of events and actions at Fukushima Daiichi. A common timeline would be the basis for discussions of lessons learned and needed actions.

Near-term actions and the setting of priorities should be based on what is known. Where information is incomplete, additional actions should await a more complete understanding of the accidents.

The Fukushima spent fuel pools are an example of where facts have invalidated earlier conclusions. Shortly following the initial events, many believed that water levels in the pools—the Unit 4 pool, in particular—had fallen to the point that the spent fuel had overheated, failed and contributed to the accident. Now, with the benefit of visual inspections and samples from the four affected fuel pools, it is evident that the spent fuel rods did not experience major and significant failure.

**Preparations for Beyond Design Basis Events**

In addressing the wide range of potential beyond design bases events, such as large fires and explosions, approaches that encompass diversity and flexibility with redundancy have proven to be the most effective. Beyond design basis events are, by their very nature, "...sequences that are possible but were not fully considered in the design process because they were judged to be too unlikely."[2] This suggests that we should be enhancing the means for our operating crews to react to beyond design basis event symptoms with flexibility and agility, which requires diverse and redundant equipment, not single, fixed systems that are designed for a limited set of circumstances.

An example of this point is the NRC's Near-Term Task Force recommendation that NRC "[o]rder licensees to have an installed seismically qualified means to spray water into the spent fuel pools, including an easily accessible connection to supply the water (*e.g.,* using a portable pump or pumper truck) at grade outside the building."[3] A permanent standpipe with a connection at grade outside the building would be effective for spraying water into the pools only under limited circumstances. It would not be effective if the pipe connection was, for example, inundated with flood waters that exceeded the flooding design basis; was blocked by debris deposited by a tornado; the portable pump could not access the connection due to any number of reasons, including debris, earthquake damage, etc.; was damaged or destroyed by an explosion

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[2] NRC Glossary (http://www.nrc.gov/reading-rm/basic-ref/glossary/beyond-design-basis-accidents.html).
[3] USNRC, Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (July 21, 2011) at 46.

or aircraft crash. A question to contemplate is whether such a standpipe would have remained intact and operable at Fukushima Daiichi given the explosions in Units 1, 3 and 4.

A far better enhancement would be to increase the amount of B.5.b equipment (consistent with the number of units with operating licenses on a site), place the B.5.b equipment in diverse locations and train operating crews to be flexible and agile in their approach to such events. This requires that the operators know the water level and temperature in the pools. As discussed in the attachment, the industry supports enhancing spent fuel pool monitoring through diverse and redundant means with the flexibility to accommodate varying plant configurations.

**"Adequate Protection" for Post-Fukushima Requirements**

NRC's Near-Term Task Force Report concluded that "...continued operation and continued licensing activities [at nuclear power plants] do not impose an imminent risk to the public health and safety and are not inimical to the common defense and security."[4] The report also states that all the recommendations in the report should be implemented through an expansion of adequate protection.[5] Under the Atomic Energy Act, the Backfit Rule and related court decisions, the NRC has broad authority to determine what is meant by adequate protection.[6]

Under the NRC's Backfit Rule, there is an exception to the requirement for cost-benefit analysis and justification for imposing new requirements if the NRC determines that the change is needed to provide adequate protection.[7] As part of its determination, the NRC is required to provide a "documented evaluation" of the backfit stating the objectives of, and reasons for, the modification and the basis for invoking the exception.[8] The NRC should adhere to the long-established regulatory requirements of the Backfit Rule and prepare the required evaluations as it makes those determinations. Further, even recognizing NRC's broad discretion in determining what protection is adequate, the industry nonetheless suggests that the agency engage with stakeholders prior to reaching a determination regarding adequate protection and any additional regulatory actions.

If NRC ultimately determines that a post-Fukushima requirement should be imposed based on what is necessary for adequate protection, the NRC should consider, as is provided for under the Backfit Rule, the cost-benefit among different methodologies for meeting the requirement.[9] This will be particularly important as the agency evaluates flexible regulatory approaches to address beyond design basis events.

