ADVERSE WEATHER PROTECTION

INSPECTABLE AREA: Adverse Weather Protection

CORNERSTONE: Initiating Events
Mitigating Systems

EFFECTIVE DATE: January 1, 2016

INSPECTION BASES: Weather conditions leading to loss of offsite power (LOOP), freezing temperatures, high temperatures, and high winds dominate external risk. Adverse weather can lead to loss of multiple trains and loss of redundant equipment due to common causes. Lasting effects (e.g., drought, flood) can also result from adverse weather, which may impact the effectiveness of the ultimate heat sink.

Flooding due to adverse weather and other external causes has been shown to be a significant contributor to risk at some facilities. Flooding has the potential to make multiple trains of equipment and support equipment inoperable. Flooding may also affect operator mitigation and recovery actions.

LEVEL OF EFFORT: Prior to the high grid loading season, conduct 1 review of summer readiness of offsite and alternate AC power systems (section 02.01 of this procedure).

In addition, evaluate a site's readiness for adverse weather (this includes weather conditions which may result in lasting effects - e.g., drought, icing, etc.). Conduct 1-2 reviews of a site's readiness for seasonal extreme weather conditions (section 02.02 of this procedure); and conduct 1-2 reviews of the readiness for impending adverse weather conditions (section 02.03 of this procedure).

For sites where external flooding is a risk, conduct 1 review of the site's readiness to cope with external flooding prior to the onset of adverse weather that poses a risk of flooding (section 02.04 of this procedure).

71111.01-01 INSPECTION OBJECTIVE

This inspection will focus on verifying that the design features and implementation of the licensee's procedures protect mitigating systems from adverse weather effects. This procedure would be used in response to impending seasonal and/or storm-related adverse weather conditions. For the purposes of this procedure adverse weather would include events such as high winds, hurricanes, electrical storms, tornadoes, extreme high or low temperatures, conditions affecting the ultimate heat sink (debris, ice blockages, frazil ice, sea grass, fish, etc.), offsite power system, and alternate AC power source. The inspection of the flooding hazard will focus on verifying that the licensee's flooding mitigation plans and equipment are consistent with the licensee's design requirements and the risk analysis assumptions.

71111.01-02 INSPECTION REQUIREMENTS

This review shall be performed for the types of weather-related risks identified for the site. The inspector should review the licensee's operating experience, corrective action program, UFSAR, etc., to determine the types of seasonal and/or storm-related adverse weather challenges to which the site is susceptible. The actual inspection for the adverse weather condition should then be performed prior to experiencing expected seasonal temperatures extremes and when expected adverse weather conditions are imminent at the site. When selecting a sample, it is recommended that the inspector consider multiple systems that are collectively risk-significant.

02.01 Evaluate Summer Readiness of Offsite and Alternate AC Power Systems.

Verify that plant features, and procedures for operation and continued availability of offsite and alternate AC power systems are appropriate.

a. Verify the licensee's/nuclear power plant (NPP) procedures address measures to monitor and maintain availability and reliability of both the offsite AC power system and the onsite alternate AC power system. Inspectors only need to perform the procedure adequacy review if equipment or procedure changes which potentially affect operation or reliability of offsite and alternate AC power systems have occurred since the last performance of the IP 71111.01 Summer Readiness sample. *Review the NPP procedures affecting these areas and the communications protocols between the transmission system operator (TSO) and the NPP to verify that the appropriate information is exchanged when issues arise that could impact the offsite power system. Examples of appropriate information to be conveyed would include: (1) coordination between the TSO and the NPP during an off-normal or emergency event affecting the NPP, (2) explanation of the event, (3) an estimate of when the offsite power system will be returned to a normal state, and (4) notification to the NPP when the offsite power system is returned to normal. [C1]* Specifically, ensure the procedures address:

    1. The actions to be taken when notified by the TSO that the post-trip voltage of the offsite power system at the NPP will not be acceptable to assure the continued operation of the safety-related loads without transferring to the onsite power supply.

2. The compensatory actions identified to be performed if it is not possible to predict the post-trip voltage at the NPP for the current grid conditions.

3. Required re-assessment of plant risk based on maintenance activities which could affect grid reliability, or the ability of the transmission system to provide offsite power.

