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**The Evolution of Mitigating Measures
For Large Fire and Explosions**

**A Chronological History
From
September 11, 2001
Through
October 7, 2009**

ENCLOSURE

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I. Abstract

After the terrorist attacks on September 11, 2001, the NRC promptly assessed the potential for deliberate attacks using large commercial aircraft on NRC-licensed facilities, the physical effects of such a strike on the facility, and the potential for such strikes to result in large, rapid releases of radioactive material to the environment. Using state-of-the-art structural and fire analyses, NRC staff and national experts from several U.S. Department of Energy laboratories conducted these assessments. The NRC also consulted with other US Government agencies and industry representatives. For the commercial power reactor facilities analyzed, the results confirmed that the likelihood is low that such strikes could both damage the reactor core and release radioactivity that could affect public health and safety. The results of the studies gave the NRC information which it incorporated into Security Advisories and implementing guidance issued to power reactor licensees to further reduce this risk and enhance safety and security.

On February 25, 2002, the NRC issued EA-02-026, "Order for Interim Safeguards and Security Compensatory Measures" (referred to here as the ICM Order), which modified current operating licenses for commercial power reactor facilities to require compliance with specified interim safeguards and security compensatory measures. Section B.5.b of the ICM Order requires licensees to adopt mitigation strategies using readily available resources to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities to cope with the loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design-basis aircraft impacts. Following issuance of the ICM Order, the staff met and corresponded with industry representatives on many occasions in an attempt to clarify the implementing details for the mitigating strategies required by Section B.5.b of the ICM Order. During the period from October 2002 to October 2003 the staff performed an inspection at each site to evaluate the adequacy of the mitigating strategies licensees had implemented to address the ICM Order. Based on the results of these inspections the staff determined that additional guidance should be developed. The staff worked with industry representatives to develop this additional guidance which included insights gained through NRC ongoing research and lessons learned from security assessments. On February 25, 2005, the staff forwarded a letter to all power reactor licensees, which provided guidance for implementing Section B.5.b of the ICM Order. This guidance was further refined in a series of interactions with industry representatives. By August 2007, all operating power reactor licensees had implemented the guidance via commitments and in new conditions of their operating licenses. By December 2008, the NRC staff had completed licensing reviews and onsite inspections to verify implementation of the licensee actions.

On March 27, 2009, the NRC amended Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and Part 73, "Physical Protection of Plants and Materials," with new requirements published in the *Federal Register* dated March 27, 2009 (74 FR 13926). The purpose of this amendment was to make security requirements similar to those previously imposed by the Commission Orders issued after the terrorist attacks of September 11, 2001, generically applicable to operating reactors and new reactors. The staff has implemented guidance for inspection of these requirements on a routine basis at operating reactors. The staff has also prepared interim staff guidance for review of combined license applications for new reactors.

II. Summary

This summary provides a high level narrative of the significant activities since September 11, 2001. It discusses these significant activities (i.e., ongoing research, Phases 1, 2 and 3) as separate topics; not necessarily in chronological order. It was developed by the staff based on their review of the information contained in the Chronological History and their recollection of the events since September 11, 2001.

The Chronological History provides additional details and accession numbers for those documents reviewed by the staff that are available in ADAMS. It also provides a description of documents reviewed by the staff which are not available in ADAMS, either because they exist as paper copies only or because they contain Safeguards or Classified information. For additional information on any of the documents described in this summary, the reader should use the event or document date¹ to find the entry in the Chronological History.

Further details for each of the items in the Chronological History can be found in the Consolidated Timeline Documents database available on the NRC Knowledge Center's B.5.b Inspections Community of Practice. This database includes fields for document date, ADAMS Accession Number (if available), Document/Event Type, Cognizant Office, Subject, and Comments. It also provides hyperlinks to those documents that are available in ADAMS. For many documents, the comment field provides a summary of the contents of the actual document. For Safeguards or Classified documents, the comment field provides a summary of the document that could be handled as Official Use Only—Security-Related Information.

1. The U.S. Nuclear Regulatory Commission Issued Security Advisories Following the September 11, 2001, Terrorist Attacks.

