Progress Energy	R REFERENCE USE

HARRIS NUCLEAR PLANT

PLANT OPERATING MANUAL

VOLUME 2

PART 5

PROCEDURE TYPE: PLANT EMERGENCY PROCEDURE

NUMBER: **EP-EAL**

TITLE: **Emergency Action Levels**

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ABBEVIATIONS / ACRONYMS

%/PCT ..... percent
≤ ..... less than or equal to
≥ ..... greater than or equal to
ΔT ..... differential temperature
< ..... less than
> ..... greater than

AC ..... alternating current
ACP ..... auxiliary control panel
AFW ..... auxiliary feedwater
AHU ..... air handling unit
ALB ..... alarm light box
AMSAC ..... ATWS mitigating system actuation circuitry
AOV ..... air-operated valve
ATP ..... auxiliary transfer panel
ATWS ..... anticipated transient without scram

BIT ..... boron injection tank

CCW ..... component cooling water
CDE ..... committed dose equivalent
CFC ..... containment fan cooler
CFR ..... code of federal regulations
CI ..... containment isolation
cont'd ..... continued
CP&L ..... Carolina Power and Light Company
CS ..... containment spray
CSAS ..... containment spray actuation signal
CSF ..... critical safety function
CSFST ..... critical safety function status tree
CSIP ..... charging/safety injection pump
CST ..... condensate storage tank
CNMT ..... containment
CVCS ..... chemical and volume control system

DC ..... direct current
DCH ..... direct containment heating
DDT ..... deflagration to detonation transition
DHR ..... decay heat removal
DOT ..... department of transportation

EAB ..... Exclusion Area Boundary
EAL ..... emergency airlock

EAL ..... emergency action level
ECCS ..... emergency core cooling system
ECL ..... emergency classification level
EDG ..... emergency diesel generator
EOF ..... emergency operations facility
EOP ..... emergency operating procedure
EPA ..... environmental protection agency
EPRI ..... Electric Power Research Institute
ERG ..... emergency response guideline
ESF ..... engineered safety feature
ESFAS ..... engineered safety features actuation system
ESS ..... emergency safeguards sequencer
ESU ..... emergency service water
ESW ..... emergency service water

F ..... farenheit
FAA ..... federal aviation administration
FBI ..... federal bureau of investigation
FEMA ..... federal emergency management agency
FHB ..... fuel handling building
FSAR ..... final safety analysis report
FT ..... flow transmitter

GE ..... general emergency

HHSI ..... high head safety injection
Hi ..... high
HOO ..... headquarters operations officer
HPSI ..... high pressure safety injection
HRA ..... human reliability analysis
HVAC ..... heating ventilation and air conditioning
HX ..... heat exchanger

IA ..... instrument air
IC ..... initiating condition
ICCM ..... inadequate core cooling monitor
ILRT ..... integrated leakrate test
IPE ..... individual plant examination
IPEEE ..... individual plant examination of external events (Generic Letter 88-20)
ISFSI ..... independent spent fuel storage installation
ISLOCA ..... inter-system loss of coolant accident

K ..... kelvin
Keff ..... effective neutron multiplication factor
kV ..... kilovolt

LCO..... limiting condition of operation
LER..... licensee event report
LHSI ..... low head safety injection
LLRT ..... local leakrate test
Lo ..... low
LOCA ..... loss of coolant accident
LT ..... level transmitter
LWR..... light water reactor

KPPH ..... kilo (thousand) pounds per hour

MCB ..... main control board
MCC ..... motor control center
MFW ..... main feedwater
MG ..... motor generator
MOV ..... motor-operated valve
mR ..... milliRoentgen
MRI ..... manual rod insertion
MSIV ..... main steam isolation valve
MSL..... main steam line
MTC ..... moderator temperature coefficient
MW..... megawatt

N2 ..... nitrogen
NE..... northeast
NEI..... Nuclear Energy Institute
NESP ..... National Environmental Studies Project
NORAD..... North American Aerospace Defense Command
NPP..... nuclear power plant
NRC ..... Nuclear Regulatory Commission
NSAC ..... Nuclear Safety Analysis Center
NSSS ..... nuclear steam supply system
NSW ..... normal service water
NW..... northwest

OBE ..... operating basis earthquake
OCA ..... owner controlled area
ODCM..... offsite dose calculation manual
ORO..... offsite response organization

PA ..... protected area
PAG ..... protective action guideline
PAL ..... personnel airlock
PASS ..... post-accident sampling system

POAH..... point of adding heat
PORV ..... power-operated relief valve
PRA ..... probabilistic risk assessment
PSA..... probabilistic safety assessment
PRT ..... pressurizer relief tank
PSI ..... pounds per square inch
PSIA ..... pounds per square inch absolute
PSID ..... pounds per square inch differential
PSIG ..... pounds per square inch gage
PT ..... pressure transmitter
PWR..... pressurized water reactor

R ..... roentgen
RAB ..... reactor auxiliary building
RCC ..... reactor control console
RCDT ..... reactor coolant drain tank
RCP ..... reactor coolant pump
RCS ..... reactor coolant system
rem..... roentgen equivalent man
RETS ..... radiological effluent technical specifications
RHR ..... residual heat removal
RPS ..... reactor protection system
RPV ..... reactor pressure vessel
RSVR..... reservoir
RVLIS ..... reactor vessel level indicating system
RWST ..... refueling water storage tank

SAE..... site area emergency
SBO ..... station blackout
SE ..... southeast
SEC..... site emergency coordinator
SFP..... spent fuel pool
SG ..... steam generator
SGTR ..... steam generator tube rupture
SHNPP ..... Shearon Harris Nuclear Power Plant
SI ..... safety injection
SOV ..... solenoid-operated valve
SPDS ..... Safety parameter display system
SRO ..... senior reactor operator
SRO ..... senior reactor operator
SRV ..... safety relief valve
SSE..... safe shutdown earthquake
SSPS ..... solid state protection system
SUT ..... startup transformer
SW ..... service water

SW ..... southwest

TEDE ..... total effective dose equivalent
TOAF ..... top of active fuel
TSC..... technical support center

UAT ..... unit auxiliary transformer
UE..... unusual event

V..... volt
VCT ..... volume control tank

WE ..... westinghouse electric
WOG..... westinghouse owners group

1.0 PURPOSE

This document provides an explanation and rationale for each Emergency Action Level (EAL) included in the EAL Upgrade Project for Shearon Harris Nuclear Power Plant (HNP). It should be used to facilitate review of the HNP EALs and provide historical documentation for future reference. Decision-makers responsible for implementation of PEP-110, Emergency Classification and Protective Action Recommendations, may use this document as a technical reference in support of EAL interpretation. This information may assist the Emergency Director in making classifications, particularly those involving judgment or multiple events. The basis information may also be useful in training, for explaining event classifications to off-site officials, and would facilitate regulatory review and approval of the classification scheme.

The expectation is that emergency classifications are to be made as soon as conditions are present and recognizable for the classification, but within 15 minutes in all cases of conditions present. Use of this document for assistance is not intended to delay the emergency classification.

2.0 DISCUSSION

2.1 Background

EALs are the plant-specific indications, conditions or instrument readings that are utilized to classify emergency conditions defined in the HNP Emergency Plan.

In 1992, the NRC endorsed NUMARC/NESP-007 “Methodology for Development of Emergency Action Levels” as an alternative to NUREG-0654 EAL guidance.

NEI 99-01 (NUMARC/NESP-007) Revision 4 was subsequently issued for industry implementation. Enhancements over earlier revisions included:

- Consolidating the system malfunction initiating conditions and example emergency action levels which address conditions that may be postulated to occur during plant shutdown conditions.

- Initiating conditions and example emergency action levels that fully address conditions that may be postulated to occur at permanently Defueled Stations and Independent Spent Fuel Storage Installations (ISFSIs).
- Simplifying the fission product barrier EAL threshold for a Site Area Emergency.

Subsequently, Revision 5 of NEI 99-01 has been issued which incorporates resolutions to numerous implementation issues including the NRC EAL FAQs. Using NEI 99-01 Revision 5 Final (February 2008), HNP conducted an EAL implementation upgrade project that produced the EALs discussed herein.

2.2 Fission Product Barriers

Many of the EALs derived from the NEI methodology are fission product barrier based. That is, the conditions that define the EALs are based upon loss or potential loss of one or more of the three fission product barriers. “Loss” and “Potential Loss” signify the relative damage and threat of damage to the barrier. “Loss” means the barrier no longer assures containment of radioactive materials; “potential loss” infers an increased probability of barrier loss and decreased certainty of maintaining the barrier.

The primary fission product barriers are:

A. Reactor Fuel Clad (FC): The Fuel Clad barrier consists of the zircalloy or stainless steel fuel bundle tubes that contain the fuel pellets.

B. Reactor Coolant System (RCS): 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.

C. Containment (CNMT): The Containment Barrier includes the containment building and connections up to and including the outermost containment isolation valves. This barrier also includes the main steam, feedwater, and blowdown line extensions outside the containment building up to and including the outermost secondary side isolation valve.

2.3 Emergency Classification Based on Fission Product Barrier Degradation

The following criteria are the bases for event classification related to fission product barrier loss or potential loss:

Unusual Event:

Any loss or any potential loss of Containment

Alert:

Any loss or any potential loss of either Fuel Clad or RCS

Site Area Emergency:

Loss or potential loss of any two barriers

General Emergency:

Loss of any two barriers and loss or potential loss of third barrier

2.4 EAL Relationship to EOPs and Critical Safety Function Status

Where possible, the EALs have been made consistent with and utilize the conditions defined in the HNP Emergency Operating Procedure (EOP) network. While the symptoms that drive operator actions specified in the EOPs are not indicative of all possible conditions which warrant emergency classification, they define the symptoms, independent of initiating events, for which reactor plant safety and/or fission product barrier integrity are threatened. When these symptoms are clearly representative of one of the NEI 99-01 Rev. 5 Initiating Conditions, they have been utilized as an EAL. This permits rapid classification of emergency situations based on plant conditions without the need for additional evaluation or event diagnosis. Although some of the EALs presented here are based on conditions defined in the EOPs, classification of emergencies using these EALs is not dependent upon EOP entry or execution. The EALs can be utilized independently or in conjunction with the EOPs.

2.5 Symptom-Based vs. Event-Based Approach

To the extent possible, the EALs are symptom-based. That is, the action level threshold is defined by values of key plant operating parameters that identify emergency or potential emergency conditions. This approach is appropriate because it allows the full scope of variations in the types of events to be classified as emergencies. However, a purely symptom-based approach is not sufficient to address all events for which emergency classification is appropriate. Particular events to which no predetermined symptoms can be ascribed have also been utilized as EALs since they may be indicative of potentially more serious conditions not yet fully realized.

2.6 EAL Organization

The HNP EAL scheme includes the following features:

- Division of the EAL set into three broad groups:
    - EALs applicable under all plant operating modes – This group would be reviewed by the EAL-user any time emergency classification is considered.
    - EALs applicable only under hot operating modes – This group would only be reviewed by the EAL-user when the plant is in Hot Shutdown, Hot Standby, Startup, or Power Operation mode.
    - EALs applicable only under cold operating modes – This group would only be reviewed by the EAL-user when the plant is in Cold Shutdown, Refueling or Defueled mode.

  The purpose of the groups is to avoid review of hot condition EALs when the plant is in a cold condition and avoid review of cold condition EALs when the plant is in a hot condition. This approach significantly minimizes the total number of EALs that must be reviewed by the EAL-user for a given plant condition, reduces EAL-user reading burden and, thereby, speeds identification of the EAL that applies to the emergency.
- Within each of the above three groups, assignment of EALs to categories/subcategories – Category and subcategory titles are selected to represent conditions that are operationally significant to the EAL-user. Subcategories are used as necessary to further divide the EALs of a category into logical sets of possible emergency classification thresholds. The HNP EAL categories/subcategories and their relationship to NEI 99-01 Rev. 5 Recognition Categories are listed below.

EAL Groups, Categories and Subcategories

EAL Group/Category	EAL Subcategory
<u>Any Operating Mode:</u>	
R – Abnormal **R**ad Release / Rad Effluent	1 – Offsite Rad Conditions 2 – Onsite Rad Conditions & Spent Fuel Events 3 – CR/CAS Rad
H – **H**azards	1 – Natural or Destructive Phenomena 2 – Fire or Explosion 3 – Hazardous Gas 4 – Security 5 – Control Room Evacuation 6 – Judgment
<u>Hot Conditions:</u>	
S – **S**ystem Malfunction	1 – Loss of AC Power 2 – Loss of DC Power 3 – Criticality & RPS Failure 4 – Inability to Reach or Maintain Shutdown Conditions 5 – Instrumentation 6 – Communications 7 – Fuel Clad Degradation 8 – RCS Leakage
F – **F**ission Product Barrier Degradation	None
<u>Cold Conditions:</u>	
C – **C**old Shutdown / Refueling System Malfunction	1 – Loss of AC Power 2 – Loss of DC Power 3 – RCS Level 4 – RCS Temperature 5 – Communications 6 – Inadvertent Criticality

The primary tool for determining the emergency classification level is the EAL Classification Matrix. The user of the EAL Classification Matrix may (but is not required to) consult the EAL Technical Bases Document in order to obtain additional information concerning the EALs under classification consideration. The user should consult Sections 2.7 and 2.8, and Attachments 1 and 2 of this document for such information.

2.7 Technical Bases Information

EAL technical bases are provided in Attachment 1 for each EAL according to EAL group (Any, Hot, Cold), EAL category (R, C, H, S and F) and EAL subcategory. A summary explanation of each category and subcategory is given at the beginning of the technical bases discussions of the EALs included in the category. For each EAL, the following information is provided:

Category Letter & Title

Subcategory Number & Title

Initiating Condition (IC)

Site-specific description of the generic IC given in NEI 99-01 Rev. 5.

EAL Identifier (enclosed in rectangle)

Each EAL is assigned a unique identifier to support accurate communication of the emergency classification to onsite and offsite personnel. Four characters define each EAL identifier:

1. First character (letter): Corresponds to the EAL category as described above (R, C, H, S or F)
2. Second character (letter): The emergency classification (G, S, A or U)

   G = General Emergency

   S = Site Area Emergency

   A = Alert

   U = Unusual Event
3. Third character (number): Subcategory number within the given category. Subcategories are sequentially numbered beginning with the number one (1). If

a category does not have a subcategory, this character is assigned the number one (1).

4. Fourth character (number): The numerical sequence of the EAL within the EAL subcategory. If the subcategory has only one EAL, it is given the number one (1).

Classification (enclosed in rectangle):

Unusual Event (U), Alert (A), Site Area Emergency (S) or General Emergency (G)

EAL (enclosed in rectangle)

Wording of the EAL as it appears in the EAL Classification Matrix

Mode Applicability

One or more of the following plant operating conditions comprise the mode to which each EAL is applicable: 1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown, 5 - Cold Shutdown, 6 - Refueling, D - Defueled, or All. (See Section 2.8 for operating mode definitions.)

Basis:

A Generic basis section provides a description of the rationale for the EAL as provided in NEI 99-01 Rev. 5. This is followed by a Plant-Specific basis section that provides HNP-relevant information concerning the EAL.

HNP Basis Reference(s):

Site-specific source documentation from which the EAL is derived

2.8 Operating Mode Applicability (Technical Specifications Table 1.2)

1 Power Operations

$K_{eff} \geq 0.99$ and rated thermal power > 5% and average coolant temperature $T_{avg} \geq 350°F$

2 Startup

$K_{eff} \geq 0.99$ and rated thermal power ≤ 5% and average coolant temperature $T_{avg} \geq 350°F$

3 Hot Standby

$K_{eff} < 0.99$ and average coolant temperature $T_{avg} \geq 350°F$

4 Hot Shutdown

K_{eff} < 0.99 and average coolant temperature 350°F > T_{avg} > 200°F (excluding decay heat)

5 Cold Shutdown

K_{eff} < 0.99 and average coolant temperature T_{avg} ≤ 200°F

6 Refueling

K_{eff} < 0.95 and average coolant temperature T_{avg} ≤ 140°F; fuel in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed

D Defueled

All reactor fuel removed from reactor pressure vessel (full core off load during refueling or extended outage)

The plant operating mode that exists at the time that the event occurs (prior to any protective system or operator action is initiated in response to the condition) should be compared to the mode applicability of the EALs. If a lower or higher plant operating mode is reached before the emergency classification is made, the declaration shall be based on the mode that existed at the time the event occurred.

2.9 Validation of Indications, Reports and Conditions

All emergency classifications shall be based upon valid indications, reports or conditions. An indication, report, or condition, is considered to be valid when it is verified by (1) an instrument channel check, or (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

2.10 Planned vs. Unplanned Events

Planned evolutions involve preplanning to address the limitations imposed by the condition, the performance of required surveillance testing, and the implementation of specific controls prior to knowingly entering the condition in accordance with the specific

requirements of the site's Technical Specifications. Activities which cause the site to operate beyond that allowed by the site's Technical Specifications, planned or unplanned, may result in an EAL threshold being met or exceeded. Planned evolutions to test, manipulate, repair, perform maintenance or modifications to systems and equipment that result in an EAL value being met or exceeded are not subject to classification and activation requirements as long as the evolution proceeds as planned and is within the operational limitations imposed by the specific operating license. However, these conditions may be subject to the reporting requirements of 10 CFR 50.72.

2.11 Classifying Transient Events

For some events, the condition may be corrected before a declaration has been made. The key consideration in this situation is to determine whether or not further plant damage occurred while the corrective actions were being taken. In some situations, this can be readily determined, in other situations, further analyses may be necessary (e.g., coolant radiochemistry following an ATWS event, plant structural examination following an earthquake, etc.). Classify the event as indicated and terminate the emergency once assessment shows that there were no consequences from the event and other termination criteria are met.

Existing guidance for classifying transient events addresses the period of time of event recognition and classification (15 minutes). However, in cases when EAL declaration criteria may be met momentarily during the normal expected response of the plant, declaration requirements should not be considered to be met when the conditions are a part of the designed plant response, or result from appropriate Operator actions.

There may be cases in which a plant condition that exceeded an EAL was not recognized at the time of occurrence but is identified well after the condition has occurred (e.g., as a result of routine log or record review), and the condition no longer exists. In these cases, an emergency should not be declared. Reporting requirements of 10 CFR 50.72 are applicable and the guidance of NUREG-1022, Event Reporting Guidelines 10 CFR 50.72 and 50.73, should be applied.

2.12 Imminent EAL Thresholds

Although the majority of the EALs provide very specific thresholds, the Site Emergency Coordinator (SEC) must remain alert to events or conditions that lead to the conclusion that exceeding the EAL threshold is imminent. If, in the judgment of the SEC, an imminent situation is at hand, the classification should be made as if the threshold has been exceeded. While this is particularly prudent at the higher emergency classes (the early classification may permit more effective implementation of protective measures), it is nonetheless applicable to all emergency classes.

3.0 REFERENCES

3.1 Developmental

3.1.1 NEI 99-01 Rev. 5 Final, Methodology for Development of Emergency Action Levels, February 2008, ADAMS Accession Number ML080450149

3.1.2 NRC Regulatory Issue Summary (RIS) 2003-18, Supplement 2, Use of Nuclear Energy Institute (NEI) 99-01, Methodology for Development of Emergency Action Levels Revision 4, Dated January 2003 (December 12, 2005)

3.2 Implementing

3.2.1 PEP-110, Emergency Classification and Protective Action Recommendations

3.2.2 EAL Comparison Matrix

3.2.3 EAL Classification Matrix

3.3 Commitments

None

4.0 DEFINITIONS (ref. 3.1.1 except as noted)

Affecting Safe Shutdown

Event in progress has adversely affected functions that are necessary to bring the plant to and maintain it in the applicable hot or cold shutdown condition. Plant condition applicability is determined by Technical Specification LCOs in effect.

Example 1: Event causes damage that results in entry into an LCO that requires the plant to be placed in hot shutdown. Hot shutdown is achievable, but cold shutdown is not. This event is not "affecting safe shutdown."

Example 2: Event causes damage that results in entry into an LCO that requires the plant to be placed in cold shutdown. Hot shutdown is achievable, but cold shutdown is not. This event is "affecting safe shutdown."

Bomb

Refers to an explosive device suspected of having sufficient force to damage plant systems or structures.

Civil Disturbance

A group of people violently protesting station operations or activities at the site.

Confinement Boundary

Is the barrier(s) between areas containing radioactive substances and the environment.

Containment Closure

The site specific procedurally defined actions taken to secure containment and its associated structures, systems, and components as a functional barrier to fission product release under existing plant conditions. As applied to HNP, Containment Closure is established when containment penetration closure is established in accordance with Technical Specifications 3/4.9.4.

Exclusion Area Boundary

A circle of approximately 7000 ft. radius (1.3 miles).

Explosion

A rapid, violent, unconfined combustion, or catastrophic failure of pressurized/energized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems, or components.

Extortion

Is an attempt to cause an action at the station by threat of force.

Faulted

In a steam generator, the existence of secondary side leakage that results in an uncontrolled drop in steam generator pressure or the steam generator being completely depressurized.

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.

Hostage

Person(s) held as leverage against the station to ensure that demands will be met by the station.

Hostile Action

An act toward HNP or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included.

Hostile Action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on HNP. Non-terrorism-based EALs should be used to address such activities, (e.g., violent acts between individuals in the owner controlled area).

Hostile Force

One or more individuals who are engaged in a determined assault, overtly or by stealth and deception, equipped with suitable weapons capable of killing, maiming, or causing destruction.

Imminent

Mitigation actions have been ineffective, additional actions are not expected to be successful, and trended information indicates that the event or condition will occur. Where imminent timeframes are specified, they shall apply.

Intrusion

The act of entering without authorization. Discovery of a bomb in a specified area is indication of intrusion into that area by a hostile force.

Independent Spent Fuel Storage Installation (ISFSI)

A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

Normal Plant Operations

Activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or emergency operating procedures, or deviation from normal security or radiological controls posture, is a departure from Normal Plant Operations.

Owner Controlled Area

That area surrounding the Protected Area beyond which HNP exercises access control.

Projectile

An object directed toward a NPP that could cause concern for its continued operability, reliability, or personnel safety.

Protected Area

An area which normally encompasses all controlled areas within the security protected area fence as depicted in FSAR Figure 1.2.2-1, Site Plan.

Ruptured

In a steam generator, existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.

Sabotage

Deliberate damage, mis-alignment, or mis-operation of plant equipment with the intent to render the equipment inoperable. Equipment found tampered with or damaged due to malicious mischief may not meet the definition of sabotage until this determination is made by security supervision.

Security Condition

Any security event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A security condition does not involve a hostile action.

Significant Transient

An unplanned event involving any of the following:

- Runback > 25% thermal power
- Electrical load rejection > 25% full electrical load
- Reactor scram
- ECCS injection
- Thermal power oscillations > 10%

Site Boundary

A circle of approximately 2500 ft. radius (0.47 miles).

Strike Action

Work stoppage within the Protected Area by a body of workers to enforce compliance with demands made on IPEC. The strike action must threaten to interrupt Normal Plant Operations.

Unisolable

A breach or leak that cannot be promptly isolated.

Unplanned

A parameter change or an event that is not the result of an intended evolution and requires corrective or mitigative actions.

Valid

An indication, report, or condition, is considered to be valid when it is verified by (1) an instrument channel check, or (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

Visible Damage

Damage to equipment or structure that is readily observable without measurements, testing, or analysis. Damage is sufficient to cause concern regarding the continued operability or reliability of affected structure, system, or component. Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering. Surface blemishes (e.g., paint chipping, scratches) should not be included.

Vital Area

Any area, within the HNPP Protected Area, which contains equipment, systems, components, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation.

5.0 HNP-TO-NEI 99-01 EAL CROSS REFERENCE

This cross-reference is provided to facilitate association and location of a HNP EAL within the NEI 99-01 IC/EAL identification scheme. Further information regarding the development of the HNP EALs based on the NEI guidance can be found in the EAL Comparison Matrix.

HNP	NEI 99-01	
EAL	**IC**	**Example EAL**
RU1.1	AU1	1
RU1.2	AU1	2
RU1.3	AU1	3
RU2.1	AU2	1
RU2.2	AU2	2
RA1.1	AA1	1
RA1.2	AA1	2
RA1.3	AA1	3
RA2.1	AA2	2
RA2.2	AA2	1
RA3.1	AA3	1
RS1.1	AS1	1
RS1.2	AS1	2
RS1.3	AS1	4
RG1.1	AG1	1
RG1.2	AG1	2
RG1.3	AG1	4
CU1.1	CU3	1
CU3.1	CU1	1

HNP	NEI 99-01	
EAL	IC	Example EAL
CU3.2	CU2	1
CU3.3	CU2	2
CU4.1	CU4	1
CU4.2	CU4	2
CU5.1	CU6	1, 2
CU6.1	CU8	2
CU2.1	CU7	1
CA1.1	CA3	1
CA3.1	CA1	1, 2
CA4.1	CA4	1, 2
CS3.1	CS1	1
CS3.2	CS1	2
CS3.3	CS1	3
CG3.1	CG1	1
CG3.2	CG1	2
FU1.1	FU1	1
FA1.1	FA1	1
FS1.1	FS1	1
FG1.1	FG1	1
HU1.1	HU1	1
HU1.2	HU1	2
HU1.3	HU1	3
HU1.4	HU1	4
HU1.5	HU1	5
HU2.1	HU2	1

HNP	NEI 99-01	
EAL	IC	Example EAL
HU2.2	HU2	2
HU3.1	HU3	1
HU3.2	HU3	2
HU4.1	HU4	1, 2, 3
HU6.1	HU5	1
HA1.1	HA1	1
HA1.2	HA1	2
HA1.3	HA1	3
HA1.4	HA1	4
HA1.5	HA1	6
HA1.6	HA1	5
HA2.1	HA2	1
HA3.1	HA3	1
HA4.1	HA4	1, 2
HA5.1	HA5	1
HA6.1	HA6	1
HS4.1	HS4	1
HS5.1	HS2	1
HS6.1	HS3	1
HG4.1	HG1	1
HG4.2	HG1	2
HG6.1	HG2	1
SU1.1	SU1	1
SU3.1	SU8	2
SU4.1	SU2	1

HNP	NEI 99-01	
EAL	IC	Example EAL
SU5.1	SU3	1
SU6.1	SU6	1, 2
SU7.1	SU4	2
SU7.2	SU4	1
SU8.1	SU5	1, 2
SA1.1	SA5	1
SA3.1	SA2	1
SA5.1	SA4	1
SS1.1	SS1	1
SS3.1	SS2	1
SS5.1	SS6	1
SS2.1	SS3	1
SG1.1	SG1	1
SG3.1	SG2	1

6.0 ATTACHMENTS

6.1 Attachment 1, Emergency Action Level Technical Bases

6.2 Attachment 2, Fission Product Barrier Loss / Potential Loss Matrix and Bases

6.3 Attachment 3, Harris Nuclear Plant Emergency Action Level Matrix

Category R – Abnormal Rad Release / Rad Effluent

EAL Group: ANY (EALs in this category are applicable to any plant condition, hot or cold.)

Many EALs are based on actual or potential degradation of fission product barriers because of the elevated potential for offsite radioactivity release. Degradation of fission product barriers though is not always apparent via non-radiological symptoms. Therefore, direct indication of elevated radiological effluents or area radiation levels are appropriate symptoms for emergency classification.

At lower levels, abnormal radioactivity releases may be indicative of a failure of containment systems or precursors to more significant releases. At higher release rates, offsite radiological conditions may result which require offsite protective actions. Elevated area radiation levels in plant may also be indicative of the failure of containment systems or preclude access to plant vital equipment necessary to ensure plant safety.

Events of this category pertain to the following subcategories:

1. Offsite Rad Conditions

Direct indication of effluent radiation monitoring systems provides a rapid assessment mechanism to determine releases in excess of classifiable limits. Projected offsite doses, actual offsite field measurements or measured release rates via sampling indicate doses or dose rates above classifiable limits.

2. Onsite Rad Conditions & Spent Fuel Events

Sustained general area radiation levels in excess of those indicating loss of control of radioactive materials or those levels which may preclude access to vital plant areas also warrant emergency classification.

3. CR/CAS Rad

Sustained general area radiation levels which may preclude access to areas requiring continuous occupancy also warrant emergency classification.

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM for 60 minutes or longer

EAL:

RU1.1 Unusual Event

Valid reading on **any** Gaseous monitors > Table R-1 column "UE" for ≥ 60 min. (Note 2)

Note 2: The SEC should **not** wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 µCi/sec	1.26E+8 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 µCi/sec	1.27E+8 µCi/sec	1.08E+6 µCi/sec	1.08E+4 µCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.95E+7 µCi/sec	1.95E+5 µCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This EAL addresses a potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 2 x High Alarm multiples are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 4x ODCM for 30 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the IC.

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a discharge permit would not normally be prepared.

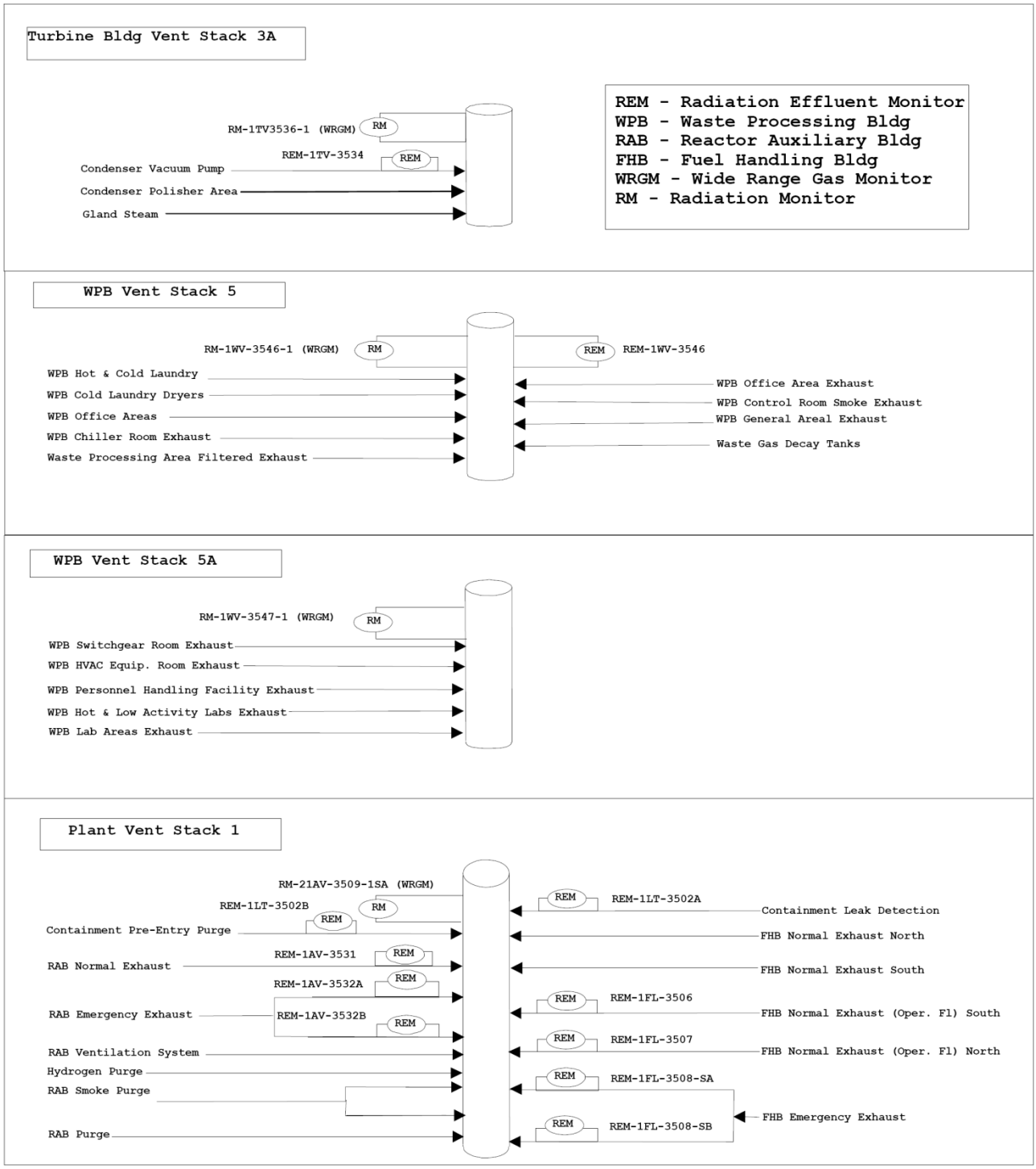
Plant-Specific

Figure R-1 illustrates the gaseous release streams. The column “UE” gaseous release values in Table R-1 represent two times the High Alarm setpoint of the specified monitors. The setpoints are established to ensure the ODCM release limits are not exceeded. (ref. 1)

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 3.0, Gaseous Effluents
2. Calculation EP-EALCALC-HNP-0801 Radiological Gaseous Effluent EAL Values (EAL AG1, AS1, AA1 and AU1)

Figure R-1 Gaseous Release Streams



Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM for 60 minutes or longer

EAL:

RU1.2 Unusual Event

Valid reading on **any** Liquid monitors > Table R-1 column "UE" for ≥ 60 min. (Note 2)

Note 2: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 μCi/sec	1.26E+8 μCi/sec	1.14E+6 μCi/sec	1.14E+4 μCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 μCi/sec	1.27E+8 μCi/sec	1.08E+6 μCi/sec	1.08E+4 μCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 μCi/sec	9.84E+7 μCi/sec	1.95E+7 μCi/sec	1.95E+5 μCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 μCi/sec	9.84E+7 μCi/sec	1.14E+6 μCi/sec	1.14E+4 μCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This IC addresses a potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 2 x High Alarm multiples are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 4x ODCM for 30 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the EAL established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

Plant-Specific

Figures R-2a and R-2b illustrate the liquid release streams. The column “UE” liquid release values in Table R-1 represent two times the alarm setpoint of the specified monitors. The setpoints are established to ensure the ODCM release limits are not exceeded. (ref. 1)

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 2.0, Liquid Effluents

Figure R-2a Liquid Release Streams

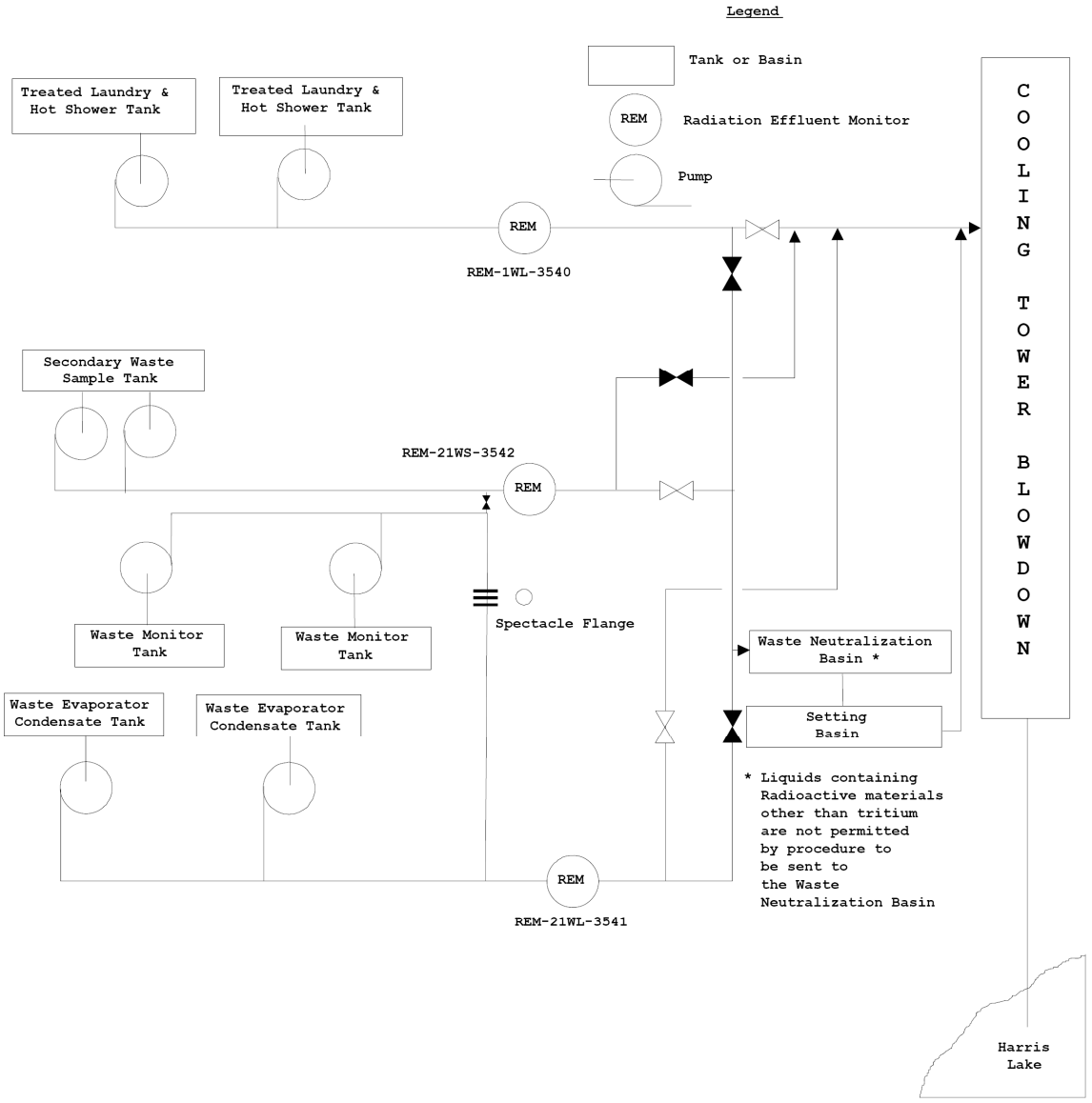
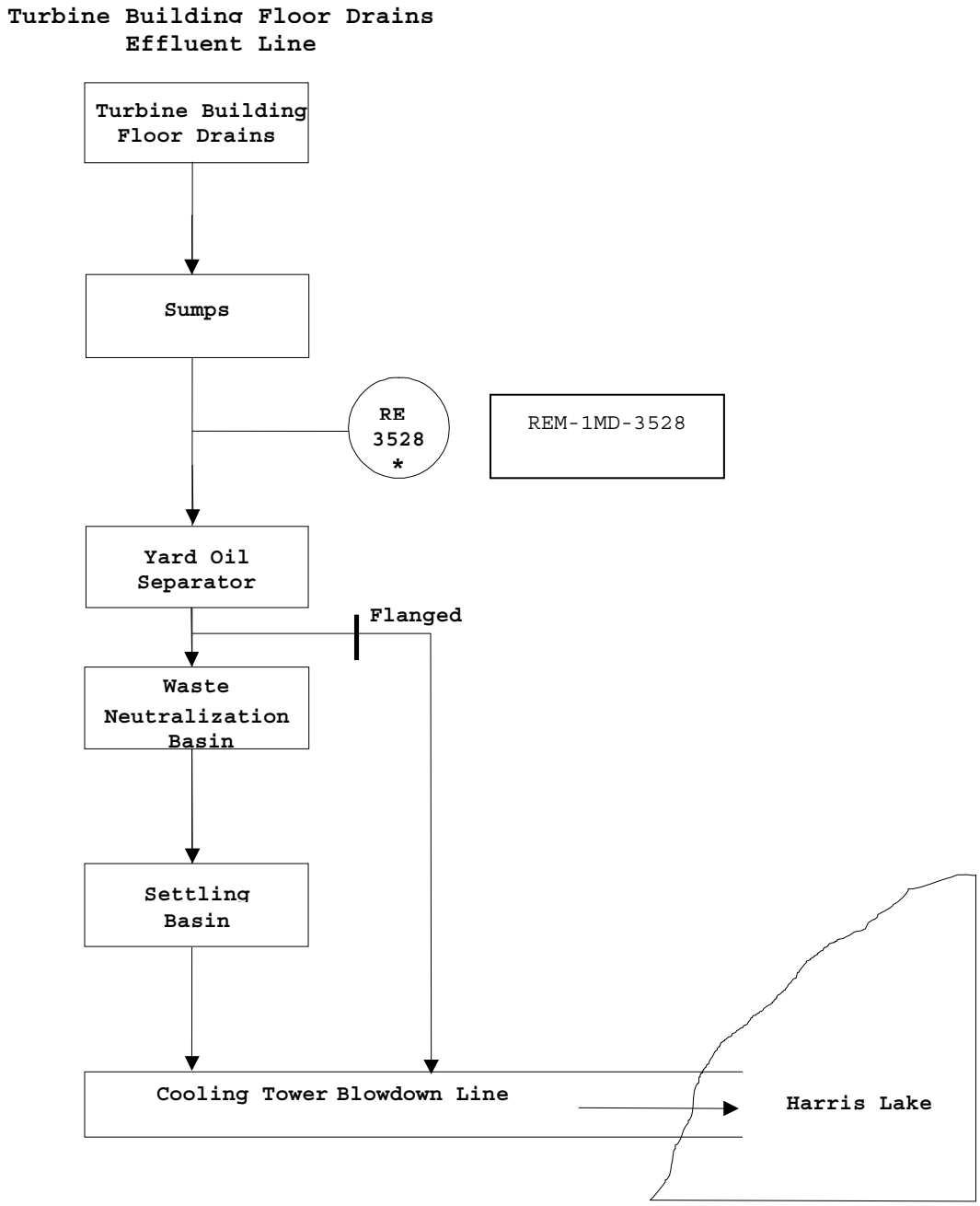


Figure R-2b Liquid Release Streams



* Turbine Building Floor Drains Effluent can be Diverted to the Secondary Waste Treatment System

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM for 60 minutes or longer

EAL:

RU1.3 Unusual Event

Confirmed sample analyses for gaseous or liquid releases indicate concentrations or release rates > 2 x ODCM limits for ≥ 60 min. (Note 2)

Note 2: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This EAL addresses a potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 2 x ODCM multiples are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 4x ODCM for 30 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.

Plant-Specific

Releases in excess of two times the site Offsite Dose Calculation Manual (ODCM) (ref. 1) instantaneous limits that continue for 60 minutes or longer represent an uncontrolled situation and hence, a potential degradation in the level of safety. The final integrated dose (which is very low in the Unusual Event emergency class) is not the primary concern here; it is the degradation in plant control implied by the fact that the release was not isolated within 60 minutes. Therefore, it is not intended that the release be averaged over 60 minutes. For example, a release of 4 times the ODCM limit for 30 minutes does not exceed this initiating condition. Further, the SEC should not wait until 60 minutes has elapsed, but should declare the event as soon as it is determined that the release duration has or will likely exceed 60 minutes.

