ECL: Notification of Unusual Event

Initiating Condition: UNPLANNED loss of water level above irradiated fuel.

Operating Mode Applicability: All

Emergency Action Levels:

(1) a. UNPLANNED water level drop in the REFUELING PATHWAY as indicated by ANY of the following:

Personnel report of low water level
Annunciator EH2 "SFP LVL HI/LO"

~~(site-specific level indications).~~

AND

b. UNPLANNED rise in area radiation levels as indicated by **ANY** of the following radiation monitors.

RE-5 in the spent fuel pool building
RE-2 in containment
RE-27A **OR** B in containment

~~(site-specific list of area radiation monitors)~~

Commented [29]: V7 Alarm Response – FNP-1(2)-ARP-1.5 (SFP Level)

Commented [30]: V8 Rad Monitor Information (FSAR)

Commented [31]: V8 Rad Monitor Information (FSAR)

Commented [32]: V8 Rad Monitor Information (FSAR)

Basis:

REFUELING PATHWAY: This includes the reactor refuel cavity the fuel transfer canal, the spent fuel pool, canals and pools through which irradiated fuel may be moved, but not including the reactor vessel.

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses a decrease in water level above irradiated fuel sufficient to cause elevated radiation levels. This condition ~~could~~ can be a precursor to a more serious event and ~~is also indicative of~~indicates a minor loss in the ability to control radiation levels within the plant. It is therefore a potential degradation in the level of ~~safety of the plant~~plant safety.

A water level decrease will be primarily determined by indications from available level instrumentation. Other sources of level indications ~~may~~ include reports from plant personnel (e.g., from a refueling crew) or video camera observations (if available). A significant drop in the water level may also cause an increase in the radiation levels of adjacent areas that can be detected by monitors in those locations.

The effects of planned evolutions ~~should~~ will be considered. For example, a refueling bridge area radiation monitor reading may increase due to planned evolutions such as lifting of the

reactor vessel head or movement of a fuel assembly. Note that this EAL is applicable only in cases where the elevated reading is due to an UNPLANNED loss of water level.

A drop in water level above irradiated fuel within the reactor vessel may be classified in accordance with Recognition Category C during the Cold Shutdown and Refueling modes.

Escalation of the emergency classification level ~~would be via~~uses IC RA2.

~~**Developer Notes:**~~

~~The "site-specific level indications" are those indications that may be used to monitor water level in the various portions of the REFUELING PATHWAY. Specify the mode applicability of a particular indication if it is not available in all modes.~~

~~The "site-specific list of area radiation monitors" should contain those area radiation monitors that would be expected to have increased readings following a decrease in water level in the site-specific REFUELING PATHWAY. In cases where a radiation monitor(s) is not available or would not provide a useful indication, consideration should be given to including alternate indications such as UNPLANNED changes in tank and/or sump levels.~~

~~Development of the EALs should consider the availability and limitations of mode-dependent, or other controlled but temporary, radiation monitors. Specify the mode applicability of a particular monitor if it is not available in all modes.~~

~~ECL Assignment Attributes: 3.1.1.A and 3.1.1.B~~

~~7~~4 COLD SHUTDOWN / REFUELING SYSTEM MALFUNCTION ICS/EALS

~~Table C-1: Recognition Category "C" Initiating Condition Matrix~~

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
CG1 Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory affecting fuel clad integrity with containment challenged. *Op. Modes: Cold Shutdown, Refueling*	**CS1** Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory affecting core decay heat removal capability. *Op. Modes: Cold Shutdown, Refueling*	**CA1** Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory. *Op. Modes: Cold Shutdown, Refueling*	**CU1** UNPLANNED loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory for 15 minutes or longer. *Op. Modes: Cold Shutdown, Refueling*
		CA2 Loss of all offsite and all onsite AC power to emergency buses for 15 minutes or longer. *Op. Modes: Cold Shutdown, Refueling, Defueled*	**CU2** Loss of all but one AC power source to emergency buses for 15 minutes or longer. *Op. Modes: Cold Shutdown, Refueling, Defueled*
		CA3 Inability to maintain the plant in cold shutdown. *Op. Modes: Cold Shutdown, Refueling*	**CU3** UNPLANNED ~~increase~~ rise in RCS temperature. *Op. Modes: Cold Shutdown, Refueling*
			CU4 Loss of Vital DC power for 15 minutes or longer. *Op. Modes: Cold Shutdown, Refueling*
			CU5 Loss of all onsite or offsite communications capabilities. *Op. Modes: Cold* Shutdown, *Refueling, Defueled*
		CA6 Hazardous event affecting a SAFETY SYSTEM needed for the current operating mode. *Op. Modes: Cold Shutdown, Refueling*	

CG1

ECL: General Emergency

Initiating Condition: Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory affecting fuel clad integrity with containment challenged.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: ~~(1 or 2)~~

Note: The emergency director ~~should~~ will declare the General Emergency promptly upon determining that 30 minutes has been exceeded, or will likely be exceeded.

~~(1) a. (Reactor vessel/RCS [*PWR*] or RPV [*BWR*])RPV level less than elevation 118' (site-specific level) for 30 minutes or longer.~~

~~**AND**~~

~~b. **ANY** indication from the Containment Challenge Table C1 (see below).~~

~~(2)~~(1) a. ~~(Reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~ Reactor vessel level cannot be monitored for 30 minutes or longer.

AND

b. Core uncovery is indicated by **ANY** of the following:

- Containment High Range Radiation Monitor RE27A or 27B~~(Site-specific radiation monitor)~~ reading greater than or equal to 100 R/hr ~~(site-specific value)~~
- Erratic source range monitor indication ~~[*PWR*]~~
- UNPLANNED rise in Containment Sump, or Reactor Coolant Drain Tank (RCDT), or Waste Holdup Tank (WHT)~~(site-specific sump and/or tank)~~ levels of sufficient magnitude to indicate core uncovery
- ~~(Other site-specific indications)~~

AND

c. **ANY** indication from the Containment Challenge Table C1 ~~(see below)~~.

Containment Challenge Table C1
■ CONTAINMENT CLOSURE not established*
■ Greater than or equal to 6 % H_2 ~~(Explosive mixture)~~ exists inside containment
■ UNPLANNED increase in containment pressure
* If CONTAINMENT CLOSURE is re-established prior to exceeding the 30-minute time limit, then declaration of a General Emergency is not required.

Commented [33]: V2 Rad Monitor Calculation

Commented [34]: V11 Cont Sump-RCDT-WHT FSAR Reference

Commented [35]: V12 H_2 Concentration

Basis:

CONTAINMENT CLOSURE: Per FNP-1(2)-STP-18.4, "Containment Integrity Verification and Closure".

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses the inability to restore and maintain reactor vessel level above the top of active fuel with containment challenged. This condition represents actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed EPA PAG exposure levels offsite for more than the immediate site area.

Following an extended loss of core decay heat removal and inventory makeup, decay heat will cause reactor coolant boiling and a further reduction in reactor vessel level. If ~~RCS/reactor vessel~~RPV level cannot be restored, fuel damage is probable.

With CONTAINMENT CLOSURE not established, there is a high potential for a direct and unmonitored release of radioactivity to the environment. If CONTAINMENT CLOSURE is re-established prior to exceeding the 30-minute time limit, then declaration of a General Emergency is not required.

The existence of an explosive mixture means, at a minimum, that the containment atmospheric hydrogen concentration is sufficient to support a hydrogen burn (i.e., at the lower deflagration limit). A hydrogen burn will raise containment pressure and could result in collateral equipment damage leading to a loss of containment integrity. It therefore represents a challenge to Containment integrity.

In the early stages of a core uncovery event, it is unlikely that hydrogen buildup due to a core uncovery could result in an explosive gas mixture in containment. If all installed hydrogen gas monitors are out-of-service during an event leading to fuel cladding damage, it may not be possible to obtain a containment hydrogen gas concentration reading as ambient conditions within the containment will preclude personnel access. During periods when installed containment hydrogen gas monitors are out-of-service, operators may use the other listed indications to assess whether ~~or not~~ containment is challenged.

In EAL ~~2~~1.b, the 30-minute criterion is tied to a readily recognizable event start time (i.e., the total loss of ability to monitor level), and allows sufficient time to monitor, assess and correlate reactor and plant conditions to determine if core uncovery has actually occurred (i.e., to account for various accident progression and instrumentation uncertainties). It also allows sufficient time for ~~performance of~~ actions to terminate leakage, recover inventory control~~/~~ or makeup equipment, and/or restore level monitoring.

The inability to monitor ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they ~~are indicative of~~indicate leakage from the ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV.

These EALs address concerns raised by Generic Letter 88-17, *Loss of Decay Heat Removal*;

SECY 91-283, *Evaluation of Shutdown and Low Power Risk Issues*; NUREG-1449, *Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States*; and NUMARC 91-06, *Guidelines for Industry Actions to Assess Shutdown Management*.

