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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

NRC GENERIC LETTER 2005-XX: GRID RELIABILITY AND THE IMPACT ON PLANT RISK AND THE OPERABILITY OF OFFSITE POWER

ADDRESSEES

All holders of operating licenses for nuclear power reactors except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

PURPOSE

To determine if compliance is being maintained with U.S. Nuclear Regulatory Commission (NRC) regulatory requirements governing electric power sources and associated personnel training for your plant, the NRC is issuing this generic letter (GL) to obtain information from its licensees in four areas:

(1) use of protocols between the nuclear power plant (NPP) and the transmission system operator (TSO), independent system operator (ISO), or reliability coordinator/authority (RC/RA) and the use of real-time contingency analysis (RTCA)[1] software or an equivalent state-of-the-art software program by TSOs to assist NPPs in monitoring grid conditions to determine the operability of offsite power systems under plant technical specifications. (The TSO, ISO, or RA/RC is responsible for preserving the reliability of the local transmission system. In this GL the term TSO is used to denote these entities);

(2) use of NPP/TSO protocols and RTCA programs by TSOs to assist NPPs in monitoring grid conditions for consideration in maintenance risk assessments;

(3) offsite power restoration procedures in accordance with Section 2 of NRC Regulatory Guide (RG) 1.155, “Station Blackout;” and

(4) losses of offsite power caused by grid failures at a frequency equal to or greater than once in 20 site-years in accordance with RG 1.155.

Enclosure 1

[1] In this GL, the RTCA includes equivalent state-of-the-art programs

Pursuant to 10 CFR 50.54(f), addressees are required to submit a written response to this GL.

BACKGROUND

Based on information obtained from inspections and risk insights developed by an internal NRC expert panel (further described below), the staff is concerned that several conditions associated with assurance of grid reliability may impact public health and safety and/or compliance with applicable regulations. These conditions include use of long-term periodic grid studies and informal communication arrangements to monitor real-time grid operability, potential shortcomings in grid reliability evaluations performed as part of maintenance risk assessments, lack of preestablished arrangements identifying local grid power sources and transmission paths, and potential elimination of grid events from operating experience and training. The staff identified these issues as a result of considering the August 14, 2003, blackout event.

On August 14, 2003, the largest power outage in U.S. history occurred in the Northeastern United States and parts of Canada. Nine U.S. nuclear power plants (NPPs) tripped. Eight of these lost offsite power, along with one NPP that was already shut down. The length of time until power was available to the switchyard ranged from approximately one hour to six and one half hours. Although the onsite emergency diesel generators (EDGs) functioned to maintain safe shutdown conditions, this event was significant in terms of the number of plants affected and the duration of the power outage.

The loss of all alternating current (AC) power to the essential and nonessential switchgear buses at a NPP involves the simultaneous loss of offsite power (LOOP), turbine trip, and the loss of the onsite emergency power supplies (typically EDGs). Such an event is referred to as a station blackout (SBO). Risk analyses performed for NPPs indicate that the SBO can be a significant contributor to the core damage frequency. Although NPPs are designed to cope with a LOOP event through the use of onsite power supplies, LOOP events are considered precursors to SBO. An increase in the frequency or duration of LOOP events increases the probability of core damage.

The NRC issued a regulatory issue summary (RIS 2004-5, "Grid Operability and the Impact on Plant Risk and the Operability of Offsite Power," dated April 15, 2004) to advise NPP addressees of the requirements in Section 50.65 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.65), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants;" 10 CFR 50.63, "Loss of all alternating current power;" 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17,[2] "Electric power systems;" and plant technical specifications on operability of offsite power. In addition, the NRC issued Temporary Instruction (TI) 2515/156, "Offsite Power System Operational Readiness," dated April 29, 2004, and TI 2515/163, "Operational Readiness of Offsite Power," dated May 05, 2005, which instructed the regional offices to perform followup inspections at plant sites on the issues identified in the RIS.

[2] In this GL, GDC 17 includes equivalent plant specific principal design criteria.

The NRC needs additional information from its licensees in the four areas identified above in order to determine if regulatory compliance is being maintained.

On April 26, 2005, the Commission was briefed on grid stability and offsite power issues by a stakeholder panel that included representatives of the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Council (NERC), the National Association of Regulatory Utilities Commissioners, PJM Interconnection (one of the country's largest transmission system operators), a FirstEnergy Corporation executive representing the Nuclear Energy Institute, and the NRC staff. In light of this briefing, the Commission issued a staff requirements memorandum (SRM) dated May 19, 2005, in which the Commission directed the staff to review NRC programs related to operator examination and training and ensure that these programs adequately capture the importance of grid conditions and offsite power issues to the design, assessment, and safe operation of the plant, including appropriate interactions with grid operators. The SRM further directed the staff to determine whether the operator licensing program needs to be revised to incorporate additional guidance on grid reliability.