4. Required communications between the NPP and the TSO when changes at the NPP could impact the transmission system, or when the capability of the transmission system to provided adequate offsite power is challenged. It is important to remember that the TSO is completely independent of the licensee.

b. Review the material condition of offsite AC power systems and onsite alternate AC power systems to the plant (to include switchyard and transformers). Ensure the systems will continue to provide appropriate "as designed" capabilities.

1. When possible and practical, review outstanding work orders for these systems and assess the corrective actions for any degraded conditions. While it is recognized that the licensee may have limited control over prioritization of outstanding work orders depending on the grid operator, verify that the licensee has considered the degraded conditions when considering risk and establishing appropriate compensatory measures.

2. Perform a walkdown of the switchyard with appropriate plant personnel to observe the material condition of the offsite power sources.

02.02 Evaluate Readiness for Seasonal Extreme Weather Conditions.

Perform a detailed review of the station's adverse weather procedures written for seasonal extremes (e.g., extreme high temperatures, extreme low temperatures, or hurricane season preparations). Verify that weather related equipment deficiencies identified during the previous year have been corrected prior to the onset of seasonal extremes. Evaluate implementation of the adverse weather preparation procedures and compensatory measures for the affected conditions before the onset of and during adverse weather conditions. Select for inspection 2 to 4 risk-significant systems that are required to be protected from the adverse weather condition.

a. As applicable, verify, including review of UFSAR, Technical Specifications, and plant documents, that the selected systems or components will remain functional when challenged by adverse weather. Verify that plant features and procedures for operation and continued availability of the ultimate heat sink (i.e., river, lake, and ocean) during adverse weather are appropriate. Additionally, evaluate the licensee's plans to address the ramifications of potentially lasting effects of adverse weather conditions (e.g., drought, flood, extreme cold weather).

b. As applicable, verify cold weather protection features, such as heat tracing, space heaters, and weatherized enclosures are monitored sufficiently to ensure they support

operability of the system, structure, or component (SSC) they protect. This includes instrument controller and alarm calibration programs as necessary to support the cold weather protection function. Perform necessary walkdowns to verify the physical condition of weather protection features. Additional references for cold weather are listed in Section 06.

c. Verify that operator actions defined in the licensee's adverse weather procedure maintain readiness of essential systems. Verify that minimum/adequate operator staffing is specified. (Note: Consider accessibility of controls, indications, and equipment)

d. If a system/component affected by the adverse weather condition is required for a reactor shutdown, verify that it would be available for performance of the reactor shutdown function under the weather conditions assumed prior to the shutdown.

e. Verify that the licensee can demonstrate through testing or analysis that diesel fuel oil Cloud Point[1] specifications are acceptable for operability of diesel generator systems with above ground fuel storage tanks (i.e., emergency diesel generators, station blackout diesel generators, fire protection diesel generators, etc.) during extreme cold weather conditions.

02.03 Evaluate Readiness for Impending Adverse Weather Conditions.

Review the overall preparations/protection of the risk-significant systems for the weather conditions expected.

a. Evaluate implementation of the adverse weather preparation procedures and compensatory measures for the affected conditions before the onset of and during adverse weather conditions. Review the licensee's plans to address the ramifications of potentially lasting effects that may result from the adverse weather conditions (e.g., drought, flood).

b. Verify that operator actions defined in the licensee's adverse weather procedure maintain readiness of essential systems. Verify that minimum/adequate operator staffing is specified. (Note: Consider accessibility of controls, indications, and equipment.)

c. Verify that required surveillances are current, or are scheduled and completed, if practical, before anticipated extreme weather conditions develop.

d. Verify the licensee implements periodic equipment walkdowns, if practical, or other measures to ensure that the condition of plant equipment is good and that potentially inoperable equipment does not prompt a NOED request. NOTE: The Enforcement

[1] Cloud Point defines the temperature at which a cloud or haze of wax crystals appears in the oil under prescribed test conditions which generally relates to the temperature at which wax crystals begin to precipitate from the oil in use. [Source: ASTM D-975]