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[4] *Id.* at 18.
[5] *Id.*
[6] *For example,* the D.C. Circuit has opined that "the determination of what constitutes 'adequate protection' under the Act ... is just such a situation where the Commission should be permitted to have discretion to make case-by-case judgments based on its technical expertise ...."*Union of Concerned Scientists v. Nuclear Regulatory Comm'n., 880 F. 2d 552, 558 (D.C. Cir. 1989).*
[7] 10 C.F.R. § 50.109(a)(5)
[8] 10 C.F.R. § 50.109(a)(6)
[9] 10 C.F.R. § 50.109(a)(7)

**Prioritization of Post-Fukushima Regulatory Actions**

The attachment to this letter discusses the industry's views on the priorities for action, which remain the items discussed in our September 2, 2011 letter.

As the NRC considers the priorities of the post-Fukushima recommended regulatory actions, the industry strongly suggests that potential actions be ranked by contribution to safety. The individual post-Fukushima regulatory actions should also be compared to all the other regulatory actions the NRC and the industry are pursuing on the same basis such that an overall priority can be developed.

In closing, the industry commits to continuing our efforts to work closely with the NRC in devising the needed response to what is learned from events in Japan. We look forward to additional discussions with NRC staff on these and related topics.

Sincerely,

Adrian P. Heymer

Attachments

c: The Honorable Gregory B. Jaczko, Chairman, U.S. Nuclear Regulatory Commission
The Honorable Kristine L. Svinicki, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable William D. Magwood, IV, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable George Apostolakis, Commissioner, U.S. Nuclear Regulatory Commission
The Honorable William C. Ostendorff, Commissioner, U.S. Nuclear Regulatory Commission
Mr. R. William Borchardt, EDO, NRC
Mr. Martin J. Virgilio, EDO, NRC
Mr. Eric J. Leeds, NRR, NRC
Mr. Brian W. Sheron, RES, NRC
Mr. Michael R. Johnson, NRO, NRC
Mr. David L. Skeen, NRR/DE, NRC

**Attachment**

# Nuclear Industry Input on the Approach to, and Prioritization of, NRC Actions Associated with the Fukushima Daiichi Accident Docket Number NRC-2011-0196

## Industry Response to the Fukushima Daiichi Accident

In light of the events in Japan and the industry's need to understand and take appropriate actions at U.S. nuclear power plants in response to the accident, the industry leadership formed the Fukushima Response Steering Committee—a set of nine chief nuclear officers and senior executives from the three industry associations, INPO,[1] EPRI[2] and NEI[3]—to lead the U.S. nuclear power industry's response to the events in Japan. The steering group:

- developed a strategic plan[4] that articulates the strategic goals, structure and process for defining the industry's overall response to Fukushima;
- ensures that identified issues are appropriately coordinated among industry organizations and that lead and supporting roles are clearly established;
- monitors the status of action plans on key issues to ensure priorities and schedules are consistent with the strategic plan and that the overall impact on operating plants is balanced and appropriate to the industry's prime focus, excellence in safe operations; and
- works with NRC and other parties to establish a common understanding of the events that took place in Japan and a congruent as possible vision of needed changes going forward.

Immediately following the accident, INPO took several actions to ensure that the equipment each plant must have on-site for responding to terrorist attacks (pursuant to 10 CFR 50.54(hh)) was available and operating crews were knowledgeable in its use;[5] to require each plant to

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[1] The Institute of Nuclear Power Operations (INPO) promotes the highest levels of safety and reliability – to promote excellence – in the operation of commercial nuclear power plants by establishing performance objectives, criteria and guidelines for the nuclear power industry, conducting regular detailed evaluations of nuclear power plants, and providing assistance to help nuclear power plants continually improve their performance.

[2] The Electric Power Research Institute, Inc. (EPRI) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, health, safety and the environment. EPRI's members represent more than 90 percent of the electricity generated and delivered in the United States, and international participation extends to 40 countries.

[3] NEI is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and entities involved in the nuclear energy industry.

[4] "The Way Forward – U.S. Industry Leadership in Response to Events at the Fukushima Daiichi Nuclear Power Plant" (Washington, D.C.) June 8, 2011.