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM)

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM for 15 minutes or longer

EAL:

RA1.1 Alert

Valid reading on **any** Gaseous monitors > Table R-1 column "Alert" for ≥ 15 min. (Note 2)

Note 2: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 µCi/sec	1.26E+8 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 µCi/sec	1.27E+8 µCi/sec	1.08E+6 µCi/sec	1.08E+4 µCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.95E+7 µCi/sec	1.95E+5 µCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This EAL addresses an actual or substantial potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 200 x High Alarm multiples are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the

Releases should not be prorated or averaged. For example, a release exceeding 600x ODCM for 5 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL is intended for sites that have established effluent monitoring on non-routine release pathways for which a discharge permit would not normally be prepared.

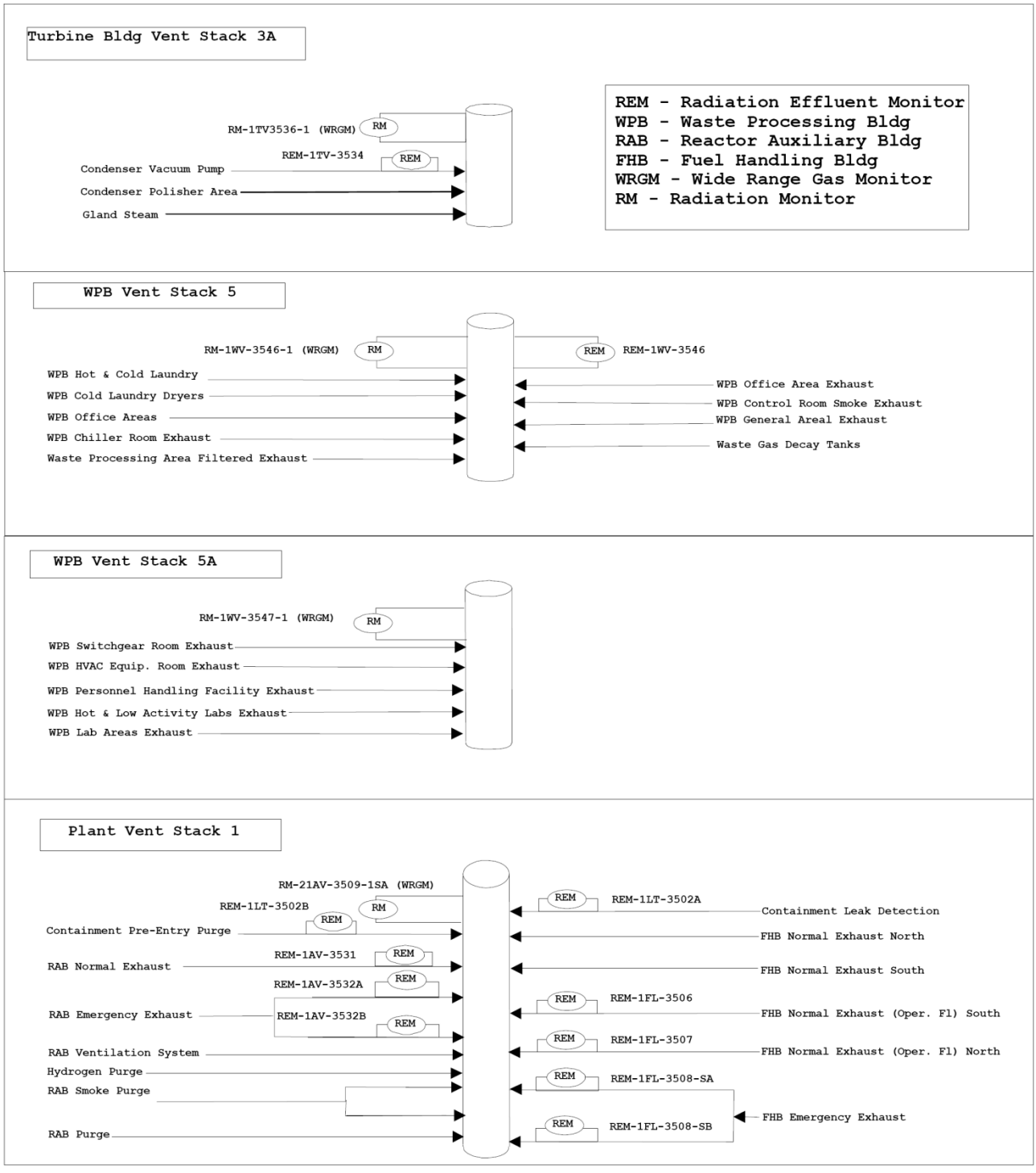
Plant-Specific

Figure R-1 illustrates the gaseous release streams. This event escalates from the Unusual Event by escalating the magnitude of the release by a factor of 100. The column “Alert” gaseous release values in Table R-1 are 200 times the monitor alarm setpoints. The setpoints are established to ensure the ODCM release limits are not exceeded. (ref. 1)

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 3.0, Gaseous Effluents
2. Calculation EP-EALCALC-HNP-0801 Radiological Gaseous Effluent EAL Values (EAL AG1, AS1, AA1 and AU1)

Figure R-1 Gaseous Release Streams



Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM for 15 minutes or longer

EAL:

RA1.2 Alert

Valid reading on **any** Liquid monitors > Table R-1 column "Alert" for ≥ 15 min. (Note 2)

Note 2: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 μCi/sec	1.26E+8 μCi/sec	1.14E+6 μCi/sec	1.14E+4 μCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 μCi/sec	1.27E+8 μCi/sec	1.08E+6 μCi/sec	1.08E+4 μCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 μCi/sec	9.84E+7 μCi/sec	1.95E+7 μCi/sec	1.95E+5 μCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 μCi/sec	9.84E+7 μCi/sec	1.14E+6 μCi/sec	1.14E+4 μCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This EAL addresses an actual or substantial potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 200 x High Alarm multiples are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 600x ODCM for 5 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL addresses radioactivity releases, that for whatever reason, cause effluent radiation monitor readings to exceed the threshold identified in the EAL established by the radioactivity discharge permit. This value may be associated with a planned batch release, or a continuous release path.

Plant-Specific

Figures R-2a and R-2b illustrate the liquid release streams. This event escalates from the Unusual Event by escalating the magnitude of the release by a factor of 100. The column "Alert" liquid release values in Table R-1 represent two hundred times the alarm setpoint (or off-scale high depending on the established alarm setpoint) of the specified monitors. The setpoints are established to ensure the ODCM release limits are not exceeded. (ref. 1) Depending on the established alarm setpoint for the liquid effluent monitors, a value 200 times the alarm setpoint may be above the maximum scale of the effluent monitor.

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 2.0, Liquid Effluents

Figure R-2a Liquid Release Streams

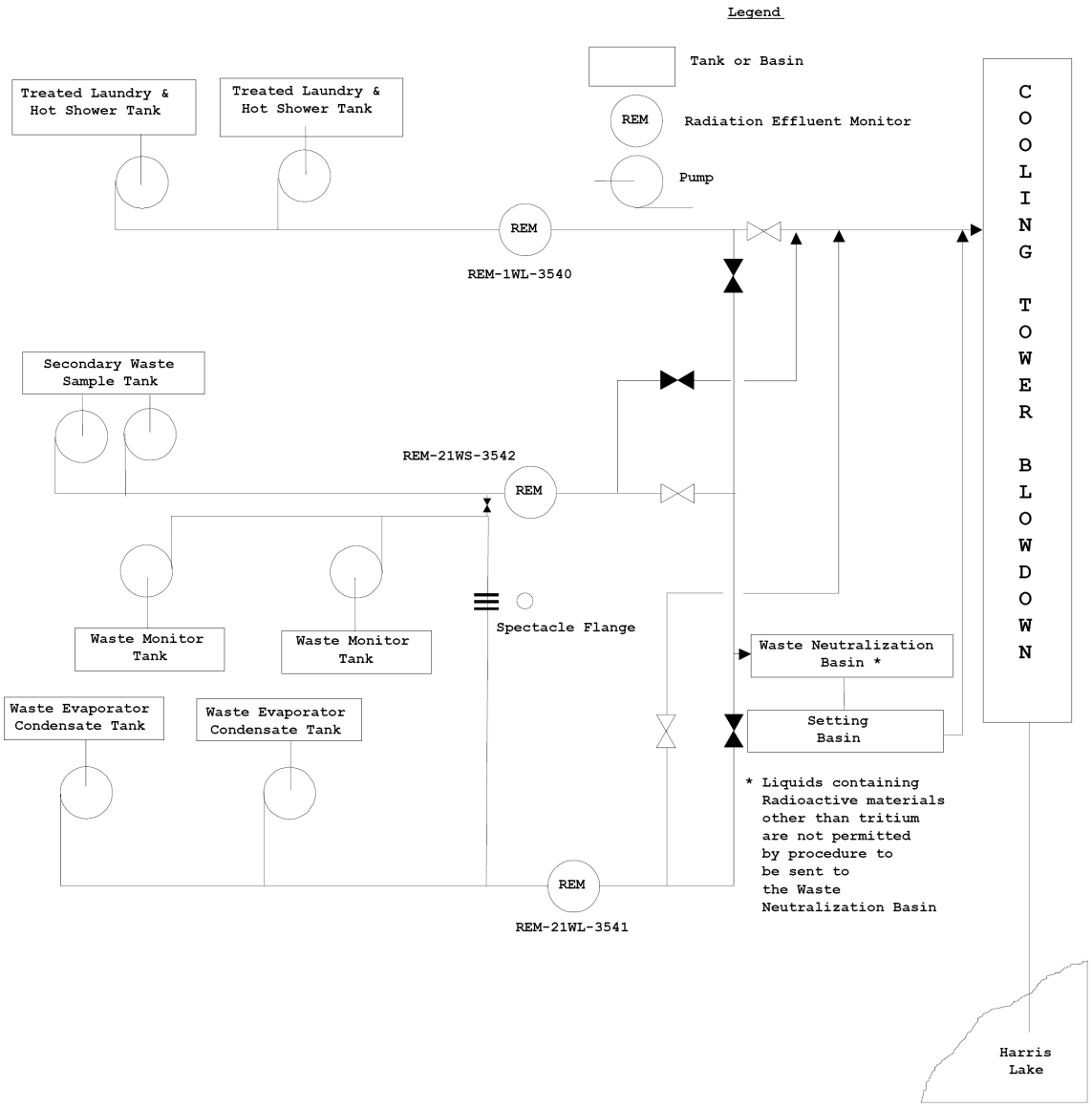
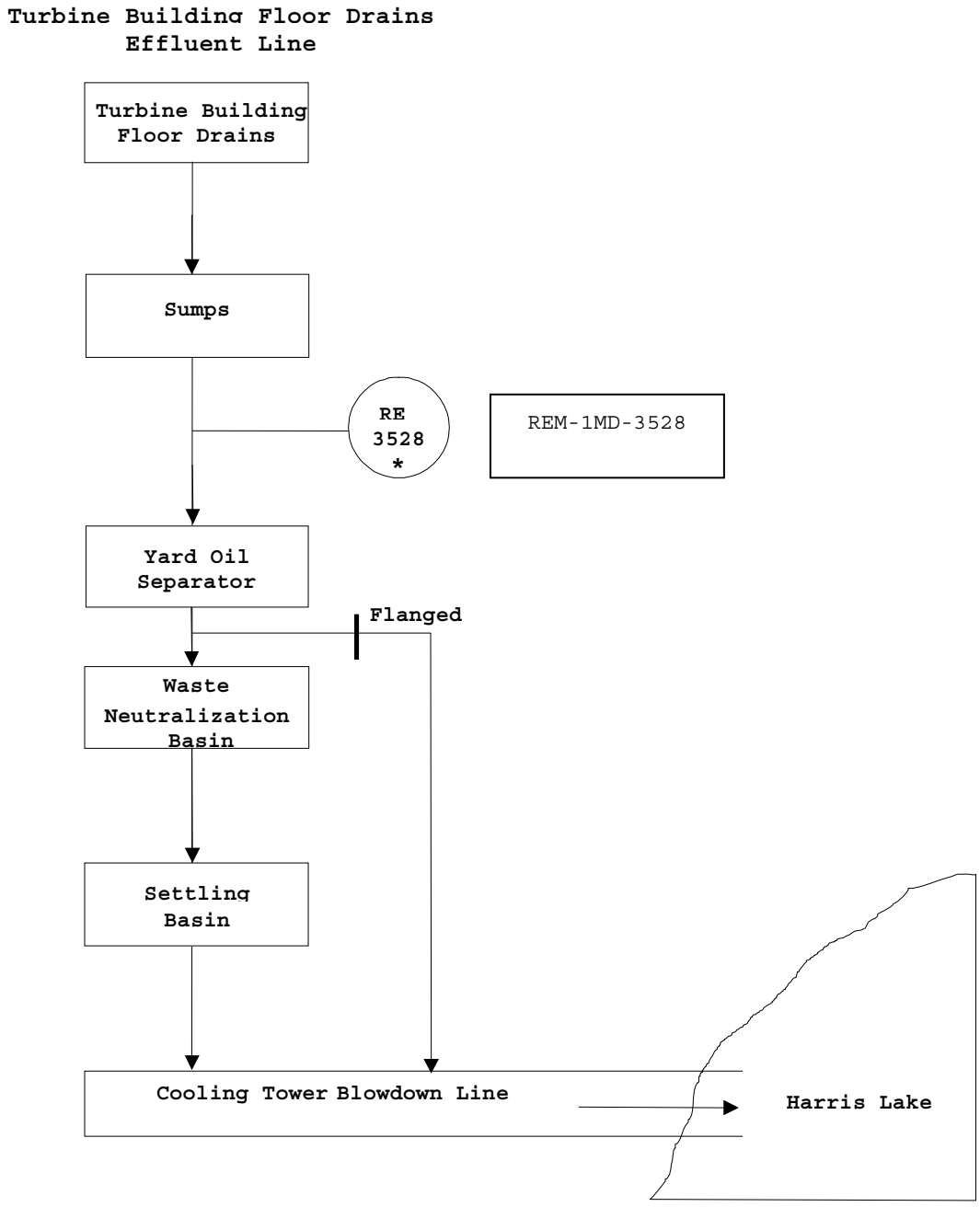


Figure R-2b Liquid Release Streams



* Turbine Building Floor Drains Effluent can be Diverted to the Secondary Waste Treatment System

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: **Any** release of gaseous or liquid radioactivity to the environment greater than 200 times the ODCM for 15 minutes or longer

EAL:

RA1.3 Alert

Confirmed sample analyses for gaseous or liquid releases indicate concentrations or release rates > 200 x ODCM limits for ≥ 15 min. (Note 2)

Note 2: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the release duration has exceeded, or will likely exceed, the applicable time. In the absence of data to the contrary, assume that the release duration has exceeded the applicable time if an ongoing release is detected and the release start time is unknown.

Mode Applicability:

All

Basis:

Generic

The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time.

This EAL addresses an actual or substantial potential decrease in the level of safety of the plant as indicated by a radiological release that exceeds regulatory commitments for an extended period of time.

Nuclear power plants incorporate features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, or control and monitor intentional releases. The occurrence of extended, uncontrolled radioactive releases to the environment is indicative of a degradation in these features and/or controls.

The 200 x ODCM limits are specified only to distinguish between non-emergency conditions. While these multiples obviously correspond to an off-site dose or dose rate, the emphasis in classifying these events is the degradation in the level of safety of the plant, not the magnitude of the associated dose or dose rate.

Releases should not be prorated or averaged. For example, a release exceeding 600x ODCM for 5 minutes does not meet the threshold.

This EAL includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

This EAL addresses uncontrolled releases that are detected by sample analyses, particularly on unmonitored pathways, e.g., spills of radioactive liquids into storm drains, heat exchanger leakage

Plant-Specific

Confirmed sample analyses in excess of two hundred times the site Offsite Dose Calculation Manual (ODCM) limits that continue for 15 minutes or longer represent an uncontrolled situation and hence, a potential degradation in the level of safety. This event escalates from the Unusual Event by raising the magnitude of the release by a factor of 100 over the Unusual Event level (i.e., 200 times ODCM). Prorating the 500 mRem/yr basis of the 10 CFR 20 non-occupational MPC limits for both time (8766 hr/yr) and the 200 multiplier, the associated Exclusion Area Boundary dose rate would be approximately 10 mRem/hr. If sample analysis indicates the threshold is met and nothing is done within 15 minutes to effect a release reduction, the SEC can conclude that the EAL threshold is met without second sample results.

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM)

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity exceeds 100 mRem TEDE or 500 mRem thyroid CDE for the actual or projected duration of the release

EAL:

RS1.1 Site Area Emergency

Valid reading on **any** radiation monitors > Table R-1 column "SAE" for ≥ 15 min. (Note 1)

Note 1: The SEC should **not** wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time

If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values (see EAL RS1.2/RG1.2). Do **not** delay declaration awaiting dose assessment results

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 µCi/sec	1.26E+8 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 µCi/sec	1.27E+8 µCi/sec	1.08E+6 µCi/sec	1.08E+4 µCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.95E+7 µCi/sec	1.95E+5 µCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed 10% of the EPA Protective Action Guides (PAGs). Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

The site specific monitor list in Table R-1 includes effluent monitors on all potential release pathways.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

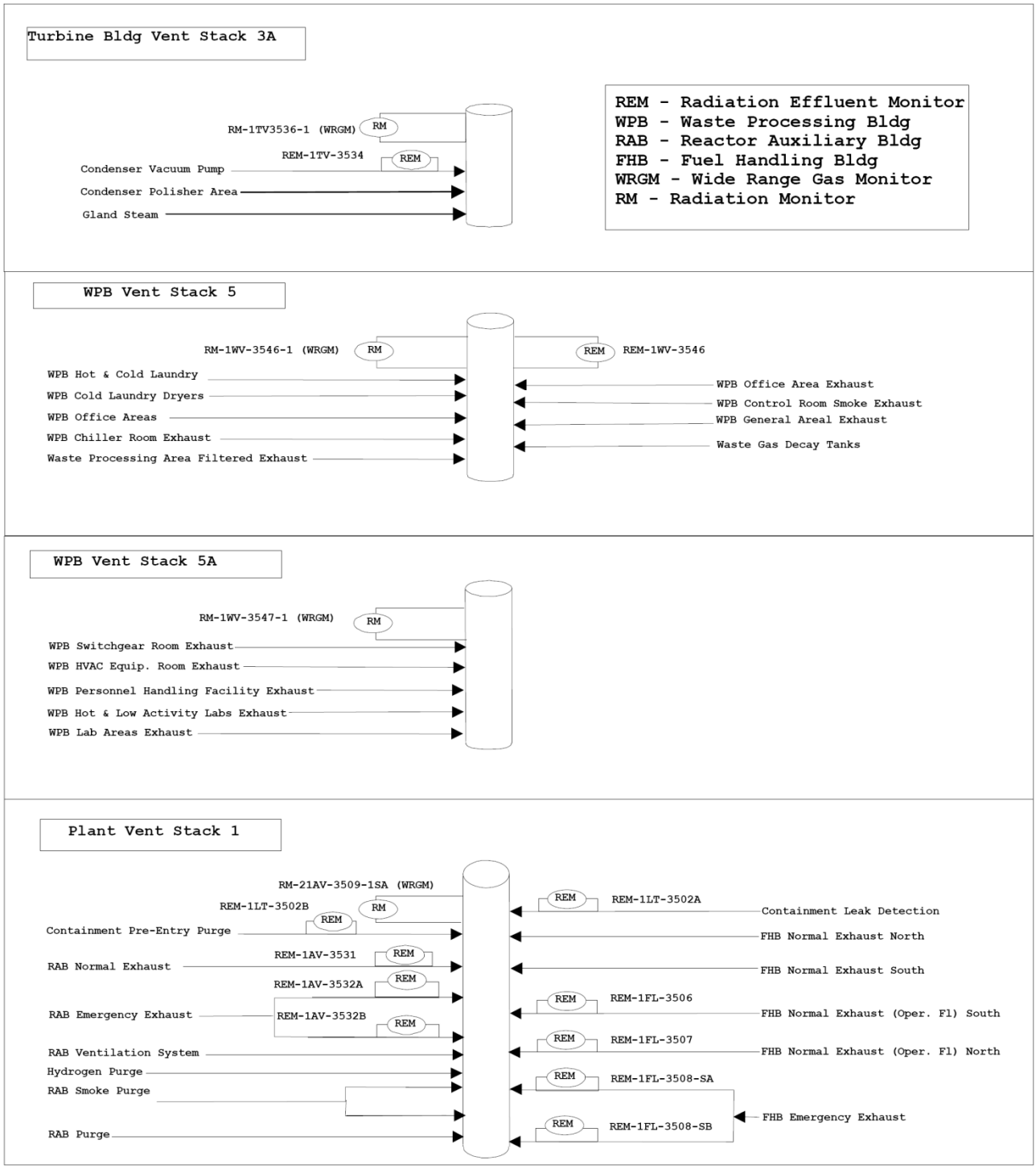
Plant-Specific

Figure R-1 illustrates the gaseous release streams. (ref. 1)

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 3.0, Gaseous Effluents
2. Calculation EP-EALCALC-HNP-0801 Radiological Gaseous Effluent EAL Values (EAL AG1, AS1, AA1 and AU1)

Figure R-1 Gaseous Release Streams



Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity exceeds 100 mRem TEDE or 500 mRem thyroid CDE for the actual or projected duration of the release

EAL:

RS1.2 Site Area Emergency

Dose assessment using actual meteorology indicates doses > 100 mRem TEDE or 500 mRem thyroid CDE at or beyond the site boundary

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed 10% of the EPA Protective Action Guides (PAGs). Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

Plant-Specific

Operators have indications that people outside the immediate area may be or are being exposed to small amounts of radiation. Actual meteorological readings should result in doses which are significantly less than the criteria using adverse meteorological conditions.

“Adverse meteorological conditions” (ADVERSE MET DATA) is defined as “G” stability class and a wind speed of ≤ 1.0 MPH (ref. 1).

The site boundary is depicted in Technical Specifications Figure 5.1.3 (ref. 2).

HNP Basis Reference(s):

1. PEP-340 Dose Assessment
2. Technical Specification Figure 5.1-3, Site Boundary for Radioactive Gaseous and Liquid Effluents

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity exceeds 100 mRem TEDE or 500 mRem thyroid CDE for the actual or projected duration of the release

EAL:

RS1.3 Site Area Emergency

Field survey results indicate closed window dose rates > 100 mRem/hr expected to continue for ≥ 60 min. at or beyond the site boundary

OR

Analyses of field survey samples indicate thyroid CDE > 500 mRem for 1 hr of inhalation at or beyond the site boundary (Note 1)

Note 1: The SEC should **not** wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed 10% of the EPA Protective Action Guides (PAGs). Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

Plant-Specific

The site boundary is depicted in Technical Specifications Figure 5.1-3 (ref. 1).

HNP Basis Reference(s):

1. Technical Specification Figure 5.1-3, Site Boundary for Radioactive Gaseous and Liquid Effluents

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem thyroid CDE for the actual or projected duration of the release using actual meteorology

EAL:

RG1.1 General Emergency

Valid reading on **any** radiation monitors > Table R-1 column "GE" for ≥ 15 min. (Note 1)

Note 1: The SEC should **not** wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time

If dose assessment results are available, declaration should be based on dose assessment instead of radiation monitor values (see EAL RS1.2/RG1.2). Do **not** delay declaration awaiting dose assessment results

Table R-1 Effluent Monitor Classification Thresholds

	Release Point	Monitor	GE	SAE	Alert	UE
Gaseous	Plant Vent Stack 1 WRGM	RM-21AV-3509-1SA	1.26E+9 µCi/sec	1.26E+8 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Gaseous	Turbine Building Vent Stack 3A WRGM	RM-1TV-3536-1	1.27E+9 µCi/sec	1.27E+8 µCi/sec	1.08E+6 µCi/sec	1.08E+4 µCi/sec
Gaseous	WPB Vent Stack 5 WRGM	RM-1WV-3546-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.95E+7 µCi/sec	1.95E+5 µCi/sec
Gaseous	WPB Vent Stack 5A WRGM	RM-1WV-3547-1	9.84E+8 µCi/sec	9.84E+7 µCi/sec	1.14E+6 µCi/sec	1.14E+4 µCi/sec
Liquid	Treated Laundry & Hot Shower Tank Discharge	REM-1WL-3540	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Waste Monitor/Waste Evaporator Condensate Tank Discharge	REM-21WL-3541	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Secondary Waste Sample Tank Discharge	REM-21WS-3542	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*
Liquid	Turbine Building Floor Drain Effluent	REM-1MD-3528	----	----	200 x High Alarm or off-scale high*	2 x High Alarm*

* With effluent discharge **not** isolated

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed the EPA Protective Action Guides (PAGs). Public protective actions will be necessary. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public and likely involve fuel damage.

The monitor list in Table R-1 includes effluent monitors on all potential release pathways.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

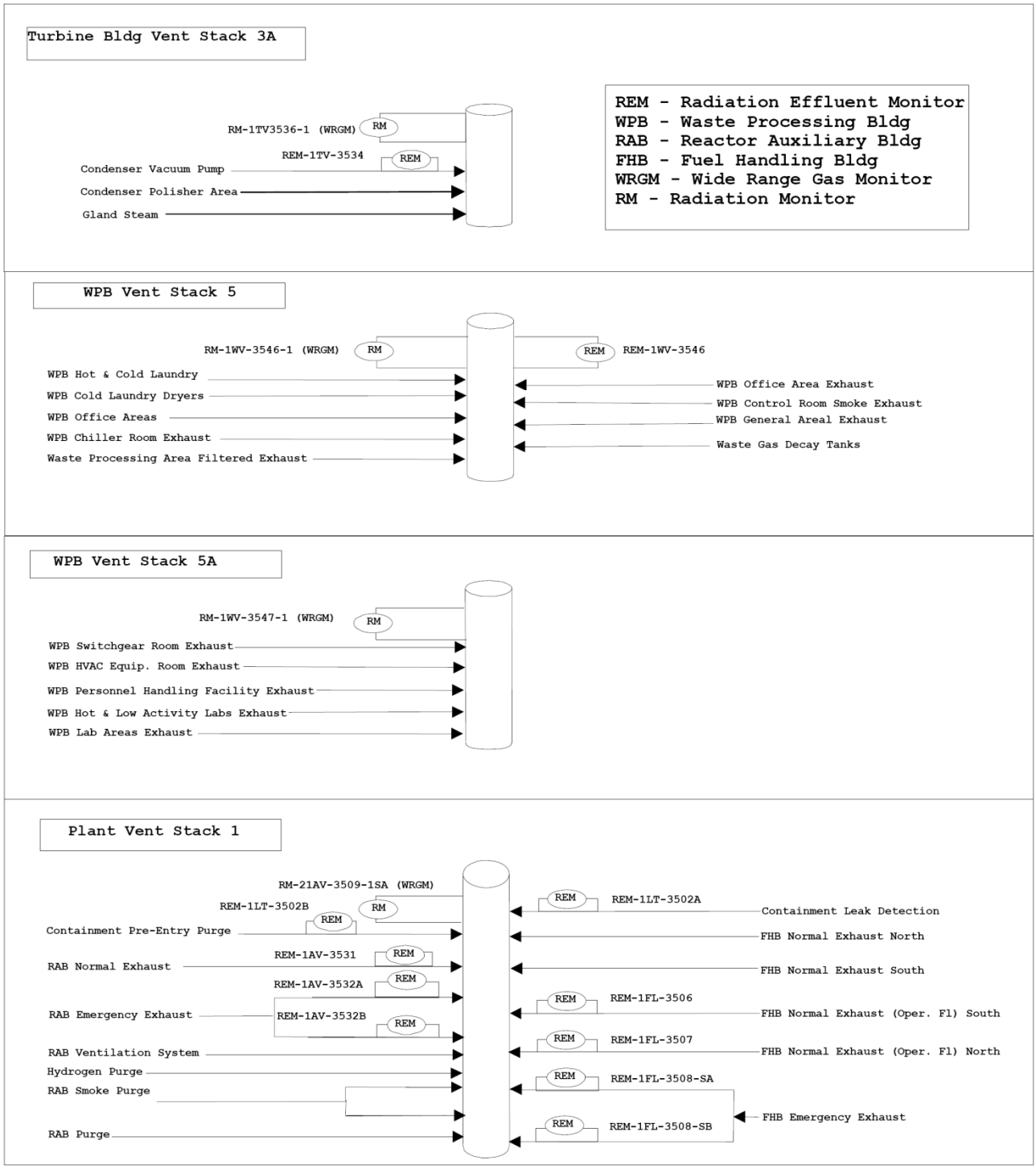
Plant-Specific

Figure R-1 illustrates the gaseous release streams. The Table R-1 column “GE” effluent monitor readings are one decade greater than the “SAE” values (ref. 2).

HNP Basis Reference(s):

1. Shearon Harris Nuclear Power Plant Offsite Dose Calculation Manual (ODCM) Section 3.0, Gaseous Effluents
2. Calculation EP-EALCALC-HNP-0801 Radiological Gaseous Effluent EAL Values (EAL AG1, AS1, AA1 and AU1)

Figure R-1 Gaseous Release Streams



Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem thyroid CDE for the actual or projected duration of the release using actual meteorology

EAL:

RG1.2 General Emergency

Dose assessment using actual meteorology indicates doses > 1,000 mRem TEDE or 5,000 mRem thyroid CDE at or beyond the site boundary

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed the EPA Protective Action Guides (PAGs). Public protective actions will be necessary. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public and likely involve fuel damage.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

Plant-Specific

Operators have indications that people outside the immediate area may be or are being exposed to small amounts of radiation. Actual meteorological readings should result in doses which are significantly less than the criteria using adverse meteorological conditions.

“Adverse meteorological conditions” (ADVERSE MET DATA) is defined as “G” stability class and a wind speed of ≤ 1.0 MPH (ref. 1).

The site boundary is depicted in Technical Specifications Figure 5.1-3 (ref. 2).

HNP Basis Reference(s):

1. PEP-340 Dose Assessment
2. Technical Specification Figure 5.1-3, Site Boundary for Radioactive Gaseous and Liquid Effluents

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 1 – Offsite Rad Conditions

Initiating Condition: Offsite dose resulting from an actual or imminent release of gaseous radioactivity greater than 1000 mRem TEDE or 5000 mRem thyroid CDE for the actual or projected duration of the release using actual meteorology

EAL:

RG1.3 General Emergency

Field survey results indicate closed window dose rates > 1,000 mRem/hr expected to continue for ≥ 60 min. at or beyond the site boundary

OR

Analyses of field survey samples indicate thyroid CDE > 5,000 mRem for 1 hr of inhalation at or beyond the site boundary (Note 1)

Note 1: The SEC should **not** wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition will likely exceed the applicable time

Mode Applicability:

All

Basis:

Generic

This EAL addresses radioactivity releases that result in doses at or beyond the site boundary that exceed the EPA Protective Action Guides (PAGs). Public protective actions will be necessary. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public and likely involve fuel damage.

Since dose assessment is based on actual meteorology, whereas the monitor reading EAL is not, the results from these assessments may indicate that the classification is not warranted, or may indicate that a higher classification is warranted. For this reason, emergency implementing procedures should call for the timely performance of dose assessments using actual meteorology and release information. If the results of these dose assessments are available when the classification is made (e.g., initiated at a lower classification level), the dose assessment results override the monitor reading EAL.

Plant-Specific

The site boundary is depicted in Technical Specifications Figure 5.1-3 (ref. 1).

HNP Basis Reference(s):

1. Technical Specification Figure 5.1-3, Site Boundary for Radioactive Gaseous and Liquid Effluents

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 2 – Onsite Rad Conditions & Spent Fuel Events

Initiating Condition: Unplanned rise in plant radiation levels

EAL:

RU2.1 Unusual Event

Unplanned water level drop in the reactor refueling cavity, spent fuel pool or fuel transfer canal as indicated by low level alarm or visual observation

AND

Valid Table R-2 radiation monitor reading rises due to loss of shielding above irradiated fuel (Note 3)

Note 3: If loss of water level in the refueling pathway occurs while in Mode 5, 6 or DEF, consider classification under EALs CU3.1, CU3.2 or CU3.3

Table R-2 Radiation Monitors

Containment Ventilation Isolation Monitors

- RM-1CR-3561A-SA Containment Ventilation Isolation
- RM-1CR-3561B-SB Containment Ventilation Isolation
- RM-1CR-3561C-SA Containment Ventilation Isolation
- RM-1CR-3561D-SB Containment Ventilation Isolation

Spent Fuel Pool Monitors

- Refueling cavity level < 23 ft
  - RM-1CR-3561A-SA Containment Ventilation Isolation
  - RM-1CR-3561B-SB Containment Ventilation Isolation
  - RM-1CR-3561C-SA Containment Ventilation Isolation
  - RM-1CR-3561D-SB Containment Ventilation Isolation
- ALB-023-4-17 SPENT FP HI/LO LEVEL, or ALB-023-5-17, NEW FP HI/LO LEVEL
  - RM-1FR-3564A-SA Spent Fuel Pool SW, SE, SW
  - RM-1FR-3564B-SB Spent Fuel Pool SW, SE, SE
  - RM-1FR-3565A-SA Spent Fuel Pool SW, SE, SW
  - RM-1FR-3565B-SB Spent Fuel Pool SW, SE, SE
- ALB-023-4-18 SFP C HI/LO LEVEL, or ALB-023-5-18 SFP D HI/LO LEVEL
  - RM-1FR-3566A-SA Spent Fuel Pool NE, NW, NE
  - RM-1FR-3566B-SB Spent Fuel Pool NW, NE, NW
  - RM-1FR-3567A-SA Spent Fuel Pool NW, NE, NW
  - RM-1FR-3567B-SB Spent Fuel Pool NE, NW, NE

FHB Emergency Exhaust

- REM-*1FL-3508A-SA, FHB Emergency Exhaust
- REM-*1FL-3508B-SB, FHB Emergency Exhaust

Mode Applicability:

All

Basis:

Generic

This EAL addresses increased radiation levels as a result of water level decreases above irradiated fuel or events that have resulted, or may result, in UNPLANNED increases in radiation dose rates within plant buildings. These radiation increases represent a loss of control over radioactive material and represent a potential degradation in the level of safety of the plant.

The refueling pathway is a combination of cavities, tubes, canals and pools. While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

For refueling events where the water level drops below the RPV flange classification would be via EAL CU3.1, CU3.2 or CU3.3. This event escalates to an Alert per EAL RA2.1 if irradiated fuel outside the reactor vessel is uncovered. For events involving irradiated fuel in the reactor vessel, escalation would be via the Fission Product Barrier Table for events in operating modes 1-4.

Plant-Specific

The reactor refueling cavity, spent fuel pool and fuel transfer canal comprise the refueling pathway.

Fuel handling accidents are not expected to result in a significant external radiation hazard, because all operations involving spent fuel assemblies are conducted under water, and spent fuel casks are designed to withstand drops in excess of the maximum drop postulated in the accident analysis. However, the internal and airborne radiation hazards can be significant if fuel integrity is lost. The fission product inventory present in a fuel assembly is located in two places within the assembly: within the fuel pellet matrix itself, and within the fuel pellet-cladding gap. That portion that is contained within the fuel pellet matrix is released only very slowly, and will not be a significant contributor to the activity present in the building atmosphere immediately following damage of the assembly. Any actual pellet fragments that end up in the water will be eventually removed by the SFP Purification System.

The activity of most concern is that which is contained in the volatile fission product gases contained in the fuel pellet to cladding gap. When a fuel pin is damaged, this fission product inventory can be released to the SFP water. Technical Specifications 3.9.10 and

3.9.11 require a minimum water level of 23 feet in the SFP and Refueling Cavity specifically to reduce the potential dose resulting from a fuel handling accident (ref. 1, 2). This amount of water will capture 99% of the assumed 10% iodine activity present in the pellet to clad gap before it breaks the surface of the water. However, although the water is expected to retain a large fraction of this activity, a portion of it will reach the surface and bubble out into the FHB or CNMT atmosphere. (Since halogens are soluble, a large fraction of these halogens will be retained by the water, whereas noble gases, being insoluble, will not be retained.) Once in the atmosphere, much of this fission product activity will cause an observed increase in area radiation levels. (Gases such as Kr-85 which are primarily beta hazards will not be detectable using installed monitors.) (ref. 3, 4, 5, 6)

The magnitude of the release will depend on several factors, among them the following:

- The power history of the damaged fuel assemblies
- The time that has elapsed since the fuel assemblies were last in an operating core
- The severity and extent of the damage to the fuel assemblies

The fuel transfer canal is only of concern in assessing this EAL when irradiated fuel transfer is in progress, in which case the SFP gates are open and connected to the fuel transfer canal.

HNP Basis Reference(s):

1. Technical Specifications 3.9.10
2. Technical Specifications 3.9.11
3. AOP-013 Fuel Handling Accident
4. AOP-031 Loss of Refueling Floor Integrity
5. AOP-005 Radiation Monitoring System
6. DBD-304 Radiation Monitoring System & Gross Failed Fuel Detector

Category: R – Radioactivity Release / Area Radiation

Subcategory: 2 – Onsite Rad Conditions & Spent Fuel Events

Initiating Condition: Unplanned rise in plant radiation levels

EAL:

RU2.2 Unusual Event

Unplanned valid area radiation reading increases by a factor of 1000 over normal* levels

* Normal levels can be considered as the highest reading in the past 24 hours excluding the current peak value

Mode Applicability:

All

Basis:

Generic

This EAL addresses increased radiation levels as a result of water level decreases above irradiated fuel or events that have resulted, or may result, in UNPLANNED increases in radiation dose rates within plant buildings. These radiation increases represent a loss of control over radioactive material and represent a potential degradation in the level of safety of the plant.

This EAL addresses increases in plant radiation levels that represent a loss of control of radioactive material resulting in a potential degradation in the level of safety of the plant.

This EAL excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials. A specific list of ARMs is not required as it would restrict the applicability of the Threshold. The intent is to identify loss of control of radioactive material in any monitored area.

Plant-Specific

None

HNP Basis Reference(s):

1. AOP-005 Radiation Monitoring System

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 2 – Onsite Rad Conditions & Spent Fuel Events

Initiating Condition: Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the Reactor Vessel

EAL:

RA2.1 Alert

A valid High Alarm on **any** Table R-2 radiation monitor due to damage to irradiated fuel or loss of water level

Table R-2 Radiation Monitors

Containment Ventilation Isolation Monitors

- RM-1CR-3561A-SA Containment Ventilation Isolation
- RM-1CR-3561B-SB Containment Ventilation Isolation
- RM-1CR-3561C-SA Containment Ventilation Isolation
- RM-1CR-3561D-SB Containment Ventilation Isolation

Spent Fuel Pool Monitors

- Refueling cavity level < 23 ft
  - RM-1CR-3561A-SA Containment Ventilation Isolation
  - RM-1CR-3561B-SB Containment Ventilation Isolation
  - RM-1CR-3561C-SA Containment Ventilation Isolation
  - RM-1CR-3561D-SB Containment Ventilation Isolation
- ALB-023-4-17 SPENT FP HI/LO LEVEL, or
  ALB-023-5-17, NEW FP HI/LO LEVEL
  - RM-1FR-3564A-SA Spent Fuel Pool SW, SE, SW
  - RM-1FR-3564B-SB Spent Fuel Pool SW, SE, SE
  - RM-1FR-3565A-SA Spent Fuel Pool SW, SE, SW
  - RM-1FR-3565B-SB Spent Fuel Pool SW, SE, SE
- ALB-023-4-18 SFP C HI/LO LEVEL, or
  ALB-023-5-18 SFP D HI/LO LEVEL
  - RM-1FR-3566A-SA Spent Fuel Pool NE, NW, NE
  - RM-1FR-3566B-SB Spent Fuel Pool NW, NE, NW
  - RM-1FR-3567A-SA Spent Fuel Pool NW, NE, NW
  - RM-1FR-3567B-SB Spent Fuel Pool NE, NW, NE

FHB Emergency Exhaust

- REM-*1FL-3508A-SA, FHB Emergency Exhaust
- REM-*1FL-3508B-SB, FHB Emergency Exhaust

Mode Applicability:

All

Basis:

Generic

This EAL addresses increases in radiation dose rates within plant buildings, and may be a precursor to a radioactivity release to the environment. These events represent a loss of control over radioactive material and represent an actual or substantial potential degradation in the level of safety of the plant.

This EAL addresses radiation monitor indications of fuel uncovery and/or fuel damage.

Increased ventilation monitor readings may be indication of a radioactivity release from the fuel, confirming that damage has occurred. Increased background at the ventilation monitor due to water level decrease may mask increased ventilation exhaust airborne activity and needs to be considered.

While a radiation monitor could detect an increase in dose rate due to a drop in the water level, it might not be a reliable indication of whether or not the fuel is covered.

Escalation of this emergency classification level, if appropriate, would be based on RS1.1, RS1.2, RS1.3, RG1.1, RG1.2 or RG1.3.

Plant-Specific

Table R-2 lists the radiation monitors applicable to this EAL (ref. 1, 2, 3, 4, 5):

- Containment Ventilation Isolation Monitors

  On high alarm, these monitors will actuate containment ventilation isolation. The High Alarm set point is set at less than or equal to two times the background value at rated thermal power to ensure the alarm does not exceed the Technical Specification limit. The Alert alarm set point is set at a fractional value ≤ 0.8 times the High Alarm set point and provides an indication of an adverse trend.

  The alarm setpoints are determined by averaging the background trends of each Containment Ventilation Isolation area monitor at rated thermal power (100% reactor power) and these average background trends are used to determine the maximum alarm set point for each monitor. During refueling operations, the background radiation levels in the Containment are less than during power operation. As a result, the High Alarm set points for the Containment Ventilation

Isolation area monitors are set at150 mR/hr. The Alert alarm set point is set at < 0.8 times the High Alarm setpoint.

- Spent Fuel Pool Monitors

  The receipt of a high radiation alarm on any channel on these monitors will result in the automatic isolation of normal FHB ventilation and the initiation of FHB emergency ventilation. Design calculations for a fuel handling accident indicate that all monitors in the vicinity of the accident will read ≥ 149 mR/hr. Extrapolating these calculations to actual source-to-detector distances indicate that at least half of the channels will read ≥ 149 mR/hr. Therefore, the High Alarm is conservatively set at 100 mR/hr. The Alert alarm set points for these monitors are set at a fractional value less than or equal to 80% of the High Alarm set points.

- FHB Normal Exhaust

  Since the FHB Normal Exhaust discharges into the plant stack, the alarm set points for these monitors are calculated based on airborne release limits which are determined in accordance with the ODCM. The calculated setpoint conservatively assumes that the effluent release consists entirely of FHB exhaust discharged from the plant at a flow rate equivalent to the design flow of the plant vent stack.

