



**ANSWERS TO UNANSWERED QUESTIONS  
FOR RIC 2013**

**Tuesday, March 12, 2013**

**Chairman Keynote**

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**Wednesday, March 13, 2013**

**Commissioner Magwood**

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**PLENARY SESSIONS**  
Tuesday, March 12, 2013, 8:30 a.m. – 12:00 p.m.

**Chairman Keynote – “The Next 25 Years,” Allison M. Macfarlane**

*Answers to questions not addressed during the above session will be posted when they become available in the near future.*

**PLENARY SESSIONS**  
Wednesday, March 13, 2013, 8:30 a.m. – 12:00 p.m.

**Commissioner Plenary – “Perspectives from a Commissioner,” William D. Magwood**

*The questions below were not answered during the above session.*

**Question 1:** Can you speak to who you are?

**Answer 1:** First and foremost, I am someone who has a strong belief in public service. I believe that anyone who works on behalf of the American people has an absolute obligation to bring their best judgment, a very high standard of values, a strong sense of ethics, and a recognition that they serve the public and not the other way around. I have always held this view in any public service role in which I have served. When I first came to the NRC, I made a promise to do the right thing even when the right thing isn't easy. I am proud to say that I have held firm to that promise. In addition, as an NRC Commissioner, I strive to exhibit and promote the NRC values—particularly those of openness and independence. As such, I am committed to



consider all issues that come before me with an open mind, a questioning attitude, and freedom from bias or prejudice. I once told someone that if you come to the job as a safety regulator with the motivation to either promote nuclear power or to end it, you shouldn't be an NRC Commissioner. I continue to believe that.

**Question 2:** Do you have concerns about science, technology, and engineering education in the U.S., particularly in grades K-12?

**Answer 2:** Yes. We face many challenges as a nation. We face serious economic questions, the threat of terrorism, a raft of foreign policy issues, and much more. But I don't think anything threatens our future more than the state of education today. While we continue to produce the world's best and brightest in our finest universities, far, far too many children in our public schools are being deprived of a fair chance at a future of learning and discovery. In many cities, two-thirds of all students fail to graduate high school. Across the country, science and math are cut back and watered down. Standards are sacrificed to the teaching to standardized tests. I believe we are in crisis. Obviously, it is not the job of NRC to solve this crisis. But I believe that any organization in government that relies on the application of science and technology has an inherent responsibility to help when it can. We must work to engage students' interest in STEM subjects early in their academic careers—including as early as kindergarten or first grade. At the NRC, we have many people who are highly trained in many areas of science and mathematics who are willing to go to schools on their own time to speak to students and encourage them. We have many role models who can inspire students and support teachers. We should help them do this as much as we can.

**Question 3:** You challenged us to ensure the plants are safe from an incredible event. How is the NRC balancing this goal with the more realistic challenges of day-to-day operations?

**Answer 3:** We can't distract or impair operations with mods or rules for incredible events. This is the most important regulatory issue facing us today. It is essential that operators remain focused on day-to-day safe operation of plants - but we also have a responsibility to learn from the Fukushima Daiichi experience and assure that we are prepared for low-probability, high-consequence events. The NRC is taking the approach to phase in new requirements in a manner such that implementation schedules are realistic and as minimally disruptive. However, I think we can do more in the future. I believe the time is ripe to develop a more sophisticated approach to regulation that will allow us to more closely tailor regulatory activities to site-specific, plant-specific issues. I am hopeful that the agency will be able to begin developing such approaches in the not too-distant future.

**Question 4:** When can the citizens within 20 kilometers of Fukushima Dai-ichi expect to return to their homes, especially with reports of low-dose radiation in the area?

**Answer 4:** The efforts of the Japanese people and government to deal with the aftermath of the Fukushima tragedy have been commendable, but much remains to be done. Only Japanese authorities in Japan can speak to a timetable for any possible return to all or part of the evacuated areas. Moreover, even when science may say that it is safe to return, it is difficult to say when people will have the confidence to return to their homes. In any event, it will likely be many years. However, many people of the affected areas are determined to return and resume



their lives and some have taken small steps in this direction. I believe that they will continue to work toward this goal and eventually succeed.

**Question 5:** Wouldn't it serve the NRC's commitment to openness and public engagement to release the Yucca SER—to inform the debate over waste confidence and the feasibility of a repository—without being ordered by the court to do so?

**Answer 5:** I don't think there is serious debate over the feasibility of a repository. There is more than enough information—including much released by the NRC—that demonstrates that a deep geologic repository is a very achievable and practical component to addressing the disposition of high-level wastes. With regard to waste confidence, I don't think the Yucca Mountain SER would provide any insights that would assist in bringing this issue to resolution. Absent a clear direction from either Congress or the courts about the next steps in the nation's high-level waste program, I believe it is best for agencies such as NRC to stand down and avoid inserting themselves in a public policy debate over which we have no control. We can only provide technical support for a high-level waste policy. We cannot compel policymakers to make a policy.

**Question 6:** Having worked for DOE and NRC, which group is more "prompt" as identified by the Blue Ribbon Commission? How would you resolve the back end of the fuel cycle?

**Answer 6:** The roles of these agencies are very different with respect to the back end of the nuclear fuel cycle. DOE, as a policy-oriented organization, in many ways is a pace-setter, determining, along with the White House and Congress, our national policy with respect to the back end of the fuel cycle. Because the NRC does not set policy, we are in many ways a reactionary agency. Our job is to make sure that we have a regulatory structure in place that will support policy decisions made by the Executive Branch and Congress and market decisions made by industry, and, more importantly, once the regulatory structure is in place, to use that structure to review any application placed before the agency to ensure that public health and safety will be adequately protected.

From a personal standpoint, I believe we will eventually, as a nation, develop a geological repository - when, as the Commission stated in 2010, such a repository is truly needed. However, this repository will not be developed until there is political will to do so.

In the interim, the NRC has a vital responsibility to assure that commercial high-level wastes are stored safely pending their disposition. Doing so will provide the nation time. Time to consider where to place high-level wastes and time to develop advanced technologies that could one day significantly reduce the toxicity and quantity of high-level wastes. Implementing such technologies would not only help us deal with these wastes, but do so in a manner that assures the protection of future generations.



**Question 7:** In your review, what was most surprising or unusual aspect of the Fukushima nuclear accident? Plant siting? Coping? Design Vulnerability? Extent of the tsunami?

**Answer 7:** Most of the technical aspects of the accident actually generated little surprise. In some ways, the event confirmed what we already understood about plant design and natural hazards. However, I do think that observing the fact that a single set of natural events could disable both off-site power supplies and on-site emergency diesel generators was a significant lesson-learned.

**Question 8:** Regarding spent fuel storage and safety, where do you see the country going?

**Answer 8:** I believe the most important focus will remain on assuring the continued safe storage of spent fuel on nuclear power plant sites. NRC has long maintained that storage in pools and in dry casks is safe. We are conducting further analysis to challenge and verify this assertion. If we learn anything from this work that provides new safety sights, we will take action. Otherwise, I expect the status quo to remain in place until a clear policy is established by Congress.

**Question 9:** We're two years into Fukushima lessons learned; what do you think of the staff and industry effort to date?

**Answer 9:** In the aftermath of Fukushima, the NRC staff has demonstrated why it is generally considered the best in the world. The staff has challenged convention, debated internally, and made many bold recommendations to the Commission. They have taken the lessons of Fukushima to heart, both as an organization and as individuals. As an agency, we have established an ambitious, yet practical agenda that will enhance the assurance of nuclear safety in the U.S. and the staff has made excellent progress towards its implementation.

With respect to the industry, I have been impressed with the level of coordination and cooperation evident in their response. In particular, I note that the FLEX program, developed entirely by the industry, represents a significant enhancement in the industry's—and the country's—emergency response capabilities. Industry is often portrayed as caring more about cost than safety. Certainly in the area of its response thus far to Fukushima, industry has been forward-leaning, forthright, creative, and responsible.

**Question 10:** Is Japan taking optimum advantage of Three Mile Island fuel removal experience? (Please elaborate on knowledge transfer).

**Answer 10:** It is important to recognize that the scope and complexity of the challenge facing Japan at the Fukushima Dai-ichi site is orders of magnitude beyond what was faced in the aftermath of Three Mile Island. Nevertheless, there are lessons from which to draw. The fuel removal efforts at Three Mile Island occurred over 5 years, they were well documented, and most of that information is publicly available. In addition, experts who were involved in the Three Mile Island fuel removal have been consulted. There is an astounding amount of very difficult work being done at the Fukushima site, however, based on what we have seen so far, it will be quite some time until the damaged fuel in the cores could reasonably be expected to be removed. [▲Top](#)



**TECHNICAL SESSIONS**  
**Tuesday, March 12, 2013, 1:30 p.m. – 3:00 p.m.**

**T1     Developments in Generic Safety Issue 191**

Session Chair: Jack Davis, Deputy Director, Division of Safety Systems, NRR/NRC

Session Coordinator: John Stang, Senior Project Manager, Division of Safety Systems, NRR/NRC, 301-415-1345, [John.Stang@nrc.gov](mailto:John.Stang@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)***

**T2     Knowledge Management: An International Perspective**

Session Chair: Dan Dorman, Deputy Director for Engineering and Corporate Support, NRR/NRC

Session Coordinator: Jon Hopkins, Senior Project Manager for International Activities, Division of Inspection and Regional Support, NRR/NRC, 301-415-3027, [Jon.Hopkins@nrc.gov](mailto:Jon.Hopkins@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)***

**T3     Severe Accident Codes Analysis and Fukushima Response Activities**

Session Chair: Kathy Halvey Gibson, Director, Division of Systems Analysis, RES/NRC

Session Coordinator: Annie Ramirez, Reactor Systems Engineer (NSPDP), Division of Systems Analysis, RES/NRC, 301-251-7537, [Annie.Ramirez@nrc.gov](mailto:Annie.Ramirez@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Comparing what we knew then (pre-Fukushima) and what we know now (post-Fukushima), Have significant analytical gaps been identified in the way that we model hydrogen generation, transport and overall behavior during a severe accident?

**Answer 1:** In general, our understanding of hydrogen behavior was not overturned by the events at Fukushima. However, we may not fully appreciate all of the possible leakage locations, such as penetrations and hatches, and the potential accelerated degradation of polymer seals associated with these locations. Thus, during a severe accident, hydrogen may show up in more locations (reactor building for example) than previously appreciated.



**Question 2:** How do you account for different operating time of RCIC pumps for units 2 +3?

**Answer 2:** In both cases (Unit 2 and Unit 3), the reactor core isolation cooling (RCIC) pump operation was more durable than we might expect based on our current Probabilistic Risk Assessment (PRA)-level model treatments. For example, in Unit 2 where DC power was lost, it is generally believed that uncontrolled RCIC pump operation led to flooding of the main steam lines and consequently the RCIC pump turbine. Our PRA-level models would have assumed turbine and pump failure following flooding with liquid water. Instead, the liquid water carryover appears to have slowed the turbine spin rate, which drew more energy from the reactor pressure vessel and reduced the water flooding rate. Because of this, the Unit 2 RCIC pump operated for far longer than we would have assumed based on the current more conservative PRA models. In Unit 3, the RCIC pump ran normally until operators shut it down and opted to run the high pressure coolant injection turbine (a much larger steam-driven pump). The RCIC pump would likely start to degrade when the suppression pool became thermally saturated. This condition may have been avoided by the unexpected flooding of the torus room with seawater which may have prevented reaching a saturated condition in the suppression pool. In summary, the Unit 3 RCIC pump had a shorter operating time because it was manually shut down by the operators.

Randy Gaunt: DOE Forensic analysis and Fukushima response

**Question 3:** As you pointed out that leakage is from containment head bolts extension. Can you comment on the benefit of Hardened vent Leakage of head gasket start earlier than release from head vent?

**Answer 3:** Containment venting using hardened vents is a viable strategy for preventing early containment overpressure (before fission products have accumulated) and later venting using hardened vents drawing from the suppression pools would allow reliable controlled vent path to the stack.

**Question 4:** Base on the calculations done; which information would you need from the decommissioning of the Fukushima reactor to remove the existing uncertainties?

**Answer 4:** In general, the new information that will become available from Fukushima as decommissioning and further analysis is completed will be beneficial for improving and refining the models currently used to anticipate reactor performance.

From a MELCOR perspective, it would be beneficial to see video examinations of the main steam lines for Unit 1 and Unit 3, video examinations of the drywell cavity for each of the units. This will help to understand and improve the MELCOR codes predictions and uncertainty. Additional information on the precise nature of the core to lower head melt progression, the nature of lower head damages, evidence of steel melting in the upper shroud and steam separator/dryer regions would improve certain specific aspects of the model. In the near future, we will be developing a comprehensive list of areas for additional investigation that will be requested during the decommissioning process aimed.



**Question 5:** Was there any significant impact of having MOX Fuel? (Unit 3 over Unit 1) (beneficial or detrimental)

**Answer 5:** Aside from the specific isotope inventory subject to release to the environment, we have not seen any MOX-specific aspects of accident progression. This is consistent with our expectations.

**Question 6:** To what extent does MELCOR is relevant and account for geometric configuration of steam lines and RPV penetrations. What effect they have on a blow down and RPV depressurization? (alt Fukushima and generally)

**Answer 6:** MELCOR represents the steam lines and safety relief valve (SRV) lines and valves and “understands” that there are elevation differences over the reactor pressure vessel (RPV) and down to the suppression pool where the SRV will vent steam below the wet well water level. Because a cycling SRV will at time vent very high temperature gases through the steam line, SRV, and into the suppression pool, a creep failure model of the steam line is included. This model accounts for wall thickness, RPV pressure, and material properties, as well as a SRV failure model where seizure of the valve in a partially open/closed (or fully open) position as a result of high temperature, excessive cycling, or both. The least degree of fidelity is given to modeling penetrations in the lower head, where we believe that global creep failure of the head itself is more likely and more significant than potential localized failures of penetrations.

**Question 7:** Is DOE/NRC interested in using FUKUSHIMA to gain understanding of instrument survivability?

**Answer 7:** Instrument survivability could be one the pieces of additional information that will be developed as the Fukushima decommissioning continues. The NRC will be interested in this information.

**Question 8:** What is your assessment of possible leakage into RB thru open vent for unit 1?

**Answer 8:** Such a vent path was initially contemplated until it became apparent that the drywell head flange was the more likely vent path into the reactor building. It is our understanding that the Unit 1 vent was hardened such that leakage into the building via the vent path itself was not expected. Simple engineering analysis shows that there was no physical way to avoid leakage at the head flange. More studies will be required to determine if there are any aspects of the stand by gas treatment system that could have allowed an escape of hydrogen before reaching the vent stack.

**Question 9:** During Fukushima accident dirty sea water was injected into the core and containment for a few days. Are there any specific activities to incorporate new models for sea water effects?

**Answer 9:** Presently we have no efforts in this area underway.



**Question 10:** Does the potential that MELCOR results in late steam line calculated failure have implications for PWR Hot leg vs. TISGTR? That is, does it indicate that hot leg failure could be de dominant failure mode?

**Answer 10:** The MELCOR BWR steam line rupture model is derived from earlier MELCOR models for the hot leg nozzle, surge line and steam generator tubes. Adjustments were made for geometry and materials for the steam line. The PWR Thermally Induced Steam Generator Tube Rupture (TISGTR) issue has been investigated using CFD methods and MELCOR where the early Westinghouse 1/7<sup>th</sup> scale tests provided the original phenomenological basis for the heat transport analysis. In the BWR, heat transport is mainly due to opening and closing of the safety relief valves (SRV's), where opened SRV sends a burst of hot steam and possibly hydrogen through the steam line, heating the wall. In a TISGTR, nozzle rupture would be the result of counter current flow of hot gases in the hot leg to steam generator segment. Factors affecting relative timing of TISGTR include uncertainties in circulation behavior, hot plume focusing under the steam generator tube sheet and possible steam generator tube flaws. Overall, the hot leg nozzle fails prior to other reactor coolant system components in most calculated results from MELCOR analyses.

**Question 11:** Gauntt said: That the start of increased radiation dose rate at Unit 1 would coincide with lower head failure. But, wouldn't the MSL break introduce enough radiation as into the D/W to explain the increase without LHF?

**Answer 11:** The leakage of the drywell head flange was driven by rapidly increasing drywell pressures. MELCOR calculates large steam generation when the lower head failed, as core materials dropped to the wet drywell floor. The water was present because of the earlier predicted steam line failure which ejected steam and water into the drywell where it accumulated on the cavity floor. While MELCOR predicts this rapid sequence of events at about 14 hours, we believe that the prediction may be late (2 hours) when compared the current information from Fukushima. At Fukushima, the radiation at the site's front gate soared up at about the 12 hour mark. The radiation at the gate is taken as indicative of when the continuous leak at the drywell head flange began where MELCOR predicts the first large releases of steam, hydrogen, and fission products to the reactor building operations floor.

**Question 12:** What initiated the H2 burn in the refueling building when the steam condensed?

**Answer 12:** The MELCOR analyses predicts that the hydrogen and steam entered the operations floor of the reactor building during the interval between 14 and 23 hours into the accident, when the drywell head flange was leaking continuously, as evidenced by the sustained measured drywell pressure and the MELCOR-calculated leakage of hydrogen, CO, steam, and fission products. Additionally, during this time MELCOR predicts that this gas mixture in the reactor building was comprised of more than 50% (mole) steam, and was therefore incapable of burning due to the inert effects of the steam. Then, at about 24 hours, water injection to the reactor pressure vessel (cavity floor) was terminated and the drywell manual venting operation was performed. The two actions are calculated to have reduced steam flow into the reactor building whereupon ongoing condensation of the existing steam continued, un-replenished by the now terminated (of diminished) head flange leak. MELCOR then calculates that air (oxygen) is drawn back into the reactor building, being previously





displaced by the continuous inflow of steam and hydrogen from the drywell leak. As air was drawn in, conditions favoring hydrogen combustion were steadily increasing until an explosion was observed to have occurred at approximately 24 hours. We do not currently know what may have triggered the explosion.

Hossein Esmaili: MELCOR

**Question 13:** Is efficiency of spray in SFP supported by test, and is the effect of the spray on criticality taken into account?

**Answer 13:** For the spent fuel pool, there are two options for spray modeling in the absence of specific data. In one case, MELCOR containment spray model is invoked to model heat transfer between the spray drops and the atmosphere using a mechanistic heat and mass transfer analogy model, and in the second case, the spray droplets that form a pool in a hydrodynamic cell are assumed to cover the fuel rods using a simplified regime model. The first case represents the spray drops that fall through the control volume and in the process cool the atmosphere and thereby the fuel rods by convective cooling, and in the second case, the water film that forms on the rods will directly remove heat from fuel. MELCOR is a severe accident computational tool and focuses on potential large radioactive release. Criticality events are not considered within the framework of MELCOR modeling.

**Question 14:** Please explain lifetime rule.

**Answer 14:** The Argonne National Laboratory data for air oxidation of cladding has shown that the time to breakaway oxidation is a function of temperature. This can be correlated using a Larson-Miller type modeling (similar to modeling for time to creep rupture in structural analysis); however, since the temperature is not constant during the transient, the time to breakaway has to be integrated over time to predict the timing of the breakaway.

**Question 15:** The Sandia Zirconium fire experiments have shown Nitrogen consumption. How does MELCOR consider Zirconium nitration and re-oxidation?

**Answer 15:** Nitriding is not currently modeled in MELCOR. Generally, this phenomenon is only important under oxygen-starved conditions which presumes very rapid air oxidation and temperature escalation (typically accompanied by fuel degradation) prior to depletion of oxygen and is within uncertainties encountered during severe accidents. Nevertheless, the NRC is currently looking into potential models.

**Question 16:** Does the SFP modeling to date support the claim that there is no spent fuel decay time long enough to exclude the possibility of ignition of Zirc fire in a dense packed pool? What about for 1X4 constituents?

**Answer 16:** The spent fuel pool scoping study is currently in progress and these conditions will be addressed in the study.

**Question 17:** What is the outcome of the SFP accident scoping studies with MELCOR?

**Answer 17:** The study is currently in progress. [▲Top](#)



#### **T4 Construction Inspection Experience—The First Year**

Session Chair: James D. Beardsley, Branch Chief, Division of Construction Inspection and Operational Programs, NRO/NRC

Session Coordinator: Robert Lukes, Senior Reactor Operations Engineer, Division of Construction Inspection and Operational Programs, NRO/NRC, 301-415-4025, [Robert.Lukes@nrc.gov](mailto:Robert.Lukes@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** There is a construction experience database set up at OECD/NEA. How is this data transmitted to the field inspectors and are they of use?

**Answer 1 (NRC):** Designated individuals at participating countries upload significant construction events to the construction experience (ConEx) database in accordance with procedure ConEx PR01. The NRC reviews these events periodically and screens them in accordance with our approved internal procedures. Depending on their significance and applicability, events are then disseminated to the applicable Technical Review Groups, internal communication groups or via generic communications. The NRC considers screening and evaluating all construction events whether uploaded to the ConEx database or obtained otherwise, instrumental to accomplishing its mission.

**Question 2:** Does your significance determination project take into account SSCs that have actually been constructed in the field versus noncompliance with conditions identified within the construction documents?

**Answer 2 (NRC):** Yes. The phase of construction is taken into consideration when applying the construction significance determination process. More information regarding this question can be found in IMC 2519P, "Construction Significance Determination Process - Pilot."