~~**Developer Notes:**~~

~~Accident analyses suggest that fuel damage may occur within one hour of uncovery depending upon the amount of time since shutdown; refer to Generic Letter 88-17, SECY 91-283, NUREG-1449 and NUMARC 91-06.~~

~~The type and range of RCS level instrumentation may vary during an outage as the plant moves through various operating modes and refueling evolutions, particularly for a PWR. As appropriate to the plant design, alternate means of determining RCS level are installed to assure that the ability to monitor level within the range required by operating procedures will not be interrupted. The instrumentation range necessary to support implementation of operating procedures in the Cold Shutdown and Refueling modes may be different (e.g., narrower) than that required during modes higher than Cold Shutdown.~~

~~For EAL #1.a – The "site-specific level" should be approximately the top of active fuel. If the availability of on-scale level indication is such that this level value can be determined during some shutdown modes or conditions, but not others, then specify the mode-dependent and/or configuration states during which the level indication is applicable. If the design and operation of water level instrumentation is such that this level value cannot be determined at any time during Cold Shutdown or Refueling modes, then do not include EAL #1 (classification will be accomplished in accordance with EAL #2).~~

~~For EAL #2.b – first bullet – As water level in the reactor vessel lowers, the dose rate above the core will increase. Enter a "site-specific radiation monitor" that could be used to detect core uncovery and the associated "site-specific value" indicative of core uncovery. It is recognized that the condition described by this IC may result in a radiation value beyond the operating or display range of the installed radiation monitor. In those cases, EAL values should be determined with a margin sufficient to ensure that an accurate monitor reading is available. For example, an EAL monitor reading might be set at 90% to 95% of the highest accurate monitor reading. This provision notwithstanding, if the estimated/calculated monitor reading is greater than approximately 110% of the highest accurate monitor reading, then developers may choose not to include the monitor as an indication and identify an alternate EAL threshold.~~

~~To further promote accurate classification, developers should consider if some combination of monitors could be specified in the EAL to build-in an appropriate level of corroboration between monitor readings into the classification assessment.~~

~~For BWRs that do not have installed radiation monitors capable of indicating core uncovery, alternate site-specific level indications of core uncovery should be used if available.~~

~~For EAL #2.b – second bullet – Post-TMI accident studies indicated that the installed PWR nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations. Because BWR Source Range Monitor (SRM) nuclear instrumentation detectors are typically located below core mid-plane, this may not be a viable indicator of core uncovery for BWRs.~~

~~For EAL #2.b – third bullet - Enter any "site-specific sump and/or tank" levels that could be expected to change if there were a loss of inventory of sufficient magnitude to indicate core uncovery. Specific level values may be included if desired.~~

~~For EAL #2.b – fourth bullet - Developers should determine if other reliable indicators exist to identify fuel uncovery (e.g., remote viewing using cameras). The goal is to identify any unique or site-specific indications, not already used elsewhere, that will promote timely and accurate emergency classification.~~

~~For the Containment Challenge Table:~~

~~Site shutdown contingency plans typically provide for re-establishing CONTAINMENT CLOSURE following a loss of RCS heat removal or inventory control functions.~~

~~For "Explosive mixture", developers may enter the minimum containment atmospheric hydrogen concentration necessary to support a hydrogen burn (i.e., the lower deflagration limit). A concurrent containment oxygen concentration may be included if the plant has this indication available in the Control Room.~~

~~For BWRs, the use of secondary containment radiation monitors should provide indication of increased release that may be indicative of a challenge to secondary containment. The "site-specific value" should be based on the EOP maximum safe values because these values are easily recognizable and have a defined basis.~~

~~ECL Assignment Attributes: 3.1.4.B~~

CS1

ECL: Site Area Emergency

Initiating Condition: Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory affecting core decay heat removal capability.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: (1 or 2 ~~or 3~~)

Note: The emergency director ~~should~~ will declare the Site Area Emergency promptly upon determining that 30 minutes has been exceeded, or will likely be exceeded.

(1) a. CONTAINMENT CLOSURE not established.

AND

b. ~~(Reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RVLIS (Mode 5) level less than 121'0" (6" below bottom ID of RCS loop) ~~(site-specific level)~~.

~~(2) a. CONTAINMENT CLOSURE established.~~

~~**AND**~~

~~b. (Reactor vessel/RCS [*PWR*] or RPV [*BWR*])RPV level less than 118' (Top of Active Fuel) (site-specific level).~~

~~(3)~~(2) a. ~~(Reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level cannot be monitored for 30 minutes or longer.

AND

b. Core uncovery is indicated by **ANY** of the following:

- Containment High Range Radiation Monitor RE27A or 27B ~~(Site-specific radiation monitor)~~ reading greater than or equal to 100 R/hr~~(site-specific value)~~
- Erratic source range monitor indication ~~[*PWR*]~~
- UNPLANNED rise in Containment Sump, or Reactor Coolant Drain Tank (RCDT), or Waste Holdup Tank (WHT)~~(site-specific sump and/or tank)~~ levels of sufficient magnitude to indicate core uncovery
- ~~(Other site-specific indications)~~

Basis:

CONTAINMENT CLOSURE: Per FNP-1(2)-STP-18.4, "Containment Integrity Verification and Closure".

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Commented [36]: V9 RVLIS/RPV Level

Commented [37]: V10 RPV Level Calculation

Commented [38]: V2 Rad Monitor Calculation

Commented [39]: V11 Cont Sump-RCDT-WHT FSAR Reference

This IC addresses a significant and prolonged loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory control and makeup capability leading to IMMINENT fuel damage. The lost inventory may be due to a RCS component failure, a loss of configuration control or prolonged boiling of reactor coolant. These conditions entail major failures of plant functions needed ~~for protection of~~to protect the public and ~~thus~~ warrant a Site Area Emergency declaration.

Following an extended loss of core decay heat removal and inventory makeup, decay heat will cause reactor coolant boiling and a further reduction in reactor vessel level. If ~~RCS/reactor vessel~~RPV level cannot be restored, fuel damage is probable.

The level specified in EAL 1.b represents a level in the RPV that is 6 inches below the bottom ID of the reactor vessel penetration. This level is lower than the RPV monitoring capability of RCS level instrumentation and therefore must be monitored using RVLIS. This level will only be observable in Mode 5 with RVLIS operable. In Mode 6, when RVLIS is not operable, this IC should be evaluated using EAL #2.

Outage/shutdown contingency plans typically provide for re-establishing or verifying CONTAINMENT CLOSURE following a loss of heat removal or RCS inventory control functions. The ~~difference in the~~ specified RCS/reactor vessel levels of EAL~~s~~ 1.b ~~and 2.b~~ reflect ~~the fact~~ that without CONTAINMENT CLOSURE established, there is a ~~lower~~ higher probability of a fission product release to the environment.

In EAL ~~3~~2.a, the 30-minute criterion is tied to a readily recognizable event start time (i.e., the total loss of ability to monitor level), and allows sufficient time to monitor, assess and correlate reactor and plant conditions to determine if core uncovery has actually occurred (i.e., to account for various accident progression and instrumentation uncertainties). It also allows sufficient time for ~~performance of~~ actions to terminate leakage, recover inventory control~~/~~ or makeup equipment, and/or restore level monitoring.

The inability to monitor ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they ~~are indicative of~~indicate leakage from the ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV.

These EALs address concerns raised by Generic Letter 88-17, *Loss of Decay Heat Removal*; SECY 91-283, *Evaluation of Shutdown and Low Power Risk Issues*; NUREG-1449, *Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States*; and NUMARC 91-06, *Guidelines for Industry Actions to Assess Shutdown Management*.

Escalation of the emergency classification level ~~would be via~~uses IC CG1 or RG1.

~~**Developer Notes:**~~

~~Accident analyses suggest that fuel damage may occur within one hour of uncovery depending upon the amount of time since shutdown; refer to Generic Letter 88-17, SECY 91-283, NUREG-1449 and NUMARC 91-06.~~

~~The type and range of RCS level instrumentation may vary during an outage as the plant moves through various operating modes and refueling evolutions, particularly for a PWR. As appropriate to the plant design, alternate means of determining RCS level are installed to assure that the ability to monitor level within the range required by operating procedures will not be interrupted. The instrumentation range necessary to support implementation of operating procedures in the Cold Shutdown and Refueling modes may be different (e.g., narrower) than that required during modes higher than Cold Shutdown.~~

~~PWR~~

~~For EAL #1.b – the "site-specific level" is 6" below the bottom ID of the RCS loop. This is the level at 6" below the bottom ID of the reactor vessel penetration and not the low point of the loop. If the availability of on-scale level indication is such that this level value can be determined during some shutdown modes or conditions, but not others, then specify the mode-dependent and/or configuration states during which the level indication is applicable. If the design and operation of water level instrumentation is such that this level value cannot be determined at any time during Cold Shutdown or Refueling modes, then do not include EAL #1 (classification will be accomplished in accordance with EAL #3).~~

~~For EAL #2.b – The "site-specific level" should be approximately the top of active fuel. If the availability of on-scale level indication is such that this level value can be determined during some shutdown modes or conditions, but not others, then specify the mode-dependent and/or configuration states during which the level indication is applicable. If the design and operation of water level instrumentation is such that this level value cannot be determined at any time during Cold Shutdown or Refueling modes, then do not include EAL #2 (classification will be accomplished in accordance with EAL #3).~~

~~For EAL #3.b – first bullet - As water level in the reactor vessel lowers, the dose rate above the core will increase. Enter a "site-specific radiation monitor" that could be used to detect core uncovery and the associated "site-specific value" indicative of core uncovery. It is recognized that the condition described by this IC may result in a radiation value beyond the operating or display range of the installed radiation monitor. In those cases, EAL values should be determined with a margin sufficient to ensure that an accurate monitor reading is available. For example, an EAL monitor reading might be set at 90% to 95% of the highest accurate monitor reading. This provision notwithstanding, if the estimated/calculated monitor reading is greater than approximately 110% of the highest accurate monitor reading, then developers may choose not to include the monitor as an indication and identify an alternate EAL threshold.~~

~~To further promote accurate classification, developers should consider if some combination of monitors could be specified in the EAL to build-in an appropriate level of corroboration between monitor readings into the classification assessment.~~

~~For EAL #3.b – second bullet - Post-TMI accident studies indicated that the installed PWR nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations.~~

~~For EAL #3.b – third bullet – Enter any 'site-specific sump and/or tank" levels that could be expected to change if there were a loss of RCS/reactor vessel inventory of sufficient magnitude to indicate core uncovery. Specific level values may be included if desired.~~

~~For EAL #3.b – fourth bullet - Developers should determine if other reliable indicators exist to identify fuel uncovery (e.g., remote viewing using cameras). The goal is to identify any unique or site-specific indications, not already used elsewhere, that will promote timely and accurate emergency classification.~~

~~BWR~~

~~For EAL #1.b – "site-specific level" is the Low-Low-Low ECCS actuation setpoint / Level 1. The BWR Low-Low-Low ECCS actuation setpoint / Level 1 was chosen because it is a standard operationally significant setpoint at which some (typically low pressure ECCS) injection systems would automatically start and attempt to restore RPV level. This is a RPV water level value that is observable below the Low-Low/Level 2 value specified in IC CA1, but significantly above the Top of Active Fuel (TOAF) threshold specified in EAL #2.~~

~~For EAL #2.b – The "site-specific level" should be for the top of active fuel.~~