- FHB Emergency Exhaust

  A fuel handling accident that would isolate the normal ventilation and actuate the emergency ventilation may drive the FHB emergency exhaust monitors off-scale. Therefore, the High Alarm set points are arbitrarily set at about mid-scale of each channel range and the Alert set points are set at one tenth the High Alarm.

  Alert Alarm: 3.4 x 10-5 µCi/cc above background

  High Alarm: 3.4 x 10-4 µCi/cc above background

HNP Basis Reference(s):

1. AOP-013 Fuel Handling Accident
2. AOP-031 Loss of Refueling Floor Integrity
3. AOP-005 Radiation Monitoring System
4. DBD-304 Radiation Monitoring System & Gross Failed Fuel Detector
5. HPP-500 Radiation Monitoring System Data Base Manual

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 2 – Onsite Rad Conditions & Spent Fuel Events

Initiating Condition: Damage to irradiated fuel or loss of water level that has resulted or will result in the uncovering of irradiated fuel outside the Reactor Vessel

EAL:

RA2.2 Alert

A water level drop in the reactor refueling cavity, spent fuel pool or fuel transfer canal that will result in irradiated fuel becoming uncovered

Mode Applicability:

All

Basis:

Generic

This event represents a loss of control over radioactive material and represent an actual or substantial potential degradation in the level of safety of the plant.

Escalation of this emergency classification level, if appropriate, would be based on RS1.1, RS1.2, RS1.3, RG1.1, RG1.2 or RG1.3.

Plant-Specific

There is no remote level indication in the reactor refueling cavity, spent fuel pool or fuel transfer canal that can detect if level has dropped to the level of the irradiated fuel other than visual observation (ref. 1). Depending on available level indication, the declared threshold may need to be based on indications of makeup rate or decrease in Refueling Water Storage Tank level (ref. 2).

The movement of irradiated fuel assemblies within Containment requires a minimum water level of 23 ft above the Reactor Vessel flange and the top of spent fuel in the SFP. During refueling activities, this maintains sufficient water level in the refueling cavity, fuel transfer canal and SFP. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident.

Allowing level to decrease could result in spent fuel being uncovered, reducing spent fuel decay heat removal and creating an extremely hazardous radiation environment.

HNP Basis Reference(s):

1. Technical Specifications 3.9.10
2. Technical Specifications 3.9.11
3. AOP-013 Fuel Handling Accident
4. AOP-031 Loss of Refueling Floor Integrity

Category: R – Abnormal Rad Release / Rad Effluent

Subcategory: 3 – CR/CAS Rad

Initiating Condition: Rise in radiation levels within the facility that impedes operation of systems required to maintain plant safety functions

EAL:

RA3.1 Alert

Valid dose rates > 15 mRem/hr in **EITHER** of the following areas requiring continuous occupancy to maintain plant safety functions:

Control Room

OR

CAS

Mode Applicability:

All

Basis:

Generic

This EAL addresses increased radiation levels that: impact continued operation in areas requiring continuous occupancy to maintain safe operation or to perform a safe shutdown.

The cause and/or magnitude of the increase in radiation levels is not a concern of this EAL. The SEC must consider the source or cause of the increased radiation levels and determine if any other EAL may be involved.

Areas requiring continuous occupancy include the Control Room and CAS.

Plant-Specific

The Control Room area radiation monitor is RM-21RR-3560-SA. This monitor performs no automatic function. The radiation alarm set points are (ref. 1):

Alert = 0.25 mR/hr

High Alarm = 2.5 mR/hr.

The Central Alarm Station (CAS) is included in this EAL because of its importance to permitting access to areas required to assure safe plant operations. Radiation levels in CAS are obtained by survey.

HNP Basis Reference(s):

1. HPP-500 Radiation Monitoring System Data Base Manual
2. DBD-304 Radiation Monitoring System & Gross Failed Fuel Detector

Category C – Cold Shutdown / Refueling System Malfunction

EAL Group: Cold Conditions (RCS temperature ≤ 200ºF);
EALs in this category are applicable only in
one or more cold operating modes.

Category C EALs are directly associated with cold shutdown or refueling system safety functions. Given the variability of plant configurations (e.g., systems out-of-service for maintenance, containment open, reduced AC power redundancy, time since shutdown) during these periods, the consequences of any given initiating event can vary greatly. For example, a loss of decay heat removal capability that occurs at the end of an extended outage has less significance than a similar loss occurring during the first week after shutdown. Compounding these events is the likelihood that instrumentation necessary for assessment may also be inoperable. The cold shutdown and refueling system malfunction EALs are based on performance capability to the extent possible with consideration given to RCS integrity, containment closure, and fuel clad integrity for the applicable operating modes (5 - Cold Shutdown, 6 - Refueling, D – Defueled).

The events of this category pertain to the following subcategories:

1. Loss of AC Power

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of onsite and offsite power sources for the 6.9 KV safeguard buses

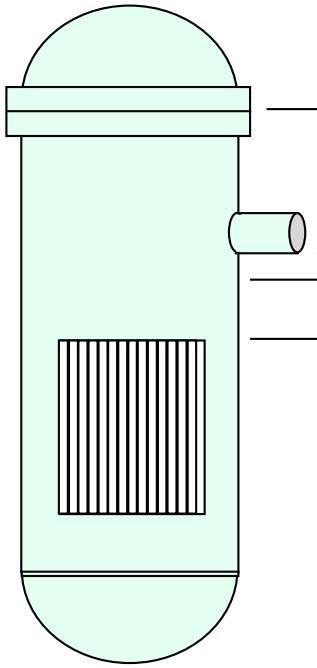
2. Loss of DC Power

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of power to the 125 VDC safeguard buses.

3. RCS Level

Reactor Vessel or RCS water level is directly related to the status of adequate core cooling and, therefore, fuel clad integrity. RCS levels associated with Category C EALs are listed in Table C-5.

Table C-5 RCS Level Thresholds



	Plant El.	Standpipe	RVLIS Full Range	EAL
Reactor Vessel Flange	260.62'	0"	89%	CU3.2
Bottom of Hotleg	252.54'	-96.5"	72%	CA3.1
6 in. < Bottom of Hotleg	252.04'	-----	70%	CS3.1
Top of Active Fuel	249.01'	-----	63%	CS3.2 CG3.1

4. RCS Temperature

Uncontrolled or inadvertent temperature or pressure increases are indicative of a potential loss of safety functions.

5. Communications

Certain events that degrade plant operator ability to effectively communicate with essential personnel within or external to the plant warrant emergency classification.

6. Inadvertent Criticality

Inadvertent criticalities pose potential personnel safety hazards as well being indicative of losses of reactivity control.

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: AC power capability to emergency buses reduced to a single power source for ≥15 min. such that **any** additional single failure would result in station blackout

EAL:

CU1.1 Unusual Event

AC power capability to 6.9 KV emergency buses 1A-SA and 1B-SB reduced to a single power source for ≥ 15 min. (Note 6)

AND

Any additional single power source failure will result in station blackout

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

The condition indicated by this EAL is the degradation of the off-site and on-site AC power systems such that any additional single failure would result in a station blackout. This condition could occur due to a loss of off-site power with a concurrent failure of all but one emergency generator to supply power to its emergency busses. The subsequent loss of this single power source would escalate the event to an Alert in accordance with EAL CA1.1.

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

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure C-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

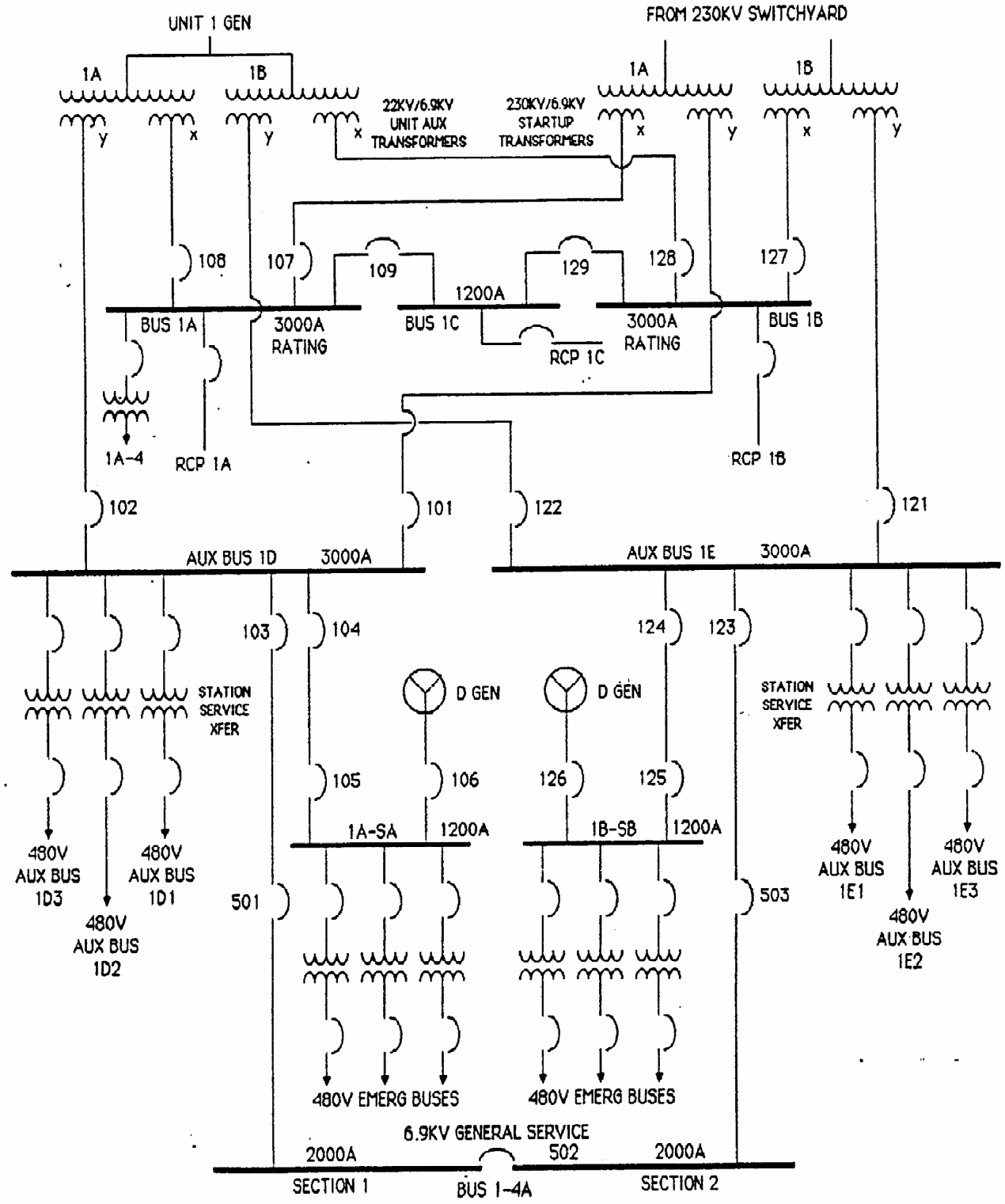
An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. EOP-EPP-001 Loss of AC Power to 1A-SA and 1B-SB Buses
5. OST-1023 Off Site Power Availability

Figure C-1


UNIT 1 GEN
FROM 230KV SWITCHYARD
1A
1B
22KV/6.9KV UNIT AUX TRANSFORMERS
230KV/6.9KV STARTUP TRANSFORMERS
y
x
108
107
109
129
128
127
1200A
BUS 1A
3000A RATING
BUS 1C
RCP 1C
3000A RATING
BUS 1B
1A-4
RCP 1A
RCP 1B
102
101
122
121
AUX BUS 1D
3000A
AUX BUS 1E
3000A
103
104
124
123
STATION SERVICE XFER
D GEN
D GEN
STATION SERVICE XFER
105
106
126
125
1A-SA
1200A
1B-SB
1200A
480V AUX BUS 1D3
480V AUX BUS 1D1
480V AUX BUS 1D2
501
503
480V AUX BUS 1E1
480V AUX BUS 1E2
480V AUX BUS 1E3
480V EMERG BUSES
480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
SECTION 1
502
BUS 1-4A
2000A
SECTION 2

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: Loss of **all** offsite and **all** onsite AC power to emergency buses for ≥ 15 min.

EAL:

CA1.1 Alert

Loss of **all** offsite and **all** onsite AC power to 6.9 KV emergency buses 1A-SA and 1B-SB for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling, D - Defueled

Basis:

Generic

Loss of all AC power compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink.

The event can be classified as an Alert when in cold shutdown, refueling, or defueled mode because of the significantly reduced decay heat and lower temperature and pressure, increasing the time to restore one of the emergency busses, relative to that specified for the Site Area Emergency EAL.

Escalating to Site Area Emergency, if appropriate, is by EALs in Category R.

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

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure C-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two

transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

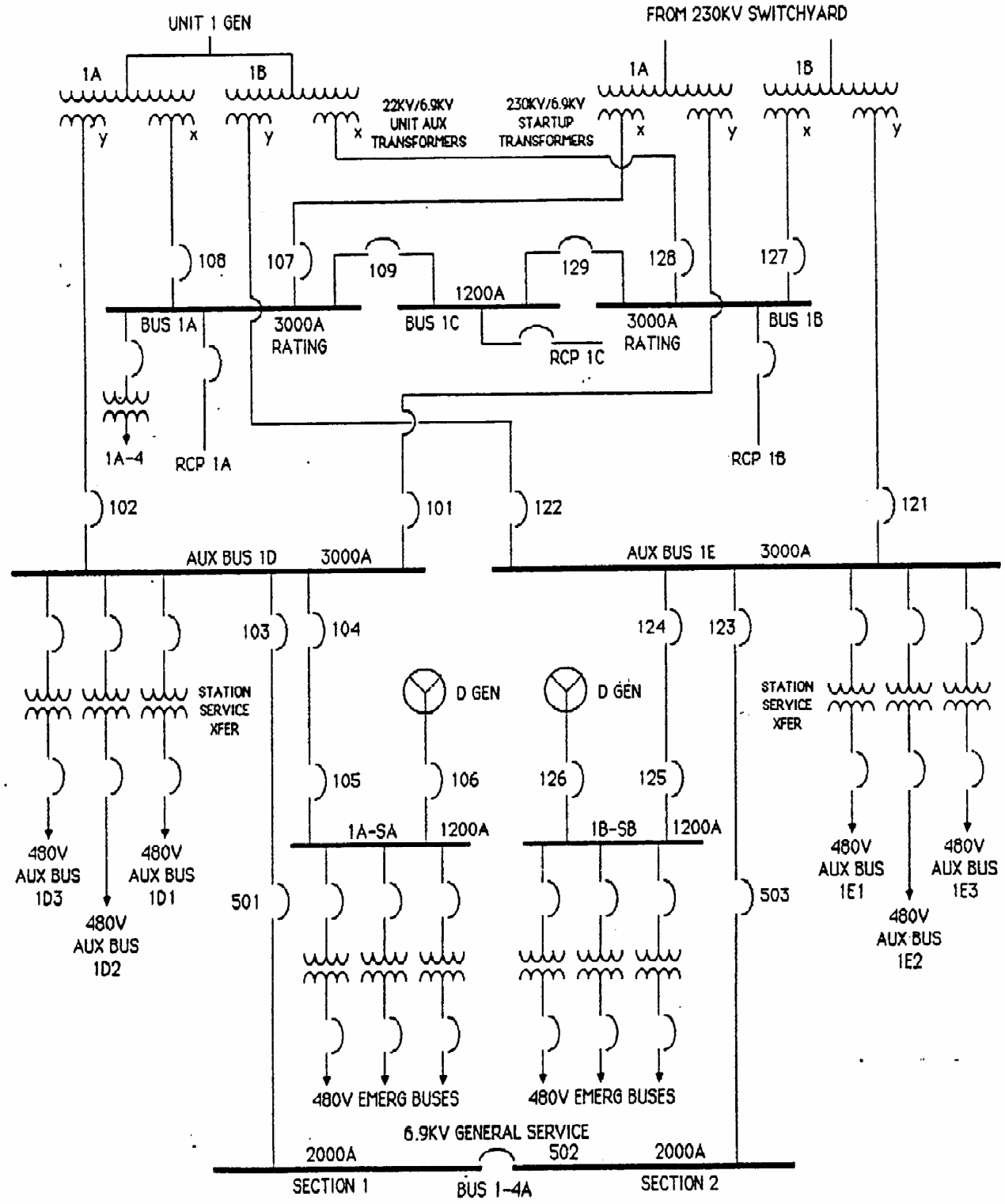
An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. EOP-EPP-001 Loss of AC Power to 1A-SA and 1B-SB Buses
5. OST-1023 Off Site Power Availability

Figure C-1


UNIT 1 GEN
FROM 230KV SWITCHYARD
1A
1B
22KV/6.9KV UNIT AUX TRANSFORMERS
230KV/6.9KV STARTUP TRANSFORMERS
108
107
109
129
128
127
1200A
BUS 1A
3000A RATING
BUS 1C
RCP 1C
3000A RATING
BUS 1B
1A-4
RCP 1A
RCP 1B
102
101
122
121
AUX BUS 1D 3000A
AUX BUS 1E 3000A
103
104
124
123
STATION SERVICE XFER
D GEN
D GEN
STATION SERVICE XFER
105
106
126
125
1A-SA 1200A
1B-SB 1200A
480V AUX BUS 1D3
480V AUX BUS 1D1
480V AUX BUS 1D2
501
503
480V AUX BUS 1E1
480V AUX BUS 1E2
480V AUX BUS 1E3
480V EMERG BUSES
480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
502
2000A
SECTION 1
BUS 1-4A
SECTION 2

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 2 – Loss of DC Power

Initiating Condition: Loss of **required** DC power for ≥ 15 min.

EAL:

CU2.1 Unusual Event

< 105 VDC on **required** Emergency DC Buses (125V) (DP-1A-SA, DP-1B-SB) for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

The purpose of this EAL is to recognize a loss of DC power compromising the ability to monitor and control the removal of decay heat during Cold Shutdown or Refueling operations.

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

Plant-Specific

The DC Power System is shown in Figure C-2 (ref. 1). The DC Power System is designed to provide a source of reliable continuous power for the plant protection system, control and instrumentation and other loads for start-up, operation, and shutdown modes of plant operation. The DC Power System consists of three 60 cell, 125V batteries and one 120 cell, 250V battery, each with its own battery chargers, and DC load center. The 125VDC ESF (safety-related) batteries 1A-SA and 1B-SB are located in separate Battery Rooms in the Electrical Switchgear Room on the 286' elevation of the Reactor Auxiliary Building. The battery chargers for batteries 1A-SA and 1B-SB are rated at 150 amperes DC at a nominal charging voltage of 132VDC. Normal operation of the DC system is such that the battery chargers supply all load current while the batteries serve as an emergency source of power in the event power to the chargers is lost. The battery chargers are capable of providing the normal DC load and also maintaining the connected battery in a fully charged condition (ref. 2). When the plant is in Modes 1, 2, 3 or 4, as a minimum, the 125-volt

battery bank 1A-SA and either full capacity charger 1A-SA or 1B-SA and the 125-volt battery bank 1B-SB and either full capacity charger 1A-SB or 1B-SB shall be operable. (ref. 3)

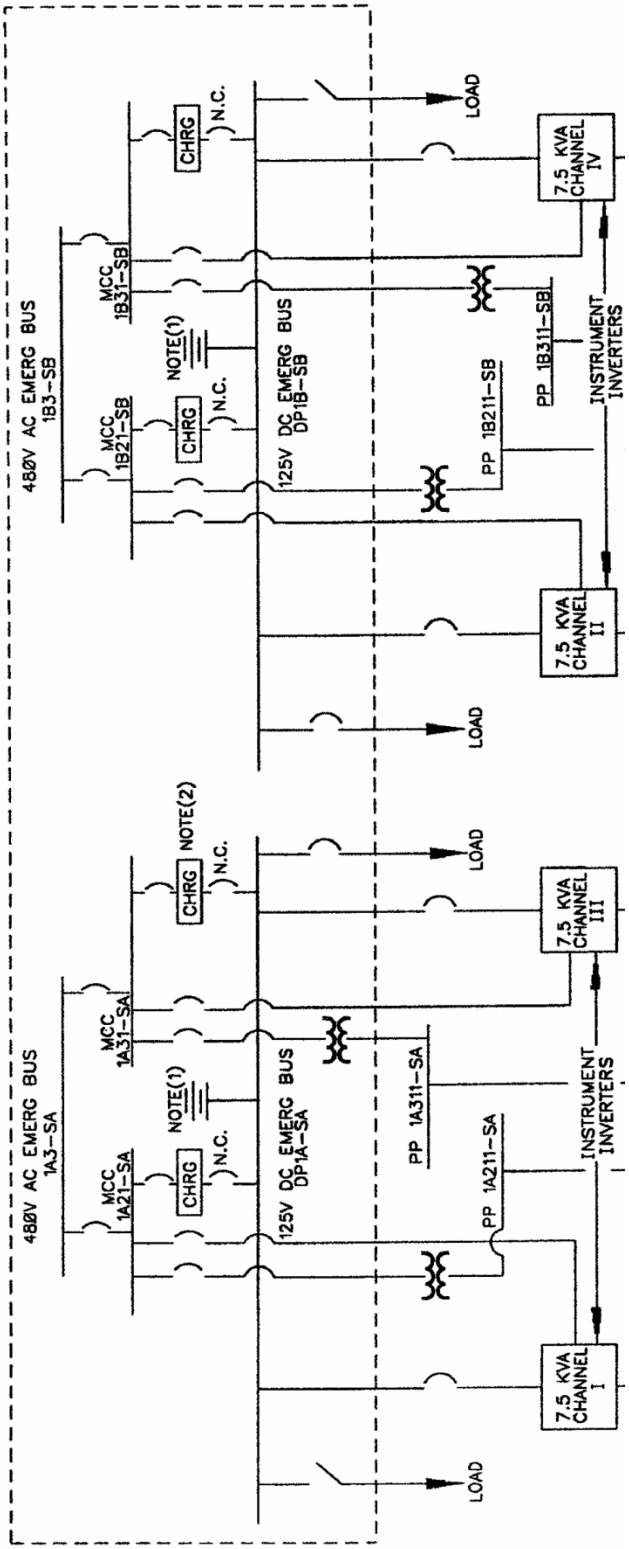
Minimum bus voltage is 105 VDC (ref. 4, 5).

This EAL is the cold condition equivalent of the hot condition loss of DC power EAL SS2.1.

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-3
2. FSAR 8.3.2
3. Technical Specifications 3.8.2.1
4. FSAR Table 8.3.1-1
5. MST-E0013 1E Battery Performance Test

Figure C-2


480V AC EMERG BUS 1A3-SA
480V AC EMERG BUS 1B3-SB
MCC 1A21-SA
MCC 1A31-SA
MCC 1B21-SB
MCC 1B31-SB
CHRG
N.C.
NOTE(1)
NOTE(2)
125V DC EMERG BUS DP1A-SA
125V DC EMERG BUS DP1B-SB
PP 1A211-SA
PP 1A311-SA
PP 1B211-SB
PP 1B311-SB
INSTRUMENT INVERTERS
7.5 KVA CHANNEL I
7.5 KVA CHANNEL II
7.5 KVA CHANNEL III
7.5 KVA CHANNEL IV
LOAD

Subcategory: 3 – RCS Level

Initiating Condition: RCS leakage

EAL:

CU3.1 Unusual Event

RCS leakage results in the inability to maintain or restore **EITHER** of the following for ≥15 min. (Note 6, 9):

Pressurizer level > 17%

OR

RCS level within the target band established by the General Procedure (when the level band is established below the pressurizer)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Note 9: If area radiation levels rise with loss of water level, consider classification under EALs in subcategory R.2, Onsite Rad Conditions & Spent Fuel Events

Mode Applicability:

5 - Cold Shutdown

Basis:

Generic

This EAL is considered to be a potential degradation of the level of safety of the plant. The inability to maintain or restore level is indicative of loss of RCS inventory.

Relief valve normal operation should be excluded from this EAL. However, a relief valve that operates and fails to close per design should be considered applicable to this EAL if the relief valve cannot be isolated.

Prolonged loss of RCS Inventory may result in escalation to the Alert emergency classification level via either EAL CA3.1 or EAL CA4.1.

Plant-Specific

When pressurizer level drops to 17%, letdown isolates and pressurizer heaters are deenergized. This condition is signaled by annunciator ALB-9/4-3, PRESSURIZER LOW LEVEL LTDN SECURED AND HTRS OFF. Pressurizer level is indicated on: LI-459, LR-459, LI-460, LI-461 and associated computer points and displays.

In Cold Shutdown mode, pressurizer level may be intentionally lowered below the letdown isolation setpoint (e.g., in preparation to detension the reactor vessel head, etc.). For such

evolutions, this EAL is applicable if RCS level cannot be restored and maintained within the prescribed target band specified in the General Procedures.

HNP Basis Reference(s):

1. APP-ALB-009 Main Control Board
2. AOP-016, Excessive Primary Plant Leakage
3. MST-I0052 Pressurizer Level Loop (L-0459) Calibration
4. MST-I0053 Pressurizer Level Loop (L-0460) Calibration
5. MST-I0054 Pressurizer Level (L-0461) Calibration

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: RCS Leakage

EAL:

CU3.2 Unusual Event

Unplanned RCS level drop below **EITHER** of the following for ≥ 15 min. (Note 6, 9):

Reactor Vessel flange, Table C-5 (when the level band is established above the flange)

OR

Target band (when the level band is established below the flange)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Note 9: If area radiation levels rise with loss of water level, consider classification under EALs in subcategory R.2, Onsite Rad Conditions & Spent Fuel Events

Mode Applicability:

6 - Refueling

Basis:

Generic

This EAL is a precursor of more serious conditions and considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water level below the Reactor Vessel flange are carefully planned and procedurally controlled. An UNPLANNED event that results in water level decreasing below the Reactor Vessel flange, or below the planned RCS water level for the given evolution (if the planned RCS water level is already below the Reactor Vessel flange), warrants declaration of a UE due to the reduced RCS inventory that is available to keep the core covered.

The allowance of 15 minutes was chosen because it is reasonable to assume that level can be restored within this time frame using one or more of the redundant means of refill that should be available. If level cannot be restored in this time frame then it may indicate a more serious condition exists.

Continued loss of RCS Inventory will result in escalation to the Alert emergency classification level via either EAL CA3.1 or EAL CA4.1.

This EAL involves a decrease in RCS level below the top of the Reactor Vessel flange that continues for 15 minutes due to an UNPLANNED event. This EAL is not applicable to decreases in flooded reactor cavity level, which is addressed by EAL RU2.1, until such time as the level decreases to the level of the vessel flange.

Plant-Specific

The Reactor Vessel flange level is at 260.62’ el. or 0 in. indicated on standpipe. RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

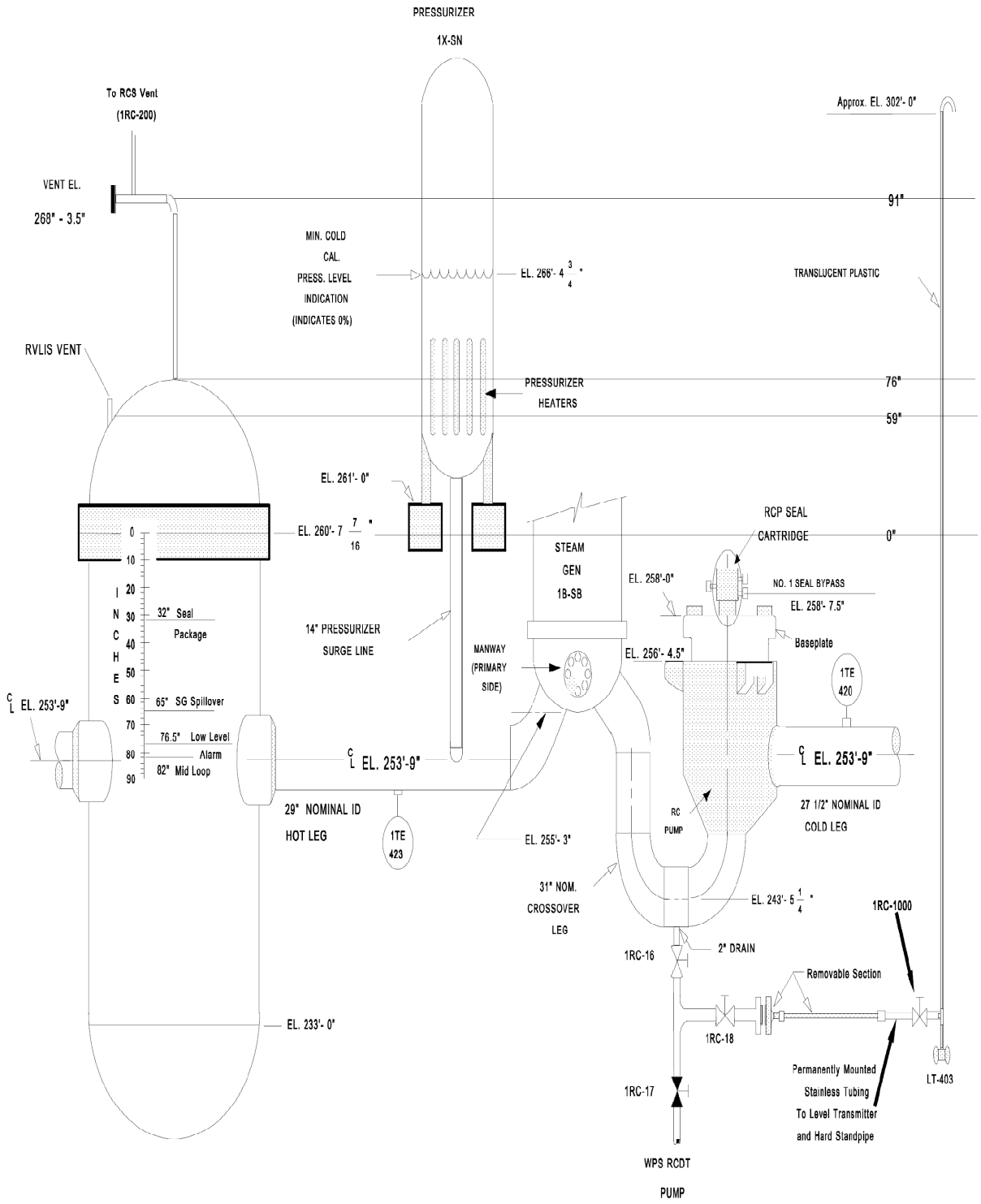
Table C-5 illustrates the RCS levels associated with Category C EALs.

If RCS level cannot be monitored, sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the Containment to ensure they are indicative of leakage (see EAL CU3.3).

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: RCS Leakage

EAL:

CU3.3 Unusual Event

RCS level **cannot** be monitored with a loss of RCS inventory as indicated by an unexplained level rise in **any** Table C-1 sump / tank attributable to RCS leakage (Note 9)

Note 9: If area radiation levels rise with loss of water level, consider classification under EALs in subcategory R.2, Onsite Rad Conditions & Spent Fuel Events

Table C-1 Sumps / Tanks

- Containment sumps
- PRT
- RCDT
- CCW surge tank
- RAB sumps
- RWST
- RMWST
- Recycle Holdup Tank

Mode Applicability:

6 - Refueling

Basis:

Generic

This EAL is a precursor of more serious conditions and considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water level below the Reactor Vessel flange are carefully planned and procedurally controlled. An UNPLANNED event that results in water level decreasing below the Reactor Vessel flange, or below the planned RCS water level for the given evolution (if the planned RCS water level is already below the Reactor Vessel flange), warrants declaration of a UE due to the reduced RCS inventory that is available to keep the core covered.

Continued loss of RCS Inventory will result in escalation to the Alert emergency classification level via either EAL CA3.1 or EAL CA4.1.

This EAL addresses conditions in the refueling mode when normal means of core temperature indication and RCS level indication may not be available. Redundant means of RCS level indication will normally be installed (including the ability to monitor level visually) to assure that the ability to monitor level will not be interrupted. However, if all level indication were to be lost during a loss of RCS inventory event, the operators would need to determine that RCS inventory loss was occurring by observing sump and tank level changes. Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

Plant-Specific

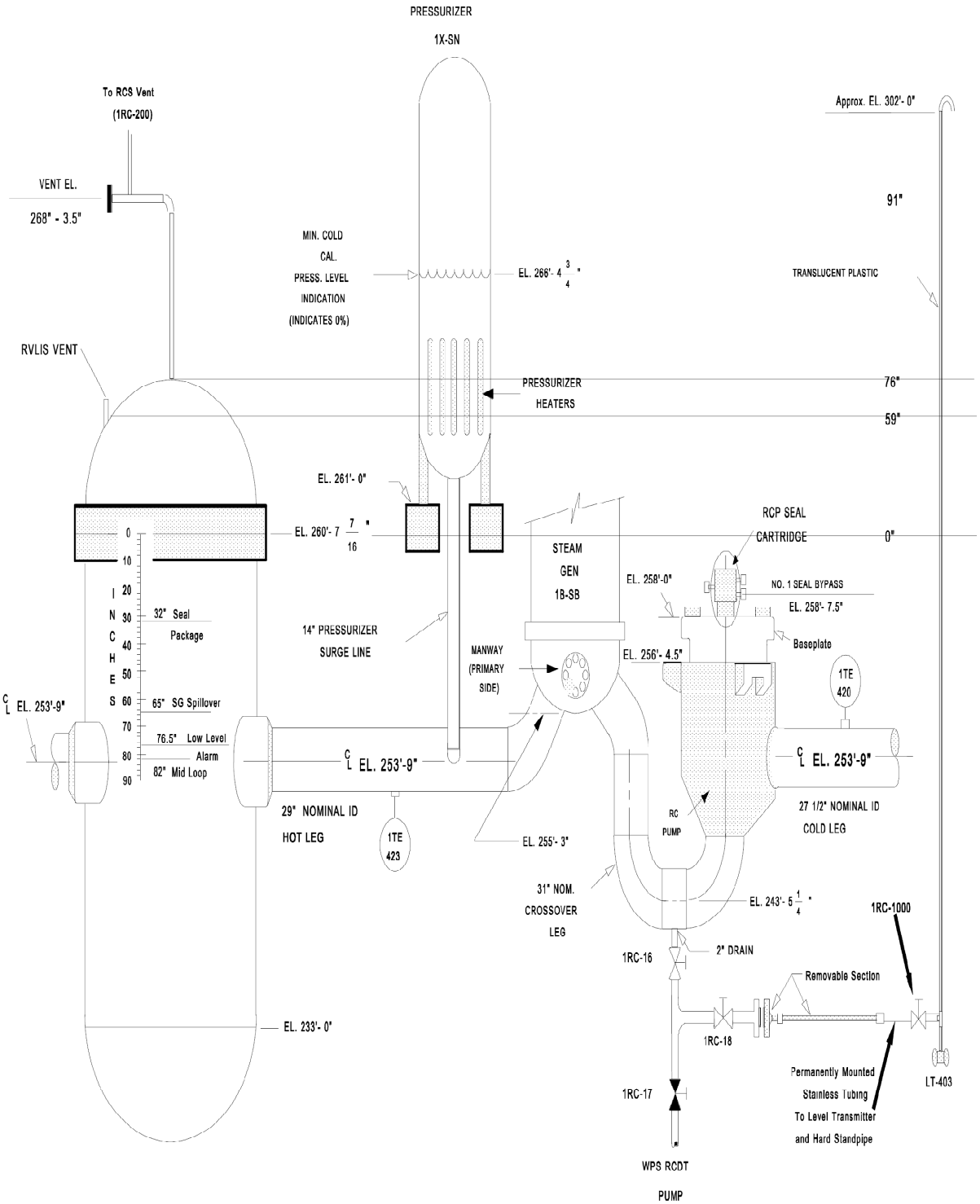
RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

In this EAL, all water level indication is unavailable, and the RCS inventory loss must be detected by sump or tank level changes (Table C-1). Procedures provide instructions for calculating primary system leak rate by manual or computer-based water inventory balances. Sump/tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the Containment to ensure they are indicative of RCS leakage (ref. 5-13).

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. AOP-008 Release of Liquid Waste
6. AOP-016 Primary Leakage
7. OST-1226 Reactor Coolant System Leakage Evaluation, Manual Calculation, Daily Interval, Modes 1-2-3-4
8. OST-1081 CONTAINMENT VISUAL INSPECTION WHEN CONTAINMENT INTEGRITY IS REQUIRED MODE 5
9. OST-1803 Containment Sump Visual Inspection 18 Month Interval Mode 5
10. FSAR Table 6.3.2-5
11. FSAR 11.2
12. 5-G-0184 Flow Diagram Reactor Auxiliary Building Drainage System Unit 1
13. 5-G-0185 Flow Diagram containment, Turbine Building & Tank Area Drainage

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of RCS inventory

EAL:

CA3.1 Alert

RCS standpipe level < -96.5 in. (< 72% RVLIS Full Range), Table C-5

OR

RCS level **cannot** be monitored for ≥ 15 min. with a loss of RCS inventory as indicated by an unexplained level rise in **any** Table C-1 sump / tank attributable to RCS leakage (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Table C-1 Sumps / Tanks

- Containment sumps
- PRT
- RCDT
- CCW surge tank
- RAB sumps
- RWST
- RMWST
- Recycle Holdup Tank

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL serves as a precursor to a loss of ability to adequately cool the fuel. The magnitude of this loss of water indicates that makeup systems have not been effective and may not be capable of preventing further RCS level decrease and potential core uncovery. This condition will result in a minimum emergency classification level of an Alert.

The inability to restore and maintain level after reaching this setpoint would be indicative of a failure of the RCS barrier.

If RCS level continues to lower then escalation to Site Area Emergency will be via EAL CS3.1, EAL CS3.2 or EAL CS3.3.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

RCS standpipe level of -96.5 in. (ref. 2) and 72% RVLIS Full Range (ref. 2, 5) correspond to the level of the bottom ID of the RCS hot leg penetration (252.54' el.). 6% has been added to the RVLIS setpoint to account for instrument uncertainties (ref. 5).

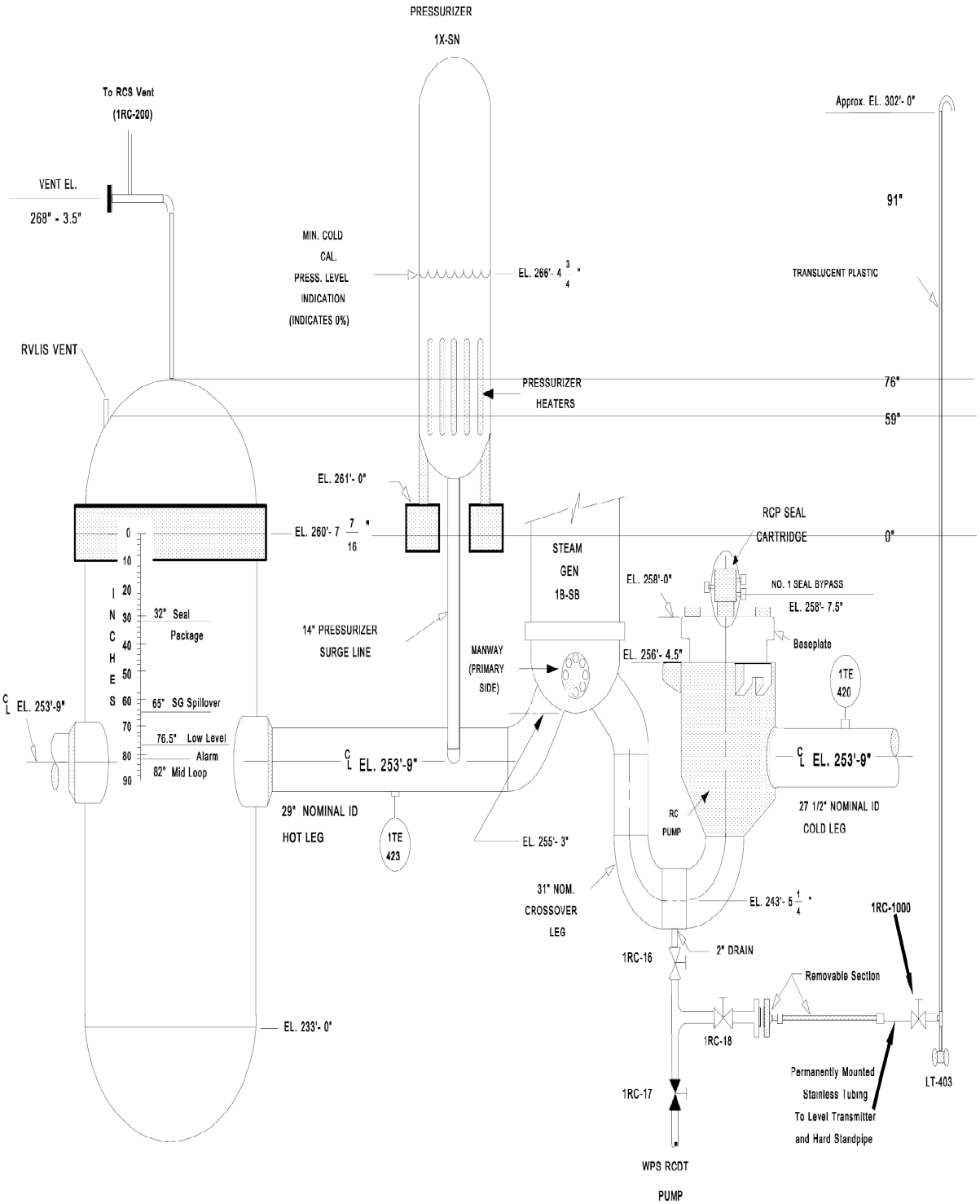
Table C-5 illustrates the RCS levels associated with Category C EALs.

If all water level indication is unavailable, the RCS inventory loss must be detected by sump or tank level changes (Table C-1). Procedures provide instructions for calculating primary system leak rate by manual or computer-based water inventory balances. Sump/tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the Containment to ensure they are indicative of RCS leakage (ref. 6-14).

