U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

## 19.4 STRATEGIES AND GUIDANCE TO ADDRESS LOSS OF LARGE AREAS OF THE PLANT DUE TO EXPLOSIONS AND FIRES

### REVIEW RESPONSIBILITIES

**Primary -** Organization responsible for the review of mitigating strategies.

**Secondary -** Organization responsible for the review of reactor systems.

### I. AREA OF REVIEW

On March 27, 2009, the U.S. Nuclear Regulatory Commission (NRC) amended Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, and 10 CFR Part 52 with new requirements (74 FR 13926; March 27, 2009) to address loss of large areas (LOLAs) of the plant due to explosions or fire. Section 50.54(hh)(2) requires power reactor licensees to develop guidance and strategies for addressing the LOLAs of the plant due to explosions or fire. Sections 50.34(i) and 52.80(d) require an applicant to submit a description and plans for implementation of the

Revision 0 – May 2013

guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with the LOLAs of the plant due to explosions or fire as required by Section 50.54(hh)(2) as part of the application for an operating license under Part 50 or a combined license (COL) under Part 52.

1. Specifically, Section 50.54(hh)(2) requires licensees to develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities under the circumstances associated with LOLAs of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release. The requirements in Section 50.54(hh)(2) are based on similar requirements originally found in Section B.5.b of the NRC's Interim Compensatory Measures (ICM) Order issued February 25, 2002.[1]

   The NRC staff issued guidance to current reactor licensees on February 25, 2005.[2] Following issuance of the guidance, the NRC staff conducted inspections at operating reactor sites using Temporary Instruction (TI) 2515/164 (Safeguards Information (SGI)) to gather information on actions taken in response to the ICM order using the February 25, 2005, guidance. The NRC staff then convened assessment panels to evaluate the adequacy of licensee actions taken to date. These assessment panels developed acceptance criteria to determine the adequacy of licensee responses to each of the 34 expectations identified in Attachment B to the February 25, 2005, guidance. On January 18 and 26, 2006, the NRC staff met with industry representatives and provided further clarifying information, including staff acceptance criteria regarding how licensees could meet Section B.5.b of the ICM Order. The NRC clarifying information for acceptance of each expectation was disseminated in Sections 05.02(c) and 05.02(d) of TI 2515/168 (SGI). This clarifying information represented acceptable methods, along with staff acceptance criteria, for satisfying the expectations.

   By letters dated January 24, 2006, May 15, 2006, and June 27, 2006, the Nuclear Energy Institute (NEI) proposed additional criteria for strategies and guidance to maintain or restore core cooling, containment, and SFP cooling capabilities. The NRC staff accepted these proposals along with the proposal to document the additional requirements by license condition in a letter dated June 29, 2006.

   The NRC staff used this clarifying information and the additional proposed strategy criteria in developing its safety evaluations, imposing conforming license conditions, and inspecting then current power reactor licensees' compliance with Section B.5.b of the ICM Order.

   10 CFR 50.54(hh)(2) made permanent and generically applicable the requirements imposed by Section B.5.b of the ICM Order and the subsequently imposed license conditions.

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[1] Order Modifying Licenses (Effective Immediately), Samuel J. Collins (NRC), EA-02-026, February 25, 2002. (Safeguards Information (SGI))

[2] Letter from James E. Dyer (NRC) to Holders of Licenses for Operating Power Reactors, "NRC Staff Guidance for Use in Achieving Satisfactory Compliance with February 25, 2002 Order Section B.5.b," February 25, 2005. (SGI)

2. Combined License Action Items and Certification Requirements and Restrictions. For a standard design certification application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

   For a COL application referencing a standard design certification, a COL applicant must address COL action items (referred to as COL information in certain standard design certifications) included in the referenced standard design certification. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced standard design certification.

Review Interfaces

Other Standard Review Plan (SRP) sections interface with this section as follows:

- Review of engineered safety feature components of the reactor coolant system under SRP Section 5.4

## II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

Section 50.54(hh)(2) requires that each licensee develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with LOLAs of the plant due to explosions or fire, to include strategies in the following areas:

(i) Fire fighting;
(ii) Operations to mitigate fuel damage; and
(iii) Actions to minimize radiological release.

Section 52.80(d) requires an applicant for a COL to submit descriptions and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with the LOLAs of the plant due to explosions or fire as required by Section 50.54(hh)(2). Applicants that elect to submit their application under 10 CFR Part 50 should submit descriptions and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities as part of their application for an operating license as required by Section 50.34(i).

The NRC staff considers conformance with the February 25, 2005, guidance, TI 2515/168, and NEI 06-12 “B.5.b Phase 2 & 3 Submittal Guideline,” Revision 2, acceptable for use by holders of a construction permit or a license to operate a power reactor facility issued under 10 CFR Part 50 prior to May 26, 2009, in satisfying the Commission’s requirements in 10 CFR 50.54(hh)(2) and 10 CFR 50.34(i).

The NRC staff considers conformance with the February 25, 2005, guidance, TI 2515/168, and NEI 06-12, Revision 3, acceptable for use by applicants for a 10 CFR Part 52 COL or a 10 CFR Part 50 operating license, in satisfying the Commission's requirements in 10 CFR 50.54(hh)(2), 10 CFR 50.34(i), and 10 CFR 52.80(d), with the following exceptions:

1. Section 4.2.1 of NEI 06-12, Revision 3 states that new nuclear power plants (NPPs) should address the Phase 1[3] issues as current power reactor licensees have done, by implementing guidance issued by the NRC on February 25, 2005.

   Staff Position

   Additional clarifying information documented in Sections 05.02(c) and 05.02(d) of NRC TI 2515/168 was disseminated to Part 50 licensees on January 18 and 26, 2006. This clarifying information describes acceptable methods, along with staff acceptance criteria, for satisfying the NRC staff's expectations documented in the February 25, 2005, guidance.