~~For EAL #3.b – first bullet - As water level in the reactor vessel lowers, the dose rate above the core will increase. Enter a "site-specific radiation monitor" that could be used to detect core uncovery and the associated "site-specific value" indicative of core uncovery. It is recognized that the condition described by this IC may result in a radiation value beyond the operating or display range of the installed radiation monitor. In those cases, EAL values should be determined with a margin sufficient to ensure that an accurate monitor reading is available. For example, an EAL monitor reading might be set at 90% to 95% of the highest accurate monitor reading. This provision notwithstanding, if the estimated/calculated monitor reading is greater than approximately 110% of the highest accurate monitor reading, then developers may choose not to include the monitor as an indication and identify an alternate EAL threshold.~~

~~To further promote accurate classification, developers should consider if some combination of monitors could be specified in the EAL to build-in an appropriate level of corroboration between monitor readings into the classification assessment.~~

~~For BWRs that do not have installed radiation monitors capable of indicating core uncovery, alternate site-specific level indications of core uncovery should be used if available.~~

~~For EAL #3.b – second bullet - Because BWR source range monitor (SRM) nuclear instrumentation detectors are typically located below core mid-plane, this may not be a viable indicator of core uncovery for BWRs.~~

~~For EAL #3.b – third bullet – Enter any "site-specific sump and/or tank" levels that could be expected to change if there were a loss of RPV inventory of sufficient magnitude to indicate core uncovery. Specific level values may be included if desired.~~

~~For EAL #3.b – fourth bullet - Developers should determine if other reliable indicators exist to identify fuel uncovery (e.g., remote viewing using cameras). The goal is to identify any unique or site-specific indications, not already used elsewhere, that will promote timely and accurate emergency classification.~~

~~ECL Assignment Attributes: 3.1.3.B~~

ECL: Alert

Initiating Condition: Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: (1 or 2)

Note: The emergency director ~~should~~ will declare the Alert promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) Loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory as indicated by level less than 122' 11"~~(site-specific level)~~.

(2) a. ~~(Reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level cannot be monitored for 15 minutes or longer

AND

b. UNPLANNED increase in Containment sump, Reactor Coolant Drain Tank (RCDT) or Waste Holdup Tank (WHT)~~(site-specific sump and/or tank)~~ levels due to a loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory.

Commented [40]: V9 RVLIS/RPV Level

Commented [41]: V11 Cont Sump-RCDT-WHT FSAR Reference

Basis:

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses conditions that are precursors to a loss of the ability to adequately cool irradiated fuel (i.e., a precursor to a challenge to the fuel clad barrier). This condition represents a potential substantial reduction in the level of plant safety.

For EAL #1, a lowering of water level below ~~(site-specific level)~~ 122' 11" indicates that operator actions have not been successful in restoring and maintaining ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV water level. The 122' 11" level specified in EAL #1 is the minimum RCS level for RHR operation provided in procedure for mid loop operations. Below this level, loss of RHR pump net positive suction head (NPSH) may occur resulting in a loss of decay heat removal capability. The heat-up rate of the coolant will increase as the available water inventory is reduced. A continuing decrease in water level will lead to core uncovery.

Although related, EAL #1 is concerned with the loss of RCS inventory and not the potential concurrent effects on systems needed for decay heat removal (e.g., loss of a residual heat removal suction point). An increase in RCS temperature caused by a loss of decay heat removal capability is evaluated under IC CA3.

For EAL #2, the inability to monitor ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank

level changes must be evaluated against other potential sources of water flow to ensure they ~~are indicative of~~indicate leakage from the ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV.

The 15-minute duration for the loss of level indication was chosen because it is half of the EAL duration specified in IC CS1.

If the ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory level continues to lower, then escalation to Site Area Emergency ~~would be via~~uses IC CS1.

~~**Developer Notes:**~~

~~For EAL #1 – the "site-specific level" should be based on either:~~

- ~~[*BWR*] Low-Low ECCS actuation setpoint/Level 2. This setpoint was chosen because it is a standard operationally significant setpoint at which some (typically high pressure ECCS) injection systems would automatically start and is a value significantly below the low RPV water level RPS actuation setpoint specified in IC CU1.~~
- ~~[*PWR*] The minimum allowable level that supports operation of normally used decay heat removal systems (e.g., Residual Heat Removal or Shutdown Cooling). If multiple levels exist, specify each along with the appropriate mode or configuration dependency criteria.~~

~~For EAL #2 – The type and range of RCS level instrumentation may vary during an outage as the plant moves through various operating modes and refueling evolutions, particularly for a PWR. As appropriate to the plant design, alternate means of determining RCS level are installed to assure that the ability to monitor level within the range required by operating procedures will not be interrupted. The instrumentation range necessary to support implementation of operating procedures in the Cold Shutdown and Refueling modes may be different (e.g., narrower) than that required during modes higher than Cold Shutdown.~~

~~Enter any "site-specific sump and/or tank" levels that could be expected to increase if there were a loss of inventory (i.e., the lost inventory would enter the listed sump or tank).~~

~~ECL Assignment Attributes: 3.1.2.B~~

CA2

ECL: Alert

Initiating Condition: Loss of all offsite and all onsite AC power to emergency buses for 15 minutes or longer.

Operating Mode Applicability: Cold Shutdown, Refueling, Defueled

Emergency Action Levels:

Note: The emergency director ~~should~~ will declare the Alert promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) Loss of **ALL** offsite and **ALL** onsite AC Power to~~(site-specific emergency buses)~~ **BOTH** 4160V ESF busses 1(2)F **AND** 1(2)G for 15 minutes or longer.

Commented [42]: V13 ESF Busses Drawing

Table S1	
Unit 1	**Unit 2**
Start-up Aux XFMR 1A	Start-up Aux XFMR 2A
Start-up Aux XFMR 1B	Start-up Aux XFMR 2B
Diesel Generator 1-2A	Diesel Generator 1-2A
Diesel Generator 1B	Diesel Generator 2B
Diesel Generator 1C	Diesel Generator 1C
Diesel Generator 2C	Diesel Generator 2C

Commented [43]: V13 ESF Busses Drawing

Basis:

This IC addresses a total loss of AC power (see Table S1 above) that compromises the performance of all SAFETY SYSTEMS requiring electric power including those necessary for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal and the ultimate heat sink.

When in the cold shutdown, refueling, or defueled mode, this condition is not classified as a Site Area Emergency because of the increased time available to restore an emergency bus to service. Additional time is available due to the reduced core decay heat load, and the lower temperatures and pressures in various plant systems. ~~Thus, w~~When in these modes, this condition represents an actual or potential substantial degradation of the level of ~~safety of the plant~~plant safety.

Fifteen minutes ~~was selected as a~~is the threshold to exclude transient or momentary power losses.

Escalation of the emergency classification level ~~would be via~~uses IC CS1 or RS1.

~~**Developer Notes:**~~

~~For a power source that has multiple generators, the EAL and/or Basis section should reflect the minimum number of operating generators necessary for that source to provide adequate power to an AC emergency bus. For example, if a backup power source is comprised of two generators~~

~~(i.e., two 50% capacity generators sized to feed 1 AC emergency bus), the EAL and Basis section must specify that both generators for that source are operating.~~

~~The "site-specific emergency buses" are the buses fed by offsite or emergency AC power sources that supply power to the electrical distribution system that powers SAFETY SYSTEMS. There is typically 1 emergency bus per train of SAFETY SYSTEMS.~~

~~The EAL and/or Basis section may specify use of a non-safety-related power source provided that operation of this source is controlled in accordance with abnormal or emergency operating procedures, or beyond design basis accident response guidelines (e.g., FLEX support guidelines). Such power sources should generally meet the "Alternate ac source" definition provided in 10 CFR 50.2.~~

~~At multi-unit stations, the EALs may credit compensatory measures that are proceduralized and can be implemented within 15 minutes. Consider capabilities such as power source cross-ties, "swing" generators, other power sources described in abnormal or emergency operating procedures, etc. Plants that have a proceduralized capability to supply offsite AC power to an affected unit via a cross-tie to a companion unit may credit this power source in the EAL provided that the planned cross-tie strategy meets the requirements of 10 CFR 50.63.~~

~~ECL Assignment Attributes: 3.1.2.B~~

CA3

ECL: Alert

Initiating Condition: Inability to maintain the plant in cold shutdown.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: (1 or 2)

Note: The emergency director ~~should~~ will declare the Alert promptly upon determining that the applicable time has been exceeded, or will likely be exceeded.

(1) UNPLANNED increase in RCS temperature to greater than 200 °F~~(site-specific Technical Specification cold shutdown temperature limit)~~ for greater than the duration specified in ~~the following table~~Table C2.

Commented [44]: V1 TS Table 1.1-1 Modes

Table C2: RCS Heat-up Duration Thresholds		
RCS Status	**Containment Closure Status**	**Heat-up Duration**
Not Intact (or at reduced inventory)	Not Established	0 minutes
	Established	20 minutes*
Intact (but not at reduced inventory)	Not applicable	60 minutes*
* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is not applicable.		

(2) UNPLANNED RCS pressure increase greater than ~~(site-specific pressure reading)~~10 psig. (This EAL does not apply during water-solid plant conditions).~~ [*PWR*])~~

Basis:

CONTAINMENT CLOSURE: Per FNP-1(2)-STP-18.4, "Containment Integrity Verification and Closure".

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses conditions involving a loss of decay heat removal capability or an addition of heat to the RCS in excess of that which can currently be removed. Either condition represents an actual or potential substantial degradation of the level of ~~safety of the plant~~plant safety.

A momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available does not warrant a classification.

The RCS Heat-up Duration Thresholds table addresses the case where there is an increase in RCS temperature, the RCS is not intact or is at reduced inventory, and CONTAINMENT CLOSURE is not established. In this case, no heat-up duration is allowed (i.e., 0 minutes). This is because 1) the evaporated reactor coolant may be released directly into the Containment

atmosphere and subsequently to the environment, and 2) there is reduced reactor coolant inventory above the top of irradiated fuel.

The RCS Heat-up Duration Thresholds table addresses an increase in RCS temperature when CONTAINMENT CLOSURE is established but the RCS is not intact, or RCS inventory is reduced (e.g., mid-loop operation in PWRs). The 20-minute criterion was included to allow time for operator action to address the temperature increase.