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. EOP Setpoint Study, Revision 9, 4.0, FN K03
6. AOP-008 Release of Liquid Waste
7. AOP-016 Primary Leakage
8. OST-1226 Reactor Coolant System Leakage Evaluation, Manual Calculation, Daily Interval, Modes 1-2-3-4
9. OST-1081 CONTAINMENT VISUAL INSPECTION WHEN CONTAINMENT INTEGRITY IS REQUIRED MODE 5
10. OST-1803 Containment Sump Visual Inspection 18 Month Interval Mode 5
11. FSAR Table 6.3.2-5
12. FSAR 11.2
13. 5-G-0184 Flow Diagram Reactor Auxiliary Building Drainage System Unit 1
14. 5-G-0185 Flow Diagram containment, Turbine Building & Tank Area Drainage

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of RCS inventory affecting core decay heat removal capability

EAL:

CS3.1 Site Area Emergency

With Containment closure **not** established, RCS level < 70% RVLIS Full Range, Table C-5

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

Under the conditions specified by this EAL, continued decrease in RCS level is indicative of a loss of inventory control. Inventory loss may be due to an RCS breach, pressure boundary leakage, or continued boiling in the RCS. Thus, declaration of a Site Area Emergency is warranted.

Escalation to a General Emergency is via EAL CG3.1, EAL CG3.2, RG1.1, RG1.2 or RG1.3.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

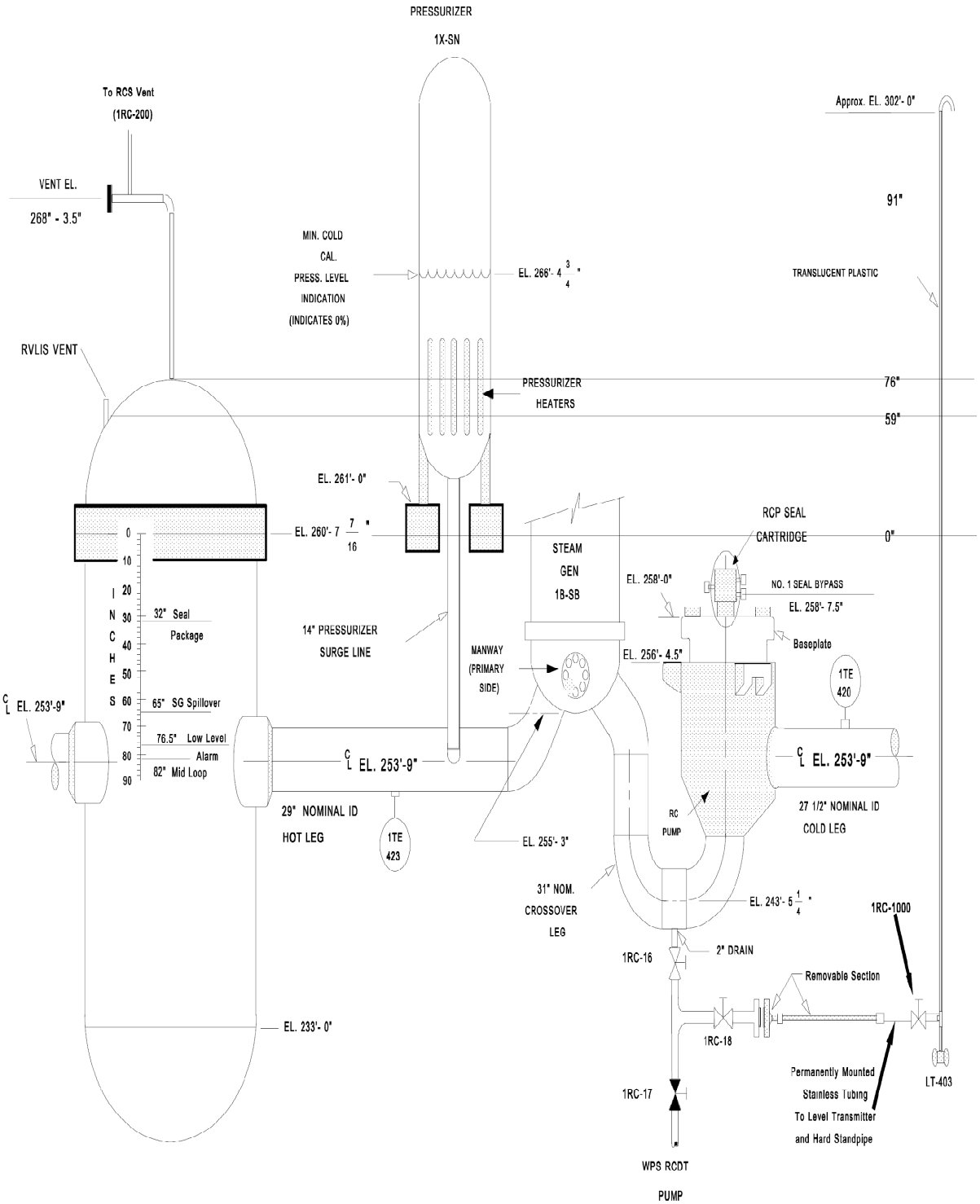
70% RVLIS Full Range (ref. 2, 5) corresponds to the level of six inches below the bottom ID of the RCS hot leg penetration (252.04' el.). 6% has been added to the RVLIS setpoint to account for instrument uncertainties (ref. 5).

Table C-5 illustrates the RCS levels associated with Category C EALs.

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. EOP Setpoint Study, Revision 9, 4.0, FN K03

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of RCS inventory affecting core decay heat removal capability

EAL:

CS3.2 Site Area Emergency

With Containment closure established, RCS level < 63% RVLIS Full Range, Table C-5

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

Under the conditions specified by this EAL, continued decrease in RCS level is indicative of a loss of inventory control. Inventory loss may be due to an RCS breach, pressure boundary leakage, or continued boiling in the RPV. Thus, declaration of a Site Area Emergency is warranted.

Escalation to a General Emergency is via EAL CG3.1, EAL CG3.2, RG1.1, RG1.2 or RG1.3.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

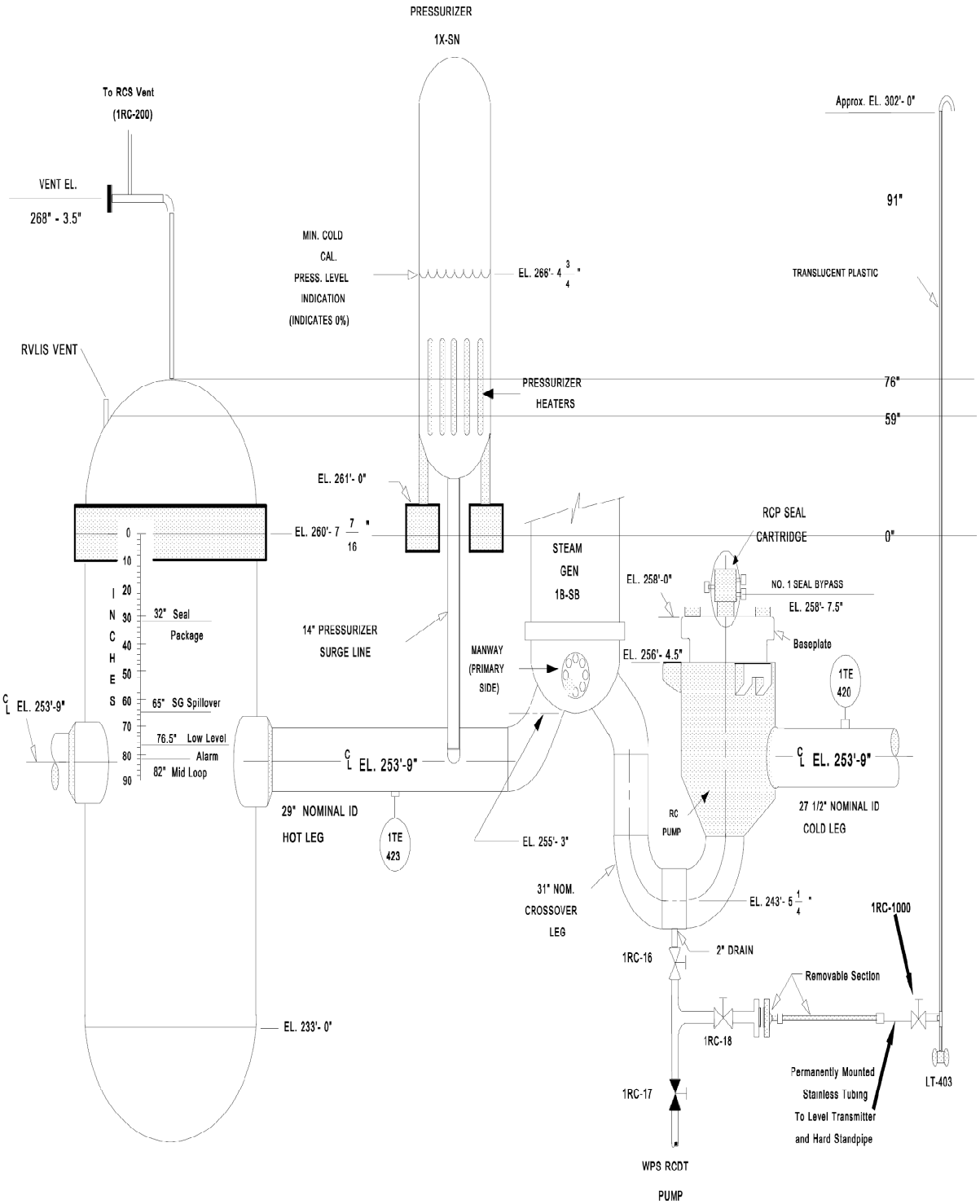
63% RVLIS Full Range (ref. 2, 5) corresponds to the top of active fuel (249.01' el.). Other RCS level instruments are off-scale low when core uncovery occurs. 6% has been added to the RVLIS setpoint to account for instrument uncertainties (ref. 5).

Table C-5 illustrates the RCS levels associated with Category C EALs.

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. EOP Setpoint Study, Revision 9, 4.0, FN K03

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of RCS inventory affecting core decay heat removal capability

EAL:

CS3.3 Site Area Emergency

RCS level **cannot** be monitored with a loss of RCS inventory as indicated by **any** of the following for ≥ 30 min. (Note 6):

- Containment radiation > 10,000 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)
- Erratic source range monitor indication
- Unexplained level rise in **any** Table C-1 sump / tank attributable to RCS leakage

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Table C-1 Sumps / Tanks

- Containment sumps
- PRT
- RCDT
- CCW surge tank
- RAB sumps
- RWST
- RMWST
- Recycle Holdup Tank

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

Under the conditions specified by this EAL, continued decrease in RCS level is indicative of a loss of inventory control. Inventory loss may be due to an RCS breach, pressure boundary leakage, or continued boiling in the RCS. Thus, declaration of a Site Area Emergency is warranted.

Escalation to a General Emergency is via EAL CG3.1, EAL CG3.2, RG1.1, RG1.2 or RG1.3.

The 30-minute duration allows sufficient time for actions to be performed to recover inventory control equipment.

As water level in the RPV lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

The dose rate due to core shine should result in elevated indication on the listed monitors (ref. 5, 6, 7).

Post-TMI studies indicate that the installed nuclear instrumentation will operate erratically when the core is uncovered and source range monitors can be used as a tool for making such determinations. Figure C-4 shows the response of the source range monitor during the first few hours of the TMI-2 accident. The instrument reported an increasing signal about 30 minutes into the accident. At this time, the reactor coolant pumps were running and the core was adequately cooled as indicated by the core outlet thermocouples. Hence, the increasing signal was the result of an increasing two-phase void fraction in the reactor core and vessel downcomer and the reduced shielding that the two-phase mixture provides to the source range monitor (ref. 8, 9). Source range is indicated in the Control Room on Source Range CPS Neutron Level Meters NI-01RE-0031BW and NI-01RE-0032BW, ERFIS, and the audio countrate monitor (ref. 10, 11).

If water level indication is unavailable, the RCS inventory loss may be detected by sump or tank level changes (Table C-1). Procedures provide instructions for calculating primary system leak rate by manual or computer-based water inventory balances. Sump/tank level increases must be evaluated against other potential sources of leakage such as cooling

water sources inside the Containment to ensure they are indicative of RCS leakage (ref. 12-20).

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. AOP-031-BD Loss of Refuel Cavity Integrity
6. MST-I0401 Containment High Range Accident Monitor RM-01CR-3589SA Calibration
7. MST-I0403 Containment High Range Accident Monitor RM-01CR-3590SB Calibration
8. Severe Accident Management Guidance Technical Basis Report, Volume 1: Candidate High-Level Actions and Their Effects, pgs 2-18, 2-19
9. Nuclear Safety Analysis Center (NSAC), 1980, “Analysis of Three Mile Island - Unit 2 Accident,” NSAC-1
10. MST-I0050 Nuclear Instrumentation System Source Range N31 Calibration
11. MST-I0051 Nuclear Instrumentation System Source Range N32 Calibration
12. AOP-008 Release of Liquid Waste
13. AOP-016 Primary Leakage
14. OST-1226 Reactor Coolant System Leakage Evaluation, Manual Calculation, Daily Interval, Modes 1-2-3-4
15. OST-1081 CONTAINMENT VISUAL INSPECTION WHEN CONTAINMENT INTEGRITY IS REQUIRED MODE 5
16. OST-1803 Containment Sump Visual Inspection 18 Month Interval Mode 5
17. FSAR Table 6.3.2-5
18. FSAR 11.2
19. 5-G-0184 Flow Diagram Reactor Auxiliary Building Drainage System Unit 1
20. 5-G-0185 Flow Diagram containment, Turbine Building & Tank Area Drainage

Figure C-3: RCS Levels and Indications (ref. 1)

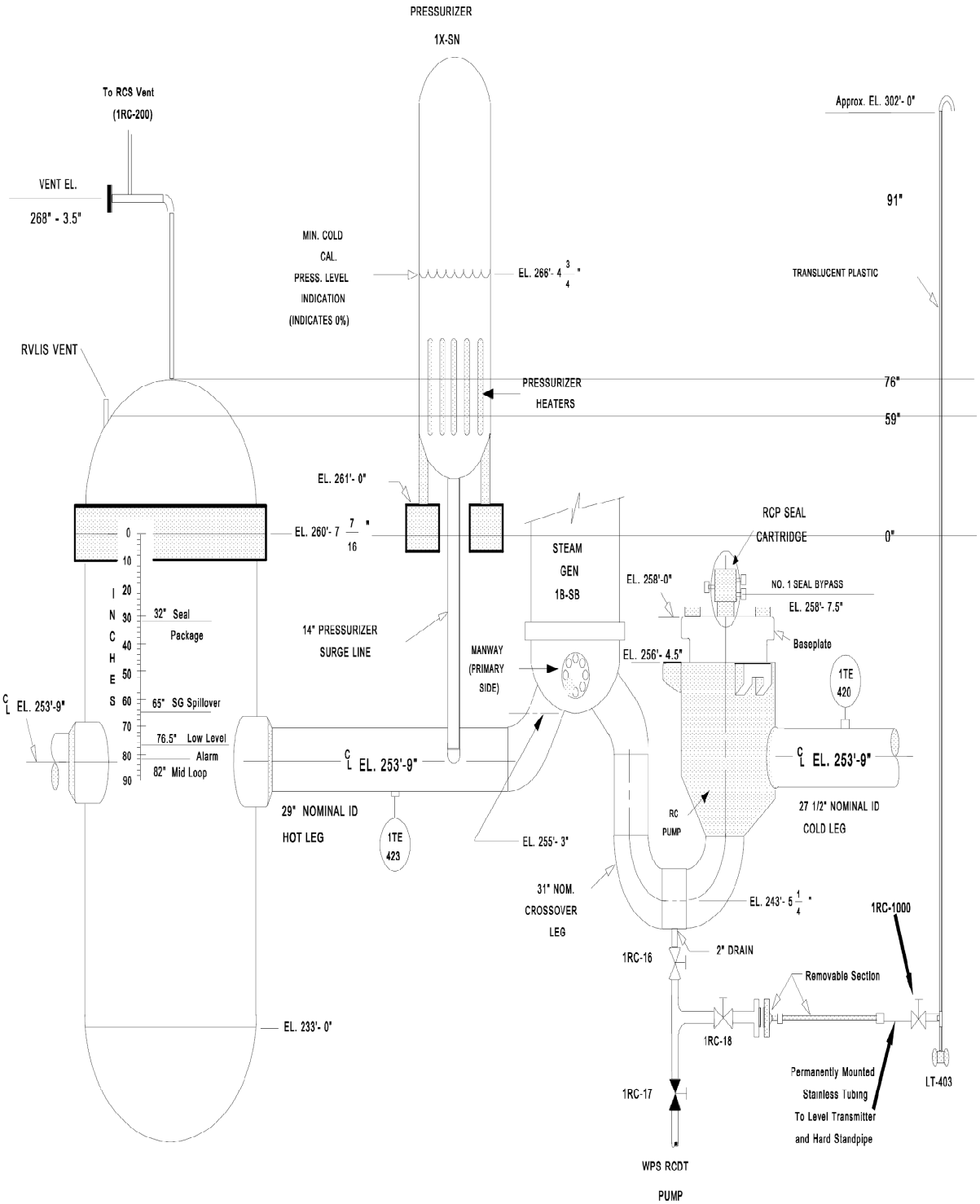
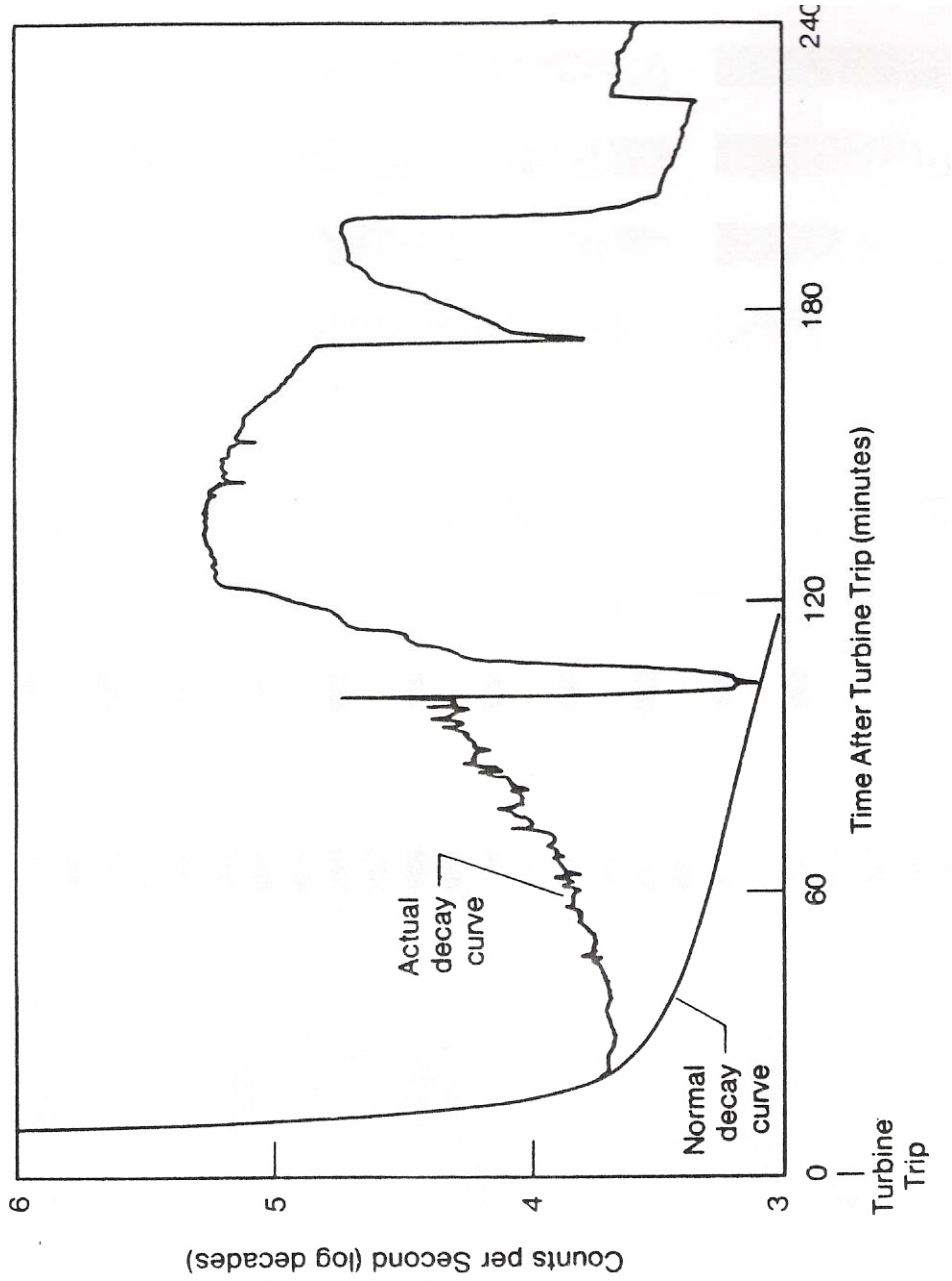


Figure C-4: Response of the TMI-2 Source Range Measurement During the First Six Hours of the Accident (ref. 10, 11)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of RCS inventory affecting fuel clad integrity with Containment challenged

EAL:

CG3.1 General Emergency

RCS level < 63% RVLIS Full Range for ≥ 30 min., Table C-5 (Note 6)

AND

Any Containment Challenge Indication, Table C-4

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Table C-4 Containment Challenge Indications

- Containment Closure **not** established
- Containment hydrogen concentration ≥ 4%
- Unplanned rise in Containment pressure

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL represents the inability to restore and maintain RCS level to above the top of active fuel with containment challenged. Fuel damage is probable if RCS level cannot be restored, as available decay heat will cause boiling, further reducing the RCS level. With the CONTAINMENT breached or challenged then the potential for unmonitored fission product release to the environment is high. This represents a direct path for radioactive inventory to be released to the environment. This is consistent with the definition of a GE. The GE is declared on the occurrence of the loss or IMMINENT loss of function of all three barriers.

A number of variables can have a significant impact on heat removal capability challenging the fuel clad barrier. Examples include: mid-loop, reduced level/flange level, head in place, cavity flooded, RCS venting strategy, decay heat removal system design, vortexing pre-disposition, steam generator U-tube draining

Analysis indicates that core damage may occur within an hour following continued core uncovery therefore, 30 minutes was conservatively chosen.

If CONTAINMENT CLOSURE is re-established prior to exceeding the 30 minute core uncovery time limit then escalation to GE would not occur.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

63% RVLIS Full Range (ref. 2, 5) corresponds to the top of active fuel (249.01' el.). Other RCS level instruments are off-scale low when core uncovery occurs. 6% has been added to the RVLIS setpoint to account for instrument uncertainties (ref. 5).

Table C-5 illustrates the RCS levels associated with Category C EALs.

Three indications are associated with Containment challenges:

- Containment closure is the action to secure Containment as a functional barrier to fission product release during plant shutdown conditions. Containment closure means that all potential escape paths are closed or capable of being closed. The status of Containment closure is tracked if plant conditions change that could raise the risk of a fission product release as a result of a loss of decay heat removal.
- 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 mixture of dissolved gases in Containment. However, Containment monitoring and/or sampling should be performed to verify this assumption. A combustible mixture can be formed when hydrogen gas concentration in the Containment atmosphere is greater than 4% by volume. Hydrogen concentration is recorded and displayed on the Remote Control Panel located in the Control Room. Hydrogen concentration may also be obtained from any of the following (ref. 6, 7, 8):
    - SPDS
    - Computer points ACM0700A and ACM0700B
    - Locally at hydrogen control panels

  A high hydrogen concentration (3% by volume) at any sample point will activate an alarm in the Control Room. The hydrogen analyzers are capable of measuring in

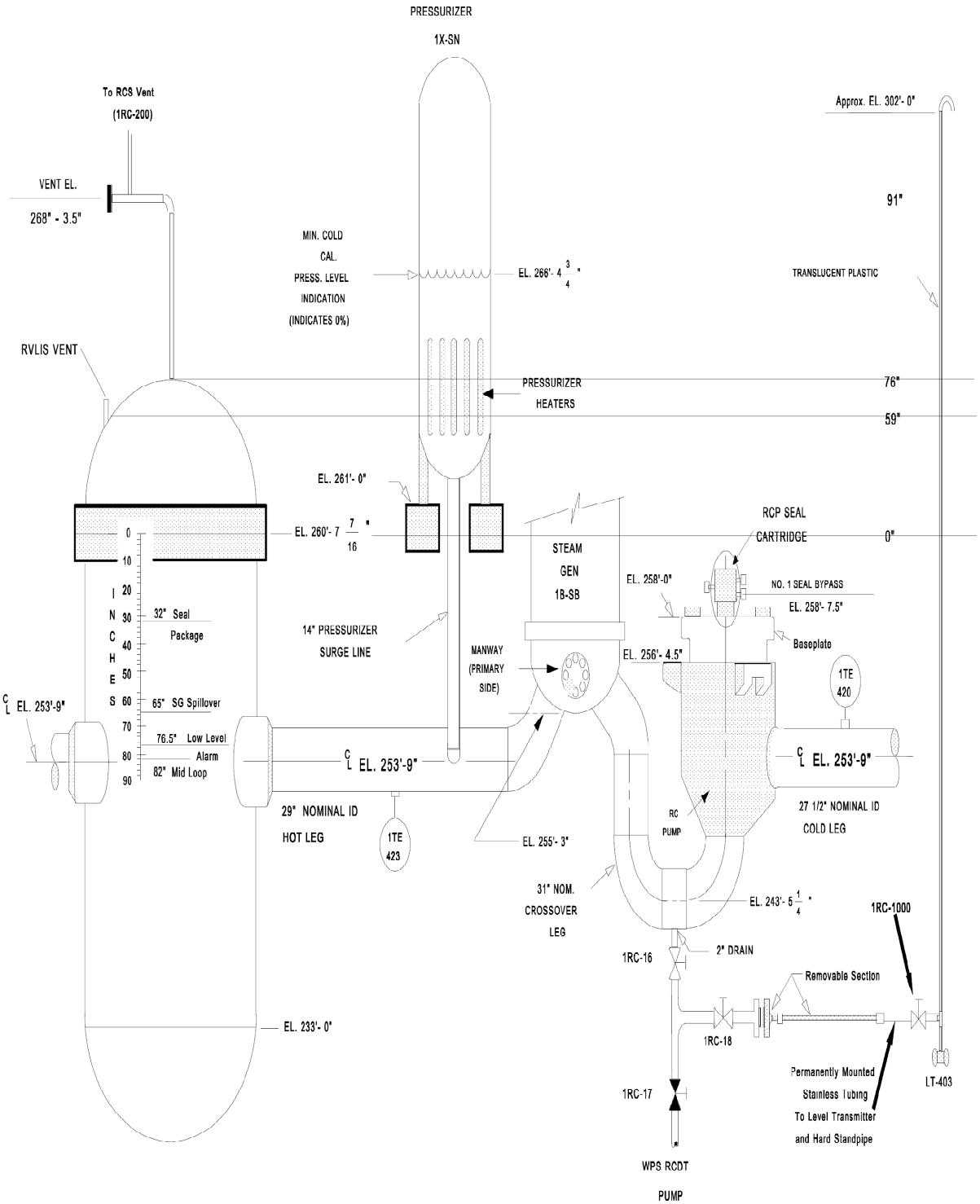
the 0-10 percent hydrogen range by volume, with an accuracy of ±2.0 percent of full scale. Hydrogen analyzers are normally in standby.

- An unplanned pressurization that can breach the Containment barrier signifies a challenge to the Containment pressure retaining capability which is dependent on the status of the Containment. If Containment integrity is established for full power operation, a breach could occur if the design containment pressure is exceeded (45 psig) (ref. 9). For this condition, a small unplanned pressure rise above atmospheric pressure does not challenge Containment. If in refueling operations, however, a breach could occur if the unplanned pressure rise exceeded the capability of a temporary containment seal. This would occur at a much lower pressure than the Containment design pressure.

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. EOP Setpoint Study, Revision 9, 4.0, FN K03
6. EOP-GUIDE-1 PATH-1 GUIDE
7. DBD-305 Post Accident Hydrogen Analyzer System
8. OP-125 Post Accident Hydrogen System
9. EOP-CSFST Containment CSF-5

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 3 – RCS Level

Initiating Condition: Loss of Reactor Vessel inventory affecting fuel clad integrity with Containment challenged

EAL:

CG3.2 General Emergency

RCS level **cannot** be monitored with core uncovery indicated by **any** of the following for ≥ 30 min. (Note 6):

- Containment radiation > 10,000 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)
- Erratic source range monitor indication
- Unexplained level rise in **any** Table C-1 sump / tank attributable to RCS leakage

AND

Any Containment Challenge Indication, Table C-4

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Table C-1 Sumps / Tanks

- Containment sumps
- PRT
- RCDT
- CCW surge tank
- RAB sumps
- RWST
- RMWST
- Recycle Holdup Tank

Table C-4 Containment Challenge Indications
• Containment Closure **not** established • Containment hydrogen concentration ≥ 4% • Unplanned rise in Containment pressure

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL represents the inability to restore and maintain RCS level to above the top of active fuel with containment challenged. Fuel damage is probable if RCS level cannot be restored, as available decay heat will cause boiling, further reducing the RCS level. With the CONTAINMENT breached or challenged then the potential for unmonitored fission product release to the environment is high. This represents a direct path for radioactive inventory to be released to the environment. This is consistent with the definition of a GE. The GE is declared on the occurrence of the loss or IMMINENT loss of function of all three barriers.

A number of variables can have a significant impact on heat removal capability challenging the fuel clad barrier. Examples include: *PWRs*] mid-loop, reduced level/flange level, head in place, cavity flooded, RCS venting strategy, decay heat removal system design, vortexing pre-disposition, steam generator U-tube draining

Analysis indicates that core damage may occur within an hour following continued core uncovery therefore, 30 minutes was conservatively chosen.

If CONTAINMENT CLOSURE is re-established prior to exceeding the 30 minute core uncovery time limit then escalation to GE would not occur.

Sump and tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage.

As water level in the RCS lowers, the dose rate above the core will increase. The dose rate due to this core shine should result in site specific monitor indication and possible alarm.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

The dose rate due to core shine should result in elevated indication on the listed monitors (ref. 5, 6, 7).

Post-TMI studies indicate that the installed nuclear instrumentation will operate erratically when the core is uncovered and source range monitors can be used as a tool for making such determinations. Figure C-4 shows the response of the source range monitor during the first few hours of the TMI-2 accident. The instrument reported an increasing signal about 30 minutes into the accident. At this time, the reactor coolant pumps were running and the core was adequately cooled as indicated by the core outlet thermocouples. Hence, the increasing signal was the result of an increasing two-phase void fraction in the reactor core and vessel downcomer and the reduced shielding that the two-phase mixture provides to the source range monitor (ref. 8, 9). Source range is indicated in the Control Room on Source Range CPS Neutron Level Meters NI-01RE-0031BW and NI-01RE-0032BW, ERFIS, and the audio countrate monitor (ref. 10, 11).

If water level indication is unavailable, the RCS inventory loss may be detected by sump or tank level changes (Table C-1). Procedures provide instructions for calculating primary system leak rate by manual or computer-based water inventory balances. Sump/tank level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the Containment to ensure they are indicative of RCS leakage (ref. 12-20).

Three indications are associated with Containment challenges:

- Containment closure is the action to secure Containment as a functional barrier to fission product release during plant shutdown conditions. Containment closure means that all potential escape paths are closed or capable of being closed. The status of Containment closure is tracked if plant conditions change that could raise the risk of a fission product release as a result of a loss of decay heat removal.
- 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 mixture of dissolved gases in Containment. However, Containment monitoring and/or sampling should be performed to verify this assumption. A combustible mixture can be formed when hydrogen gas concentration in the Containment atmosphere is greater than 4% by volume. Hydrogen concentration is recorded and displayed on the Remote Control

Panel located in the Control Room. Hydrogen concentration may also be obtained from any of the following (ref. 21, 22, 24):

- SPDS
- Computer points ACM0700A and ACM0700B
- Locally at hydrogen control panels

A high hydrogen concentration (3% by volume) at any sample point will activate an alarm in the Control Room. The hydrogen analyzers are capable of measuring in the 0-10 percent hydrogen range by volume, with an accuracy of ±2.0 percent of full scale. Hydrogen analyzers are normally in standby.

- An unplanned pressurization that can breach the Containment barrier signifies a challenge to the Containment pressure retaining capability which is dependent on the status of the Containment. If Containment integrity is established for full power operation, a breach could occur if the design containment pressure is exceeded (45 psig) (ref. 24). For this condition, a small unplanned pressure rise above atmospheric pressure does not challenge Containment. If in refueling operations, however, a breach could occur if the unplanned pressure rise exceeded the capability of a temporary containment seal. This would occur at a much lower pressure than the Containment design pressure.

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. AOP-031-BD Loss of Refuel Cavity Integrity
6. MST-I0401 Containment High Range Accident Monitor RM-01CR-3589SA Calibration
7. MST-I0403 Containment High Range Accident Monitor RM-01CR-3590SB Calibration
8. Severe Accident Management Guidance Technical Basis Report, Volume 1: Candidate High-Level Actions and Their Effects, pgs 2-18, 2-19
9. Nuclear Safety Analysis Center (NSAC), 1980, “Analysis of Three Mile Island - Unit 2 Accident,” NSAC-1
10. MST-I0050 Nuclear Instrumentation System Source Range N31 Calibration
11. MST-I0051 Nuclear Instrumentation System Source Range N32 Calibration

12. AOP-008 Release of Liquid Waste
13. AOP-016 Primary Leakage
14. OST-1226 Reactor Coolant System Leakage Evaluation, Manual Calculation, Daily Interval, Modes 1-2-3-4
15. OST-1081 CONTAINMENT VISUAL INSPECTION WHEN CONTAINMENT INTEGRITY IS REQUIRED MODE 5
16. OST-1803 Containment Sump Visual Inspection 18 Month Interval Mode 5
17. FSAR Table 6.3.2-5
18. FSAR 11.2
19. 5-G-0184 Flow Diagram Reactor Auxiliary Building Drainage System Unit 1
20. 5-G-0185 Flow Diagram containment, Turbine Building & Tank Area Drainage
21. EOP-GUIDE-1 PATH-1 GUIDE
22. DBD-305 Post Accident Hydrogen Analyzer System
23. OP-125 Post Accident Hydrogen System
24. EOP-CSFST Containment CSF-5

Figure C-3: RCS Levels and Indications (ref. 1)

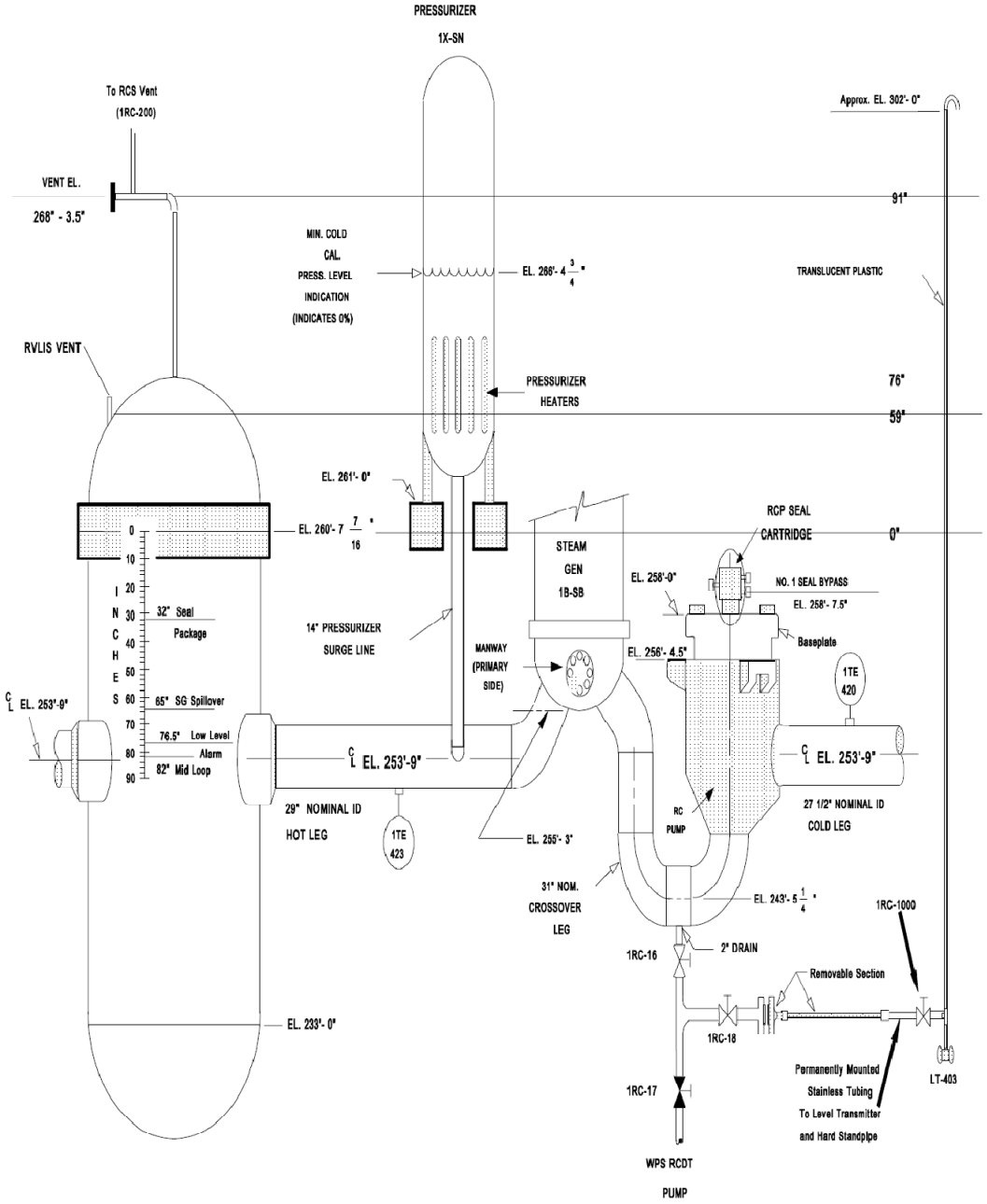
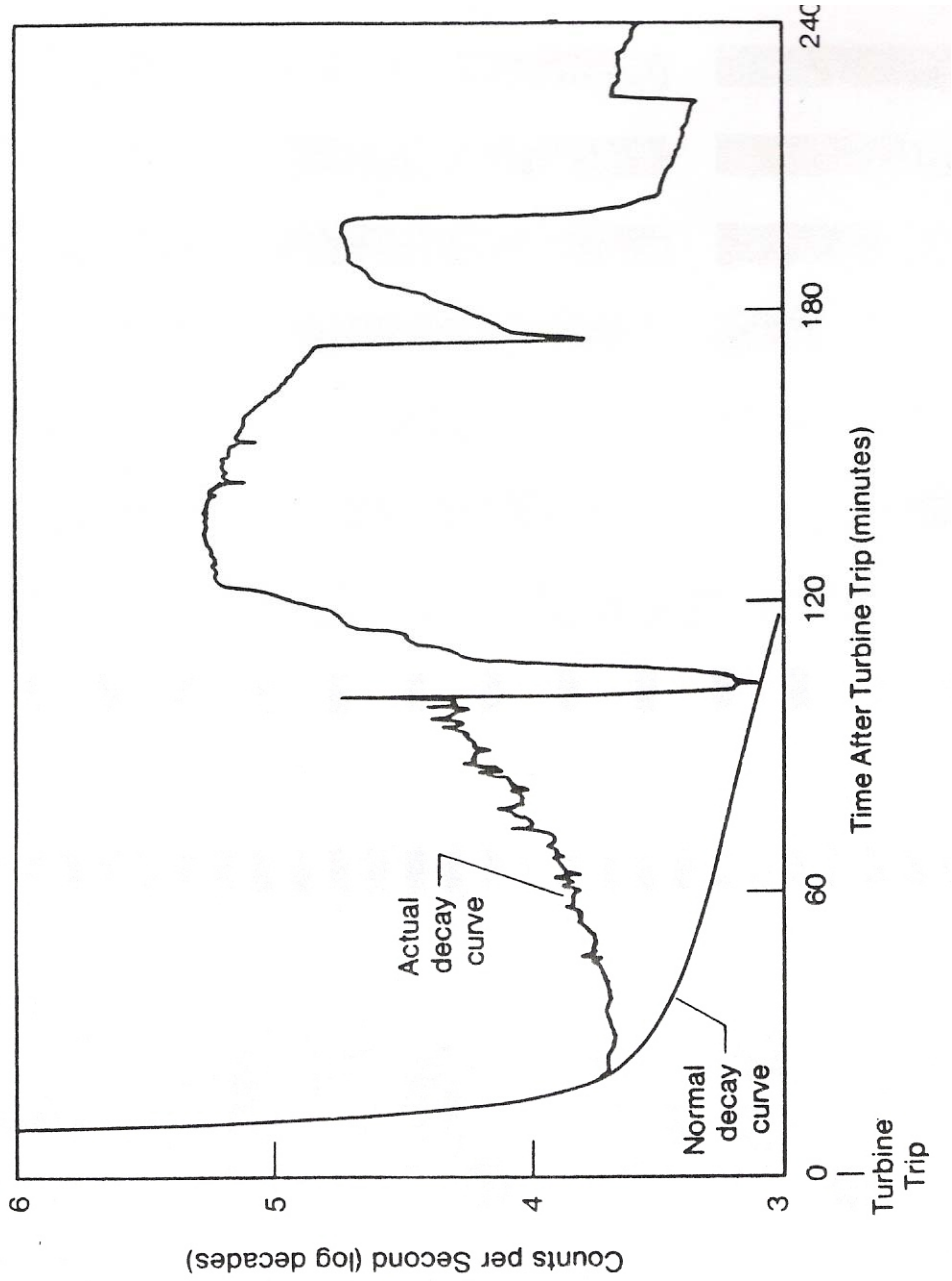


Figure C-4: Response of the TMI-2 Source Range Measurement During the First Six Hours of the Accident (ref. 10, 11)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 4 – RCS Temperature

Initiating Condition: Unplanned loss of decay heat removal capability with irradiated fuel in the Reactor Vessel

EAL:

CU4.1 Unusual Event

Unplanned event results in RCS temperature > 200°F

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL is a precursor of more serious conditions and, as a result, is considered to be a potential degradation of the level of safety of the plant. In cold shutdown the ability to remove decay heat relies primarily on forced cooling flow. Operation of the systems that provide this forced cooling may be jeopardized due to the unlikely loss of electrical power or RCS inventory. Since the RCS usually remains intact in the cold shutdown mode a large inventory of water is available to keep the core covered.

During refueling the level in the RCS will normally be maintained above the Reactor Vessel flange. Refueling evolutions that decrease water level below the Reactor Vessel flange are carefully planned and procedurally controlled. Loss of forced decay heat removal at reduced inventory may result in more rapid increases in RCS temperatures depending on the time since shutdown.