[5] The NRC parallel inspections of these items and procedures, and the results have been well documented and not described here.

have available in the control room information on how long it would take the spent fuel pools to reach 200°F given the parameters in the pool at the time and to ensure that the pool would not reach 200°F for 72 hours following loss of active cooling; and to assess how long station blackout coping times can be extended. Future actions will be taken based on the information reported back to INPO combined with additional knowledge about the events that transpired at Fukushima.

**Fukushima Event Timeline**

As discussed at the September 21, 2011 meeting between NRC senior management and representatives of the industry's Fukushima Response Steering Committee, the industry agrees that there are important lessons to be learned and implemented from the Fukushima Daiichi accident. Near-term actions and the setting of priorities should be based on what is known. Additional actions should be studied, but held in abeyance until there is a more complete understanding of the accidents.

In this regard, the industry is developing a timeline—in conjunction with the Tokyo Electric Power Company—of the events at Fukushima Daiichi. This is expected to be completed by early November 2011. It is our intent to share the timeline with the NRC. It is important that the NRC, the industry and the public have a common understanding of the progression of events and actions at Fukushima Daiichi. A common timeline would be the basis for discussions of lessons learned and needed actions.

**Beyond Design Basis Events**

In dealing with beyond design bases events and accident management, the industry has recognized that it is not possible to identify the specific accident progression among a very broad set of potential events. Therefore, it makes little sense to permanently install fixed equipment and systems that can, by their very nature of being fixed, be useful in only a limited number of beyond design basis scenarios. As a result, we have adopted a diverse, redundant, risk-informed, performance-based approach to severe accident management relying on dispersed, portable equipment and guidelines rather than fixed equipment and prescriptive criteria and detailed procedures, so that operating crews can react with flexibility and agility to the symptoms of the events. In other words, multiple different types of equipment (with appropriate training) located in different places that allow operating crews to respond to the symptoms being able to use the same equipment for different conditions or different equipment for the same conditions.

This approach would also allow for individual plants to take into account the variations in siting, geographical and geological locations, and plant designs for implementing post-Fukushima accident enhancements. It would allow specific plant operators and emergency response organizations to develop successful mitigation measures based on knowing their technical knowledge, their specific plant and its systems, and general guidance.

**Priority of Post-Fukushima Actions**

Nuclear generating plants are complex with a myriad of systems and numerous inter-dependencies. Thus, many of the 34 recommendations made by the NRC Near-Term Task Force

have an impact on, or are dependent upon, other recommendations or plant aspects. Such interdependencies call for an integrated understanding of the plants and the effect expected of the recommended actions and enhancements.

Based on a coarse, qualitative risk assessment, many of the 34 recommendations have small or negligible risk significance. However, there are six priority recommendations that we consider to have need for immediate action.

The priority recommendations are:

- Recommendation 2.3 – Verification of capability to meet current design basis for external flooding and seismic and verification of monitoring and maintenance for protective features.
- Recommendation 4.1 – Enhanced capability to cope with multi-unit loss of ac power conditions.
- Recommendation 5.1 – Enhanced capability to vent BWR Mark I containments under loss of AC conditions.
- Recommendation 8.1 – Integration of EDMGs and SAMGs and enhanced training on the EOP-SAMG/EDMG interface.[6]
- Recommendation 7.1 – Spent fuel pool monitoring
- Recommendations 9 and 10 – Emergency Planning (EP) as they relate to implementation of the new EP rule.

## Discussion of the High-Priority Recommendations

- **Recommendation 2**: Verification of capability to meet current design basis for external flooding and seismic and verification of monitoring and maintenance of protective features.
    - Conduct walk-downs to assure that plant conforms to its design. Separate regulatory interactions on flooding and seismic should take place in advance of the walk-downs to reach a common understanding on the approach and acceptance criteria prior to commencing the activity.
    - Specific 10-year updates are unnecessary. Any new and pertinent information is always assessed as it is identified to determine if there is a potential impact on the plant and the design bases. A generic process with predetermined criteria for identifying and assessing new information and a process for updating the design bases, if required, with a suitable time period for implementation needs to be developed. However, the industry firmly believes that from a safety perspective, we

[6] EDMG = Extensive Damage Mitigation Guideline; SAMG = Severe Accident Management Guideline; EOP = Emergency Operating Procedure

should not wait to perform a review and update every 10 years. New information should be evaluated as it is identified and, if necessary, action—including the update of the design bases—should be taken.