   Applicants for and holders of COL or operating licenses should use the guidance in the section titled "SRP Acceptance Criteria" in this SRP, along with the guidance issued by the NRC on February 25, 2005, to develop and implement strategies and guidance as required by 10 CFR 50.54(hh)(2). This additional guidance is consistent with the guidance provided in TI 2515/168 and recognizes that there will be differences between the designs of new power reactor facilities and those of Part 50 facilities operating prior to May 26, 2009.

   The NRC staff recognizes that new nuclear power reactor facilities may incorporate design features and functional capabilities that may lead applicants for, and holders of, COL or operating licenses to propose alternative approaches to meeting the NRC staff's expectations described in this SRP. For each of the expectations described, applicants should provide a description of the strategy to be implemented, a commitment to implement an approach acceptable to the NRC, or a description of their alternative approach, including the design feature(s) or functional capability(ies) that have led to that approach. This information should be included with the description and plans for implementation of the guidance and strategies that applicants are required to submit to the NRC per 10 CFR 52.80(d) or 10 CFR 50.34(i). NEI 99-04, Revision 0, "Guidelines for Managing NRC Commitment Changes," (Agencywide documents Access and Management Systems (ADAMS) Accession No. ML003680088), accepted in Regulatory Issue Summary (RIS) 2000-017 (ADAMS Accession No. ML091190065) provides acceptable guidance for the control of these regulatory commitments.

2. Guidance in Section 4.2.2 of NEI 06-12, Revision 3 describes conditions under which an applicant for a COL or operating license may use guidance in Chapter 2 of NEI 06-12, Revision 3 for developing guidance and strategies intended to maintain or restore SFP cooling and preparing plans for future implementation of the guidance and strategies. Section 4.2.3 of NEI 06-12, Revision 3 describes conditions under which an applicant for a

[3] Current holders of an operating license addressed the requirements of the ICM Order in three Phases. Phase 1 addressed all requirements except for requirements to develop and implement specific measures to mitigate damage to fuel in the SFP (Phase 2) and requirements to develop and implement specific measures to mitigate damage to fuel in the reactor vessel and minimize radiological releases from the containment (Phase 3).

COL or operating license may use guidance in Chapter 3 of NEI 06-12, Revision 3 for developing guidance and strategies intended to maintain or restore core cooling and containment capabilities, and preparing plans for future implementation of the guidance and strategies.

Staff Position

These chapters of NEI 06-12, Revision 3 have not been updated from Revision 2 to address the necessary improvements in the guidance identified during NRC inspections at licensed power reactor facilities.

Applicants for COLs or operating licenses should ensure that the guidance and strategies developed to comply with 10 CFR 50.54(hh)(2) reflect the experience gained from the implementation of guidance and strategies at licensed power reactor facilities that are applicable to their facility, as described in Appendix A of this SRP. Holders of COLs or operating licenses should ensure that the strategies and guidance are translated into operating guidelines that reflect this experience.

The NRC staff expects that the strategies will be described at the application stage in sufficient detail to permit the NRC to make the findings required for licensing. The NRC staff will subsequently perform inspection of this information, including specific guidelines, and plant hardware to verify that the strategies identified in the license application have been implemented subsequent to licensing. To support the NRC inspection program, an item related to 10 CFR 50.54(hh)(2) should be incorporated into the standard license conditions in Chapter 13 of the Final Safety Analysis Report (FSAR) related to (1) implementation of specified programs and (2) submitting schedules to support planning for and conduct of NRC inspections. The guidance and strategies required under 10 CFR 50.54(hh)(2) should be fully implemented no later than the time nuclear fuel is first loaded into the reactor and maintained until certifications required under 10 CFR 50.82(a) or 10 CFR 52.110(a)(1) have been submitted.

SRP Acceptance Criteria

Specific SRP acceptance criteria for the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC's regulations.

1. Staging of Fire Brigade Equipment (Item B.1.a)[4]

Appropriate fire brigade equipment (i.e., enough turnout gear, self-contained breathing apparatus, and radios to equip a typical five person fire brigade) will be staged in a location at least 100 yards from the target areas. Target areas may include containments, reactor buildings,

[4] Item numbers refer to guidance in the February 25, 2005 guidance letter from James E. Dyer (NRC) to Holders of Licenses for Operating Power Reactors, "NRC Staff Guidance for Use in Achieving Satisfactory Compliance with February 25, 2002 Order Section B.5.b." (SGI).

auxiliary buildings, control buildings, and turbine buildings. If a distance of 100 yards is not achievable, a lesser distance is acceptable if that location is hardened, if there is an intervening structure, or if equipment is stored at a number of diverse locations at the site providing sufficient assurance that equipment would be available to support fire brigade response. Strategies described in the application should be consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

2. Dispersal of Personnel (Items B.1.b and B.2.a)

For aircraft imminent threat, personnel are to be evacuated from target buildings. (For a ground threat, sheltering personnel may be a more viable strategy and is not intended to be addressed by these items.) Personnel need to be warned to move rapidly from most likely target buildings to buildings less likely to be targeted. Generically, sheltering in place is not an acceptable solution. If a safe shelter area in a target building can be justified, then sheltering in place may be an appropriate action if evacuation from target buildings is not feasible. Some licensees at facilities currently operating have committed to "maximizing survivability" by dispersing operations and fire brigade members to locations that are sufficiently distant from each other (e.g., opposite ends of the turbine building or opposite sides of the containment structure), but still located in target buildings. This approach is acceptable provided that dispersing personnel outside of the target areas is not achievable. Strategies described in the application should be consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

For Item B.1.b, fire brigade members should be relocated at least 100 yards from targeted buildings, even during imminent threat conditions. This location could be an area that has pre-staged fire fighting equipment (e.g., turnout gear, radios) as identified in Item B.1.a. If a distance of 100 yards is not achievable, a lesser distance is acceptable if that location is either hardened or if there is an intervening reinforced concrete structure. Fire brigade members should not report to a location in target buildings to gather equipment before reporting to the designated dispersal area.