Policy provides for the exercise of enforcement discretion under circumstances in which maintaining the stability and reliability of the electrical power supply system is consistent with protecting the public health and safety. Weather-related NOED requests usually involve a missed surveillance, an improperly scheduled surveillance, or inoperable equipment.

e. Plant modifications, maintenance activities (i.e., temporary hazard barrier removal), new evolutions, procedure revisions, or operator workarounds implemented to address periods of adverse weather can inadvertently affect maintenance rule SSCs and must be reviewed. Determine that the licensee has assessed and managed these challenges to safe plant operation. Further follow-up may be appropriate using related inspection procedures such as IP 71111.12 "Maintenance Rule Implementation," IP 71111.13 "Maintenance Risk Assessments and Emergent Work Control," IP 71111.15 "Operability," and IP 71111.18 "Plant Modifications."

02.04 Evaluate Readiness to Cope with External Flooding.

Inspect flood protection barriers and review procedures for coping with external flooding.

a. Review the FSAR and related flood analysis documents to identify those areas that can be affected by external flooding, including water intake facilities. Review seasonal susceptibilities such as floods caused by hurricanes, heavy rains and flash flood. Review licensee documentation that shows the design flood levels for areas containing safety-related equipment.

b. Based on licensee's flooding risk studies, select plant areas containing risk significant structures, systems, and components (SSCs) which are below flood levels or otherwise susceptible to flooding. Use weather related information gathered during plant status reviews or from external news sources to assist in scheduling this inspection prior to the season of highest risk.

c. Conduct a walkdown of the selected areas or rooms. By observation/review of design feature(s) (including reviews of preventive maintenance (PM) activities), consider the following, giving priority to those attributes which are risk significant for the site specific installation:

1. Sealing of equipment below the flood line, such as electrical conduits. Verify that the service life of seals is consistent with the manufacturer's recommendations or that a documented engineering evaluation provides justification for service life beyond the manufacturer's recommendations.

2. Sealing of equipment floor plugs, holes or penetrations in floors and walls between flood areas. Verify that the licensee has implemented procedures or programs to inspect seals or grout to monitor for degrading conditions.

3. Adequacy of watertight doors between flood areas. Verify alignment of "dog ears," adequacy of seals, and inspect for wear or impact damage on critical parts of the doors.

4. Common drain system and sumps, including floor drain piping and check valves, were credited for isolation of flood areas within plant buildings.

5. Adequate protection of the drain system (e.g., screens/covers) to prevent debris from disabling the drain system or components in the drain system.

6. Operable sump pumps, level alarm and control circuits including maintenance and calibrations of flood protection equipment.

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7. Condition, availability, and sufficient quantity of temporary or removable flood barriers (i.e., gaskets, sand bags, sand baskets, or other temporary barriers).

8. Protection of access to the ultimate heat sink for safe shutdown from storm surge debris impact.

d. For those areas where operator actions are credited, verify that the procedures such as abnormal or emergency procedures for coping with flooding can reasonably be used to achieve the desired actions, including whether the flooding event could limit or preclude the required operator actions. Observe flood mitigation drills/tabletops when possible.

Evaluations of operator actions must consider:

1. Can the procedures or activities be executed as specified and within the required timeframe(s)? For example, are flood mitigation actions (e.g., closure of water-tight doors) achievable in the available timeframe between the flood warning and the onset of the flooding?

2. Will the water levels and associated effects (e.g., waves, run-up, or debris) impair support functions or the performance of necessary actions?

3. Will other factors (e.g., equipment availability and staffing) prevent implementation of the required actions?

4. Will the proposed actions result in consequences that adversely affect other required safety or security functions (e.g., impairing required cooling functions)?

5. Do the procedures or activities include a discussion on warning time and notification that a flood is imminent?

6. Does the procedure include a discussion on how long the site could be flooded and appropriate considerations for the duration of the flood (e.g., availability of required consumables)?

e. Evaluate implementation of flood protection preparation procedures and compensatory measures during impending conditions of flooding or heavy rain, including the process for incorporating or assimilating information from external sources (NOAA, Army Corp of Engineers, etc.).