Finally, the RCS Heat-up Duration Thresholds table also addresses an increase in RCS temperature with the RCS intact. The status of CONTAINMENT CLOSURE is not crucial in this condition since the intact RCS is providing a high pressure barrier to a fission product release. The 60-minute time frame ~~should~~ will allow sufficient time to address the temperature increase without a substantial degradation in plant safety.

~~Finally, in the case where there is an increase in RCS temperature, the RCS is not intact or is at reduced inventory [*PWR*], and CONTAINMENT CLOSURE is not established, no heat-up duration is allowed (i.e., 0 minutes). This is because 1) the evaporated reactor coolant may be released directly into the Containment atmosphere and subsequently to the environment, and 2) there is reduced reactor coolant inventory above the top of irradiated fuel.~~

EAL #2 provides a pressure-based indication of RCS heat-up.

Escalation of the emergency classification level ~~would be via~~uses IC CS1 or RS1.

~~**Developer Notes:**~~

~~For EAL #1 - Enter the "site-specific Technical Specification cold shutdown temperature limit" where indicated. The RCS should be considered intact or not intact in accordance with site-specific criteria.~~

~~For EAL #2 - The "site-specific pressure reading" should be the lowest change in pressure that can be accurately determined using installed instrumentation, but not less than 10 psig.~~

~~For PWRs, this IC and its associated EALs address the concerns raised by Generic Letter 88-17, *Loss of Decay Heat Removal*. A number of phenomena such as pressurization, vortexing, steam generator U-tube draining, RCS level differences when operating at a mid-loop condition, decay heat removal system design, and level instrumentation problems can lead to conditions where decay heat removal is lost and core uncovery can occur. NRC analyses show that there are sequences that can cause core uncovery in 15 to 20 minutes, and severe core damage within an hour after decay heat removal is lost. The allowed time frames are consistent with the guidance provided by Generic Letter 88-17 and believed to be conservative given that a low pressure Containment barrier to fission product release is established.~~

~~ECL Assignment Attributes: 3.1.2.B~~

CA6

ECL: Alert

Initiating Condition: Hazardous event affecting a SAFETY SYSTEM needed for the current operating mode.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels:

(1) a. The occurrence of **ANY** of the following hazardous events:

- Seismic event (earthquake)
- Internal or external flooding event
- High winds or tornado strike
- FIRE
- EXPLOSION
- ~~(site-specific hazards)~~
- Other events with similar hazard characteristics as determined by the Shift Manager

AND

b. **EITHER** of the following:

- Event damage has caused indications of degraded performance in at least one train of a SAFETY SYSTEM needed for the current operating mode.
- The event has caused VISIBLE DAMAGE to a SAFETY SYSTEM component or structure needed for the current operating mode.

Basis:

FIRE: Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute FIRES. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

EXPLOSION: A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events may require a post-event inspection to determine if the attributes of an explosion are present.

SAFETY SYSTEM: A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related.

VISIBLE DAMAGE: Damage to a component or structure that is readily observable without measurements, testing, or analysis. The visual impact of the damage is sufficient to cause concern regarding the operability or reliability of the affected component or structure.

This IC addresses a hazardous event that causes damage to a SAFETY SYSTEM, or a structure containing SAFETY SYSTEM components, needed for the current operating mode. This

condition significantly reduces the margin to a loss or potential loss of a fission product barrier, and therefore represents an actual or potential substantial degradation of the level of ~~safety of the plant~~plant safety.

The first threshold for EAL 1.b~~.1~~ addresses damage to a SAFETY SYSTEM train that is in service/operation since indications for it will be readily available. The indications of degraded performance ~~should~~ will be significant enough to cause concern regarding the operability or reliability of the SAFETY SYSTEM train.

The second threshold for EAL 1.b~~.2~~ addresses damage to a SAFETY SYSTEM component that is not in service/operation or readily apparent through indications alone, or to a structure containing SAFETY SYSTEM components. Operators will make this determination based on ~~the totality of~~all available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage.

Escalation of the emergency classification level ~~would be via~~uses IC CS1 or RS1.

~~**Developer Notes:**~~

~~For (site-specific hazards), developers should consider including other significant, site-specific hazards to the bulleted list contained in EAL 1.a (e.g., a seiche).~~

~~Nuclear power plant SAFETY SYSTEMS are comprised of two or more separate and redundant trains of equipment in accordance with site-specific design criteria.~~

~~ECL Assignment Attributes: 3.1.2.B~~

CU1

ECL: Notification of Unusual Event

Initiating Condition: UNPLANNED loss of ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV inventory for 15 minutes or longer.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: (1 or 2)

Note:	The emergency director ~~should~~ will declare the Unusual Event promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) UNPLANNED loss of reactor coolant results in ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level less than a required lower limit for 15 minutes or longer.

(2) a. ~~(Reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level cannot be monitored.

AND

b. UNPLANNED rise in Containment sump, Reactor Coolant Drain Tank, or Waste Holdup Tank levels.

Commented [45]: V11 Cont Sump-RCDT-WHT FSAR References

Basis:

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses the inability to restore and maintain water level to a required minimum level (or the lower limit of a level band), or a loss of the ability to monitor ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level concurrent with indications of coolant leakage. Either of these conditions is considered to be a potential degradation of the level of ~~safety of the plant~~plant safety.

Refueling evolutions that decrease RCS water inventory are carefully planned and controlled. An UNPLANNED event that results in water level decreasing below a procedurally required limit warrants the declaration of an Unusual Event due to the reduced water inventory that is available to keep the core covered.

EAL #1 recognizes that the minimum required ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level can change several times during the course of a refueling outage as different plant configurations and system lineups are implemented. This EAL is met if the minimum level, specified for the current plant conditions, cannot be maintained for 15 minutes or longer. The minimum level is typically specified in the applicable operating procedure but may be specified in another controlling document.

The 15-minute threshold duration allows sufficient time for prompt operator actions to restore and maintain the expected water level. This criterion excludes transient conditions causing a brief lowering of water level.

EAL #2 addresses a condition where all means to determine ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level have been lost. In this condition, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they ~~are indicative of~~indicate leakage from the ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV.

Continued loss of RCS inventory may result in escalation to the Alert emergency classification level ~~via~~ using either IC CA1 or CA3.

CU2

ECL: Notification of Unusual Event

Initiating Condition: Loss of all but one AC power source to emergency buses for 15 minutes or longer.

Operating Mode Applicability: Cold Shutdown, Refueling, Defueled

Emergency Action Levels:

Note: The emergency director ~~should~~ will declare the Unusual Event promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) a. AC power capability to ~~(site-specific emergency buses)~~ **BOTH** 4160V ESF busses 1(2)F **AND** 1(2)G is reduced to a single power source for 15 minutes or longer.

AND

b. Any additional single power source failure will result in loss of all AC power to SAFETY SYSTEMS.

Table S1	
Unit 1	**Unit 2**
Start-up Aux XFMR 1A	Start-up Aux XFMR 2A
Start-up Aux XFMR 1B	Start-up Aux XFMR 2B
Diesel Generator 1-2A	Diesel Generator 1-2A
Diesel Generator 1B	Diesel Generator 2B
Diesel Generator 1C	Diesel Generator 1C
Diesel Generator 2C	Diesel Generator 2C

Commented [46]: V13 ESF Busses Drawing

Commented [47]: V13 ESF Busses Drawing

Basis:

SAFETY SYSTEM: A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related.

This IC describes a significant degradation of offsite and onsite AC power sources ~~such that~~where any additional single failure would result in a loss of all AC power to SAFETY SYSTEMS. In this condition, the sole AC power source may be powering one, or more than one, train of safety-related equipment.

When in the cold shutdown, refueling, or defueled mode, this condition is not classified as an Alert because of the increased time available to restore another power source to service. Additional time is available due to the reduced core decay heat load, and the lower temperatures and pressures in various plant systems. ~~Thus, w~~When in these modes, this condition is considered to be a potential degradation of the level of ~~safety of the plant~~plant safety.

An "AC power source" is a source recognized in AOPs and EOPs, and capable of supplying required power to an emergency bus (see Table S1 above). ~~Some e~~Examples of this condition ~~are presented below.~~include:

- A loss of all offsite power with a concurrent failure of all but one emergency power source (e.g., an onsite diesel generator).
- A loss of all offsite power and loss of all emergency power sources (e.g., onsite diesel generators) with a single train of emergency busses being back-fed from the unit main generator.
- A loss of emergency power sources (e.g., onsite diesel generators) with a single train of emergency busses being back-fed from an offsite power source.

Fifteen minutes ~~was selected as a~~is the threshold to exclude transient or momentary losses of power.

The subsequent loss of the remaining single power source would escalate the event to an Alert in accordance with IC CA2.

~~**Developer Notes:**~~

~~For a power source that has multiple generators, the EAL and/or Basis section should reflect the minimum number of operating generators necessary for that source to provide required power to an AC emergency bus. For example, if a backup power source is comprised of two generators (i.e., two 50% capacity generators sized to feed 1 AC emergency bus), the EAL and Basis section must specify that both generators for that source are operating.~~

~~The "site-specific emergency buses" are the buses fed by offsite or emergency AC power sources that supply power to the electrical distribution system that powers SAFETY SYSTEMS. There is typically 1 emergency bus per train of SAFETY SYSTEMS.~~

~~Developers should modify the bulleted examples provided in the basis section, above, as needed to reflect their site-specific plant designs and capabilities.~~

~~The EALs and Basis should reflect that each independent offsite power circuit constitutes a single power source. For example, three independent 345kV offsite power circuits (i.e., incoming power lines) comprise three separate power sources. Independence may be determined from a review of the site-specific UFSAR, SBO analysis or related loss of electrical power studies.~~

~~The EAL and/or Basis section may specify use of a non-safety-related power source provided that operation of this source is recognized in AOPs and EOPS, or beyond design basis accident response guidelines (e.g., FLEX support guidelines). Such power sources should generally meet the "Alternate ac source" definition provided in 10 CFR 50.2.~~

~~At multi-unit stations, the EALs may credit compensatory measures that are proceduralized and can be implemented within 15 minutes. Consider capabilities such as power source cross-ties, "swing" generators, other power sources described in abnormal or emergency operating procedures, etc. Plants that have a proceduralized capability to supply offsite AC power to an affected unit via a cross-tie to a companion unit may credit this power source in the EAL provided that the planned cross-tie strategy meets the requirements of 10 CFR 50.63.~~

~~ECL Assignment Attributes: 3.1.1.A~~

CU3

ECL: Notification of Unusual Event

Initiating Condition: UNPLANNED increase in RCS temperature.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels: (1 or 2)

Note:	The emergency director ~~should~~ will declare the Unusual Event promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) UNPLANNED increase in RCS temperature to greater than 200 °F~~(site-specific Technical Specification cold shutdown temperature limit)~~.