DISCUSSION

Use of protocols between the NPP and the TSO, ISO, or RC/RA and the use of RTCA software programs by TSOs to assist NPP in monitoring grid conditions to determine the operability of offsite power systems under plant technical specifications (TS)

A licensee's ability to comply with TS for offsite power may depend on grid conditions and plant status; in particular, maintenance on, and degraded conditions of, key elements of the plant switchyard and offsite power grid can affect the operability of the offsite power system, especially during times of high grid load and high grid stress. A communication interface with the plant's TSO, together with training and other local means to maintain NPP operator awareness of changes in the plant switchyard and offsite power grid, is important to enable the licensee to determine the effects of these changes on the operability of the offsite power system. The staff found a good deal of variability in the TI 2515/156 and TI 2515/163 responses on the use of these NPP/TSO communication protocols. Some licensees apparently rely on informal NPP/TSO communication arrangements and long-term grid studies without real-time control of operation to within the limits of the studies to assure offsite power operability. However, the staff also learned that most TSOs serving NPP sites now have, or will shortly have, RTCA software programs.

The RTCAs give the TSO the capability to determine the impact of the loss or unavailability of various transmission system elements (called contingencies) on the condition of the transmission system. The transmission systems can generally cope with several contingencies without undue impairment of grid reliability, but it is important that the NPP operator know when the transmission system near the NPP can no longer sustain NPP voltage based on the TSO's analysis of a reasonable number of contingencies. This knowledge helps the operator understand the general condition of the NPP offsite power system. To satisfy the maintenance

rule, the NPP operator should know the grid's condition before taking a risk-significant piece of equipment out of service, and should monitor it for as long as the equipment remains out of service.

It is especially important that the NPP operator know when the trip of the NPP will result in LOOP to the plant. As stated earlier, a reduction in NPP switchyard voltage due to a trip is the main cause of a LOOP event. It is important to understand that the transmission systems can generally tolerate voltages lower than required by plant TS for NPP system, structures and components (SSC) operability. As a result, the TSO will not necessarily keep the transmission system voltage above the level needed for the NPP unless the TSO has been informed of the needed voltage level and agreements have been formalized to maintain the voltage level. It was not always clear from the data collected in accordance with TI 2515/156 whether the TSO would notify the NPP of inadequate transmission system contingency voltages or inadequate voltages required for the NPP SSC operability.

Inadequate NPP contingency post-trip switchyard voltages will result in TS inoperability of the NPP offsite power system due to actuation of NPP degraded voltage protection circuits during certain events that result in an NPP trip. NPPs of certain designs have occasionally experienced other inoperabilities in these circumstances (e.g., overloaded EDGs or loss of certain safety features due to interaction with circuit breaker logic). Safety-related motors may also be started more than once under these circumstances, which could result in operation outside the motors' specifications and actuation of overload protection. Unavailability of plant-controlled equipment such as voltage regulators, transformer auto tap changers, and generator automatic voltage regulation can contribute to the more frequent occurrence of inadequate NPP post-trip voltages.

The RTCA programs in use by the TSOs, together with properly implemented NPP/TSO communication protocols and training, can keep NPP operators better informed about conditions affecting the NPP offsite power system. However, the RTCA programs are not always available to the TSO. This was the case during the period leading up to the August 14, 2003, blackout; and events have shown that the data used in the programs sometimes do not represent actual conditions and capabilities. These shortcomings have been offset to some degree by notification of RTCA unavailability to NPP operators. The NPP operators then perform operability determinations to assess post-trip switchyard voltages following inadvertent NPP trips.

Use of NPP/TSO protocols and RTCA programs by TSOs to assist NPPs in monitoring grid conditions for consideration in maintenance risk assessments

As discussed above (when warranted by worsening grid conditions, etc.), grid reliability evaluations should be performed as part of the maintenance risk assessment required by 10 CFR 50.65 (or in any reassessment.) To perform meaningful and comprehensive grid reliability evaluations (or reevaluations as appropriate), it is essential that the NPP communicate with the TSO before, and periodically for the duration of, grid-risk-sensitive maintenance activities. The communication between the NPP and its TSO should enable the NPP operator to obtain up-to-date information on existing and projected grid reliability for use in maintaining a current and valid maintenance risk assessment and in managing possibly changing risk.

The communication with the TSO should include whether a loss of the NPP's electrical output could impact the local grid, as do two of the three types of grid-risk-sensitive maintenance (activities that increase the likelihood of (1) a plant trip and (2) a LOOP).

With regard to risk management, an internal NRC expert panel convened to obtain short-term, grid-related risk insights found that it is important to have effective NPP configuration risk management (including the maintenance risk management required by Section 50.65(a)(4)) when grid reliability is degraded or threatened. In particular, a potentially significant increase in NPP risk may occur if equipment required to prevent and mitigate station blackout is unavailable when the grid is degraded. Recent NRC studies have found that since 1997, LOOP events have occurred more frequently during the summer (May through October) than before 1997, that the probability of a LOOP event due to a reactor trip has also increased during the summer months, and the durations of LOOP events have generally increased. The staff is concerned about extended maintenance activities scheduled for equipment required to prevent and mitigate station blackout during these months, especially in areas of the country that experience a high level of grid stress.