- 1.1. In response to the September 11, 2001, terrorist attacks and intelligence information subsequently obtained, the U.S. Nuclear Regulatory Commission (NRC) took certain actions to ensure that the agency was able to monitor the situation in a heightened threat environment and advise licensees on measures they should take to respond to any events that might occur. These actions included issuing Security Advisories² (SAs) to strengthen licensees' capabilities and readiness to respond to a potential attack on a nuclear facility. Also, shortly after September 11, 2001, the Office of Nuclear Regulatory Research (RES) began to assess potential mitigation strategies for aircraft attacks on nuclear power plants. For example, on September 12, 2001, the NRC Incident Response Center's (IRC's) Executive Team (ET), under the direction of Chairman Meserve, assigned RES the task of assessing the design bases of the existing power plants and identifying any resources that would lend insight into the capacity of the existing facilities to withstand an insult of the nature of the September 11, 2001, attacks. RES briefed the IRC ET on its initial conclusions on September 19, 2001, and these conclusions were used to inform the press release "NRC Reacts to Terrorist Attacks," issued on September 21, 2001

¹ Most dates in the summary include the month, day and year. However, some documents, such as reports issued by the national laboratories and NEI, are identified by month and year only.

² Security advisories (SAs) convey urgent, usually time-sensitive information regarding security issues or vulnerabilities that have a direct effect on common defense and security. Advisories will not convey or imply new requirements, nor will they transmit new interpretations of regulations or staff positions. However, SAs may request that licensees consider voluntarily taking an action, providing information, or identifying their intention to implement specific corrective actions that can be accomplished over a short term and designed to address the security-related issue or vulnerability.

(<http://www.nrc.gov/reading-rm/doc-collections/news/2001/01-112.html>). During the week of September 24, 2001, Chairman Meserve directed funding to RES to initiate a program using designated national laboratories to examine the effects of a deliberate attack using a large commercial aircraft on a nuclear power plant. The initial elements of this program were to be completed during the period, October 1, 2001 through January 2002.

- 1.2. On September 28, 2001, Chairman Meserve directed the staff to undertake a thorough review of the NRC's safeguards and security programs which focused on identifying any necessary adjustments to the response capabilities of the licensees and included an evaluation of the vulnerability of NRC-licensed facilities to attacks that exceed the design-basis threat (DBT). In this review, the staff was to comprehensively examine the basic assumptions underlying the NRC's current safeguards and security programs and produce a "scoping paper" containing a proposed course of action. Subsequently, on October 9, 2001, the Executive Director for Operations established a Response to Terrorist Acts Task Force, comprising senior managers from selected offices and a region to develop the required scoping paper.
 - 1.3. On October 6, 2001, based on the insights derived to that date from the terrorist attacks, the NRC issued an SA for power reactors, decommissioning reactors, Category 1 fuel facilities, and gaseous diffusion plants. The NRC used this advisory to communicate certain prompt actions and additional actions to enhance safety and safeguards at NRC-licensed facilities by strengthening licensee capability to respond to a terrorist attack. The SA stated that the prompt actions could be readily implemented and had significant value in addressing threats at or beyond the DBT. The additional actions also had significant value in addressing such threats but might require more deliberation on the part of the NRC and licensees. One of the prompt actions at power reactors was the need to develop plans for plant actions to be taken in the event of a beyond-design-basis terrorist attack that was imminent or occurring. Among the additional actions for power reactors were licensee consideration of access to additional or alternative resources, which entailed the identification and use of existing or readily available resources and the need for coordination with additional local fire departments. Also specified were additional actions³ for spent fuel pools (SFPs) at operating reactors.
- 2. The NRC Issued the Interim Safeguards and Security Compensatory Measures Order on February 25, 2002.**
- 2.1. On November 28, 2001, the staff submitted SECY-01-0215, "Scoping Paper for a Comprehensive Review of the NRC's Safeguards and Security Programs in Light of the Terrorist Attacks on September 11, 2001," to the Commission. This scoping paper specified proposed actions in response to terrorist acts and included an evaluation of the need for interim compensatory measures (ICMs), which was based on a preliminary assessment of the threat environment using both consequence- and vulnerability-informed insights. The paper included a classified preliminary assessment of the then-current threat environment facing NRC licensees. The scoping paper noted that the assessment of the threat environment focused on the

³ The additional actions for SFPs specified in this SA were the only "mitigation strategy" required by any of the SAs issued by the NRC since September 11, 2001. Subsequently, the February 25, 2002, ICM Order required operating reactors to address mitigating strategies for the reactor, the containment, and the SFPs.

overall scope and capability of potential adversaries rather than a specific DBT. Additionally, the scoping paper stated that the staff intended to identify appropriate ICMs and included a recommendation that the Commission approve the staff approach to the development of proposed ICMs.