Commented [48]: V1 TS Table 1.1-1 Modes

(2) Loss of **ALL** RCS temperature **AND** ~~(reactor vessel/RCS [*PWR*] or RPV [*BWR*])~~RPV level indication for 15 minutes or longer.

Basis:

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

This IC addresses an UNPLANNED increase in RCS temperature above the Technical Specification cold shutdown temperature limit, or the inability to determine RCS temperature and level~~,~~. It represents a potential degradation of the level of ~~safety of the plant~~plant safety. If the RCS is not intact and CONTAINMENT CLOSURE is not established during this event, the emergency director ~~should~~ will also refer to IC CA3.

A momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available does not warrant a classification.

EAL #1 involves a loss of decay heat removal capability, or an addition of heat to the RCS in excess of that which can currently be removed, ~~such that~~where reactor coolant temperature cannot be maintained below the cold shutdown temperature limit specified in Technical Specifications. During this condition, there is no immediate threat of fuel damage because the core decay heat load has been reduced since the cessation of power operation.

During an outage, the level in the reactor vessel will normally be maintained above the reactor vessel flange. Refueling evolutions that lower water level below the reactor vessel flange are carefully planned and controlled. A loss of forced decay heat removal at reduced inventory may result in a rapid increase in reactor coolant temperature depending on the time after shutdown.

EAL #2 reflects a condition where there has been a significant loss of instrumentation capability necessary to monitor RCS conditions and operators ~~would be~~are unable to monitor key parameters necessary to assure core decay heat removal. During this condition, there is no immediate threat of fuel damage because the core decay heat load has been reduced since the cessation of power operation.

Fifteen minutes ~~was selected as a~~is the threshold to exclude transient or momentary losses of indication.

Escalation to Alert ~~would be via~~uses IC CA1 based on an inventory loss or IC CA3 based on exceeding plant configuration-specific time criteria.

~~**Developer Notes:**~~

~~For EAL #1, enter the "site-specific Technical Specification cold shutdown temperature limit" where indicated.~~

~~ECL Assignment Attributes: 3.1.1.A~~

CU4

ECL: Notification of Unusual Event

Initiating Condition: Loss of Vital DC power for 15 minutes or longer.

Operating Mode Applicability: Cold Shutdown, Refueling

Emergency Action Levels:

Note: The emergency director ~~should~~ will declare the Unusual Event promptly upon determining that 15 minutes has been exceeded, or will likely be exceeded.

(1) Indicated voltage is less than 105 VDC~~(site-specific bus voltage value)~~ on Technical Specification required 125 VDC ~~Vital DC~~ vital busses for 15 minutes or longer.

Commented [49]: V14 DC Voltage Reference

Basis:

This IC addresses a loss of vital DC power ~~which~~ that compromises the ability to monitor and control operable SAFETY SYSTEMS when the plant is in the cold shutdown or refueling mode. In these modes, the core decay heat load has been significantly reduced, and coolant system temperatures and pressures are lower; these conditions increase the time available to restore a vital DC bus to service. ~~Thus, t~~This condition is considered to be a potential degradation of the level of ~~safety of the plant~~plant safety.

As used in this EAL, "required" means the vital DC busses necessary to support operation of the in-service, or operable, train or trains of SAFETY SYSTEM equipment. For example, if Train A is out-of-service (inoperable) for scheduled outage maintenance work and Train B is in-service (operable), then a loss of vital DC power affecting Train B would require the declaration of an Unusual Event. A loss of vital DC power to Train A would not warrant an emergency classification.

Fifteen minutes ~~was selected as a~~is the threshold to exclude transient or momentary power losses.

Depending upon the event, escalation of the emergency classification level ~~would be via~~uses IC CA1 or CA3, or an IC in Recognition Category R.

~~**Developer Notes:**~~

~~The "site-specific bus voltage value" should be based on the minimum bus voltage necessary for adequate operation of SAFETY SYSTEM equipment. This voltage value should incorporate a margin of at least 15 minutes of operation before the onset of inability to operate those loads. This voltage is usually near the minimum voltage selected when battery sizing is performed.~~

~~The typical value for an entire battery set is approximately 105 VDC. For a 60 cell string of batteries, the cell voltage is approximately 1.75 Volts per cell. For a 58 string battery set, the minimum voltage is approximately 1.81 Volts per cell.~~

~~ECL Assignment Attributes: 3.1.1.A~~

ECL: Notification of Unusual Event

Initiating Condition: Loss of all onsite or offsite communications capabilities.

Operating Mode Applicability: Cold Shutdown, Refueling, Defueled

Emergency Action Levels: (1 or 2 or 3)

(1) Loss of **ALL** of the following onsite communication methods:

In plant telephones
Public address system
Plant radio systems

~~(site-specific list of communications methods)~~

(2) Loss of **ALL** of the following ORO communications methods:

ENN (Emergency Notification Network)
Commercial phones

~~(site-specific list of communications methods)~~

(3) Loss of **ALL** of the following NRC communications methods:

ENS on Federal Telecommunications System (FTS)
Commercial phones

~~(site-specific list of communications methods)~~

Basis:

This IC addresses a significant loss of on-site or offsite communications capabilities. While not a direct challenge to plant or personnel safety, this event warrants prompt notifications to OROs and the NRC.

This IC ~~should~~ will be assessed only when extraordinary means are ~~being utilized~~used to make communications possible (e.g., use of non-plant, privately owned equipment~~,~~; relaying of on-site information via individuals or multiple radio transmission points~~,~~; individuals being sent to offsite locations~~, etc.~~).

EAL #1 addresses a total loss of the communications methods used in support of routine plant operations.

EAL #2 addresses a total loss of the communications methods used to notify all OROs of an emergency declaration. The OROs referred to here are the states of Alabama, Georgia, and Florida; Houston and Henry Counties, Alabama; and Early County, Georgia. ~~(see Developer Notes).~~

EAL #3 addresses a total loss of the communications methods used to notify the NRC of an emergency declaration.

~~**Developer Notes:**~~

~~EAL #1 - The "site-specific list of communications methods" should include all communications methods used for routine plant communications (e.g., commercial or site telephones, page-party systems, radios, etc.). This listing should include installed plant equipment and components, and not items owned and maintained by individuals.~~

~~EAL #2 - The "site-specific list of communications methods" should include all communications methods used to perform initial emergency notifications to OROs as described in the site Emergency Plan. The listing should include installed plant equipment and components, and not items owned and maintained by individuals. Example methods are ring-down/dedicated telephone lines, commercial telephone lines, radios, satellite telephones and internet-based communications technology.~~

~~In the Basis section, insert the site-specific listing of the OROs requiring notification of an emergency declaration from the Control Room in accordance with the site Emergency Plan, and typically within 15 minutes.~~

~~EAL #3 - The "site-specific list of communications methods" should include all communications methods used to perform initial emergency notifications to the NRC as described in the site Emergency Plan. The listing should include installed plant equipment and components, and not items owned and maintained by individuals. These methods are typically the dedicated Emergency Notification System (ENS) telephone line and commercial telephone lines.~~

~~ECL Assignment Attributes: 3.1.1.C~~

85 INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) ICS/EALS

~~Table E-1: Recognition Category "E" Initiating Condition Matrix~~

UNUSUAL EVENT

E-HU1 Damage to a loaded cask CONFINEMENT BOUNDARY.
Op. Modes: All

E-HU1

ECL: Notification of Unusual Event

Initiating Condition: Damage to a loaded cask CONFINEMENT BOUNDARY.

Operating Mode Applicability: All

Emergency Action Levels:

(1) Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by an on-contact radiation reading greater than ~~(2 times the site-specific cask specific technical specification allowable radiation level) on the surface of the spent fuel cask~~ANY of the values listed in Table E1.

Commented [50]: V15 ISFSI TS/Dose Reading Calculation

Table E1	
Location of Dose Rate	**Total Dose Rate (Neutron + Gamma mR/hr)**
HI-TRAC 125	
Side-Mid-height	1360
Top	260
HI-STORM 100	
Side – 60 inches below mid-height	340
Side – Mid- height	350
Side – 60 inches above mid-height	170
Center of lid	50
Middle of top lid	60
Top (outlet) duct	160
Bottom (inlet) duct	460

Commented [51]: V15 ISFSI TS/Dose Reading Calculation

Basis:

CONFINEMENT BOUNDARY: The barrier(s) between areas containing radioactive substances and the environment.

This IC addresses an event that results in damage to the CONFINEMENT BOUNDARY of a storage cask containing spent fuel. It applies to irradiated fuel that is licensed for dry storage beginning at the point that the loaded storage cask is sealed. The issues of concern are the creation of a potential or actual release path to the environment, degradation of one or more fuel assemblies due to environmental factors, and configuration changes ~~which~~ that could cause challenges in removing the cask or fuel from storage.

The existence of "damage" is determined by radiological survey. The radiation reading values listed in the table represent 2 times the site-specific cask specific technical specification allowable radiation level on the designated surface of the spent fuel cask. The technical specification multiple of "2 times"~~, which is also used in Recognition Category R IC RU1,~~ is

used here to distinguish between non-emergency and emergency conditions. The emphasis for this classification is the degradation in the level of safety of the spent fuel cask and not the magnitude of the associated dose or dose rate. It is recognized that in the case of extreme damage to a loaded cask, ~~the fact that~~determining if the "on-contact" dose rate limit is exceeded may be ~~determined~~ based on measurement of a dose rate at some distance from the cask.

Security-related events for ISFSIs are covered under ICs HU1 and HA1.