The staff found a good deal of variability in the data collected in accordance with TI 2515/156 and TI 2515/163 regarding grid reliability evaluations performed when warranted as discussed above, as part of the maintenance risk assessment required by 10 CFR 50.65. Some licensees communicate routinely with their TSOs once per shift to determine grid conditions, while others rely solely on the TSOs to inform them of deteriorating grid conditions and do not inquire about grid conditions before performing grid-risk-sensitive maintenance activities. Some licensees do not consider the NPP post-trip switchyard voltages in their evaluations, and some do not coordinate grid-risk-sensitive maintenance with their TSOs. The NPP/TSO communication protocol is a useful tool for obtaining the information necessary for the grid reliability evaluations that should be performed, when warranted, as discussed above, as part of the maintenance risk assessment required by 10 CFR 50.65. The protocol is also useful in effectively implementing the guidance in the 2000 revision of Section 11 of NUMARC 93-01, Rev. 2, on reassessing plant risk in light of emergent conditions. As discussed under the previous topic, the RTCAs available to most TSOs give them the capability to determine the impact of various transmission system contingencies on the condition of the transmission system. It is important that the NPP operator know when the transmission system near the NPP cannot sustain a reasonable level of contingencies. In summary, the NPP operator should know and stay informed of the general condition of the NPP offsite power system and be adequately trained to assess and manage risk under the Maintenance Rule before performing and for the duration of grid-risk-sensitive maintenance activities (i.e., activities that could increase risk under degraded grid reliability conditions).

Offsite power restoration procedures in accordance with Section 2 of RG 1.155

LOOP events can also have numerous unpredictable initiators such as natural events, potential adversaries, human error, or design problems. Pursuant to 10 CFR 50.63, "Loss of all alternating current power," the NRC requires that each NPP licensed to operate be able to withstand an SBO for a specified duration and recover from the SBO. NRC RG 1.155 provides NRC guidance for licensees on developing their approaches for complying with 10 CFR 50.63. Section 2 of RG 1.155 provides guidance on the procedures necessary to restore offsite power,

including losses following "grid undervoltage and collapse." Section 2 states: "Procedures should include the actions necessary to restore offsite power and use nearby power sources when offsite power is unavailable."

Preestablished agreements between NPP and TSOs that identify local power sources and transmission paths that could be made available to resupply NPPs following a LOOP event and NPP operator training help to minimize the durations of LOOP events, especially unpredictable LOOP events. Discussions with NPP licensees indicate that some licensees do not have such agreements in place, but instead only attempt restoration of their EDGs following a potential SBO. RIS 2004-05 states that NPPs should have procedures available consistent with the guidance in Section 2 of RG 1.155 for restoration of offsite power following a LOOP or SBO event.

Losses of offsite power caused by grid failures at a frequency equal to or greater than once in 20 site-years in accordance with RG 1.155

The data collected in accordance with TI2515/156 indicate that grid failures that caused total loss of offsite power at some nuclear power plants have occurred since the nuclear power plants were initially analyzed in accordance with the criteria in RG 1.155. The staff is concerned that these nuclear power plants have not been reanalyzed to determine whether their SBO coping durations have remained consistent with the guidance in RG 1.155 after these LOOP events. The staff is also concerned that some plants may be inappropriately eliminating some of these grid events from their operating experience database.

Thus, power reactor licensees may depend on information obtained from their TSOs to make operability determinations for TS compliance, to perform risk assessments under the Maintenance Rule, and to assure compliance with the SBO Rule. Accordingly, the NRC staff is requesting information on such matters from addressees.

However, the NRC staff has not identified any corrective actions that might be warranted.

APPLICABLE REGULATORY REQUIREMENTS

GDC 17 and plant TSs

For NPPs licensed in accordance with the GDC in Appendix A to 10 CFR Part 50, the design criteria for onsite and offsite electrical power systems are provided in GDC 17. For NPPs not licensed in accordance with the GDC in Appendix A, the applicable design criteria are provided in the updated final safety analysis report (UFSAR). These reports set forth criteria similar to GDC 17, which requires, among other things, that an offsite electric power system be provided to permit the functioning of certain SSCs important to safety in the event of anticipated operational occurrences and postulated accidents.

The transmission network (grid) is the source of power to the offsite power system. The final paragraph of GDC 17 requires, in part, provisions to minimize the probability of the loss of

power from the transmission network given a loss of the power generated by the nuclear power unit(s). The loss of the power generated by the nuclear power unit (trip) is an anticipated operational occurrence. The offsite power circuits must therefore be designed to be available following a trip of the unit(s) to permit the functioning of SSCs necessary to respond to the event.

The trip of an NPP can affect the grid so as to result in a LOOP. Foremost among such effects is a reduction in the plant's switchyard voltage as a result of the loss of the reactive power supply to the grid from the NPP's generator. If the voltage is low enough, the plant's degraded voltage protection could actuate and separate the plant safety buses from offsite power. Less likely results of the trip of a nuclear plant are grid instability, potential grid collapse, and subsequent LOOP due to the loss of the real and/or reactive power support supplied to the grid from the plant's generator.

In general, plant TSs require the offsite power system to be operable as part of the limiting condition for operation and specify actions to be taken when the offsite power system is not operable. Plant operators should therefore be aware of (1) the capability of the offsite power system to supply power, as specified by TS, during operation and (2) situations that can result in a LOOP following a trip of the plant. If the offsite power system is not capable of providing the requisite power in either situation, the system should be declared inoperable and pertinent plant TS provisions followed.