- **Recommendation 4**: Rulemaking to enhance the capability to cope with an extended and complete loss of ac power at all units on a site.

  - This is a complex and low-probability issue with varying impact and outcomes dependent on the numerous design configurations and potential site-specific solutions. With varying grid and plant configurations, geographical, geological and transportation infrastructure differences, the potential for a complete loss of AC power at all units varies from site to site, as does the capability to restore that power. While the industry supports the need for improving the coping duration for a complete loss of AC power, there needs to be recognition of site-specific differences. A flexible, diverse, performance-based approach that takes into account site- and design-specific nuances would address this issue.

  - A performance-based approach would not support a specific, prescribed duration interval of 72 hours. The duration should be based on a determination of how long it would take to either restore a reliable AC power supply from the grid or from portable offsite support.

  - Importantly, the NRC staff recognizes the value of the 10 CFR 50.54(hh) equipment. The industry will assess the adequacy of this equipment to deal with a multi-unit event and will adjust its approach accordingly.

  - Some new plant designs have the capability to cope with a complete loss of AC power for 72 hours. Other new designs have additional safety systems or enhanced protection features that could assure safety-related emergency electrical equipment is adequately protected. This reinforces the need for a performance-based approach as opposed to a prescriptive set of generic requirements for new or existing plants. In addition, the Near-Term Task Force report provides no basis for requiring new plants to extend the coping duration beyond 72 hours using portable 10 CFR 50.54(hh) equipment. Well-documented processes for imposing new requirements on new designs are provided in 10 CFR Part 52: 10 CFR 52.83, 52.98 and 50.109. ITAAC[7] are not the appropriate vehicle for imposing new regulatory requirements on new plants.

  - We agree that new plants should meet 10 CFR 50.54(hh) for each unit, yet such equipment should not have to be procured and commissioned before the authorization to load fuel (10 CFR 52.103 finding) has been made.

- **Recommendation 5**: BWR Mark I hardened venting systems should remain reliable and functional under a complete loss of AC power.

[7] ITAAC = Inspections, Tests, Analyses, and Acceptance Criteria

- Even though there is a lack of understanding of the exact progression of events and decision-making at Fukushima Daiichi, the industry agrees that there must be confidence in the reliability of operation of BWR Mark I hardened vent systems.

- The industry will take action to ensure that the hardened vents on BWR Mark I containments are accessible and functional during a loss of AC power. We strongly recommend that this is the definition of "reliable" in the meaning of Recommendation 5. Regulatory interactions are needed prior to taking this action to assure a common understanding of the requirements and acceptance criteria for reliable hardened vents.

- Any additional changes to BWR Mark I containment vents should not be determined until better information is available about the venting process at Fukushima Daiichi.

- As with implementing other recommendations, there is a need for flexibility in implementation to take into account the varying system configurations at individual sites.

- **Recommendation 8**: Integration of SAMGs and EDMGS with EOPs with additional training.

  - There would be benefit in enhancing operator awareness on the relationships among EOPs, SAMGs and EDMGs. It is important that operating crews and the emergency response organizations understand how to move from EOPs into SAMGs and EDMGs. This is especially important since the EOPs are step-wise procedures, while—owing to the types of events they cover (see discussion above concerning beyond design basis events)—the SAMGs and EDMGs are guidelines. The industry intends to provide additional training within the industry's accreditation program on SAMGs, while recognizing that the standard for operators should be one of familiarization, not in-depth detailed knowledge. From a safety perspective, it is critical that operator training emphasis be on normal, abnormal and EOPs, which are the far more likely events.

**Discussion of the Lower-Priority Items**

- **Recommendation 7**: Spent fuel pools.

  - Based on the events at Fukushima Daiichi, as they are now understood, there is clearly a benefit to remote monitoring of the spent fuel pool during the evolution of a reactor accident to prevent incorrect conclusions and actions. Such action could result in the diversion of needed resources away from more safety-significant activities. Remote monitoring would enable operators to know when actions are needed to provide additional water to the pools. This recommendation is consistent with the action already taken by the industry on knowing the time until the pool will reach 200°F.