~~**Developer Notes:**~~

~~The results of the ISFSI Safety Analysis Report (SAR) [per NUREG-1536], or a SAR referenced in the cask Certificate of Compliance and the related NRC Safety Evaluation Report, identify the natural phenomena events and accident conditions that could potentially affect the CONFINEMENT BOUNDARY. This EAL addresses damage that could result from the range of identified natural or man-made events (e.g., a dropped or tipped over cask, EXPLOSION, FIRE, EARTHQUKE, etc.).~~

~~The allowable radiation level for a spent fuel cask can be found in the cask's technical specification located in the Certificate of Compliance.~~

~~ECL Assignment Attributes: 3.1.1.B~~

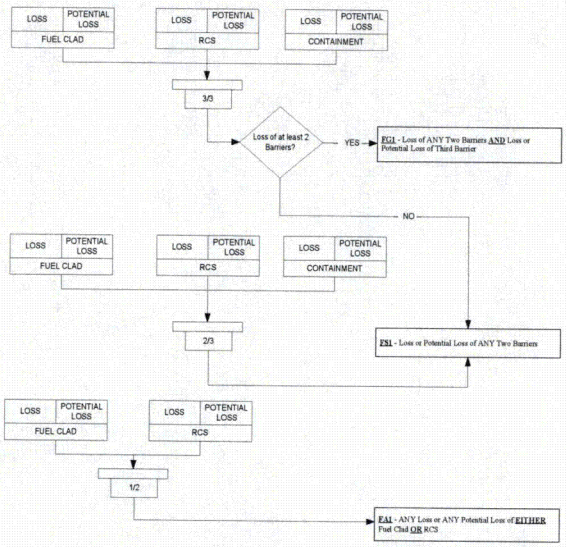
96 FISSION PRODUCT BARRIER ICS/EALS

~~Table 9-F-1:~~ Recognition Category "F" Initiating Condition Matrix

GENERAL EMERGENCY	
FG1	Loss of any two barriers and Loss or Potential Loss of the third barrier. *Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown*
SITE AREA EMERGENCY	
FS1	Loss or Potential Loss of any two barriers. *Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown*
ALERT	
FA1	Any Loss or any Potential Loss of either the Fuel Clad or RCS barrier. *Op. Modes: Power Operation, Hot Standby, Startup, Hot Shutdown*

~~**See Table 9-F-3 for PWR EALs**~~

~~**Developer Note:** The adjacent logic flow diagram is for use by developers and is not required for site-specific implementation; however, a site-specific scheme must include some type of user-aid to facilitate timely and accurate classification of fission product barrier losses and/or potential losses. Such aids are typically comprised of logic flow diagrams, "scoring" criteria or checkbox-type matrices. The user-aid logic must be consistent with that of the adjacent diagram.~~



~~**Developer Notes**~~

1. ~~The logic used for these initiating conditions reflects the following considerations:~~

   - ~~The Fuel Clad Barrier and the RCS Barrier are weighted more heavily than the Containment Barrier.~~

   - ~~Unusual Event ICs associated with fission product barriers are addressed in Recognition Category S.~~

2. ~~For accident conditions involving a radiological release, evaluation of the fission product barrier thresholds will need to be performed in conjunction with dose assessments to ensure correct and timely escalation of the emergency classification. For example, an evaluation of the fission product barrier thresholds may result in a Site Area Emergency classification while a dose assessment may indicate that an EAL for General Emergency IC RG1 has been exceeded.~~

3. ~~The fission product barrier thresholds specified within a scheme are expected to reflect plant-specific design and operating characteristics. This may require that developers create different thresholds than those provided in the generic guidance.~~

4. ~~Alternative presentation methods for the Recognition Category F ICs and fission product barrier thresholds are acceptable and include flow charts, block diagrams, and checklist-type tables. Developers must ensure that the site-specific method addresses all possible threshold combinations and classification outcomes shown in the BWR or PWR EAL fission product barrier tables. The NRC staff considers the presentation method of the Recognition Category F information to be an important user aid and may request a change to a particular proposed method if, among other reasons, the change is necessary to promote consistency across the industry.~~

5. ~~As used in this Recognition Category, the term RCS leakage encompasses not just those types defined in Technical Specifications but also includes the loss of RCS mass to any location - inside containment, a secondary-side system (i.e., PWR steam generator tube leakage), an interfacing system, or outside of containment. The release of liquid or steam mass from the RCS due to the as-designed/expected operation of a relief valve is not considered to be RCS leakage.~~

6. ~~At the Site Area Emergency level, classification decision-makers should maintain cognizance of how far present conditions are from meeting a threshold that would require a General Emergency declaration. For example, if the Fuel Clad and RCS fission product barriers were both lost, then there should be frequent assessments of containment radioactive inventory and integrity. Alternatively, if both the Fuel Clad and RCS fission product barriers were potentially lost, the Emergency Director would have more assurance that there was no immediate need to escalate to a General Emergency.~~

7. ~~The ability to escalate to a higher emergency classification level in response to degrading conditions should be maintained. For example, a steady increase in RCS leakage would represent an increasing risk to public health and safety.~~

Fission Product Barrier Table

Thresholds for LOSS or POTENTIAL LOSS of Barriers

FG1 GENERAL EMERGENCY	FS1 SITE AREA EMERGENCY	FA1 ALERT
Loss of any two barriers and Loss or Potential Loss of the third barrier.	Loss or Potential Loss of any two barriers.	Any Loss or any Potential Loss of either the Fuel Clad or RCS barrier.

Fuel Clad Barrier		RCS Barrier		Containment Barrier	
LOSS	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**
1. RCS or SG Tube Leakage		**1. RCS or SG Tube Leakage**		**1. RCS or SG Tube Leakage**	
Not Applicable	A. CORE COOLING CSF - ORANGE entry conditions met~~RCS/reactor vessel level less than (site-specific level)~~.	A. An automatic or manual ECCS ~~(SI)~~ actuation is required by **EITHER** of the following: • UNISOLABLE RCS leakage • SG tube RUPTURE.	A. Operation of a standby charging ~~(makeup)~~ pump is required by **EITHER** of the following: • UNISOLABLE RCS leakage • SG tube leakage. **OR** B. RCS INTEGRITY CSF - RED entry conditions met~~RCS cooldown rate greater than (site-specific pressurized thermal shock criteria/limits defined by site-specific indications).~~	A. A leaking or RUPTURED SG is FAULTED outside of containment.	Not Applicable

Commented [52]: V16 CSFST Information

Commented [53]: V16 CSFST Information

Fuel Clad Barrier		RCS Barrier		Containment Barrier	
LOSS	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**
2. Inadequate Heat Removal		**2. Inadequate Heat Removal**		**2. Inadequate Heat Removal**	
A. CORE COOLING CSF - RED entry conditions met~~Core exit thermocouple readings greater than (site-specific temperature value).~~	A. CORE COOLING CSF - ORANGE entry conditions met **OR** ~~B. HEAT SINK CSF - RED entry conditions met Core exit thermocouple readings greater than (site-specific temperature value).~~ ~~**OR**~~ ~~B. Inadequate RCS heat removal capability via steam generators as indicated by (site-specific indications).~~ NOTE: Heat Sink CSF should not be considered RED if total AFW flow is less than 395 gpm due to operator action.	Not Applicable	A. HEAT SINK CSF - RED entry conditions met~~Inadequate RCS heat removal capability via steam generators as indicated by (site-specific indications).~~ NOTE: Heat Sink CSF should not be considered RED if total AFW flow is less than 395 gpm due to operator action.	Not Applicable	~~A.~~ CORE COOLING CSF - RED entry conditions met for 15 minutes or longer~~1. (Site-specific criteria for entry into core cooling restoration procedure)~~ ~~**AND**~~ ~~2. Restoration procedure not effective within 15 minutes.~~
3. RCS Activity / Containment Radiation		**3. RCS Activity / Containment Radiation**		**3. RCS Activity / Containment Radiation**	
A. Containment radiation monitor RE-27 A or B greater than 600 R/Hr ~~reading greater than (site-specific value).~~ **OR**	Not Applicable	A. Containment radiation monitor RE-2 greater than 1 R/Hr **OR** Containment radiation monitor RE-7 greater than	Not Applicable	Not Applicable	A. Containment radiation monitor RE-27 A or B greater than 8000 R/Hr ~~reading greater than (site-specific value).~~

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Commented [55]: V16 CSFST Information

Commented [57]: V16 CSFST Information

Commented [58]: V16 CSFST Information

Commented [56]: V16 CSFST Information

Commented [60]: V2 Rad Monitor Calculation

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Commented [62]: V2 Rad Monitor Calculation

Fuel Clad Barrier		RCS Barrier		Containment Barrier	
LOSS	POTENTIAL LOSS	LOSS	POTENTIAL LOSS	LOSS	POTENTIAL LOSS
B. ~~(Site-specific~~ ~~:~~Indications that reactor coolant activity is greater than 300 µCi/gm dose equivalent I-131~~)~~.		500 mR/Hr ~~rreading greater than (site-specific value).~~			

Commented [61]: V2 Rad Monitor Calculation

Fuel Clad Barrier		RCS Barrier		Containment Barrier	
LOSS	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**
4. Containment Integrity or Bypass		**4. Containment Integrity or Bypass**		**4. Containment Integrity or Bypass**	
Not Applicable	Not Applicable	Not Applicable	Not Applicable	A. Containment isolation is required **AND** **EITHER** of the following: • Containment integrity has been lost based on Emergency Director judgment. • UNISOLABLE pathway from the containment to the environment exists. **OR** B. Indications of RCS leakage outside of containment as indicated by alarms on any of the following instruments: • RE-10 • RE-14 • RE-21 • RE-22	A. CONTAINMENT CSF RED entry conditions met ~~Containment pressure greater than (site-specific value)~~ **OR** B. Containment Hydrogen concentration greater than 5.5% ~~Explosive mixture exists inside containment~~ **OR** C. 1. CONTAINMENT CSF ORANGE conditions met ~~Containment pressure greater than (site-specific pressure setpoint)~~ **AND** 2. Less than one CTMT fan coolers and one full train of ~~(site-specific system or equipment)~~ CTMT Spray is operating per design for 15 minutes or longer.
5. Other Indications		**5. Other Indications**		**5. Other Indications**	

Commented [64]: V16 CSFST Information

Commented [65]: V12 H_2 Concentration

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Commented [63]: V17 Rad Monitor ARP

Fuel Clad Barrier		RCS Barrier		Containment Barrier	
LOSS	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**	**LOSS**	**POTENTIAL LOSS**
Not applicable~~A. (site-specific as applicable)~~	Not applicable~~A. (site-specific as applicable)~~	Not applicable~~A. (site-specific as applicable)~~	Not applicable~~A. (site-specific as applicable)~~	Not applicable~~A. (site-specific as applicable)~~	Not applicable~~A. (site-specific as applicable)~~
6. Emergency Director Judgment		**6. Emergency Director Judgment**		**6. Emergency Director Judgment**	
A. **ANY** condition in the opinion of the emergency director that indicates loss of the fuel clad barrier.	A. **ANY** condition in the opinion of the emergency director that indicates potential loss of the fuel clad barrier.	A. **ANY** condition in the opinion of the emergency director that indicates loss of the RCS barrier.	A. **ANY** condition in the opinion of the emergency director that indicates potential loss of the RCS barrier.	A. **ANY** condition in the opinion of the emergency director that indicates loss of the containment barrier.	A. **ANY** condition in the opinion of the emergency director that indicates potential loss of the containment barrier.