10 CFR 50.65

Section 50.65(a)(4) requires that licensees assess and manage the increase in risk that may result from proposed maintenance activities before performing the maintenance activities. These activities include, but are not limited to, surveillances, post-maintenance testing, and corrective and preventive maintenance. The scope of the assessment may be limited to SSCs that a risk-informed evaluation process has shown to be significant to public health and safety.

In NRC RG 1.182, the NRC endorsed the February 22, 2000, revision to Section 11 of NUMARC 93-01, Revision 2, as providing acceptable methods for meeting 10 CFR 50.65(a)(4). (The revised Section 11 was later incorporated into Revision 3 of NUMARC 93-01.) The revised Section 11 addressed grid stability and offsite power availability in several areas. Section 11.3.2.8 states that:

> emergent conditions may result in the need for action prior to conduct of the assessment, or could change the conditions of a previously performed assessment. Examples include plant configuration or mode changes, additional SSCs out of service due to failures, or *significant changes in external conditions (weather, offsite power availability)* [emphasis added].

Additionally, Section 11.3.4 states that "the assessment for removal from service of a single SSC for the planned amount of time may be limited to the consideration of *unusual external conditions that are present or imminent (e.g., severe weather, offsite power instability*)"

[emphasis added].

Accordingly, licensees should perform grid reliability evaluations as part of the maintenance risk assessment required by 10 CFR 50.65 before performing "grid-risk-sensitive" maintenance activities (such as surveillances, post-maintenance testing, and preventive and corrective maintenance). Such activities are those which could increase risk under existing or imminent degraded grid reliability conditions, including (1) conditions that could increase the likelihood of a plant trip, (2) conditions that could increase the likelihood of LOOP or SBO, and (3) conditions impacting the plant's ability to cope with a LOOP or SBO, such as out-of-service risk-significant equipment (e.g., an EDG, a battery, a steam-driven pump, an alternate AC power source, etc.). The likelihood of LOOP and SBO should be considered in the maintenance risk assessment, whether quantitatively or qualitatively. If the grid reliability evaluation indicates that degraded grid reliability conditions may exist during maintenance activities, the licensee should consider rescheduling any grid-risk-sensitive maintenance activities (i.e., activities that tend to increase the likelihood of a plant trip, increase LOOP frequency, or reduce the capability to cope with a LOOP or SBO). If there is some overriding need to perform grid-risk-sensitive maintenance activities under existing or imminent conditions of degraded grid reliability, the licensee should consider alternate equipment protection measures and compensatory actions to manage the risk.

With regard to conditions that emerge during a maintenance activity in progress, Section 11.3.2.8 in the 2000 revision to Section 11 of NUMARC 93-01 states that emergent conditions could change the conditions of a previously performed risk assessment. Offsite power availability is one example given of an emergent condition that could change the conditions of a previously performed risk assessment. Licensees should reassess the plant risk in view of an emergent condition that affects an existing maintenance risk assessment, except as discussed below, and should take a worsening grid condition into account when doing so. However, as discussed in the Statements of Consideration for 10 CFR 50.65(a)(4) and also in the associated industry guidance (revised Section 11 of NUMARC 93-01), this reassessment of the risk should not interfere with or delay measures to place and maintain the plant in a safe condition, in general, or in response to or preparation for the worsening grid conditions. Note also that as discussed in the Statements of Consideration for 10 CFR 50.65(a)(4) and also in the associated industry guidance (revised Section 11 of NUMARC 93-01, Revision 3), if the emergent condition (including degrading grid reliability) is corrected (or ceases to exist) before the risk reassessment is completed, the reassessment need not be completed.

10 CFR 50.63

Pursuant to 10 CFR 50.63, "Loss of all alternating current power," the NRC requires that each NPP licensed to operate be able to withstand an SBO for a specified duration and recover from the SBO. NRC RG 1.155 provides guidance for licensees to use in developing their approach for complying with 10 CFR 50.63. A series of tables in the RG define a set of pertinent plant and plant site parameters that have been found to affect the likelihood of a plant experiencing an SBO event of a given duration. Using the tables allows a licensee to determine a plant's relative vulnerability to SBO events of a given duration and identify an acceptable minimum SBO coping duration for the plant.

With regard to grid-related losses of offsite power, Table 4 in RG 1.155 indicates that the following plant sites should be assigned to Offsite Power Design Characteristic Group P3:

> Sites that expect to experience a total loss of offsite power caused by grid failures at a frequency equal to or greater than once in 20 site-years, unless the site has procedures to recover AC power from reliable alternative (nonemergency) AC power sources within approximately one-half hour following a grid failure.

The majority of U.S. NPPs fall into the four hour minimum coping capability category set forth in RG 1.155. However, Table 2 in RG 1.155 indicates that a typical plant with two redundant EDGs per nuclear unit should have at least an eight hour minimum coping duration if it falls into the P3 group. Therefore, plants that have experienced a grid-related LOOP that were evaluated in accordance with the SBO guidance in RG 1.155 may no longer be consistent with that guidance.