For Item B.2.a, operations and support staff members are relocated at least 100 yards away from targeted buildings. The NRC staff recognizes that a minimum number of operators are required in the control room. Any operators not required to be in the control room to implement imminent threat procedures should be relocated to safe locations.

3. Airlifted Resources (Item B.1.c)

A 2-hour total response criterion (2 hours from door to door) is to be used for airlifted resources. Resources may be acquired via mutual aid agreements, as long as there is an awareness of what resources are available via this system and how those resources are activated. Airlifted resources may include helicopter/fixed-wing transport for personnel/equipment, securing airfields for takeoff/landing, and helicopter water drop capability. Where possible, Memoranda of Understanding (MOUs) should be established; however, when an MOU is not possible, the nature of the agreement should be documented. Strategies for use of airlifted resources should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

4. Command and Control (Item B.1.d)

Protocols for command and control for an event that is of the magnitude of a LOLA event will be covered in guidelines, and those guidelines will include protocols for interface with offsite responders. Furthermore, licensees should maintain command and control authority for onsite firefighting actions to ensure that firefighting priorities, as defined by operations, are communicated to the incident commander. Plant staff will have a means for providing immediate technical assistance (i.e., a licensed operator) to the incident commander. In cases where state law prevents the licensee from being in charge of the onsite fire fighting actions, the licensee should have a means to ensure that the fire fighting priority is to support plant recovery efforts. Strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

5. Evaluating Capabilities of Offsite Resources (Item B.1.e)

The capabilities of mutual aid or other local/regional resources that could be available to respond to the plant, including what equipment might be brought to bear during an event, should be evaluated. Specifically, this item refers to "specialized capabilities." Specialized capabilities include, but are not limited to, debris removal equipment (e.g., bulldozers, large cranes, etc.), specialized firefighting equipment (e.g., low-expansion foam, hard sleeves, etc.), and hazmat response equipment. In conjunction with Items B.1.c and B.1.g, these capabilities should be described in site guidelines. The plans and strategies for using the capabilities of mutual aid or other local/regional resources should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

6. Evaluation of MOUs for Offsite Resources (Item B.1.f)

MOUs should be developed with offsite response organizations for personnel and equipment to ensure appropriate offsite support during a LOLA event. Roles and responsibilities should be consistent with Item B.1.d, with regard to the licensee maintaining overall command and control of onsite actions. The plans and strategies for developing MOUs with offsite response organizations should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

7. Coordination with Regional Resources (Item B.1.g)

There should be a 2-hour total response criterion (2 hours from door to door) for ground-based regional resources. Resources may be acquired via mutual aid agreements, including county or state emergency response arrangements, as long as there is an awareness of what resources are available via this system and how those resources are activated. Municipal fire departments, military facilities, airports (crash trucks), and large industrial facilities (i.e., petrochemical) should be evaluated to determine what level of heavy firefighting resources are available. Where possible, MOUs should be established; however, when an MOU is not possible, the nature of the agreement should be documented. The availability and use of these resources should be evaluated and documented in site guidelines. The plans and strategies for acquiring regional resources should be described in the application in a manner consistent with guidance in

Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

8. Controlling Emergency Response Vehicles and Dosimetry for Responders (Item B.1.h)

Staging areas should be established and documented in guidelines for large numbers of responding vehicles. Provisions should be made with local law enforcement agencies to ensure that responding vehicles (e.g., firefighting, plant personnel, etc.) are not restricted at roadblocks and prevented from accessing the site. Those provisions should be documented in plant security procedures. General site familiarization (overall layout of the site, access points, staging areas, etc.) should be provided to local law enforcement agencies personnel. Sufficient dosimetry should be staged and available for initial arriving offsite response personnel. This dosimetry should be staged in a location at least 100 yards from target areas. The appropriate number of dosimetry is expected to be performance-based. An estimate should be made of the number of responders expected onsite during the initial stages of a LOLA event that do not normally carry dosimetry with them. There should be enough dosimetry provided for those individuals. It is expected that licensees could acquire/relocate additional dosimetry for longer-term arriving assets. The plans and strategies for controlling emergency response vehicles and dosimetry for responders should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

9. Communications Equipment (Items B.1.i and B.2.b)

For Item B.1.i, the focus is on radios for firefighting response. The issue of interoperability[5] of radios will be addressed by either pairing site personnel holding site radios with offsite responders or having radios that are interoperable by nature. The appropriate number of radios should be performance-based, predicated on an evaluation of the number of radios needed to support firefighting responders expected to be involved during a LOLA event and the method they use to distribute these radios. That number of radios (with associated batteries and chargers) is to be provided in a location at least 100 yards from target areas.

For Item B.2.b, the focus is on radios used for operational recovery of the plant (similar to those that are used in the Operations Support Center (OSC)). The appropriate number of radios should be performance-based, predicated on an evaluation of the number of radios needed to support operational recovery teams (such as those that would normally operate from the OSC) expected to be involved during a LOLA event. That number of radios (with associated batteries and chargers) is to be provided in a location at least 100 yards from the power block. A communications scheme, using multiple radio channels, should be established to minimize crosstalk and confusion during an event. The plans and strategies for providing communication equipment should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

Radios for Items B.1.i and B.2.b should not be the same radios. They may be stored in the same location; however, these radios may all need to be in service simultaneously and cannot be

[5] Interoperability – Ability for emergency responders from different organizations to communicate with each other by radio, e.g., on site fire brigade can communicate with offsite fire department or with the offsite law enforcement organization.

shared. Credit should be given to mitigation strategies that provide for augmentation of radios from offsite resources.