Basis Information For Fission Product Barrier EALs ~~Table 9-F-3~~

~~**Developer Notes:**~~

~~**Threshold Parameters and Values**~~

~~Each PWR owner's group has developed a methodology for guiding the development and implementation of EOPs (i.e., assessing plant parameters, and determining and prioritizing operator actions). Many of the thresholds contained in the PWR EAL Fission Product Barrier Table reflect conditions that are specifically addressed in EOPs (e.g., a loss of heat removal capability by the steam generators). When developing a site-specific threshold, developers should use the parameters and values specified within their EOPs that align with the condition described by the generic threshold and basis, and related developer notes. This approach will ensure consistency between the site-specific EOPs and emergency classification scheme, and thus facilitate more timely and accurate classification assessments.~~

~~In support of EOP development and implementation, the Westinghouse Owners Group (WOG) developed a defined set of Critical Safety Functions as part of their Emergency Response Guidelines. The WOG approach structures EOPs to maintain and/or restore these Critical Safety Functions, and to do so in a prioritized and systematic manner. The WOG Critical Safety Functions are presented below.~~

- ~~Subcriticality~~
- ~~Core Cooling~~
- ~~Heat Sink~~
- ~~RCS Integrity~~
- ~~Containment~~
- ~~RCS Inventory~~

~~The WOG ERGs provide a methodology for monitoring the status of the Critical Safety Functions and classifying the significance of a challenge to a function; this methodology is referred to as the Critical Safety Function Status Trees (CSFSTs). For plants that have implemented the WOG ERGs, the guidance in NEI 99-01 allows for use of certain CSFST assessment results as EALs and fission product barrier loss/potential loss thresholds. In this manner, an emergency classification assessment may flow directly from a CSFST assessment.~~

~~It is important to understand that the CSFSTs are evaluated using plant parameters, and that they are simply a vendor-specific method for collectively evaluating a set of parameters for purposes of driving emergency operating procedure usage. For the emergency conditions of interest, the generic thresholds within the PWR EAL Fission Product Barrier Table specify the plant parameters that define a potential loss or loss of a fission product barrier; however, as described in the associated Developer Notes, a CSFST terminus may be used as well. For this reason, inclusion of the CSFST-related thresholds would be redundant to the parameter-based thresholds for plants that employ the WOG ERGs.~~

~~Sites that employ the WOG ERGs may, at their discretion, include the CSFST-based loss and potential loss thresholds as described in the Developer Notes. Developers at these sites should~~

~~consult with their classification decision-makers to determine if inclusion would assist with timely and accurate emergency classification. This decision should consider the effects of any site-specific changes to the generic WOG CSFST evaluation logic and setpoints, as well as those arising from user rules applicable to emergency operating procedures (e.g., exceptions to procedure entry or transition due to specific accident conditions or loss of a support system).~~

~~The CSFST thresholds may be addressed in one of 3 ways:~~

~~1) Not incorporated; thresholds will use parameters and values as discussed in the Developer Notes.~~

~~2) Incorporated along with parameter and value thresholds (e.g., a fuel clad loss would have 2 thresholds such as "CETs > 1200°F" and "Core Cooling Red entry conditions met".~~

~~3) Used in lieu of parameters and values for all thresholds.~~

~~With one exception, if a decision is made to include the CSFST-based thresholds, then all such allowed thresholds must be used in the table (e.g., it is not permissible to use only the C Orange terminus as a potential loss of the fuel clad barrier threshold and disregard all other CSFST-based thresholds). The one exception is the RCS Integrity (P) CSFST. Because of the complexity of the P Red decision-point that relies on an assessment a pressure-temperature curve, a P Red condition may be used as an RCS potential loss threshold without the need to incorporate the other CSFST-based thresholds.~~

~~PWR~~ FUEL CLAD BARRIER THRESHOLDS:

The fuel clad barrier consists of the cladding material that contains the fuel pellets.

1. RCS or SG Tube Leakage

There is no Loss threshold associated with RCS or SG Tube Leakage.

Potential Loss 1.A

This ~~reading~~ condition indicates a reduction in reactor vessel water level sufficient to allow the onset of heat-induced cladding damage.

~~**Developer Notes:**~~

~~Potential Loss 1.A~~

~~Enter the site-specific reactor vessel water level value(s) used by EOPs to identify a degraded core cooling condition (e.g., requires prompt restoration action). The reactor vessel level that corresponds to approximately the top of active fuel may also be used.~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the reactor vessel level(s) used for the Core Cooling Orange Path (including dependencies upon the status of RCPs, if applicable).~~

~~Westinghouse ERG Plants~~

~~Developers should consider including a threshold the same as, or similar to, "Core Cooling Orange entry conditions met" in accordance with the guidance at the front of this section.~~

2. Inadequate Heat Removal

Loss 2.A

This ~~reading~~ condition indicates temperatures within the core are sufficient to cause significant superheating of reactor coolant.

Potential Loss 2.A

This ~~reading~~ condition indicates temperatures within the core are sufficient to allow the onset of heat-induced cladding damage.

Potential Loss 2.B

NOTE: Heat Sink CSF should not be considered RED if total AFW flow is less than 395 gpm due to operator action.

This condition indicates an extreme challenge to the ability to remove RCS heat using the steam generators (i.e., loss of an effective secondary-side heat sink). This condition represents a potential loss of the fuel clad barrier. In accordance with EOPs, there may be unusual accident conditions during which operators intentionally reduce the heat

removal capability of the steam generators; during these conditions, classification using threshold is not warranted.

Meeting this threshold results in a Site Area Emergency because this threshold is identical to RCS barrier potential loss threshold 2.A; both will be met. This condition warrants a Site Area Emergency declaration because inadequate RCS heat removal may result in fuel heat-up sufficient to damage the cladding and increase RCS pressure to the point where mass will be lost from the system.

~~**Developer Notes:**~~

~~Some site-specific EOPs and/or EOP user guidelines may establish decision-making criteria concerning the number or other attributes of thermocouple readings necessary to drive actions (e.g., 5 CETs reading greater than 1,200°F is required before transitioning to an inadequate core cooling procedure). To maintain consistency with EOPs, these decision-making criteria may be used in the core exit thermocouple reading thresholds.~~

~~Loss 2.A~~

~~Enter a site-specific temperature value that corresponds to significant in-core superheating of reactor coolant. 1,200°F may also be used.~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the parameters and values used in the Core Cooling Red Path.~~

~~Potential Loss 2.A~~

~~Enter a site-specific temperature value that corresponds to core conditions at the onset of heat-induced cladding damage (e.g., the temperature allowing for the formation of superheated steam assuming that the RCS is intact). 700°F may also be used.~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the parameters and values used in the Core Cooling Orange Path.~~

~~Potential Loss 2.B~~

~~Enter the site-specific parameters and values that define an extreme challenge to the ability to remove heat from the RCS via the steam generators. These will typically be parameters and values that would require operators to take prompt action to address this condition.~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the parameters and values used in the Heat Sink Red Path.~~

~~Westinghouse ERG Plants~~

~~As a loss indication, developers should consider including a threshold the same as, or similar to, "Core Cooling Red entry conditions met" in accordance with the guidance at the front of this section.~~

~~**PWR FUEL CLAD BARRIER THRESHOLDS:**~~

~~As a potential loss indication, developers should consider including a threshold the same as, or similar to, "Core Cooling Orange entry conditions met" in accordance with the guidance at the front of this section.~~

~~As a potential loss indication, developers should consider including a threshold the same as, or similar to, "Heat Sink Red entry conditions met" in accordance with the guidance at the front of this section.~~

3. RCS Activity~~-/-~~Containment Radiation

Loss 3.A

The radiation monitor reading corresponds to an instantaneous release of all reactor coolant mass into the containment, assuming that reactor coolant activity equals 300μCi/gm dose equivalent I-131. Reactor coolant activity above this level is greater than that expected for iodine spikes and corresponds to an approximate range of 2~~%~~ percent to 5~~%~~ percent fuel clad damage. Since this condition indicates that a significant amount of fuel clad damage has occurred, it represents a loss of the fuel clad barrier.

The radiation monitor reading in this threshold is higher than that specified for RCS barrier loss threshold 3.A since it indicates a loss of both the fuel clad barrier and the RCS barrier. Note that a combination of the two monitor readings appropriately escalates the emergency classification level to a Site Area Emergency.

Loss 3.B

This threshold indicates that RCS radioactivity concentration is greater than 300 μCi/gm dose equivalent I-131. Reactor coolant activity above this level is greater than that expected for iodine spikes and corresponds to an approximate range of 2~~%~~ percent to 5~~%~~ percent fuel clad damage. Since this condition indicates that a significant amount of fuel clad damage has occurred, it represents a loss of the fuel clad barrier.

It is recognized that sample collection and analysis of reactor coolant with highly elevated activity levels could require several hours to complete. Nonetheless, a sample related threshold is included as a backup to other indications.

There is no potential loss threshold associated with RCS activity/containment radiation.