Section 2 of RG 1.155 provides guidance on the procedures necessary to restore offsite power, including losses following "grid undervoltage and collapse." Section 2 states: "Procedures should include the actions necessary to restore offsite power and use nearby power sources when offsite power is unavailable." These procedures are a necessary element in minimizing LOOP durations following a LOOP or SBO event.

10 CFR 55.59 and 10 CFR 50.120

Pursuant to 10 CFR 55.59(c)(2), operator requalification programs must include preplanned lectures on a regular basis throughout the license period in areas where operator and senior operator written examinations and facility operating experience indicate that more scope and depth of coverage is needed in the following subjects:

(i) Theory and principles of operation
(ii) General and specific plant operating characteristics
(iii) Plant instrumentation and control systems
(iv) Plant protection systems
(v) Engineered safety systems
(vi) Normal, abnormal, and emergency operating procedures
(vii) Radiation control and safety
(viii) Technical specifications
(ix) Applicable portions of Title 10, Chapter I, Code of Federal Regulations

Section 55.59(c)(3)(i) requires operator requalification programs to include on-the-job training on a number of control manipulations and plant evolutions if they are applicable to the plant design; the loss of electrical power (or degraded power sources) is but one of the evolutions to be performed annually by each operator. Moreover, section 55.59(c)(3)(iv) requires each licensed operator and senior operator to review the contents of all abnormal and emergency procedures on a regularly scheduled basis.

In addition, 10 CFR 55.59(c) states that, in lieu of the programs specified in 10 CFR 55.59(c)(2) and (3) above, the Commission may approve a program developed by using a systems

approach to training (SAT).

According to 10 CFR 50.120, each nuclear power plant licensee must establish, implement, and maintain a SAT-based program for training and qualifying nonlicensed operators, shift supervisors, and electrical and mechanical maintenance personnel (among several other job categories). The training program must be periodically evaluated and revised as appropriate to reflect industry experience and changes to the facility and procedures (among other things).

SAT-based training programs, which are developed, implemented, and maintained by facility licensees and accredited by the National Nuclear Accrediting Board (NNAB), should incorporate lessons learned as a result of industry operating events, such as the 2003 blackout. The NRC staff routinely monitors the industry's accreditation process, administers the initial operator licensing examinations, conducts biennial licensed operator requalification training program inspections, and retains authority to conduct for-cause training program inspections. However, these activities do not provide the staff with information sufficient to verify that all facility licensee training programs have adequately captured the importance of grid conditions and offsite power issues in advance of the 2006 peak summer cooling season. Accordingly, the staff has included questions on operator training in the information requested below.

REQUESTED INFORMATION

In accordance with 10 CFR 50.54(f), addressees are required to submit written responses to this GL within 60 days of its date.

In their responses, addressees are requested to answer the following questions and provide the information to the NRC with respect to each of their NPPs:

Use of protocols between the NPP and the TSO, ISO, or RC/RA and the use of RTCA software programs by TSOs to assist NPP in monitoring grid conditions to determine the operability of offsite power systems under plant TS .

GDC 17, 10 CFR Part 50, Appendix A, requires that licensees minimize the probability of the loss of power from the transmission network given a loss of the power generated by the nuclear power unit(s).

1. Describe your formal agreements with your transmission system operator (TSO) to promptly notify you when conditions of the surrounding grid are such that degraded voltage (i.e., below TS requirements) or LOOP could occur following a trip of the reactor unit(s).

   (a) What is the time period required for the notification?

   (b) Describe the procedures to periodically check with the TSO to determine the grid condition and ascertain any conditions that would require a notification. If you do not have procedures, describe how you assess grid condition that would require notifications.

(c) Describe how NPP operators are trained and tested on the use of the procedures in 1.(b).

(d) Describe the grid conditions that would trigger a notification.

(e) If you do not have a formal agreement with your TSO, describe why you believe you comply with the provisions of GDC 17 as stated above, or describe what actions you intend to take to establish the necessary formal agreement with your TSO.

(f) If you have existing formal interconnection agreements and related protocols that ensure adequate communication and coordination between the NPP and the TSO, describe such agreements to promptly notify you when the conditions of the surrounding grid could result in degraded voltage (i.e., below TS nominal trip setpoint value requirements; including NPPs using allowable value in its TSs) or LOOP after a trip of the reactor unit(s).

(g) Describe the low switchyard voltage conditions that would initiate operation of plant degraded voltage protection

2. Describe how you ensure (i.e., the criteria and any methodologies used to assess) that the offsite power system will remain operable following a trip of your NPP.

(a) Does your NPP's TSO use a RTCA program, or an online analytical transmission system studies program or other equivalent predictive methods, to determine the grid conditions that would make the NPP offsite power system inoperable during various contingencies? Provide a brief description of such a program used by the TSO.

(b) Does your NPP's TSO use the RTCA program as the basis for notifying the NPP when such a condition is identified? If not, how does the TSO notify the NPP of such a condition on the grid?

(c) Would the RTCA program utilized by your TSO identify a condition in which a trip of the NPP would result in switchyard voltages (immediate and/or long-term) below TS nominal trip setpoint value requirements (including NPPs using allowable value in its TSs) and would actuate plant degraded voltage protection? If not, discuss how such a condition would be identified on the grid.