**Question 3:** It seems all field change requests require NRC review or a license amendment request. Is this accurate? Is this reasonable?

**Answer 3 (NRC):** No, not all field changes requests require NRC review of a license amendment request. With respect to changes within scope of a referenced design certification rule, the combined license holder may make changes without NRC review and approval in accordance with the change process that is detailed in Section XIII of the design certification rules in the four appendices to of 10 CFR Part 52. Essentially, the FSAR contains information designated as Tier 1, Tier 2\* and Tier 2. Most of the information in the FSAR is designated as Tier 2 information. A change to Tier 2 information does not automatically require NRC approval, but must be evaluated per the requirements in 10 CFR Part 52 to determine if the change requires NRC approval before implementation. If NRC approval is required, a license amendment request (LAR) would be submitted for NRC approval.



For changes outside the scope of the referenced design certification, the applicable NRC change control process would apply (usually 10 CFR § 50.59).

**Question 4:** What specific lessons learned have been identified related to Tier 2\* information and how are they being incorporated in the DCD?

**Answer 4 (NRC):** It may be too early to tell what the lessons learned are from the information that is designated as Tier 2\*.

There are some examples where there may be conflicting information or unclear information in drawings and figures (and notes thereto) that are designated as Tier 2\* and, consequently, the interpretation of what exactly is Tier 2\* information on a drawing may be confusing. So as part of an eventual holistic review of Tier 2\* information, perhaps specific examples of these occurrences could be looked at. But if there is confusion between what is Tier 2\* and what is not, the licensees may always submit a license amendment request for review by the NRC staff.

**Question 5:** Any advice for current applicants that can be implemented prior to the receipt of a COL to ease the transition to construction and ITAAC closure?

**Answer 5 (NRC):** Having a dedicated ITAAC group to manage the overall life-cycle of an ITAAC from the start of construction is important. ITAAC related activities may start prior to COL issuance. Examples include: off-site component fabrication and testing, on-site module fabrication, on-site containment vessel fabrication, etc. The regulatory significance of ITAAC is such that it might take a dedicated group of staff from multiple organizations and functional areas to assure that the ITAAC-related activities are properly planned, executed, tracked, and documented. This is necessary to effectively facilitate ITAAC closure, which may occur years after the ITAAC-related activity is actually performed.

**Question 6:** How does the NRC inspection and construction oversight program for the AP1000s being built in the USA compare to the AP1000s being built in other parts of the world?

**Answer 6 (NRC):** It is difficult to compare the construction of an AP1000 from country to country, from a regulatory perspective, because regulatory oversight is significantly different from country to country. One significant example, China does not have the inspection of the ITAAC as a regulatory requirement. [▲Top](#)

## **T5 Enhancing Law Enforcement Tactical Response to Commercial Nuclear Power Reactor Sites**

Session Chair: Michael Layton, Deputy Director, Division of Security Policy, NSIR/NRC

Session Coordinator: John Tomlinson, Consultant, Division of Security Policy, NSIR/NRC, 301-415-0071, [John.Tomlinson@nrc.gov](mailto:John.Tomlinson@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** What is NRC Office of Investigation's role in the initiative, if any?



If there is none, could your OI be effectively integrated into this effort?

**Answer 1 (NRC):** The NRC Office of Investigation currently has no role in the Integrated Response Program. The Integrated Response Program focuses on the law enforcement tactical response during the first several hours after the initiation of a beyond-Design Basis Threat attack at a commercial power reactor facility. Under those circumstances, the NRC staff expects the Federal Bureau of Investigation will take command of the incident and all post-attack activities. As part of its established liaison with the NRC Office of Investigation, the Federal Bureau of Investigation would communicate appropriate information from the post-attack crime scene processing and subsequent interviews and investigations. As with other programs, the NRC staffs regularly look at opportunities to enhance program areas, Integrated Response being among them.

**Question 2:** Please explain how the FBI's intelligence threat analysis obligation under the MOU is integrated with local LE.

**Answer 2 (FBI):** The FBI leverages its existing structures of communication with federal, state and local law enforcement as well as emergency response agencies to disseminate threat information. At the local level each of the FBI's 56 field offices has a Joint Terrorism Task Force (JTTF) which is composed of task force officers (TFO's) from various state and local agencies. Each of these specially trained state and local law enforcement personnel serve on the task force and actively participate in the bureau's counter-terrorism investigations. This includes sharing of intelligence to include threats to nuclear facilities. In the event of an incident, NRC analysts and watch standers will serve in the FBI's Strategic Information Operations Center (SIOC) to provide knowledge and assistance to the FBI's incident command team.

**Question 3:** Please comment on use of deadly force by licensees outside the prohibited area boundary as a mean of preventing breach of Protected Area (PA) territory, given state law restriction on lethal force use within a PA boundary. This has become an issue in recent FOF exercises at modern power plants.

**Answer 3 (NRC):** NRC licensees are responsible for understanding and complying with applicable state laws governing the use of force, including deadly force. In accordance with Appendix B to 10 CFR Part 73, Section VI, paragraph E.1. (e), and Regulatory Guide 5.75, *Training and Qualification of Security Personnel at Nuclear Power Reactor Facilities*, July 2009, page 42, Section 8.2, power reactor licensees are responsible for ensuring all armed members of their security organizations are instructed on, and understand, the use of force continuum, including the use of deadly force, as authorized by applicable state laws.



**Question 4:** What will this cost per year/per site?

**Answer 4 (FBI/NEI/NRC):** FBI, The Nuclear Energy Institute, and NRC staffs agree that the annual site cost will be dependent upon several factors not yet determined or able to be fully understood at this point in program development.

These factors include:

1. The NEI programmatic guidance is currently undergoing industry review prior to implementation. The required actions to be included within the guidance will affect the final implementation and maintenance costs.
2. The level of limited exercise to be performed is another cost affecting factor. While the developing NEI guidance sets a standard for both the table top and limited exercises, it will be a site based decision on how extensive and interactive these exercises could become. As sites and local law enforcement gain experience with tactical operations within the site and plant environs, there may be a desire to implement additional exercise elements based upon individual site experiences and lessons learned.
3. All involved organizations are conscious of the significant burden caused by the cumulative effects of increasing regulation. The NRC and NEI are reviewing ways to lessen the impact and establish some form of flexibility in regulatory burden in response for establishment of a robust integrated response planning exercise program. Until the program details are finalized and the results of this effort to reduce burden are understood, it would again be hard to provide an estimated cost for this program.

**Question 5:** Are there any offsets to security costs or is this just adding more costs?

**Answer 5 (FBI/NEI/NRC):** All engaged partners are conscious of the significant burden caused by the cumulative effects of increasing regulation. The NRC and NEI are reviewing ways to lessen the impact and establish some form of flexibility in regulatory burden in response for establishment of a robust integrated response planning exercise program. Until the program details are finalized and the results of this effort to reduce burden are understood, it would again be hard to provide an estimate. Also see related response to questions 3 and 4.

**Question 6:** How does the USNRC regulate the interface between Emergency Preparedness and Security related program on commercial NPP sites?

**Answer 6 (NRC):** Commercial power reactor licensees and offsite response organizations must demonstrate they can effectively implement emergency plans and procedures during periodic, evaluated exercises. As part of the Reactor Oversight Process, the NRC reviews licensees' emergency planning, procedures, and training. Pursuant to the 2011 Emergency Preparedness Enhancement Final Rule, licensees conduct required hostile action-based drills and exercises to prepare for, and demonstrate, their ability to coordinate onsite security, emergency response and other relevant actions with offsite organizations, such as Federal, state, and local law enforcement and emergency management.



**Question 7:** How do the DHS exercises you described relate to the NRC's force on force exercises for modern plants?

**Answer 7 (DHS/NRC):** The NRC's force-on-force exercises are designed to assess nuclear power plants' ability to defend against the Design Basis Threat, which is a composite set of adversary characteristics for which the plants must design physical protection systems and response strategies. A full force-on-force exercise, spanning several days, includes both tabletop drills and simulated combat between a mock commando-type adversary force and the nuclear plant security force. During the attack, the adversary force attempts to reach and damage key safety systems and components that protect the reactor's core (containing radioactive fuel) or the spent nuclear fuel pool, potentially causing a radioactive release to the environment. The nuclear power plant's security force, in turn, seeks to stop the adversaries from reaching the plant's equipment and causing such a release. Federal, state or local law enforcement representatives may participate in force-on-force tabletop discussions or observe the simulated combat exercises, but nuclear power plants are required to demonstrate their capability to defend against the Design Basis Threat without outside assistance.

In comparison, Federal, state and local law enforcement agencies are integral to the Integrated Response Program exercises, which are specifically designed to prepare law enforcement to respond to nuclear power plants during beyond-Design Basis Threat attacks in an effort to assist the plants with preventing or mitigating an offsite radiological release. Nuclear power plants and Federal, state and local law enforcement tactical teams collaborate to develop integrated response plans and ensure law enforcement response actions complement plants' priorities to protect public health and safety. The tabletop exercise component of the Integrated Response Program validates the integrated response plans, and the Program's limited exercise component enables law enforcement tactical teams to demonstrate several response actions, including planning for onsite missions, navigating to onsite objectives, and communicating to, from and within plant structures.

**Question 8:** In case of a nuclear related emergency what is role and jurisdiction of DHS?

**Answer 8 (DHS):** The 2008 Nuclear/Radiological Incident Annex to the National Response Framework describes the policies, situations, concepts of operations, and responsibilities of the Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving release of radioactive materials to address the consequences of the event. This document is maintained and updated by FEMA, through the Federal Radiological Preparedness Coordinating Committee (FRPCC).

As the principal Federal official for domestic incident management, the Secretary for Homeland Security is responsible for coordinating Federal operations within the United States to prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. When exercising this role, the Secretary is supported by other coordinating agencies and cooperating agencies. Coordinating agencies provide the leadership, expertise, and authorities to implement critical and specific nuclear/radiological aspects of the response, and facilitate nuclear/radiological aspects of the response in accordance with those authorities and capabilities. Cooperating agencies include other Federal agencies that provide additional technical and resource support specific to nuclear/radiological incidents to DHS and the



coordinating agencies. Under the Homeland Security Act, DHS has control of the Nuclear Incident Response Team (NIRT). DHS also assumes domestic incident management responsibilities and is the coordinating agency for all deliberate attacks involving nuclear/radiological facilities or materials, including RDDs and INDs.

Generally through Customs and Border Protection (CBP), DHS is a coordinating agency for incidents involving the inadvertent import of radioactive materials as well as any other incidents where radioactive material is detected at borders. For incidents at the border, DHS/CBP maintains radiation detection equipment and nonintrusive inspection technology at ports of entry and Border Patrol checkpoints to detect the presence of radiological substances transported by persons, cargo, mail, or conveyance arriving from foreign countries.

The US Coast Guard (USCG) is the coordinating agency for the Federal response to incidents involving the release of nuclear/radioactive materials that occur in certain areas of the coastal zone, including:

- Release from transportation incidents involving the release of nuclear/radioactive materials that are not licensed or owned by a Federal agency or Agreement State.
- Incidents involving space vehicles not managed by DOD or NASA that impact certain areas of the coastal zone.
- Incidents involving foreign or unknown sources of radioactive material.

DHS/USCG coordinates agency response for these incidents during the prevention and emergency response phase, and transfers responsibility for later response phases to the appropriate agency.

**Question 9:** How does NRC justify using funds to supplement tax payer-funded law enforcement activity?

**Answer 9 (NRC):** There are four primary reasons the NRC supports Integrated Response. First, the NRC and FBI have a Memorandum of Understanding that addresses threats involving NRC-licensed facilities, materials and activities (see *Federal Register*, Vol. 65, No. 95, pages 31197-98, May 16, 2000). Although that agreement includes a number of elements designed to prevent threats from emerging, it also establishes the framework for FBI and NRC to work together to cultivate timely, reliable and effective responses to attacks at U.S. commercial power reactor sites. Under the Memorandum of Understanding, the NRC supports integrated response planning, training and exercises involving sites and law enforcement agencies.

Second, Integrated Response aligns with the NRC's Design Basis Threat for radiological sabotage (10 CFR 73.1). In 2007, the Commission limited the Design Basis Threat to "the composite set of adversary features against which private security forces should reasonably have to defend." Commercial power reactor sites are required to successfully defend against Design Basis Threat attacks without external assistance (10 CFR 73.20). Although sites would also defend against attacks that exceed the Design Basis Threat, the primary responsibility for doing so rests with the Federal, state and local governments. Integrated Response activities help governments fulfill that responsibility by preparing law enforcement to effectively respond to beyond-Design-Basis-Threat attacks.



The third reason the NRC is interested in Integrated Response is it improves the safety-security interface (10 CFR 73.58) and provides additional defense in depth. By coordinating and integrating law enforcement tactical operations, we advance the concept of safety-security interface from pre-incident planning to one that applies during the response phase for ongoing hostile action-based events. And, we increase the likelihood that law enforcement actions will be consistent with site priorities and efforts to protect public health and safety, vice being potentially detrimental to those ends (e.g., uncoordinated use of enhanced weapons or explosives, preventing mitigation actions or personnel access to a site).

Finally, the 2011 Emergency Preparedness Enhancement Final Rule (see *Federal Register*, Vol. 76, No. 226, pages 72560-600, November 23, 2011) recognizes during an actively hostile event, commercial power reactor sites and offsite response organizations will need to be able to deal with unique challenges, including: 1) executing initial onsite response actions within a hostile environment; 2) having limited access to plant equipment due to fire, locked doors, security measures, or adversary activity; and 3) prioritizing efforts to protect plant equipment or secure access to plant areas for repair. Integrated Response activities enable sites to leverage law enforcement assistance to help address these challenges. [▲Top](#)

**T6 New Procedure IP 71111.11, “Licensed Operator Requalification Program and Licensed Operator Performance”—Insights and Lessons Learned: A Panel Discussion**

Session Chair: Hironori Peterson, Branch Chief, Division of Reactor Safety, RIII/NRC

Session Co-Coordinator:

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John McHale, Branch Chief, Division of Inspection and Regional Support, NRR/NRC, 301-415-3254, [John.McHale@nrc.gov](mailto:John.McHale@nrc.gov)

***Questions submitted during the above session were answered during the session’s Q/A period. [▲Top](#)***





**TECHNICAL SESSIONS**  
**Tuesday, March 12, 2013, 3:30 p.m. – 5:00 p.m.**

**T7    Human Impacts**

Session Chair: Undine Shoop, Branch Chief, Division of Risk Assessment, NRR/NRC

Session Coordinator: Kamishan Martin, Human Factors Engineer, Division of Risk Assessment, NRR/NRC, 301-415-3469, [Kamishan.Martin@nrc.gov](mailto:Kamishan.Martin@nrc.gov)

*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

**T8    Status and Path Forward on the Management of Gas Accumulation in Nuclear Power Plant Systems**

Session Chair: Christopher Jackson, Acting Deputy Division Director, DSS/NRR

Session Coordinator: Jennifer Gall, Reactor Systems Engineer, Division of Safety Systems, NRR/NRC, 301-415-3256, [Jennifer.Gall@nrc.gov](mailto:Jennifer.Gall@nrc.gov)

*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

**T9    Probabilistic Flood Hazard Assessments for Nuclear Facilities**

Session Chair: Thomas Nicholson, Senior Technical Advisor for Radionuclide Transport, Division of Risk Analysis, RES/NRC

Session Co-Coordinators:

Michelle Bensi, Civil Engineer, Division of Site Safety and Environmental Analysis, NRO/NRC, 301-415-0073, [Michelle.Bensi@nrc.gov](mailto:Michelle.Bensi@nrc.gov)

Fernando Ferrante, Reliability and Risk Analyst, Division of Risk Assessment, NRR/NRC, 301-415-8385, [Fernando.Ferrante@nrc.gov](mailto:Fernando.Ferrante@nrc.gov)



***The questions below were not answered during the above session.***

**Question 1:** Where is the guidance laid out for what NRC considers "appropriate justification" to use event frequency of severe/extreme floods in PRA evaluation?

**Answer 1 (NRC):** As stated in ISG-JLD-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding" (ML12311A214), for most flood mechanisms, widely accepted and well-established methodologies are not available for assigning initiating event frequencies to severe floods for the performance of probabilistic flood hazard assessment (PFHA). Because generic guidance that explicitly addresses this issue is limited, NRC will assess the justification for PFHAs on a case-by-case basis.

Moreover, NRC continues to work to further the state-of-the-art in PFHA in conjunction with other federal agencies and researchers. In particular, NRC has experience related to the development, refinement, and use of various methodologies to estimate frequencies of rare events as well as use of those frequencies in a risk-informed manner. NRC experience includes use of a variety of established statistical methods supplemented by the use of other structured processes, such as the formalized gathering of expert judgment (i.e., expert elicitation); consideration and accounting for potentially high uncertainties; and use of risk-informed decision-making processes in light of uncertainties. While, explicit and extensive NRC guidance related to PFHA is not available for all flood hazard mechanisms, there are number of guidance documents that have been published by NRC that may be leveraged to facilitate the understanding of flood frequencies (including attendant uncertainties) for use in risk-informed processes and to develop and refine methods in PFHA for future efforts. In addition, recent NRC guidance on tsunami and storm surge flood hazard assessment (e.g., JLD-ISG-2012-06, "Interim Staff Guidance for Performing a Tsunami, Surge, or Seiche Hazard Assessment") provides guidance on use of probabilistic methodologies for tsunami and storm surge.

For more information on how other entities (including other federal agencies) treat this subject as well as recent NRC activities related to advancing the state-of-the-art in PFHA, see the webpage devoted to a recent PFHA workshop: <http://www.nrc.gov/public-involve/public-meetings/meeting-archives/research-wkshps.html>.

**Question 2:** "Deterministic methods have proven over time to be safe." How can you conclude this when reactors have only operated for 40 years, when our goals are for events that occur 1/50,000 times per year?

**Answer 2: (NRC):** The NRC staff believes deterministic methods contain conservatisms that provide sufficient margin for adequate protection at operating reactors as contained in NRC regulations and requirements, if correctly applied, despite the limited time record with respect to probabilistic criteria.



**Question 3:** Can you comment on the protection of security sensitive information regarding dam failures and coordination with Homeland Security on this matter? And, how it restricts analysis of flooding hazards...

**Answer 3 (NRC):** The NRC has, and will continue to, coordinate the release of sensitive security-related information with the appropriate federal agencies, including the Department of Homeland Security and the Federal Energy Regulatory Commission, in order to balance the need for protecting security sensitive information while promoting NRC values in transparency and public access to flooding hazard issues for licensed facilities. Moreover, NRC staff is working to assure the required analyses and information are available to NRC staff to make safety assessments.

**Question 4:** I am impressed with the direction taken to assess "design basis floods." Do you require facilities to assess 'beyond design basis flood'? That is, step away from probability and assess consequences of the facility being flooded. Why? Why not?

**Answer 4 (NRC):** The NRC is currently engaged with licensees of nuclear power plant sites in the reassessment of flooding hazards via the Fukushima Lessons Learned Recommendation 2.1. As part of the 50.54(f) Request for Information submitted to the current holders of operating reactor licenses, licensees will evaluate flood hazards using present-day guidance and methodologies. If the reevaluated hazard exceeds the site's design basis, licensees are requested to perform an integrated assessment, which may involve evaluation of a licensee's capability to respond to a flooded site.

**Question 5:** How equipped do you think utilities are to apply PRA in flooding risk assessment? When you worked with Exelon, what activities were done in-house vs. outsourced to Erin(?)

**Answer 5 (ERIN):** PRA has several challenges with respect to external flood as a hazard. Human reliability analysis (HRA) shifts from short-term, confined actions into organizational and multi-step responses to a hazard that has a wider impact on the site. Although it is qualitatively possible to characterize reliability, additional research will be required to develop a process to numerically quantify the reliability of these more complex actions. I believe that utilities are well equipped to determine the impacts of an external flood on their plants. Detailed models exist to help gain insights when equipment is postulated to not be available during and after a flood event. However, as the topic of all the speakers at the RIC session indicated, characterizing the hazard in probabilistic terms is the biggest limitation on risk assessments for floods. Methods and processes have been successfully used for other non-nuclear facilities to help better characterize their floods and the industry needs to apply these to their sites. This will allow the technology to move forward, gather insights and understand the limitations on the process and what it is really telling us about our risk from the hazard.

The Risk Management function at Exelon is outsourced to ERIN Engineering. As such, ERIN performs all of Exelon's PRA analyses. [▲Top](#)



## **T10 Small Modular Reactors—Deployment Status**

Session Chair: Stewart Magruder, Branch Chief, Division of Advanced Reactors and Rulemaking, NRO/NRC

Session Coordinator: Yanelly Malave, Project Manager, Division of Advanced Reactors and Rulemaking, NRO/NRC, 301-415-1519, [Yanelly.Malave@nrc.gov](mailto:Yanelly.Malave@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Have a size/scale question. For each pictured reactor: how tall? mass?

**Answer 1 (NRC):** The information provided below for each of the reactors is publicly available through their particular websites.

The mPower™ reactor measures 83ft tall x 13 ft in diameter (at the flanges) and have a dry weigh of 1.4 Mlbm.