10. Mass Casualties (Item B.1.j)

The handling of a mass casualty situation should be addressed in site guidelines. It is important to pre-plan for an event of mass casualties (an event beyond the typical contaminated injured individual medical emergency). Use of county or state mass casualty plans is acceptable, as long as the site plans reference the framework of those offsite procedures. If a state or county mass casualty plan is not utilized, then there should be assurance that the existing medical mutual aid/MOU response framework can deliver adequate medical capabilities. Additional regional medical resources may need to be sought. Licensees are not required to have the medical expertise or equipment onsite to treat casualties; but should provide for the care of casualties until offsite expertise and equipment arrives. The plans and strategies for handling a mass casualty situation should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

11. Triage Areas (Item B.1.k)

Although the title of this item is generic in nature with respect to alternate assembly areas, for Item B.1.k, it is specific to using alternate assembly areas for triage. Triage areas should be in an appropriate location(s), of sufficient size, and be documented in plant guidelines or guidance documents. Licensees are not required to have the medical expertise or equipment onsite to treat casualties; but should provide for the care of casualties until offsite expertise and equipment arrives.

An acceptable location would be an area at least 100 yards from target areas. The area could be indoors or outdoors (although indoors is preferred due to weather uncertainty), as long as there is sufficient area to hold a large number of injured individuals (approximately 30 to 50). A good practice is to locate a triage area near an area capable of supporting helicopter landing.

Triage areas should be defined in plant guidelines. The NRC staff will accept multiple triage areas, as long as these areas and the decision process detailing which to use is captured in guidelines or guidance documents.

It is acceptable for guidelines or guidance documents to be annotated to indicate that although preplanned triage areas are defined in the plant documents, the incident commander may chose to locate the triage area at a previously undefined location. This is the prerogative of the incident commander. In this case, the licensees' preplanned areas provide options to the incident commander. The plans and strategies for establishing triage areas should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

12. Firefighting Training and Exercises (Item B.1.l)

Firefighting training on accelerant-fed fire should be provided to onsite fire brigade members. In addition, fire brigade training should address the coordinated fire response between onsite and offsite fire responders (including interface with operations). Site familiarization training should be

provided to local offsite responders and, if possible, information on LOLA event related mitigation strategies and measures should be shared with offsite responders. A site tabletop exercise should be conducted prior to initial fuel load. The site exercise should involve, at a minimum, MOU firefighting responders, site fire brigade, and operations staff to enhance the understanding of the coordinated response strategies for a LOLA event. The tabletop exercise can be held onsite or offsite and should also focus on the coordinated response strategies involving onsite and offsite responders for a LOLA event. The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

13. Means for Feeding the Fire Protection Ring Header (Item B.1.m)

A means to feed the fire protection water supply mains located underground (also called a ring header) using alternate water supplies (e.g., lake, river, cooling tower basin, available water tanks, etc.) with either appropriately staged onsite equipment or arriving offsite equipment should be developed and implemented. The means should be either documented in site guidelines or demonstrated by the appropriate fire responders. The plans and strategies for feeding the fire protection ring header from alternate water supplies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

14. Boiling Water Reactor: Containment Venting and Vessel Flooding (Item B.2.e)

For applicable power plant designs, guidelines should be developed for venting primary containment to secondary containment (or atmosphere, if venting to secondary containment is not achievable) in a condition where no power is available. Also, procedures should be developed for using condensate pumps to provide cooling water to the reactor vessel. The plans and strategies for containment venting and vessel flooding should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

15. Use of Plant Equipment During Loss of Power Situations (Item B.2.g)

This item includes development of procedures to start an emergency diesel generator without direct current (dc) power, development of procedures to start non-alternating current (ac) powered pumps used for decay heat removal without dc power, and development of guidelines to use a fire pumper to supply cooling water to the reactor core—for power plant designs with injection capability—and to the SFP. These procedures should be written based on strategies developed using guidance in NEI 06-12, Revision 3. The plans and strategies for use of plant equipment during loss of power situations should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

16. Compartmentalization (Item B.2.h)

It is expected that an analysis or walk down of target areas will be performed with a LOLA event in mind and that the results will be documented. The primary consideration during this walk down is accelerant fluid flow. Any feasible compartmentalization enhancements should be implemented, as long as they do not impact other barrier programs (e.g., fire protection). Some

examples of enhancements may include sealing of floor plugs, expedited closure of floor plugs, enhanced fire door closing mechanisms, flood berms, and closing of tornado hatches. Enhancements may also be incorporated by design and this should be considered by applicants.

The plans and strategies for an analysis or walk down of target areas should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site guidelines by the licensee.

17. SFP Mitigative Measures (Item B.2.m)

For Item B.2.m.1, spent fuel should be put in a 1 x 4 repeating pattern, as described in Reference 1 or equivalent. Holders of COLs or operating licenses should pre-configure the SFP to enable direct placement of the expended assemblies from the vessel to the final distributed fuel pattern. The NRC staff has accepted alternate strategies for the timing to achieve the appropriate pattern at Part 50 facilities currently operating. This was done in consideration of the feasibility and practicality of such an operation in a pool filled with many cycles of spent fuel, and possibly containing fuel storage racks with different designs. Such timing considerations are not considered necessary for newly designed spent fuel storage facilities.

Applicants who choose to conform to the NRC-approved resolution are expected to include the following concept in procedures: "Where practical, consistent with safe fuel handling practices, the licensee should make every attempt to pre-configure the SFP to enable direct placement of the expended assemblies from the vessel to the final distributed fuel pattern". Where this is not practical, licenses should distribute the fuel into the final pattern as soon as reasonably possible. Applicants should document whether they will use the NRC-approved timing resolution or an alternate timing resolution in their plans submitted in accordance with Sections 52.80(d) and 50.34(i) of the Commission's regulations.