(d) How frequently does the RTCA program update?

(e) Provide details of RTCA-identified contingency conditions that would trigger an NPP notification from the TSO.

(f) Is the NPP notified of periods when the RTCA program is unavailable to the TSO, and does the NPP conduct an offsite power system operability determination when such a notification is received?

(g) After an unscheduled inadvertent trip of the NPP, are the resultant switchyard voltages verified by procedure to be bounded by the voltages predicted by the RTCA?

(h) If an RTCA program is not available to the NPP's TSO, are there any plans for the TSO to obtain one? If so, when?

(i) If an RTCA program is not available, does your TSO perform periodic studies to verify that adequate offsite power capability, including adequate NPP post-trip switchyard voltages (immediate and/or long-term), will be available to the NPP licensee over the projected timeframe of the study?

(i) Are the key assumptions and parameters of these periodic studies translated into TSO guidance to ensure that the transmission system is operated within the bounds of the analyses?

(ii) If the bounds of the analyses are exceeded, does this condition trigger the notification provisions discussed in question 1 above?

(j) If your TSO does not use, or you do not have access to the results of a RTCA program, or your TSO does not perform and make available to you periodic studies that determine the adequacy of offsite power capability, please describe why you believe you comply with the provisions of GDC 17 as stated above, or describe what compensatory actions you intend to take to ensure that the offsite power system will be sufficiently reliable and remain operable with high probability following a trip of your NPP.

3. NPP TS require that the plant's offsite power system be operable as part of the plant's limiting condition of operation. Describe how you ensure (i.e., the criteria and any methodologies used to assess) that the NPP's offsite power system and safety-related components will remain operable when switchyard voltages are degraded.

(a) When the TSO notifies the NPP operator that a trip of the NPP or the loss of most critical transmission line or the largest supply to the grid would result in switchyard voltages (immediate and/or long-term) below TS nominal trip setpoint value requirements (including NPPs using allowable value in its TSs) and would actuate plant degraded voltage protection, is the NPP offsite power system declared inoperable under the plant TSs? If not, why not?

(b) If onsite safety-related equipment (e.g., emergency diesel generators or safety-related motors) is lost when subjected to a double sequencing (LOCA with delayed LOOP event) as a result of the anticipated system performance and is incapable of performing its safety functions as a result of responding to an emergency actuation signal during this condition, is the equipment considered inoperable? If not, why not, including any compensatory actions?

(c) Describe your evaluation of onsite safety-related equipment to determine whether it will operate as designed during the condition described in question 3.(b).

(d) When the NPP is notified by the TSO of other grid conditions that may impair the capability or availability of offsite power, are any plant TS action statements entered? If so, please identify them.

(e) If you believe your plant TSs do not require you to declare your offsite power system or safety-related equipment inoperable in any of these circumstances, explain why you believe you comply with the provisions of GDC 17 and your plant TSs, or describe what compensatory actions you intend to take to ensure that the offsite power system and safety-related components will remain operable when switchyard voltages are degraded.

(f) Describe how NPP operators are trained and tested on the compensatory actions mentioned in questions 3.(a) through (e).

4. NPP TS require that the plant's offsite power system be operable as part of the plant's limiting conditions of operation. Describe how you ensure (i.e., the criteria and any methodologies used to assess) that the offsite power system will remain operable following a trip of your NPP.

(a) Do the NPP operators have any guidance in plant TS bases sections, the final safety analysis report, or plant procedures regarding situations where the condition of plant-controlled or -monitored equipment (e.g., voltage regulators, auto tap changing transformers, capacitors, static VAR compensators, main generator voltage regulators) can adversely affect the operability of the NPP offsite power system?

(b) Describe how NPP operators are trained and tested on the guidance and procedures described question 4.(a).

(c) If your TS bases sections, the final safety analysis report, or plant procedures do not provide guidance regarding situations where the condition of plant-controlled or -monitored equipment can adversely affect the operability of the NPP offsite power system, explain why you believe you comply with the provisions of GDC 17 and the plant TSs, or describe what actions you intend to take to provide guidance on situations where the condition of plant-controlled or -monitored equipment can adversely affect the operability of the NPP offsite power system.

Use of NPP/TSO protocols and RTCA programs by TSOs to assist NPPS in monitoring grid conditions for consideration in maintenance risk assessments

The Maintenance Rule (10 CFR 50.65(a)(4)) requires that licensees assess the increase in risk that may result from proposed maintenance activities before performing them.

5. Describe how you perform grid reliability evaluations as part of the maintenance risk assessments required by 10 CFR 50.65(a)(4).

(a) Is a grid reliability evaluation performed at your NPP as part of the maintenance risk assessment required by 10 CFR 50.65(a)(4) before performing grid-risk-sensitive maintenance activities? This includes surveillances, post-maintenance testing, and

preventive and corrective maintenance that could increase the probability of a plant trip or LOOP or impact LOOP or SBO coping capability, for example, before taking a risk-significant piece of equipment (such as an EDG, a battery, a steam-driven pump, an alternate AC power source) out of service?