- 2.2. On December 7, 2001, Commissioner Diaz issued COMNJD-01-0002, which stated that the scoping paper provided by the staff in SECY-01-0215 addressed a myriad of issues and recommended, in part, that the Commission address the need to promptly establish ICMs in a high-threat environment as identified in SECY-01-0215. Attachment 1 to COMNJD-01-0002 described an approach that includes obtaining licensee commitments to threat readiness measures, as specified in the October 6, 2001, SA. In “Staff Requirements Memorandum: COMNJD-01-0002—Physical Security Measures,” dated February 8, 2002, the Commission approved the implementation of ICMs for physical security in a high-threat environment as delineated in a Safeguards Information attachment applicable to power reactors and selected fuel facilities. This staff requirements memorandum (SRM) required the staff to draft Orders to licensees as outlined in the Safeguards Information attachment and stated that the staff should review the October 6, 2001, SA to determine which of the specific actions should be incorporated in the Orders. While the attachment to the SRM was oriented to the DBT, the Commission’s direction to the staff to consider the use of SA actions resulted in the ICMs that addressed threats at or beyond the DBT.
- 2.3. On February 25, 2002, the NRC issued the Interim Safeguards and Security Compensatory Measures Order (known as the ICM Order) to each nuclear power plant licensee. It stated that the ICMs listed in Attachment 2 to the Order were needed to provide assurance that licensees of nuclear power reactors would take prudent measures to achieve a consistent level of protection to address the threat environment. Section B.5.b of the ICM Order required licensees to adopt mitigation strategies using readily available resources to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities to cope with the loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design-basis aircraft impacts, but did not specify the measures to be taken. Licensees were required to complete implementation of the ICMs no later than August 31, 2002. By including Section B.5.b in the February 25, 2002, ICM Order, the NRC demonstrated a pragmatic approach that recognized (1) that in an elevated threat environment, there is significant value in addressing threats at or beyond the DBT and (2) that Section B.5.b has broad applicability because it is not event specific and involves the development of mitigation strategies for both the reactors and SFPs in responding to circumstances associated with loss of large areas of the plant due to large fires and explosions.
- 2.4. Following issuance of the ICM Order, the staff met and corresponded frequently with industry representatives in an attempt to clarify the implementing details for the mitigating strategies required by Section B.5.b. Section B.5.b indicated that “readily available” strategies were required. However, the term “readily available” and the extent of assumed damage in the event of a successful attack were not defined. This led to differing interpretations by the staff and industry as to which strategies should be developed to address the requirements of the ICM Order. Industry representatives interpreted the definition more narrowly than did the staff, which resulted in a smaller number of required strategies. This continuing disagreement resulted in the NRC’s position that additional actions by licensees were necessary to

meet the requirements of the ICM Order, after August 31, 2002, which was the original implementation date for the ICM Order.

- 2.5. From October 2002 to October 2003, the staff performed an inspection at each site using Temporary Instruction (TI) 2515/148, "Inspection of Nuclear Reactor Safeguards Interim Compensatory Measures." Section IV.E.2 of this TI, "Mitigative Measures," provided guidance to inspectors on the intent of these requirements and factors to consider in determining the adequacy of licensee actions. Although many licensees had met the expectations contained in the TI, the staff noted a wide spectrum of variability in the licensees' approach to implementation of the mitigative strategies developed to address section B.5.b of the ICM Order. Based on these findings, the staff concluded that additional guidance and clarification were needed.
- 2.6. In an August 25, 2004 SRM the Commission directed the staff to provide a program of reviews and inspections to implement mitigative measures required by Section B.5.b of the ICM Order no later than December 2004. The Commission also directed the staff to inform licensees that B.5.b was an ongoing requirement and that they were expected to take into account new information that might bear on the strategies and measures taken to meet B.5.b. As new insights from analysis of plant-specific vulnerabilities and mitigative strategies were developed, licensees could be required to adopt those strategies within the scope of B.5.b if they could be effectively implemented using existing or readily available resources.
- 2.7. In letters dated November 24, 2004, and January 14, 2005, the staff provided additional guidance to licensees including the definition approved by the Commission for the term "readily available equipment." The letter also stated that the staff would coordinate with the Nuclear Energy Institute (NEI) Security Working Group to develop additional guidance for implementing Section B.5.b mitigative measures. This additional guidance would include insights gained through the NRC ongoing research and lessons learned from security assessments. The NRC would develop detailed guidance separately for use in a forthcoming industry workshop.
- 2.8. The November 24, 2004, and January 14, 2005, letters also informed licensees of NRC plans to implement a two-phase approach to enhancing the mitigation measures required under Section B.5.b of the ICM Order. For Phase 1, the NRC expected licensees to use information from (1) existing programs and equipment and operational know-how, including maintaining capabilities currently in place, (2) industry best practices developed during the initial response by licensees, and (3) application of generic lessons learned from engineering analyses conducted over the last few years to develop and implement appropriate Section B.5.b. mitigation measures. For Phase 2, the NRC would oversee the industry's plant-specific analyses of potential impacts associated with the loss of large areas of the plant. The specific goals of Phase 2 were to (1) confirm the effectiveness of existing mitigation strategies and measures, (2) identify additional mitigation strategies or measures that use existing or readily available resources to further enhance the plant's effectiveness in maintaining core and SFP cooling and containment integrity despite the effects of large fires and explosions, and (3) identify potential practicable options for the use of generic, deployable, or other backup mitigation capabilities that exceed the NRC's requirements.
- 2.9. By the end of October 2004, the NRC staff had approved completely revised physical security plans for each commercial power reactor site in the country. The

