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, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," with new requirements (74 FR 13926; March 27, 2009) to address loss of large areas (LOLAs) of the plant due to explosions or fire. 10 CFR 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. 10 CFR 50.34(i) and 10 CFR 52.80(d) require an applicant to submit a description and plans for implementation of the 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 10 CFR 50.54(hh)(2), as part of the application for an operating license under 10 CFR Part 50 or a combined license (COL) under 10 CFR Part 52.

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1. Specifically, 10 CFR 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) Firefighting;

   (ii) Operations to mitigate fuel damage; and

   (iii) Actions to minimize radiological release.

   The requirements in 10 CFR 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 (NRC, 2002).

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
- Review of containment under SRP Section 6.2
- Review of spent fuel pool cooling under SRP Section 9.1.3
- Review of fire protection under SRP Section 9.5.1
- Review of communications under SRP Section 9.5.2
- Review of conduct of operations under SRP Section 13

II. ACCEPTANCE CRITERIA

Requirements

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

10 CFR 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.

10 CFR 50.34(i) and 10 CFR 52.80(d) require an operating license applicant and a COL applicant, respectively, 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 10 CFR 50.54(hh)(2).

Staff Position on NEI Guidance

The NRC staff considers conformance with guidance issued on February 25, 2005 (NRC, 2005), TI 2515/168 (NRC, 2006b), and NEI 06-12, "B.5.b, Phase 2 & 3 Submittal Guideline," Revision 2 (NEI, 2006), 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 (NEI, 2009) 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:

a. Section 4.2.1 of NEI 06-12, Revision 3 states that new nuclear power plants (NPPs) should address the Phase 1[1] issues as current power reactor licensees have done by implementing guidance issued by the NRC on February 25, 2005. However, additional clarifying information documented in Sections 05.02(c) and 05.02(d) of NRC TI 2515/168 was disseminated to 10 CFR 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.

b. 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 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

[1] 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).

containment capabilities, and preparing plans for future implementation of the guidance and strategies.

These chapters of NEI 06-12, Revision 3 have not been updated from Revision 2 to address the improvements in 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. This experience has been incorporated within the Acceptance Criteria of this SRP section. Holders of COLs or operating licenses should ensure that the strategies and guidance are translated into operating guidelines that reflect this experience.

c. The guideline "approximately 100 yards or more" from a target area was not consistently interpreted by current licensees. 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 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.

d. 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. 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.

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 and describe 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. License Conditions and Implementation Schedule

The reviewer should verify that a license condition related to 10 CFR 50.54(hh)(2) is included that addresses (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 should be maintained until

certifications required under 10 CFR 50.82(a) or 10 CFR 52.110(a)(1) have been submitted.

2. License Commitments

The reviewer should verify that applicants 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. 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.

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. 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.

3. Steam Generator Level

The reviewer should verify that for applicants utilizing a nuclear power plant design similar to current operating pressurized water reactors (PWRs) that have adopted 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 steam generator (SG) level is necessary for the strategy to be successful. If so, portable SG level measurement should be included as part of the strategy. The portable means of measuring SG level should provide information on the degree and rate of SG depressurization or makeup rate. 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.

4. Staging of Fire Brigade Equipment

The reviewer should verify that 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. 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 should subsequently be implemented in the site guidelines by the licensee.

5. Dispersal of Personnel

The reviewer should verify that the applicant has provided a description of the pre-planned positioning of personnel if advance warning is given. 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.

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 firefighting equipment (e.g., turnout gear, radios) as identified in Item 4 above. 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.

Operations and support staff members should be 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.

6. Airlifted Resources

The reviewer should verify that the applicant has described the use of any airlifted resources that may be available. A 2-hour total response criterion (2 hours from door to door) should 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.

7. Command and Control

The reviewer should verify that the applicant has described the command and control structure that will be used for a LOLA event. 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 should 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 should 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.

8. Evaluating Capabilities of Offsite Resources

The reviewer should verify that the applicant describes 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 a LOLA event. 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 Item 5, above and item 10 below, 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.

9. Evaluation of Memoranda of Understanding for Offsite Resources

The reviewer should verify that the applicant describes the MOUs and/or agreements with local offsite response organizations. The 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 7 above, 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.

10. Coordination with Regional Resources

The reviewer should verify that the applicant describes what ground based regional resources are available. A 2-hour total response criterion (2 hours from door to door) should be used 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.

11. Controlling Emergency Response Vehicles and Dosimetry for Responders

The reviewer should verify that the applicant describes the areas that will be used for staging large numbers of responding vehicles and that sufficient dosimetry is available for initial arriving offsite personnel. Staging areas should be established and documented in guidelines for responding vehicles (fire, emergency medical, law enforcement, plant personnel, etc.). Provisions should be made with local law enforcement agencies to ensure that responding vehicles 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.

12. Communications Equipment

The reviewer should verify that the applicant describes the communications equipment used for firefighting and operational recovery. For firefighting communications, the focus is on radios for firefighting response. The issue of interoperability[2] of radios should 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) should be provided in a location at least 100 yards from target areas.