(b) Is grid status monitored by some means for the duration of the grid-risk-sensitive maintenance to confirm the continued validity of the risk assessment and is risk reassessed when warranted? If not, how is the risk assessed during grid-risk-sensitive maintenance?

(c) Is there a seasonal variation in the stress on the grid in the vicinity of your NPP site? Is there a seasonal variation in the LOOP frequency? If yes to either question, discuss when do they occur and what is the magnitude of the variations.

(d) Are seasonal variations in the probability of a LOOP at your plant site considered in the grid-risk-sensitive maintenance evaluation? If not, what is your basis for not considering them?

(e) Describe your contacts with the TSO to determine current and anticipated grid conditions as part of the grid reliability evaluation performed before conducting grid-risk-sensitive maintenance activities

(f) Describe your use of a formal agreement with your TSO or use formal procedures to assure that a worsening grid condition has not emerged during a maintenance activity in progress.

(g) Do you contact the TSO periodically for the duration of the grid-risk-sensitive maintenance activities?

(h) Describe how NPP operators and maintenance personnel are trained and tested on these agreements and procedures in question 5.(f).

(i) Is the TSO expected to notify the NPP of such a condition? If so, why can the TSO be relied on to do so?

(j) If a grid reliability evaluation performed as part of the maintenance risk assessment required by 10 CFR 50.65(a)(4) does not consider or rely on some arrangement for communication with the TSO, explain why you believe you comply with 10 CFR 50.65(a)(4).

(k) If risk is not assessed (when warranted) based on continuing communication with the TSO throughout the duration of grid-risk-sensitive maintenance activities, explain why you believe you have effectively implemented the relevant provisions of the endorsed industry guidance associated with the maintenance rule.

(l) With respect to questions 5.(j) and 5.(k), you may, as an alternative, describe what actions you intend to take to ensure that the increase in risk that may result from

proposed grid-risk-sensitive activities is assessed before and reassessed during grid-risk-sensitive maintenance activities, respectively, during existing, imminent, or worsening degraded grid reliability conditions.

6. Describe how you use the results of your risk assessment, including the results of the grid reliability evaluations, in managing maintenance risk, as required by 10 CFR 50.65(a)(4).

(a) Describe how the TSO coordinates transmission system maintenance activities that can have an impact on the NPP operation with the NPP operator.

(b) Describe how the NPP operator coordinates NPP maintenance activities that can have an impact on the transmission system with the TSO.

(c) Describe how you consider, and implement if warranted, the rescheduling of grid-risk-sensitive maintenance activities (activities that could (i) increase the likelihood of a plant trip, (ii) increase LOOP probability, or (iii) reduce LOOP or SBO coping capability) under existing, imminent, or worsening degraded grid reliability conditions?

(d) If there is an overriding need to perform grid-risk-sensitive maintenance activities under existing, or imminent conditions of degraded grid reliability, or continue grid-risk-sensitive maintenance when grid conditions worsen how do you effectively implement when warranted, appropriate risk management actions, including alternate equipment protection and compensatory measures to limit or minimize risk?

(e) Describe how these actions (in question 6.(a) through (d)) are accomplished and how the procedures in place provide reasonable assurance they are accomplished consistently and effectively.

(f) Describe how NPP operators and maintenance personnel are trained and tested on these procedures (in question 6.(e)).

(g) If there is no effective coordination between the NPP operator and the TSO regarding transmission system maintenance or NPP maintenance activities, please explain why you believe you comply with the provisions of 10 CFR 50.65(a)(4).

(h) If you do not consider and effectively implement appropriate risk management actions during the conditions described above, explain why you believe you effectively addressed the relevant provisions of the associated NRC-endorsed industry guidance.

(i) You may, as an alternative to questions 6.(g) and (h) describe what actions you intend to take to ensure that the increase in risk that may result from grid-risk-sensitive maintenance activities is managed in accordance with 10 CFR 50.65(a)(4).

Offsite power restoration procedures in accordance with 10 CFR 50.63 as developed in Section 2 of RG 1.155

Pursuant to 10 CFR 50.63, the NRC requires that each NPP licensed to operate be able to withstand an SBO for a specified duration and recover from the SBO. NRC RG 1.155 gives licensees guidance on developing their approaches for complying with 10 CFR 50.63.

7. Consistent with the recommendations in Section 2 of RG 1.155, you are expected to have established an agreement with your plant's TSO that identifies local power sources[3] that could be made available to resupply your plant following a LOOP event. Briefly describe any agreement made with the TSO.

   (a) Describe how NPP operators are trained and tested on identifying and using local power sources to resupply your plant following a LOOP event.

   (b) If you have not established an agreement with your plant's TSO that identifies local power sources that could be made available to resupply your plant following a LOOP event, explain why you believe you comply with the provisions of 10 CFR 50.63, or describe what actions you intend to take to establish compliance.

Losses of offsite power caused by grid failures at a frequency of equal to or greater than once in 20 site-years in accordance with Table 4 of Regulatory Guide 1.155 for complying with 10 CFR 50.63.

Pursuant to 10 CFR 50.63, the NRC requires that each NPP licensed to operate be able to withstand an SBO for a specified duration and recover from the SBO. NRC RG 1.155 gives licensees guidance on developing their approaches for complying with 10 CFR 50.63.