Normal means of core temperature indication and RCS level indication may not be available in the refueling mode. Redundant means of RCS level indication are therefore procedurally installed to assure that the ability to monitor level will not be interrupted. Escalation to Alert would be via EAL CA3.1 based on an inventory loss or EAL CA4.1 based on exceeding its temperature duration or pressure criteria.

Plant-Specific

Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (200°F, ref. 1). These include loop TRH0604A (TRH0604B), RHR Pump A (B) Disch Temp TR-604 (TR-606) red pen, RHRP-A (B) Disch, and RCS Wide Range Thot and Tcold (ref. 1) as well as Core Exit Thermocouples (CETs) (ref. 2, 3).

HNP Basis Reference(s):

1. OP-111 Residual Heat Removal
2. GP-007 Normal Plant Cooldown Mode 3 to Mode 5
3. AOP-020 Loss of RCS Inventory or Residual Heat Removal While Shutdown

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 4 – RCS Temperature

Initiating Condition: Unplanned loss of decay heat removal capability with irradiated fuel in the Reactor Vessel

EAL:

CU4.2 Unusual Event

Loss of **all** RCS temperature and RCS level indication for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL is a precursor of more serious conditions and, as a result, is considered to be a potential degradation of the level of safety of the plant. In cold shutdown the ability to remove decay heat relies primarily on forced cooling flow. Operation of the systems that provide this forced cooling may be jeopardized due to the unlikely loss of electrical power or RCS inventory. Since the RCS usually remains intact in the cold shutdown mode a large inventory of water is available to keep the core covered.

During refueling the level in the RCS will normally be maintained above the Reactor Vessel flange. Refueling evolutions that decrease water level below the Reactor Vessel flange are carefully planned and procedurally controlled. Loss of forced decay heat removal at reduced inventory may result in more rapid increases in RCS temperatures depending on the time since shutdown.

Normal means of core temperature indication and RCS level indication may not be available in the refueling mode. Redundant means of RCS level indication are therefore procedurally installed to assure that the ability to monitor level will not be interrupted. However, if all level and temperature indication were to be lost in either the cold shutdown of refueling modes, this EAL would result in declaration of a UE if both temperature and level indication cannot be restored within 15 minutes from the loss of both means of indication. Escalation to Alert would be via EAL CA3.1 based on an inventory loss or EAL CA4.1 based on exceeding its temperature criteria.

Plant-Specific

RCS elevations and level indication capabilities are illustrated in Figure C-3 (ref. 1-4).

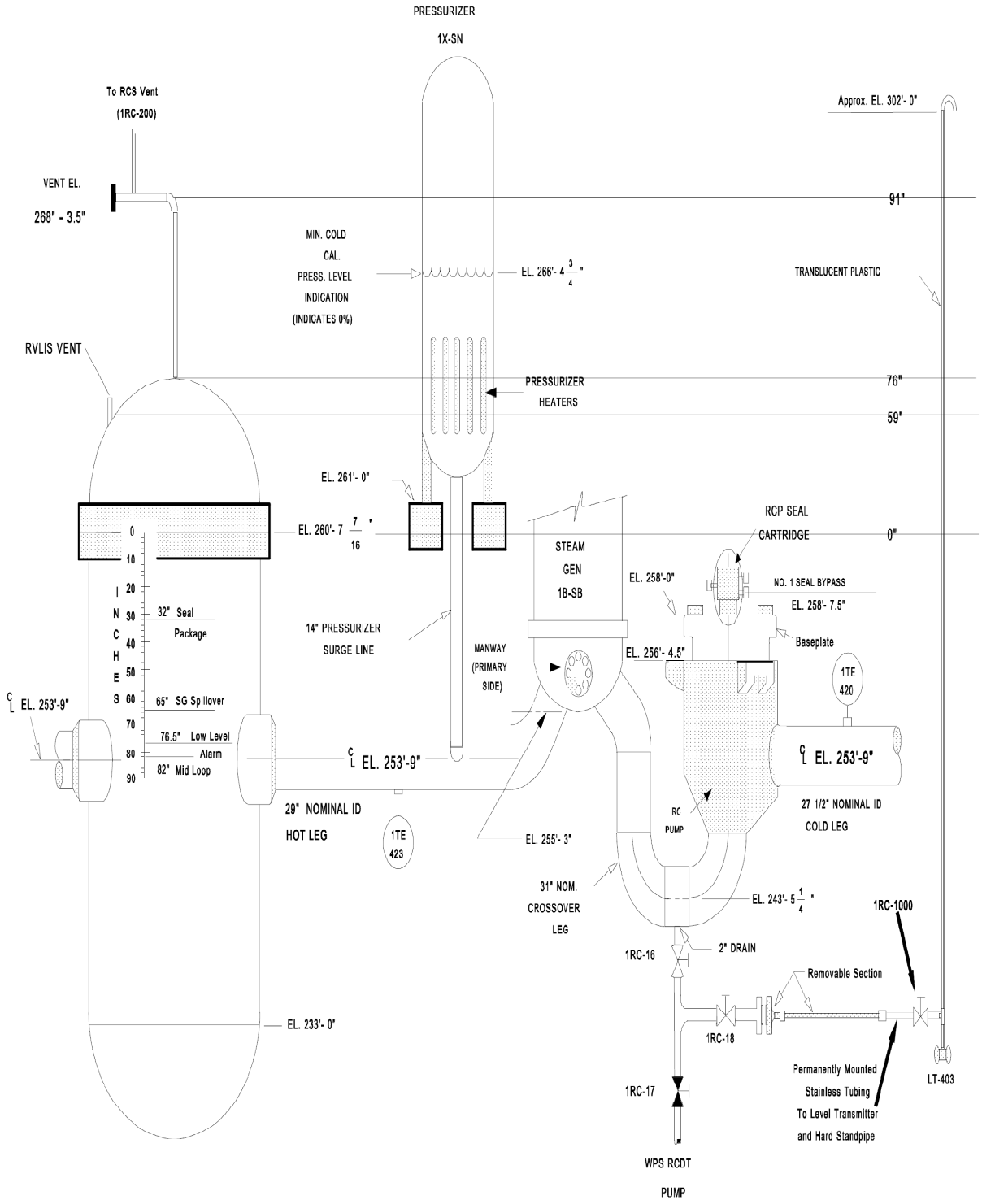
Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (200°F, ref. 1). These include loop TRH0604A (TRH0604B), RHR Pump A (B) Disch Temp TR-604 (TR-606) red pen,

RHRP-A (B) Disch, and RCS Wide Range Thot and Tcold (ref. 5) as well as Core Exit Thermocouples (CETs) (ref. 6, 7).

HNP Basis Reference(s):

1. GP-001 Reactor Coolant System Fill and Vent Mode 5
2. GP-008 Draining the Reactor Coolant System
3. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5
4. MST-I0322 Reactor Vessel Level Monitoring System Transmitter Calibration
5. OP-111 Residual Heat Removal
6. GP-007 Normal Plant Cooldown Mode 3 to Mode 5
7. AOP-020 Loss of RCS Inventory or Residual Heat Removal While Shutdown

Figure C-3: RCS Levels and Indications (ref. 1)



Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 4 – RCS Temperature

Initiating Condition: Inability to maintain plant in cold shutdown

EAL:

CA4.1 Alert

An unplanned event results in **EITHER**:

RCS temperature > 200°F for > Table C-3 duration

OR

RCS pressure increase > 10 psig due to a loss of RCS cooling (this condition is **not** applicable in solid plant conditions)

Table C-3 RCS Reheat Duration Thresholds

* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is **not** applicable

RCS Status	Containment Closure Status	Duration
Intact **AND not** reduced inventory	N/A	60 min.*
Not intact **OR** reduced inventory	established	20 min.*
	not established	0 min.

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Basis:

Generic

The RCS Reheat Duration Thresholds table addresses complete loss of functions required for core cooling for greater than 60 minutes during refueling and cold shutdown modes when RCS integrity is established. The 60 minute time frame should allow sufficient time to restore cooling without there being a substantial degradation in plant safety.

The RCS Reheat Duration Thresholds table also addresses the complete loss of functions required for core cooling for greater than 20 minutes during refueling and cold shutdown modes when CONTAINMENT CLOSURE is established but RCS integrity is not established or RCS inventory is

reduced. The allowed 20 minute time frame was included to allow operator action to restore the heat removal function, if possible.

Finally, complete loss of functions required for core cooling during refueling and cold shutdown modes when neither CONTAINMENT CLOSURE nor RCS integrity are established is addressed. No delay time is allowed because the evaporated reactor coolant that may be released into the Containment during this heatup condition could also be directly released to the environment.

The note (*) indicates that this EAL is not applicable if actions are successful in restoring an RCS heat removal system to operation and RCS temperature is being reduced within the specified time frame.

The 10 psi pressure increase addresses situations where, due to high decay heat loads, the time provided to restore temperature control, should be less than 60 minutes. The RCS pressure setpoint was chosen because it is the lowest pressure that the site can read on installed Control Board instrumentation that is equal to or greater than 10 psi.

Escalation to Site Area Emergency would be via EAL CS3.1 should boiling result in significant RPV level loss leading to core uncovery.

A loss of Technical Specification components alone is not intended to constitute an Alert. The same is true of a momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available.

The SEC must remain alert to events or conditions that lead to the conclusion that exceeding the EAL is IMMINENT. If, in the judgment of the SEC an IMMINENT situation is at hand, the classification should be made as if the threshold has been exceeded.

Plant-Specific

Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (200°F, ref. 1). These include loop TRH0604A (TRH0604B), RHR Pump A (B) Disch Temp TR-604 (TR-606) red pen, RHRP-A (B) Disch, and RCS Wide Range T_{hot} and T_{cold} (ref. 1).

Containment closure is the action to secure Containment as a functional barrier to fission product release during plant shutdown conditions. Containment closure means that all potential escape paths are closed or capable of being closed. The status of Containment closure is tracked if plant conditions change that could raise the risk of a fission product release as a result of a loss of decay heat removal.

A 10 psig RCS pressure increase can be monitored on PI-402A and associated computer points (ref. 2). When solid plant conditions exist, the 10 psig pressure increase threshold is not applicable.

HNP Basis Reference(s):

1. OP-111 Residual Heat Removal
2. MST-I0080 Reactor Coolant System Wide Range Pressure (P-0402) Calibration

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 5 – Communications

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

EAL:

CU5.1 Unusual Event

Loss of **all** Table C-2 onsite (internal) communication methods affecting the ability to perform routine operations

OR

Loss of **all** Table C-2 offsite (external) communication methods affecting the ability to perform offsite notifications

Table C-2 Communications Systems

System	Onsite (internal)	Offsite (external)
PABX telephone system (desk phones)	X	X
HE&EC PABX telephone system		X
Site paging system	X	
Satellite phone		X
Radio communications networks	X	
NRC ETS Phone		X
NRC HPN Phone		X

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling, D - Defueled

Basis:

Generic

The purpose of this EAL is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with off-site authorities. The loss of off-site communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

The availability of one method of ordinary off-site communications is sufficient to inform federal, state, and local authorities of plant issues. This EAL is intended to be used only when

extraordinary means (e.g., relaying of information from radio transmissions, individuals being sent to off-site locations, etc.) are being utilized to make communications possible.

Plant-Specific

Onsite/offsite communications systems are listed in Table C-2 (ref. 1, 2, 3).

This EAL is the cold condition equivalent of the hot condition EAL SU6.1.

HNP Basis Reference(s):

1. FSAR 9.5.2
2. PLP-201 Emergency Plan, Section 3.8
3. OMM-009 Shift Communications, Section 5.2
4. OP-180 Plant Communication Systems
5. DBD-206 Plant Communications Systems

Category: C – Cold Shutdown / Refueling System Malfunction

Subcategory: 6 – Inadvertent Criticality

Initiating Condition: Inadvertent criticality

EAL:

CU6.1 Unusual Event

An unplanned sustained positive startup rate observed on nuclear instrumentation

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling

Basis:

Generic

This EAL addresses criticality events that occur in Cold Shutdown or Refueling modes such as fuel mis-loading events and inadvertent dilution events. This EAL indicates a potential degradation of the level of safety of the plant, warranting a UE classification.

Escalation would be by SEC judgment.

Plant-Specific

This condition can be identified using IR N35/N36, SR N31/N32,Recorder NR-01RE-0045W (Pen 1 & Pen 2), Audio Count Rate, and Computer Point ANM0110 (ref.).

HNP Basis Reference(s):

1. MST-I0048 Excore Nuclear Instrumentation System Intermediate Range N35 Calibration
2. MST-I0049 Excore Nuclear Instrumentation System Intermediate Range N36 Calibration
3. MST-I0050 Nuclear Instrumentation System Source Range N31 Calibration
4. MST-I0051 Nuclear Instrumentation System Source Range N32 Calibration

Category H – Hazards

EAL Group: ANY (EALs in this category are applicable to any plant condition, hot or cold.)

Hazards are non-plant, system-related events that can directly or indirectly affect plant operation, reactor plant safety or personnel safety.

The events of this category pertain to the following subcategories:

1. Natural or Destructive Phenomena

Natural events include hurricanes, earthquakes or tornados that have potential to cause plant structure or equipment damage of sufficient magnitude to threaten personnel or plant safety. Non-naturally occurring events that can cause damage to plant facilities and include aircraft crashes, missile impacts, etc.

2. Fire or Explosion

Fires can pose significant hazards to personnel and reactor safety. Appropriate for classification are fires within the site Protected Area or which may affect operability of equipment needed for safe shutdown

3. Hazardous Gas

Non-naturally occurring events that can cause damage to plant facilities and include toxic, asphyxiant, corrosive or flammable gas leaks.

4. Security

Unauthorized entry attempts into the Protected Area, bomb threats, sabotage attempts, and actual security compromises threatening loss of physical control of the plant.

5. Control Room Evacuation

Events that are indicative of loss of Control Room habitability. If the Control Room must be evacuated, additional support for monitoring and controlling plant functions is necessary through the emergency response facilities.

6. Judgment

The EALs defined in other categories specify the predetermined symptoms or events that are indicative of emergency or potential emergency conditions and thus warrant

classification. While these EALs have been developed to address the full spectrum of possible emergency conditions which may warrant classification and subsequent implementation of the Emergency Plan, a provision for classification of emergencies based on operator/management experience and judgment is still necessary. The EALs of this category provide the SEC the latitude to classify emergency conditions consistent with the established classification criteria based upon SEC judgment.

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting the Protected Area

EAL:

HU1.1 Unusual Event

Seismic event identified by **any two** of the following:

- Seismic event confirmed at the Strong Motion Accelerograph by **EITHER**:

  Amber EVENT ALARM light illuminates

  OR

  EVENT INDICATOR flag turns from black to white
- Earthquake felt in plant
- National Earthquake Center

Mode Applicability:

All

Basis:

Generic

This EAL is categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

Damage may be caused to some portions of the site, but should not affect ability of safety functions to operate.

As defined in the EPRI-sponsored Guidelines for Nuclear Plant Response to an Earthquake, dated October 1989, a "felt earthquake" is: An earthquake of sufficient intensity such that: (a) the vibratory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of control room operators on duty at the time, and (b) for plants with operable seismic instrumentation, the seismic switches of the plant are activated.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

Plant-Specific

The Strong Motion Accelerograph Recording and Playback System (SMA-3), in its normal standby mode (ref. 1, 2, 3), waits for a signal from the remote seismic trigger unit indicating that acceleration larger than the preset threshold of 0.01g has been sensed. This is well below the operating basis earthquake level. When either the vertical or horizontal triggers in the starter unit sense the threshold acceleration, four functions occur simultaneously:

1. Power is sent to activate three remote accelerometers.
2. Magnetic tape recorders are activated.
3. The alarm light on the SMA-3 control panel is illuminated.
4. The "Event" indicator turns from black to white.

HNP Basis Reference(s):

1. AOP-021 Seismic Disturbances
2. FSAR 3.7.4
3. DBD-004 Seismic Monitoring System

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting the Protected Area

EAL:

HU1.2 Unusual Event

Tornado striking within Protected Area boundary

OR

Sustained high winds > 89 mph

Mode Applicability:

All

Basis:

Generic

This EAL is categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

This EAL is based on a tornado striking (touching down) or high winds within the PROTECTED AREA.

Escalation of this emergency classification level, if appropriate, would be based on VISIBLE DAMAGE, or by other in plant conditions, via EAL HA1.2.

Plant-Specific

The plant Seismic Category I structures are designed to withstand the effects of the design wind, a maximum wind of 179 mph at 30 feet above plant grade. The design wind is based on a 1000-year return period "fastest mile of wind." Sudden, brief fluctuations in the wind speed (gusts) and the dynamic nature of load were accounted for through application of the gust factors. The gust factors were assigned the same values as those suggested by the ANSI Code. (ref. 1)

The range of the wind speed computer points (e.g., ERFIS point MMT1008) is 0-135 mph. The wind sensor is a R.M.Young Model 05305 and has a range of 0-90 mph with wind gust survival up to 100 mph. 89 mph has, therefore, been selected for the EAL threshold since wind speeds of greater magnitude are beyond the range of the sensor and cannot be reliably indicated. (ref. 2)

Winds speed indications from the meteorological tower are 15-minute average values; therefore, any wind-speed readings obtained from the meteorological tower are considered sustained winds. (ref. 3, 4)

The Protected Area refers to the designated security area around the process buildings and is depicted in FSAR Figure 1.2.2-1, Site Plan (ref. 5).

HNP Basis Reference(s):

1. FSAR 3.3.1.1
2. VM-CES
3. AP-300 Severe Weather Response
4. DBD-318 Meteorological and Environmental Monitoring System
5. FSAR Figure 1.2.2-1

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting the Protected Area

EAL:

HU1.3 Unusual Event

Internal flooding that has the potential to affect safety-related equipment required by Technical Specifications for the current operating mode in **any** of the following areas:

- Reactor Auxiliary Building
- DG Room A
- DG Room B

Mode Applicability:

All

Basis:

Generic

This EAL is categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps.

Escalation of this emergency classification level, if appropriate, would be based VISIBLE DAMAGE via EAL HA1.3, or by other plant conditions.

Plant-Specific

In the Reactor Auxiliary Building (RAB), the RHR pump rooms on level 190 have critical equipment and are subject to flooding from many sources. The area above this room on level 216 communicates with the RHR pump rooms. The large open area on level 236 contains numerous critical components, including equipment designed to serve redundant functions. The high head pump cubicles are also located on level 236 and are considered in conjunction with level 236 floods. Although not a critical area in terms of equipment, the service water tunnel could be a source of flooding. Floods initiated in the tunnel that then propagate to level 236 and sources on level 236 were considered in the flooding analysis.

The Diesel Generator (DG) building contains important equipment and potential flood sources. Except for electrical cable tunnels, the building is physically separate from the other facilities and does was not considered relative to inter-building flood propagation. The DG building obviously includes the diesels which are important to protection of the reactor core when normal AC power is not available. The rooms housing the two diesels at level 261 in the building (DG Rooms A and B) are therefore critical areas. (ref. 1)

HNP Basis Reference(s):

1. Calculation HNP-F/PSA-0057 HNP PRA – Appendix I – Internal Flooding Analysis

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting the Protected Area

EAL:

HU1.4 Unusual Event

Turbine failure resulting in casing penetration or damage to turbine or generator seals

Mode Applicability:

All

Basis:

Generic

These EALs are categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

This EAL addresses main turbine rotating component failures of sufficient magnitude to cause observable damage to the turbine casing or to the seals of the turbine generator. Generator seal damage observed after generator purge does not meet the intent of this EAL because it did not impact normal operation of the plant.

Of major concern is the potential for leakage of combustible fluids (lubricating oils) and gases (hydrogen cooling) to the plant environs. Actual FIRES and flammable gas build up are appropriately classified via EAL HU2.1 and EAL HU3.1.

This EAL is consistent with the definition of a UE while maintaining the anticipatory nature desired and recognizing the risk to non-safety related equipment.

Escalation of this emergency classification level, if appropriate, would be to EAL HA1.4 based on damage done by PROJECTILES generated by the failure or in conjunction with a steam generator tube rupture. These latter events would be classified by the Category R EALs or Category F EALs.

Plant-Specific

The turbine generator stores large amounts of rotational kinetic energy in its rotor. In the unlikely event of a major mechanical failure, this energy may be transformed into both rotational and translational energy of rotor fragments. These fragments may impact the surrounding stationary parts. If the energy-absorbing capability of these stationary turbine generator parts is insufficient, external projectiles will be released. These ejected projectiles may impact various plant structures, including those housing safety related equipment.

In the event of projectile ejection, the probability of a strike on a plant region is a function of the energy and direction of an ejected projectile and of the orientation of the turbine with respect to the plant region. (ref. 1, 2)

HNP Basis Reference(s):

1. AOP-006 Turbine Generator Trouble
2. FSAR 3.5.1.3

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting the Protected Area

EAL:

HU1.5 Unusual Event

Flood waters > 261 ft (plant grade)

OR

Aux RSVR Level Low: LSC8752A (B) < 250 ft

OR

Main RSVR Level Low: LSC8750A (B) < 206 ft

Mode Applicability:

All

Basis:

Generic

This EAL is categorized on the basis of the occurrence of an event of sufficient magnitude to be of concern to plant operators.

This EAL addresses other site specific phenomena that can also be precursors of more serious events.

Plant-Specific

The plant grade has been established at a minimum elevation of 261 ft. which is 21.1 ft above the maximum main reservoir still water level of 238.9 ft and 4.0 ft above the maximum auxiliary reservoir still water level of 256.0 ft.

Maximum wave run-up and wind setup level along the plant site in the Main and Auxiliary Reservoirs are expected to be at elevation 240.2 ft and 257.7 ft respectively. All structures are thus protected against floods in the Main or Auxiliary Reservoirs. All structures on the plant site are protected to at least Elevation 261 ft and no structure has any access openings below Elevation 261 ft. The Technical Specification LCO low Aux Reservoir level < 250 ft and low Main Reservoir level < 206 ft are indications of a threat to Service Water availability. (ref. 1, 2, 3, 4, 5, 6, 7)

HNP Basis Reference(s):

1. AOP-022 Loss of Service Water
2. FSAR 2.4.11
3. FSAR 2.5.6
4. FSAR 9.2.1
5. FSAR 9.2.5
6. FSAR 3.6A.6
7. Technical Specifications 3/4.7.5

Category: H – Hazards

Subcategory: Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.1 Alert

Seismic event > OBE as indicated by **any** of the following:

- ALB-10/4-4, SEISMIC MON SYS OBE EXCEEDED is ALARMED
- ALARM light on Seismic Switch Power Supply is LIT
- **Any** red alarm light is LIT on the Response Spectrum Annunciator

AND

Earthquake confirmed by **any** of the following:

- Earthquake felt in plant
- National Earthquake Center
- Control Room indication of degraded performance of systems required for the safe shutdown of the plant.

Mode Applicability:

All

Basis:

Generic

This EAL escalates from HU1.1 in that the occurrence of the event may have resulted in visible damage to plant structures or areas containing equipment necessary for a safe shutdown, or may have caused damage to the safety systems in those structures evidenced by control room indications of degraded system response or performance. The occurrence of visible damage and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

Escalation of this emergency classification level, if appropriate, would be based on System Malfunction EALs.

Seismic events of this magnitude can result in a VITAL AREA being subjected to forces beyond design limits, and thus damage may be assumed to have occurred to plant safety systems.

The National Earthquake Center can confirm if an earthquake has occurred in the area of the plant.

Plant-Specific

The Operating Basis Earthquake (OBE) is defined as that earthquake which could reasonably be expected to affect the plant site during the operating life of the plant, based on the earthquake potential of the geographic area. At Harris Plant, this is defined as half of the vibration defined for an SSE or 0.075g. Facility design ensures that all equipment necessary to operate the plant without undue risk to the health and safety of the public will remain functional for any seismic event where ground motion is less than that of the OBE. If OBE criteria are exceeded, however, the plant must be shut down and inspected to determine the extent of any damages, and remain shut down until it can be demonstrated to the NRC that the plant can be safely operated.

HNP Basis Reference(s):

1. AOP-21 Seismic Disturbances
2. FSAR 3.7.4
3. DBD-004 Seismic Monitoring System
4. FSAR 7.4
5. AOP-036, Safe Shutdown Following A Fire

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.2 Alert

Tornado striking or sustained high winds > 89 mph resulting in **EITHER**:

Visible damage (Note 4) to **any** Table H-1 structure containing systems or components required for safe shutdown of the plant

OR

Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)

Note 4: Visible Damage is:

- Damage to equipment or structure that is readily observable without measurements, testing, or analysis
- Damage is sufficient to cause concern regarding the continued operability or reliability of affected safety structure, system, or component
- Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering

Visible Damage does **not** include surface blemishes (e.g., paint chipping, scratches)

Table H-1 Structures Containing Safe Shutdown Equipment

- Containment
- Reactor Auxiliary Building
- Fuel Handling Building
- Waste Processing Building
- Turbine Building (including Transformer Area)
- Emergency Diesel Generator Building
- Diesel Fuel Oil Storage Building (DFOST)
- ESW Intake Structure
- Auxiliary Reservoir Intake Structure
- NSW Structure
- Switchyard
- Yard 261 Duct Banks (underground raceways containing Safe Shutdown power, control and instrument cables) serving **any** of the above areas

Mode Applicability:

All

Basis:

Generic

This EAL escalates from HU1.2 in that the occurrence of the event has resulted in VISIBLE DAMAGE to plant structures or areas containing equipment necessary for a safe shutdown, or has caused damage to the safety systems in those structures evidenced by control room indications of degraded system response or performance. The occurrence of VISIBLE DAMAGE and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

Escalation of this emergency classification level, if appropriate, would be based on System Malfunction EALs.

This EAL is based on a tornado striking (touching down) or high winds that have caused VISIBLE DAMAGE to structures containing functions or systems required for safe shutdown of the plant.

Plant-Specific

The plant Seismic Category I structures are designed to withstand the effects of the design wind, a maximum wind of 179 mph at 30 feet above plant grade. The design wind is based on a 1000-year return period "fastest mile of wind." Sudden, brief fluctuations in the wind speed (gusts) and the dynamic nature of load were accounted for through application of the gust factors. The gust factors were assigned the same values as those suggested by the ANSI Code. (ref. 1)

The range of the wind speed computer points (e.g., ERFIS point MMT1008) is 0-135 mph. The wind sensor is a R.M.Young Model 05305 and has a range of 0-90 mph with wind gust survival up to 100 mph. 89 mph has, therefore, been selected for the EAL threshold since wind speeds of greater magnitude are beyond the range of the sensor and cannot be reliably indicated. (ref. 2)

Winds speed indications from the meteorological tower are 15-minute average values; therefore, any wind-speed readings obtained from the meteorological tower in excess of 179 mph are considered sustained winds. (ref. 3, 4)

The Table H-1 structures were obtained from the HNP safe shutdown analysis. Equipment within the Turbine Building that is important for safe shutdown of the plant includes the components required to bring offsite power into the plant 6.9 KV buses, and the ability of

the 250 VDC system to supply the 60 KVA inverter. Equipment in the Yard 261 Duct Banks includes components needed to bring offsite power into the plant 6.9 KV buses and underground cables and piping for the ESW, EDG and NSW systems. (ref. 5, 6, 7)

HNP Basis Reference(s):

1. FSAR 3.3.1.1
2. VM-CES
3. AP-300 Severe Weather Response
4. DBD-318 Meteorological and Environmental Monitoring System
5. AOP-036, Safe Shutdown Following A Fire
6. AOP-035-BD Main Transformer Trouble
7. FSAR Figure 1.2.2-1
8. FSAR 7.4

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.3 Alert

Internal flooding in the Reactor Auxiliary Building, DG Room A or DG Room B resulting in **EITHER**:

An electrical shock hazard that precludes access to operate or monitor safety equipment

OR

Control Room indication of degraded performance of systems in the flooded area required for the safe shutdown of the plant

Mode Applicability:

All

Basis:

Generic

Escalation of this emergency classification level, if appropriate, would be based on System Malfunction EALs.

This EAL addresses the effect of internal flooding caused by events such as component failures, equipment misalignment, or outage activity mishaps. It is based on the degraded performance of systems, or has created industrial safety hazards (e.g., electrical shock) that preclude necessary access to operate or monitor safety equipment. The inability to access, operate or monitor safety equipment represents an actual or substantial potential degradation of the level of safety of the plant.

Flooding as used in this EAL describes a condition where water is entering the room faster than installed equipment is capable of removal, resulting in a rise of water level within the room. Classification of this EAL should not be delayed while corrective actions are being taken to isolate the water source.

Plant-Specific

In the Reactor Auxiliary Building (RAB), the RHR pump rooms on level 190 have critical equipment and are subject to flooding from many sources. The area above this room on level 216 communicates with the RHR pump rooms. The large open area on level 236 contains numerous critical components, including equipment designed to serve redundant

functions. The high head pump cubicles are also located on level 236 and are considered in conjunction with level 236 floods. Although not a critical area in terms of equipment, the service water tunnel could be a source of flooding. Floods initiated in the tunnel that then propagate to level 236 and sources on level 236 were considered in the flooding analysis.

The Diesel Generator (DG) building contains important equipment and potential flood sources. Except for electrical cable tunnels, the building is physically separate from the other facilities and does was not considered relative to inter-building flood propagation. The DG building obviously includes the diesels which are important to protection of the reactor core when normal AC power is not available. The rooms housing the two diesels at level 261 in the building (DG Rooms A and B) are therefore critical areas. (ref. 1)

HNP Basis Reference(s):

1. Calculation HNP-F/PSA-0057 HNP PRA – Appendix I – Internal Flooding Analysis
2. AOP-036, Safe Shutdown Following A Fire
3. FSAR 7.4

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.4 Alert

Turbine failure-generated projectiles resulting in **EITHER**:

Visible damage (Note 4) to or penetration of **any** Table H-1 structure containing systems or components required for safe shutdown of the plant

OR

Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)

Note 4: Visible Damage is:

- Damage to equipment or structure that is readily observable without measurements, testing, or analysis
- Damage is sufficient to cause concern regarding the continued operability or reliability of affected safety structure, system, or component
- Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering

Visible Damage does **not** include surface blemishes (e.g., paint chipping, scratches)

Table H-1 Structures Containing Safe Shutdown Equipment

- Containment
- Reactor Auxiliary Building
- Fuel Handling Building
- Waste Processing Building
- Turbine Building (including Transformer Area)
- Emergency Diesel Generator Building
- Diesel Fuel Oil Storage Building (DFOST)
- ESW Intake Structure
- Auxiliary Reservoir Intake Structure
- NSW Structure
- Switchyard
- Yard 261 Duct Banks (underground raceways containing Safe Shutdown power, control and instrument cables) serving **any** of the above areas

Mode Applicability:

All

Basis:

Generic

This EAL escalates from HU1.4 in that the occurrence of the event has resulted in VISIBLE DAMAGE to plant structures or areas containing equipment necessary for a safe shutdown, or has caused damage to the safety systems in those structures evidenced by control room indications of degraded system response or performance. The occurrence of VISIBLE DAMAGE and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

Escalation of this emergency classification level, if appropriate, would be based on System Malfunction EALs.

This EAL addresses the threat to safety related equipment imposed by PROJECTILEs generated by main turbine rotating component failures. Therefore, this EAL is consistent with the definition of an ALERT in that the potential exists for actual or substantial potential degradation of the level of safety of the plant.

Plant-Specific

The turbine generator stores large amounts of rotational kinetic energy in its rotor. In the unlikely event of a major mechanical failure, this energy may be transformed into both rotational and translational energy of rotor fragments. These fragments may impact the surrounding stationary parts. If the energy-absorbing capability of these stationary turbine generator parts is insufficient, external projectiles will be released. These ejected projectiles may impact various plant structures, including those housing safety related equipment.

In the event of projectile ejection, the probability of a strike on a plant region is a function of the energy and direction of an ejected projectile and of the orientation of the turbine with respect to the plant region. (ref. 1, 2)

The Table H-1 structures were obtained from the HNP safe shutdown analysis. Equipment within the Turbine Building that is important for safe shutdown of the plant includes the components required to bring offsite power into the plant 6.9 KV buses, and the ability of the 250 VDC system to supply the 60 KVA inverter. Equipment in the Yard 261 Duct Banks includes components needed to bring offsite power into the plant 6.9 KV buses and underground cables and piping for the ESW, EDG and NSW systems. (ref. 3, 4, 5)

HNP Basis Reference(s):

1. AOP-006 Turbine Generator Trouble
2. FSAR 3.5.1.3
3. AOP-036, Safe Shutdown Following A Fire
4. AOP-035-BD Main Transformer Trouble
5. FSAR Figure 1.2.2-1
6. FSAR 7.4

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.5 Alert

Aux RSVR Level Low: LSC8752A (B) < 248 ft

OR

Main RSVR Level Low: LSC8750A (B) < 205.5 ft

Mode Applicability:

All

Basis:

Generic

This EAL addresses other site specific phenomena that result in VISIBLE DAMAGE to VITAL AREAS or results in indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant that can also be precursors of more serious events.

Plant-Specific

Both Auxiliary and Main Reservoir levels are checked and, if below 248 ft MSL (Auxiliary Reservoir) or 206 ft MSL (Main Reservoir), the reactor is tripped. A Main Reservoir water level of 205 ft is the minimum indicated water level provided by ERFIS/OSIPI points LSC8750A and LCS8750B. Also, it is approximately the level at the end of the 30-day emergency period (203.6 ft MSL), which is above the minimum operating level of the Service Water and Cooling Tower Make-up Water Pumps. Low Aux Reservoir level < 248 ft MSL or Main Reservoir level < 205.5 ft MSL is an indication of a threat to the Ultimate Heat Sink. (ref. 1, 2, 3, 4, 5, 6, 7)

HNP Basis Reference(s):

1. AOP-022 Loss of Service Water
2. FSAR 2.4.11
3. FSAR 2.5.6
4. FSAR 9.2.1
5. FSAR 9.2.5
6. FSAR 3.6A.6
7. PIC-1275, Table 3

Category: H – Hazards

Subcategory: 1 – Natural or Destructive Phenomena

Initiating Condition: Natural or destructive phenomena affecting Vital Areas

EAL:

HA1.6 Alert

Vehicle crash resulting in **EITHER**:

Visible damage (Note 4) to **any** Table H-1 structure containing systems or components required for safe shutdown of the plant

OR

Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)

Note 4: Visible Damage is:

- Damage to equipment or structure that is readily observable without measurements, testing, or analysis
- Damage is sufficient to cause concern regarding the continued operability or reliability of affected safety structure, system, or component
- Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering

Visible Damage does **not** include surface blemishes (e.g., paint chipping, scratches)

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- Waste Processing Building
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- Emergency Diesel Generator Building
- Diesel Fuel Oil Storage Building (DFOST)
- ESW Intake Structure
- Auxiliary Reservoir Intake Structure
- NSW Structure
- Switchyard
- Yard 261 Duct Banks (underground raceways containing Safe Shutdown power, control and instrument cables) serving **any** of the above areas

Mode Applicability:

All

Basis:

Generic

The occurrence of VISIBLE DAMAGE and/or degraded system response is intended to discriminate against lesser events. The initial report should not be interpreted as mandating a lengthy damage assessment prior to classification. No attempt is made in this EAL to assess the actual magnitude of the damage. The significance here is not that a particular system or structure was damaged, but rather, that the event was of sufficient magnitude to cause this degradation.

Escalation of this emergency classification level, if appropriate, would be based on System Malfunction EALs.

This EAL addresses vehicle crashes within the PROTECTED AREA that results in VISIBLE DAMAGE to VITAL AREAS or indication of damage to safety structures, systems, or components containing functions and systems required for safe shutdown of the plant.

Plant-Specific

The Table H-1 structures were obtained from the HNP safe shutdown analysis. Equipment within the Turbine Building that is important for safe shutdown of the plant includes the components required to bring offsite power into the plant 6.9 KV buses, and the ability of the 250 VDC system to supply the 60 KVA inverter. Equipment in the Yard 261 Duct Banks includes components needed to bring offsite power into the plant 6.9 KV buses and underground cables and piping for the ESW, EDG and NSW systems. (ref. 1, 2, 3)

This EAL is intended to address crashes of vehicle types large enough to cause significant damage to plant structures containing functions and systems required for safe shutdown of the plant. Vehicle types include automobiles, aircraft, trucks, cranes, forklifts, waterborne craft, etc.

HNP Basis Reference(s):

1. FSAR 3.3.1.1
2. AP-300 Severe Weather Response
3. DBD-318 Meteorological and Environmental Monitoring System
4. AOP-036, Safe Shutdown Following A Fire
5. FSAR 7.4

Category: H – Hazards

Subcategory: 2 – Fire or Explosion

Initiating Condition: Fire within the Protected Area **not** extinguished within 15 min. of detection or explosion within the Protected Area

EAL:

HU2.1 Unusual Event

Fire **not** extinguished within 15 min. of Control Room notification or verification of a Control Room fire alarm in **any** Table H-1 area (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Table H-1 Structures Containing Safe Shutdown Equipment

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- Diesel Fuel Oil Storage Building (DFOST)
- ESW Intake Structure
- Auxiliary Reservoir Intake Structure
- NSW Structure
- Switchyard
- Yard 261 Duct Banks (underground raceways containing Safe Shutdown power, control and instrument cables) serving **any** of the above areas

Mode Applicability:

All

Basis:

Generic

This EAL addresses the magnitude and extent of FIRES that may be potentially significant precursors of damage to safety systems. It addresses the FIRE, and not the degradation in performance of affected systems that may result.

As used here, detection is visual observation and report by plant personnel or sensor alarm indication.

The 15 minute time period begins with a credible notification that a FIRE is occurring, or indication of a fire detection system alarm/actuation. Verification of a fire detection system alarm/actuation includes actions that can be taken within the control room or other nearby HNP location to ensure that it is not spurious. An alarm is assumed to be an indication of a FIRE unless it is disproved within the 15 minute period by personnel dispatched to the scene. In other words, a personnel report from the scene may be used to disprove a sensor alarm if received within 15 minutes of the alarm, but shall not be required to verify the alarm.

The intent of this 15 minute duration is to size the FIRE and to discriminate against small FIRES that are readily extinguished (e.g., smoldering waste paper basket).

Plant-Specific

The Table H-1 vital area structures were obtained from the HNP safe shutdown analysis (ref. 1).

This EAL does not include fires within office areas, trash bin fires, H_2 tank vent stack fires extinguished per OP-152.02, or other small fires of no plant safety consequence (ref. 2).

HNP Basis Reference(s):

1. AOP-036, Safe Shutdown Following A Fire
2. OP-152.02 Hydrogen Storage and Distribution System
3. FSAR 7.4

Category: H – Hazards

Subcategory: 2 – Fire or Explosion

Initiating Condition: Fire within the Protected Area **not** extinguished within 15 min. of detection or explosion within the Protected Area

EAL:

HU2.2 Unusual Event

Explosion of sufficient force to damage permanent structures or equipment within the Protected Area

Mode Applicability:

All

Basis:

Generic

This EAL addresses the magnitude and extent of EXPLOSIONS that may be potentially significant precursors of damage to safety systems. It addresses the EXPLOSION, and not the degradation in performance of affected systems that may result.

This EAL addresses only those EXPLOSIONS of sufficient force to damage permanent structures or equipment within the PROTECTED AREA.

No attempt is made to assess the actual magnitude of the damage. The occurrence of the EXPLOSION is sufficient for declaration.

The SEC also needs to consider any security aspects of the EXPLOSION, if applicable.

Escalation of this emergency classification level, if appropriate, would be based on EAL HA2.1.

Plant-Specific

The Protected Area Protected Area includes the plant and all areas within the security fence and is depicted in FSAR Figure 1.2.2-1, Site Plan (ref. 1).

While some explosions may also result in fires that exceed EAL HU2.1, no fire is necessary to declare an emergency in the event of an explosion. If a fire also occurs as a result or with an explosion, declare the Unusual Event based on the explosion and monitor the progress of the fire for potential escalation due to fire damage.

A steam line break or steam explosion that damages surrounding permanent structures or equipment would be classified under this EAL. This does not mean the emergency is

classified simply because the steam line break occurred. The method of damage is not as important as the degradation of plant structures or equipment. The need to classify the steam line break itself is considered in fission product barrier degradation monitoring (EAL Category F).

HNP Basis Reference(s):

1. FSAR Figure 1.2.2-1

Category: H – Hazards

Subcategory: 2 – Fire or Explosion

Initiating Condition: Fire or explosion affecting the operability of plant safety systems required to establish or maintain safe shutdown

EAL:

HA2.1 Alert

Fire or explosion resulting in **EITHER**:

Visible damage (Note 4) to **any** Table H-1 structure OR system/component required for safe shutdown of the plant

OR

Control Room indication of degraded performance of **any** safe shutdown structure, system, or component within **any** Table H-1 area

Note 4: Visible Damage is:

- Damage to equipment or structure that is readily observable without measurements, testing, or analysis
- Damage is sufficient to cause concern regarding the continued operability or reliability of affected safety structure, system, or component
- Example damage includes: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering

Visible Damage does **not** include surface blemishes (e.g., paint chipping, scratches)

Table H-1 Structures Containing Safe Shutdown Equipment

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- NSW Structure
- Switchyard
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Mode Applicability:

All

Basis:

Generic

VISIBLE DAMAGE is used to identify the magnitude of the FIRE or EXPLOSION and to discriminate against minor FIRES and EXPLOSIONS.

The reference to structures containing safety systems or components is included to discriminate against FIRES or EXPLOSIONS in areas having a low probability of affecting safe operation. The significance here is not that a safety system was degraded but the fact that the FIRE or EXPLOSION was large enough to cause damage to these systems.

The use of VISIBLE DAMAGE should not be interpreted as mandating a lengthy damage assessment prior to classification. The declaration of an Alert and the activation of the Technical Support Center will provide the SEC with the resources needed to perform detailed damage assessments.

The SEC also needs to consider any security aspects of the EXPLOSION.

Escalation of this emergency classification level, if appropriate, will be based on EALs in Category S, Category F or Category R.

Plant-Specific

The Table H-1 vital area structures were obtained from the HNP safe shutdown analysis (ref. 1).

A steam line break or steam explosion that damages permanent structures or equipment would be classified under this EAL. The method of damage is not as important as the degradation of plant structures or equipment. The need to classify the steam line break itself is considered in fission product barrier degradation monitoring (EAL Category F).

HNP Basis Reference(s):

1. AOP-036, Safe Shutdown Following A Fire
2. FSAR 7.4

Category: H – Hazards

Subcategory: 3 – Hazardous Gas

Initiating Condition: Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to normal plant operations

EAL:

HU3.1 Unusual Event

Toxic, corrosive, asphyxiant or flammable gases in amounts that have or could adversely affect normal plant operations

Mode Applicability:

All

Basis:

Generic

This EAL is based on the release of toxic, corrosive, asphyxiant or flammable gases of sufficient quantity to affect NORMAL PLANT OPERATIONS.