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

For operational recovery, 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) should be provided in a location at least 100 yards from target areas. A communications scheme, using multiple radio channels, should be established to minimize crosstalk and confusion during an event. Radios used for firefighting and operational recovery 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 shared. Credit should be given to mitigation strategies that provide for augmentation of radios from offsite resources. 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.

13. Mass Casualties

The reviewer should verify that the applicant has described the procedures for handling a mass casualty situation. The procedures for 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.

14. Triage Areas

The reviewer should verify that the applicant has described the location of triage areas. The 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.

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 choose 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.

15. Firefighting Training and Exercises

The reviewer should verify that the applicant has described the training that will be given to the fire brigade and off site responders to assist them in handling fires that may be caused by a LOLA event. 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.

16. Means for Feeding the Fire Protection Ring Header

The reviewer should verify that the applicant has described 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. The means should be documented in site guidelines. 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.

17. Boiling Water Reactor: Containment Venting and Vessel Flooding

The reviewer should verify that for the applicable power plant designs, guidelines are developed for venting primary containment to secondary containment (or to the 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.

18. Use of Plant Equipment During Loss of Power Situations

The reviewer should verify that the applicant describes the procedures to start any backup electrical device without direct current (dc) power, describes the procedures to start non-alternating current (ac) powered pumps used for decay heat removal without dc power, and describes the 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.

19. Compartmentalization

The reviewer should verify that the applicant describes the procedures to be used for doing an analysis or walk down of the plant with the primary consideration of limiting accelerant fluid flow. An analysis or walk down of target areas should be performed with a LOLA event in mind and the results should 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.

20. SFP Mitigative Measures

The reviewer should verify that the applicant describes the orientation of spent fuel in the SFP. Spent fuel should be put in a 1 x 4 repeating pattern, as described in NRC (2005). 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 10 CFR 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 (NRC, 2005) should 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 10 CFR 52.80(d) and 10 CFR 50.34(i).

The reviewer should verify that the applicant indicates that freshly discharged fuel[3] will not be 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.

The reviewer should verify that the applicant indicates that, a contiguous area will be established in the SFP and procedures will 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.

Applicants should assure that 200 gpm of spray flow reaches the SFP and that the entire SFP is covered. 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. 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.

The applicant should develop procedures/guidance to enhance air cooling of fuel in the SFP, in the event spray cooling cannot be established. This can be accomplished by promoting passive ventilation of the bulk air space above the pool with the environs (e.g., opening doorways or blowout panels, etc.

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.

21. Training

The reviewer should verify that the applicant describes how training (preferably classroom training) will be incorporated into the licensee's initial licensed operator training program as well as their licensed operator requalification program. The frequency of training on LOLA procedures and strategies should be 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

[3] 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.

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.

22. Water Spray Scrubbing and Runoff

The reviewer should verify that the applicant describe the procedures or guidance for 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. 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. 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.

23. Maintenance and Testing

The reviewer should verify that the applicant describes how equipment relied upon to implement the strategies required by 10 CFR 50.54(hh)(2) will 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 should 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.

24. Extensive Damage Mitigation Guidelines

The plan should contain Extensive Damage Mitigation Guidelines (EDMGs). 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.

Technical Rationale

1. 10 CFR 50.54(hh)(2) states that 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 10 CFR 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. 10 CFR 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 10 CFR 50.54(hh)(2).

3. 10 CFR 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 10 CFR 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 other NRC approvals (e.g., 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.

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 10 CFR 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. Nuclear Energy Institute, "B.5.b Phase 2 & 3 Submittal Guideline," NEI 06-12, Revision 2, December 2006, ADAMS Accession No. ML070090060.

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

3. U.S. Nuclear Regulatory Commission, Order Modifying Licenses (Effective Immediately), Samuel J. Collins (NRC), EA-02-026, February 25, 2002. (Safeguards Information (SGI))

4. U.S. Nuclear Regulatory Commission, "NRC Staff Guidance for Use in Achieving Satisfactory Compliance with February 25, 2002, Order Section B.5.b," Letter from James

E. Dyer (NRC) to Holders of Licenses for Operating Power Reactors, February 25, 2005. (SGI)

5. U.S. Nuclear Regulatory Commission, “B.5.b Phase 1 Issues Regarding Spent Fuel Dispersal,” Letter from James E. Dyer (NRC) to Nuclear Energy Institute, March 16, 2006a, ADAMS Accession No. ML060690339.

6. U.S. Nuclear Regulatory Commission, "Closeout Inspection of Nuclear Reactor Safeguards Interim Compensatory Measures - Section B.5.b Plant Mitigating Strategies to Address Loss of Large Areas of the Plant due to Explosion or Fire," TI 2515/168, May 2006b (SGI) ADAMS Accession No. ML092890400.

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

Standard Review Plan, Section 19.4 is a new 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.