operating license for each plant was revised to include a direct reference to these newly-approved security plans. Each of these plans included a section which described the licensees' commitments with respect to implementing the provisions of ICM B.5.b.

3. The NRC Changed the Two-Phase Approach for Implementing the February 25, 2002, ICM Order to a Three-Phase Approach.

3.1. In June 2005, the NRC changed the two-phase approach to implementing Section B.5.b of the ICM Order to a three-phase approach. Phase 1 would remain the same and consist of verification of compliance with specified interim safeguards and security compensatory measures (ICMs). Phase 2 would be changed to address assessment of SFPs only. A new Phase 3 would address assessment of the reactor and containment. This change allowed the staff to give priority to the assessment of SFPs before the reactor and containment.

3.2. This change was made in response to heightened public and congressional interest in the potential vulnerability of the SFPs. This heightened interest stemmed from the January 31, 2003, paper by Robert Alvarez, "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," published in *Science & Global Security*, Volume 11, No.1, Spring 2003. This paper prompted Congress to request that the National Academy of Sciences (NAS) study the issue. On July 28, 2004, the NAS issued the paper "Safety and Security of Commercial Spent Nuclear Fuel Storage," which was reviewed by Congress and the NRC. In a March 14, 2005, letter, NRC Chairman Diaz responded to Congress by stating that the NRC had already taken numerous actions to enhance the security of spent nuclear fuel and that it continued to evaluate power reactor security, including SFP security, in force-on-force exercises. Subsequent implementation of SFP mitigation strategies addressed the concerns identified during the Phase 2 assessments.

4. The NRC Issued February 25, 2005, Guidance for Implementing Section B.5.b of the ICM Order Dated February 25, 2002.

In a letter dated February 25, 2005, the NRC forwarded to power reactor licensees the final implementing guidance for Section B.5.b of the February 25, 2002, ICM Order (the Phase 1 Guidance Document). This guidance had been coordinated with the NEI Security Working Group and had been revised to address industry comments received at the workshops on January 14 and February 5, 2005. This guidance addressed (1) firefighting response strategies, (2) plant operations to mitigate fuel damage, and (3) actions to minimize releases. The guidance also addressed the specific expectations for mitigative measures that should be evaluated by each licensee for potential inclusion in its B.5.b mitigative strategies. The letter asked each licensee to provide a detailed response describing its site-specific plans and schedule to address the various considerations in the enclosed guidance by May 31, 2005, and in addition, to implement all of the planned mitigating strategies described in its response no later than August 31, 2005. Licensees were expected to identify and implement those strategies that were readily available at their facilities.

5. The NRC Performed Phase 1 Inspections (September – December 2005) to Verify Implementation of Section B.5.b of the February 25, 2002, ICM Order.