8. Describe how your NPP maintains its SBO coping capabilities in accordance with 10 CFR 50.63.

   (a) Has your NPP experienced a total loss of offsite power caused by grid failure since the plant's coping duration was initially determined under 10 CFR 50.63?

   (b) If so, have you reevaluated the NPP using the guidance in Table 4 of RG 1.155 to determine if it should be assigned to the P3 offsite power design characteristic group?

   (c) What were the results of this reevaluation, and was the initially determined coping duration for the NPP adjusted?

   (d) If your NPP has experienced a total loss of offsite power caused by grid failure since the plant's coping duration was initially determined under 10 CFR 50.63 and has not been reevaluated using the guidance in Table 4 of RG 1.155, explain why you believe you comply with the provisions of 10 CFR 50.63 as stated above, or describe what actions you intend to take to ensure that the NPP maintains its SBO coping capabilities in accordance with 10 CFR 50.63.

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[3] This includes items such as nearby or onsite gas turbine generators, portable generators, hydro generators, and black-start fossil power plants.

Actions to ensure compliance

9. If you determine that any action is warranted to bring your NPP into compliance with NRC regulatory requirements, including TSs, GDC 17, 10 CFR 50.65(a)(4), 10 CFR 50.63, 10 CFR 55.59 or 10 CFR 50.120, describe the schedule for implementing it.

REQUIRED RESPONSE

In accordance with 10 CFR 50.54(f), in order to determine whether a facility license should be modified, suspended, or revoked, or whether other action should be taken, an addressee is required to respond as described below.

An addressee should consult SECY-04-0191, "Withholding Sensitive Unclassified Information Concerning Nuclear Power Reactors From Public Disclosure," dated October 19, 2004, and 10 CFR 2.390 to determine if its response contains sensitive unclassified (nonsafeguards) information and should be withheld from public disclosure. SECY-04-0191 is available on the NRC public Web site.

Within 60 days of the date of this generic letter, an addressee is required to submit a written response. If an addressee is unable to provide the requested information or can not meet the requested completion date, it must address in its response any alternative course of action that it proposes to take, including the basis for the acceptability of the proposed alternative course of action.

The required written response should be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, 11555 Rockville Pike, Rockville, Maryland 20852, under oath or affirmation under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). In addition, a copy of the response should be sent to the appropriate regional administrator.

REASONS FOR INFORMATION REQUEST

This GL requests addressees to submit information. The requested information will enable the NRC staff to determine whether applicable requirements (plant TSs in conjunction with 10 CFR Part 50, Appendix A, General Design Criteria 17; 10 CFR 50.65(a)(4); 10 CFR 50.63; 10 CFR 55.59; and 10 CFR 50.120) are being met in regard to the grid topics addressed.

RELATED GENERIC COMMUNICATIONS

NRC Regulatory Issue Summary 2004-05, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power," dated April 15, 2004 (ADAMS Accession No. ML040990550).

BACKFIT DISCUSSION

Under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and

10 CFR 50.54(f), this GL transmits an information request for the purpose of verifying compliance with applicable existing requirements. Specifically, the requested information will enable the NRC staff to determine whether applicable requirements (plant TSs in conjunction with 10 CFR Part 50, Appendix A, General Design Criteria 17; 10 CFR 50.65(a)(4); 10 CFR 50.63; 10 CFR 55.59; and 10 CFR 50.120) are being met in regard to the grid topics addressed. No backfit is either intended or approved in the context of issuance of this generic letter. Therefore, the staff has not performed a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment on this generic letter was published in the *Federal Register* (70 FR 19125) on April 12, 2005. Approximately 65 comments were received from 10 nuclear entities comprising of utilities, owners groups, and nuclear organizations such as NEI; one comment each was received from the Oak Ridge National Laboratory, the State of New Jersey, the Department of Energy (Bonneville Power Administration), and Mr. K. M. Strickland. There were 15 comments on GDC 17 and the use of a real-time contingency analysis program, 8 comments on the Maintenance Rule, 8 comments on the Station Blackout Rule, and 4 comments on applicable regulations and rules; 28 comments were categorized as miscellaneous since they could not be binned into other categories, and 1 comment was on extending the response time of the proposed GL. The staff considered all comments that were received. The staff's evaluation of the comments is publicly available through the NRC's Agency wide Documents Access and Management System (ADAMS) under Accession No. ML052440417.

SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT

The NRC has determined that this action is not subject to the Small Business Regulatory Enforcement Fairness Act of 1996.

PAPERWORK REDUCTION ACT STATEMENT

This generic letter contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval number 3150-0011, which expires on February 28, 2007.

The burden to the public for these mandatory information collections is estimated to average 122 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of these information collections, including suggestions for reducing the burden, to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet electronic mail to INFOCOLLECTS@NRC.GOV; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011), Office of Management and Budget, Washington, DC 20503.

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.

CONTACT

Please direct any questions about this matter to the technical contact or the lead project manager listed below.

Christopher I. Grimes, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Paul Gill, NRR
301-415-3316

Lead PM: Kimberley Corp, NRR
301-415-1091

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