The NuScale reactor measures 65 feet tall x 9 feet in diameter. It sits within a containment vessel that measure 80' x 15' cylindrical. The containment vessel module contains the reactor and steam generator and weights 650 tons as shipped from fabrication shop.

The Westinghouse SMR reactor has an outer diameter of 1.5 ft and a height of 81.0 ft. The upper vessel package weights 280 Tons.

**Question 2:** What will be the most significant challenges in modifying the existing regulatory structure, including Emergency Planning (EP) and Security, to meet the needs of SMRs without requiring operating and maintenance cost that would make SMRs economically unattractive?

**Answer 2 (NRC):** NRC staff has been working to develop the necessary infrastructure for the review of SMR designs and haven't identified any issues (including those related to EP and Security) that would require rulemaking. The staff provided options to the Commission on issues associated with Advanced Reactor designs, specifically SECY-11-0152 addresses EP and SECY-00-0184 addresses Security for SMR design. The staff will continue to work with industry to identify specific needs for each reactor design.

**Question 3:** NEI has stated that "a stable and predictable regulatory process is essential." This morning several speakers said sequestration will delay activities that are not identified with the safety of existing reactors, how will this impact the US SMR vendors?

**Answer 3 (NRC):** The NRC will be ready to review SMR applications when they are submitted. The current emphasis is on the design(s) selected under the DOE FOA. Other applications will be addressed based on resource availability at the time. As always, the success of reviews will be dependent on receiving complete, high quality applications and timely and open interactions with the applicant.



**Question 4:** SMR could not operate under existing NRC fee structures on a per reactor basis. How will the NRC address this issue and will it take congressional action?

**Answer 4 (NRC):** The NRC is proceeding with rulemaking to determine annual fees differently for new reactors in three ranges of licensed reactor size (MWt). The ranges are less than or equal to 250 MWt licensed power; a variable scale region where the annual fee would be based linearly on licensed thermal power greater than 250 MWt, but less than or equal to 2000 MWt, and a maximum reactor annual fee for reactors licensed above 2000 MWt. Also, the NRC will provide a definition for a multi-module nuclear plant that would receive single site treatment for licensed reactor modules up to 4000 MWt. More details can be found in a Memo to the Commission with ADAMS No. ML110380251.

**Question 5:** Does the 10-8 safety goal for CDF include external events as well as internal?

**Answer 5 (TVA):** It is mPower's intent, based on a comprehensive PRA under development, to demonstrate that the mPower SMR reduces Core Damage Frequency (CDF) to approximately 10-8 per reactor year of operation including external events. It is currently planned for the PRA to include internal and external events and address all plant operating modes for which standards exist.

**Question 6:** Given that commercial orders are needed to jumpstart this for SMRs. (a) How many SMRs have been ordered? (b) Would U.S. government look to place an order for the first 10 SMRs to build, own, and initially operate for privatization sale after 5 years?

**Answer 6 (NSS/NRC):**

(a) To the best of our knowledge, no SMRs have been ordered in the U.S.

(b) There are no current plans for the U.S. government to place an order for an SMR. The Department of Energy is supporting the development of SMRs through its SMR Licensing Technical Support Program.

<http://energy.gov/articles/energy-department-announces-new-funding-opportunity-innovative-small-modular-reactors>

**Question 7:** If the administration believes so much in nuclear – why did they (illegally) close Yucca Mountain? Does that have implications for SMRs?

**Answer 7 (NSS/NRC):**

This question is outside the scope of this session. The Department of Energy published its "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste" in January 2013.

<http://energy.gov/downloads/strategy-management-and-disposal-used-nuclear-fuel-and-high-level-radioactive-waste>



**Question 8:** In light of Chairperson McFarlane's desire to have an integrated approach to the fuel cycle, has any effort gone into producing an integrated fuel cycle for SMR's (e.g., recycling of SMR used fuel)?

**Answer 8 (DOE):** Any Federal actions regarding a national policy on fuel cycles will impact small and large reactors equally. The Department took action to address spent fuel issues by commissioning a Reactor and Fuel Cycle Technology Subcommittee as a part of the Blue Ribbon Commission on America's Nuclear Future (BRC). The subcommittee was formed to examine issues related to the potential of existing and future reactor and fuel cycle technologies and its conclusions were included in the final BRC report issued on January 21, 2012. The report acknowledges that advances in nuclear reactor and fuel cycle technologies may hold promise for achieving substantial benefits in terms of the Nation's safety, waste disposal, economic, environmental, and energy security goals. The report goes on to say that the United States should continue to pursue a program of nuclear energy RD&D both to improve the safety and performance of existing technologies and to develop new technologies that could offer significant advantages to various fuel cycle options. However, the Department has no plans at this time to proceed with a reprocessing or recycling spent nuclear fuel strategy. More information on the Blue Ribbon Commission proceedings can be found at [www.brc.gov](http://www.brc.gov).

**Question 9:** Considering the lighter [sic.? Assume this was supposed to be "higher"] cost per MW and lower thermal efficiency of SMR designs, as well as the dwindling Uranium or suppliers, has the DOE investigated the viability of implementing new, comprehensive, SNF reprocessing plant to accompany SMR deployment?

**Answer 9 (DOE):** Part of the reason that the Federal Government is interested in pursuing SMRs as a clean nuclear energy option is the potential for reducing the overall cost per MW of electricity. While we agree that the initial plants are likely to have high costs, we believe that the economies of replication that are inherent to factory fabrication will ultimately result in reduction in the cost per MW of electricity supplied by SMRs that has the potential to compete with existing generation technologies. We do not agree that the SMR designs that are being considered for Government support have lower thermal efficiencies than their larger counterparts; in fact these efficiencies are largely equivalent. With respect to the question about developing a spent nuclear fuel reprocessing plant, the Department commissioned a Reactor and Fuel Cycle Technology Subcommittee as a part of the Blue Ribbon Commission on America's Nuclear Future (BRC) to examine issues related to the potential of existing and future reactor and fuel cycle technologies. The BRC's final report acknowledges that advances in nuclear reactor and fuel cycle technologies may hold promise for achieving substantial benefits in terms of the Nation's safety, waste disposal, economic, environmental, and energy security goals. The report goes on to say that the United States should continue to pursue a program of nuclear energy RD&D both to improve the safety and performance of existing technologies and to develop new technologies that could offer significant advantages to various fuel cycle options. However, the Department has no plans at this time to proceed with a reprocessing or recycling spent nuclear fuel strategy. More information on the Blue Ribbon Commission proceedings can be found at [www.brc.gov](http://www.brc.gov).



**Question 10:** Is there concern about placing SMRs in urban areas near neighborhoods, etc., if they are to replace coal plants that retire?

**Answer 10 (DOE):** Any utility that intends to construct an SMR at a specific location will need to comply with Nuclear Regulatory Commission (NRC) regulations pertaining to siting, including establishing emergency preparedness zones (EPZ). The SMR industry has been examining the potential for adjusting EPZ requirements based on the reduced potential for radionuclide release from a SMR during postulated accident conditions versus a large reactor simply based on a smaller core size. The NRC has agreed to consider exemption requests relative to SMR siting. However, any siting and licensing decisions will be made based on a thorough technical review of the reactor design and siting parameters and will need to comply with all federal rules and regulations set forth by the NRC. Any exemptions made to these rules will assure that the licensee is providing an equivalent level of safety to the public.

**Question 11:** Please comment on the market for SMRs. What are forecasts based on? Is this a component in DOE's award of funding? What is the view of competition in the International SMR market?

**Answer 11 (DOE):** The DOE sees SMRs as filling a niche in the domestic and international power market based on the compatibility of their output to smaller grids or remote locations and their ability to meet load growth in incremental units at lower cost than the 1000 megawatt reactors. DOE does not have specific forecasts for potential SMR sales as SMRs are in a very early stage of design. However, DOE is aware of a great deal of interest in SMRs from both domestic and foreign utilities and governments through public interactions such as the RIC, international interactions with groups like the International Atomic Energy Agency and the International Framework for Nuclear Energy Cooperation, and the response to our funding opportunity announcements (FOA). DOE is taking into account as a part of our SMR Licensing Technical Support program FOA selection process the interest expressed by both domestic and foreign utilities as factors that would be attractive to improving the deployment outlook for SMRs. One of the focus areas of the program is to aid our domestic vendors in capturing the international market by accelerating the commercialization potential of these designs. Currently, U.S designs are in competition with designs from a number of foreign countries including the SMART SMR design in South Korea, a barge-based design in Russia, the CAREM in Argentina, and several advanced designs such as the 4S sodium-cooled design in Japan. It is DOE's opinion that achieving a Nuclear Regulatory Commission (NRC) design certification will give our domestic designs a significant advantage in the international marketplace.

**Question 12:** Why is the DOE SMR focused only on light water reactors? Shall gas cooled reactors can be designed, licensed, etc.? We had Fort St. Vrain and Peach Bottom I, what happened to NGNP? Gas reactor Research and Development? Can SMRs with water liquid coolant use TRISO fuel particles in its fuel? (source term lower)

**Answer 12 (DOE):** For the purposes of the FOAs issued by DOE, we are not focusing specifically on LW-based designs and will consider application involving designs of any technology. However, the program goals involve expediting the certification, licensing and deployment of SMR technologies, and LW units do have a distinct advantage in that they are a technology that is well-understood by the regulator and generally use low-enriched uranium fuel



rod designs that are already qualified. DOE is continuing efforts on gas reactor research and development and believes that gas cooled reactors can and will be certified and licensed, although not within the same timeframe as the light water technologies. TRISO fuels are designed to withstand high temperatures and pressures and provide increased resistance to fission product release over more conventional fuels. Although it may be possible to fuel LW reactor units with TRISO fuels, this application has not been licensed for commercial use in the U.S.

**Question 13:** What is the projected cost per MW of SMRs vs LWRs? e.g. AP1000

**Answer 13 (DOE):** In their report assessing the prospects for SMRs, Robert Rosner and Steve Goldberg at the Energy Policy Institute of the University of Chicago estimated the overnight construction cost for gigawatt-scale light water reactors to be around \$4,220/kW whereas the expected overnight cost of an SMR plant is estimated to be around \$4,700/kW for an Nth-of-a-kind SMR plant when configured as a fully operational, 6 module-600 MW plant. The Nth-of-a-kind designation implies that the cost has been reduced to some reasonably achievable level by realizing "economies of mass manufacturing." In spite of the slightly larger construction cost, the SMRs would be expected to be very attractive as their smaller investment scale would reduce the risk and expense of bringing the project to market.

**Question 14:** Can you speak more about the idea of feed in tariffs for SMRS? Currently nuclear operations have been moving to the fleet model. Feed in tariffs suggest non-utility operators and more diverse ownership. Is that what you envision?

**Answer 14 (DOE):** A feed-in tariff can be thought of as one of a class of policies that would serve to reduce the economic risk to early adopters of the technology. While a feed-in tariff has been used to support distributed renewable deployment in some countries, the main aspect for SMRs would be to establish a reliable revenue stream to offset the first-of-a-kind risks associated with a new technology. SMRs are expected to extend the trend of fleet management for nuclear units. Having a larger set of standardized reactor systems should facilitate the ability to efficiently operate and maintain the reactors.

**Question 15:** (a) Please address fuel cycle, including level of enrichment, burn-up, and used fuel management, compare to today's LWRs. (b) Without fuel shuffling total power output per unit uranium is about 2/3rds on large reactors. Is SMR design including use of new fuel concepts to reduce this difference?

**Answer 15 (mPower):** The B&W mPower™ reactor core design is consistent with existing, well understood parameters for pressurized water reactor fuel. The fuel design is similar to existing 17X17 fuel with enrichments <5% U-235, and an expected burnup of approximately 40 GWd/MT. Used fuel management is also completely consistent with current experience, with a spent fuel pool capacity of 20 years and provisions for offloading for dry storage. Fuel utilization is also consistent with the expected 2/3 ratio for power output per unit uranium with a once-through core design, maximizing utilization through the use of control rod patterns and assembly design and placement within the core while achieving a four-year fuel cycle.





**Question 16:** In your schedule, how much time did you put in for licensing hearings and the licensing process for the Construction Permit, Operating License, and Design Certification?

**Answer 16 (mPower):** The actual review schedules for the TVA Clinch River construction permit application (CPA) and operating license application (OLA) and for the B&W mPower™ reactor design certification application (DCA) will be established by the NRC staff as part of the acceptance reviews for these applications. The NRC staff has indicated their intent to establish an aggressive review schedule for the DCA with a goal of two rounds of requests for additional information and completion of the review and rulemaking in 30 months. For planning purposes, Generation mPower has assumed comparable review durations for the CPA and OLA reviews.

**Question 17:** (a) Have there been any studies focused on increasing thermal efficiency to a degree commensurate or beyond existing LWR designs? Also, (b) can elements of the subterranean containment structure design be adapted to other LWR designs?

**Answer 17 (mPower):** (a) Conceptual design efforts included establishing a balance between steam generator surface size, outlet steam conditions, and thermal efficiency; in large part because of our preference to maintain conditions within existing pressurized water reactor experience and maintain component sizes and weights within certain envelopes, we have not considered pushing the reactor beyond current operating temperatures.

(b) The Generation mPower design includes a free standing steel vessel, supported by a foundation. While the containment vessel itself is similar to current operating reactors, it is also fully integrated into the subterranean reactor service building, which offers substantial benefits in many areas. Other LWR designs could presumably benefit from a similar design concept, although “backfitting” subterranean design into an existing design likely would be cost prohibitive, while the Generation mPower design benefits from the efficiencies of designing this aspect of the plant from its initial concept.

**Question 18:** (a) Regarding your] tag line of “made in North America,” how much (\$\$ or %) is USA supplied? (b) What percent of North America is not seismically suitable for mPower design?

**Answer 18 (mPower):** (a) Generation mPower expects to achieve >90% domestic supply chain (North America) for deployment of the lead plant.

(b) The standard Generation mPower seismic design spectra is intended to address seismic hazards in 85% of North America. Certain areas of high seismic activity would require additional design beyond that for the standard plant in order to deploy there. [▲Top](#)

## **T11 Promoting Success for Emergency Preparedness Guidance**

Session Chair: Mark Thaggard, Deputy Director for Emergency Preparedness, Division of Preparedness and Response, NSIR/NRC

Session Coordinator: Bethany Cecere, Emergency Preparedness Specialist, Division of Preparedness and Response, NSIR/NRC, 301-415-6754, [Bethany.Cecere@nrc.gov](mailto:Bethany.Cecere@nrc.gov)



*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

**T12 International Capacity Building and Coordination: Nuclear Safety and Regulation among New and Developed Nuclear Energy Programs**

Session Chair: Nader Mamish, Assistant for Operations, OEDO/NRC

Session Coordinator: Danielle Emche, International Relations Specialist, OIP/NRC, 301-415-2644, [Danielle.Emche@nrc.gov](mailto:Danielle.Emche@nrc.gov)

*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

<b>TECHNICAL SESSIONS</b> <b>Wednesday, March 13, 2013, 1:30 p.m. – 3:00 p.m.</b>
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**W13 Steam Generator Issues—Lessons Learned**

Session Chair: James Andersen, Deputy Team Manager – SONGS Special Project, RIV/NRC

Session Coordinator: Gloria Kulesa, Branch Chief, Division of Engineering, NRR/NRC, 301-415-6011, [Gloria.Kulesa@nrc.gov](mailto:Gloria.Kulesa@nrc.gov)

*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

**W14 Evolving Nuclear Fuel Pool Storage Criticality Regulations and Guidance**

Session Chair: Jack Davis, Deputy Director, Division of Safety Systems, NRR/NRC

Session Coordinator: Davida Cunanan, Reactor Systems Engineer, Division of Safety Systems, NRR/NRC, 301-415-3573, [Davida.Cunanan@nrc.gov](mailto:Davida.Cunanan@nrc.gov)

*Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)*

**W15 Part 1—International Research— Post-Fukushima Research**

Session Chair: Brian W. Sheron, Office Director, RES/NRC

Session Coordinator: Lisa Culp, International Relations Specialist, RES/NRC, 301-251-7672, [Lisa.Culp@nrc.gov](mailto:Lisa.Culp@nrc.gov)



***The questions below were not answered during the above session.***

**Question 1:** Level 3 Probabilistic Risk Assessment (PRA) considers human health effect from radiation. Is there any consideration of the extent of long-term land condemnation? Post-accident studies are showing post-traumatic stress disorder (PTSD) in populations, some resulting in deaths.

**Answer 1:** In current practice where NRC uses consequence information, such as in regulatory analyses, the consequences of condemned land are part of the accounting for off-site human health and economic consequences. SECY-12-0110, Enclosure 9, explains how the MACCS2 code estimates off-site consequences, including the decision process and when land is assumed to be condemned, which incurs an economic cost. SECY-12-0110, Enclosure 3, also explains that federal courts have ruled that the NRC's public health and safety responsibilities under the Atomic Energy Act do not have to include psychological effects (such as PTSD). The metrics that will be reported in the Level 3 PRA project has not yet been decided.

**Question 2:** IRSN presented an impressive list of specific research issues. How does the NRC program compare to this?

**Answer 2:** The NRC has ongoing research in several areas related to external hazards including seismic, tsunami, flooding, weather events, and others. Much of the research is described in NUREG-1925, Research Activities, available online at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1925/>. As discussed during the NRC presentation at this particular RIC session, there is also ongoing research related to areas identified following the Fukushima accident.

**Question 3:** Vessel Level Indication was a big problem at Fukushima. How is NRC research assessing this problem?

**Answer 3:** There were numerous instrumentation indication issues at Fukushima that impacted the operator's abilities to monitor and control the event. Two examples are 1) the extended station blackout and flooding damage impacted power to key instrumentation and 2) remote monitoring of the Spent Fuel Pool levels was lacking. The NRC Japan Lessons Learned Project Directorate (JLD) Near-Term Task Force (NTTF) recommended a number of actions that address the key problems encountered. Among these are the order for improvements in Spent Fuel Pool Instrumentation, the mitigating strategies order, and the extended station blackout rulemaking. During their review of NTTF recommendations, Advisory Committee on Reactor Safeguards (ACRS) suggested that the NRC should include a review of the severe accident instrumentation needs and instrument survivability. The JLD accepted the ACRS recommendation and formed a NTTF Tier 3 action for Severe Accident Instrumentation which will consider all severe accident instrumentation needs. Rather than focus on specific instrumentation types, the Tier 3 action is investigating what are the drivers, either in severe accident analysis or SAMG procedure development, that will identify the parameters, instrumentation needs and severe accident environmental factors impacting instrument survivability. Additionally the Tier 3 team is participating with International Atomic Energy Agency (IAEA) to better understand instrumentation performance issues during the Fukushima event, analyses needed to identify instrumentation needs and instrumentation survivability



requirements. IAEA plans to issue a TecDoc on this study which will assist in international efforts to improve industry standards for post-accident instrumentation. The NRC Tier 3 team is following and participating in the Tier 1 actions and international efforts to determine if they adequately address instrumentation issues or if additional NRC regulatory action may be needed.

**Question 4:** Is the Level 3 Probabilistic Risk Assessment (PRA) based on the outputs of an existing level 2 PRA? What are the initiating events taken into account? Does the 4-year program focus only on development of Level 3 PRA or also to the preliminary update of level 1 and level 2 PRAs?

**Answer 4:** The Level 3 PRA project study will consider all modes of operation (e.g., full power and shutdown), all hazards (internal and external hazards including fire, flooding, high winds), and all major sources of radioactivity in the site (i.e., both cores, spent fuel pools, and dry cask storage). Although the NRC will leverage the existing PRA work done by Southern Nuclear Corporation (SNC) for Vogtle Units 1 and 2, we will be doing a complete study and will not rely on the outputs of previous Level 1 or Level 2 work completed by SNC. In other words, the study will cover Level 1 (calculating plant damage states), Level 2 (calculating release categories), and Level 3 (calculating offsite consequences) for the aforementioned project scope.

**Question 5:** Is there general agreement regarding how much liner melt through? Recovery containment method? Impact of sequester on this research?

**Answer 5:** To summarize the issue, the problem is concerned with the possibility that the molten material released from the reactor vessel in a severe accident of a boiling water reactor Mark I containment (containment type of the Fukushima reactors) will come into contact with the containment liner and cause a breach. This breach would result in a containment failure. This liner melt through issue was studied extensively in the 90's and the results documented in two NUREG reports (NUREG/CR-5423 and NUREG/CR-6025). The work was peer reviewed by a large group of international experts. The general consensus reached as a result of the work is that in the presence of water on the drywell floor, a liner failure is "physically unreasonable", i.e., the probability of liner failure given a core melt accident is less than  $10^{-3}$ . The U.S. and some international BWR Mark I containment plants have since adopted a severe accident management strategy to flood the cavity (drywell floor) in a core-on-the-floor type accident scenario.

Drywell flooding also provides the benefit of core cooling thereby maintaining the pressure and temperature in the containment environment within the specified limits and assuring containment integrity. Thus, it provides a means to recover the containment. Other methods of containment recovery include venting to control overpressure.

The NRC along with the international community continues to track the Fukushima accident damage assessments which should provide insight into the level of liner melt through that units 1, 2, and 3 sustained (if any).



As the federal government continues to deal with the consequences of the budget sequestration, the NRC's planning and preparations are allowing us to carry on with our mission and work with modest impacts to this research area.