5.1. In June 2005, the NRC issued inspection procedure TI 2515/164, "Inspection of Nuclear Reactor Safeguards Interim Compensatory Measures—Section B.5.b of the February 25, 2002 ICM Order." During fall 2005, the NRC resident inspectors at each of the 65 operating nuclear power plant sites used this TI to assess the actions taken by licensees in response to the guidance document issued February 25, 2005. An internal NRC Management Assessment Panel reviewed the results of inspections and additional information obtained from licensees to ensure that the NRC was evaluating the licensees' implementation of the guidance in a consistent manner. In January 2006, inspection reports were issued that documented the results of these inspections and the conclusions of the NRC Management Assessment Panel. Findings that identified the need for licensees to further enhance their mitigation strategies and measures were identified as "unresolved items" in the inspection reports. The staff discussed these unresolved items with each licensee during the period from January through April 2006. Each licensee made commitments to the NRC to implement further mitigation strategies and measures to resolve the inspection findings.

5.2. From June to December 2006, NRC resident inspectors at each operating nuclear power plant performed an inspection using TI 2515/168, "Closeout Inspection of Nuclear Reactor Safeguards Interim Compensatory Measures—Section B.5.b of the February 25, 2002, Orders." This TI provided guidance on acceptable methods, along with staff acceptance criteria, for satisfying the B.5.b Phase 1 items. The inspectors used this guidance to confirm that licensees had implemented these commitments and closed the unresolved items from the TI 2515/164 inspections performed in fall 2005.

6. The NRC Performed Section B.5.b Phase 2 Assessments (June – December 2005) to Identify SFP Mitigation Strategies.

6.1 In September 2004 the NRC established the division of Nuclear Security Special Projects (NSSP) in the Office of the Executive Director for Operations (OEDO) and assigned John A. Grobe as its Director. NSSP was assigned responsibility for implementing a program of reviews and inspections to verify licensee implementation of mitigative measures required by Section B.5.b of the ICM Order. The NSSP staff conducted the Phase 2 independent assessments of SFPs at all operating reactors in response to SRM-M050421B, "Discussion of Security Issues," dated May 12, 2005. These assessments evaluated potential impacts on the ability to maintain SFP cooling from a range of threat-independent terrorist actions. The primary concern was that a terrorist action could breach the SFP, which could allow the cooling water level to lower below the spent fuel. This loss of cooling water could allow recently discharged fuel to overheat. Each assessment considered site-specific physical characteristics and capabilities. The NSSP teams relied on the respective site operating and engineering personnel for in depth plant knowledge. Multiple strategies for maintaining SFP cooling were identified for all sites except those that had been "screened out" during the assessment process.⁴ These strategies included

⁴ Strategies were not identified for several sites because the NRC assessments had determined that the SFP was not susceptible to being breached and drained of cooling water. The NRC made this determination based on site-specific physical characteristics of the SFP. These SFPs were considered "screened out" during subsequent TI 2515/171 inspections.

the use of alternative systems for refilling and spraying the SFP. The expected effectiveness of each strategy varied according to the circumstances affecting the site. The NSSP assessment teams further categorized the mitigation strategies as “readily available” or “beyond readily available” and further distinguished readily available strategies as voluntary or required. The teams completed all assessments

by December 16, 2005, and issued a site-specific report (SGI) documenting the assessment approach and results for each plant. In addition, an internal report on the results of the Phase 2 assessments for operating plants, entitled “Report on Spent Fuel Pool Mitigation Strategy Study (Phase 2),” was provided to the Commission on December 16, 2005.