The fact that SCBA may be worn does not eliminate the need to declare the event.

This EAL is not intended to require significant assessment or quantification. It assumes an uncontrolled process that has the potential to affect plant operations. This would preclude small or incidental releases, or releases that do not impact structures needed for plant operation.

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

Escalation of this emergency classification level, if appropriate, would be based on EAL HA3.1.

Plant-Specific

Normal plant operations is defined to mean activities at the plant site associated with routine testing, maintenance, or equipment operations, in accordance with normal operating or administrative procedures. Entry into abnormal or emergency operating procedures, or deviation from normal security or radiological controls posture, is a departure from Normal Plant Operations.

HNP Basis Reference(s):

None

Category: H – Hazards

Subcategory: 3 – Hazardous Gas

Initiating Condition: Release of toxic, corrosive, asphyxiant or flammable gases deemed detrimental to normal plant operations

EAL:

HU3.2 Unusual Event

Recommendation by local, county or state officials to evacuate or shelter site personnel based on offsite event

Mode Applicability:

All

Basis:

Generic

Escalation of this emergency classification level, if appropriate, would be based on EAL HA3.1.

Plant-Specific

None

HNP Basis Reference(s):

None

Category: H – Hazards

Subcategory: 3 – Hazardous Gas

Initiating Condition: Access to a Vital Area is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of operable equipment required to maintain safe operations or safely shutdown the reactor

EAL:

HA3.1 Alert

Access to a Vital Area is prohibited due to toxic, corrosive, asphyxiant or flammable gases which jeopardize operation of systems required to maintain safe operations or safely shut down the reactor (Note 5)

Note 5: If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then EAL HA3.1 should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.

Mode Applicability:

All

Basis:

Generic

Gases in a VITAL AREA can affect the ability to safely operate or safely shutdown the reactor.

The fact that SCBA may be worn does not eliminate the need to declare the event.

Declaration should not be delayed for confirmation from atmospheric testing if the atmosphere poses an immediate threat to life and health or an immediate threat of severe exposure to gases. This could be based upon documented analysis, indication of personal ill effects from exposure, or operating experience with the hazards.

If the equipment in the stated area was already inoperable, or out of service, before the event occurred, then this EAL should not be declared as it will have no adverse impact on the ability of the plant to safely operate or safely shutdown beyond that already allowed by Technical Specifications at the time of the event.

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

An uncontrolled release of flammable gasses within a facility structure has the potential to affect safe operation of the plant by limiting either operator or equipment operations due to the potential for ignition and resulting equipment damage/personnel injury. Flammable gasses, such as hydrogen and acetylene, are routinely used to maintain plant systems (hydrogen) or to repair

equipment/components (acetylene - used in welding). This EAL assumes concentrations of flammable gasses which can ignite/support combustion.

Escalation of this emergency classification level, if appropriate, will be based on EALs in Category S, Category F or Category R.

Plant-Specific

None

HNP Basis Reference(s):

None

Category: H – Hazards

Subcategory: 4 – Security

Initiating Condition: Confirmed security condition or threat which indicates a potential degradation in the level of safety of the plant

EAL:

HU4.1 Unusual Event

A security condition that does **not** involve a hostile action as reported by the Security Shift Supervision

OR

A credible site-specific security threat notification

OR

A validated notification from NRC providing information of an aircraft threat

Mode Applicability:

All

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the Control Room is crucial for the implementation of effective Security EALs.

Security events which do not represent a potential degradation in the level of safety of the plant are reported under 10 CFR 73.71 or in some cases under 10 CFR 50.72. Security events assessed as HOSTILE ACTIONS are classifiable under EAL HA4.1, EAL HS4.1 and EAL HG1.1.

A higher initial classification could be made based upon the nature and timing of the security threat and potential consequences. The licensee shall consider upgrading the emergency response status and emergency classification level in accordance with the HNP Security Plan.

First Condition

Reference is made to security shift supervision because these individuals are the designated personnel on-site qualified and trained to confirm that a security event is occurring or has occurred. Training on security event classification confirmation is closely controlled due to the strict secrecy controls placed on the HNP Security Plan.

This threshold is based on site specific security plans. The HNP Security Plan is based on guidance provided by NEI 03-12.

Second Condition

This threshold is included to ensure that appropriate notifications for the security threat are made in a timely manner. This includes information of a credible threat. Only the plant to which the specific threat is made need declare the Unusual Event.

The determination of “credible” is made through use of information found in the HNP Security Plan.

Third Condition

The intent of this EAL is to ensure that notifications for the aircraft threat are made in a timely manner and that OROs and plant personnel are at a state of heightened awareness regarding the credible threat. It is not the intent of this EAL to replace existing non-hostile related EALs involving aircraft.

This EAL is met when a plant receives information regarding an aircraft threat from NRC. Validation is performed by calling the NRC or by other approved methods of authentication. Only the plant to which the specific threat is made need declare the Unusual Event.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an airliner (airliner is meant to be a large aircraft with the potential for causing significant damage to the plant). The status and size of the plane may be provided by NORAD through the NRC.

Escalation to Alert emergency classification level via EAL HA4.1 would be appropriate if the threat involves an airliner within 30 minutes of the plant.

Plant-Specific

None

HNP Basis Reference(s):

1. HNP Security Plan

Category: H – Hazards

Subcategory: 4 – Security

Initiating Condition: Hostile action within the Owner Controlled Area or airborne attack threat

EAL:

HA4.1 Alert

A hostile action is occurring or has occurred within the Owner Controlled Area as reported by Security Shift Supervision

OR

A validated notification from NRC of an airliner attack threat within 30 min. of the site

Mode Applicability:

All

Basis:

Generic

Note: Timely and accurate communication between Security Shift Supervision and the Control Room is crucial for the implementation of effective Security EALs.

This EAL addresses the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. They are not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack or is an identified attack target with minimal time available for further preparation or additional assistance to arrive requires a heightened state of readiness and implementation of protective measures that can be effective (such as on-site evacuation, dispersal or sheltering).

First Condition

This condition addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the OCA. Those events are adequately addressed by other EALs.

Note that this condition is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA.

Second Condition

This condition addresses the immediacy of an expected threat arrival or impact on the site within a relatively short time.

The intent of this condition is to ensure that notifications for the airliner attack threat are made in a timely manner and that Offsite Response Organizations (OROs) and plant personnel are at a state of heightened awareness regarding the credible threat. Airliner is meant to be a large aircraft with the potential for causing significant damage to the plant.

This condition is met when a plant receives information regarding an airliner attack threat from NRC and the airliner is within 30 minutes of the plant. Only the plant to which the specific threat is made need declare the Alert.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an airliner (airliner is meant to be a large aircraft with the potential for causing significant damage to the plant). The status and size of the plane may be provided by NORAD through the NRC.

Plant-Specific

None

HNP Basis Reference(s):

1. HNP Security Plan

Category: H – Hazards

Subcategory: 4 – Security

Initiating Condition: Hostile action within the Protected Area

EAL:

HS4.1 Site Area Emergency

A hostile action is occurring or has occurred within the Protected Area as reported by Security Shift Supervision

Mode Applicability:

All

Basis:

Generic

This condition represents an escalated threat to plant safety above that contained in the Alert in that a HOSTILE FORCE has progressed from the OWNER CONTROLLED AREA to the PROTECTED AREA.

This EAL addresses the contingency for a very rapid progression of events, such as that experienced on September 11, 2001. It is not premised solely on the potential for a radiological release. Rather the issue includes the need for rapid assistance due to the possibility for significant and indeterminate damage from additional air, land or water attack elements.

The fact that the site is under serious attack with minimal time available for further preparation or additional assistance to arrive requires ORO readiness and preparation for the implementation of protective measures.

This EAL addresses the potential for a very rapid progression of events due to a HOSTILE ACTION. It is not intended to address incidents that are accidental events or acts of civil disobedience, such as small aircraft impact, hunters, or physical disputes between employees within the PROTECTED AREA. Those events are adequately addressed by other EALs.

Escalation of this emergency classification level, if appropriate, would be based on actual plant status after impact or progression of attack.

Plant-Specific

None

HNP Basis Reference(s):

1. HNP Security Plan

Category: H – Hazards

Subcategory: 4 – Security

Initiating Condition: Hostile action resulting in loss of physical control of the facility

EAL:

HG4.1 General Emergency

A hostile action has occurred such that plant personnel are unable to operate equipment required to maintain safety functions

Mode Applicability:

All

Basis:

Generic

This EAL encompasses conditions under which a HOSTILE ACTION has resulted in a loss of physical control of VITAL AREAS (containing vital equipment or controls of vital equipment) required to maintain safety functions and control of that equipment cannot be transferred to and operated from another location.

If control of the plant equipment necessary to maintain safety functions can be transferred to another location, then the threshold is not met.

Plant-Specific

Functions needed to maintain safety functions are:

- Reactivity Control – Inability to insert control rods and/or boration capability to maintain reactor shutdown.
- RCS inventory – Loss of both emergency diesel generators with loss of offsite power or both vital buses or all three charging pumps.
- Secondary Heat Sink Capability – Loss of all three auxiliary feedwater pumps with no alternate means of supplying makeup water to the steam generators

Loss of physical control of the control room or remote shutdown capability alone may not prevent the ability to maintain safety functions per se. Design of the remote shutdown capability and the location of the transfer switches should be taken into account.

HNP Basis Reference(s):

1. HNP Security Plan

Category: H – Hazards

Subcategory: 4 – Security

Initiating Condition: Hostile action resulting in loss of physical control of the facility

EAL:

HG4.2 General Emergency

A hostile action has caused failure of Spent Fuel Cooling systems

AND

Imminent fuel damage is likely for a freshly off-loaded reactor core in pool

Mode Applicability:

All

Basis:

Generic

This EAL addresses failure of spent fuel cooling systems as a result of HOSTILE ACTION if IMMINENT fuel damage is likely, such as when a freshly off-loaded reactor core is in the spent fuel pool.

Plant-Specific

A freshly off-loaded core in pool is defined to exist during the period of time between the start of core off-load (GP-009 Step 5.3.17) and completion of core reload (GP-009 Step 5.7) (ref. 2).

HNP Basis Reference(s):

1. HNP Security Plan
2. GP-009 Refueling Cavity Fill, Refueling and Drain of the Refueling Cavity Modes 5-6-5

Category: H – Hazards

Subcategory: 5 – Control Room Evacuation

Initiating Condition: Control Room evacuation has been initiated

EAL:

HA5.1 Alert

Control Room evacuation has been initiated

Mode Applicability:

All

Basis:

Generic

With the control room evacuated, additional support, monitoring and direction through the Technical Support Center and/or other emergency response facilities may be necessary.

Inability to establish plant control from outside the control room will escalate this event to a Site Area Emergency.

Plant-Specific

AOP-004, Remote Shutdown, is entered when Control Room evacuation is deemed necessary.

HNP Basis Reference(s):

1. AOP-004 Remote Shutdown

Category: H – Hazards

Subcategory: 5 – Control Room Evacuation

Initiating Condition: Control Room evacuation has been initiated and plant control **cannot** be established

EAL:

HS5.1 Site Area Emergency

Control Room evacuation has been initiated

AND

Control of the plant **cannot** be established within 15 min.

Mode Applicability:

All

Basis:

Generic

The intent of this EAL is to capture those events where control of the plant cannot be reestablished in a timely manner. In this case, expeditious transfer of control of safety systems has not occurred (although fission product barrier damage may not yet be indicated).

The intent of the EAL is to establish control of important plant equipment and knowledge of important plant parameters in a timely manner. Primary emphasis should be placed on those components and instruments that supply protection for and information about safety functions. Typically, these safety functions are reactivity control (ability to shutdown the reactor and maintain it shutdown), reactor water level (ability to cool the core), and decay heat removal (ability to maintain a heat sink).

The determination of whether or not control is established at the remote shutdown panel is based on SEC judgment. The SEC is expected to make a reasonable, informed judgment within the site specific time for transfer that the licensee has control of the plant from the remote shutdown panel.

Escalation of this emergency classification level, if appropriate, would be by EALs in Category F or Category R.

Plant-Specific

None

HNP Basis Reference(s):

1. AOP-004 Remote Shutdown

Category: H – Hazards

Subcategory: 6 – Judgment

Initiating Condition: Other conditions existing that in the judgment of the SEC warrant declaration of a UE

EAL:

HU6.1 Unusual Event

Other conditions exist which in the judgment of the SEC indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. **No** releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs

Mode Applicability:

All

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the SEC to fall under the UE emergency classification level.

Plant-Specific

None

HNP Basis Reference(s):

1. PLP-201 Emergency Plan

Category: H – Hazards

Subcategory: 6 – Judgment

Initiating Condition: Other conditions exist that in the judgment of the SEC warrant declaration of an Alert

EAL:

HA6.1 Alert

Other conditions exist which in the judgment of the SEC indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of hostile action. **ANY** releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels (1,000 mRem TEDE and 5,000 mRem thyroid CDE)

Mode Applicability:

All

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the SEC to fall under the Alert emergency classification level.

Plant-Specific

None

HNP Basis Reference(s):

1. PLP-201 Emergency Plan

Category: H – Hazards

Subcategory: 6 – Judgment

Initiating Condition: Other conditions existing that in the judgment of the SEC warrant declaration of a Site Area Emergency

EAL:

HS6.1 Site Area Emergency

Other conditions exist which in the judgment of the SEC indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or hostile action that results in intentional damage or malicious acts; (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. **Any** releases are **not** expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels (1,000 mRem TEDE and 5,000 mRem thyroid CDE) beyond the site boundary

Mode Applicability:

All

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the SEC to fall under the emergency classification level description for Site Area Emergency.

Plant-Specific

None

HNP Basis Reference(s):

1. PLP-201 Emergency Plan

Category: H – Hazards

Subcategory: 6 – Judgment

Initiating Condition: Other conditions exist that in the judgment of the SEC warrant declaration of a General Emergency

EAL:

HG6.1 General Emergency

Other conditions exist which in the judgment of the SEC indicate that events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity or hostile action that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels (1,000 mRem TEDE and 5,000 mRem thyroid CDE) offsite for more than the immediate site area

Mode Applicability:

All

Basis:

Generic

This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the SEC to fall under the emergency classification level description for General Emergency.

Plant-Specific

None

HNP Basis Reference(s):

1. PLP-201 Emergency Plan

Category S – System Malfunction

EAL Group: Hot Conditions (RCS temperature > 200ºF);
EALs in this category are applicable only in
one or more hot operating modes.

Numerous system-related equipment failure events that warrant emergency classification have been identified in this category. They may pose actual or potential threats to plant safety.

The events of this category pertain to the following subcategories:

1. Loss of AC Power

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of onsite and offsite AC power sources for the 6.9 KV safeguard buses.

2. Loss of DC Power

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of power to the 125 VDC safeguard buses.

3. Criticality & RPS Failure

Inadvertent criticalities pose potential personnel safety hazards as well being indicative of losses of reactivity control.

Events related to failure of the Reactor Protection System (RPS) to initiate and complete reactor trips. In the plant licensing basis, postulated failures of the RPS to complete a reactor trip comprise a specific set of analyzed events referred to as Anticipated Transient Without Scram (ATWS) events. For EAL classification however, ATWS is intended to mean any trip failure event that does not achieve reactor shutdown. If RPS actuation fails to assure reactor shutdown, positive control of

reactivity is at risk and could cause a threat to fuel clad, RCS and Containment integrity.

4. Inability to Reach or Maintain Shutdown Conditions

System malfunctions may lead to failure of the plant to be brought to the required plant operating condition required by technical specifications if a limiting condition for operation (LCO) is not met.

5. Instrumentation

Certain events that degrade plant operator ability to effectively assess plant conditions within the plant warrant emergency classification. Losses of annunciators are in this subcategory.

6. Communications

Certain events that degrade plant operator ability to effectively communicate with essential personnel within or external to the plant warrant emergency classification.

7. Fuel Clad Degradation

During normal operation, reactor coolant fission product activity is very low. Small concentrations of fission products in the coolant are primarily from the fission of tramp uranium in the fuel clad or minor perforations in the clad itself. Any significant increase from these base-line levels (2% - 5% clad failures) is indicative of fuel failures and is covered under Category F, Fission Product Barrier Degradation. However, lesser amounts of clad damage may result in coolant activity exceeding Technical Specification limits. These fission products will be circulated with the reactor coolant and can be detected by coolant sampling and/or the Gross Failed Fuel Detector.

8. RCS Leakage

The Reactor Vessel provides a volume for the coolant that covers the reactor core. The Reactor Vessel and associated pressure piping (reactor coolant system) together provide a barrier to limit the release of radioactive material should the reactor fuel clad integrity fail.

Excessive RCS leakage greater than Technical Specification limits are utilized to indicate potential pipe cracks that may propagate to an extent threatening fuel clad, RCS and Containment integrity.

Category: S – System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: Loss of **all** offsite AC power to emergency buses for ≥ 15 min.

EAL:

SU1.1 Unusual Event

Loss of **all** offsite AC power to 6.9 KV emergency buses 1A-SA and 1B-SB for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

Prolonged loss of off-site AC power reduces required redundancy and potentially degrades the level of safety of the plant by rendering the plant more vulnerable to a complete loss of AC power to emergency busses.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of off-site power.

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure S-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

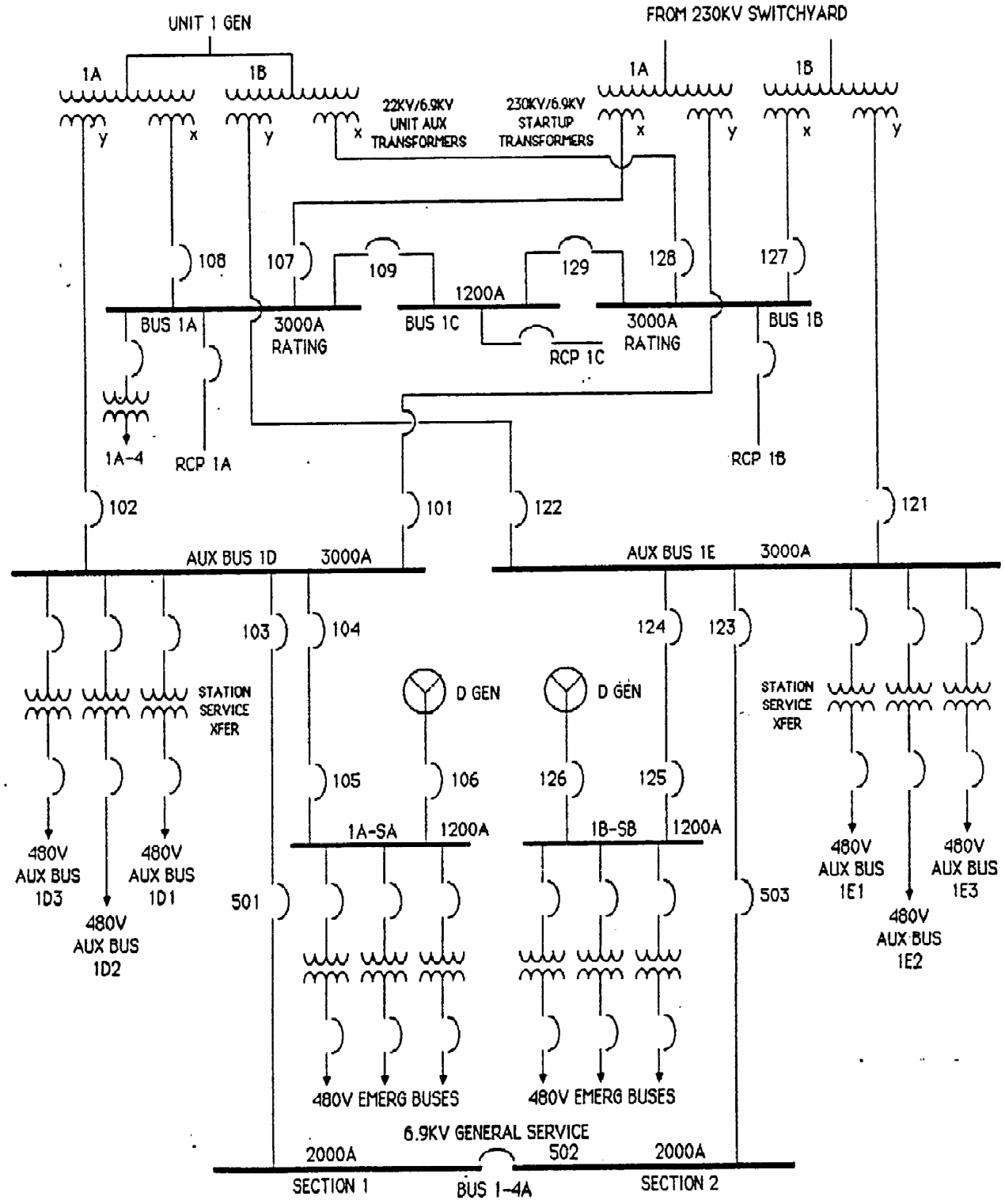
An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. EOP-EPP-001 Loss of AC Power to 1A-SA and 1B-SB Buses
5. OST-1023 Off Site Power Availability

Figure S-1


UNIT 1 GEN
FROM 230KV SWITCHYARD
1A
1B
22KV/6.9KV UNIT AUX TRANSFORMERS
230KV/6.9KV STARTUP TRANSFORMERS
108
107
109
129
128
127
1200A
BUS 1A
3000A RATING
BUS 1C
RCP 1C
3000A RATING
BUS 1B
1A-4
RCP 1A
RCP 1B
102
101
122
121
AUX BUS 1D 3000A
AUX BUS 1E 3000A
103
104
124
123
STATION SERVICE XFER
D GEN
D GEN
STATION SERVICE XFER
105
106
126
125
1A-SA 1200A
1B-SB 1200A
480V AUX BUS 1D3
480V AUX BUS 1D1
480V AUX BUS 1D2
501
503
480V AUX BUS 1E1
480V AUX BUS 1E2
480V AUX BUS 1E3
480V EMERG BUSES
480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
502
2000A
SECTION 1
BUS 1-4A
SECTION 2

Category: S – System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: AC power capability to emergency buses reduced to a single power source for ≥ 15 min. such that **any** additional single failure would result in station blackout

EAL:

SA1.1 Alert

AC power capability to 6.9 KV emergency buses 1A-SA and 1B-SB reduced to a single power source for ≥ 15 min. (Note 6)

AND

Any additional single power source failure will result in station blackout

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

The condition indicated by this EAL is the degradation of the off-site and on-site AC power systems such that any additional single failure would result in a station blackout. This condition could occur due to a loss of off-site power with a concurrent failure of all but one emergency generator to supply power to its emergency busses. Another related condition could be the loss of all off-site power and loss of on-site emergency generators with only one train of emergency busses being backfed from the unit main generator, or the loss of on-site emergency generators with only one train of emergency busses being backfed from off-site power. The subsequent loss of this single power source would escalate the event to a Site Area Emergency in accordance with EAL SS1.1.

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

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure S-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

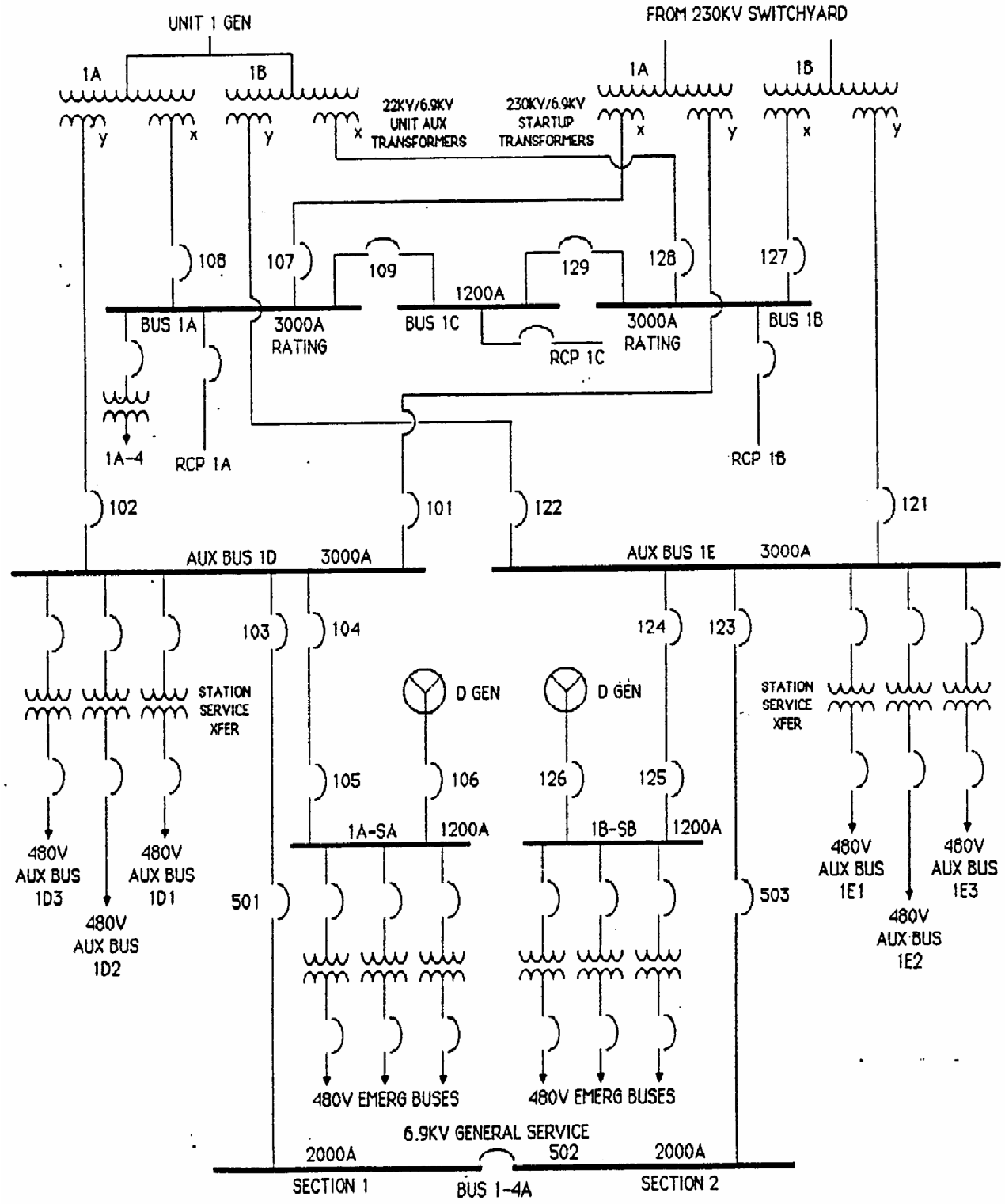
An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. EOP-EPP-001 Loss of AC Power to 1A-SA and 1B-SB Buses
5. OST-1023 Off Site Power Availability

Figure S-1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RCP 1A
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D GEN
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480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
SECTION 1
BUS 1-4A
502
2000A
SECTION 2

Category: S – System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: Loss of **all** offsite and **all** onsite AC power to emergency buses for ≥ 15 min.

EAL:

SS1.1 Site Area Emergency

Loss of **all** offsite and **all** onsite AC power to 6.9 KV emergency buses 1A-SA and 1B-SB for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of Fuel Clad, RCS, and Containment, thus this event can escalate to a General Emergency.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of off-site power.

Escalation to General Emergency is via EALs in Category F or EAL SG1.1.

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure S-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two

transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

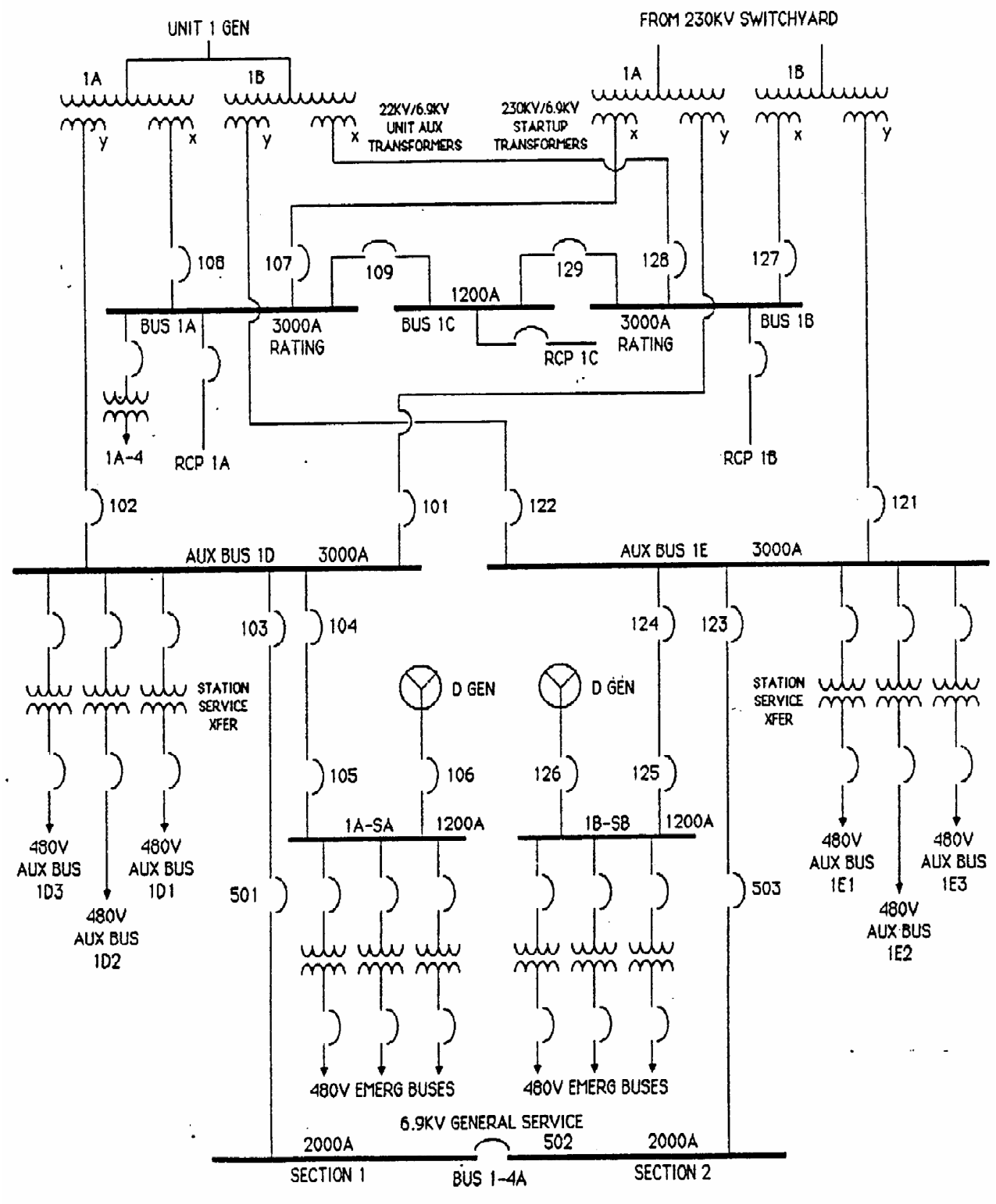
An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. EOP-EPP-001 Loss of AC Power to 1A-SA and 1B-SB Buses
5. OST-1023 Off Site Power Availability

Figure S-1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BUS 1C
RCP 1C
3000A RATING
BUS 1B
1A-4
RCP 1A
RCP 1B
102
101
122
121
AUX BUS 1D 3000A
AUX BUS 1E 3000A
103
104
124
123
STATION SERVICE XFER
D GEN
D GEN
STATION SERVICE XFER
105
106
126
125
1A-SA 1200A
1B-SB 1200A
480V AUX BUS 1D3
480V AUX BUS 1D1
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480V AUX BUS 1E2
480V EMERG BUSES
480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
502
2000A
SECTION 1
BUS 1-4A
SECTION 2

Category: S –System Malfunction

Subcategory: 1 – Loss of AC Power

Initiating Condition: Prolonged loss of **all** offsite and **all** onsite AC power to emergency buses

EAL:

SG1.1 General Emergency

Loss of **all** offsite and **all** onsite AC power to 6.9 KV emergency buses 1A-SA and 1B-SB

AND EITHER:

Restoration of at least one emergency bus within 4 hours is **not** likely

OR

CSFST Core Cooling-RED or ORANGE entry conditions met

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

Loss of all AC power to emergency busses compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all AC power to emergency busses will lead to loss of fuel clad, RCS, and containment, thus warranting declaration of a General Emergency.

This IC is specified to assure that in the unlikely event of a prolonged station blackout, timely recognition of the seriousness of the event occurs and that declaration of a General Emergency occurs as early as is appropriate, based on a reasonable assessment of the event trajectory.

The likelihood of restoring at least one emergency bus should be based on a realistic appraisal of the situation since a delay in an upgrade decision based on only a chance of mitigating the event could result in a loss of valuable time in preparing and implementing public protective actions.

In addition, under these conditions, fission product barrier monitoring capability may be degraded.

Plant-Specific

The HNP Plant Electric Power Distribution System is illustrated in Figure S-1 (ref. 1).

Power is supplied from the main generator to the switchyard through a main transformer bank. The main generator is directly connected to the main transformer bank through a 22 KV bus system and the 230 KV switchyard.

The Plant Electric Power Distribution System receives power under normal operating conditions from the main generator through two unit auxiliary transformers.

For startup and shutdown, when the main generator is unavailable, power is obtained through two start-up transformers from the grid and the 230 KV switchyard. These two transformers have sufficient capacity to provide for start-up and full load operation of the Unit. They also provide two separate sources of preferred (offsite) power to the Unit.

An additional path of power supply from the grid to the Plant Electric Power Distribution System can be made available after opening the disconnect links and disconnecting the main generator from the 22 KV bus. Power can be fed from the offsite power system through the main transformer bank and 22 KV bus to the unit auxiliary transformer, leaving the main generator disconnected. (ref. 2)

Emergency buses 1A-SA and 1B-SB provide power to supply all of the safety-related loads. The normal source of power for the emergency buses is the main generator/unit auxiliary transformer. When this source of power is not available, power is supplied from the 230 KV switchyard through the start-up transformers or, with the generator disconnect links removed, from the main and unit auxiliary transformers. When neither of these sources is available, power to the two emergency buses is supplied from diesel generators EDG A and EDG B (one diesel generator for each emergency bus). (ref. 3)

The station blackout coping time is four hours (ref. 4, 5, 6)

Indication of continuing core cooling degradation is manifested by entry to Critical Safety Function Status Tree (CSFST) Core Cooling-RED or ORANGE path (ref. 7).

Critical Safety Function Status Tree (CSFST) Core Cooling-RED path entry conditions are:

- Core Exit TCs greater than 1200ºF, or
- All of the following:
    - Core Exit TCs less than 1200ºF
    - RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M
    - No RCPs running
    - Core Exit TCs greater than 730ºF

- RVLIS Full Range less than 39%

The three Critical Safety Function Status Tree (CSFST) Core Cooling-ORANGE path entry conditions are:

- Core Exit TCs less than 1200ºF, and RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, no RCPs running, Core Exit TCs greater than 730ºF, and RVLIS Full Range greater than 39%
- Core Exit TCs less than 1200ºF, and RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, no RCPs running, Core Exit TCs less than 730ºF, and RVLIS Full Range less than 39%
- Core Exit TCs less than 1200ºF, RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, at least one RCP running, and RVLIS Dynamic Head Range:
  - < 60% - 3 RCPs
  - < 33% - 2 RCPs
  - < 25% - 1 RCP

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 8).

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 9).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

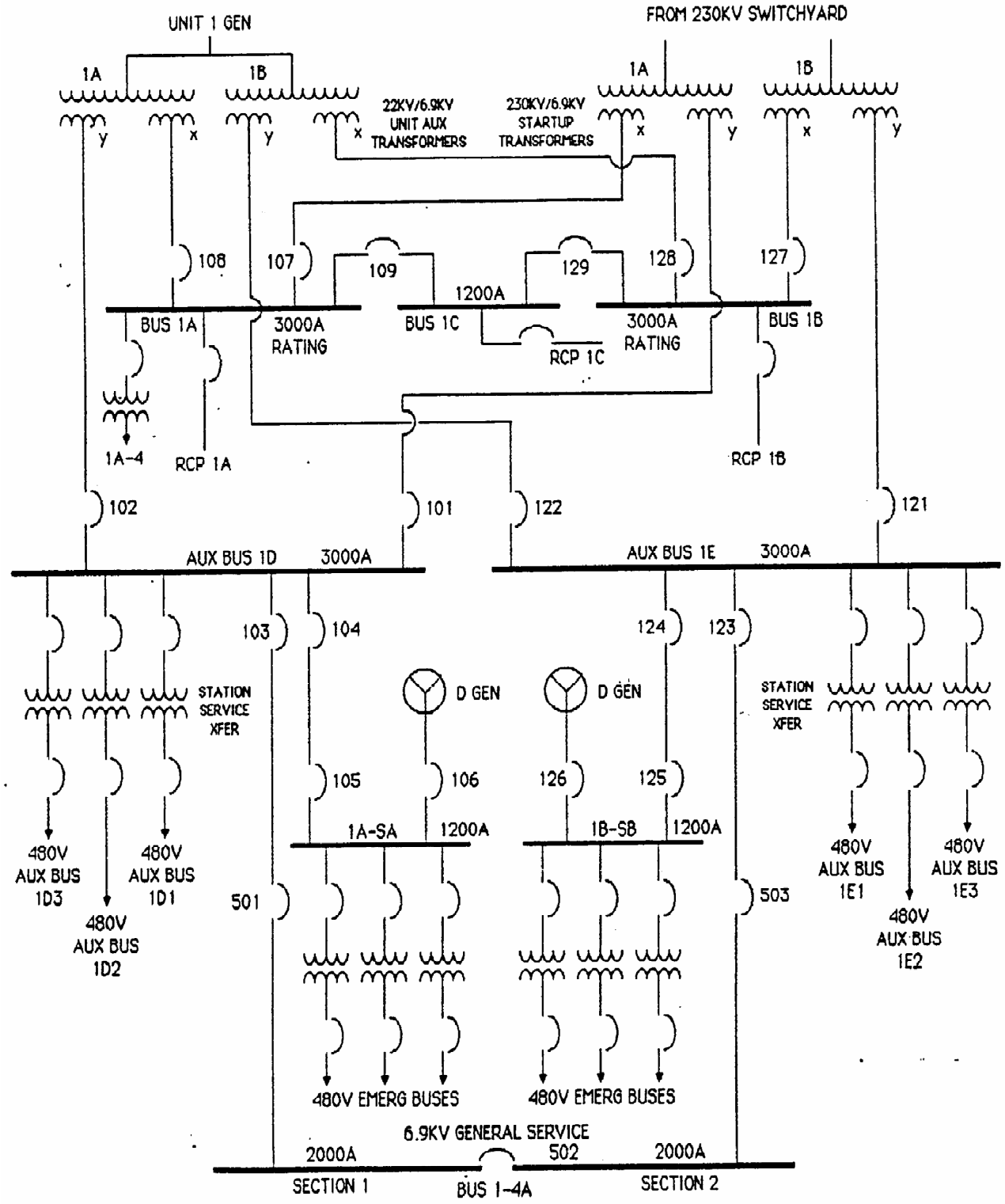
- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 10).

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-1
2. FSAR 8.2
3. FSAR 8.3
4. FSAR 8.3.1.2.21.2
5. SBO-Calc-001
6. HNP-P-LR-0006 Station Blackout (SBO) Coping Calculation
7. EOP-CSFST Core Cooling CSF-2
8. EOP-User's Guide
9. OP-163 ERFIS
10. EOP User's Guide, Section 5.2.6

Figure S-1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BUS 1A
3000A RATING
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3000A RATING
BUS 1B
1A-4
RCP 1A
RCP 1B
102
101
122
121
AUX BUS 1D 3000A
AUX BUS 1E 3000A
103
104
124
123
STATION SERVICE XFER
D GEN
D GEN
STATION SERVICE XFER
105
106
126
125
1A-SA 1200A
1B-SB 1200A
480V AUX BUS 1D3
480V AUX BUS 1D1
480V AUX BUS 1D2
501
503
480V AUX BUS 1E1
480V AUX BUS 1E2
480V AUX BUS 1E3
480V EMERG BUSES
480V EMERG BUSES
6.9KV GENERAL SERVICE
2000A
SECTION 1
BUS 1-4A
502
2000A
SECTION 2

Category: S – System Malfunction

Subcategory: 2– Loss of DC Power

Initiating Condition: Loss of **all** vital DC power for ≥ 15 min.

EAL:

SS2.1 Site Area Emergency

< 105 VDC on **both** Emergency DC Buses (125V) (DP-1A-SA, DP-1B-SB) for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

Loss of all DC power compromises ability to monitor and control plant safety functions. Prolonged loss of all DC power will cause core uncovering and loss of containment integrity when there is significant decay heat and sensible heat in the reactor system.

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

Escalation to a General Emergency would occur by EALs in Category R and Category F.