For Item B.2.m.2, freshly discharged fuel[6] is not placed over SFP rack feet. This restriction should be addressed in procedures. If an analysis concludes that flow is not restricted by rack feet, then this item is not applicable. The analysis should be available for NRC inspection.

For Item B.2.m.3, a contiguous area should be established in the SFP and procedures should ensure that sufficient space is available to support the downcomer effect for natural circulation cooling. This space may be limited by SFP loading issues (such as space, criticality, technical specification issues, and boraflex degradation). The downcomer area should be maximized based on limiting conditions in the pool.

SFP mitigation measures should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

18. Training (Item B.2.n)

Training on LOLA guidance and strategies (preferably classroom training) should be incorporated into the licensee's initial licensed operator training program, as well as their licensed operator

[6] Freshly discharged fuel, also known as "hot fuel," is the most recently removed fuel from the reactor and has the highest decay heat load relative to other fuel in the spent fuel pool.

requalification program. The NRC staff considers a training frequency on LOLA procedures and strategies to be acceptable if it is the same as or more frequent than severe accident management guidelines (SAMG) training.

Emergency response organization personnel, as well as licensed and non-licensed operators, should be trained as determined by a training needs analysis. For an event of LOLA magnitude, training and preplanning are paramount to effective event response. The personnel involved in implementing and supporting LOLA mitigation strategies need to understand and appreciate the scale and consequences of this event. In addition, they need to be able to have advanced knowledge of the unique and challenging strategies that may need to be implemented. The plans for training should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the training program by the licensee.

19. Water Spray Scrubbing and Runoff (Item B.3.a)

Procedures or guidance should be developed describing water spray scrubbing using either onsite equipment or arriving offsite equipment. Spray scrubbing uses large volumes of water and could last for days; therefore, containment of potentially contaminated runoff is also of concern. Depending on the site topography, containment of runoff may not be readily achievable. If enhancements to the containment of runoff are achievable, they should be included in guidance or guidelines. The plans and strategies for water spray scrubbing and containment of contaminated runoff should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

20. Staging of Equipment for Water Spray Scrubbing (Item B.3.b)

If a strategy for water spray scrubbing that relies upon onsite equipment is developed, then that equipment should be stored in an appropriate location at least 100 yards from the target areas. This item in not applicable if a licensee is relying solely on offsite equipment for water spray scrubbing.

Technical Rationale

1. Section 50.54(hh)(2) states: Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with LOLAs of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and, (iii) Actions to minimize radiological release. The Commission's statement of considerations for these requirements states that new reactor licensees must address core cooling, SFP cooling, and containment integrity by employing the same 14 general strategies that have been required through an operating license condition for current Part 50 power reactor licensees (74 FR 13926, 13957; March 27, 2009). The statement of considerations also states that the mitigation strategies employed by new reactors as required by the rule also need to account for, as appropriate, the specific features of the plant design, or any design changes made as a result of an aircraft impact assessment that are performed in accordance with the Commission's Aircraft Impact Assessment rule 10 CFR 50.150. New reactor applicants

and new holders of a COL may have additional safety and design features and functions beyond those of operating reactors. The effects of these additional features and design differences on the original guidance in NEI 06-12, Revision 2 are addressed through the additional guidance found in NEI 06-12, Revision 3 which is beyond that developed for current power reactor licensees.

2. Section 52.80(d) requires a COL applicant to submit a description and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with the LOLAs of the plant due to explosions or fire as required by Section 50.54(hh)(2). Section 50.34(i) requires operating license applicants under 10 CFR Part 50 to submit descriptions and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities as required by Section 50.54(hh)(2).

III. REVIEW PROCEDURES

The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the NRC staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Section II of this SRP.

For each type of submittal, the NRC staff will conduct the review as follows:

1. New Reactor Applications

   For operating license or COL applications submitted in accordance with 10 CFR Part 50 or 10 CFR Part 52, the NRC staff reviews information provided by the applicant in its application. All applicable areas of review listed in Section II of this SRP should be included in the review for a new reactor application.

2. For review of a standard design certification application that includes design features addressing the requirements of 10 CFR 50.54 (hh)(2), the reviewer should follow all applicable areas of review listed in Section II of this SRP to verify that the design set forth in the FSAR meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the standard design certification FSAR.

   For review of a COL application, the scope of the review is dependent on whether the COL applicant references a standard design certification, manufacturing license, or topical report).

   For review of both standard design certification and COL applications, SRP Section 14.3 should be followed for the review of inspections, tests, analyses, and acceptance criteria

(ITAAC), if applicable. The review of ITAAC cannot be completed until after the completion of this section.

3. License Amendments

The staff reviews license amendments for modifications to, additions to, or deletions from the terms of a new reactor application or of an existing operating reactor.

## IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review supports conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the basis for those conclusions.

1. New Reactor Applications

For operating license or COL applications submitted in accordance with 10 CFR Part 50 or 10 CFR Part 52, the NRC staff concludes that the applicant's description and plans for the implementation of guidance and strategies are acceptable and meet the applicable requirements of 10 CFR 50.54(hh)(2), 10 CFR 50.34(i), and 10 CFR 52.80(d). The NRC staff concludes that the applicant has met the guidelines of this SRP and related industry guidance.

The NRC staff concludes that for differences between the licensee's application and these SRP acceptance criteria, the proposed alternatives provide an acceptable method of complying with the NRC regulations. Sufficient information has been provided for the NRC staff to resolve all safety issues.

The NRC staff concludes that the applicant's mitigative strategies descriptions and plans are fully described and that implementation milestones have been identified. The NRC staff concludes that the program and implementation milestones are included in the application.

The NRC staff concludes that the program and associated implementation milestone(s) are included within the license condition on operational programs and implementation.