**Question 6:** Does the NRC intend to extend the studies to other external hazards (e.g. hurricanes)?

**Answer 6:** This response assumes that the questioner is referring to the NRC's Spent Fuel Pool Scoping Study (SFPSS) which is a limited-scope consequence study that will be used to update the best-estimate consequences expected from the application of a postulated beyond-design-basis earthquake to a selected U.S. Mark I boiling-water reactor spent fuel pool.

For the SFPSS, a seismic event was judged to be the logical focus of this limited-scope consequences assessment because this initiating event has the largest probability of fuel uncovering as found in previous studies. For more information please see NUREG-1353, "Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools,"" issued April 1989, and NUREG-1738.

There are no current plans to extend the SFPSS scope to include other external hazards at this time. However, the NRC currently has a new comprehensive site Level 3 PRA underway and this study will consider all creditable external hazards.

**Questions 7 and 8:** There is a backfit passive heat removal system available for boiling water reactors (BWRs) and possibly pressurized water reactors (PWRs). This would be a way to prevent a Fukushima accident. Why isn't the industry investing money in this area? and Why has the NRC been so quick to embrace the FLEX approach as contrasted with the French "hardened core", especially since you will be conducting research in FLEX-type mitigation for several years?

Note: According to the Nuclear Energy Institute, "FLEX is a strategy developed by the nuclear energy industry to implement the Nuclear Regulatory Commission (NRC)'s Fukushima task force recommendations quickly and effectively. FLEX addresses the main safety challenges at Fukushima—the loss of cooling capability and electrical power resulting from a severe natural event—to make U.S. facilities even safer.

The strategy is "flexible" in that it relies on portable equipment to protect against even the most unlikely events — events that go beyond the plant's design basis.

FLEX is also site-specific to take into account the differences in the designs and the most likely risks at each nuclear energy facility. A flexible approach ensures that each plant can focus on planning for extreme events that have a greater probability of occurring locally. For example, the risk of floods is more likely in the Midwest, while earthquake risks are greater on the West Coast.



<http://safetyfirst.nei.org/news/nei-fact-sheets/nuclear-energy-industry-develops-flex-strategy-to-increase-safety-address-nrcs-post-fukushima-recommendations/>

**Answers 7 and 8:** A: The NRC's March 12, 2012 Mitigating Strategies Order (EA-12-049) established objectives for U.S. nuclear power plants to meet with regards to core cooling, containment, and spent fuel pool cooling given a beyond-design-basis extended station blackout event, and required all licensees to be in compliance with the requirements of the Order by no later than December 31, 2016. The NRC did not prescribe specific technologies for licensees to employ to meet the requirements of the Mitigating Strategies Order. Licensees may pursue, and submit for NRC approval, any approach which will meet the requirements of the Order. In response to the objectives given in the Mitigating Strategies Order, the U.S. nuclear industry proposed its FLEX approach. Based upon the staff's interactions with the industry since the Order was issued, the staff believes that the industry's FLEX approach, if implemented appropriately, can meet the established objectives of the Order by the given due date. The staff will be reviewing each licensee's plan for implementation of the FLEX approach, and conducting onsite inspections, to ensure that every licensee comes into compliance with the Order requirements.

**Question 9:** Japan has been criticized for not learning lessons from the Blayais flooding in 1999. Did the NRC itself make any changes to address the "cliff-edge effects" revealed by Blayais (before Fukushima)?

**Answer 9:** NRC began the process of revising Regulatory Guide 1.59, Design Basis Floods for Nuclear Power Plants well before the accident in Japan. In the process of this revision, information on the Blayais flooding was acquired from Electricite de France and a representative came to the NRC to discuss the incident at the 2010 Regulatory Information Conference. The measures being taken in France to assess and address the vulnerabilities were also discussed. The NRC has taken that information into account in developing the revision to Regulatory Guide 1.59, which should be issued for public comment near the end of the summer of 2013.

**Question 10:** Is research being considered to understand the impact of climate change on severe weather challenges to nuclear facilities along with the sea level changes relevant to flooding?

**Answer 10:** The NRC is cooperating with other federal agencies involved in research on climate change to develop a common understanding of the range of impacts that may be associated with changes or variations in climate. As our understanding improves, the NRC will reflect any important information in revised guidance to its licensees.



**Question 11:** In France, what is the regulatory requirement concerning land contamination?

**Answer 11 (IRSN):** In France, the management of contaminated land is done through the definition of two specific zones: the public protection zone, a perimeter in which it is justified to carry out actions designed to reduce people's exposure (health objective); and the territorial surveillance zone, a perimeter within which controls must be implemented in order to verify the compliance of foodstuffs, as a priority, or products manufactured according to regulatory commercialisation criteria.

**Question 12:** We have heard that French pressurized water reactors (PWRs) have replaced some of the cast austenitic stainless steel elbows in main coolant piping. Has the French Institute for Radiological Protection and Nuclear Safety (IRSN) conducted research on this issue? Why are these elbows being replaced?

**Answer 12 (IRSN):** Thermal ageing of duplex stainless steels is a well-known phenomenon which leads to an embrittlement of the ferritic phase by hardening. This embrittlement which can be significant depends on the chemical composition, on the operating temperature and holding time. Among cast elbows equipping light water pressurised power plants, Électricité de France (EDF) analyses showed that on some hot leg elbows located in the entrance of steam generators, toughness could become low before the end of life of a power plant (40 Years). EDF thus took advantage of operations of steam generator replacement to remove these few elbows. IRSN led in the past some R&D actions of accelerated ageing on cast parts which did not lead to question the ageing prediction models developed by EDF.

**Question 13:** What are the French Institute for Radiological Protection and Nuclear Safety (IRSN) recommendations in terms of improvement of Emergency Management programs for French nuclear utilities?

**Answer 13 (IRSN):** IRSN considers that all major emergency management missions (alert, mitigation, rescue, radiological characterization of the environment...) during an emergency situation must be accomplished, even in a "degraded" mode. Thus, a specific hardened emergency management building should be available on the site in order to avoid, as far as possible, abandoning the site. More, in the light of the Fukushima accident, external forces should be available to help the local operator. Beyond these requirements, a recommendation could be to think about instrumentation that could be developed and put in place in order to understand as far as possible what occurs in the reactor building during a severe accident.

**Question 14:** In Tokyo Electric Power Company's (TEPCO's) final report they did not conclusively attribute certain radiation spikes with venting – and they concluded suppression scrubbing was effective. Does TEPCO now concur with your assessment?

**Answer 14 (JNES):** We haven't received any comment from TEPCO. We know that TEPCO concluded scrubbing was effective in its final report. As I mentioned in my presentation, the Japan Nuclear Energy Safety Organization (JNES) is now planning to conduct experiments on scrubbing under saturated water condition with depressurization. We hope the experiment could clarify to what extent it was effective.



**Question 15:** Could you please clarify the mechanism by which the Unit 2 radiological releases occurred? The drywell (D/W) rapidly depressurized but how did this occur?

**Answer 15 (JNES):** We don't understand the mechanism yet. In the MELCOR calculation which I showed you, it was simply assumed that a leakage from the D/W took place in the morning of March 15 (set by time). In the case of unit 1, however, we believe the sealing material of the top head flange failed due to over temperature. But in the case of unit 2, the drywell temperature is still not very high at that timing. So, we don't think we have enough data to clarify it at the moment.

**Question 16:** What have you learned from the accident at Fukushima which you consider unexpected new information?

**Answer 16 (JNES):** Although we don't yet understand all the phenomena involved in the accident, there seems to be no completely unexpected new information at the moment. What we have learned most is lax safety culture: we should have been more careful and taken measures in a timely manner to the external events.

**Question 17:** Is JNES considering the opportunity to obtain data and knowledge on core damage phenomena from the decommissioning of the Fukushima reactors?

**Answer 17 (JNES):** Yes, we are very much expecting that useful data for fact findings will be taken during the process of the decommissioning. Good examples are the failure locations and failure modes of the containment as well as the reactor pressure vessel.

**Question 18:** Any comment from the Fukushima Plant operators?

**Answer 18 (JNES):** No, we haven't had any at the moment. [▲Top](#)

#### **W16 Risk Applications: Emerging Challenges and Opportunities**

Session Chair: Kimberly Hawkins, Deputy Director, Division of Safety Systems and Risk Assessment, NRO/NRC

Session Coordinator: Tony Nakanishi, Reliability and Risk Analyst, Division of Safety Systems and Risk Assessment, NRO/NRC, 301-415-3211, [Tony.Nakanishi@nrc.gov](mailto:Tony.Nakanishi@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Can a member of the public take the SAPHIRE class?

**Answer 1:** The NRC changed its training policy in July 2011 and no longer offers training to the members of the general public. Information on SAPHIRE classes taught at the Idaho National Laboratory is available from their website, [https://saphire.inl.gov/training\\_info.cfm](https://saphire.inl.gov/training_info.cfm). [▲Top](#)





## **W17 Regional Administrators' Session**

Session Chair: Michael R. Johnson, Deputy Executive Director for Reactor and Preparedness Programs, OEDO/NRC

Session Coordinator: Julio Lara, Technical Support Staff Team Leader, Division of Reactor Projects, RIII/NRC

***The questions below were not answered during the above session.***

**Question 1:** Please provide insights into the recent Component Design Basis Inspections (CDBI) violations associated with making charging pumps inoperable during venting surveillances.

**Answer 1:** This question appears to focus on a specific inspection at a licensee facility and makes it difficult to provide generic perspectives. The technical issues and nuances associated with this issue are best discussed among the Regional staff and affected licensees through the normal, existing communication processes.

**Question 2:** The method used to clarify cross-cutting aspects will continue to create conflicts with licensees. At most plants, issues that are identified as violations/findings will have a causal evaluation. Since the cross-cutting aspects (CCA) cannot be the same as the primary cause, the licensee's causal analysis fails to look at the CCA causes. Are there any changes planned?

**Answer 2:** The NRC continuously reviews inspection program guidance documents to incorporate recommendations for improvements and clarify existing inspection guidance. The NRC recognizes this is an area of interest for inspection staff and external stakeholders. Two existing agency documents provide guidance in this area: MC 0310, Components Within the Cross-Cutting Areas, and MC 0612, Power Reactor Inspection Reports. Both these documents are available from the NRC's public website at:

<http://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/index.html>

The NRC provides opportunities for external stakeholder input as part of periodic Revised Oversight Process working group public meetings.

**Question 3:** At a public meeting on August 29, 2012, NRC staff said it plans to revise inspection procedures to document observations of non-conformances with the groundwater protection initiative in inspection reports. What exactly is planned, and how do these plans mesh with the discretion in the August 15, 2012 Staff Requirements Memorandum on SECY 11-0019? This direction was not to incorporate the voluntary initiative on groundwater protection into the regulatory framework.

**Answer 3:** In the Staff Requirements Memorandum for SECY-11-0019 the Commission indicated:

"If the staff finds that the voluntary initiatives are not conducted in a committed and enduring fashion, the staff should present information to this effect to the Commission which can and, if necessary, will revisit this matter."



The staff is revising the inspection procedures to allow NRC inspectors to document observations about the Industry's implementation of the groundwater protection initiative (NEI 07-07) in inspection reports. This will provide the NRC staff with a basis to formulate a conclusion on whether the voluntary initiatives are being effectively implemented.

**Question 4:** How do different Regions determine the Beyond Design Basis seismic threshold for specific plants in their Region?

**Answer 4:** NRC inspections focus on ensuring compliance with NRC requirements, design bases and licensing basis as described in the facilities' Updated Final Safety Analysis Report and related licensing documents. Please view related Fact Sheet for Seismic Issues for Nuclear Power Plants at <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-seismic-issues.pdf> for further information.

**Question 5:** Do the different Regions issue news releases? Are the news releases accessible through a single website?

**Answer 5:** NRC news releases are issued by the various offices, including the Regions. All news releases are posted to the public website: <http://www.nrc.gov/reading-rm/doc-collections/news/>

**Question 6:** Your thoughts on the EP, Security, and deterministic significance determination process (SDP) process outcomes when compared to a mitigating system failure/probabilistic SDPs.

**Answer 6:** Comparisons are not likely to be meaningful due to the intentional differences in significance assessment amongst the various Revised Oversight Process cornerstones. It is important to recognize that the emergency plan is implemented only once an accident has occurred and is therefore independent of the probability of an accident occurring. The emergency preparedness (EP) SDP process significance determination process is not risk-based, but it is risk-informed, with higher significance assigned to those findings associated with the planning standards contained within 10CFR50.47, Emergency Plans, that were determined to be risk-significant with regard to their potential impact on public health and safety. These consist of:

- 50.47(b)(4), Classification Scheme
- 50.47(b)(5), "Notifications"
- 50.47(b)(9), "Assessment of Radioactivity Releases"
- 50.47(b)(10), "Protective Actions"

If risk-significant planning standard (RSPS) functions are not capable of being performed in an adequate manner, the public may be placed at greater risk should an accident occur. Hence greater emphasis is placed on RSPS functions. Also, since an accident could occur at any time, the EP SDP does not consider the conditions that may be present at the time the finding was identified, but instead considers what the impact that finding would have had should an accident occur in the future. While the EP and security SDP processes do not rely upon analytical



probabilistic risk models for determining risk significance, the processes are developed to evaluate potential public and security risk. [▲Top](#)

### **W18 Advances in Low-Level Waste Guidance: How Uniform is Your Uniform Manifest?**

Session Chair: Aby Mohseni, Deputy Director for Environmental Protection and Performance Assessment Directorate, Division of Waste Management and Environmental Protection, FSME/NRC

Session Coordinator: James Kennedy, Senior Project Manager, Division of Waste Management and Environmental Protection, FSME/NRC, 301-415-6668, [James.Kennedy@nrc.gov](mailto:James.Kennedy@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Given that waste is not classified until destined for disposal and it undergoes processing before that, how can the Utah Radiation Control Board be opposed to “downblending” just to lower the class?

**Answer 1 (Utah):** At the time the Utah Radiation Control Board passed their policy statement on waste blending, the Board had adjudicative authorities for resolving issues brought before it. The intent of the policy statement was to guide the Board's discussions and activities as it dealt with issues related to waste blending. The original intent of the policy was, in part, how the Board would address perceived weaknesses in the federal guidance regarding blended wastes that could potentially circumvent the Utah ban on B/C wastes.

The authority of Board policies have always been considered only within the context of issues heard before the Board. However, in 2012 the Utah Legislature reorganized the Radiation Control Board and withdrew the Board's adjudicative role. Currently, the Board's authority is mostly limited to rule-making activities. Under the new organization, it is unclear how the old Board policies will be applied.

**Question 2:** Does Canada plan to dispose of all reactor decommissioning waste at the Deep Geologic Repository facility, including the large volumes of what would be Class A waste in the U.S.?

**Answer 2 (CNSC):** Ontario Power Generation (OPG) is an operator of nuclear power plants in Ontario Canada. OPG has applied to manage low and intermediate level waste in a Deep Geological Repository (DGR) located adjacent to the Bruce Nuclear site. A copy of the OPG project description, including details of the types of waste to be managed, can be found at:

<http://www.ceaa.gc.ca/050/documents/39411/39411E.pdf>

The OPG proposal does not include reactor decommissioning waste. The proposal does include:



Approximately 95% of the waste would be Low Level Waste (LLW). LLW consists of industrial items that have become slightly contaminated with radioactive and are of no further use, such as mops, rags, paper towels, temporary floor coverings, floor sweepings, protective clothing and hardware items such as tools. The primary radionuclides found in LLW are cobalt-60, cesium-137 and tritium.

The remaining 5% of the waste would be Intermediate Level Waste (ILW). ILW consists primarily of used nuclear reactor components, and the ion-exchange resins and filters used to purify reactor water systems.

**Question 3:** Wasn't Class B/C waste kept out of the Clive facility due to Northwest Compact legislation and agreements?

**Answer 3 (Utah):** The prohibition for receiving and disposing of Class B/C wastes was instituted directly via a law passed by the Utah Legislature and signed by the Governor (see Utah S.B. 172, 2003 General Session). This action on the part of Utah was not associated with the Compact. The issue relative to the Compact concerned low-level radioactive waste coming from foreign sources and not a matter solely related to its waste classification.

**Question 4:** Will the NRC adopt the Canadian intruder scenarios for modeling acceptability of LLW, especially for concentration averaging?

**Answer 4 (NRC):** NRC has used generic human intrusion scenarios to establish the waste classification system in 10 CFR 61.55 and in the 1995 (currently in effect) and May 2012 draft of the Concentration Averaging and Encapsulation Branch Technical Position (BTP). NRC's scenarios apply to all disposal facilities in the U.S. As noted by the Canadian presenter, their scenarios are site-specific. The NRC's scenarios for developing the waste classification tables in 10 CFR 61.55 are similar to those used by Canada for its Port Hope surface disposal facility.

NRC is developing a rulemaking to amend the disposal regulations in 10 CFR Part 61 that would require site-specific human intrusion analyses. Similarly, the revised Concentration Averaging BTP that will be issued later this year provides for site-specific averaging approaches. Licensees could consider the Canadian approaches to human intrusion to inform their selection of site-specific scenarios, if they wished to pursue that approach. Otherwise, they can simply rely on NRC's generic approaches.

**Question 5:** How does the New Mexico regulator share in groundwater monitoring statutes, data analysis, and compliance under the Safe Drinking Water Act for the WCS facility on the border between Texas and New Mexico?

**Answer 5 (TCEQ):** New Mexico and Texas are subject to the same EPA drinking water standards for potable sources of groundwater. Monitoring requirements are prescribed under



the SDWA and would be consistent among the states. Additional information on groundwater monitoring for the State of New Mexico would have to be obtained from the New Mexico state environmental program.

**Question 6:** You mentioned an updated performance assessment (PA) for depleted uranium disposal at the WCS facility. How much DU is assumed for disposal in that PA and what is the status of the review of the updated PA?

**Answer 6 (TCEQ):** The TCEQ is currently reviewing a license amendment for disposal of DU. The requested volume in the amendment request is 10,000 m<sup>3</sup>. In addition, the license requires an annual updated PA to be submitted before the end of March. As of the time of this response we have not received the annual update.

**Question 7:** Regarding Co-60 and Cs-137 sources, why are they not recycled? Are there cost or technical issues?

**Answer 7 (DOE/NNSA):** Certain disused Co60 and Cs137 sealed sources can be recycled by source or device manufacturers. The primary limiting factors are the decayed activity of the source and the transportation cost. The activity is especially limiting in the case of Co60. Because of its short half-life (5 years), certain manufacturers have stated they are not interested in Co60 for recycle unless its 1,000Ci or higher. This decayed activity level is fairly uncommon in disused sealed sources. If the disused source meets the activity threshold, manufacturers are usually willing to accept a source for recycle IF the owner pays the cost of shipping the device/source back to the manufacturer. With transportation of Cs137 (over 54Ci) and Co60 (over 11Ci), an NRC-certified Type B package is required. Renting a Type B package, and hiring someone with the appropriate Radioactive Materials License to work on the device, typically costs anywhere from \$50,000 to \$100,000. Many owners of disused devices/sources owners do not have resources set aside to cover these costs.

**Question 8:** Why was the WCS Commercial Waste Facility (CWF) situated along the New Mexico border? What if any interaction ensued from locating the facility so close to the State border, and given that proximity, was New Mexico considered a stakeholder?

**Answer 8 (TCEQ):** WCS has operated a RCRA disposal facility at this location for the last 15 years. They expanded their operations to include byproduct disposal and LLRW disposal. Yes, New Mexico and its nearby residents were considered stakeholders.

**Question 9:** Does the Concentration Averaging BTP consider the potential for a large waste stream that would consist of a large volume waste item, where most of the volume is void space. Asked another way, would spent nuclear fuel casks (storage or transportation) that were no longer in use be allowed to use the volume averaging approach?

**Answer 9 (NRC):** Spent fuel casks that were disposed of in a licensed LLW disposal facility could use concentration averaging to determine their waste class. The CA BTP states that major void volumes should be subtracted from the envelope volume. However, an alternative approaches section of the BTP could provide for use of the entire volume in averaging, if justified, such as by the use of encapsulating media in the voids.



**Question 10:** How do you determine the likelihood of human intrusion? Can you discuss the basis for determining the probability?

**Answer 10 (CNSC):** This is a challenging question that both the CNSC and the 'IAEA Human Intrusion working group' is working on; with expected consensus achieved at a November workshop in Vienna. The CNSC guidance suggests that a proponent should estimate both the dose and probability of a human intrusion scenario, but does not say how.

"Scenarios assessing the risk from inadvertent intrusion should be case-specific, based on the type of waste and the design of the facility, and should consider both the probability of intrusion and its associated consequences. Surface and near-surface facilities (e.g., tailings sites) are more likely to experience intrusion than deep geological facilities. "

The CNSC requires licensees to calculate the dose consequences (so as to optimize the siting and design) but just conservatively assume that the probability of Human Intrusion occurrence is 1 over the long term. This assumption would ensure that a facility is optimized to ensure the dose consequences are minimized.

**Question 11:** You recently took part in the NRC workshop in Phoenix AZ on the "difficult to measure" radionuclides." Several alternatives were cited to address the issue of reporting the Phantom 4 radionuclides on shipping manifests. What do you think was the best alternative discussed, i.e., the path forward for this issue?