Plant-Specific

The DC Power System is shown in Figure S-2 (ref. 1). The DC Power System is designed to provide a source of reliable continuous power for the plant protection system, control and instrumentation and other loads for start-up, operation, and shutdown modes of plant operation. The DC Power System consists of three 60 cell, 125V batteries and one 120 cell, 250V battery, each with its own battery chargers, and DC load center. The 125VDC ESF (safety-related) batteries 1A-SA and 1B-SB are located in separate Battery Rooms in the Electrical Switchgear Room on the 286' elevation of the Reactor Auxiliary Building. The battery chargers for batteries 1A-SA and 1B-SB are rated at 150 amperes DC at a nominal charging voltage of 132VDC. Normal operation of the DC system is such that the battery chargers supply all load current while the batteries serve as an emergency source of power in the event power to the chargers is lost. The battery chargers are capable of

providing the normal DC load and also maintaining the connected battery in a fully charged condition (ref. 2). When the plant is in Modes 1, 2, 3 or 4, as a minimum, the 125-volt battery bank 1A-SA and either full capacity charger 1A-SA or 1B-SA and the 125-volt battery bank 1B-SB and either full capacity charger 1A-SB or 1B-SB shall be operable. (ref. 3)

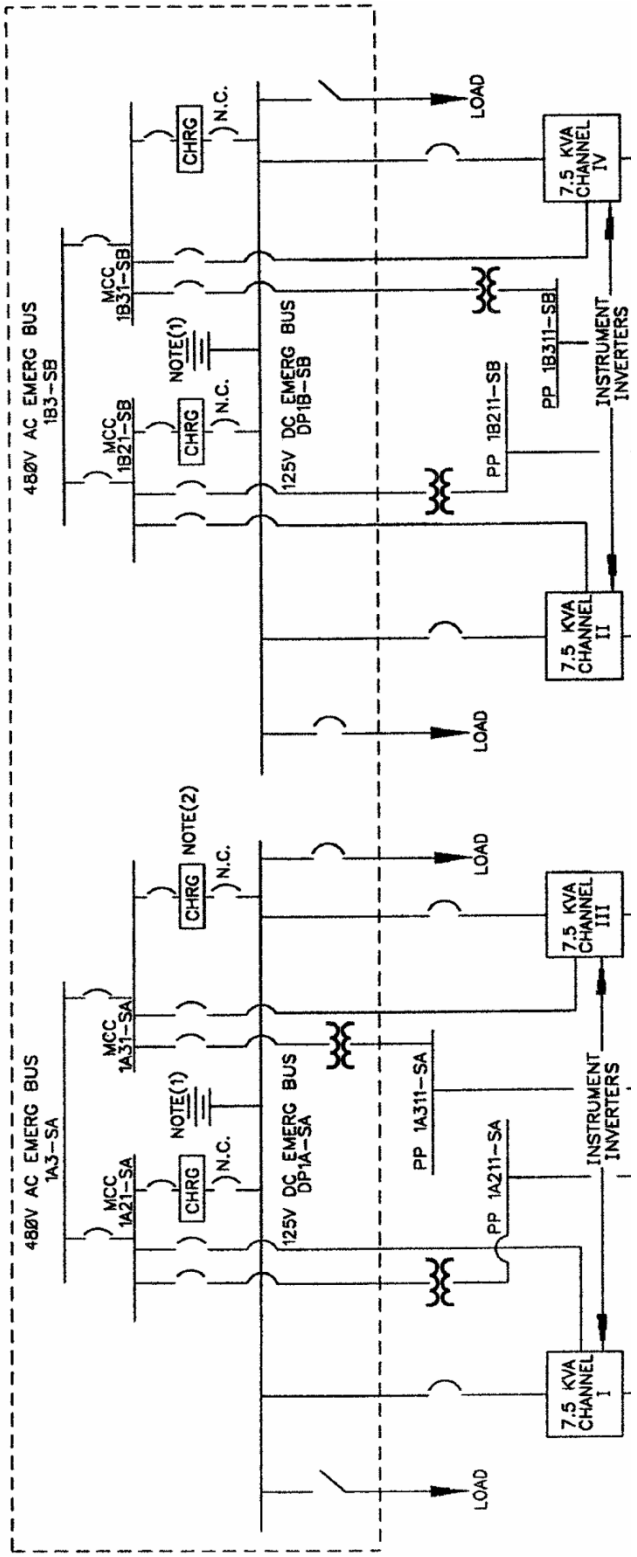
Minimum bus voltage is 105 VDC (ref. 4, 5).

This EAL is the hot condition equivalent of the cold condition loss of DC power EAL CU2.1.

HNP Basis Reference(s):

1. FSAR Figure 8.1.3-3
2. FSAR 8.3.2
3. Technical Specifications 3.8.2.1
4. FSAR Table 8.3.1-1
5. MST-E0013 1E Battery Performance Test

Figure S-2


480V AC EMERG BUS 1B3-SB
480V AC EMERG BUS 1A3-SA
MCC 1B31-SB
MCC 1B21-SB
MCC 1A31-SA
MCC 1A21-SA
CHRG
N.C.
NOTE(1)
NOTE(2)
125V DC EMERG BUS DP1B-SB
125V DC EMERG BUS DP1A-SA
PP 1B211-SB
PP 1B311-SB
PP 1A211-SA
PP 1A311-SA
INSTRUMENT INVERTERS
7.5 KVA CHANNEL IV
7.5 KVA CHANNEL II
7.5 KVA CHANNEL III
7.5 KVA CHANNEL I
LOAD

Category: S – System Malfunction

Subcategory: 3 – Criticality & RPS Failure

Initiating Condition: Inadvertent criticality

EAL:

SU3.1 Unusual Event

An unplanned sustained positive startup rate observed on nuclear instrumentation

Mode Applicability:

3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL addresses inadvertent criticality events. While the primary concern of this EAL is criticality This EAL addresses inadvertent criticality events. This EAL indicates a potential degradation of the level of safety of the plant, warranting a UE classification. This EAL excludes inadvertent criticalities that occur during planned reactivity changes associated with reactor startups (e.g., criticality earlier than estimated).

Escalation would be by EALs in Category F, as appropriate to the operating mode at the time of the event.

Plant-Specific

This condition can be identified using IR N35/N36, SR N31/N32,Recorder NR-01RE-0045W (Pen 1 & Pen 2), Audio Count Rate, and Computer Point ANM0110 (ref. 1, 2, 3, 4).

HNP Basis Reference(s):

1. MST-I0048 Excore Nuclear Instrumentation System Intermediate Range N35 Calibration
2. MST-I0049 Excore Nuclear Instrumentation System Intermediate Range N36 Calibration
3. MST-I0050 Nuclear Instrumentation System Source Range N31 Calibration
4. MST-I0051 Nuclear Instrumentation System Source Range N32 Calibration

Category: S – System Malfunction

Subcategory: 3 – Criticality & RPS Failure

Initiating Condition: Automatic trip fails to shut down the reactor and the manual actions taken from the reactor control console are successful in shutting down the reactor

EAL:

SA3.1 Alert

An automatic trip failed to shut down the reactor

AND

Manual actions taken at the reactor control console (actuation of MCB Reactor Trip Switch #1, #2 or MCB Turbine Trip switch) successfully shut down the reactor as indicated by reactor power < 5%

Mode Applicability:

1 - Power Operation

Basis:

Generic

Manual trip actions taken at the reactor control console are any set of actions by the reactor operator(s) which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

This condition indicates failure of the automatic protection system to trip the reactor. This condition is more than a potential degradation of a safety system in that a front line automatic protection system did not function in response to a plant transient. Thus the plant safety has been compromised because design limits of the fuel may have been exceeded. An Alert is indicated because conditions may exist that lead to potential loss of fuel clad barrier or RCS barrier and because of the failure of the Reactor Protection System to automatically shut down the plant.

If manual actions taken at the reactor control console fail to shut down the reactor, the event would escalate to a Site Area Emergency.

Plant-Specific

A reactor trip is automatically initiated by the Reactor Protection System (RPS) when certain continuously monitored parameters exceed predetermined setpoints. The following are symptoms that require a reactor trip (ref. 1):

- Power Range Neutron Flux (High Setpoint) 109%
- Power Range Neutron Flux (Low Setpoint) 25%

- Power Range High Positive Rate +5%/2 seconds
- Power Range High Negative Rate -5%/2 seconds
- Intermediate Range High Flux 25%
- Source Range High Count Rate 10^5 cps
- Overtemperature Delta T > calculated setpoint
- Overpower Delta T > calculated setpoint
- Pressurizer Low Pressure 1960 psig
- Pressurizer High Pressure 2385 psig
- Pressurizer High Level 92%
- Steam Generator Low-Low Water Level 25%
- Steam Generator Low Water Level 25% (level)

  Coincident with Steam/Feedwater Flow Mismatch 40% (flow)
- Reactor Coolant Pump Undervoltage 5148 Volts
- Reactor Coolant Pump Underfrequency 57.5 Hz
- Loss of Reactor Coolant Flow 90.5%
- Turbine Trip
  - Low Fluid Oil Pressure 1150 psig
  - Turbine Throttle Valves Closure > 1% open
- Safety Injection Signal Actuated

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a few percent of the original power level and then decays to a level some 8 decades less at a startup rate of about -1/3 DPM. The reactor power drop continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as

sensed by the nuclear instrumentation and a negative startup rate as nuclear power drops into the source range (ref. 2).

The operator ensures that the reactor has tripped by (ref. 1, 3):

- Manually tripping the reactor (using MCB switch #1 and/or #2 as required)
- Checking the reactor trip breakers are open
- Checking that all control rod position rod bottom lights are lit
- Observing neutron flux is decreasing

If the reactor has not tripped, the operator is then instructed to manually trip the turbine from the MCB before attempting more detailed and time-consuming actions to shut down the reactor from outside the Control Room. For purposes of emergency classification, a "successful" manual reactor trip, therefore, includes only those immediate actions taken by the reactor operator in the Control Room to:

- Actuate MCB switch #1 and #2
- Trip the turbine from the MCB

The reactor control console is defined to be the Control Room panels on which the above switches are located (Panels 1A2, 1C and 1B2). Reactor shutdown achieved by emergency boration and actions to locally trip the turbine and open reactor trip breakers, MG set generator output breakers, and MG set motor breakers are not considered in this EAL.

In the event that the operator identifies a reactor trip is imminent and successfully initiates a manual reactor trip before the automatic trip setpoint is reached, no declaration is required. The successful manual trip of the reactor before it reaches its automatic trip setpoint or reactor trip signals caused by instrumentation channel failures do not lead to a potential fission product barrier loss. If manual reactor trip actions in the Control Room fail to reduce reactor power below 5% (ref. 4), the event escalates to the Site Area Emergency under EAL SS3.1.

HNP Basis Reference(s):

1. EOP-GUIDE-1 PATH-1 GUIDE
2. EOP-User's Guide
3. EOP-FRP-S.1 Response to Nuclear Power Generation/ATWS
4. EOP-CSFST Subcriticality CSF-1

Category: S – System Malfunction

Subcategory: 3 – Criticality & RPS Failure

Initiating Condition: Automatic trip fails to shut down the reactor and manual actions taken from the reactor control console are **not** successful in shutting down the reactor

EAL:

SS3.1 Site Area Emergency

An automatic trip failed to shut down the reactor

AND

Manual actions taken at the reactor control console (actuation of MCB Reactor Trip Switch #1, #2 or MCB Turbine Trip switch) do **not** shut down the reactor as indicated by reactor power ≥ 5%

Mode Applicability:

1 - Power Operation

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful. A Site Area Emergency is warranted because conditions exist that lead to IMMINENT loss or potential loss of both fuel clad and RCS.

Manual scram (trip) actions taken at the reactor control console are any set of actions by the reactor operator(s) at which causes or should cause control rods to be rapidly inserted into the core and shuts down the reactor.

Manual trip actions are not considered successful if action away from the reactor control console is required to trip the reactor. This EAL is still applicable even if actions taken away from the reactor control console are successful in shutting the reactor down because the design limits of the fuel may have been exceeded or because of the gross failure of the Reactor Protection System to shutdown the plant.

Escalation of this event to a General Emergency would be due to a prolonged condition leading to an extreme challenge to either core-cooling or heat removal.

Plant-Specific

A reactor trip is automatically initiated by the Reactor Protection System (RPS) when certain continuously monitored parameters exceed predetermined setpoints. The following are symptoms that require a reactor trip (ref. 1):

- Power Range Neutron Flux (High Setpoint) 109%
- Power Range Neutron Flux (Low Setpoint) 25%
- Power Range High Positive Rate +5%/2 seconds
- Power Range High Negative Rate -5%/2 seconds
- Intermediate Range High Flux 25%
- Source Range High Count Rate 10^5 cps
- Overtemperature Delta T > calculated setpoint
- Overpower Delta T > calculated setpoint
- Pressurizer Low Pressure 1960 psig
- Pressurizer High Pressure 2385 psig
- Pressurizer High Level 92%
- Steam Generator Low-Low Water Level 25%
- Steam Generator Low Water Level 25% (level)
- Coincident with Steam/Feedwater Flow Mismatch 40% (flow)
- Reactor Coolant Pump Undervoltage 5148 Volts
- Reactor Coolant Pump Underfrequency 57.5 Hz
- Loss of Reactor Coolant Flow 90.5%
- Turbine Trip
    - Low Fluid Oil Pressure 1150 psig
    - Turbine Throttle Valves Closure > 1% open
- Safety Injection Signal Actuated

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a few percent of the original power level and then decays to a level some 8 decades less at a startup rate of about -1/3 DPM. The reactor power drop

continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as sensed by the nuclear instrumentation and a negative startup rate as nuclear power drops into the source range (ref. 2).

The operator ensures that the reactor has tripped by (ref. 1, 3):

- Manually tripping the reactor (using MCB switch #1 and/or #2 as required)
- Checking the reactor trip breakers are open
- Checking that all control rod position rod bottom lights are lit
- Observing neutron flux is decreasing

If the reactor has not tripped, the operator is then instructed to manually trip the turbine from the MCB before attempting more detailed and time-consuming actions to shut down the reactor from outside the Control Room. For purposes of emergency classification, a "successful" manual reactor trip, therefore, includes only those immediate actions taken by the reactor operator in the Control Room to:

- Actuate MCB switch #1 and #2
- Trip the turbine from the MCB

The reactor control console is defined to be the Control Room panels on which the above switches are located (Panels 1A2, 1C and 1B2). Reactor shutdown achieved by emergency boration and actions to locally trip the turbine and open reactor trip breakers, MG set generator output breakers, and MG set motor breakers are not considered in this EAL.

In the event that the operator identifies a reactor trip is imminent and successfully initiates a manual reactor trip before the automatic trip setpoint is reached, no declaration is required. The successful manual trip of the reactor before it reaches its automatic trip setpoint or reactor trip signals caused by instrumentation channel failures do not lead to a potential fission product barrier loss. If all actions fail to reduce reactor power below 5% (ref. 4), the event may escalate to the General Emergency under EAL SG3.1 if conditions are met for entry to CSFST Core Cooling-RED or CSFST Heat Sink-RED.

HNP Basis Reference(s):

1. EOP-GUIDE-1 PATH-1 GUIDE
2. EOP-User's Guide
3. EOP-FRP-S.1 Response to Nuclear Power Generation/ATWS
4. EOP-CSFST Subcriticality CSF-1

Category: S – System Malfunction

Subcategory: 3 – Criticality & RPS Failure

Initiating Condition: Automatic trip and **all** manual actions fail to shut down the reactor and indication of an extreme challenge to the ability to cool the core exists

EAL:

SG3.1 General Emergency

An automatic trip fails to shut down the reactor

AND

All manual actions do **not** shut down the reactor as indicated by reactor power ≥ 5%

AND EITHER of the following exist or have occurred due to continued power generation:

CSFST Core Cooling-RED entry conditions met

OR

CSFST Heat Sink-RED entry conditions met

Mode Applicability:

1 - Power Operation

Basis:

Generic

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed and efforts to bring the reactor subcritical are unsuccessful.

In the event either of these challenges exists at a time that the reactor has not been brought below the power associated with the safety system design a core melt sequence exists. In this situation, core degradation can occur rapidly. For this reason, the General Emergency declaration is intended to be anticipatory of the fission product barrier table declaration to permit maximum off-site intervention time.

Plant-Specific

A reactor trip is automatically initiated by the Reactor Protection System (RPS) when certain continuously monitored parameters exceed predetermined setpoints. The following are symptoms that require a reactor trip (ref. 1):

- Power Range Neutron Flux (High Setpoint) 109%
- Power Range Neutron Flux (Low Setpoint) 25%

- Power Range High Positive Rate +5%/2 seconds
- Power Range High Negative Rate -5%/2 seconds
- Intermediate Range High Flux 25%
- Source Range High Count Rate 10^5 cps
- Overtemperature Delta T > calculated setpoint
- Overpower Delta T > calculated setpoint
- Pressurizer Low Pressure 1960 psig
- Pressurizer High Pressure 2385 psig
- Pressurizer High Level 92%
- Steam Generator Low-Low Water Level 25%
- Steam Generator Low Water Level 25% (level)
- Coincident with Steam/Feedwater Flow Mismatch 40% (flow)
- Reactor Coolant Pump Undervoltage 5148 Volts
- Reactor Coolant Pump Underfrequency 57.5 Hz
- Loss of Reactor Coolant Flow 90.5%
- Turbine Trip
    - Low Fluid Oil Pressure 1150 psig
    - Turbine Throttle Valves Closure > 1% open
- Safety Injection Signal Actuated

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a few percent of the original power level and then decays to a level some 8 decades less at a startup rate of about -1/3 DPM. The reactor power drop continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as

sensed by the nuclear instrumentation and a negative startup rate as nuclear power drops into the source range (ref. 2).

The operator ensures that the reactor has tripped by (ref. 1, 3):

- Manually tripping the reactor (using MCB switch #1 and/or #2 as required)
- Checking the reactor trip breakers are open
- Checking that all control rod position rod bottom lights are lit
- Observing neutron flux is decreasing

For purposes of emergency classification at the General Emergency level, all manual actions to shut down the reactor are considered including:

- Actuate MCB switch #1 and #2
- Trip the turbine from the MCB
- Emergency boration
- Local turbine trip turbine
- Opening the reactor trip breakers, MG set generator output breakers, and MG set motor breakers

The reactor power threshold, 5% (ref. 4), corresponds to the condition for entry to Subcriticality-RED.

CSFST Core Cooling-RED and CSFST Heat Sink-RED signify core cooling and heat removal are extremely challenged (ref. 5, 6).

Critical Safety Function Status Tree (CSFST) Core Cooling-RED path entry conditions are:

- Core Exit TCs greater than 1200ºF, or
- All of the following:
    - Core Exit TCs less than 1200ºF
    - RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M
    - No RCPs running
    - Core Exit TCs greater than 730ºF
    - RVLIS Full Range less than 39%

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 2).

The Critical Safety Function Status Tree (CSFST) Heat Sink-RED path entry conditions are Narrow Range Level in all SGs less than 25% [40%] and total feed flow to SGs less than 210 KPPH (ref. 7):

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 2).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 2).

HNP Basis Reference(s):

1. EOP-GUIDE-1 PATH-1 GUIDE
2. EOP-User’s Guide
3. EOP-FRP-S.1 Response to Nuclear Power Generation/ATWS
4. EOP-CSFST Subcriticality CSF-1
5. EOP-CSFST Core Cooling CSF-2
6. EOP-CSFST Heat Sink CSF-3
7. OP-163 ERFIS

Category: S – System Malfunction

Subcategory: 4 – Inability to Reach or Maintain Shutdown Conditions

Initiating Condition: Inability to reach required shutdown within Technical Specification limits

EAL:

SU4.1 Unusual Event

Plant is **not** brought to required operating mode within Technical Specifications LCO action statement time

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

Limiting Conditions of Operation (LCOs) require the plant to be brought to a required operating mode when the Technical Specification required configuration cannot be restored. Depending on the circumstances, this may or may not be an emergency or precursor to a more severe condition. In any case, the initiation of plant shutdown required by the site Technical Specifications requires a four hour report under 10 CFR 50.72 (b) Non-emergency events. The plant is within its safety envelope when being shut down within the allowable action statement time in the Technical Specifications. An immediate UE is required when the plant is not brought to the required operating mode within the allowable action statement time in the Technical Specifications. Declaration of a UE is based on the time at which the LCO-specified action statement time period elapses under the site Technical Specifications and is not related to how long a condition may have existed.

Plant-Specific

None

HNP Basis Reference(s):

1. Technical Specifications for Shearon Harris Unit 1 NPF-63

Category: S – System Malfunction

Subcategory: 5 – Instrumentation

Initiating Condition: Unplanned loss of safety system annunciation or indication in the Control Room for ≥ 15 min.

EAL:

SU5.1 Unusual Event

Unplanned loss of approximately 75% (or more) of annunciation or indication on **all** MCB panels for ≥ 15 min. (Note 6)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment.

Recognition of the availability of computer based indication equipment is considered.

"Planned" loss of annunciators or indicators includes scheduled maintenance and testing activities.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UE is based on EAL SU4.1.

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

This UE will be escalated to an Alert based on a concurrent loss of compensatory indications or if a SIGNIFICANT TRANSIENT is in progress during the loss of annunciation or indication.

Plant-Specific

SPDS/ ERFIS plant computer and OSI/PI monitor selected instrument channels to supplement the display information (ref. 1, 2, 3).

HNP Basis Reference(s):

1. Spec. X-G-003, Emergency Response Facility Information System Data Acquisition replacement Project Specification, 05/01/2002
2. OP-163 ERFIS
3. SD-163 Process Computer System – ERFIS
4. OMM-001 Operations - Conduct of Operations, Attachment 6
5. AOP-037 Loss of Main Control Room Annunciators
6. 6-G-0324 Control Room Plan
7. 1364-002280 Main Control Board (1B1, 1B2 & 1BB)
8. 1364-002317 Main Control Board (1AA, 1A1 & 1A2)
9. 1364-003498 Main Control Board (Light Box Wiring Diagram)
10. 1364-004094 Main Control Board (Light Box Mechanical Design)
11. 1364-012956 Main Control Board (1D1 & 1D2)
12. 1364-032161 Main Control Board (Cathode Ray Tubes)
13. 1364-036625 Main Control Board (Light Box Wiring Diagram)
14. 1364-036673 Main Control Board (Light Box Assy)
15. 1364-040956 to 040961 Main Control Board (Wiring Diagrams)
16. 1364-044059 to 044067 Main Control Board (Plug In Modules)
17. 1364-048873 Main Control Board (Legend and Notes)

Category: S – System Malfunction

Subcategory: 5 – Instrumentation

Initiating Condition: Unplanned loss of safety system annunciation or indication in the Control Room with either (1) a significant transient in progress, or (2) compensatory indicators are unavailable

EAL:

SA5.1 Alert

Unplanned loss of approximately 75% (or more) of annunciation or indication on **all** MCB panels for ≥ 15 min. (Note 6)

AND EITHER:

A significant transient is in progress, Table S-1

OR

Compensatory indications are unavailable (ERFIS, OSI/PI)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Table S-1 Significant Transients

Reactor trip
Electrical load rejection > 25% full electrical load
Runback > 25% reactor power
ECCS injection
Reactor power oscillations > 10%

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment during a SIGNIFICANT TRANSIENT.

"Planned" loss of annunciators or indicators includes scheduled maintenance and testing activities.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the instrumentation lost but use the value as a judgment threshold for determining the severity of the

plant conditions. It is also not intended that the SEC be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the UE is based on EAL SU4.1.

"Compensatory indications" in this context includes computer based information such as SPDS.

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

This Alert will be escalated to a Site Area Emergency if the operating crew cannot monitor the transient in progress due to a concurrent loss of compensatory indications with a SIGNIFICANT TRANSIENT in progress during the loss of annunciation or indication.

Plant-Specific

SPDS/ ERFIS plant computer and OSI/PI are considered compensatory indication and monitor selected instrument channels to supplement the display information (ref. 1, 2, 3).

Significant transients are listed in Table S-1.

HNP Basis Reference(s):

1. Spec. X-G-003, Emergency Response Facility Information System Data Acquisition replacement Project Specification, 05/01/2002
2. OP-163 ERFIS
3. SD-163 Process Computer System – ERFIS
4. OMM-001 Operations - Conduct of Operations, Attachment 6
5. AOP-037 Loss of Main Control Room Annunciators
6. 6-G-0324 Control Room Plan
7. 1364-002280 Main Control Board (1B1, 1B2 & 1BB)
8. 1364-002317 Main Control Board (1AA, 1A1 & 1A2)
9. 1364-003498 Main Control Board (Light Box Wiring Diagram)
10. 1364-004094 Main Control Board (Light Box Mechanical Design)
11. 1364-012956 Main Control Board (1D1 & 1D2)
12. 1364-032161 Main Control Board (Cathode Ray Tubes)
13. 1364-036625 Main Control Board (Light Box Wiring Diagram)
14. 1364-036673 Main Control Board (Light Box Assy)
15. 1364-040956 to 040961 Main Control Board (Wiring Diagrams)

16. 1364-044059 to 044067 Main Control Board (Plug In Modules)
17. 1364-048873 Main Control Board (Legend and Notes)

Category: S – System Malfunction

Subcategory: 5 – Instrumentation

Initiating Condition: Inability to monitor a significant transient in progress

EAL:

SS5.1 Site Area Emergency

Loss of approximately 75% (or more) of annunciation or indication on **all** MCB panels for ≥ 15 min. (Note 6)

AND

A significant transient is in progress, Table S-1

AND

Compensatory indications are unavailable (ERFIS, OSI/PI)

Note 6: The SEC should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time

Table S-1 Significant Transients
Reactor trip
Electrical load rejection > 25% full electrical load
Runback > 25% reactor power
ECCS injection
Reactor power oscillations > 10%

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is intended to recognize the threat to plant safety associated with the complete loss of capability of the control room staff to monitor plant response to a SIGNIFICANT TRANSIENT.

"Planned" and “UNPLANNED” actions are not differentiated since the loss of instrumentation of this magnitude is of such significance during a transient that the cause of the loss is not an ameliorating factor.

Quantification is arbitrary, however, it is estimated that if approximately 75% of the safety system annunciators or indicators are lost, there is an increased risk that a degraded plant condition could go undetected. It is not intended that plant personnel perform a detailed count of the

instrumentation lost but use the value as a judgment threshold for determining the severity of the plant conditions. It is also not intended that the SEC be tasked with making a judgment decision as to whether additional personnel are required to provide increased monitoring of system operation.

It is further recognized that most plant designs provide redundant safety system indication powered from separate uninterruptible power supplies. While failure of a large portion of annunciators is more likely than a failure of a large portion of indications, the concern is included in this EAL due to difficulty associated with assessment of plant conditions. The loss of specific, or several, safety system indicators should remain a function of that specific system or component operability status. This will be addressed by the specific Technical Specification. The initiation of a Technical Specification imposed plant shutdown related to the instrument loss will be reported via 10 CFR 50.72. If the shutdown is not in compliance with the Technical Specification action, the NOUE is based on EAL SU4.1

A Site Area Emergency is considered to exist if the control room staff cannot monitor safety functions needed for protection of the public while a significant transient is in progress.

Site specific indications needed to monitor safety functions necessary for protection of the public must include control room indications, computer generated indications and dedicated annunciation capability.

"Compensatory indications" in this context includes computer based information such as SPDS. This should include all computer systems available for this use depending on specific plant design and subsequent retrofits.

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

Plant-Specific

SPDS/ ERFIS plant computer and OSI/PI are considered compensatory indication and monitor selected instrument channels to supplement the display information (ref. 1, 2, 3).

Significant transients are listed in Table S-1.

HNP Basis Reference(s):

1. Spec. X-G-003, Emergency Response Facility Information System Data Acquisition replacement Project Specification, 05/01/2002
2. OP-163 ERFIS
3. SD-163 Process Computer System – ERFIS
4. OMM-001 Operations - Conduct of Operations, Attachment 6
5. AOP-037 Loss of Main Control Room Annunciators
6. 6-G-0324 Control Room Plan
7. 1364-002280 Main Control Board (1B1, 1B2 & 1BB)
8. 1364-002317 Main Control Board (1AA, 1A1 & 1A2)
9. 1364-003498 Main Control Board (Light Box Wiring Diagram)
10. 1364-004094 Main Control Board (Light Box Mechanical Design)

11. 1364-012956 Main Control Board (1D1 & 1D2)
12. 1364-032161 Main Control Board (Cathode Ray Tubes)
13. 1364-036625 Main Control Board (Light Box Wiring Diagram)
14. 1364-036673 Main Control Board (Light Box Assy)
15. 1364-040956 to 040961 Main Control Board (Wiring Diagrams)
16. 1364-044059 to 044067 Main Control Board (Plug In Modules)
17. 1364-048873 Main Control Board (Legend and Notes)

Category: S – System Malfunction

Subcategory: 6 –Communications

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

EAL:

SU6.1 Unusual Event

Loss of **all** Table S-2 onsite (internal) communication methods affecting the ability to perform routine operations

OR

Loss of **all** Table S-2 offsite (external) communication methods affecting the ability to perform offsite notifications

Table S-2 Communications Systems

System	Onsite (internal)	Offsite (external)
PABX telephone system (desk phones)	X	X
HE&EC PABX telephone system		X
Site paging system	X	
Satellite phone		X
Radio communications networks	X	
NRC ETS Phone		X
NRC HPN Phone		X

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

The purpose of this EAL is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate issues with off-site authorities.

The availability of one method of ordinary off-site communications is sufficient to inform federal, state, and local authorities of plant problems. This EAL is intended to be used only when extraordinary means (e.g., relaying of information from non-routine radio transmissions, individuals being sent to off-site locations, etc.) are being used to make communications possible.

Plant-Specific

Onsite/offsite communications systems are listed in Table S-2 (ref. 1, 2, 3).

This EAL is the hot condition equivalent of the cold condition EAL CU5.1.

HNP Basis Reference(s):

1. FSAR 9.5.2
2. PLP-201 Emergency Plan, Section 3.8
3. OMM-009 Shift Communications, Section 5.2
4. OP-180 Plant Communication Systems
5. DBD-206 Plant Communications Systems

Category: S – System Malfunction

Subcategory: 7 – Fuel Clad Degradation

Initiating Condition: Fuel clad degradation

EAL:

SU7.1 Unusual Event

RCS specific activity > 60 µCi/gm dose equivalent I-131

(or >1 µCi/gm dose equivalent I-131 for > 48 hrs) (Note 7)

Note 7: See Fission Product Barrier thresholds (Table F-1) for possible escalation above the Unusual Event

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is included because it is a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant.

Escalation of this EAL to the Alert level is via the EALs in Category F.

This threshold addresses coolant samples exceeding coolant technical specifications for transient iodine spiking limits.

Plant-Specific

This EAL addresses reactor coolant samples exceeding Technical Specification 3.4.8 which are applicable in Modes 1, 2, 3 and 4. The Technical Specification limits accommodate an iodine spike phenomenon that may occur following changes in thermal power. The Technical Specification LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident (ref. 1, 2). Note that the 100/E-bar specific activity LCO is not listed in this EAL because it cannot be reached without first exceeding the 60µCi/gm limit.

Note 7 is a reminder to review the fission product barrier thresholds in Table F-1 for possible escalation above the Unusual Event classification.

HNP Basis Reference(s):

1. Technical Specification 3.4.8
2. AOP-032 High RCS Activity

Category: S – System Malfunction

Subcategory: 7 – Fuel Clad Degradation

Initiating Condition: Fuel clad degradation

EAL:

SU7.2 Unusual Event

Valid Gross Failed Fuel Detector (RS-7411A) high alarm (> 1E+04 cpm) (Note 7)

Note 7: See Fission Product Barrier thresholds (Table F-1) for possible escalation above the Unusual Event

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is included because it is a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant.

Escalation of this EAL to the Alert level is via the EALs in Category F.

This threshold addresses site-specific radiation monitor readings that provide indication of a degradation of fuel clad integrity.

Plant-Specific

This EAL addresses indication of gross failed fuel that may be in excess of Technical Specification coolant activity limits. The Gross Failed Fuel Detector System continuously monitors the delayed neutron activity in a sample drawn from the RCS. This provides a rapid indication of gross amounts of fission products contained in the RCS resulting from possible fuel defects (ref. 1).

Note 7 is a reminder to review the fission product barrier thresholds in Table F-1 for possible escalation above the Unusual Event classification.

HNP Basis Reference(s):

1. APP-ALB-026 2-1 Gross Failed Fuel Det Trouble
2. AOP-032 High RCS Activity

Category: S – System Malfunction

Subcategory: 8 – RCS Leakage

Initiating Condition: RCS leakage

EAL:

SU8.1 Unusual Event

Unidentified or pressure boundary leakage > 10 gpm

OR

Identified leakage > 25 gpm (Note 7)

Note 7: See Fission Product Barrier thresholds (Table F-1) for possible escalation above the Unusual Event

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

This EAL is included as a UE because it may be a precursor of more serious conditions and, as result, is considered to be a potential degradation of the level of safety of the plant. The 10 gpm value for the unidentified or pressure boundary leakage was selected as it is observable with normal control room indications. Lesser values must generally be determined through time-consuming surveillance tests (e.g., mass balances).

Relief valve normal operation should be excluded from this EAL. However, a relief valve that operates and fails to close per design should be considered applicable to this EAL if the relief valve cannot be isolated.

The EAL for identified leakage is set at a higher value due to the lesser significance of identified leakage in comparison to unidentified or pressure boundary leakage. In either case, escalation of this EAL to the Alert level is via EALs in Category F.

Plant-Specific

Unidentified leakage and identified leakage are determined by performance of the RCS water inventory balance. Pressure boundary leakage would first appear as unidentified leakage and can only be positively identified by inspection (ref. 1). OST-1026 and OST-1226 are used to ensure RCS leakage is within Technical Specification limits (ref. 1, 2). AOP-016, Excessive Primary Plant Leakage, is used for excessive RCS leakage (ref. 3).

Technical Specifications (ref. 4) defines RCS leakage as follows:

Identified Leakage:

a. Leakage (except controlled leakage) into closed systems, such as pump seal or valve packing leaks that are captured and conducted to a sump or collecting tank , or

b. Leakage into the containment atmosphere from sources that are both specifically located or known either not to interfere with the operation of leakage detection systems or not to be pressure boundary leakage, or

c. RCS leakage through a steam generator to the Secondary Coolant System (primary-to-secondary leakage).

Unidentified Leakage:

All leakage which is not identified Leakage or controlled leakage. (Controlled leakage is that seal water flow supplied to the reactor coolant pump seals.)

Pressure Boundary Leakage:

Leakage (except primary-to-secondary leakage) through a non-isolable fault in a RCS component body, pipe wall, or vessel wall.

General symptoms of RCS leakage include the following (ref. 4):

- Increase in identified or unidentified RCS leakage
- Unexplained loss of RCS inventory
- Valid Containment radiation alarm
- Containment Ventilation isolation
- Valid Main Steam Line radiation alarms
- Valid SGBD radiation alarms
- Valid CVPETS radiation alarm
- Containment Unidentified Leakage or Trouble alarm based on computer, instrumentation or alarm circuit malfunction

Note 7 is a reminder to review the fission product barrier thresholds in Table F-1 for possible escalation above the Unusual Event classification.

HNP Basis Reference(s):

1. OST-1026, Reactor Coolant System Leakage Evaluation, Computer Calculation, Daily Interval, Modes 1-2-3-4
2. OST-1226, Reactor Coolant System Leakage Evaluation, Manual Calculation, Daily Interval, Modes 1-2-3-4 AOP-016 Primary Leakage, Step 16
3. AOP-016 Excessive Primary Plant Leakage
4. Technical Specifications, Definitions

Category F – Fission Product Barrier Degradation

EAL Group: Hot Conditions (RCS temperature > 200ºF);
EALs in this category are applicable only in
one or more hot operating modes.

EALs in this category represent threats to the defense in depth design concept that precludes the release of highly radioactive fission products to the environment. This concept relies on multiple physical barriers any one of which, if maintained intact, precludes the release of significant amounts of radioactive fission products to the environment. The primary fission product barriers are:

A. Reactor Fuel Clad (FC): The Fuel Clad barrier consists of the zircalloy or stainless steel fuel bundle tubes that contain the fuel pellets.
B. Reactor Coolant System (RCS): 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.
C. Containment (CNMT): The Containment Barrier includes the containment building and connections up to and including the outermost containment isolation valves. This barrier also includes the main steam, feedwater, and blowdown line extensions outside the containment building up to and including the outermost secondary side isolation valve.

The EALs in this category require evaluation of the loss and potential loss thresholds listed in the fission product barrier matrix of Table F-1 (Attachment 2). “Loss” and “Potential Loss” signify the relative damage and threat of damage to the barrier. “Loss” means the barrier no longer assures containment of radioactive materials. “Potential Loss” means integrity of the barrier is threatened and could be lost if conditions continue to degrade. The number of barriers that are lost or potentially lost and the following criteria determine the appropriate emergency classification level:

Unusual Event:
Any loss or any potential loss of Containment

Alert:
Any loss or any potential loss of either Fuel Clad or RCS

Site Area Emergency:
Loss or potential loss of any two barriers

General Emergency:
Loss of any two barriers and loss or potential loss of the third barrier

The logic used for Category F EALs reflects the following considerations:

- The Fuel Clad Barrier and the RCS Barrier are weighted more heavily than the Containment Barrier. UE EALs associated with RCS and Fuel Clad Barriers are addressed under Category S.
- At the Site Area Emergency level, there must be some ability to dynamically assess how far present conditions are from the threshold for a General Emergency. For example, if Fuel Clad and RCS Barrier "Loss" thresholds existed, that, in addition to off-site dose assessments, would require continual assessments of radioactive inventory and containment integrity. Alternatively, if both Fuel Clad and RCS Barrier "Potential Loss" thresholds existed, the SEC would have more assurance that there was no immediate need to escalate to a General Emergency.
- The ability to escalate to higher emergency classification levels as an event deteriorates must be maintained. For example, RCS leakage steadily increasing would represent an increasing risk to public health and safety.
- The Containment Barrier should not be declared lost or potentially lost based on exceeding Technical Specification action statement criteria, unless there is an event in progress requiring mitigation by the Containment barrier. When no event is in progress (Loss or Potential Loss of either Fuel Clad and/or RCS) the Containment Barrier status is addressed by Technical Specifications.

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: **Any** loss or **any** potential loss of Containment

EAL:

FU1.1 Unusual Event

Any loss or **any** potential loss of Containment (Table F-1)

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

None

Plant-Specific

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

Fuel Clad and RCS barriers are weighted more heavily than the Containment barrier. Unlike the Fuel Clad and RCS barriers, the loss of either of which results in an Alert (EAL FA1.1), loss of the Containment barrier in and of itself does not result in the relocation of radioactive materials or the potential for degradation of core cooling capability. However, loss or potential loss of the Containment barrier in combination with the loss or potential loss of either the Fuel Clad or RCS barrier results in declaration of a Site Area Emergency under EAL FS1.1.

HNP Basis Reference(s):

None

Category: Fission Product Barrier Degradation
Subcategory: N/A
Initiating Condition: **Any** loss or **any** potential loss of either Fuel Clad or RCS
EAL:

FA1.1 Alert

Any loss or **any** potential loss of either Fuel Clad or RCS (Table F-1)

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

None

Plant-Specific

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the Alert classification level, Fuel Clad and RCS barriers are weighted more heavily than the Containment barrier. Unlike the Containment barrier, loss or potential loss of either the Fuel Clad or RCS barrier may result in the relocation of radioactive materials or degradation of core cooling capability. Note that the loss or potential loss of Containment barrier in combination with loss or potential loss of either Fuel Clad or RCS barrier results in declaration of a Site Area Emergency under EAL FS1.1.

HNP Basis Reference(s):

None

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: Loss or potential loss of **any** two barriers

EAL:

FS1.1 Site Area Emergency

Loss or potential loss of **any** two barriers (Table F-1)

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

None

Plant-Specific

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the Site Area Emergency classification level, each barrier is weighted equally. A Site Area Emergency is therefore appropriate for any combination of the following conditions:

- One barrier loss and a second barrier loss (i.e., loss - loss)
- One barrier loss and a second barrier potential loss (i.e., loss - potential loss)
- One barrier potential loss and a second barrier potential loss (i.e., potential loss - potential loss)

At the Site Area Emergency classification level, the ability to dynamically assess the proximity of present conditions with respect to the threshold for a General Emergency is important. For example, the existence of Fuel Clad and RCS Barrier loss thresholds in addition to offsite dose assessments would require continual assessments of radioactive inventory and Containment integrity in anticipation of reaching a General Emergency classification. Alternatively, if both Fuel Clad and RCS potential loss thresholds existed, the SEC would have greater assurance that escalation to a General Emergency is less imminent.

HNP Basis Reference(s):

None

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: Loss of **any** two barriers and loss or potential loss of the third barrier

EAL:

FG1.1 General Emergency

Loss of **any** two barriers

AND

Loss or potential loss of the third barrier (Table F-1)

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Basis:

Generic

None

Plant-Specific

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the General Emergency classification level each barrier is weighted equally. A General Emergency is therefore appropriate for any combination of the following conditions:

- Loss of Fuel Clad, RCS and Containment barriers
- Loss of Fuel Clad and RCS barriers with potential loss of Containment barrier
- Loss of RCS and Containment barriers with potential loss of Fuel Clad barrier
- Loss of Fuel Clad and Containment barriers with potential loss of RCS barrier

HNP Basis Reference(s):

None

Introduction

Table F-1 lists the threshold conditions that define the Loss and Potential Loss of the three fission product barriers (Fuel Clad, Reactor Coolant System, and Containment). The table is structured so that each of the three barriers occupies adjacent columns. Each fission product barrier column is further divided into two columns; one for Loss thresholds and one for Potential Loss thresholds.

The first column of the table (to the left of the Fuel Clad Loss column) lists the categories (types) of fission product barrier thresholds. The fission product barrier categories are:

A. Critical Safety Function Status

B. Core Exit TCs

C. Radiation

D. Inventory

E. Other

F. Judgment

Each category occupies a row in Table F-1 thus forming a matrix defined by the category rows and the Loss/Potential Loss columns. The intersection of each category row with each Loss/Potential Loss column forms a cell in which one or more fission product barrier thresholds appear. If NEI 99-01 does not define a threshold for a barrier Loss/Potential Loss, the word “None” is entered in the cell.

Thresholds are assigned sequential numbers within each Loss and Potential Loss column beginning with number one. In this manner, a threshold can be identified by its category title and number. For example, the first Fuel Clad barrier Loss in Category A is “FC Loss A.1,” the third Containment barrier Potential Loss is “CNMT P-Loss B.3,” etc.

If a cell in Table F-1 contains more than one numbered threshold, each of the numbered thresholds, if exceeded, signifies a Loss or Potential Loss of the barrier. It is not necessary to exceed all of the thresholds in a category before declaring a barrier Loss/Potential Loss.

Subdivision of Table F-1 by category facilitates association of plant conditions to the applicable fission product barrier Loss and Potential Loss thresholds. This structure promotes a systematic approach to assessing the classification status of the fission product barriers.

When equipped with knowledge of plant conditions related to the fission product barriers, the EAL-user first scans down the category column of Table F-1, locates the likely category and then reads across the row of fission product barrier Loss and Potential Loss thresholds in that category to determine if any threshold has been exceeded. If a threshold has not been exceeded in that category row, the EAL-user proceeds to the next likely category and continues review of the row of thresholds in the new category

The EAL-user must examine each of the three fission product barriers to determine if other barrier thresholds in the category are lost or potentially lost. For example, if Containment radiation is sufficiently high (i.e., greater than 601.2 R/hr), a Loss of the Fuel Clad and RCS barriers and a Potential Loss of the Containment barrier exist. Barrier Losses and Potential Losses are then applied to the algorithms given in EALs FG1.1, FS1.1, FA1.1 and FU1.1 to determine the appropriate emergency classification.

In the remainder of this Attachment, the Fuel Clad barrier threshold bases appear first, followed by the RCS barrier and finally the Containment barrier threshold bases. In each barrier, the bases are given according category Loss followed by category Potential Loss beginning with Category A, then B…F.