  - The power supplies, however, do not have to be safety-related. Based on the thermal inertia, the time it takes for the spent fuel pool water level to reach a point

of concern for public health and safety, and coupled with the experiences at Fukushima Daiichi where safety-related power supplies would not have changed the situation, it is difficult to understand why safety-related power supplies for spent fuel pool monitoring are needed. Diversity and redundancy would appear to be a more important attributes than the more traditional equipment qualification and special treatment requirements.

- The commission should allow flexibility in implementation based on the variety of spent fuel pool cooling system configurations.

- Regulatory interactions should take place in advance of plants providing spent fuel pool monitoring to reach a common understanding on the approach and acceptance criteria for the monitoring.

- **Recommendations 9 and 10**: Emergency preparedness.

  - The first priority should be to implement the EP improvements prescribed in the newly-amended EP regulations. As the industry moves forward with implementing the new requirements, regulatory interactions can take place to assess the need, benefit and implementation of additional staffing to manage simultaneous multi-unit events in parallel with implementing the amended rule. An action plan for implementing the other task force recommendations will be developed in 2012, with implementation to follow once licensees have implemented the amended EP rule requirements.

**Other Recommendations**

- **Recommendation 1**: Development of a new regulatory framework to better balance the risk-informed approach with defense-in-depth.

  - This is not a high-priority item and is not directly related to the Fukushima accidents. The industry will provide input to the NRC staff on the additional detailed proposals for this item over the next 18 months.

  - The industry encourages the NRC staff to build on the work performed in the 2001 to 2007 time frame. The purpose of the risk-insight is to focus the NRC and industry attention on those items truly important to safety. Risk-insights and defense-in-depth are not opposites, with risk-insights influencing the need and application of defense-in-depth attributes.

- **Recommendation 5.2**: Reevaluate the need for hardened vents for other containment designs (Non-BWR Mark I containments).

  - Once more information is known and validated about the events at Fukushima Daiichi, the NRC and industry will be in a better position to make a determination on the need for additional evaluations on containment integrity, heat removal, combustible gas control and pressure control capabilities for all containment designs.

Before agency and industry resources are committed to an extensive reevaluation of other designs, the basis for requiring such an evaluation should be fully understood.

- **Recommendation 6**: Hydrogen control and mitigation.

  - As stated for Recommendation 5.2, once there is a better understanding of the pathway of hydrogen into the reactor buildings at Fukushima Daiichi, the NRC and industry will be in a better position to determine whether there is a need for plant modifications and reassessment of hydrogen control and mitigation capabilities. We hope to be in a position to make that determination in the next few months.

- **Recommendation 7.4**: Addition of a seismically-qualified spray line for spent fuel pool cooling.

  - The provision of a permanent, seismically-qualified spray line would not provide a significant improvement in safety benefit when considering the other measures that are available for supplying make-up water to the spent fuel pool during a beyond design basis event. Additional spent fuel make-up capacity is better assured through enhancing the means for operating crews to react to beyond design basis event symptoms with flexibility and agility, which requires diverse and redundant equipment, not single, fixed systems that are designed for a limited set of circumstances.

  - Spent fuel pool cooling events are slowly evolving. 10 CFR 50.54(hh) contingency measures already provide for additional spent fuel pool make-up water; such measures will be enhanced.

- **Recommendation 11**: NRC staff action related to EP decision-making, radiation protection and public education.

  - While this recommendation is more related to the NRC and other government agencies, the industry believes it has an important role in educating and informing the public, especially in areas surrounding the power plants, in regard to radiation protection.

  - The industry is already taking steps to identify nationally-recognized practitioners and medical experts in the radiological protection and health field. Education and awareness is an area where a combined industry-government approach would be beneficial.

  - The industry outreach and information would recognize the variations in licensee programs and local circumstances and the guidance should allow for flexibility in implementation at the site, fleet or regional level.

- **Recommendation 11.3**: Study the efficacy of real-time radiation monitoring onsite and within the Emergency Planning Zones (including consideration of AC power independence and real-time availability on the Internet).

- Additional discussion among stakeholders is needed to fully understand the intent and benefit of this recommendation.

- **Recommendation 11.4**: Training, in coordination with the appropriate federal partners, on radiation, radiation safety and the appropriate use of potassium iodide (KI) in the local community around each nuclear power plant.