**Answer 11 (EPRI):** My initial thoughts on this would be to consider lowering the required LLD by 10 times from 10% to 1% of Table 1, this may also resolve much of the C-14 uncertainty. Tc-99 will still usually be LLD and I-129 will always be LLD. Ten times is achievable but further order of magnitude reductions would probably lead to unreasonable count times (hours to days per sample). Tc-99 and I-129 scale well to Cs-137 absent a positive detect, rather than manifest the LLD values a constant scaling factor could be used to obtain a more accurate value for the nuclide. Many other countries use constant scaling factors some without even doing analyses. There are reasonable and technically accurate constant scaling factors for Tc-99 and I-129 derived from mass spectroscopy measurements and published by NRC in NUREG/CR-6567 that could be used.

**Question 12:** DU reaches peak concentration at approximately 2.1 million years into the future. Will the performance assessment (PA) for the WCS site evaluate curies today (disposed) or will the PA account for ingrowth in 2.1 million years?

**Answer 12 (TCEQ):** Currently Texas regulations require the timeframe for PA to be a minimum of 1000 years or the time when peak dose occurs. If the peak dose occurs at 2.1 million years then that information should be provided as part of the PA. If that is the case, then a policy decision will be made taking into account factors including, but not limited to, the uncertainty associated with evaluating such long time frames, trans-generational equity, imposing requirements to limit doses in the future, and economic variables.



**Question 13:** Have any LLW sites reached capacity for the Phantom 4 radionuclides?

**Answer 13 (EPRI):** Older sites (mostly closed) have had inventory issues where they may have had to recalculate the site inventory because of concern over inventory. There is a far more detailed discussion of the problem and concerns in NUREG-1418 “Roles Report”, 1990 and DOE/EH-0332P, LLW & MW Disposal During 1990, 1993.

**Question 14:** Can you speak more to the effort to dispose of depleted uranium? What is the timeline for that assessment?

**Answer 14 (TCEQ):** Based on the most current information available the U.S. stockpile of DU is roughly 700,000 metric tons. It is currently in secured storage in various locations throughout the country. One disposal option for limited quantities of DU currently exists in Utah. The timeline for evaluating DU for disposal in Texas is roughly 1-2 years. [▲Top](#)

<b>TECHNICAL SESSIONS</b> <b>Wednesday, March 13, 2013, 3:30 p.m. – 5:00 p.m.</b>
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**W19 Recent Operating Reactors Materials Issues**

Session Chair: Robert Hardies, Senior Level Advisor for Materials Issues, Division of Engineering, NRR/NRC

Session Coordinator: Timothy Lupold, Branch Chief, Division of Engineering, NRR/NRC, 301-415-6448, [Timothy.Lupold@nrc.gov](mailto:Timothy.Lupold@nrc.gov)

***Questions submitted during the above session were answered during the session’s Q/A period. [▲Top](#)***

**W20 Spent Fuel Safety**

Session Chair: Greg Casto, Branch Chief, Division of Safety Systems, NRR/NRC

Session Coordinator: Richard Daniel, Safety Culture Specialist, OE/NRC, 301-415-6319, [Richard.Daniel@nrc.gov](mailto:Richard.Daniel@nrc.gov)

***Questions submitted during the above session were answered during the session’s Q/A period. [▲Top](#)***

**W21 Part 2—International Research— Post-Fukushima Research**

Session Chair: Brian W. Sheron, Office Director, RES/NRC

Session Coordinator: Lisa Culp, International Relations Specialist, RES/NRC, 301-251-7672, [Lisa.Culp@nrc.gov](mailto:Lisa.Culp@nrc.gov)



***The questions below were not answered during the above session.***

**Question 1:** The NRC will soon begin writing safety evaluation reports (SERs) on FLEX submittals, many of which contain battery load shed and electrical coping analyses. Will the Brookhaven extended battery study have any impact on these SERs? Will the study be finished in time to support draft SERs?

**Answer 1:** The Brookhaven study will not have an immediate impact on the SERs. The FLEX submittals have already been sent to the NRC and the extended battery testing at Brookhaven National Laboratory is still ongoing. The current Research Test Program involving Class 1E Vented Lead-Calcium batteries is intended to demonstrate the capability of these batteries, which are similar to those used by the nuclear industry, to supply power at a reduced demand (amperage/current) over an extended period of time (i.e., up to 72 hours). If the Research Test Program is able to demonstrate the capability of these batteries to perform under the specified circumstances, then the NRC would gain confidence in this battery technology to be used/credited for supplying power for an extended duration (presuming that licensees can show the NRC that the batteries being tested by the NRC are equivalent to theirs and that the assumed conditions/profile are similar as well). The Brookhaven study will be published as a NUREG/CR and the test results could indeed provide further confirmation of the capability of the batteries to perform under the specified circumstances and could be used to support other regulatory actions, e.g., station blackout (SBO) rulemaking and implementation guidance.

**Question 2:** Spent Fuel Pool (SFP) Crack: How does the stainless steel liner behave when concrete is cracked in a beyond design basis (BDB) seismic event?

**Answer 2:** The stainless steel liner would behave in a ductile manner. Cracks on concrete by themselves would not lead to leakage of water from the pool. It is necessary that the seismic loads produce structural deformations and cracks in the concrete that are sufficiently large to induce strains in the liner that can initiate liner tearing. High strains in the liner would be localized in regions of strain concentrations which are, for example, those in which the liner bends at the junctions between the spent fuel pool walls and floor. The strains induced in the liner in these regions of strain concentrations also depend on the details of the liner attachments to the concrete. Strains at which liner tearing would start also depend on details of the liner design and welding as well as liner degradation if any.

**Question 3:** What happened to Electromagnetic Pulse (EMP) concerns of yesteryear?

**Answer 3:** The NRC has conducted research on the potential impacts of EMP events on nuclear power plants (NPP). A Sandia National Lab study from the early 1980's reviewed E fields transmitted by high altitude nuclear weapon EMP events for potential impacts on NPP equipment. That study concluded that NPP safe shutdown could still be achieved following such an EMP event. In 2009 the NRC received a Sandia update to this study to include improved models and assessment of implications for new digital systems. The new study reached a similar conclusion, i.e. safe shutdown could still be achieved. However, such EMP events could have negative impacts on other critical infrastructure such as the Electrical Distribution Grid and telecommunication systems. These impacts have been analyzed and reported to Congress by the Commission to Assess the Threat to the United States from





Electromagnetic Pulse Attack. The NRC does not plan any additional regulatory actions or research for EMP related events at this time, however, the NRC as well as the Federal Energy

Regulatory Commission are currently considering rulemaking activities related to potential impacts from naturally occurring electromagnetic events such as severe solar storms.

Additional information on these rulemaking activities can be found on [www.regulations.gov](http://www.regulations.gov) under Docket ID numbers NRC-2011-0069 and FERC-RM-12-22-000. [▲Top](#)

## **W22 Vendor Performance for New Construction and Safe Operation**

Session Chair: James Luehman, Deputy Director, Division of Construction Inspection and Operational Programs, NRO/NRC

Session Coordinator: Michelle Hayes, Technical Assistant, Division of Construction Inspection and Operational Programs, NRO/NRC, 301-415-8375, [Michelle.HayesNRO@nrc.gov](mailto:Michelle.HayesNRO@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** How do Westinghouse Electric Company (WEC) and CB&I differentiate internal safety culture and safety conscious work environment (SCWE)?

**Answer 1 (Westinghouse):** Nuclear safety culture is defined as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and environment. It includes, but is not limited to SCWE.

**(CB&I):** We define our nuclear safety culture consistent with the NRC's nine traits of a positive safety culture. Trait No. 6, Environment for Raising Concerns, is that very important element of our nuclear safety culture that addresses SCWE. We have both a Nuclear Safety Culture Policy Statement and a Safety Conscious Work Environment Policy Statement.

**Question 2:** What actions have Westinghouse Electric Company (WEC) and CB&I taken to improve internal safety culture and safety conscious work environment (SCWE)?

**Answer 2 (Westinghouse):** Managers are accountable to foster an environment where trust permeates the organization so there can be a free flow of information in which issues are raised and addressed. Personnel can raise safety concerns without fear of retribution and have confidence their concerns will be addressed. Westinghouse has launched various activities to improve our Nuclear Safety Culture and SCWE. This includes, but is not limited to:

- Mandatory, all-employee training introducing the INPO Traits for a Healthy Nuclear Safety Culture that emphasizes the importance of safety culture and explains that there is now a common language for safety culture across the industry.
- Standardized safety briefings are distributed to all managers on a monthly basis that focus safety briefings on one of the INPO Traits, Industrial Safety, Human Performance, & Environmental-Health-and-Safety (EHS) topics.
- Currently conducting a company-wide nuclear safety culture assessment (survey).



- Westinghouse is adopting NEI 09-07, Fostering a Strong Nuclear Safety Culture, to develop our own safety culture monitoring process to regularly gauge the organization's safety culture health.
- Westinghouse is developing an all-employee nuclear safety culture handbook that speaks to leadership's expectations and standards, provides information on how the Traits apply to what we do, ties Human Performance Tools to work activities and the Traits, and is intended to be a daily resource for employees.

**(CB&I):** Last year we updated our Nuclear Safety Culture Policy Statement and our Safety Conscious Work Environment Policy Statement. We also updated our procedure for maintaining a positive nuclear safety culture and safety conscious work environment, which makes clear supervisor and management responsibilities for maintaining a safety conscious work environment. These documents were disseminated throughout the leadership teams in our Charlotte office and at the project sites.

**Question 3:** What percentage of materials and equipment for China's nuclear plants are supplied domestically?

**Answer 3 (NNSA – China):** For the M310 design, about 80% of the materials and equipment are supplied domestically. For the first four AP1000 units, the percentage of materials and equipment supplied domestically is about 30%, 50%, 60% and 70%. [▲Top](#)

### **W23 Are You Prepared for a Hostile Action-Based Exercise?**

Session Chair: Mark Thaggard, Deputy Director for Emergency Preparedness, Division of Preparedness and Response, NSIR/NRC

Session Coordinator: Bethany Cecere, Emergency Preparedness Specialist, Division of Preparedness and Response, NSIR/NRC, 301-415-6754, [Bethany.Cecere@nrc.gov](mailto:Bethany.Cecere@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)***

### **W24 Storage and Transportation of High Burnup Fuel**

Session Chair: Meraj Rahimi, Branch Chief, Division of Spent Fuel Storage and Transportation, NMSS/NRC

Session Coordinator: Jeremy Smith, Senior Nuclear Engineer, Division of Spent Fuel Storage and Transportation, NMSS/NRC, 301-492-3340, [Jeremy.Smith@nrc.gov](mailto:Jeremy.Smith@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)***



**TECHNICAL SESSIONS**  
**Thursday, March 14, 2013, 8:30 a.m. – 10:00 a.m.**

**TH25 Research for Long-term Operations and Subsequent License Renewal**

Session Chair: John Lubinski, Director, Division of License Renewal, NRR/NRC

Session Coordinator: Evelyn Gettys, Project Manager, Division of License Renewal, NRR/NRC, 301-415-4029, [Evelyn.Gettys@nrc.gov](mailto:Evelyn.Gettys@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Oak Ridge Labs is pulling containment samples at Zion. Why can't NRC coordinate with DOE to pull nearby samples at Kewaunee? Cost Share?

**Answer 1 (NRC):** NRC's Office of Nuclear Regulatory Research (RES) is investigating the possibility of collecting various components or materials (i.e., samples) from Kewaunee as it goes through the various stages of shut down and decommissioning. NRC plans to expand a list originally developed for Zion to include Kewaunee specific samples that would be useful for research. RES has memoranda of understanding (MOUs) with the Department of Energy and with the Electric Power Research Institute to cooperate in research related to long term operation of nuclear power plants and to share information and/or costs whenever such cooperation and cost sharing is appropriate and mutually beneficial. Under these MOUs, NRC and the other stakeholders can jointly fund research on materials or components from a nuclear power plant.

**Question 2:** Is there currently an aging management requirement for Low/Med/High Voltage, safety related cables in the US? Are Plans in the place for the future?

**Answer 2 (NRC):** The answer to both questions is yes. 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" requires aging management review for in-scope safety related systems structures and components. For safety-related cables and their connections identified as in-scope for license renewal it must be demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

NUREG-1801 (The GALL Report) contains the staff's generic evaluation of existing plant programs and documents the technical basis for determining where existing programs are adequate as aging management programs and where existing programs should be augmented for the period of extended operation (i.e., the license renewal period). An applicant may reference NUREG-1801 to demonstrate that the aging management programs at a licensee's facility are consistent with the programs reviewed and approved in NUREG-1801. NUREG-1801 also includes aging management program (AMP) guidance for the evaluation of aging mechanisms and their effects applicable for in-scope electrical components including safety related low, medium, and high voltage cables (i.e., XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification



Requirements,” XI.E2, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits,” XI.E3, “Inaccessible Power cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and X.E1, “Environmental Qualification (EQ) of Electric Components).

Although not specifically referenced as “aging management” regulations applicable to current operating licenses (e.g., 10 CFR 50.55a(h)) require that a means be provided for checking the operational availability of each protection system input. Regulations also require that the capability be provided for testing and calibrating protection system equipment. General Design Criteria 21, “Protection system Reliability and Testability”, of Appendix A, General Design Criteria for Nuclear Power Plants,” to 10 CFR Part 50 requires that the protection systems permit periodic testing during reactor operation. GDC 18, “Inspections and Testing of Electrical Power Systems,” requires that electrical power systems important to safety are designed to permit periodic testing, including performance of components and the system as a whole.

Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50, Criterion XI, Test Control,” requires that a test program be established to ensure that all testing, including operational testing, required to demonstrate that systems and components will perform satisfactorily in service, are identified and performed according to written test procedures.

In addition to the above general requirements, specific requirements for the qualification of certain electrical equipment are addressed in 10 CFR 50.49, “Environmental Qualification of Electrical Equipment Important to safety for Nuclear Power Plants”.

10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants”, paragraph (a)(1) requires a licensee to monitor the performance or condition of structures, systems, or components such that there is reasonable assurance that these structures, systems or components are capable of fulfilling their intended functions or, as an option, paragraph (a)(2) states that instead of monitoring, it can be shown that the condition or performance of the structure system or component is being effectively controlled through preventive maintenance.

The above requirements are supplemented with additional documents (e.g., regulatory guides, interim staff guidance, regulatory issue summaries, information notices, and other generic communication) that provide methods, guidance, technical or policy positions the NRC considers acceptable for implementing specific parts of the NRCs regulations. Specific application to cables are provided, among others, through Regulatory Guide (RG) 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, RG 1.211, “Qualification of Safety related Cables and Field Splices for Nuclear Power Plants, RG 1.218, “Condition-Monitoring Techniques for Electric cables Used in Nuclear Power Plants”, RG 1.89, Environmental qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants”, and RG 1.118, “Periodic Testing of Electric Power and Protection Systems”.

As industry operating experience, industry and NRC research, or regulatory initiatives applicable to testing and monitoring of low, medium and high voltage cable may become available; the NRC considers this information and updates its regulations and guidance as required.



**Question 3:** Why has small bore piping become a new focus to NRC? Is it not more a licensee economic issue rather than a safety issue?

**Answer 3 (NRC):** The scope of license renewal reviews has always focused on important piping, systems, and components, as described in 10 CFR Part 54.4. As a regulator, NRC's primary focus, and mission is to ensure adequate protection of public health and safety, and to protect the environment. Specifically to small bore piping, the issue is mostly based on industry operating experience (OE), socket weld piping related failures in particular. There have been over a hundred socket weld failures causing un-isolatable reactor coolant system (RCS) leaks, and many of those leaks have resulted in plant shutdowns. Please refer to the NRC database [<https://lersearch.inl.gov/Entry.aspx>] and search using keywords "socket, weld" to read actual cases. For some time, the industry was being reactive in its approach – by using only to visual examination in its inservice inspection. This was inadequate in regards to age management in license renewal under 10 CFR Part 54. The license renewal staff provides the industry with clear guidance that recommends more robust inspections which include visual, surface and volumetric examinations focused on ASME Code Class 1 small bore piping at locations most susceptible to failures. The goal is to manage aging, and prevent or minimize failures that cause un-isolatable reactor coolant system leaks.

**Question 4:** Do you consider periodic external risk evaluations? Do you consider periodic evaluation of public safety expectations?

**Answer 4 (NRC):** Commercial nuclear power plants are designed to cope with events outside of licensees' direct control, also referred to as design basis accidents caused by external risks, such as extreme weather, earthquakes, flooding, etc. Licensees are required to maintain their licensing basis throughout the life of the plant, and licensees assess their licensing basis when presented with new information that may challenge such basis. As occurred in the aftermath of the Fukushima event, the NRC can also take action to require licensees to reassess their licensing bases for appropriate action. Such regulatory actions are taken to ensure public health and safety, and are based, in part, on public safety expectations. While these periodic assessments are currently not part of license renewal safety review, the staff is considering including periodic assessments, among other matters, for appropriate application to the subsequent license renewal review process.

**Question 5:** If "Advanced I&C" provide benefit, why are their adoptions tied to or contingent on license renewal? Slide (19- DOE) implied this, but 10CFR 50.59 already contains provisions for plant modifications. Is it primarily a safety or financial consideration?

**Answer 5 (EPRI):** EPRI is working with the DOE-LWRS Program on Advance I&C tools as an economic enhancement for plants that are considering long-term operations. This is being done by gathering lessons learned, pilot plant applications, simulations and publications of guideline documents. [▲Top](#)



## **TH26 When Experience Knocks...Who Is Answering?...Why?...and How?**

Session Chair: Harold Chernoff, Branch Chief, Division of Inspection and Regional Support, NRR/NRC

Session Coordinator: Eric Thomas, Senior Reactor Systems Engineer, Division of Inspection and Regional Support, NRR/NRC, 301-415-6772, [Eric.Thomas@nrc.gov](mailto:Eric.Thomas@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)***

## **TH27 Radiation Protection and Health Studies**

Session Chair: Stephanie Bush-Goddard, Branch Chief, Division of Systems Analysis, RES/NRC

Session Coordinator: Gladys Figueroa, Reactor Systems Engineer, Division of Systems Analysis, RES/NRC, 301-251-7545, [Gladys.Figueroa@nrc.gov](mailto:Gladys.Figueroa@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Dr. Cool mentioned that NRC is collaborating with other Federal agencies to implement the latest ICRP recommendations. Please comment on how this is going with DOE and OSHA?

**Answer 1 (NRC):** NRC has ongoing collaboration with other Federal Agencies through the Interagency Steering Committee on Radiation Standards (ISCORS). DOE and OSHA are represented on the Committee. DOE has recently completed some revisions to their requirements in 10 CFR Parts 834 and 835 which better align their requirements with the 1990 ICRP recommendations (ICRP Publication 60). The NRC staff understands that an active revision is not currently underway. OSHA published a Request for Information in the Federal Register several years ago, and has not moved a proposal to the next stage at this time.

**Question 2:** Did the Commission's decision not to revise the occupational TEDE limit takes into account pending Protective Action Guidelines under review at the EPA?

**Answer 2 (NRC):** The Commission's decision on the occupational TEDE limit is independent of the ongoing work by EPA to propose revisions to the Protective Action Guidelines. The NRC staff is aware of EPA's work and has participated in the Federal interagency reviews as the proposals have been developed.

**Question 3:** Anyone willing to debunk the Linear Non-Threshold model?

**Answer 3 (NRC):** The Linear Non-Threshold (LNT) model is one model for estimating risk at dose levels below what is currently scientifically verifiable. The NRC staff is aware of, encourages, and closely follows the continuing work to understand the presence or absence of



risk at low levels of dose and dose rate. The LNT is supported by the reports of the Biological Effects of Ionizing Radiation, the National Council on Radiation Protection and Measurements, and the International Commission on Radiological Protection, all of which have indicated that LNT is an appropriate model for prospective regulatory control.

**Question 4:** Other than fostering unwarranted fear of radiation exposure at any level, of what value is the continued support of the LNT hypothesis by regulatory organizations?

**Answer 4 (NRC):** The LNT model has been recommended by various national and international organizations for the purpose of prospective regulatory control programs. NRC's regulatory system must ensure adequate protection, and must function in a consistent, transparent manner to provide protection for all individuals. In the absence of convincing evidence that there is a dose threshold or alternatively, that low levels of radiation are beneficial, the Commission believes that the assumptions regarding a LNT model for cancer and genetic effects, and the existence of thresholds only for certain non-stochastic effects, remain appropriate for formulating radiation protection standards and planning radiation protection programs.

**Question 5:** Does IAEA sponsor or contribute to develop platform enabling to collect data and to manage and to compare occupational exposition at international level?

**Answer 5 (IAEA):** The IAEA prepares or already runs following platforms dealing with occupational exposure data:

- ISEMIR - The Information System on Occupational Exposure in Medicine, Industry and Research; currently under development
- ISOE - The Information System on Occupational Exposure; it is jointly sponsored by the OECD NEA and the IAEA and the IAEA provides for Technical Secretariat
- Currently developing platform for occupationally exposed workers in uranium mining industry.

**Question 6:** What work is being done to explore the psychological effects of radiation exposure? Have you explored the use of social media to teach the public about Radiation?

**Answer 6 (IAEA):** The IAEA Division of Human Health runs a program addressing this issue, and the Division of Radiation, Transport and Waste Safety provides for supporting technical background on status and setting of radiation protection principles.