~~**Developer Notes:**~~

~~Loss 3.A~~

~~The reading should be determined assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory, with RCS radioactivity concentration equal to 300 μCi/gm dose equivalent I-131, into the containment atmosphere.~~

~~**PWR FUEL CLAD BARRIER THRESHOLDS:**~~

~~Loss 3.B~~

~~Threshold values should be determined assuming RCS radioactivity concentration equals 300 µCi/gm dose equivalent I-131. Other site-specific units may be used (e.g., µCi/cc).~~

~~Depending upon site-specific capabilities, this threshold may have a sample analysis component and/or a radiation monitor reading component.~~

~~Add this paragraph (or similar wording) to the Basis if the threshold includes a sample analysis component, "It is recognized that sample collection and analysis of reactor coolant with highly elevated activity levels could require several hours to complete. Nonetheless, a sample-related threshold is included as a backup to other indications."~~

4. Containment Integrity or Bypass

Not applicable (included for numbering consistency)

5. Other Indications

Not applicable (included for numbering consistency)

~~Loss and/or Potential Loss 5.A~~

~~This subcategory addresses other site-specific thresholds that may be included to indicate loss or potential loss of the Fuel Clad barrier based on plant-specific design characteristics not considered in the generic guidance.~~

~~**Developer Notes:**~~

~~Loss and/or Potential Loss 5.A~~

~~Developers should determine if other reliable indicators exist to evaluate the status of this fission product barrier (e.g., review accident analyses described in the site Final Safety Analysis Report, as updated). The goal is to identify any unique or site-specific indications that will promote timely and accurate assessment of barrier status.~~

~~Any added thresholds should represent approximately the same relative threat to the barrier as the other thresholds in this column. Basis information for the other thresholds may be used to gauge the relative barrier threat level.~~

6. Emergency Director Judgment

Loss 6.A

This threshold addresses any other factors ~~that may be~~ used by the emergency director in determining whether the fuel clad barrier is lost.

~~**PWR FUEL CLAD BARRIER THRESHOLDS:**~~

Potential Loss 6.A

This threshold addresses any other factors ~~that may be~~ used by the emergency director in determining whether the fuel clad barrier is potentially lost. The emergency director ~~should~~ will also consider whether or not to declare the barrier potentially lost in the event that barrier status cannot be monitored.

~~**Developer Notes:**~~

~~None~~

~~PWR~~ RCS BARRIER THRESHOLDS:

The RCS barrier includes the RCS primary side and its connections up to and including the pressurizer safety and relief valves, and other connections up to and including the primary isolation valves.

1. RCS or SG Tube Leakage

Loss 1.A

This threshold is based on an UNISOLABLE RCS leak of sufficient size to require an automatic or manual actuation of the Emergency Core Cooling System (ECCS). This condition clearly represents a loss of the RCS Barrier.

This threshold is applicable to unidentified and pressure boundary leakage, as well as identified leakage. It is also applicable to UNISOLABLE RCS leakage through an interfacing system. The mass loss may be into any location – inside containment, to the secondary-side (i.e., steam generator tube leakage) or outside of containment.

A steam generator with primary-to-secondary leakage of sufficient magnitude to require a safety injection is considered to be RUPTURED. If a RUPTURED steam generator is also FAULTED outside of containment, the declaration escalates to a Site Area Emergency since the containment barrier loss threshold 1.A will also be met.

Potential Loss 1.A

This threshold is based on an UNISOLABLE RCS leak that results in the inability to maintain pressurizer level within specified limits by operation of a normally used charging (makeup) pump, but an ECCS (SI) actuation has not occurred. The threshold is met when an operating procedure, or operating crew supervision, directs that a standby charging (makeup) pump be placed in service to restore and maintain pressurizer level.

This threshold is applicable to unidentified and pressure boundary leakage, as well as identified leakage. It is also applicable to UNISOLABLE RCS leakage through an interfacing system. The mass loss may be into any location – inside containment, to the secondary-side (i.e., steam generator tube leakage) or outside of containment.

If a leaking steam generator is also FAULTED outside of containment, the declaration escalates to a Site Area Emergency since the containment barrier loss threshold 1.A will also be met.

Potential Loss 1.B

This condition indicates an extreme challenge to the integrity of the RCS pressure boundary due to pressurized thermal shock – a transient that causes rapid RCS cooldown while the RCS is in Mode 3 or higher (i.e., hot and pressurized).

~~**PWR RCS BARRIER THRESHOLDS:**~~

~~**Developer Notes:**~~

~~Loss 1.A~~

~~Actuation of the ECCS may also be referred to as Safety Injection (SI) actuation or other appropriate site-specific term.~~

~~Potential Loss 1.A~~

~~Depending upon charging pump flow capacities and RCS volume control parameters, developers may use an RCS leak rate value of 50 gpm, or an appropriate site-specific value, as an alternate Potential Loss threshold. If used, the threshold wording should reflect that the determination of the leak rate value excludes normal reductions in RCS inventory (e.g., by the letdown system or RCP seal leakoff).~~

~~Potential Loss 1.B~~

~~Enter the site-specific indications that define an extreme challenge to the integrity of the RCS pressure boundary due to pressurized thermal shock – a transient that causes rapid RCS cooldown while the RCS is in Mode 3 or higher (i.e., hot and pressurized). These will typically be parameters and values that would require operators to take prompt action to address a pressurized thermal shock condition. Developers should also determine if the threshold needs to reflect any dependencies used as EOP transition/entry decision points or condition validation criteria (e.g., an EOP used to respond to an excessive RCS cooldown may not be entered or immediately exited if RCS pressure is below a certain value).~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the parameters and values used in the RCS Integrity Red Path. Because of the complexity of certain decision-points within the Red Path of this CSFST, developers at these plants may elect to not include the specific parameters and values, and instead follow the guidance below.~~

~~Westinghouse ERG Plants~~

~~As a potential loss indication, developers should consider including a threshold the same as, or similar to, "RCS Integrity Red entry conditions met" in accordance with the guidance at the front of this section. As noted above, developers should ensure that the threshold wording reflects any EOP transition/entry decision points or condition validation criteria. For example, a threshold might read "RCS Integrity (P) Red entry conditions met with RCS pressure > 300 psig."~~

2. Inadequate Heat Removal

There is no loss threshold associated with inadequate heat removal.

~~**PWR RCS BARRIER THRESHOLDS:**~~

Potential Loss 2.A

NOTE: Heat Sink CSF should not be considered RED if total AFW flow is less than 395 gpm due to operator action.

This condition indicates an extreme challenge to the ability to remove RCS heat using the steam generators (i.e., loss of an effective secondary-side heat sink). This condition represents a potential loss of the RCS Barrier. In accordance with EOPs, there may be unusual accident conditions during which operators intentionally reduce the heat removal capability of the steam generators; during these conditions, classification using threshold is not warranted.

Meeting this threshold results in a Site Area Emergency because this threshold is identical to fuel clad barrier potential loss threshold 2.B; both will be met. This condition warrants a Site Area Emergency declaration because inadequate RCS heat removal may result in fuel heat-up sufficient to damage the cladding and increase RCS pressure to the point where mass will be lost from the system.

~~**Developer Notes:**~~

~~Potential Loss 2.A~~

~~Enter the site-specific parameters and values that define an extreme challenge to the ability to remove heat from the RCS via the steam generators. These will typically be parameters and values that would require operators to take prompt action to address this condition.~~

~~For plants that have implemented Westinghouse Owners Group Emergency Response Guidelines, enter the parameters and values used in the Heat Sink Red Path.~~

~~Westinghouse ERG Plants~~

~~Developers should consider including a threshold the same as, or similar to, "Heat Sink Red entry conditions met" in accordance with the guidance at the front of this section.~~

3. RCS Activity~~-/-~~Containment Radiation

Loss 3.A

The radiation monitor reading corresponds to an instantaneous release of all reactor coolant mass into the containment, assuming that reactor coolant activity equals Technical Specification allowable limits. This value is lower than that specified for fuel clad barrier loss threshold 3.A since it indicates a loss of the RCS barrier only.

There is no potential loss threshold associated with RCS activity~~-/-~~containment radiation.

~~**PWR RCS BARRIER THRESHOLDS:**~~

~~**Developer Notes:**~~

~~Loss 3.A~~

~~The reading should be determined assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory, with RCS activity at Technical Specification allowable limits, into the containment atmosphere. Using RCS activity at~~

~~Technical Specification allowable limits aligns this threshold with IC SU3. Also, RCS activity at this level will typically result in containment radiation levels that can be more readily detected by containment radiation monitors, and more readily differentiated from those caused by piping or component "shine" sources. If desired, a plant may use a lesser value of RCS activity for determining this value.~~

~~In some cases, the site-specific physical location and sensitivity of the containment radiation monitor(s) may be such that radiation from a cloud of released RCS gases cannot be distinguished from radiation emanating from piping and components containing elevated reactor coolant activity. If so, refer to the Developer Notes for Loss/Potential Loss 5.A and determine if an alternate indication is available.~~

4. Containment Integrity or Bypass

Not applicable (included for numbering consistency)

5. Other Indications

Not applicable (included for numbering consistency)

~~Loss and/or Potential Loss 5.A~~

~~This subcategory addresses other site-specific thresholds that may be included to indicate loss or potential loss of the RCS barrier based on plant-specific design characteristics not considered in the generic guidance.~~

~~**Developer Notes:**~~

~~Loss and/or Potential Loss 5.A~~

~~Developers should determine if other reliable indicators exist to evaluate the status of this fission product barrier (e.g., review accident analyses described in the site Final Safety Analysis Report, as updated). The goal is to identify any unique or site-specific indications that will promote timely and accurate assessment of barrier status.~~

~~Any added thresholds should represent approximately the same relative threat to the barrier as the other thresholds in this column. Basis information for the other thresholds may be used to gauge the relative barrier threat level.~~

~~**PWR RCS BARRIER THRESHOLDS:**~~

6. Emergency Director Judgment

Loss 6.A

This threshold addresses any other factors ~~that may be~~ used by the emergency director in determining whether the RCS Barrier is lost.

Potential Loss 6.A

This threshold addresses any other factors ~~that may be~~ used by the emergency director in determining whether the RCS Barrier is potentially lost. The emergency director ~~should~~ will also consider whether or not to declare the barrier potentially lost in the event that barrier status cannot be monitored.

~~**Developer Notes:**~~

~~None~~