  - This should be part of a national campaign for all nuclear incidents (not just power plants) that involve radioactive products and not limited to communities near nuclear power plants.

  - Training and public information in the vicinity of nuclear power plants needs to be coordinated by the licensee in conjunction with state and local public health organizations.

- **Recommendation 12**: The NRC strengthen regulatory oversight of licensee safety performance (*i.e.*, the Reactor Oversight Program) by focusing more attention on defense-in-depth requirements consistent with the recommended defense-in-depth framework.

  - This is labeled as a NRC staff action, yet it will have significant resource and operational impact on the industry.

  - The ROP was established in 2000 to provide a logical rationale for what the NRC inspects and how it assesses violations. As new information becomes available through operating experience and events such as the accident at Fukushima Daiichi, inspection modules are reviewed and updated as necessary along with the NRC process for assessing violations. The industry has continued to interact with the NRC staff on updating and strengthening the ROP process since 2000.

  - The events at Fukushima Daiichi need to be understood in greater detail to determine what changes need to be made to the inspection process, including areas of defense-in-depth. There needs to be careful consideration of what to change in the areas of inspection. Risk-informed assessment—not risk-based—of where to place inspection emphasis should not be lightly discarded. We recommend that the NRC work with its stakeholders to ensure that operating experience is appropriately included in any changes to the ROP (see discussion above concerning Recommendation 1).

- **Loss of Ultimate Heat Sink**: This is an issue that warrants further review and discussion in view of the events in Japan. At the moment, there is insufficient information to warrant a specific recommendation on this topic. Once there is a common understanding on what happened at the Fukushima Daiichi and Daini stations, a better determination can be made on whether U.S. plants need to assess and, if necessary, take steps to enhance prevention or mitigation capabilities associated with such an event.

# THE WAY FORWARD

## U.S. Industry Leadership in Response to Events at the Fukushima Daiichi Nuclear Power Plant

NEI® NUCLEAR ENERGY INSTITUTE

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EPRI ELECTRIC POWER RESEARCH INSTITUTE

June 8, 2011

## 1. EXECUTIVE SUMMARY

The earthquake and tsunami in Japan on March 11, 2011 and subsequent nuclear accident at Tokyo Electric Power Co.'s Fukushima Daiichi nuclear power plant have resulted in worldwide attention toward nuclear energy safety. The leadership of the U.S. commercial nuclear industry is dedicated to gaining a deep understanding of the events at Fukushima Daiichi and to taking the necessary actions to improve safety and emergency preparedness at America's nuclear energy facilities.

The Electric Power Research Institute (EPRI), Institute of Nuclear Power Operations (INPO), and Nuclear Energy Institute (NEI), in conjunction with senior utility executives, have created a joint leadership model to integrate and coordinate the U.S. nuclear industry's response to events at the Fukushima Daiichi nuclear energy facility. This will ensure that lessons learned are identified and well understood, and that response actions are effectively coordinated and implemented throughout the industry. This must be accomplished while electric companies continue to ensure that the safe and reliable operation of commercial reactors is our highest priority. This effort will not diminish the independent roles of the industry support groups, such as the role of INPO to promote the highest levels of safety in U.S. commercial reactors, as actions are taken to fulfill their missions.

An important and integral aspect of the industry's response is the awareness and involvement of the industry's many stakeholders, including industry vendors, architect-engineering companies, industry owners' groups and national consensus nuclear standards organizations. This will ensure that the interests of each stakeholder group are considered, understood and communicated to the public and policymakers.

A comprehensive investigation of the events at Fukushima Daiichi will take considerable time. Yet, there is also a need to act in a deliberate and decisive manner. Recognizing this, America's nuclear energy industry is taking action based on a preliminary understanding of the events. The industry's response is structured to ensure that emergency response strategies are updated based on new information and insights learned during subsequent event reviews.

Separately, the U.S. Nuclear Regulatory Commission (NRC) is conducting an independent assessment and will consider actions to ensure that its regulations reflect lessons learned from the Fukushima events. The industry's response will ensure that the NRC and industry remain informed of each other's respective activities so that any new regulatory requirements are implemented in the most efficient and effective manner.