**Question 7:** Anyone willing to debunk the Linear Non-Threshold model?

**Answer 7 (IAEA):** The IAEA's work is based on internationally adopted contemporary scientific knowledge, and it follows the recommendations of the United Nations Scientific Committee on the Effects of Atomic Radiation Studies (UNSCEAR) and the International Commission on Radiological Protection (ICRP) to the extent possible.

**Question 8:** People are found to live in danger in Ramseur, Iran due to low dose radiation. Any correlation of these findings with Fukushima exposed people to hold their return to their homes?



**Answer 8 (IAEA):** Such information is certainly considered, contemporary however regulatory principles and regulations clearly discriminate between exposure from natural or background radiation and exposure from additional radiation caused by planned activities.

**Question 9:** At Fukushima Safety Conference in December 2012 in Japan, a suggestion was made to use a “Red, Yellow, and Red” representation of radiation dose for public information in case of an accident. What U.S. plans to do to simplify Radiation communication?

**Answer 9 (IAEA):** The IAEA is not in a position to answer this question.

**Question 10:** Other than fostering unwarranted fear of radiation exposure at any level, of what value is the continued support of the LNT hypothesis by regulatory organizations?

**Answer 10 (IAEA):** The same answer as the one to question no.3.

**Question 11:** How were the sites chosen for study? If Dresden presents complications from its location near other plants, why choose it?

**Answer 11 (NAS):** How were sites chosen? The sites (i.e., nuclear plants) were chosen because they provide a broad representation of designs and operating histories: Dresden, Big Rock Point, and Oyster Creek are BWRs, whereas Haddam Neck, Millstone, and San Onofre are PWRs; plant sizes range from 240 MWt (Big Rock Point) to 6876 MWt (San Onofre 2 and 3); reactors at these plant sites began operations from the late 1950s (Dresden) to the early 1980s (San Onofre); two plants (Big Rock Point and Haddam Neck) are no longer operating.

Why choose Dresden? The purpose of the pilot study is to assess the feasibility of performing cancer risk assessments in populations near nuclear plants. One of the characteristics that made Dresden attractive for the pilot study is its location near other nuclear plants--precisely because it would complicate the development of dose estimates to surrounding populations. This was judged to be a good test of feasibility.

**Question 12:** Other than fostering unwarranted fear of radiation exposure at any level, of what value is the continued support of the LNT hypothesis by regulatory organizations?

**Answer 12 (NAS):** This question is outside the scope of this NAS study. It is more appropriately directed to regulatory organizations. [▲Top](#)

## **TH28 Near-Term Task Force Recommendations 2.1 and 2.3, Status Update for Seismic and Flooding Issues**

Session Co-Chairs:

Scott Flanders, Director, and Nilesh Chokshi, Deputy Director, Division of Site Safety and Environmental Analysis, NRO/NRC

Session Coordinator: Jenise Thompson, Geologist, Division of Site Safety and Environmental Analysis, NRO/NRC, 301-415-0735, [Jenise.Thompson@nrc.gov](mailto:Jenise.Thompson@nrc.gov)





***The questions below were not answered during the above session.***

**Question 1:** During his presentation Dr. Cook mentioned “immediate” safety concerns. If a plant is meeting current licensing basis but new criteria applied via Rec 2.1 gives different results, does this constitute an immediate “safety concern”? What is the urgency of addressing this delta?

**Answer 1 (NRC):** The results of the reevaluated hazard are unlikely in and of itself to provide sufficient information to determine whether there is a potential safety concern. Nevertheless, plants with a reevaluated hazard that exceeds the current licensing basis were requested to provide interim actions while the NRC completes its longer term analysis. This specific issue was addressed in a letter from Mr. Eric Leeds to all power reactor licensees and holders of construction permits dated March 1, 2013. It should be noted that the staff considers the flood hazard reevaluations being performed pursuant to the 50.54(f) letters to be beyond the current design/licensing basis of the operating plants. See ADAMS Accession Number ML13044A561 for additional details.

**Question 2:** Flooding hazard reviews appear to be scheduled on the basis of resources and convenience. How is safety factored into the schedule?

**Answer 2 (NRC):** The review schedule was determined based on several criteria. Specifically, the staff considered the potential that an integrated assessment would be required based on the reevaluated hazard, the complexity of the flood hazard evaluation, and effective use of resources. Additional insights on how NRC prioritized the flood hazard reviews can be found in a letter from Mr. Eric Leeds to all power reactor licensees and holders of construction permits on May 11, 2012. See ADAMS Accession number ML12097A509.

**Question 3:** The staff has had the walkdown results for over 3 months now. Can you comment on whether it has provided the information that you desired or can we expect generic RAIs that will have to be considered?

**Answer 3 (NRC):** Based on the information considered to date, the NRC staff does anticipate issuing requests for additional information (RAIs) to certain licensees. The NRC staff continues to review the walkdown reports from the licensees. In addition, reports from the Resident Inspectors at every site in response to TI-187, “Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns” (ML12129A108) are still coming in. After receipt and review of the aforementioned information, the NRC staff will issue RAIs to certain licensees. In addition, site audits are being planned for a few sites to review the materials supporting the licensee’s reports and to better understand the flood protection measures, or complex procedures. After completion of all these activities, a report documenting staff’s review will be developed.

**Question 4:** What is the NRC’s staff target date to have the initial reviews done for the year 1 flooding re-evaluation reports?

**Answer 4 (NRC):** The flooding reevaluations reports are but the first stage in a two stage process. Staff intends to issue a report documenting its review of the reevaluated hazard report



about a year after the submittal. The second stage is the submittal of the Integrated Assessment report should the reevaluated flooding hazard be greater than the design basis. Licensees are required to submit the Integrated Assessment reports to the NRC within two years after the hazard report is submitted (stage one). Staff will then issue a report documenting its review of the integrated assessment a year after all necessary information has been submitted.

**Question 5:** Does the interim staff guidance on dam failure rely on updated flood hazard potential from FEMA? How is coordination with FEMA for early warning of potential dam failure captured in the ISG?

**Answer 5 (NRC):** The draft dam failure ISG uses updated guidance from FEMA, as well as guidance from other federal agencies. In addition, the NRC is discussing how to exchange information with several federal agencies at present.

**Question 6:** ANS/ANSI 2.8 is under revision and will be published in the near future. If it happens, will NRC revise NUREG/CR7046 that was based on ANS/ANSI 2.8?

**Answer 6 (NRC):** Members of the NRC staff are on the ANS/ANSI-2.8 committee, and staff is aware of this revision. However, there are no plans to update the Contractor Report (NUREG/CR-7046) when the revised/updated ANS/ANSI-2.8 is published. Instead, staff would likely consider incorporating an updated ANS/ANSI-2.8 reference(s) into NUREG-0800, which is the staff's Standard Review Plan.

**Question 7:** Is NRC or NEI helping other federal and state agencies to develop SOPs/guidance for flooding hazard reevaluations for non-nuclear critical facilities and infrastructure since Superstorm Sandy? Any plans to do so? Deterministic or probabilistic?

**Answer 7 (NRC):** The NRC staff is not aware of any such activities regarding non-nuclear facilities). We have participated in meetings with other federal and state agencies where we discussed our ongoing activities in this area, but we do not have any plans, nor have we received any request to assist other federal or state agencies on flooding hazard guidance.

**Answer 7 (NEI):** NEI's purpose and charter is to work on various issues on behalf of our members in the commercial nuclear power industry (our members include utilities, nuclear steam supply system vendors, engineering firms, etc).

**Question 8:** What are the key technical issues impacting the new attenuation model from being accepted by the NRC?

**Answer 8 (NRC):** The NRC staff received an updated ground motion model for the central and eastern United States from NEI on January 23, 2013. After a short review NRC staff had two main concerns with the model with respect to the treatment of uncertainty and the documentation of the model. These two concerns with the ground motion models were expressed by NRC staff to industry in a public meeting on February 28, 2013. Please see the meeting summary online for a more complete discussion of the NRC staff's evaluation. A public



meeting was held on March 26, 2013 to further discuss a path forward with respect to the ground motion models.

**Question 9:** If the seismic criteria don't change - why would the NRC regulate a 10-year period of re-evaluation vs. criteria based?

**Answer 9 (NRC):** The seismic criteria for nuclear power plants likely would not change every ten years. However, due to the ever evolving nature of seismic hazards analysis and the understanding of seismic sources, it is possible that new and significant information may change the seismic hazard at a site. This was observed during the review of Early Site Permits at co-located sites and resulted in the identification of Generic Issue (GI) 199. Although there has been a substantial increase in the data available to determine seismic hazard at a site, GI-199 was the first fleet-wide action to reassess the seismic hazards since the plants were licensed. GI-199 is subsumed into the seismic reevaluations to address Recommendation 2.1. Near Term Task Force Recommendation 2.2 specifies a reevaluation of seismic hazards every 10 years so that licensees can assess whether there is any new and significant information that may change the previously determined seismic hazard at a site. Similarly, NRC Regulatory Guide 1.208 also recommends that seismic models used for hazard characterizations be updated on a 10-year time interval. As new hazard models and data become available, it is important to evaluate and apply, if necessary, this information to update current hazard characterizations.

**Question 10:** On March 1, 2013, the NRC provided guidance on how operability and reportability should be addressed for new flooding information. Is the NRC going to provide similar guidance for seismic information or are licensees expected to use the flooding guidance for seismic information?

**Answer 10 (NRC):** The NRC staff is evaluating whether it is necessary to provide similar guidance specifically for seismic. However, the same operability and reportability requirements apply.

**Question 11:** Did the walkdowns put a wrench to anchorages to determine if the bolts really were tight or did they just look at the anchorage? If only looked, why is this ok?

**Answer 11 (NRC):** No, the walkdowns did not put a wrench to anchorages. The walkdowns were intended to be a near-term activity to identify any significant concerns in the plant while the more detailed hazard reevaluations are completed. The plants that will have to do further risk analyses will use the Walkdown guidance appropriate for those evaluations, which could include torquing anchors. Additionally, all plants are subject to maintenance and inspection activities that require torquing anchors.

**Question 12:** Are you looking at the consequences of a seismic event during a long-duration flood event (e.g. New Madrid event at a Missouri or Mississippi River prolonged flood)?

**Answer 12 (NRC):** Consistent with NRC current regulatory requirements and guidance, the Fukushima NTTF Recommendation 2.1 evaluates seismic and flooding hazards for the most part separately with the exception of potential flooding at nuclear power plant sites due to a



seismic event causing failure of a dam. The NRC does not evaluate multiple natural hazards occurring simultaneously.

**Question 13:** Regarding the walkdowns that simply address confirmation of conformance with CLB, why is there a need for RAIs and an SER? Why would this not simply be an inspection activity?

**Answer 13 (NRC):** The guidance issued on Walkdowns<sup>1</sup> was written by industry to provide licensees with an acceptable way to perform the walkdowns. The NRC subsequently endorsed the walkdown guidance. The purpose of the walkdowns was to identify and address degraded, non-confirming or unanalyzed conditions and verify the current plant configuration with the CLB. The staff's review involves verification of conformance with the walkdown guidance. Staff's review involves several aspects:

- the resident inspectors' independent on-site verification of the licensees' conduct of the walkdown activities using the endorsed walkdown methodology.
- the seismic, flooding, and other appropriate technical experts review of the walkdown report contents to ensure appropriate compliance with the walkdown methodology
- as required, the seismic, flooding, and other appropriate technical experts audit of the on-site documentation used by the licensee during the walkdowns.

If any questions arise during the technical experts review, the normal request for information process will be employed. Each portion of the inspection and review activities performs a different function, but ultimately all will be considered in the publicly-available safety assessments that the NRC staff will issue for each operating reactor. The safety assessment will document the NRC staff's review and final determination of the responsiveness of the licensee to the 50.54(f) letter.

**Question 14:** In the walkdowns and in the re-evaluation, did you also consider non-power (shutdown states) with different mass distributions and items in the containment that are not there in power states? e.g. refueling machine not in rest position, or higher loads of chemicals.

**Answer 14 (NRC):** Flooding reevaluations include consideration of other plant configurations, which would include plant configurations during shutdown conditions (e.g., open doors). The seismic reevaluations do not consider non-power conditions because the potential effect of ground motion on a piece of equipment remains the same whether the ground motion occurs at power or not.

**Answer 14 (SGH/EPRI):** The seismic 2.3 walkdown effort did not include "non-power" situations within its scope. Thus the types of situations that could occur in outage situations were not reviewed.

**Question 15:** Is NRC staff compiling walkdown results into a summary/NUREG report? What is the schedule? Both seismic and flooding.

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<sup>1</sup> EPRI 1025286, "Seismic Walkdown Guidance," endorsed by the NRC on May 31, 2012; and NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features," endorsed by the NRC on May 31, 2012



**Answer 15 (NRC):** A NUREG covering both the seismic and flooding walkdowns in planned with a current estimated publication date of October or November of 2013.

**Question 16:** How will the states and local communities be informed if flood re-evaluations and/or walkdown results require an integrated assessment?

**Answer 16 (NRC):** In general the reevaluated hazard reports are publically available documents, unless they contain security related information. The hazard reports will indicate whether an integrated assessment is required, and in some cases, the integrated assessment may be submitted along with the hazard report. Additionally, the NRC may determine during the course of reviewing the licensees reevaluated hazard report that an integrated assessment is needed. In these cases, NRC will issue a publically available letter notifying the licensee of its position.

NRC review of the reevaluated hazards and integrated assessments will be made publically available, including any necessary meetings or request for information.

The integrated assessment is a specific evaluation associated with the flood reevaluations, and the walkdowns are intended to confirm licensees are complying with their current licensing basis. Therefore, any issues identified during the walkdowns will not require an integrated assessment, but will instead be address through the NRC's reactor oversight process.

**Question 17:** Is the group that is discussing dam failure that was mentioned [ICODS] open to the public?

**Answer 17 (NRC):** The Interagency Committee on Dam Safety (ICODS) includes representatives from the Department of Agriculture, the Department of Defense, the Department of Energy, the Department of the Interior, the Department of Labor, Federal Emergency Management Agency (FEMA), the Federal Energy Regulatory Commission, the Nuclear Regulatory Commission, the Tennessee Valley Authority, and the United States Section of the International Boundary Commission. ICODS is chaired by FEMA and provides a forum for federal agencies to coordinate activities and discuss issues affecting national dam safety. The meetings typically occur once a quarter and generally are not open to the public. [▲Top](#)

## **TH29 Are We a Cyber-Savvy Industry?**

Session Chair: Michael Layton, Deputy Director, Division of Security Policy, NSIR/NRC

Session Coordinator: Stella Opara, Security Specialist, NSIR/NRC, 301-415-5969, [Stella.Opara@nrc.gov](mailto:Stella.Opara@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** Since the President's Executive Order on cyber security expressly does not apply to independent agencies like the NRC, what, if anything, is the NRC doing in response to the order? How is the NRC continuing to ensure that its licensees are not subject to dual regulations?



**Answer 1:** At this time, we believe the NRC's cyber security regulation for operating reactors and combined license applicants meet the intent of the President's Executive Order. The Executive Order called for the creation of a federal government cyber security framework and directed regulatory agencies to review their existing cyber security regulations relative to that framework to determine if they are sufficient and effective. Although the framework is not yet complete, we are confident that our review will validate that our existing cyber security requirements are sufficiently comprehensive. Additionally, the NRC does not believe dual regulation is, or will be, an issue with the Executive Order.

**Question 2:** Inspections of Milestone 1-7 was described as a 1 week effort. Actual experience is that this has grown to a 2 week inspection by including the XXX team on the "bag-man" week with tours and presentations. How are you communicating this change?

**Answer 2 (NRC):** Interim implementation inspections remain a one week on site inspection. During this early period of inspections, information gathering prior to the on site inspection, has varied anywhere from two to four days of actual information gathering. The amount of time needed for information gathering is directly dependent on how well the licensee provides information to the inspection team in advance of the inspection. It is anticipated with time and experience, the amount of time needed for information gathering will be reduced.

**Question 3:** What is NRC's plan to clarify expectations regarding the protection of portable media devices?

**Answer 3:** Currently staff are finalizing Security Frequently Asked Questions to clarify various expectations related to implementation of the new cyber security program requirements.

**Question 4:** We're hearing that some licensees (who have used NEI guidance) are being challenged during inspections. This suggests there are gaps between NEI guidance and NRC expectations. Why? How can licensees better prepare?

**Answer 4:** Some NEI guidance relative to cyber security requirements has been endorsed by the NRC, and other guidance has not been endorsed by the NRC. Currently staff are finalizing Security Frequently Asked Questions to clarify various expectations related to implementation of the new cyber security program requirements. These Security Frequently Asked Questions will help licensees better prepare.

**Question 5:** It was stated that the milestone 1-7 inspection is one week. Does this include the data collection that is done in advance? How many hours total are included in the overall inspection activity for each licensee site?

**Answer 5:** Interim implementation inspections remain a one week on site inspection. During this early period of inspections, information gathering prior to the on site inspection, has varied anywhere from two to four days of actual information gathering. The amount of time needed for information gathering is directly dependent on how well the licensee provides information to the inspection team in advance of the inspection. It is anticipated with time and experience, the amount of time needed for information gathering will be reduced.



**Question 6:** Can you provide examples of the kinds of threats that we've had attacking our Nuclear Power Plant computer systems?

**Answer 6 (INL):** DHS ICS-CERT published ICS-CERT Incident Response Summary Report (<http://ics-cert.us-cert.gov>). In this report ICS-CERT highlighted targeted spear-phishing campaigns against asset owners in the Nuclear, and deployed incident response teams that detected crime ware on an asset owner's enterprise network.

**Question 7:** In the past ~ 5 years how many cyber attacks have been discovered against nuclear power plants? Is the threat increasing or decreasing?

**Answer 7 (INL):** I would recommend that interested parties go to the DHS ICS-CERT web site and download the year in review document (<http://ics-cert.us-cert.gov> (Year in Review FY2012 Final.pdf)). This document provides trending information based on each sector.

**Question 8:** How are NRC goals, prevent radiological sabotages rationalized with NERC goals grid stability? Which takes precedence? Does NRC inspect aspects that ensure XXX of power generation?

**Answer 8 (NRC):** The NRC, FERC and NERC have developed an approach to cyber security regulation that ensures that each organizations respective equities are recognized and maintained. The three agencies recognize the importance of coordination on issues regarding grid reliability and security. A Memorandum of Understanding (MOU) was developed between the NRC and NERC and acknowledges the following:

- NRC's regulatory responsibilities for the oversight of cyber security for digital systems that can affect safety, security and emergency preparedness of a nuclear power plant; and,
- NERC's responsibilities for oversight of cyber security for electrical power generation and transmission systems.

As part of the MOU, the NRC and NERC agree to share information believed to be relevant to any digital system that falls under regulations by the other organization.

In 2009, the NRC and the Federal Energy Regulatory Commission (FERC) signed a Memorandum of Agreement (MOA). The purpose of the MOA is to facilitate interactions between the two agencies "on matters of mutual interest pertaining to the nation's electric power grid reliability and nuclear power plants, including but not limited to coordination of activities related to cyber security." In regards to NRC cyber security inspections, any critical digital asset or critical system that is within the scope of 10 CFR 73.54 is subject to NRC inspection. The NRC staff will share relevant operating experience and other related technical information with NERC regarding these inspections.



**Question 9:** How does the NRC see putting guidance out regarding implementation (NUREG 7140) so far into the implementation schedule to be beneficial? What impact do you foresee this having for licensees to make changes to work already completed?

**Answer 9:** NUREG/CR- 7140, “Cyber Security Controls for the Protection of Critical Digital Assets and Systems at Nuclear Facilities,” will discuss the intent, purpose, and scope of each cyber security control, promote greater understanding of the performance objectives one might seek to achieve when addressing controls defined within regulatory guidance, and aid in the development of objective criteria one might use to assess cyber security control performance within a site’s operational environment. NUREG/CR-7140 is not required to meet the requirements set forth in 10 CFR 73.54. Additionally, this document is not inspection guidance, or mandatory requirements that must be met by a licensee. This document should not impact cyber security program implementation.

**Question 10:** Why is NRC expanding scope beyond significant consequence concerns? Specifically, material control and accounting which has a long history of adequate controls in place to prevent loss of diversion of SNM?

**Answer 10:** 10 CFR 73.54 requires operating power reactor licensees and combined license applicants to provide high assurance that digital computer and communication systems and networks associated with nuclear power plant safety, security, and emergency preparedness (SSEP) functions are protected from cyber attacks. For fuel cycle facilities, non power reactors, independent spent fuel storage installations and byproduct materials licensees the NRC is presently evaluating the need for cyber security requirements. Digital assets at these facilities will be evaluated as part of the process outlined in the NRC’s Cyber Security Roadmap (ADAMS Accession Number: ML12135A050).