02.05 Identification and Resolution of Problems.

Verify whether the licensee is identifying weather related problems that could affect mitigating systems and their support systems in the licensee's corrective action program and verify that they are properly addressed for resolution. Review the historical corrective action database to identify trends and to determine whether corrective actions have been effective. History searches of adverse weather events as well as specific weather effect mitigation equipment (e.g. heat trace circuits, intake structure traveling screens, station chillers, heat exchangers, etc.) may be useful. Review the station's self-assessments or audits for adverse weather readiness.

Flooding has the potential to cause common mode failure of equipment in multiple areas. Verify that the licensee has entered the problems identified during the inspection in the licensee's corrective action program. Verify that the licensee is identifying issues at an appropriate threshold and entering them in the corrective action program. Verify that problems included in the licensee's corrective action program are properly addressed for resolution. See Inspection Procedure 71152, "Identification and Resolution of Problems," for additional guidance.

Cornerstone	Inspection Objective	Risk Priority	Example
Initiating Events	Inspect for adequate equipment protection to preclude weather induced initiating events.	For high winds, high risk exists for outdoor components, including power supplies, fuel/air lines, and sensing lines. For cold weather, high risk exists for components /sensing lines located in areas exposed to outside weather or located outside structures. Plant modifications, new evolutions, procedure revisions, or operator workarounds implemented to address periods of adverse weather. For extreme weather, high risk exists due to potential grid stress and disturbances. Potentials for common-cause failures Barriers between flood areas Area below flood plane	Adequacy of protection of equipment outside structures from high winds (tornadoes and/or hurricanes) and high wind generated missiles. Adequacy of heat tracing and space heaters for cold weather protection of piping and equipment. Adequacy of physical condition of the insulation of sensitive instrument components and lines. Adequacy of continued availability of ultimate heat sink (protection from frazil ice or intake structure blockage due to debris including ice). Adequacy of safety evaluation for modification or change. Adequacy of communication protocols between transmission operator and the NPP to verify appropriate information is conveyed when issues arise that could impact offsite power system or alternate AC power source.
	Identify external flooding which could cause initiating events		

Mitigating Systems	Inspect for the ability of the selected mitigating system or component to perform its design function under projected adverse weather. Identify internal or external flooding events which could cause loss of safe-shutdown equipment	For high winds, high risk exists for outdoor components, including power supplies, fuel/air lines, and sensing lines. For cold weather, high risk exists for components /sensing lines located in areas exposed to outside weather (including areas with natural air intake/ventilation) or located outside structures. For hot weather, high risk exists for marine fouling of various heat exchangers due to clams/mussels etc. For extreme weather, high risk exists due to potential grid stress and disturbances. Site specific: hurricane or river-level caused flooding	Adequacy of protection of equipment outside structures from high winds (tornadoes and/or hurricanes) and high wind generated missiles. Adequacy of cold weather protection of the refueling water storage tank (RWST)/condensate storage tank level, steam generator/main steam line pressure and flow, and feedwater flow sensing lines. Adequacy of cold weather protection for fire suppression systems, minimum flow path return lines for safety injection pumps to the RWST, cooling lines for service water pumps, or ultimate heat sink cooling water supply. Adequacy of site marine biofouling treatment and monitoring program. This area may be inspected when performing IP 71111.07. Adequacy of communication protocols between transmission operator and the NPP to verify appropriate information is conveyed when issues arise that could impact offsite power system or alternate AC power source. Water-tight doors, sump pumps, and alarms Adequate sealing of safe-shutdown electrical equipment below the flood line Check valves in open drain systems common to different flood areas

71111.01-04 RESOURCE ESTIMATE

The annual resource expenditure for this inspection procedure is estimated to be 24 to 30 hours at a site regardless of the number of reactor units at that site. The actual resource requirement at a site may vary, based on site specific adverse weather challenges.

71111.01-05 COMPLETION STATUS

Inspection of the minimum sample size will constitute completion of this procedure in the Reactor Program System (RPS). That minimum sample size will consist of 4 samples, regardless of the number of units at a site:

For units where external flooding IS a risk - 1 sample to evaluate the readiness of offsite and alternate AC power system readiness (per section 02.01 of this procedure), 1 sample to evaluate readiness for seasonal extreme weather conditions (per section 02.02 of this procedure), 1 sample to evaluate readiness for impending adverse weather conditions (per section 02.03 of this procedure), and 1 sample to evaluate readiness to cope with external flooding (per section 02.04 of this procedure).