This strategic overview describes how the industry will approach this challenge and is intended to serve as a reference point for the future. It articulates strategic goals and key stakeholders for the industry's integrated response. In addition, this overview describes the respective roles and coordination of industry organizations in managing the discrete elements of a comprehensive U.S. industry response plan.

## 2. STRATEGIC GOALS

The primary objective is to improve nuclear safety by learning and applying the lessons from the Fukushima Daiichi nuclear accident. In response, the U.S. nuclear industry has established the following strategic goals to maintain, and where necessary, provide added defense in depth for critical safety functions, such as reactor core cooling, spent fuel storage pool cooling and containment integrity:

1. The nuclear workforce remains focused on safety and operational excellence at all plants, particularly in light of the increased work that the response to the Fukushima event will represent.

2. Timelines for emergency response capability to ensure continued core cooling, containment integrity and spent fuel storage pool cooling are synchronized to preclude fuel damage following station blackout.

3. The U.S. nuclear industry is capable of responding effectively to any significant event in the U.S. with the response being scalable to support an international event, as appropriate.

4. Severe accident management guidelines, security response strategies (B.5.b), and external event response plans are effectively integrated to ensure nuclear energy facilities are capable of a symptom-based response to events that could impact multiple reactors at a single site.

5. Margins for protection from external events are sufficient based on the latest hazards analyses and historical data.

6. Spent fuel pool cooling and makeup functions are fully protective during periods of high heat load in the spent fuel pool and during extended station blackout conditions.

7. Primary containment protective strategies can effectively manage and mitigate post-accident conditions, including elevated pressure and hydrogen concentrations.

## 3. GUIDING PRINCIPLES

To achieve our strategic goals, the industry has established principles to guide the development of its response actions. These principles will be used to guide the resolution of issues and plant improvements and will ensure that a consistent expectation is established for incorporating lessons into the operations at each site. The strategic response actions will be designed to:

1. Ensure equipment and guidance, enhanced as appropriate, result in improvements in response effectiveness.

2. Address guidance, equipment and training to ensure long-term viability of safety improvements.

3. Develop response strategies that are performance-based, risk-informed and account for unique site characteristics.

4. Maintain a strong interface with federal regulators to ensure regulatory actions are consistent with safety significance and that compliance can be achieved in an efficient manner.

5. Coordinate with federal, state and local government and their emergency response organizations on industry actions to improve overall emergency response effectiveness.

6. Communicate aggressively the forthright approach the U.S. industry is taking to implement the lessons from the Fukushima Daiichi accident.

## 4. STAKEHOLDERS AND DESIRED OUTCOMES

The industry's strategic goals will be achieved by proactively engaging a variety of stakeholders.

### General Public

The industry will ensure that the general public is well-informed of the collective approach in response to the Fukushima accidents. Special attention will be paid to engaging stakeholders (residents, elected officials and other stakeholders) immediately surrounding nuclear energy facilities to maintain confidence in their plant's continued safe operations and ability to protect public health and safety.

### Employees

The industry will provide information to its employees to understand the operating experience from Fukushima as part of their training to execute their jobs with excellence and be advocates for nuclear safety.

### Emergency Response Organizations

The industry will continue to communicate and cooperate with federal, state and local emergency response organizations and government entities to ensure that emergency response plans reflect the lessons learned from the Fukushima Strategic Response Plan. These organizations include, but are not limited to, state and local police; fire officials; health officials/paramedics; federal, state and local governments; and transportation companies. Interactions will be focused on increasing confidence in the industry's and local government emergency preparedness programs.

### Industry

Utilities, industry vendors and owners groups, architect-engineers, manufacturers and companies and organizations involved in the nuclear fuel cycle, working as a collective worldwide industry, will continue to strive for operational excellence. These actions and goals will continue the ongoing contribution to the legacy of safe, reliable, environmentally responsible production of electricity at nuclear energy facilities. The industry will work with all interested parties to ensure the benefits of nuclear energy for future generations.

### Regulators

The industry will maintain relationships with federal and state regulators to ensure the industry participates in the regulatory process and can effectively implement any regulatory changes.