**Question 11:** How to prevent hacker attacks when their strategy is always evolving when attack occurs, it’s late?

**Answer 11:** 10 CFR 73.54 requires operating reactor licensees and combined license applicants to apply and maintain defense-in-depth protective strategies to ensure the capability to detect, respond to, and recover from cyber attacks. Defense-in-depth strategies represent a collection of complementary and redundant security controls that establish multiple layers of protection to safeguard critical digital assets (CDAs). Under a defense-in-depth strategy, the failure of a single protective strategy or security control should not result in the compromise of a safety, important-to-safety, security, or emergency preparedness function. In addition, licensees and applicants perform ongoing cyber security program effectiveness reviews, and continually screen, evaluate, mitigate, and disposition credible threat and vulnerability information to determine if additional security measures are warranted. [▲Top](#)

### **TH30 Key Insights to the Future of High-Level Waste Management**

Session Chair: Keith McConnell, Director, Waste Confidence Directorate, NMSS/NRC

Session Coordinator: Drew Stuyvenberg, Project Manager, Waste Confidence Directorate, NRC/NMSS, 301-492-3182, [Andrew.Stuyvenberg@nrc.gov](mailto:Andrew.Stuyvenberg@nrc.gov)





**Question 1 for Panel:** Why do you all say that the taxpayer is paying for interim storage of spent fuel and litigation associated with hi-level waste storage when there's a waste fund (\$ trillions) and interim storage is fee billable via license from the NRC??

**Answer 1 (DOE):** The payments for partial breach of contract for the delay in picking up waste in 1998 come from the Judgment Fund, a mandatory spending account managed by the Department of Justice. Previous court cases (see *Alabama Power*) have established that the government cannot pay utilities from the Nuclear Waste Fund for costs incurred due to the government's delay in picking up used nuclear fuel.

**Answer 1 (CCMSC):** First, let's address the waste fund and fee parts of the question. The Waste Fund contributions are made by ratepayers via the nuclear utility companies while plants are operating at the rate is 1 mil per k/whr. The government's contractual obligation is to remove spent fuel and Greater Than Class C Waste from our sites, beginning in 1998. Expenditures from that fund are made via the annual appropriations process. None have been made for, nor can they be, for continuing on-site storage at our sites. Also, NRC fees cover the "costs" of NRC's annual appropriation for its activities, not the expenses of licensees to store the material on-site. Hence, licensees collect additional funds from ratepayers to cover the costs of storage, (i.e.- facilities, construction, and security, regulatory compliance, etc.

The taxpayer is now paying the costs of on-site storage because the federal government recently began paying court mandated judgments for costs incurred by its failure to meet its contractual obligations (as mentioned above). This actual payment is a recent development that follows the government's decision to cease appeals of universally unfavorable judgments to higher-level courts. These judgments are paid from what is known as the Judgment Fund (other agencies are also sued for various liabilities at other agencies during a given year). This is an off-line budget item that is entirely taxpayer funded. Note that since judgments are being paid in constant dollars and payments occur years after the original ratepayer/licensee expenditure took place, it's a very, bad "deal" for local ratepayers and the licensees. But the government is now actually paying these costs.

**Question 2 for Panel:** Why does long term storage require Congressional action?

**Answer 2 (NRC):** The NRC did not make the assertion to which the questioner refers. The NRC's existing regulations allow for storage of spent fuel in spent-fuel pools and in dry cask storage. Regarding ultimate disposal of high-level nuclear waste, however, the Nuclear Waste Policy Act, as amended, establishes that the Department of Energy (DOE) has the responsibility to locate, build, and operate a repository for such wastes. The NRC has the responsibility to establish regulations governing the construction, operation, and closure of a repository, consistent with environmental standards established by the U.S. Environmental Protection Agency.

**Answer 2 (DOE):** Currently, the Nuclear Waste Policy Act in Section 148 dictates that the government cannot begin construction on an interim storage facility (also called a Monitored Retrievable Storage facility) until a license for construction of geologic repository has been received from the NRC. This provision makes pursuit of interim storage unworkable in the near term.



**Answer 2 (CCMSC):** This is best left to the actual lawyers of the panel but would observe:

The only authorized manner for the federal government to fulfill its contractual obligation is via the requirements of the Nuclear Waste Policy Act, which currently does not authorize an interim facility to be constructed until the Commission issues a Yucca Mountain construction authorization.

Given the growing size and costs of the failure to perform, we believe that interim storage is needed regardless of the fortunes of Yucca Mountain or any repository. Therefore, the Decommissioning Plant Coalition supports efforts/legislation to establish a consolidated storage program.

**Question 3 for Panel:** Why can't the NRC make an argument that storage is necessary for safety and security and act?

**Answer 3 (NRC):** NRC's existing regulations allow for storage of spent fuel in spent-fuel pools and in dry cask storage. The NRC considers safety and security issues in its regulations for these methods of storage. Regarding ultimate disposal of high-level nuclear waste, however, the Nuclear Waste Policy Act, as amended, establishes that the Department of Energy (DOE) has the responsibility to locate, build, and operate a repository for such wastes. The NRC has the responsibility to establish regulations governing the construction, operation, and closure of a repository, consistent with environmental standards established by the U.S. Environmental Protection Agency.

**Answer 3 (CCMSC):** The NRC, staff and Commissioners alike, often say – and correctly – that it does not set national policy.

There is a distinction between setting national policy, which the NRC doesn't do, and setting safety and civilian nuclear security policy, which the NRC should do.

The current arrangement, having the Department change its mind every so often about when and how it will meet its obligations, and having stand-alone ISFSIs proliferate at multiple sites across the country, would most likely fail to meet any "best practice" precept for spent fuel management, safety, and security.

Despite the limitations on NRC to affect how the Department and Administrations meet their obligations, the NRC can be more vocal and active in expressing its views on when and what must be done to break the gridlock, logjam, or any other term that fits the nation's current spent fuel management predicament.

**Question 4 for Panel:** Should the Yucca mountain site review continue in order to determine all issues associated with design and licensing of a geological repository?

**Answer 4 (NRC):** The question of whether the NRC should continue its review of the Yucca Mountain site is currently before the U.S. Court of Appeals for the District of Columbia Circuit in *Aiken County, et al. v. NRC*.



**Answer 4 (CCMSC):** Yes.

**Question 5 for Panel:** Without codifying the DOE strategy in the law, how does this strategy differ from the current Fed Gov practice to delay the process?

**Answer 5 (DOE):** The Administration's strategy notes that legislation is needed to move ahead with interim storage, establish a new organization, and reform funding. The Administration looks forward to working with Congress on the development of that legislation.

**Answer 5 (CCMSC):** (I'll assume that "this strategy" refers to the interim consolidated storage strategy.) The recent DOE outreach to the permanently shut down plants and its desire to proceed with a consolidated storage program are sincere and well-grounded and, if the program can be enacted, would not delay the process of DOE meeting its contractual obligations but actually expedite meeting it and have very beneficial safety, regulatory, research, and security benefits. It would also demonstrate to the growing number of localities where these storage sites exist involuntarily that the government hasn't abandoned its obligation to promptly remove the spent fuel and Greater than Class C Wastes.

**Question 6 for NRC:** In developing its Waste Confidence EIS, what principal sources does the NRC intend to rely on to treat long-term waste storage without Yucca mountain? Does the Staff intend to do any new research, or to rely on existing sources?

**Answer 6 (NRC):** As it develops the Waste Confidence Generic Environmental Impact Statement (GEIS), the NRC actively seeks out information sources that may be relevant and helpful in the preparation of the GEIS, including previous Waste Confidence rulemakings, environmental assessments and impact statements, and technical reports, as appropriate. These documents will be clearly referenced or cited in the GEIS, and members of the public will be able to comment on the NRC's conclusions regarding existing data and documents during the comment period for the draft GEIS. The NRC does not intend, at this time, to conduct new research as part of the GEIS effort.

The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act inform the staff's approach to the Waste Confidence GEIS. These regulations allow and encourage incorporation of material by reference into environmental impact statements. Regardless of information sources the NRC uses, the NRC will provide its own review of Waste Confidence in the GEIS.

**Question 7 for NRC:** How do you enjoy working with all these lawyers? How many lawyers do you have on your staff? How many engineers?

**Answer 7 (NRC):** The Waste Confidence Directorate has approximately twenty scientific, technical, support, and management staff, and has access to the expertise of the rest of NRC's engineers as needed. An [organization chart and functional descriptions](#) is available from the Waste Confidence web site. The Directorate works closely with a small team of attorneys from the NRC's Office of the General Counsel.



**Question 8 for NRC:** I'd like to hear your response to DOE's consent-based approach to repository siting.

**Answer 8 (NRC):** The Nuclear Waste Policy Act (as amended) establishes that the Department of Energy (DOE) has the responsibility to locate, build, and operate a repository for high-level radioactive waste. The NRC has the responsibility to establish regulations governing the construction, operation, and closure of the repository, consistent with environmental standards established by the U.S. Environmental Protection Agency. The NRC will review a repository application—rigorously applying its regulatory standards—however a site for a repository is selected.

**Question 9 for DOE:** From the same card:

- What is DOE doing about the Hanford leak?
- Can we look forward to more such leaks with on-site storage?
- DOE does not inspire public confidence.

**Answer 9 (DOE):** The Hanford site has 56 million gallons of radioactive waste that is contained in 177 tanks, of which 149 are single shell tanks. Over the years, some leaks have been discovered in some of the single shell tanks with 67 assumed to have leaked sometime during their life. In 2005, DOE completed the interim stabilization all of the single shell tanks by removing the pumpable liquids, thus significantly reducing the risk. DOE maintains an active monitoring system, both of the levels in the tanks as well as to detect contamination in the environment. Additionally, DOE has an advanced pump and treat system to remediate contaminants that reach the groundwater. DOE continues retrieving waste from single-shell tanks, as prioritized by the Department of Energy and the State of Washington. Those retrievals continue on schedule. The waste retrieved is stored in double-shell tanks that are newer and more robust than the single-shell tanks until the waste can be treated for permanent disposal. For approximately 20 of the tanks, including the tank confirmed to be leaking and four others suspected of leaking, process knowledge indicates the waste in these tanks may be transuranic waste and DOE has announced its preferred alternative to retrieve this waste and dispose of it at the Waste Isolation Pilot Plant in New Mexico.

**Question 10 for DOE:** Given the litigious behavior of Nevada over many years, is the concept of "consent-based" realistic? NIMBY, etc.

**Answer 10 (DOE):** The Blue Ribbon Commission on America's Nuclear Future recommended the development of a consent-based siting process where potential hosts are treated as partners and consent is obtained on multiple levels. The Administration agrees that this approach holds the most promise of moving ahead with the siting and development of facilities for the storage and disposal of used nuclear fuel and high-level waste.

**Question 11a for DOE:** You mentioned that a Consolidated Interim Storage Facility could also help with "defense wastes," could you elaborate?



**Answer 11a (DOE):** The Administration is willing to consider the transport and storage of defense high-level waste and used nuclear fuel at an interim storage facility to make progress on cleaning up Cold War legacy and other sites.

**Question 11b for DOE:** If so, will funds from sources other than the Nuclear Waste Fund be forthcoming?

**Answer 11b (DOE):** As with the previous waste management program, disposition of government used fuel and high-level waste would be funded to through general appropriations.

**Question 11c for DOE:** Could these other funds start the pilot facility now?

**Answer 11 c (DOE):** The commingling of government and utility wastes is still the Administration's policy, though it will be the subject of analysis moving forward. Any such pilot facility would need to be licensed by the NRC, and the Administration believes that such a facility would be best developed on a consent basis with the host jurisdiction.

**Question 12 for DOE:** Why not just take the waste to a federal site?

**Answer 12 (DOE):** Even at a federal site, an NRC license would still be needed. In addition, the Administration believes that cooperating with a host jurisdiction to develop a consent agreement is surest pathway to a sustainable solution to the waste problem.

**Question 13 for DOE:** What's wrong with Yucca besides politics?

**Answer 13 (DOE):** As the Administration has noted before, Yucca Mountain is not a workable solution to the waste issue and the Administration looks forward to working with Congress on developing legislation to move the country forward on this important issue.

**Question 14 for DOE:** Now we know the Administration's response to the BRC recommendation, does DOE have a plan with timeline to engage Congress and stakeholders on consent-based sitings of an interim consolidated storage facility? . . . a timeline for legislation?

**Answer 14 (DOE):** The Administration is currently engaging Congress on this important issue and will continue to do so until legislation is passed and signed by the President. While the Administration is beginning to consider a path forward on a consent-based siting process, Congress will have a significant role in defining that process and it would not be prudent to substantially pre-empt the legislative process.

**Question 15 for NEI:** Why has the Court not issued the mandate in the Aiken Case?

**Answer 15 (NEI):** The U.S. Court of Appeals for the District of Columbia continues to consider the requested writ of mandamus in *In re Aiken County v. NRC* (D.C. Cir. No. 11-1271) but, to date, has not issued a final decision. The Court exercises its discretion regarding when it issues a particular decision.



Recall that, in August, 2012, the Court issued a decision *ordering the case held in abeyance and directing the parties to file, no later than December 14, 2012, updates on the status of FY 2013 appropriations related to the Yucca Mountain licensing proceedings*. The Order was based on a 2-1 vote, with Judges Garland and Kavanaugh ruling to hold the case in abeyance, and Judge Randolph dissenting. The Court later extended that filing deadline until January 4, 2013.<sup>1</sup> Although the Court did not issue the writ of mandamus with the August decision, two judges agreed that NRC has an affirmative duty to act in conformance with the NWPA, and that NRC's failure to complete review of the Yucca Mountain application and its termination of the proceeding violate that law.

On January 4, 2013, the parties filed status reports in response to the Court's direction. The State of Washington and other petitioners' concluded that a writ of mandamus should issue immediately, because no appropriations decisions have been made since August 2012 that prohibit NRC from using its available funds to continue the agency's "mandatory" review of the YM repository license application. They also argued that the Continuing Resolution (H.J. Res. 117) that would fund the federal government until March 27, 2013 contains no statutory text precluding the NRC from using any appropriated money (including funds previously appropriated) for the YM licensing process—and, indeed, allows "activities to be started or resumed if authorized by law and funding is available" (as here).

The NRC filed a status report concluding that a writ of mandamus should not issue because no appropriations decisions have been made that explicitly allow the NRC to use its available funds to continue the YM licensing review. Rather, states NRC: "[I]t would be far more appropriate to conserve the limited amounts appropriated from the Nuclear Waste Fund so that they would be available if and when Congress decides to fund the project to allow for completion of the Yucca Mountain-related activities (or to direct their use towards an alternative high-level waste solution)." In its status report, Nevada argued that by enacting H.J. Res. 117, Congress rejected the opportunity to provide additional funds to the NRC to continue the YM licensing proceeding, as well as the opportunity to give DOE funds to continue to prosecute its license application.

The parties have filed additional status reports with the Court without any change in their positions.

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<sup>1</sup> Judge Kavanaugh's opinion emphasized that, in considering whether to compel NRC to continue the Yucca Mountain licensing proceeding, the Court was obligated to take into account practical considerations—such as action by Congress to fund or not fund DOE's used fuel management and disposal program. He reasoned that if Congress appropriated funds or did nothing, the Court would likely have to grant the requested "writ of mandamus." Judge Kavanaugh also concluded that, in light of the availability of appropriated funds to continue the licensing proceeding, NRC "appears to have no legal authority to defy the law." Judge Randolph's dissent rejected the notion that, in the face of an agency's willful defiance of a statutory obligation, a writ of mandamus would depend on potential action by Congress that might "excuse" the agency's violation. Noting that the NWPA remains good law, Judge Randolph opined that the Court's "duty is to enforce these statutes, plain and simple." "Holding the case in abeyance indefinitely, based on the mere *possibility* of future legislative action, shirks this basic obligation and perpetuates the Commission's unlawful delay."



**Question 16 for NEI:** Given that the industry projects that Yucca Mtn wouldn't open until 2042 and it took 30 years to get this far, then is it correct to assume that DOE's current strategy wouldn't actually produce a repository until 2070?

**Answer 16 (NEI):** Until DOE establishes a new program to address its obligation to dispose of used fuel or resurrects the Yucca Mountain program, it is difficult to project when a geologic repository will be available. However, the 2042 date assumes that a new program would require approximately 35 years for completion of siting, licensing and construction.

**Question 17 for NEI:** Does NEI's advocacy for a new repository siting process mean that the industry has abandoned Yucca Mountain?

**Answer 17 (NEI):** The commercial nuclear industry has been steadfast in maintaining that the NRC adjudicatory proceeding to review the Yucca Mountain repository license application should be completed. If the Administration develops and implements a program that requires a consolidated interim storage facility and/or geological repository to be sited anew, the industry supports a consensus based approach to siting. This approach is consistent with the recommendations of the Blue Ribbon Commission on America's Nuclear Future. [▲Top](#)

<b>TECHNICAL SESSIONS</b> <b>Thursday, March 14, 2013, 10:30 a.m. – 12:00 p.m.</b>
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**TH31 Regulatory Changes That Would Improve the NRC Adjudicatory Process**

Session Chair: Ronald Spritzer, Administrative Judge, Atomic Safety and Licensing Board Panel, ASLBP/NRC

Session Coordinator: Twana Ellis, Program Analyst, ASLBP/NRC, 301 415 7703, [Twana.Ellis@nrc.gov](mailto:Twana.Ellis@nrc.gov)

*The questions below were not answered during the above session.*

*The questions below were not answered during the above session. In the interest of avoiding duplication, questions concerning the same issue or related issues have been grouped together. The unanswered questions were expressly or implicitly directed to Judge Rosenthal. Other panel members were given the opportunity to respond to the questions and/or Judge Rosenthal's answers. Where they did so, their responses appear below. The Nuclear Energy Institute (NEI) states that the fact that it has not provided responses to all of Judge Rosenthal's supplemental statements should not be interpreted as agreement with the views he espouses.*



**Question 1 (three separate questions all related to timing of hearing requests):**

**#1 addressed to Judges Spritzer/Rosenthal:** By requiring contentions (safety and environmental) at the outset of the process, does not the staff/applicant have the opportunity to fine-tune the reviews/address issues raised by those contentions? Isn't this beneficial for all participants, since such issues receive enhanced attention throughout the review? Filing later eliminates this benefit, does it not? New/amended contention requirements allow issues to be raised later.

**#2 addressed to Judge Rosenthal:** Will changing the timing of the hearing lengthen the overall hearing process? Will it "backload" the hearing and make it more likely to delay issuance of Board decisions and the NRC licensing decision? Is this your intention? Given your long experience with NRC hearing process, why have you waited until now to propose this change in hearing timing?

**#3 addressed to Judge Rosenthal:** The hearing process aims to improve NRC decisionmaking not just to hold a hearing. Aren't the intervenors goals served by resolving issues early in the process? If Fermi, for example, made major changes to resolve issues, isn't that a success?

**Answer 1 (addresses all three separate questions listed above):**

**Judge Rosenthal:** On this issue, my point was simply that, it made no sense to insist that hearing requests meeting the stringent standing and contention admissibility requirements imposed by the Commission's Rules of Practice be filed when the license application is docketed—years before the Staff's technical review is completed and any evidentiary hearing on the application might take place. In that regard, I was particularly critical of the insistence that environmental contentions be filed on the basis of the environmental report (ER) submitted by the applicant along with the application. The fact is that the ER has absolutely no significance insofar as compliance with the requirements of the National Environmental Policy Act (NEPA) is concerned. That statute places a burden on the agency alone. Thus what is significant for NEPA compliance purposes is not what is contained in the ER but, rather, is what is contained in the NRC Staff's environmental assessment. That being the case, it seems to me absurd to require would-be intervenors to submit environmental contentions even before the Staff likely has embarked upon the fulfillment of its NEPA obligations.

One of the questioners suggests that requiring the filing of contentions at an early stage will provide the applicant/staff the opportunity to fine-tune the reviews/address issues raised by those contentions. With due respect, however, the questioner appears not to take into account that, under the NEPA command, environmental contentions necessarily are addressed to Staff action, which, as a general rule, is first reflected in the draft environmental impact statement (DEIS). Moreover, I perceive no legitimate basis for imposing a duty upon potential hearing requesters to do the Staff's work for it. Thus, I remain committed to the view that environmental contentions should not be required until the DEIS surfaces. That is the point at which the Staff is appropriately presented with the claim that its NEPA responsibilities are not being properly discharged; before that point, no such claim is possible.





Another questioner expresses concern that a change in the timing of the submission of hearing requests might lengthen the overall hearing process. I think not. A year often elapses between the issuances of the DEIS and the FEIS. And the evidentiary hearing may not commence until the FEIS is issued (as well as the Staff's Final Safety Analysis Report if safety contentions are also being litigated). There is additionally the consideration that, under the present timing of contentions, once the relevant final technical review documents surface, an opportunity generally is provided for the submission of new contentions based thereon.

The next timing question asks whether the intervenor's goals are served by resolving issues early in the process. The questioner adds: "If Fermi, for example, made major changes to resolve issues, isn't that a success?" My response is that there is no reason to believe that, by requiring the Fermi intervenors to file their hearing request years before a hearing that still remains to be held, any of their goals were well served. Nor do I find any cause to believe that the current timing of contentions will often operate to the intervenor's advantage in getting an earlier resolution of its concerns. In that connection, potential intervenors are always free to present their environmental and safety concerns to the Staff for its consideration at an early stage. Indeed, the Staff might well encourage such action. That is a far cry, however, from insisting that potential intervenors be required to file, at the expenditure of considerable time and money, their environmental contentions years before the Staff has issued its DEIS and even more years before an evidentiary hearing might be conducted.

Finally, with respect to the question why I have not previously raised these concerns, my views on both the timing of hearing requests and Staff participation as a party (see answer to question 3 below) were formulated years ago, and March 14, 2013 was hardly the first time that they had been stated both publicly and, in the case of the latter, in communications with NRC Chairmen. Obviously, that advocacy has met with no success to date.