For units where external flooding IS NOT a risk - 1 sample to evaluate the readiness of offsite and alternate AC power system readiness (per section 02.01 of this procedure), 1 sample to evaluate readiness for seasonal extreme weather conditions (per section 02.02 of this procedure), and 2 samples to evaluate readiness for impending adverse weather conditions (per section 02.03 of this procedure).

71111.01-06 REFERENCES

NRC Regulatory Issue Summary 2000-15, “Recommendations for Ensuring Continued Safe Plant Operation and Minimizing Requests for Enforcement Discretion During Extreme Weather Conditions”

NRC Incident Response Supplement 2650-2652, “Hurricane / Severe Weather / Natural Phenomenon Event Response”

NRC IE Bulletin 79-24, “Frozen Lines”

Licensee report to NRC Regional Administrator in response to NRC IE Bulletin 79-24

IEEE 622-1979, “Recommended Practice for the Design and Installation of Electric Pipe Heating Systems for Nuclear Power Generating Plants”

Inspection Procedure 71152, “Identification and Resolution of Problems”

NRC Generic Letter 2006-02, “Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power”

NRC Regulatory Issue Summary 2001-009, “Control of Hazard Barriers”

ASTM Standard D-975, “Standard Specification for Diesel Fuel Oils.”

END

ATTACHMENT 1
Revision History For 71111.01

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public Information)
N/A	03/02/07	Revision history reviewed for the last four years	N/A	N/A
N/A	04/03/00 CN-00-003	71111.01 has been issued to provide the minimum inspection oversight for determine the safety performance of operating nuclear power reactors.	N/A	N/A
N/A	01/17/02 CN-02-001	IP 71111.01 has been revised to provide detailed inspection requirements and guidance for evaluating licensee's readiness for seasonal susceptibilities and impending weather conditions. In addition, the inspection resource estimate is revised to provide a band for more inspection flexibility.	N/A	N/A
N/A	04/13/04 CN-04-008	IP 71111.01 has been revised to clarify sample sizes, minimum samples for completion and improve guidance provided in the inspection requirements.	N/A	N/A
C1 SRM M050426	03/23/07 CN-07-011	IP 71111.01 has been revised to address feedback form 71111.01-902 to include recommended inspection guidance and also, to incorporate inspections for the offsite power system and the alternate AC power source.	Training was performed at the Resident Inspector Counterpart Meetings and completed on 12/13/06.	ML070670471

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public Information)
N/A	01/31/08 CN-08-005	IP 71111.01 has been revised to reflect the 2007 ROP Realignment (addition of external flooding review formerly in IP 71111.06), and to address feedback form 71111.01-1163.	N/A	ML073520325
N/A	05/01/08 CN-08-013	IP 71111.01 has been revised to address feedback form 7111.01-1150 to include recommended clarification of inspection guidance regarding offsite power grid reliability verification. Revisions have also been made to include consideration for drought ramifications, and to re-organize the inspection requirements.	N/A	ML081220121
N/A	04/09/09 CN 09-011	IP 71111.01 has been revised to clarify the expectations for performing the grid reliability sample (FF 71111.01-1305).	N/A	ML090700219
N/A	11/09/09 CN 09-026	IP 71111.01 has been revised based on the 2009 ROP Realignment (adjustment of resource estimate and clarification of sample requirements).	N/A	N/A
	ML14337A104 12/04/14 CN 14-029	Editorial change based on FBF 71111.01-2043. Deleted Subsection 2.04.c.7, “Sources of potential internal flooding that are not analyzed or not adequately maintained, for example failure of flexible piping expansion joints, failure of fire protection system sprinklers, roof leaks, rest room backups, and failure of service water lines,” which is already in IP 71111.06 and not needed in IP 71111.01	N/A	71111.01-2043 ML14324A635

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML14343A684 09/04/15 CN 15-016	Incorporated Fukushima Lessons Learned (6/12/13 meeting) and Fukushima flooding inspection insights. Revised to incorporate FBF 71111.01-2130.	N/A	ML15215A044 71111.01-2130 ML15246A215