- 6.2 In part because of the continuing disagreement between the NRC and industry over interpretation of the requirements of Section B.5.b of the ICM Order, and specifically whether Phase 2 and Phase 3 mitigation strategies were regulatory requirements, a panel of NRC senior executives referred to as the Mitigation Strategies Disposition Panel (MSDP) later reviewed all site-specific mitigation strategies. The panel’s purpose was to ensure consistency and provide oversight of the results of the Phase 2 (and the later Phase 3) assessments. The MSDP reviewed the NSSP assessment teams’ recommendation as to whether a mitigation strategy was “readily available” as stated in Section B.5.b of the ICM Order. A strategy was considered to be “readily available” if it utilized available equipment as defined in the Phase 1 guidance document. The MSDP made the final determination as to whether each readily available strategy was a reasonable and evident strategy within the Phase 1 guidance. If it was not within the Phase 1 guidance, it was considered a supplementary strategy. The site-specific assessment reports included the results of the MSDP deliberations.
- 6.3 After issuance of the site-specific reports, the NSSP staff conducted briefings with each operating reactor site’s senior management to ensure that the reports were understood and to respond to questions. Concurrently, the NSSP staff presented an industrywide summary of the differing types and breadth of SFP mitigation strategies to all licensees. The letter transmitting each site-specific assessment report asked licensees to consider the required and voluntary strategies identified during the assessment and to respond within 60 days of the publication date of the industrywide summary. Licensees were asked to evaluate any personnel safety concerns, the overall feasibility of each required and voluntary strategy, and the safety/security interface of the strategy to ensure that there would not be unintended adverse impacts on the overall safety of the plant.
- 6.4 The NSSP staff also evaluated five decommissioning reactor SFPs and one fuel storage facility to determine whether additional mitigation strategies were warranted at these facilities. As a result of these evaluations, the NSSP staff concluded that no onsite or additional assessments were warranted to identify mitigation strategies beyond existing measures at these facilities. This finding was due principally to the extended decay times and resulting low levels of decay heat in the spent fuel. A separate internal report documented the evaluation of the five decommissioning reactor SFPs and one fuel storage facility.
- 6.5 In a January 24, 2006, letter, “Industry Proposal for Closure Process for B.5.b Phase 2,” NEI proposed a generic set of SFP mitigating strategies including the use of an independently powered portable pump. This pump would not have been required by Section B.5.b of the ICM Order because it would not have been “readily

available.” These strategies would provide a flow of 500 gallons per minute (gpm) of makeup water to the SFP from internal and external sources and a 200-gpm flow of cooling spray from external sources. Before this, the NRC assessments had identified a wide range of strategies that could be useful at some plants. The industry proposal selected three of these strategies that would be applicable to all plants, including acquisition of the portable pumps. This proposal for closing Phase 2 was subsequently included in the industry proposal for closing Phase 3 described in NEI 06-12, “B.5.b Phases 2 & 3 Submittal Guideline,” dated December 2006.

7. The NRC and Industry Performed B.5.b Phase 3 Assessments (October 2005 – June 2006) to Identify Reactor and Containment Mitigation Strategies.

7.1. The Phase 3 assessments were intended to identify additional effective mitigation strategies for cooling the reactor core and maintaining containment integrity. The process described in NEI 05-07, “Industry Mitigation Strategy Study Guideline,” Revision 0, issued September 2005, focused on identifying additional effective mitigation strategies to further enhance the plant’s capabilities in maintaining core cooling and containment integrity. Plant staff performed the assessments with the assistance of an NEI contractor. The NSSP staff observed the assessments and evaluated each licensee’s site-specific mitigation strategy to determine whether the licensee’s assessment was well implemented.

7.2. After completion of the site assessment, the NRC MSDP reviewed each of the strategies to ensure consistency in the determination of whether a mitigation strategy identified during the Phase 3 assessments is readily available or beyond readily available, and if readily available, whether it is within the Phase 1 guidelines. Phase 3 assessments were completed in June 2006. An appropriate spectrum of candidate enhancement strategies was identified at each site for preventing and delaying core damage and containment failure and reducing radiological releases.

7.3. On May 15, 2006, NEI provided the NRC with a proposal for closing Phase 3, which included implementing a set of generic mitigation strategies. This proposal was similar to the approach proposed by NEI for the Phase 2 SFP strategies. Based on the results of the NRC’s independent Phase 3 assessments, the staff provided NEI with additional considerations to be addressed as part of the generic reactor core and containment mitigation strategies. NEI evaluated the additional considerations and presented the NRC with an updated proposal for closing Phase 3. This proposal involved the use of a license condition to describe in each license the types of strategies required by Section B.5.b of the February 25, 2002, ICM Order, including items deferred from Phase 1 to Phases 2 and 3. The NRC agreed in principle with the NEI proposal but made acceptance for individual facilities conditional upon NRC staff evaluation of site-specific implementation and documentation of the proposed Phase 2 and 3 mitigation strategies.

8. NRC Approved the Industry Plan for Implementing B.5.b Phase 2 and 3 Mitigation Strategies.

8.1. In September 2006, after completing the Phase 2 and 3 assessments, NSSP was disestablished and responsibility for Section B.5.b implementation and verification (e.g., license amendments and inspections) was transferred to Special Projects Branch (PSPB), Division of Policy and Rulemaking (DPR) in the Office of Nuclear Reactor Regulation (NRR). Key members of the NSSP staff were reassigned to PSPB to ensure continuity.