### Technical Partners

The industry will continue to collaborate with technical associations and organizations to ensure information is disseminated and understood by all interested parties so that the benefits and positions of nuclear energy are appreciated and support the industry's long-term objectives.

### Policymakers and Opinion Leaders

The industry will proactively communicate lessons learned and industry actions such that policy and opinion leaders at the local, state and national level recognize the proactive, unwavering industry response to the Fukushima accident. The industry will continue to focus on improving confidence in the safety of U.S. nuclear energy facilities and assuring support for industry legislative proposals and programs that enhance safety.

### International Community

The U.S. nuclear industry will interact with international nuclear energy companies and organizations to compile and assess recommendations and actions for applicability to U.S. facilities and to make the international industry aware of U.S. improvements.

## 5. LEADERSHIP MODEL OVERVIEW

The nuclear industry has successfully demonstrated the ability to identify and manage the response to various issues in a coordinated manner. Under normal circumstances, the structures are in place to successfully coordinate the response to significant issues among key industry groups. For the response to the Fukushima event, however, there is a need for a greater level of coordination with the number and complexity of potential issues that are identified by each of the key industry groups. As a result, we have developed a coordinating framework for the development and execution of actions in response to the lessons of the Fukushima event.

The leadership model is based on the following elements:

- **Organization** – clear division of responsibilities among the involved parties. An industry steering committee will provide strategic direction and oversight. Ownership for analysis and execution will be organized around the industry's seven building blocks based on the type of issue being addressed.

- **Event Response Process** – each industry organization (*see chart on page 9*) is responsible for identifying issues, plant and process improvements, and regulatory reviews of the Fukushima events. Issue descriptions, including action plans and recommendations, will be developed to implement improvements. The steering committee will approve the actions and designate an industry organization and building block to lead and implement the action to resolution.

- **Issue Action Plans** – action plans with schedules and resource management tools will be developed and executed for each issue within its assigned building block.

- **Strategic Response Plan** – all issues assigned to the seven building blocks constitute the nuclear industry's response. The action plans will be summarized by building block to form the strategic response plan.

- **Execution Oversight and Status Tracking** – each industry organization and its building block(s) will regularly report the status of all issues to the steering committee.

### Building Blocks

The leadership model is organized around seven areas called building blocks. Building blocks are temporary organizations created to develop and execute action plans for issues assigned to them by the steering committee. Building blocks led by an individual assigned by the industry organization will consist of assigned managers and designated personnel from the industry organizations, utilities, and suppliers. Building block oversight is provided by the steering committee, lead industry organization, and the assigned steering committee sponsor.

The seven building blocks along with the lead organization(s) and focus are identified below:

1. **Maintain Focus on Excellence in Existing Plant Performance (INPO):** focus on continued performance improvement of U.S. reactors.

2. **Develop and Issue Lessons Learned from the Fukushima Events (INPO):** focus on comprehensive analysis of the Fukushima event and that lessons learned are applied to the U.S. nuclear industry and shared with the World Association of Nuclear Operators (WANO).

3. **Improve the Effectiveness of U.S. Industry Response Capability to Global Nuclear Events (INPO/NEI):** focus on identified lessons learned from the U.S. industry response to the Fukushima event, allowing for more effective integrated response to future events.

4. **Develop and Implement a Strategic Communications Plan (NEI):** focus on managing the industry's strategic communications and outreach campaigns to recover policymaker and public support for nuclear energy.

5. **Develop and Implement the Industry's Regulatory Response (NEI):** focus on managing the industry's regulatory interactions and resolution of applicable industry regulatory issues from the incident.

6. **Participate and Coordinate with International Organizations (INPO/EPRI):** focus on ensuring the results from international investigations are captured and effectively used to inform actions with the other building blocks.

7. **Provide Technical Support and R&D Coordination (EPRI/NSSS Owners' Groups):** focus on existing technical solutions and research and development activities and deliverables necessary to address recommended actions of this plan.

Each building block will be supported by nuclear and, in specific instances, non-nuclear industry organizations and companies, where specific technical, operational or other expertise is required.

## 6. LEADERSHIP RESPONSE ORGANIZATION AND BUILDING BLOCKS

The leadership model structure involves many industry participants and is outlined below: