RULES AND DIRECTIVES
BRANCH
USNRC

JOSEPH E. POLLOCK
Vice President, Nuclear Operations

1201 F Street, NW, Suite 1100
Washington, DC 20004
P: 202.739.8114
jep@nei.org
nei.org

NEI
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Mr. David L. Skeen
Director, Japan Lessons Learned Project Directorate
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Industry Comments on NRC Staff Working Group Evaluation of Alternatives for the Disposition of Recommendation 1 of the Fukushima Near-Term Task Force Report, Draft Working Group Document dated May 14, 2013

Project Number: 689

Dear Mr. Skeen:

NRC's Fukushima Near-Term Task Force (NTTF) Recommendation 1 stated that NRC should establish a "logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense-in-depth and risk considerations." In November 2012, the Commission tasked the NRC staff to provide a SECY paper in this regard by December 2013. NEI[1] December 13, 2012 and April 30, 2013 letters provided industry comments on two versions of an NRC staff draft document addressing potential considerations for the SECY. On May 14, NRC issued a revised document that narrowed and clarified the potential options. This document proposed improvement activities in three areas: 1) Provide a structured definition and regulatory approach with regard to regulations that are extensions of the design basis, and categorize existing and potential new regulations accordingly, but not pursue rulemaking 2) Provide an enhanced definition of defense-in-depth (DID) and incorporate into the regulatory analysis guidelines and other activities, and 3) Provide a regulatory framework relative to voluntary industry initiatives. We appreciate the staff's efforts to present their proposed considerations to stakeholders. Since we have commented extensively before, these comments address the changes in the May 14 draft with respect to previous versions. Further, we have developed an industry paper on principles of beyond design basis (BDB) regulation, which is attached. We offer the following general comments on the May 14 NRC working draft:

[1] The Nuclear Energy Institute (NEI) is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations and entities involved in the nuclear energy industry.

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Add= Dan Doyle (did)

D. Dudley (rfd)

1. Recommendation 1 addresses a long-term strategic objective to better define the regulatory framework and allow NRC to provide a more structured and predictable response to future issues that may involve beyond design basis considerations. NUREG 2150 also addresses this objective, and we believe these efforts should be integrated as soon as is practicable. Our previous comments have primarily addressed existing post-Fukushima activities and the need for near term Commission action regarding BDB regulatory treatment. We continue to believe that the existing NRC regulatory analysis guidelines provide appropriate and thorough considerations relative to criteria for BDB regulatory thresholds. However, we support the longer-term strategic objective and will engage constructively relative to the role of PRA and defense-in-depth in a future regulatory framework.
2. We have previously commented on the stated lack of safety nexus, potential near-term resource impacts on industry and NRC, and the need to consider this activity in light of cumulative impacts. While the latest NRC working draft has addressed some of the more burdensome aspects, such as the potential for a PRA requirement, we believe our previous comments as expressed in our April 30 letter remain relevant.
3. As noted above, there exists a more immediate need to address regulatory considerations for post-Fukushima orders, rulemakings, and related guidance development. Our previous letters have detailed these activities and their need for integration and a consistent, rational approach recognizing the distinction between design basis and beyond design basis approaches. With regard to improvement activity 1, we concur that rulemaking would not be necessary to provide clarity of definition and treatment of BDB conditions, at least to support near-term needs. We believe the latest NRC staff proposal for improvement activity 1, which does not require rulemaking, provides a more timely approach to this objective. Attachment 1 provides an industry paper on Principles of Beyond Design Basis Regulation for consideration in the development of the SECY document and proposed policy statement. We welcome further stakeholder dialogue in this regard. As noted, clarification is needed on a timely basis.
4. With regard to improvement activity 2, we are concerned that the defense-in-depth proposals proposed by the staff, and discussed at public meetings in some detail, appear to involve a new layer of DID expectations that would be imposed on top of the existing regulatory framework. Our concept of defense-in-depth is that it should be informed by risk considerations, rather than being an independent layer of new requirements. We remain concerned that the staff's proposed approach could undermine the viability of PRA and risk-informed approaches. Further, we are concerned that the proposal could induce instability and unpredictability of outcomes due to the many layers of considerations, some with subjective inputs. Industry recognizes the need to be proactive, and will provide a paper to NRC this Fall discussing our view of appropriate considerations for a structured, risk-informed approach to DID.
5. Regarding improvement activity 3, and as noted in previous letters, industry does not believe a regulatory footprint on industry initiatives is appropriate or necessary. Regulatory initiatives become voluntary because the NRC has determined that they do not rise to the level that warrants regulatory oversight. There are varying reasons for this, but they include a determination that the