8.2. In October 2006, the staff requested that licensees provide site-specific details for implementing Phase 2 and 3 requirements. NEI prepared NEI 06-12 to assist licensees in preparing their site-specific responses. NEI 06-12 also provided a methodology for developing the industry mitigation strategies and an approach for evaluating other strategies to determine if they are viable. The staff reviewed and provided comments on this document. In December 2006, NEI issued Revision 2 to NEI 06-12, which incorporated changes to address NRC staff comments. The staff concluded that this version of NEI 06-12 provided an acceptable method for addressing B.5.b Phases 2 and 3. This document contained standard boiling-water reactor (BWR) and pressurized-water reactor (PWR) mitigation strategies with criteria for implementation on a site-specific basis. Subsequently, all licensees made submittals in which they committed to implementing the standard list of mitigation strategies for their type of reactor. By standardizing the strategies in exchange for the industry agreement to acquire portable independently powered pumping capabilities, the issue of whether a strategy was readily available was rendered moot.

8.3. In January 2007, the staff prepared a guideline that provided criteria for reviewing the adequacy of the site-specific implementing plans for B.5.b Phase 2 and 3 mitigation strategies and for developing inputs for site-specific safety evaluation reports (SERs). The staff received submittals from all licensees by February 28, 2007. However, only three of these submittals provided all the information required by the staff to complete the review. The staff requested additional information from the remaining licensees. All licensees provided the requested information in supplemental submittals. Most licensees committed to completing implementation by December 31, 2007. These submittals also included any items that had been deferred from Phase 1.

8.4. The staff's review of the submittals confirmed the licensees' intention to incorporate the already identified mitigation strategies into their severe accident mitigation guidelines (SAMGs) or extensive damage mitigation guidelines (EDMGs) or to append the strategies to other appropriate site procedures. During subsequent inspections, the NRC staff would verify that these strategies had been incorporated into SAMGs, EDMGs, or appropriate site procedures. The staff also verified that all licensees had agreed to implement the SFP, reactor, and containment strategies described in NEI 06-12. An exception was that licensees were not required to implement the SFP strategies at sites where the SFPs had been "screened out" during the Phase 2 assessments.

8.5. The staff concluded that all licensees had identified a range of strategies that, if implemented as described, would be adequate to meet the B.5.b Phase 2 and 3 requirements. Because many strategies were conceptual in nature and had not been implemented before the submittals, the evaluation of the feasibility and effectiveness of the strategies was deferred to future onsite inspections. The staff also reviewed any

items that had been deferred from Phase 1 and concluded that they had been adequately addressed. The staff documented these reviews in SERs. Appendix A to the SERs addressed all Phase 1 strategies, including those that had been closed during the Phase 1 reviews. Appendix B to the SER addressed the Phase 2 and Phase 3 requirements and those Phase 1 strategies that had been deferred to Phases 2 and 3. The staff also imposed conforming license amendments documenting the license conditions for these requirements. The staff completed these actions by the end of August 2007.

9. The NRC Completed Onsite Inspections (December 2007 – December 2008) of Phase 2 and 3 Mitigation Strategies and Identified Two Significant Issues Requiring Resolution.

9.1. In an April 30, 2009, memorandum, the staff informed the Commission that it had performed an inspection at each power reactor site using TI 2515/171, "Verification of Site Specific Implementation of B.5.b Phase 2 and 3 Mitigation Strategies." The first inspection was performed in December 2007, and the last was completed in December 2008. The inspections were performed by a team which typically included a region based team leader, the resident inspector and a representative from the NRR Special Projects Branch with previous B.5.b experience. The inspection process identified a range of issues, which were documented in the inspection report for each site. Most significant issues (those determined to be more than minor) were identified as findings or violations. Licensees addressed these inspection findings and violations by taking appropriate corrective actions. These corrective actions included performing additional engineering calculations, establishing additional strategies, updating and correcting procedures, providing training to plant staff, and rerouting flow paths to reduce system pressure losses. The inspection process also identified two significant issues that required resolution.

9.2. The first significant issue requiring resolution was that new information became available in the PWR Owners' Group technical report WCAP 16800, "Insights for Operating Steam Generators to Minimize RCS Inventory Loss Following a Loss of All AC and DC Power," dated November 2007, that could affect the viability of three of the PWR steam generator mitigation strategies described in NEI 06-12. The staff became aware of the WCAP in mid 2007, after approximately half of the inspections had been completed. The WCAP was provided to members of the inspection team by one of the licensees during the conduct of TI 2515/171. The staff is currently performing a technical review of the report and has included appropriate inspection guidance in the Reactor Oversight Process (ROP).