For standard design certification reviews, the findings will also summarize the NRC staff's evaluation of the COL action/information items proposed by the standard design certification applicant that are relevant to this SRP section.

For COL reviews, the findings will also summarize the NRC staff's evaluation of how the COL applicant addressed those COL action/information items included in the DCD referenced in its application that are relevant to this SRP section.

2 License Amendments

The staff concludes that the proposed amendment to the application for a new reactor or to an existing operating reactor meets the requirements of Section 50.54(hh)(2).

## V. IMPLEMENTATION

The NRC staff will use this SRP section in performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52 and license amendment requests. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the NRC staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications submitted 6 months or more after the date of issuance of this SRP section, unless superseded by a later revision.

## VI. REFERENCES


1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"

2. 10 CFR Part 52, "License, Certifications, and Approvals for Nuclear Power Plants."

3. Letter from James E. Dyer (NRC) to Nuclear Energy Institute, "B.5.b Phase 1 Issues Regarding Spent Fuel Dispersal," March 16, 2006, ADAMS Accession No. ML060690339.

4. NEI 06-12, "B.5.b Phase 2 & 3 Submittal Guideline," Revision 2, December 2006, ADAMS Accession No. ML070090060.

5. NEI 06-12, "B.5.b Phase 2 & 3 Submittal Guideline," Revision 3, September 2009, ADAMS Accession No. ML092890400.

6. NEI 99-04, "Guidelines for Managing NRC Commitment Changes," Revision 0, July 1999, ADAMS Accession No. ML003680088.

7. RIS 2000-017, "Managing Regulatory Commitments Made By Power Reactor Licensees to the NRC Staff," September 2000, ADAMS Accession No. ML091190065.

8. NRC TI 2515/171, "Verification of Site Specific Implementation of B.5.B Phase 2 & 3 Mitigating Strategies," February 6, 2008, ADAMS Accession No. ML073120469.

9. NRC TI 2515/171, Revision 1, "Verification of Site Specific Implementation of B.5.B Phase 2 & 3 Mitigating Strategies," July 25, 2008, ADAMS Accession No. ML081340110.

**PAPERWORK REDUCTION ACT STATEMENT**

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50, 10 CFR Part 51, and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval numbers 3150-0011, 3150-0021, and 3150-0151.

**PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

**SRP Section 19.4**
**Description of Changes**

**Section 19.4 "STRATEGIES AND GUIDANCE TO ADDRESS LOSS OF LARGE AREAS OF THE PLANT DUE TO EXPLOSIONS AND FIRES**

Section 19.4 is a new SRP section not previously included in NUREG-0800. It was developed to provide guidance for applicants to address loss of large areas of the plant due to explosions and fires.

## Appendix A

## Experience Gained from Implementation of Temporary Instruction 2515/171 "Verification of Site Specific Implementation of B.5.b Phase 2 & 3 Mitigating Strategies" at Currently Licensed Power Reactor Sites and Related Staff Positions

1. In November of 2007, the Pressurized Water Reactor (PWR) Owners Group issued recommendations that directly affect three of the PWR strategies that could be used in responding to Beyond Design Basis Events addressed by 10 CFR 50.54(hh)(2). The three strategies are included in NEI 06-12, Revision 3. They are as follows: 1) Manually Depressurize Steam Generator (SG) to Reduce Inventory Loss (Section 3.3.2); 2) Manual Operation of Turbine Driven (or diesel-driven) Auxiliary Feedwater Pump (Section 3.3.3); and 3) Manually Depressurize SGs and Use Portable Pump (Section 3.3.4).

   Staff Position

   Applicants for COLs or operating licenses utilizing a PWR should review the recommendations from the PWR Owners Group, and where applicable, consider them in the development of strategies and guidance. The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

2. As described in the November 2007, PWR Owners Group recommendations, being able to measure SG level at facilities currently operating can be vital to successful implementation of SG strategies, in Sections 3.3.2, 3.3.3, and 3.3.4 of NEI 06-12, Revision 3. The SG level in currently operating PWRs can be measured by using a battery operated differential pressure transmitter calibration device. These devices are relatively small and portable and only need to be connected to the differential transmitter electrical terminals, either locally at the transmitter or at the containment electrical penetration, if the transmitters are located in the containment. The output from the calibration device is multiplied by a calibration factor to give SG level.

   Staff Position

   Applicants for COLs or operating licenses utilizing a design similar to current operating PWRs that adopt strategies in Section 3.3.2, 3.3.3, or 3.3.4 of NEI 06-12, Revision 3, or similar strategies should determine whether or not a portable means of measuring SG level is necessary to provide the controls on degree and rate of SG depressurization or makeup rate necessary for the strategy to be successful, and if so, include SG level measurement part of the strategy. The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

3. The terms "damage footprint" and "target area" are used interchangeably and are not clearly defined in NEI 06-12, Revision 3. There was considerable variation in the interpretation of this definition among current licensees. In addition, the guideline

"approximately 100 yards or more" was not consistently interpreted by current licensees. During inspections at licensed power reactor sites, many licensees expressed their desire for a more comprehensive definition of the "damage footprint" or "target area" and how the 100 yards should be measured.

Staff Position

As a general rule, the 100 yard stand-off distance should be measured from the outside edge of the target area, which in many cases will be the outside wall of a building.

Tools, adapters, test equipment, instruments, and radiation monitoring equipment that are intended to be used for multiple strategies should be stored outside the damage footprint/target area for all strategies. Other tools, adapters, test equipment, instruments, and radiation monitoring equipment that are intended to be used for a specific strategy may be stored in the vicinity of the area where they will be used, or where applicable, left permanently installed on the system being adapted.