identified problem poses no threat to the public health and safety, or that the NRC's legal authority to regulate the issue is questionable. If the issue addressed by a voluntary initiative constituted a legitimate risk to the public health and safety, the NRC can and would establish mandatory, legally-binding requirements to ensure that the public was adequately protected. Even without a formalized program, the NRC always reserves the ability, if it identifies a genuine safety issue with implementation of a voluntary initiative, to promulgate requirements as appropriate in accordance with their existing regulatory processes.

Industry appreciates the opportunity to provide perspective on the concept of a revised regulatory framework. If you have any questions in this regard, please do not hesitate to contact me.

Sincerely,

Joseph E. Pollock

Attachment

c: Mr. Richard F. Dudley, Jr., NRR/DPR/PRB, NRC

Industry Proposal on the Principles of Beyond Design Basis Regulation

Background

Prior to the accident at Fukushima Dai-ichi, the NRC had only a few regulations for conditions extending beyond the design basis of the plant. Examples of such regulations are the ATWS Rule (50.62) and the Station Blackout Rule (50.63). These regulatory extensions were based on specific criteria with unique considerations and treatment requirements. Furthermore, the NRC has very limited regulations for the operating fleet related to severe accidents, examples being elements of Part 100 and emergency planning requirements

The accident at Fukushima revealed shortcomings in the Japanese approach to the plant design basis for tsunami protection. As a result, regulatory attention has increased in areas that extend beyond the current design basis of U.S. plants.

NRC's Fukushima NTTF proposed in its first recommendation that NRC fundamentally revise their regulations to address the current "patchwork." While there is no direct safety nexus, the NTTF's stated goal was to provide regulations for accidents outside the current "design basis" in a more consistent and coordinated manner.

Since the accident at Fukushima, the NRC has initiated numerous, inter-related beyond design basis (BDB) regulatory activities including, Mitigating Strategies (i.e., FLEX), Hardened Containment Venting System (HCVS) for BWR Mark I & II plants, seismic and external flooding hazard updates, and Spent Fuel Pool instrumentation. The NRC has also issued unprecedented regulatory requirements for severe accidents in the updated HCVS order for severe accidents (EA-13-109) as well as the proposed rulemaking for Recommendation 8 on integration and regulatory oversight of EOPs and SAMGs. These regulatory activities significantly expand the scope of beyond design basis requirements. Further, additional beyond design basis regulatory actions are also possible for other Fukushima items. Yet, there is no consistent approach established which provide distinctions between these requirements and those associated with design basis events.

Scope of Accidents Addressed in Regulations

The scope of accidents addressed in regulations, although intended to be inclusive of the range of conditions that are anticipated, is necessarily limited. Further, with operating experience and changes in our state of knowledge of safety issues, it is necessary to periodically reconsider the regulatory requirements and the potential of extending these requirements to address previously unregulated conditions. Figure 1 is provided to present a common understanding of the relationship between different portions of the spectrum of potential events.

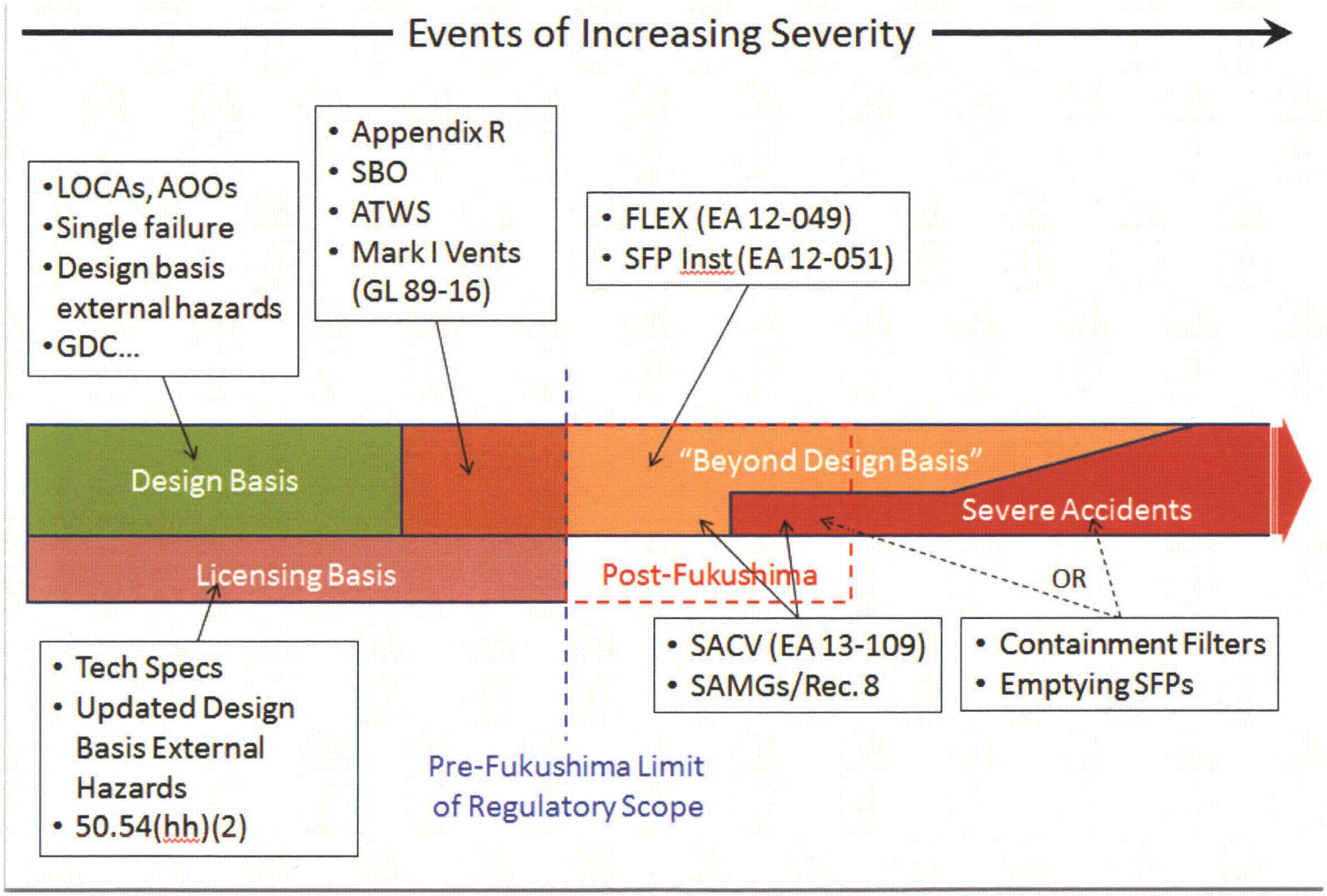
The design basis of a nuclear power plant provides the foundation on which accident prevention and mitigation capabilities are built. These requirements address a broad spectrum of defined events with specific ground rules for capabilities (e.g., General Design

Criteria) and acceptance criteria (e.g., peak clad temperature < 2200°F). These design basis requirements are promulgated to provide safety margin by utilizing conservative assumptions and criteria. This approach to the design basis has served our common goal – the protection of public health and safety, providing significant capabilities and margin for events and accidents.

The current plant licensing basis extends the requirements to address many other aspects of plant safety including the programmatic aspects such as Technical Specifications and Emergency Plans. In addition, over time new requirements have been added for addressing more severe conditions, such as Station Blackout (SBO), ATWS events, and Appendix R exposure fires. As noted, these regulations provide specific criteria and regulatory treatment relative to the subject beyond design basis conditions..