9.3. The second significant issue requiring resolution was the need for guidance to address other lessons learned during the TI 2515/171 inspections, including the need to clarify expectations for procedures, training, engineering calculations, and maintenance of B.5.b equipment (e.g., allowed out-of-service time). The inspection guidance in the ROP now includes these lessons learned.

10. The NRC Informed the Commission of Plans for Integrating B.5.b-Related Inspections into the ROP.

10.1. In an August 5, 2008, memorandum, the staff informed the Commission of its plan and schedule for integrating new areas of B.5.b-related inspection into the ROP. The staff reported that it had initiated a Community of Practice using the NRC

Knowledge Center Web site as a tool to collect results and lessons learned from these inspections. The lessons learned would be used to integrate the new areas related to Section B.5.b into the ROP.

10.2. In addition, the staff formed a B.5.b Integration Team, composed of experienced representatives from the Office of Nuclear Reactor Regulation, in coordination with the regions and the Office of Nuclear Security and Incident Response, to assess and evaluate the aspects of Phases 1, 2, and 3 of Section B.5.b activities that should be integrated into routine regulatory activities, including the ROP. The team formulated an

10.3. integration plan for issues related to Section B.5.b. Both the integration plan and the lessons learned on the confirmatory inspections were used to update the inspection program and integrate the new areas related to Section B.5.b into the ROP for use in ROP Year 11, which begins January 1, 2010.

11. The Commission Approved the Final Rule on Power Reactor Security Requirements for Operating and New Reactors.

11.1. On March 27, 2009, the NRC amended Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Part 52, "Licenses, Certifications, and Approvals," and Part 73, "Physical Protection of Plants and Materials," with new requirements (74 FR 13926, March 27, 2009). One of the sections of this rulemaking, 10 CFR 50.54(hh)(2), makes the ICM Order Section B.5.b requirement to address loss of large areas of the plant due to explosions or fires from a beyond-design-basis event generically applicable to all nuclear power plants licensed under either 10 CFR Part 50 or 10 CFR Part 52. Also added by this rulemaking, 10 CFR 52.80(d) requires submittal of information on how an applicant for a combined license for a nuclear power facility will meet these requirements. In addition, the final rule added several new requirements developed as a result of insights gained from implementation of the security Orders, reviews of site security plans, and implementation of the enhanced baseline inspection program. The final rule also updated the NRC's security regulatory framework for the licensing of new nuclear power plants. Compliance with the final rule was required by March 31, 2010, for licensees currently licensed to operate under 10 CFR Part 50.

12. The NRC Issued Draft Interim Staff Guidance for Implementing Power Reactor Security Requirements for New Reactors.

12.1. On May 1, 2009, NEI submitted Revision 3 of NEI 06-12 to the NRC for its review and endorsement. This revision provides guidance on the application of NEI 06-12 to new nuclear power plants to ensure consistency in meeting the requirements of 10 CFR 50.54(hh)(2) and 10 CFR 52.80(d). The NRC staff reviewed the revision and commented on it to NEI in e-mails dated June 8 and June 29, 2009 and at a meeting with NEI on June 23, 2009. NEI addressed these comments and resubmitted Revision 3 to the NRC for review on July 17, 2009. The submittal letter also stated that NEI was aware that the NRC had a list of lessons learned resulting from the B.5.b inspections conducted at operating plants. NEI stated that if the disposition of these lessons learned resulted in changes to NEI 06-12, Revision 3, the combined license applicants would review these changes for applicability.

12.2. On October 7, 2009, the staff forwarded Draft Interim Staff Guidance DC/COL-ISG-016, "Compliance With 10 CFR 50.54(hh)(2) and 10 CFR 52.80(d)," to NEI and requested comments within 30 days. The interim staff guidance (ISG) endorses the guidelines of NEI 06-12, Revision 3, as an acceptable approach to meeting the requirements of 10 CFR 50.54(hh)(2) and 10 CFR 52.80(d), with certain exceptions based on the lessons learned outlined above. New applicants for, and new holders of, an operating license may use other methods to satisfy these requirements, which the staff would review for acceptability on a case-by-case basis.