4. At some licensed facilities, licensees made minor plant modifications to facilitate implementation of various strategies. These types of modifications include modifying fire hose stations to increase flow rates and decrease implementation times, and installing hose fittings and valves on plant piping to allow simple connection of fire hoses for injection to plant systems, such as containment, hotwell and SGs. The licensees who made these modifications stated that they were relatively inexpensive and, in their engineering judgment, worth the expense. Based on the inspections at 65 sites, the NRC staff concluded that these types of simple modifications significantly decrease the time required to implement strategies and increase the likelihood that these strategies can be implemented successfully.

   Staff Position

   Applicants for COLs or operating licenses should consider incorporating design enhancements or facility modifications to facilitate implementation of strategies when such an enhancement or modification can substantially reduce the time required to implement the strategy. The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

5. Guidance provided in NEI 06-12, Revision 3 states that strategies can be implemented through guidance or procedures, consistent with the user's chosen approach, and that procedural steps are expected to be general in nature, consistent with the need for flexibility of deployment. NRC inspections at licensed power reactor facilities revealed the level of detail and guidance provided in procedures varied considerably between facilities. Some licensees had established high quality, comprehensive procedures with clear guidance for responding to LOLA events. However, at many sites, the guidance was incomplete, erroneous, or inadequate, which called into question the quality of the validation of these procedures or whether verification and validation were performed.

Staff Position

Implementation guidelines for strategies and the level of training on those guidelines will be considered adequate by the NRC if licensee staff members are able to walk through the strategies successfully using those guidelines.

6. During inspections at licensed power reactor facilities, the NRC staff found that some licensees had not established a maintenance program for equipment relied upon to implement strategies. A few licensees did not even test portable pumps required for some strategies. On the other hand, some licensees have established comprehensive maintenance programs which include: monthly surveillance checks, quarterly start and run checks, and annual pump flow tests. The NRC staff has found these programs acceptable.

Staff Position

Equipment relied upon to implement the strategies required by 10 CFR 50.54(hh)(2) should be maintained and periodically tested to ensure it will operate when called upon. Installed plant equipment with established maintenance and testing requirements may not need additional maintenance and testing. However, if these systems are modified to accommodate the strategies (e.g., adding fire hose connections) then licensees should confirm that existing maintenance and testing are adequate. Any new fire pumps, hoses, or nozzles purchased for these strategies should be maintained by licensees.

An adequate program for equipment requiring maintenance will include: periodic surveillance checks, start and run checks, and pump flow tests. Other tools, adaptors, wrenches, jumpers, etc., that do not require maintenance or testing should, at a minimum, be stored in an accessible location and periodically inventoried to ensure that the equipment is available when needed.

The NRC staff recognizes that equipment must be taken out of service for routine maintenance activities for varying periods of time. However, a program which allows equipment needed to implement the strategies required by 10 CFR 50.54(hh)(2) to be out of service for an indefinite period of time is considered to be inconsistent with the requirement to implement strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with LOLAs of the plant due to explosions or fire. Holders of COLs or operating licenses should ensure that reasonable controls on the availability of equipment needed to implement the strategies required by 10 CFR 50.54(hh)(2) are included in their procedures and guidance required by the rule.

7. It is expected that some strategies require connecting portable equipment, such as fire hoses or electrical devices that may not have been connected or tested in the configuration proposed for the strategy. They might also require connections between onsite and offsite (e.g., fire departments) equipment that have not been verified. At several licensed power reactor sites, NRC inspectors found incompatible fittings that would have prevented or delayed implementation of the strategy.

Staff Position

For procedures that involve connecting various pieces of equipment with fittings, adapters, jumpers or other types of connectors, the application should have a commitment for the licensee to confirm by engineering evaluation or a demonstration that (1) hoses can be connected to each other and to pumps, adapters, and fittings, (2) electrical cables, connectors, and jumpers are compatible; and, (3) fire hoses and nozzles can be attached to lifting devices and/or secured in place as needed.

8. NEI 06-12, Revision 3 requires that many strategies have an engineering basis that provides reasonable assurance that the intended makeup rate and capacities can be provided. NEI 06-12, Revision 3 also states that this basis should be auditable, but not necessarily based on a quality-related calculation. Licensees for currently operating plants used a number of different methods for establishing an engineering basis for these strategies including engineering handbooks and computer models. The NRC staff found that all of these methods were acceptable for establishing an engineering basis. However, at many sites, the NRC inspectors found errors in implementing these methods. Some licensees failed to address system piping losses, elevation losses or nozzle operating pressure requirements in their calculations. For example, at one site, the licensee's calculation for the containment flooding strategy failed to take into account the friction losses of the plant piping system, which included at least thirty-nine 90 degree elbows, seven 45 degree elbows, and 200 feet of 2.5 inch diameter piping. As a consequence, this strategy would not have provided the required 300 gpm. Some licensees chose to assume that a strategy would provide the required flow, but had not provided an auditable or documented engineering basis for this assumption. For example, at one site, the licensee assumed that providing 500 gpm flow for the SFP external makeup strategy was the worst case for pumping with the portable pump. The licensee had not done calculations for the other reactor and containment strategies that use the portable pump and may be more limiting. At another site, the licensee did not take into account the 50 psig pressure required to open the Target Rock safety relief valves when calculating flow for the reactor pressure vessel injection strategy.

Staff Position

The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee. When the technical bases for strategies and implementing procedures are developed, they should follow engineering practice and proper implementation of that practice. The quality of calculations and analyses performed by applicants in the development of strategies or by licensees during development of implementing procedures should be assured to a reasonable level. However, the level of quality required by 10 CFR Part 50, Appendix B, is not necessary.

9. During system walk downs by NRC inspectors at licensed power reactor sites, the inspectors noted that many licensees had not clearly labeled or tagged plant equipment, such as valves, flanged and threaded connection points, electrical circuit breakers, instruments, and instrument connection points that would be used to implement the strategies. Many licensees relied on existing tags, or if the tags were missing, they relied on the operator to use plant piping and instrumentation drawings. Some of this plant

equipment was not used during normal plant operation, and therefore, operators were not familiar with its location.