Figure 1

Scope of Events Addressed in Regulations



At the time of the accident at Fukushima, the NRC had no regulatory requirements for the mitigation of severe accidents (i.e., those involving core damage) and only a handful of requirements addressing conditions more severe than those identified in the design basis. The accident at Fukushima has led to consideration of numerous other possible regulatory requirements, some of which are already being implemented under Orders. The regulatory course for other possible new requirements has yet to be determined. The focus of this paper is on the principles that should be applied as these regulatory decisions are made.

Beyond design basis conditions effectively extend to an unbounded continuum, but are not synonymous with severe accidents. In fact, severe accidents are a subset of beyond design basis conditions. This distinction is important and comes about because of the safety margin built into the existing regulatory requirements. For example, the design basis accidents require assumption of the worst single failure in demonstrating the capability of the plant to respond to challenges thus ensuring the safety of the plant design. However, in many cases, the plant is actually capable of avoiding fuel damage when multiple failures are postulated. This is demonstrated in the assessment of contributors to plant-specific probabilistic risk assessments (PRAs). Regulatory actions such as Order EA 12-049 further expand this margin by providing mitigation capabilities to an even broader set of beyond design basis conditions. However, even with this expanded capability, it is always possible to postulate additional failures and conditions that lead to fuel damage and a severe accident. It is important to note that at some point, if the postulated severity of the hypothesized condition is extended far enough, a severe accident is virtually guaranteed. These conditions are far beyond the current design and licensing basis of the plant. While the spectrum of BDB events is effectively unbounded, the regulatory approach needs to specify clear criteria and conditions, with the recognition that the mitigating equipment and strategies will have some value beyond the specified parameters.

As the additional post-Fukushima actions are promulgated as regulatory requirements, the licensing basis of each plant will change. The challenge is determining which changes are required to be implemented and how.

The Challenge of Beyond Design Basis Regulation

The design basis is predicated on a defined set of events and accidents, specific design criteria, and clear treatment requirements. It is not feasible or appropriate to simply extend those requirements indefinitely for conditions beyond the design basis. The events must be considered in the context of their low likelihood, and treatment methods applied commensurately in accordance with risk-informed concepts such that plant attention is focused on matters most important to safety. Further, the scope of these conceivable BDB conditions is essentially unbounded, so traditional conservative practices to provide margin are not possible. Thus, a fundamentally different approach must be taken to establish a consistent set of principles and treatment for these BDB regulatory requirements.

In 1986, the NRC issued a Safety Goal policy statement that defined how safe is safe enough, along with quantitative health objectives (QHOs) for public health and safety. The NRC's Regulatory Analysis Guidelines and Reactor Oversight Process (ROP) are derived from a risk-informed view of the QHOs. While these regulatory tools inform decisions on the significance of changes, they do little to inform the treatment of new beyond design/licensing basis requirements or the handling of new information.

Problem Statement

While the regulatory process has a transparent and largely predictable process for justifying new regulatory requirements under the backfit rule and regulatory analysis guidelines, there is inconsistency and a lack of policy or guidance on the treatment requirements that would be justified for new BDB regulations. In accordance with NRC's principles of good regulation, all stakeholders would benefit from openness, efficiency, clarity and reliability of regulation, as well as with greater predictability/certainty as we move forward with post Fukushima regulatory requirements that may extend the scope of regulation into new and challenging areas beyond the current design/licensing basis.

While "success" in design basis terms is a prescribed set of regulatory requirements that is focused on demonstrating prevention of core damage and release, in the BDB regime, "success" should be focused on providing a robust and coordinated set of site, regional, and national capabilities for minimizing the impact of these rare beyond design basis conditions.

The purpose of this white paper is to describe a proposed set of principles to guide potential BDB regulatory requirements in order to provide greater certainty moving forward.

High-Level Guiding Principles

Known factors influencing beyond design basis regulatory requirements:

- The robustness of the design basis makes the inability of the plant to cope with beyond DB conditions (BDBC) very unlikely. BDBC is an overarching term that encompasses both challenges beyond the current design/licensing basis (e.g., beyond design basis seismic events) and beyond design/licensing basis scenarios that challenge the ability of the plant and operators to avoid an accident (e.g., multiple failures or combinations of beyond design basis events combined with failures of mitigating equipment).
- It is not possible to definitively bound BDBCs. We must accept that there are postulated BDBCs that have conditional consequences that are significant (e.g., meteor strikes). In these cases, the only alternative is to have reasonable confidence that the likelihood is very low. This is particularly true when the full capabilities of the site, utility, industry and nation are considered.
- Many BDBC conditions will always have associated large uncertainties either in the likelihood of occurrence and/or in the progression or outcome of event scenarios.
- Severe accident conditions (SACs) have historically been considered to be unbounded but are a distinct subset of BDBCs that are even more difficult to precisely define and subject to more difficult phenomenology and large, and sometimes unresolvable, uncertainties. SACs involve scenarios and conditions that occur following overheating and damage to reactor fuel, including the phenomenology that is associated with these conditions.

Given the above, the following high-level guiding principles are proposed in order to frame the consideration of beyond design basis regulatory requirements:

- Given that BDBCs are unbounded and often subject to large uncertainties, the best strategies for addressing these conditions are flexible operational capabilities to provide defense-in-depth for mitigation of potential beyond design basis conditions. This has been borne out in many prior regulatory beyond design basis regulatory requirements, including 50.62, 50.63, 50.50(hh)(2), and Orders EA 12-049 and EA 12-051.

- Experience with BDB analyses has shown that design-unique features and siting factors influence BDB capabilities and weaknesses. This is true on both a reactor/containment type basis and a plant/site-specific basis and argues for a function-based approach to BDB regulation that allows for the plant-to-plant variability.
- Some BDBCs have the potential to impact multiple units on a reactor site. The implications on equipment and personnel resources within the site should be considered.
- Regulatory treatment of BDB design or operations should be commensurate with the importance to safety and aligned with a common philosophy on DBD capabilities.
- The state of knowledge for BDBCs will continue to change over time, an example being the changing state of knowledge concerning seismic hazards. Diversity and flexibility provide the best defense against these changes in state of knowledge, but the change in hazard should be monitored over time to assure that the intended capability is maintained.

A Required Paradigm Shift

The above guiding principles identify the factors that should guide a shift from the approach taken for the regulation of design basis events and accidents. Outlining the principles of regulation to be applied to extensions of the plant licensing basis addresses one of the fundamental issues raised by the NTTF in Recommendation 1.

The following attempts to capture the philosophy of the current design basis requirements:

> **Current Design Basis Requirements**:
>
> Provide a high level of assurance of design capability to address a defined set of event conditions

As described above, this approach cannot be extended to BDB and severe accident conditions. The industry proposal for the approach to BDB requirements is framed as:

> **Beyond Design Basis Requirements:**
>
> Provide reasonable confidence in flexible operational capability for responding to, by definition, an unbounded class of event conditions

While this proposal, as written, is new, many past beyond design basis requirements comport well with this philosophy. Table 1 summarizes the alignment of a number of specific BDB requirements with this philosophy. One important element of the success of these examples lies in the clear delineation of boundary conditions for the regulatory scope. These boundary conditions, while not bounding all conceivable events, provide the basis on which reasonable confidence can be achieved. Without some sort of boundary conditions, any attempt to improve safety in the beyond design basis regime can be brought into question simply by postulating a more severe condition in the unbounded continuum.

Key Principles

In order to guide future beyond design basis regulatory actions consistent with the above philosophy, the industry proposes a set of key principles to be defined for these regulatory activities. Based on the lessons learned from past and on-going BDB regulatory activities, a set of key principles is outlined in Table 2. This table provides a summary description of these principles addressing requirements for design, human performance, quality, programmatic controls, regulatory oversight, and processes for considering new information.