**Ellen Ginsberg, NEI:** Implementation of Judge Rosenthal's position on timing of hearing requests and contentions will "backload" the hearing and generally delay issuance of a Board licensing decision. Delayed issuance of a licensing board decision can have significant financial, business and legal implications for the applicant.

Industry supports the current requirements that proposed contentions be included with the original petition for intervention because this time-tested approach will tend to expedite the NRC decision on whether a hearing is required. (There is no need for a hearing in the absence of standing and genuine material fact issues.) Moreover, some knowledge of the issues sought to be raised by the proposed intervenors can aid in the ruling on petitioners' standing.

Under current Part 2 requirements, intervenors are freely allowed to amend their environmental contentions (if submitted and admitted earlier) upon issuance of the DEIS.



**Question 2 (two separate questions related to motions in limine):**

**#1 not addressed to any specific panelist:** The need for them is directly proportioned to the Board's willingness to effectively manage proceedings, by taking active steps to clearly define (& limit) the scope of admitted contentions. They are filed, in most cases, because there is a lack of clarity on contention scope.

**#2 addressed to Judge Rosenthal:** In some situations, the scope of contentions is not clear. In order to focus the testimony of all parties and for all parties to better prepare for issues at the hearing, wouldn't motions in limine better define the issues to be resolved at the hearing?

**Answer 2 Judge Rosenthal:** On this issue, I said little at the panel discussion beyond calling attention to footnote 170 in GE-Hitachi Global Laser Enrichment LLC (GLE Commercial Facility), LBP-12-21, 76 NRC \_\_ (Sept. 19, 2012), in which the licensing board provided cogent reasons for its conclusion that, particularly in Subpart L proceedings where the board members are both the questioners and the deciders, motions in limine do not serve a useful purpose. In short, the board members are perfectly capable of separating the wheat from the chaff without the assistance of such motions that also require the expenditure of time and money on the part of the opposing party and parties (as well as the time of the board should it feel obligated to entertain the motion). Put another way, in NRC adjudication decisions are not being made by unsophisticated members of a jury.

The two comments on that subject were to like effect. Both suggested that there would not be the need for motions in limine were the scope of the contentions to be litigated better defined. Although I certainly agree that it is important that there is a clear understanding on the part of all concerned regarding what is on the table for adjudication, if there is genuine concern in that regard clarification can be sought without employing motions in limine. I would add on that score that my experience with such motions suggests that the purpose is not usually to obtain clarification of the scope of the admitted contentions, but rather to force the opponent, through its response to the motion (unless it has been summarily denied), to expend valuable time and effort on an essentially meaningless exercise.

**Question 3 (four separate questions all related to NRC Staff participation in licensing adjudicatory proceedings as a party):**

**#1 addressed to Judge Rosenthal:** You said that the positions of the staff "are invariably in lock step with the industry." Have you done a meaningful review of the licensing cases to test the accuracy of this assertion? If not, on what is your assertion based?

**#2 addressed to Judge Rosenthal:** Isn't it possible that the NRC staff agrees with applicants – sometimes because the applicant's position is correct?

**#3 addressed to Judge Rosenthal:** If the issue of staff/applicant being in lockstep is one of appearance, why don't you and other judges make it clear that the "appearance" is in error and explain that is the case. In which other agencies' adjudicatory hearings are those agencies' staff excluded as a party? How does staff defend EIS if it is not a party?



**#4 not addressed to any specific panelist:** Does not the NRC represent the interest of the general public? If not, who do they represent?

**Answer 3 Judge Rosenthal:** I became convinced not that long after my assumption of the position of Chairman of the AEC's Atomic safety and Licensing Appeal Panel in October 1972 that the NRC Staff should not be a party to adjudicatory proceedings on applications for licenses or license amendments. Nothing that has transpired in the ensuing forty years has altered that conviction which is essentially based on two considerations.

As stressed in my prepared remarks, the principal consideration is one of public perception. For good reason, the license applicant does not desire to have to confront in the adjudicatory proceeding the opposition of both the intervenor and the NRC Staff. Accordingly, the applicant will see to it that any disagreements between it and the Staff are worked out in advance of any evidentiary hearing, with the consequence that it is extremely rare that the Staff and the applicant will be other than in total agreement in opposing the intervenor challenges to the application. (Indeed, in all of my years on the Appeal Panel and, more recently, as a part-time Licensing Board Panel member, I doubt I have encountered as many as a half dozen instances of the licensee and Staff being other than in agreement on the substantive issues being litigated on intervenor contentions.) Unfortunately, however, the public in general and the intervenor community in particular are not privy to the behind-the-scenes negotiations and thus are left with the reasonable, if erroneous, impression that the Staff is not a disinterested regulator of uses of radioactive materials but, instead, is a promoter of such uses—and most particularly nuclear power facilities. Given that the Staff also joins the applicant in opposing the grant of the majority of hearing requests (and even on occasion opposes the grant of a request that the applicant has found to comply with the Rules of Practice), the public is further left with the understandable impression of Staff hostility to the hearing rights conferred by the Atomic Energy Act.

As discussed in my prepared remarks, the unacceptable impression that the Staff is not a disinterested regulator is easily avoided by removing it from participation as a party in the adjudicatory proceedings. In the final analysis, the Staff does not have a dog in the fight. The true gladiators are the applicant in search of a license or license amendment and the intervenor(s) who are in opposition to the application, in whole or in part. That does not mean, however, that the Staff has no appropriate role to play in the hearing process. To the contrary, it must be given the opportunity to defend the conduct and outcome of the environmental review required of it by NEPA. And, further, it can appropriately be called upon by the licensing board to serve as a resource on the safety issues before the board. Neither of those activities requires party status and thus the taking of a position on whether the license application should be granted.

One of the questioners asks whether I have “done a meaningful review of the licensing cases to test the accuracy of” what is characterized as my assertion that the positions of the Staff “are invariably in lock step with the industry.” I do not recall using the term “invariably” to the extent that it means “without any exceptions whatever.” If I did, it was a slight overstatement. That said, I do not think that any objective observer of the adjudicatory scene of the past forty years has any doubt that there have been almost no instances in which the Staff has taken issue with the applicant on the merits of an intervenor's contention and very few where the applicant and Staff have disagreed on standing and contention admissibility disputes. Moreover, apart from



cases involving foreign ownership issues, I cannot recall a single instance of the Staff opposing in an adjudicatory proceeding the grant of the license or license amendment being sought.

Another questioner asks whether it is not possible that the Staff “sometimes” agrees with the applicant’s position because it is right. Of course that is the case but it is totally irrelevant to the reasons that undergird my belief that the Staff need not and should not participate in adjudicatory licensing proceedings as a party.

A questioner asks who the NRC Staff represents if not the general public? That question makes my point. Beyond dispute, the role of the Staff is to protect the public health and safety and the environment in the nuclear arena. Unfortunately, its participation as a party in the licensing adjudicatory proceedings leads to the justifiable, if erroneous, impression that the Staff is not appropriately carrying out its functions as a disinterested regulator.

I am also asked whether the judges could effectively deal with the appearance problem by endeavoring to explain to the parties why the Staff and the applicant are almost always in agreement on both substantive and procedural issues. My answer is two-fold. First, that is not a proper function for judges to perform. Second, actions speak larger than words. The questioner also asks in what other agencies are the staff excluded from adjudicatory proceedings as a party and how does the NRC Staff defend its EIS if not a party? I have not researched the first part of that question, but suspect that there are very few, if any, other federal agencies in which its staff is almost always aligned with the applicant for a license or other relief against opponents of the grant of such relief. And, once again, there is no reason why the NRC Staff needs party status to defend its EIS.

**Ellen Ginsberg, NEI:** Judge Rosenthal’s supplemental answer to Question 3 reiterates his proposal that the NRC staff should not participate as a party to adjudicatory proceedings on applications for NRC licenses or license amendments.

He states that the “principal consideration” underlying his proposal is one of “public perception.” Although his experience and expertise is unassailable, Judge Rosenthal’s opinion of what public perception is on this matter does not negate the value that Staff provides in carrying out its role as a party in an adjudicatory hearing. Further, Judge Rosenthal’s “remedy” seems highly disproportionate to the perceived “problem” of staff participation.

On a related point, it is far from clear that a generalized concern about “public perception,” without more, is sufficient to support such a significant change to the NRC’s adjudicatory process. Shouldn’t this concern be balanced against other concerns such as to how best to achieve a fair, informed hearing that efficiently presents the views of the agency as well as those of the applicant and the intervenor?

Judge Rosenthal’s remarks arguably misrepresent the importance of the NRC staff as a party to adjudicatory hearings. In this context, his aphorism that “the Staff does not have a dog in the fight” is not only an exaggeration but highly questionable substantively, i.e., the comment that NRC staff and staff counsel should not “[take] a position on whether the license application should be granted.” It is the NRC staff that performs the independent review of the license application, prepares the safety and environmental licensing documents, and decides whether to issue the license or license amendment. Therefore, the public interest is better served by



having the staff (with its expertise and detailed knowledge of the application) participate fully in the proceeding.

Given the important role played by NRC staff (as Judge Rosenthal states, “Beyond dispute, the role of the Staff is to protect the public health and safety and the environment in the nuclear arena”), isn’t the public interest better served by having the staff participate as an equal party to the proceeding?

#### **Question 4:**

**Addressed to Judges Spritzer and Rosenthal:** Some cases are delayed for long periods for reasons beyond the control of the Board/parties. Has the panel brought this concern to the attention of the Commission (since it cannot direct the staff review)? This is so especially in uranium recovery. How do you think the Commission’s attention is appropriately bought to this issue of resources?

**Answer 4 Judge Rosenthal:** A questioner expresses concern regarding the long period of time that elapses before, particularly in uranium recovery cases, the issues are resolved in the adjudicatory proceeding. I agree fully with that concern. As the questioner notes, the licensing boards have no control over the Staff’s conduct of its technical review and thus can do no more than call the attention of the Commission to what a board deems to have been unacceptable delay in reaching the evidentiary stage of a particular proceeding. See Crow Butte Resources, Inc. (In Situ Leach Facility, Crawford, Nebraska), CLI-11-30, 74 NRC 627 (2011).

#### **Question 5:**

**#1 addressed to Judge Rosenthal:** The Commission & EDO have supported in recent years “NRC Organizational Values.” These include respect for others who are affected by the work of NRC employees. Do you believe ASLBP Judges display appropriate respect for all these who appear before them?

**#2 addressed to Judge Rosenthal:** Civility in the practice of law is an area which attorneys and judges routinely address as a very valuable aspect of our interactions with one another. Respect for differing options is an NRC value. How do ad hominem attacks on the NRC staff attorneys comport with principles of civility and respect?

**Answer 5 Judge Rosenthal:** I am asked whether I believe that ASLBP judges display appropriate respect for those who appear before them. From what I have personally observed, I would answer that question in the affirmative. I must add, however, that this does not mean that it is disrespectful of lawyers and witnesses for judges to subject them to sharp interrogation on the issues being presented for their decision and to indicate some measure of frustration when the answers to the questions appear evasive, uninformed, dishonest or otherwise plainly unacceptable.

The second question is purely rhetorical: obviously ad hominem attacks on NRC staff attorneys, when and if they occur, would not comport with principles of civility and respect. The question fails to identify any such ad hominem attack, but I will assume that the questioner has in mind my statement that the Staff appears almost always to march in lockstep with the arguments of



license applicants from the nuclear industry. That observation is by no means an ad hominem attack upon NRC Staff lawyers. It is, rather, simply a statement of what my long experience in this agency teaches to be indisputable fact. Moreover, in context, the statement is not to any extent a criticism of the conduct of Staff lawyers. As noted in my prepared remarks, there are very good reasons why the applicant and the Staff are almost always in agreement on both the substance of the intervenor contentions and the appropriate outcome of the proceeding.

Regrettably, however, the general public is not aware of those reasons, with the consequence that the Staff is understandably (albeit erroneously) perceived by many to be an advocate for the nuclear industry instead of a disinterested regulator of that industry. In short, I am definitely not suggesting here that the positions taken by the Staff lawyers before the licensing boards are advanced in violation of the high standards applicable to the members of our profession in general, and most particularly government lawyers. Instead, I am questioning a regulatory process that has the Staff unnecessarily and detrimentally advancing those positions as a party to the proceeding. [▲Top](#)

### **TH32 Topical Reports: Perspectives on Their Use and Benefits to the NRC and Stakeholders**

Session Chair: Sher Bahadur, Deputy Director, Division of Policy and Rulemaking, NRR/NRC

Session Coordinator: Stephen Philpott, Project Manager, Division of Policy and Rulemaking, NRR/NRC, 301-415-2365, [Stephen.Philpott@nrc.gov](mailto:Stephen.Philpott@nrc.gov)

***Answers to questions not addressed during the above session will be posted when they become available in the near future. In the meantime, please direct any questions to the Session Coordinator listed above.*** [▲Top](#)

### **TH33 Thermal-Hydraulic Codes and Analysis**

Session Chair: Stephen Bajorek, Senior Advisor for Thermal Hydraulic Code Development and Analysis, RES/NRC

Session Coordinator: Antony Calvo, Information Technology Specialist, Division of Systems Analysis, RES/NRC, 301-251-7677, [Antony.Calvo@nrc.gov](mailto:Antony.Calvo@nrc.gov)

***Questions submitted during the above session were answered during the session's Q/A period.*** [▲Top](#)

### **TH34 Guidance Enhancement to Address Lessons Learned in Review of Civil Structures for New Reactors**

Session Chair: Brian Thomas, Branch Chief, Division of Engineering, NRO/NRC

Session Coordinator: Sunwoo Park, Structural Engineer, Division of Engineering, NRO/NRC, 301-415-2690, [Sunwoo.Park@nrc.gov](mailto:Sunwoo.Park@nrc.gov)



**Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)**

### **TH35 Beyond Sirens and Radios: Advances in Public Alert and Notification Systems**

Session Chair: Robert Kahler, Branch Chief, Division of Preparedness and Response, NSIR/NRC

Session Coordinator: Bethany Cecere, Emergency Preparedness Specialist, Division of Preparedness and Response, NSIR/NRC, 301-415-6754, [Bethany.Cecere@nrc.gov](mailto:Bethany.Cecere@nrc.gov)

**Questions submitted during the above session were answered during the session's Q/A period. [▲Top](#)**

### **TH36 The NRC's Safety Culture Policy Statement - Domestic and International Initiatives**

Session Chair: Andy Campbell, Deputy Office Director, OE/NRC

Session Coordinator: Maria Schwartz, Senior Program Manager, OE/NRC, 301-415-1888, [Maria.Schwartz@nrc.gov](mailto:Maria.Schwartz@nrc.gov)

***The questions below were not answered during the above session.***

**Question 1:** I don't understand the objective of "Common Language Initiative." Safety Culture is a matter of "mind" and "heart." Language is even not needed to communicate on safety culture.

**Response 1 (NRC):** The goal of the safety culture common language initiative is to develop a shared terminology for discussing the tenets of safety culture in the nuclear power reactor industry. Industry requested this initiative as a means to align the industry's language and the NRC's language when communicating about licensee performance. The NRC endorses this initiative because it enables both the NRC and the power reactor industry to understand each other's assessments of licensee performance.

**Question 2:** Development of the Policy Statement was one of the NRC's most participatory and transparent initiatives. Is the NRC taking lessons learned on the process and its success for other agency activities?

**Response 2 (NRC):** Yes, the NRC is using the lessons learned from the development of the policy statement. For example, the common language initiative was completed by holding public workshops with a panel of representatives from NRC staff (including NRR, OE, RES, and the regional offices), the nuclear power industry (including NEI, INPO, and operating organizations), and the public. The NRC reached out during these workshops to ensure that it listened to and understood the challenges that the nuclear industry was facing as this progressed. Because the policy statement is not a regulation, it is critical to its success that



licensees understand and appreciate the NRC's expectations vis-à-vis safety culture. Likewise, the NRC must understand and appreciate our licensees' sense of "ownership" regarding implementation of a positive safety culture which includes, for nuclear reactors, a common language between the regulator and the regulated community. Lessons learned from the success of the common language initiative will also be incorporated into future agency activities.

**Question 3:** Is the NRC's safety culture policy statement outmoded since the common language has 10 traits and the policy statement has only 9?

**Response 3 (NRC):** No. The traits listed in the policy statement were not intended to be an exhaustive list. The addition of a tenth trait in is illustrative of that facet of the policy statement. The safety culture policy statement was developed to be applicable to all of the NRC's regulated communities; whereas, the common language initiative was developed specifically for the nuclear power reactor industry. The individuals who participated in the common language initiative public meetings determined that Decision Making was important enough to the nuclear power industry to incorporate it as a separate trait. Such additions may occur in other regulated communities. Additionally, some of the traits in the policy statement may not resonate with other organizations that use regulated materials.

As the policy statement points out, the Commission expects all individuals and organizations, performing or overseeing regulated activities involving regulated materials to establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. The policy statement also notes that the Commission recognizes the diversity of these organizations. Thus, a large nuclear power plant may have very different challenges involving the safe and secure use of nuclear materials than a small company using regulated material in their activities and the traits that each adopts and implements may differ.

**Question 4:** Japan's Tokai-mura criticality accident more than three decades ago represents a tragic safety culture failure. Has anyone analyzed this for lessons learned to prevent future similar incidents?

**Response 4 (NRC):** The Tokai-mura criticality accident of 1999 has been analyzed for lessons learned, particularly with regard to safety culture.

The NRC's review of the Tokai-mura accident is documented in SECY-00-0085 and is available at: <http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2000/>.

The IAEA's lessons learned document on the Tokai-mura accident is available at: <http://www-ns.iaea.org/downloads/iec/tokaimura-report.pdf>.

**Question 5:** Mr. Nagy spoke of the importance of Safety, Quality, Schedule, and Costs "in that order" (Mr. Nagy's emphasis). Please address the conflicts that exist when commercial metrics focus on schedule and cost.

**Answer 5 (NFS):** It is my experience that schedule is quickly lost and cost skyrockets when significant safety or quality issues arise. Thus, in order to achieve sustained positive performance, organizations should be constantly examining safety & quality indicators along





with production indicators and treat them with at least the same level of importance. *My opinion alone; does not represent an official position of NFS, Inc.*

**Question 6:** What is your view on the roles and significance of industry groups such as NEI and INPO for keeping the nuclear power plants safe in the US?

**Answer 6 (NFS):** NEI and INPO each play critical roles in nuclear power and fuel cycle plant safety. From a fuel cycle facility point of reference I would credit NEI in particular for helping work to achieve consensus among licensee and certificate holders on emerging regulatory issues, and helping broker solutions with the regulator that best serve the goal of safe operations. INPO is increasingly engaged with fuel cycle facilities, and provides a significant source of best practice information, leadership development training and benchmarking opportunities. *My opinion alone; does not represent an official position of NFS, Inc.*

**Question 7:** How do you rate the relationship and the level of communication between the NRC and industry?

**Answer 7 (NFS):** NRC should be commended for its efforts to reach out to all stakeholders, including industry. The RIC and FCIX provide clear examples of this. *My opinion alone; does not represent an official position of NFS, Inc.*

**Question 8:** You mentioned metrics for safety culture. What are your key metrics and how do you collect data to understand performance against those metrics?

**Answer 8 (NFS):** Hard to say which ones are key, but in addition to the typical (& lagging) safety indicators (injuries, non-compliances, reportables) a healthy set of indicators around concerns being raised (especially anonymously) and observations being made is important. What is being judged during observations is also telling, so keeping score/ratings on attributes like “questioning attitude”, “decision making” and “procedural adherence” (and similar) is also valuable. This data is easily collected through an observation program. *My opinion alone; does not represent an official position of NFS, Inc.*

**Question 9:** Mr. Nagy (Nuclear Fuel Services) spoke of the importance of Safety, Quality, Schedule, and Costs “in that order” (Mr. Nagy’s emphasis). Please address the conflicts that exist when commercial metrics focus on schedule and cost.

**Answer 9 (INPO):** There is a perception that there is a conflict between production and safety. In my opinion, this comes from a short-term perspective that sees a work delay as a reduction in production. However, using a questioning attitude and stopping when uncertain, combined with an adequate preventative maintenance program will help avoid accidents and major plant stoppages. The data clearly show that high levels of safety go with high levels of reliability. And high levels of reliability contribute to sustainability, profitability, and lower cost per megawatt hour. The irony is that when an organization’s leadership, and its culture, focus on schedule and cost control over safety they diminish the profitability and sustainability of the enterprise.



**Question 10:** Are International organizations using the survey, sharing the results with INPO?

**Answer 10 (INPO):** At this time, no non-US organizations have used the survey. A nuclear supplier with international locations is administering the survey and will be sharing the data with INPO. WANO Paris Center and EDF Energy in the UK are talking about using the survey but have not done so yet.

**Question 11:** Related to the attribute “Leadership” – what can make the difference in practice?

**Answer 11 (INPO):** There are many aspects of leadership that are important. However, if I had to pick just one, I think I would focus on the willingness of leaders to get feedback from the organization, on their behavior and decisions, and to then be willing to modify those based upon feedback. Even better is when the leadership gets input and involvement BEFORE making the decision. The acceptance of feedback and engagement of the workforce is critical for profitable, sustainable, long-term operations. [▲Top](#)