Staff Position

Applicants for COLs or operating licenses should establish measures to ensure that personnel responsible for implementing mitigation strategies following a LOLA event can locate the equipment needed to implement these strategies in a timely manner during an emergency. Labeling or tagging all applicable equipment with distinctive and reflective tags is an acceptable measure.

10. NRC inspectors noted many instances where inadequacies in procedures, limited training or oversights in engineering analyses, resulted in the plant operations staff being unable to successfully perform a walkthrough of a strategy. In one case, operators were unable to figure out which hoses should be used and where they should be connected. At several sites, the procedure did not instruct the removal of existing nozzles as assumed by the engineering flow calculation. These types of inadequacies could have been identified if the licensee had performed a thorough validation of each strategy.

Staff Position

Applicants for COLs or operating licenses should include a commitment for the licensee to verify the adequacy of the procedures, training and engineering bases for each mitigating strategy by performing a walkthrough or other type of exercise of the strategy. A walkthrough should include all steps of the procedure, either by actual performance or by simulation where considerations of personnel safety, operational restrictions, technical specifications, or other license conditions would prohibit the actual performance of the step.

11. During implementation of mitigation strategies at licensed power reactor facilities, many licensees did not understand that two external SFP spray strategies are required per NEI 06-12. One is “local spray” from the area surrounding the SFP and the other is “elevated spray” from other locations, such as from the ground or surrounding buildings. Some licensees failed to establish a “local spray” and others failed to establish an “elevated spray.” Some licensees who failed to establish an “elevated spray” strategy assumed that the portable spray strategies for reactors and containments, i.e., strategies in Sections 3.3.7 and 3.4.10 in NEI 06-12, were sufficient to replace the SFP “elevated spray.” The “portable spray” strategies and the “elevated spray” strategies have different requirements and different purposes.

Staff Position

The NRC staff expects that most, if not all, applicants will choose to implement the spray strategies described in Section 4.2.2 of NEI 06-12, Revision 3, which involve the use of multiple standpipes diversely located around the SFP and hard-piped to an external fire hose connection on the outside of the building. Those applicants that do not choose this approach and follow the approach taken by current operating plants described in Section 2.3.2 of NEI 06-12, Revision 3 must address “local spray” from the area

surrounding the SFP and “elevated spray” from other locations such as from the ground or surrounding buildings.

12. NEI 06-12, Revision 3 states that users must assure that 200 gpm of spray flow reaches the SFP and that the entire SFP is covered. During inspections, the NRC staff questioned how licensees had determined that 200 gpm was reaching the SFP and how they could be assured that the entire SFP was covered. Some licensees had performed tests to determine if they could spray an area the size of the SFP, but none had actually calculated or measured the spray flow to determine if 200 gpm had reached the SFP. At one site, the licensee had assumed that a flow rate of 218 gpm from the nozzle would be adequate to assure 200 gpm had reached the SFP, but they had no basis for that judgment.

Staff Position

The spray flow rate of 200 gpm (400 gpm for dual unit pools) for the local spray strategy is based on SFP designs at licensed Part 50 power reactor facilities. Applicants for COLs or operating licenses should justify applying such a flow rate to their pools and also justify the assumption that the complete pool is covered. The strategies should be described in the application in a manner consistent with guidance in Appendix D of NEI 06-12, Revision 3 and subsequently implemented in the site procedures by the licensee.

Elevated spray strategies should have the same nozzle flow as the local strategy and the spray should be able to reach the intended elevation of the SFP. However, since the spraying may be done through holes in the walls or roof surrounding the SFP, it is not necessary to demonstrate that the entire SFP can be sprayed.

13. NEI 06-12, Revision 3 provides different time requirements for implementation of SFP external spray strategy depending on whether fuel is stored in a dispersed or non-dispersed condition in the pool, but does not define those conditions.

Staff Position

The NRC staff considers that fuel dispersal exists when permanently discharged fuel is arranged in the defined 1 x 4 pattern, i.e., one recently discharged fuel assembly surrounded by four non-recently discharged assemblies with one on each face and without recently discharged assemblies at the corners. This guidance is consistent with guidance issued to current reactor licensees on February 25, 2005.

14 Paragraph 3.2.1 in NEI 06-12, Revision 3 describes the basic assumptions for developing the extensive damage mitigation guidelines (EDMG). One assumption is that all ac and dc power required for operation of plant systems (i.e., both Class 1E and Non-class 1E sources) is lost. This is similar to the definition for loss of internal power distribution for most PWR and BWR strategies, which require implementation without any offsite or onsite ac or dc power. Another assumption is that other onsite control rooms and personnel in separated buildings are unaffected by the damage. At one licensed power reactor site, the Unit 1 and Unit 2 control rooms are in widely separated control buildings (much greater than 100 yards). For this site, the licensee assumed that if one control room survived, it would also be reasonable to assume that the Class 1E power located in that same control

building could also be expected to survive. The licensee also assumed that the damaged control unit would be expected to lose all onsite electrical power and both units would lose all offsite power. NEI 06-12 does not specifically address this possibility. At this particular site, the control buildings are very widely separated, and therefore, the NRC inspectors concluded that the licensees approach was reasonable for this site.

Staff Position

For purposes of developing EDMGs, the developer may assume that buildings containing the control room and Class 1E vital electrical equipment (batteries, diesels, switchgear, etc.) at least 100 yards apart have adequate spatial separation. This 100 yard separation is measured from the outer wall or perimeter of the buildings (not the centerline of the building).

When developing EDMGs for multi-unit sites that have control rooms and vital Class 1E electric power equipment in control buildings that have adequate spatial separation, the developer may assume that one control building will survive and the vital Class 1E electrical power in the undamaged control building will also survive.