Table 1
Alignment of Past Regulatory Extensions to the DBD Philosophy

Regulatory Requirement	Reasonable Confidence	Flexible Operational Capability	Nature of Challenges
ATWS (10 CFR 50.62)	Credit for: • Non-safety related equipment, • Augmented quality requirements • Feasible operator actions.	Emphasis on: • Diversity • Function-based approach	Boundary conditions set by: • Risk-informed evaluation
SBO (10 CFR 50.63)	Credit for: • Non-safety related equipment, • Capability beyond EQ limits • Augmented quality requirements • Feasible operator actions.	Emphasis on: • Function-based approach with options (e.g., coping or Alternate AC supply) • Credit for feasible operator actions	Boundary conditions set by: • Risk-informed evaluation
Large Fires and Explosions (10 CFR 50.54 (hh)(2))	Credit for: • Non-safety related equipment, • Commercial quality requirements • Feasible operator actions.	Emphasis on: • Diversity of capability • Function-based approach	Specific boundary conditions not possible to define: • Address both prevention and mitigation of fuel damage • Acceptance that some conditions may not be mitigated
FLEX (EA 12-049)	Credit for: • Non-safety related equipment, • Specified quality requirements, • Feasible operator actions, • Reasonable protection and diversity to assure availability.	Emphasis on: • Diversity of capability • Function-based approach. • Reasonable judgment • Guidance to supplement procedures	Robust capabilities: • Primary and alternate means for each strategy • N+1 capability • Regional response centers

Table 2
Key Principles of Beyond Design Basis Regulation

Design Principles

- Safety can be reasonably assured by preventing or mitigating the effects of a beyond design basis event by preventing fuel damage, or mitigating the effects of severe fuel damage. SSCs relied upon for BDBCs should be designed to provide reasonable confidence of their capability based on clear boundary conditions and considering the function they support.
- Boundary conditions should be based on realistic assessments of event/accident progression, not assuming worst case conditions or additional failures, with the likelihood of occurrence providing a characterization of the credibility of the condition.
- Diversity and flexibility are sound principles for providing reasonable confidence in capabilities.
- Redundancy should not be required for capabilities implemented specifically for BDBCs, consistent with past BDB regulatory approaches.
- SSCs relied upon for BDBCs should be reasonably protected from the BDBCs for which they are intended.
- The realistic capability of SSCs should be considered, not simply the SSC design criteria, in assessing design effectiveness.
- Design requirements and supporting evaluations should document the inputs, assumptions, and basis, including human performance aspects. Documentation should be auditable but does not require Appendix B qualification.

Human & Organizational Performance Principles

- BDBCs involve response from the overall emergency response organization and should build from those existing command and control structures, e.g., EPs, EOPs, SAMGs.
- Operator/human actions will be required in response to BDBC/SAC. Human actions should be feasible and should not require heroic action.
- Instrumentation to support operator actions should be based on the types of decisions that would need to be made and include consideration of decision-making in the absence of information (i.e., default strategies)
- Training programs and controls should assure continuing personnel proficiency consistent with the systematic approach to training (SAT).

Quality Principles

- Distinctions between safety-related and non-safety-related SSCs are inconsequential and less relevant for beyond design basis/severe accident conditions. Capabilities are what matters. Commercial equipment with adequate capability is acceptable.
- Initial testing or other reasonable means should be used to confirm that equipment and human performance conforms to functional expectations. Validation of equipment source manufacturer quality is not required.

Table 2 (Cont.)
Key Principles of Beyond Design Basis Regulation

Programmatic Principles

- Maintenance & testing should be performed consistent with INPO AP 913.
- A change control process should ensure that future plant changes do not adversely impact a BDB capability.
- Plant configuration control procedures should ensure that appropriate owner-controlled administrative limits are placed for BDB mitigation equipment.

Regulatory Oversight

- INPO should take responsibility for assessing the adequacy necessary training
- NRC inspections related to BDB should focus on the on-going assurance of BDB capabilities, consistent with the defined boundary conditions.
- Given the large uncertainties and the low probability of the event occurring associated with BDB capabilities, inspection findings on BDB capabilities should be limited to correction, addressed in the licensee's corrective action program, and traditional enforcement actions, as appropriate, and should not assess significance (i.e., no colors)
- Part 21, 50.72, and 50.73 do not apply.

New Information

From time to time, new information may become available that challenges the specific design basis inputs, e.g., new information on external hazards. When such information becomes available, the licensee should review the new information to assess whether changes to the existing BDB capabilities are warranted. If reasonable confidence in those capabilities can be established, then this should be documented and there is no need to develop new regulatory requirements to address changes in the design basis inputs.