Attachment 2 – Fission Product Barrier Loss/Potential Loss Matrix and Bases

Table F-1 Fission Product Barrier Matrix

	Fuel Clad Barrier		Reactor Coolant System Barrier		Containment Barrier	
	Loss	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
A. CSFST	1. CSFST Core Cooling-RED entry conditions met	1. CSFST Core Cooling-ORANGE entry conditions met **OR** CSFST Heat Sink-RED entry conditions met due to actual loss of secondary heat sink and heat sink is required	None	1. CSFST RCS Integrity-RED entry conditions met **OR** CSFST Heat Sink-RED entry conditions met due to actual loss of secondary heat sink and heat sink is required	None	1. CSFST Containment-RED entry conditions met
B. Core Exit T/Cs	2. Core exit TCs > 1,200°F	2. Core exit TCs > 730°F	None	None	None	2. Core exit TCs > 1,200°F **AND** Restoration procedure EOP-FRP-C.1 **not** effective within 15 min. 3. **All** of the following: • Core exit TCs > 730°F • RVLIS < Table F-2 thresholds • Restoration procedure EOP-FRP-C.1 **not** effective within 15 min.
C. Radiation	3. Containment radiation >150 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)	None	1. Containment Leak Detection Monitor Noble Gas (REM-1LT-3502A-SA) > 8.3E-3 µCi/ml	None	None	4. Containment radiation > 600 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)
D. Inventory	None	3. RVLIS < Table F-2 thresholds	2. RCS leak rate > available ECCS makeup capacity as indicated by a loss of RCS subcooling (< 10°F[40°F] - C, < 20°F[50°F] - M) 3. Ruptured SG results in an ECCS (SI) actuation	2. RCS leak rate > 120 gpm with letdown isolated	1. A Containment pressure rise followed by a rapid unexplained drop in Containment pressure 2. Containment pressure or sump level response **not** consistent with LOCA conditions 3. Ruptured SG is also faulted outside of Containment 4. Primary-to-secondary leakrate > 10 gpm **AND** Unisolable steam release from affected SG to the environment	5. Containment pressure 45 psig and rising 6. Containment hydrogen concentration ≥ 4% 7. Containment pressure > 10 psig **AND** Less than one full train of depressurization equipment operating (one CNMT spray pump and two CNMT fan coolers)
E. Other	4. Coolant activity > 300 µCi/gm dose equivalent I-131	None	None	None	5. Failure of **all** valves in **any one** line to close **AND** Direct downstream pathway to the environment exists after Containment isolation signal (Note 8)	None
F. Judgment	5. **Any** condition in the opinion of the SEC that indicates loss of the Fuel Clad barrier	4. **Any** condition in the opinion of the SEC that indicates potential loss of the Fuel Clad barrier	4. **Any** condition in the opinion of the SEC that indicates loss of the RCS barrier	3. **Any** condition in the opinion of the SEC that indicates potential loss of the RCS barrier	6. **Any** condition in the opinion of the SEC that indicates loss of the Containment barrier	8. **Any** condition in the opinion of the SEC that indicates potential loss of the Containment barrier

Barrier: Fuel Clad

Category: A. Critical Safety Function Status

Degradation Threat: Loss

Threshold:

1. CSFST Core Cooling-RED entry conditions met

Basis:

Generic

Core Cooling - RED indicates significant superheating and core uncovery and is considered to indicate loss of the Fuel Clad Barrier.

Plant-Specific

Critical Safety Function Status Tree (CSFST) Core Cooling-RED path entry conditions are (ref. 1):

- Core Exit TCs greater than 1200ºF, or
- All of the following:
  - Core Exit TCs less than 1200ºF
  - RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M
  - No RCPs running
  - Core Exit TCs greater than 730ºF
  - RVLIS Full Range less than 39%

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 2).

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 3).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 4).

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2
2. EOP-User's Guide
3. OP-163 ERFIS
4. EOP User's Guide, Section 5.2.6

Barrier: Fuel Clad

Category: A. Critical Safety Function Status

Degradation Threat: Potential Loss

Threshold:

1. CSFST Core Cooling-ORANGE entry conditions met

   OR

   CSFST Heat Sink-RED entry conditions met due to actual loss of secondary heat sink and heat sink is required

Basis:

Generic

Core Cooling - ORANGE indicates subcooling has been lost and that some clad damage may occur.

Heat Sink - RED when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

Plant-Specific

The three Critical Safety Function Status Tree (CSFST) Core Cooling-ORANGE path entry conditions are (ref. 1):

- Core Exit TCs less than 1200ºF, and RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, no RCPs running, Core Exit TCs greater than 730ºF, and RVLIS Full Range greater than 39%
- Core Exit TCs less than 1200ºF, and RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, no RCPs running, Core Exit TCs less than 730ºF, and RVLIS Full Range less than 39%
- Core Exit TCs less than 1200ºF, RCS subcooling less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, at least one RCP running, and RVLIS Dynamic Head Range:
  - < 60% - 3 RCPs
  - < 33% - 2 RCPs
  - < 25% - 1 RCP

The Critical Safety Function Status Tree (CSFST) Heat Sink-RED path entry conditions are Narrow Range Level in all SGs less than 25% [40%] and total feed flow to SGs less than 210 KPPH (ref. 2):

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 3).

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 4).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 5).

EOP-FRP-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK, specifically states that functional response procedure actions should not be performed if total feed flow capability of 210 KPPH is available and total feed flow has been reduced due to operator action as directed by the EOPs. The following EOPs direct feed flow to be reduced below 210 KPPH (ref. 6):

- EPP-015 UNCONTROLLED DEPRESSURIZATION OF ALL STEAM GENERATORS
- FRP-S.1 RESPONSE TO NUCLEAR POWER GENERATION/ATWS
- FRP-P.1 RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK
- FRP-P.2 RESPONSE TO ANTICIPATED PRESSURIZED THERMAL SHOCK
- FRP-J.1 RESPONSE TO HIGH CONTAINMENT PRESSURE

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2
2. EOP-CSFST Heat Sink CSF-3
3. EOP-User's Guide
4. OP-163 ERFIS
5. EOP User's Guide, Section 5.2.6

Barrier: Fuel Clad

Category: B. Core Exit TCs

Degradation Threat: Loss

Threshold:

2. Core exit TCs > 1,200ºF

Basis:

Generic

The site specific reading should correspond to significant superheating of the coolant.

Plant-Specific

Core exit thermocouple (TC) readings greater than 1,200°F (ref. 1) indicate significant core exit superheating and core uncovery.

SPDS displays and uses a core exit TC value that is the average of the five hottest TCs (Turn-on-code: "SPTOP", Parameter: “T EXIT (DEFG)”, ERFIS point: TRC9300) to calculate subcooling and determine the status of the Core Cooling Status Tree (i.e., the 1200ºF and 730ºF setpoints). If ERFIS is unavailable or ERFIS point TRC09300 is not functioning properly, core exit temperatures must be checked using the RVLIS panel (ICCM). To determine the status of the Core Cooling Tree manually, both trains of thermocouple displays should be scanned. The TC value should be considered "greater than" if five functioning TCs are greater than the setpoint. (ref. 2)

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2
2. EOP-User’s Guide

Barrier: Fuel Clad

Category: B. Core Exit TCs

Degradation Threat: Potential Loss

Threshold:

2. Core exit TCs > 730ºF

Basis:

Generic

The site specific reading should correspond to loss of subcooling.

Plant-Specific

The core exit thermocouple (TC) value corresponds to the temperature in the Core Cooling Critical Safety Function Status Tree (CSFST) ORANGE path. This temperature indicates subcooling has been lost and that some fuel clad damage may occur. (ref. 1)

SPDS displays and uses a core exit TC value that is the average of the five hottest TCs (Turn-on-code: "SPTOP", Parameter: “T EXIT (DEFG)”, ERFIS point: TRC9300) to calculate subcooling and determine the status of the Core Cooling Status Tree (i.e., the 1200ºF and 730ºF setpoints). If ERFIS is unavailable or ERFIS point TRC09300 is not functioning properly, core exit temperatures must be checked using the RVLIS panel (ICCM). To determine the status of the Core Cooling Tree manually, both trains of thermocouple displays should be scanned. The TC value should be considered "greater than" if five functioning TCs are greater than the setpoint. (ref. 2)

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2
2. EOP-User’s Guide

Barrier: Fuel Clad

Category: C. Radiation

Degradation Threat: Loss

Threshold:

3. Containment radiation >150 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant, with elevated activity indicative of fuel damage, into the containment.

Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within technical specifications and are therefore indicative of fuel damage.

This value is higher than that specified for RCS barrier Loss threshold #1. Thus, this threshold indicates a loss of both the Fuel Clad barrier and RCS barrier that appropriately escalates the emergency classification level to a Site Area Emergency.

There is no Potential Loss threshold associated with this item.

Plant-Specific

Containment radiation monitor readings greater than 150.3 R/hr, rounded to 150 R/hr for readability, indicate the release of reactor coolant, with elevated activity indicative of fuel damage, into the Containment. The reading is derived assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 300 µCi/cc dose equivalent I-131 into the Containment atmosphere. Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within technical specifications and are therefore indicative of fuel damage (approximately 5% clad failure depending on core inventory and RCS volume). (ref. 1)

RM-1CR-3589-SA and RM-1CR-3590-SB are the Containment High Range Monitors that provide indication of radiation levels in Containment during and after postulated accidents. The Alert alarms are set at 6.5 R/hr and the High alarms are set at 17.5 R/hr. (ref. 2, 3)

HNP Basis Reference(s):

1. Calculation 3-B-12-022 DHRAM- Response to a Fuel and RCS Breach
2. DBD-304 Radiation Monitoring System and Gross Failed Fuel Monitor
3. HP-500 Radiation Monitoring System Data Base Manual

Barrier: Fuel Clad

Category: C. Radiation

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Fuel Clad

Category: D. Inventory

Degradation Threat: Loss

Threshold:

None

Barrier: Fuel Clad

Category: D. Inventory

Degradation Threat: Potential Loss

Threshold:

3. RVLIS < Table F-2 thresholds

Table F-2 RVLIS Thresholds

RVLIS		No. RCPs Operating
Full Range	39%	None
Dynamic Head Range	60%	3
	33%	2
	25%	1

Basis:

Generic

There is no Loss threshold associated with this item.

The site specific value (Table F-2) for the Potential Loss threshold corresponds to the top of the active fuel.

Plant-Specific

The Table F-2 RVLIS thresholds are used in the CSFSTs to signal core uncovery and are, therefore, indication of inadequate coolant inventory. If the RVLIS thresholds are exceeded, a core covered condition cannot be confirmed. According to the Core Cooling-ORANGE path, this water level indicates subcooling has been lost and that some fuel clad damage may occur. (ref. 1)

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2

Barrier: Fuel Clad

Category: E. Other

Degradation Threat: Loss

Threshold:

4. Coolant activity > 300 µCi/gm dose equivalent I-131

Basis:

Generic

The site specific value corresponds to 300 µCi/gm I-131 equivalent. Assessment by the EAL Task Force indicates that this amount of coolant activity is well above that expected for iodine spikes and corresponds to less than 5% fuel clad damage. This amount of radioactivity indicates significant clad damage and thus the Fuel Clad Barrier is considered lost.

There is no Potential Loss threshold associated with this item.

Plant-Specific

None

HNP Basis Reference(s):

1. NEI 99-01 Revision 5, pg 35

Barrier: Fuel Clad

Category: E. Other

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Fuel Clad

Category: F. Judgment

Degradation Threat: Loss

Threshold:

5. **Any** condition in the opinion of the SEC that indicates loss of the Fuel Clad barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the Fuel Clad barrier is lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered lost.

Plant-Specific

The SEC judgment threshold addresses any other factors relevant to determining if the Fuel Clad barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None

Barrier: Fuel Clad

Category: F. Judgment

Degradation Threat: Potential Loss

Threshold:

4. **Any** condition in the opinion of the SEC that indicates potential loss of the Fuel Clad barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the Fuel Clad barrier is l potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered potentially lost.

Plant-Specific

The SEC judgment threshold addresses any other factors relevant to determining if the Fuel Clad barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None

Barrier: Reactor Coolant System

Category: A. Critical Safety Function Status

Degradation Threat: Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: A. Critical Safety Function Status

Degradation Threat: Potential Loss

Threshold:

1. CSFST RCS Integrity-RED entry conditions met

   OR

   CSFST Heat Sink-RED entry conditions met due to actual loss of secondary heat sink and heat sink is required

Basis:

Generic

RCS Integrity - RED indicates an extreme challenge to the safety function derived from appropriate instrument readings.

Heat Sink - RED when heat sink is required indicates the ultimate heat sink function is under extreme challenge.

There is no Loss threshold associated with this item.

Plant-Specific

The Critical Safety Function Status Tree (CSFST) RCS Integrity-RED path entry conditions are temperature decrease in any cold leg greater than 100ºF in the last 60 minutes and any RCS pressure-cold leg temperature point to the left of Limit A, RCS PTS Limits Curve (ref. 1)

The Critical Safety Function Status Tree (CSFST) Heat Sink-RED path entry conditions are Narrow Range Level in all SGs less than 25% [40%] and total feed flow to SGs less than 210 KPPH (ref. 2):

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 3).

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 4).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 5).

EOP-FRP-H.1, RESPONSE TO LOSS OF SECONDARY HEAT SINK, specifically states that functional response procedure actions should not be performed if total feed flow capability of 210 KPPH is available and total feed flow has been reduced due to operator action as directed by the EOPs. The following EOPs direct feed flow to be reduced below 210 KPPH (ref. 6):

- EPP-015 UNCONTROLLED DEPRESSURIZATION OF ALL STEAM GENERATORS
- FRP-S.1 RESPONSE TO NUCLEAR POWER GENERATION/ATWS
- FRP-P.1 RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK
- FRP-P.2 RESPONSE TO ANTICIPATED PRESSURIZED THERMAL SHOCK
- FRP-J.1 RESPONSE TO HIGH CONTAINMENT PRESSURE

HNP Basis Reference(s):

1. EOP-CSFST RCS Integrity CSF-4
2. EOP-CSFST Heat Sink CSF-3
3. EOP-User's Guide
4. OP-163 ERFIS
5. EOP User's Guide, Section 5.2.6
6. EOP-FRP-H.1

Barrier: Reactor Coolant System

Category: B. Core Exit TCs

Degradation Threat: Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: B. Core Exit TCs

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: C. Radiation

Degradation Threat: Loss

Threshold:

1. Containment Leak Detection Monitor Noble Gas (REM-1LT-3502A-SA)
   > 8.3E-3 µCi/ml

Basis:

Generic

The site specific reading is a value which indicates the release of reactor coolant to the containment.

This reading will be less than that specified for Fuel Clad barrier threshold 3. Thus, this threshold would be indicative of a RCS leak only. If the radiation monitor reading increased to that specified by Fuel Clad barrier threshold, fuel damage would also be indicated.

There is no Potential Loss threshold associated with this item.

Plant-Specific

Containment radiation monitor readings on REM-1LT-3502A-SA noble gas channel greater than 8.3E-3 µCi/ml (ref. 1) indicate the release of reactor coolant to the Containment. The readings assume the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (i.e., within Technical Specifications) into the Containment atmosphere. Because of the very high fuel clad integrity, only small amounts of noble gases would be dissolved in the primary coolant.

The Containment High Range Monitors (RM-1CR-3589-SA or RM-1CR-3590-SB) are bugged to read at least 1 R/hr and are not capable of detecting this radiation level (ref. 2, 3).

HNP Basis Reference(s):

1. Calculation HNP-M/MECH-1074 Alternate Source Term Effect on REM-3205A Response to RCS Breach with Non-Failed Fuel
2. DBD-304 Radiation Monitoring System and Gross Failed Fuel Monitor
3. HP-500 Radiation Monitoring System Data Base Manual

Barrier: Reactor Coolant System

Category: C. Radiation

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: D. Inventory

Degradation Threat: Loss

Threshold:

2. RCS leak rate > available ECCS makeup capacity as indicated by a loss of RCS subcooling (< 10°F[40°F] – C, < 20°F[50°F] – M)

Basis:

Generic

This threshold addresses conditions where leakage from the RCS is greater than available inventory control capacity such that a loss of subcooling has occurred. The loss of subcooling is the fundamental indication that the inventory control systems are inadequate in maintaining RCS pressure and inventory against the mass loss through the leak.

Plant-Specific

Critical Safety Function Status Trees (CSFST), Core Cooling, indicates that if subcooling margin based on core exit TCs is less than 10ºF[40ºF] – C, 20ºF[50ºF] – M, a loss of RCS subcooling has occurred (ref. 1). AOP-016, Excessive Primary Coolant Leakage, provides appropriate actions to prevent and mitigate the consequences of RCS leakage (ref. 2).

The RCS subcooling values designated “C” (for computer) are normally used when the subcooling monitor (ERFIS) is available. The values designated “M” (for manual) are used only when the subcooling monitor is not available (ref. 3).

The CSFSTs can be monitored using the SPDS display on the Plant Computer (ref. 4).

Adverse Containment parameters (enclosed in brackets) determine when a harsh environment begins to affect instrumentation located inside Containment. The following indications identify that the Adverse Containment values should be used in the EOPs:

- Containment pressure is greater than the High-1 setpoint (3.0 psig)
- Containment radiation level has exceeded 10^3 R/hr, or
- Integrated containment radiation exposure has exceeded 10^4 R

If containment pressure subsequently decreases below 3.0 psig, normal values can be used. If radiation levels subsequently decrease below 10^3R/hr, however, use of adverse values must be continued until the plant operations staff has determined the integrated dose has not exceeded 10^4 R (ref. 5).

HNP Basis Reference(s):

1. EOP-CSFST Core Cooling CSF-2
2. AOP-016 Excessive Primary Coolant Leakage
3. EOP-User's Guide
4. OP-163 ERFIS
5. EOP User's Guide, Section 5.2.6

Barrier: Reactor Coolant System

Category: D. Inventory

Degradation Threat: Loss

Threshold:

3. Ruptured SG results in an ECCS (SI) actuation

Basis:

Generic

This threshold addresses the full spectrum of Steam Generator (SG) tube rupture events in conjunction with Containment barrier Loss thresholds. It addresses RUPTURED SG(s) for which the leakage is large enough to cause actuation of ECCS (SI). This is consistent to the RCS leak rate barrier Potential Loss threshold.

By itself, this threshold will result in the declaration of an Alert. However, if the SG is also FAULTED (i.e., two barriers failed), the declaration escalates to a Site Area Emergency per Containment barrier Loss thresholds.

There is no Potential Loss threshold associated with this item.

Plant-Specific

A ruptured SG is primary-to-secondary leakage through the steam generator tubes. A demand for Safety Injection (SI) actuation is generated by any of the following (ref. 1):

- Containment high pressure > 3.0 psig
- Pressurizer low pressure < 1850 psig
- Steam line low pressures < 601 psig
- Manual actuation

HNP Basis Reference(s):

1. EOP-Guide-1 Path-1 Guide

Barrier: Reactor Coolant System

Category: D. Inventory

Degradation Threat: Potential Loss

Threshold:

2. RCS leak rate > 120 gpm with letdown isolated

Basis:

Generic

This threshold is based on the apparent inability to maintain normal liquid inventory within the Reactor Coolant System (RCS) by normal operation of the Chemical and Volume Control System which is considered to be the flow rate equivalent to one charging pump discharging to the charging header. Isolating letdown is a standard abnormal operating procedure action and may prevent unnecessary classifications when a non-RCS leakage path such as a CVCS leak exists. The intent of this condition is met if attempts to isolate Letdown are NOT successful. Additional charging pumps being required is indicative of a substantial RCS leak.

Plant-Specific

The Chemical and Volume Control System (CVCS) includes three centrifugal charging pumps each with a capacity of 120 gpm in the normal charging mode (ref. 1).

HNP Basis Reference(s):

1. AOP-16 Excessive Primary Plant Leakage

Barrier: Reactor Coolant System

Category: E. Other

Degradation Threat: Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: E. Other

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Reactor Coolant System

Category: F. Judgment

Degradation Threat: Loss

Threshold:

4. **Any** condition in the opinion of the SEC that indicates loss of the RCS barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the RCS barrier is lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered lost.

Plant-Specific

The SEC judgment threshold addresses any other factors relevant to determining if the RCS barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None

Barrier: Reactor Coolant System

Category: F. Judgment

Degradation Threat: Potential Loss

Threshold:

3. **Any** condition in the opinion of the SEC that indicates potential loss of the RCS barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the RCS barrier is potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered potentially lost.

Plant-Specific

The SEC judgment threshold addresses any other factors relevant to determining if the RCS barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None

Barrier: Containment

Category: A. Critical Safety Function Status

Degradation Threat: Loss

Threshold:

None

Barrier: Containment

Category: A. Critical Safety Function Status

Degradation Threat: Potential Loss

Threshold:

1. CSFST Containment-RED entry conditions met

Basis:

Generic

RED path indicates an extreme challenge to the safety function derived from appropriate instrument readings and/or sampling results, and thus represents a potential loss of containment.

Conditions leading to a containment RED path result from RCS barrier and/or Fuel Clad Barrier Loss. Thus, this threshold is primarily a discriminator between Site Area Emergency and General Emergency representing a potential loss of the third barrier.

There is no Loss threshold associated with this item.

Plant-Specific

Critical Safety Function Status Tree (CSFST) Containment-RED path (Figure F-4) entry condition is met if Containment pressure is greater than 45 psig (ref. 1).

HNP Basis Reference(s):

1. EOP-CSFST Containment CSF-5

Barrier: Containment

Category: B. Core Exit TCs

Degradation Threat: Loss

Threshold:

None

Barrier: Containment

Category: B. Core Exit TCs

Degradation Threat: Potential Loss

Threshold:

2. Core exit TCs > 1,200°F

   AND

   Restoration procedure EOP-FRP-C.1 **not** effective within 15 min.

Basis:

Generic

There is no Loss threshold associated with this item.

The conditions in this threshold represents an IMMINENT core melt sequence which, if not corrected, could lead to vessel failure and an increased potential for containment failure. In conjunction with the Core Cooling and RCS Leakage criteria in the Fuel Clad and RCS barrier columns, this threshold would result in the declaration of a General Emergency -- loss of two barriers and the potential loss of a third. If the function restoration procedures are ineffective, there is no "success" path.

The function restoration procedures are those emergency operating procedures that address the recovery of the core cooling critical safety functions. The procedure is considered effective if the temperature is decreasing or if the vessel water level is increasing.

Whether or not the procedures will be effective should be apparent within 15 minutes. The SEC should make the declaration as soon as it is determined that the procedures have been, or will be ineffective.

Plant-Specific

This threshold indicates significant core exit superheating and core uncovery. If core exit thermocouple (TC) readings are greater than 1,200°F (ref. 1), Fuel Clad barrier is lost. Core exit TCs provide an indirect indication of fuel clad temperature by measuring the temperature of the primary coolant that leaves the core region. Although clad rupture due to high temperature is not expected for core exit TC readings less than the threshold, temperatures of this magnitude signal significant superheating of the reactor coolant and core uncovery. Events that result in core exit TC readings above the loss threshold are severe accidents and are a severe accident management “Badly Damaged (BD)”

condition. The BD descriptor signifies possible core overheating to the point that clad ballooning/collapse may occur and portions of the core may have melted. (ref. 2)

HNP Basis Reference(s):

1. EOP-FRP-C.1 Response to Inadequate Core Cooling
2. EOP-User's Guide

Barrier: Containment

Degradation Threat: Potential Loss

Category: B. Core Exit TCs

Threshold:

3. **All** of the following:
   - Core exit TCs > 730°F
   - RVLIS < Table F-2 thresholds
   - Restoration procedure EOP-FRP-C.1 **not** effective within 15 min.

Table F-2 RVLIS Thresholds

RVLIS		No. RCPs Operating
Full Range	39%	None
Dynamic Head Range	60%	3
	33%	2
	25%	1

Basis:

Generic

There is no Loss threshold associated with this item.

The conditions in this threshold represents an IMMINENT core melt sequence which, if not corrected, could lead to vessel failure and an increased potential for containment failure. In conjunction with the Core Cooling and RCS Leakage criteria in the Fuel Clad and RCS barrier columns, this threshold would result in the declaration of a General Emergency -- loss of two barriers and the potential loss of a third. If the function restoration procedures are ineffective, there is no "success" path.

The function restoration procedures are those emergency operating procedures that address the recovery of the core cooling critical safety functions. The procedure is considered effective if the temperature is decreasing or if the vessel water level is increasing.

Whether or not the procedures will be effective should be apparent within 15 minutes. The SEC should make the declaration as soon as it is determined that the procedures have been, or will be ineffective.

Plant-Specific

This threshold indicates subcooling has been lost (core exit TC readings >730°F), the core is uncovered and some fuel clad damage may be occurring (ineffective functional restoration procedures). (ref. 1, 2)

The Table F-2 RVLIS thresholds are used in the CSFSTs to signal core uncovery and are, therefore, indication of inadequate coolant inventory. If the RVLIS thresholds are exceeded, a core covered condition cannot be confirmed. According to the Core Cooling-ORANGE path, this water level indicates subcooling has been lost and that some fuel clad damage may occur. (ref. 3)

HNP Basis Reference(s):

1. EOP-FRP-C.1 Response to Inadequate Core Cooling
2. EOP-User's Guide
3. EOP-CSFST Core Cooling CSF-2

Barrier: Containment

Category: C. Radiation

Degradation Threat: Loss

Threshold:

None

Barrier: Containment

Category: C. Radiation

Degradation Threat: Potential Loss

Threshold:

4. Containment radiation > 600 R/hr (RM-1CR-3589-SA or RM-1CR-3590-SB)

Basis:

Generic

There is no Loss threshold associated with this item.

The site specific reading is a value which indicates significant fuel damage well in excess of the thresholds associated with both loss of Fuel Clad and loss of RCS barriers. A major release of radioactivity requiring off-site protective actions from core damage is not possible unless a major failure of fuel cladding allows radioactive material to be released from the core into the reactor coolant.

Regardless of whether containment is challenged, this amount of activity in containment, if released, could have such severe consequences that it is prudent to treat this as a potential loss of containment, such that a General Emergency declaration is warranted.

Plant-Specific

Containment radiation monitor readings greater than 601.2 R/hr, rounded to 600 R/hr for readability, (ref. 1) indicate significant fuel damage well in excess of that required for loss of the RCS barrier and the Fuel Clad barrier.

The readings are higher than that specified for Fuel Clad Loss C.3 and RCS Loss C.1. Containment radiation readings at or above the Containment barrier Potential Loss threshold, therefore, signify a loss of two fission product barriers and Potential Loss of the third, indicating the need to upgrade the emergency classification to a General Emergency.

RM-1CR-3589-SA and RM-1CR-3590-SB are the Containment High Range Monitors that provide indication of radiation levels in Containment during and after postulated accidents. The Alert alarms are set at 6.5 R/hr and the High alarms are set at 17.5 R/hr. (ref. 2, 3)

HNP Basis Reference(s):

1. Calculation 3-B-12-022 DHRAM- Response to a Fuel and RCS Breach
2. DBD-304 Radiation Monitoring System and Gross Failed Fuel Monitor
3. HP-500 Radiation Monitoring System Data Base Manual

Barrier: Containment

Category: D. Inventory

Degradation Threat: Loss

Threshold:

1. A Containment pressure rise followed by a rapid unexplained drop in Containment pressure

Basis:

Generic

Rapid unexplained loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase from a primary or secondary high energy line break indicates a loss of containment integrity. Containment pressure and sump levels should increase as a result of mass and energy release into containment from a LOCA. Thus, sump level or pressure not increasing indicates containment bypass and a loss of containment integrity.

This indicator relies on operator recognition of an unexpected response for the condition and therefore does not have a specific value associated with it. The unexpected response is important because it is the indicator for a containment bypass condition.

Plant-Specific

The containment pressure and temperature response and containment sump water temperature response versus time are given in FSAR Figures 6.2.1-1 through 6.2.1-6b for the most severe LOCAs.

HNP Basis Reference(s):

1. FSAR Figures 6.2.1-1 through 6.2.1-6b

Barrier: Containment

Category: D. Inventory

Degradation Threat: Loss

Threshold:

2. Containment pressure or sump level response **not** consistent with LOCA conditions

Basis:

Generic

Rapid unexplained loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase from a primary or secondary high energy line break indicates a loss of containment integrity. Containment pressure and sump levels should increase as a result of mass and energy release into containment from a LOCA. Thus, sump level or pressure not increasing indicates containment bypass and a loss of containment integrity.

This indicator relies on operator recognition of an unexpected response for the condition and therefore does not have a specific value associated with it. The unexpected response is important because it is the indicator for a containment bypass condition.

Plant-Specific

The containment pressure and temperature response and containment sump water temperature response versus time are given in FSAR Figures 6.2.1-1 through 6.2.1-6b for the most severe LOCAs. During the LOCA injection mode of ECCS operation, Containment sump and RWST levels are monitored to ensure switch-over from injection to cold leg recirculation is initiated automatically and completed via timely operator action.

HNP Basis Reference(s):

1. FSAR Figures 6.2.1-1 through 6.2.1-6b

Barrier: Containment

Category: D. Inventory

Degradation Threat: Loss

Threshold:

3. Ruptured SG is also faulted outside of Containment

Basis:

Generic

The loss threshold recognizes that SG tube leakage can represent a bypass of the Containment barrier as well as a loss of the RCS barrier.

Users should realize that this threshold and Containment Loss D.4 could be considered redundant. This was recognized during the development process. The inclusion of a threshold that uses Emergency Procedure commonly used terms like “RUPTURED and FAULTED” adds to the ease of the classification process and has been included based on this human factor concern.

This threshold results in a UE for smaller breaks that; (1) do not exceed the normal charging capacity threshold in RCS leak rate barrier Potential Loss threshold, or (2) do not result in ECCS actuation in RCS SG tube rupture barrier Loss threshold. For larger breaks, RCS barrier threshold criteria would result in an Alert. For SG tube ruptures which may involve multiple steam generators or unisolable secondary line breaks, this threshold would exist in conjunction with RCS barrier thresholds and would result in a Site Area Emergency. Escalation to General Emergency would be based on "Potential Loss" of the Fuel Clad Barrier.

This threshold addresses the condition in which a RUPTURED steam generator is also FAULTED. This condition represents a bypass of the RCS and containment barriers and is a subset of the Containment Loss D.4. In conjunction with RCS leak rate barrier loss threshold, this would always result in the declaration of a Site Area Emergency.

Plant-Specific

A faulted SG means the existence of secondary side leakage that results in an uncontrolled decrease in steam generator pressure or the steam generator being completely depressurized. A ruptured SG means the existence of primary-to-secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.

HNP Basis Reference(s):

1. EOP-EPP-014 Faulted Steam Generator Isolation
2. EOP-EPP-020 SGTR with Loss of Reactor Coolant: Subcooled Recovery
3. EOP-EPP-021 SGTR with Loss of Reactor Coolant: Saturated Recovery

Barrier: Containment

Category: D. Inventory

Degradation Threat: Loss

Threshold:

4. Primary-to-secondary leakrate > 10 gpm

   AND

   Unisolable steam release from affected SG to the environment

Basis:

Generic

The loss threshold recognizes that SG tube leakage can represent a bypass of the Containment barrier as well as a loss of the RCS barrier.

Users should realize that the this loss threshold and Containment Loss D.3 could be considered redundant. This was recognized during the development process. The inclusion of an threshold that uses Emergency Procedure commonly used terms like “RUPTURED and FAULTED” adds to the ease of the classification process and has been included based on this human factor concern.

This threshold results in a UE for smaller breaks that; (1) do not exceed the normal charging capacity threshold in RCS leak rate barrier Potential Loss threshold, or (2) do not result in ECCS actuation in RCS SG tube rupture barrier Loss threshold. For larger breaks, RCS barrier threshold criteria would result in an Alert. For SG tube ruptures which may involve multiple steam generators or unisolable secondary line breaks, this threshold would exist in conjunction with RCS barrier thresholds and would result in a Site Area Emergency. Escalation to General Emergency would be based on "Potential Loss" of the Fuel Clad Barrier.

This threshold addresses SG tube leaks that exceed 10 gpm in conjunction with an UNISOLABLE release path to the environment from the affected steam generator. The threshold for establishing the UNISOLABLE secondary side release is intended to be a prolonged release of radioactivity from the RUPTURED steam generator directly to the environment. This could be expected to occur when the main condenser is unavailable to accept the contaminated steam (i.e., SG tube rupture with concurrent loss of off-site power and the RUPTURED steam generator is required for plant cooldown or a stuck open relief valve). If the main condenser is available, there may be releases via air ejectors, gland seal exhausters, and other similar controlled, and often monitored, pathways. These pathways do not meet the intent of an UNISOLABLE release path to the environment. These minor releases are assessed using EALs in Category R.

Plant-Specific

None

HNP Basis Reference(s):

1. EOP-3.0 Steam Generator Tube Rupture
2. EOP-2.0A/B Faulted Steam Generator Isolation

Barrier: Containment

Category: D. Inventory

Degradation Threat: Potential Loss

Threshold:

5. Containment pressure 45 psig and rising

Basis:

Generic

The site specific pressure is based on the containment design pressure.

Plant-Specific

The specified Containment pressure (45 psig) is the Containment design pressure (ref. 1, 2). Proper actuation and operation of the Containment heat removal system when required should avoid Containment pressures in excess of this threshold. The threshold is therefore indicative of a loss of both RCS and Fuel Clad barriers in that it should not be exceeded without severe core degradation (metal-water reaction) or failure to trip in combination with RCS breach. This condition would be expected to require the declaration of a General Emergency.

HNP Basis Reference(s):

1. FSAR 6.2.1.1.2
2. Technical Specifications 5.2
3. EOP-FRP-J.1 Response to High Containment Pressure

Barrier: Containment

Category: D. Inventory

Degradation Threat: Potential Loss

Threshold:

6. Containment hydrogen concentration ≥ 4%

Basis:

Generic

Existence of an explosive mixture means a hydrogen and oxygen concentration of at least the lower deflagration limit curve exists. The indications of potential loss under this EAL corresponds to some of those leading to the RED path in Containment Potential Loss threshold A.1.

Plant-Specific

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 mixture of dissolved gases in Containment. However, Containment monitoring and/or sampling should be performed to verify this assumption and a General Emergency declared if it is determined that an explosive mixture exists. A combustible mixture can be formed when hydrogen gas concentration in the Containment atmosphere is greater than 4% by volume.

Hydrogen concentration is recorded and displayed on the Remote Control Panel located in the Control Room. Hydrogen concentration may also be obtained from any of the following (ref. 1, 2, 3):

- SPDS
- Computer points ACM0700A and ACM0700B
- Locally at hydrogen control panels

A high hydrogen concentration (3% by volume) at any sample point will activate an alarm in the Control Room. The hydrogen analyzers are capable of measuring in the 0-10 percent hydrogen range by volume, with an accuracy of ±2.0 percent of full scale.

To generate explosive mixtures of combustible gas, loss of the Fuel Clad and RCS barriers must have occurred. With the Potential Loss of the Containment barrier, the threshold hydrogen concentration, therefore, will likely warrant declaration of a General Emergency.

HNP Basis Reference(s):

1. EOP-GUIDE-1 PATH-1 GUIDE
2. DBD-305 Post Accident Hydrogen Analyzer System
3. OP-125 Post Accident Hydrogen System

Barrier: Containment

Category: D. Inventory

Degradation Threat: Potential Loss

Threshold:

7. Containment pressure > 10 psig

   AND

   Less than one full train of depressurization equipment operating (one CNMT spray pump and two CNMT fan coolers)

Basis:

Generic

This threshold represents a potential loss of containment in that the containment heat removal/depressurization system (e.g., containment sprays, CNMT fan coolers, etc.) are either lost or performing in a degraded manner, as indicated by containment pressure greater than the setpoint at which the equipment was supposed to have actuated.

Plant-Specific

The Containment pressure setpoint (10 psig) is the pressure at which the Containment Spray System should actuate (ref. 1, 2). Limiting LOCA analyses assume one Containment Spray pump and two CNMT fan coolers operate (ref. 3).

HNP Basis Reference(s):

1. EOP-CSFST CSF-5
2. OP-112 Containment Spray System
3. FSAR 6.2.1.1.3.2

Barrier: Containment

Category: E. Other

Degradation Threat: Loss

Threshold:

5. Failure of **all** valves in **any one** line to close

   AND

   Direct downstream pathway to the environment exists after Containment isolation signal (Note 8)

Note 8: A direct release is defined as a pathway from the containment to any environment outside the containment when containment or system isolation is required due to a safety injection signal, containment pressure greater than 3 psig, or a valid containment ventilation isolation signal and the pathway cannot be isolated from the Main Control Room.

Basis:

Generic

This threshold addresses incomplete containment isolation that allows direct release to the environment.

The use of the modifier “direct” in defining the release path discriminates against release paths through interfacing liquid systems. The existence of an in–line charcoal filter does not make a release path indirect since the filter is not effective at removing fission product noble gases. Typical filters have an efficiency of 95-99% removal of iodine. Given the magnitude of the core inventory of iodine, significant releases could still occur. In addition, since the fission product release would be driven by boiling in the reactor vessel, the high humidity in the release stream can be expected to render the filters ineffective in a short period.

There is no Potential Loss threshold associated with this item.

Plant-Specific

None

HNP Basis Reference(s):

1. EOP-EPP-013 LOCA Outside Containment
2. PEP-110 Emergency Classification and Protective Action Recommendations

Barrier: Containment

Category: E. Other

Degradation Threat: Potential Loss

Threshold:

None

Barrier: Containment

Category: F. Judgment

Degradation Threat: Loss

Threshold:

6. **Any** condition in the opinion of the SEC that indicates loss of the Containment barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the Containment barrier is lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered lost.

The Containment barrier should not be declared lost or potentially lost based on exceeding Technical Specification action statement criteria, unless there is an event in progress requiring mitigation by the Containment barrier. When no event is in progress (Loss or Potential Loss of either Fuel Clad and/or RCS) the Containment barrier status is addressed by Technical Specifications.

Plant-Specific

The SEC judgment threshold addresses any other factors relevant to determining if the Containment barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None

Barrier: Containment

Degradation Threat: Potential Loss

Category: F. Judgment

Threshold:

8. **Any** condition in the opinion of the SEC that indicates potential loss of the Containment barrier

Basis:

Generic

This threshold addresses any other factors that are to be used by the SEC in determining whether the Containment barrier is potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this threshold as a factor in SEC judgment that the barrier may be considered potentially lost.

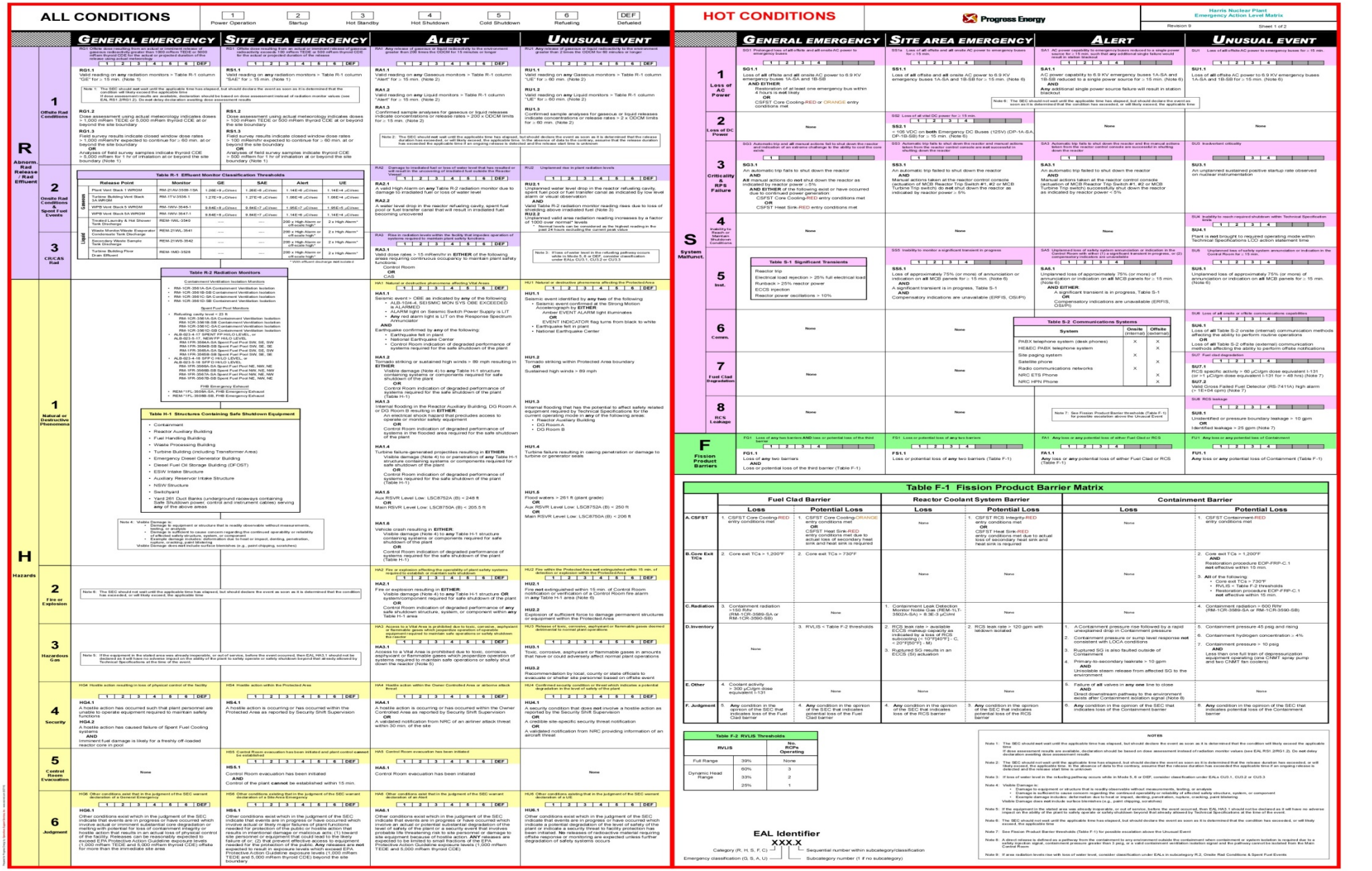
The Containment barrier should not be declared lost or potentially lost based on exceeding Technical Specification action statement criteria, unless there is an event in progress requiring mitigation by the Containment barrier. When no event is in progress (Loss or Potential Loss of either Fuel Clad and/or RCS) the Containment barrier status is addressed by Technical Specifications.

Plant-Specific

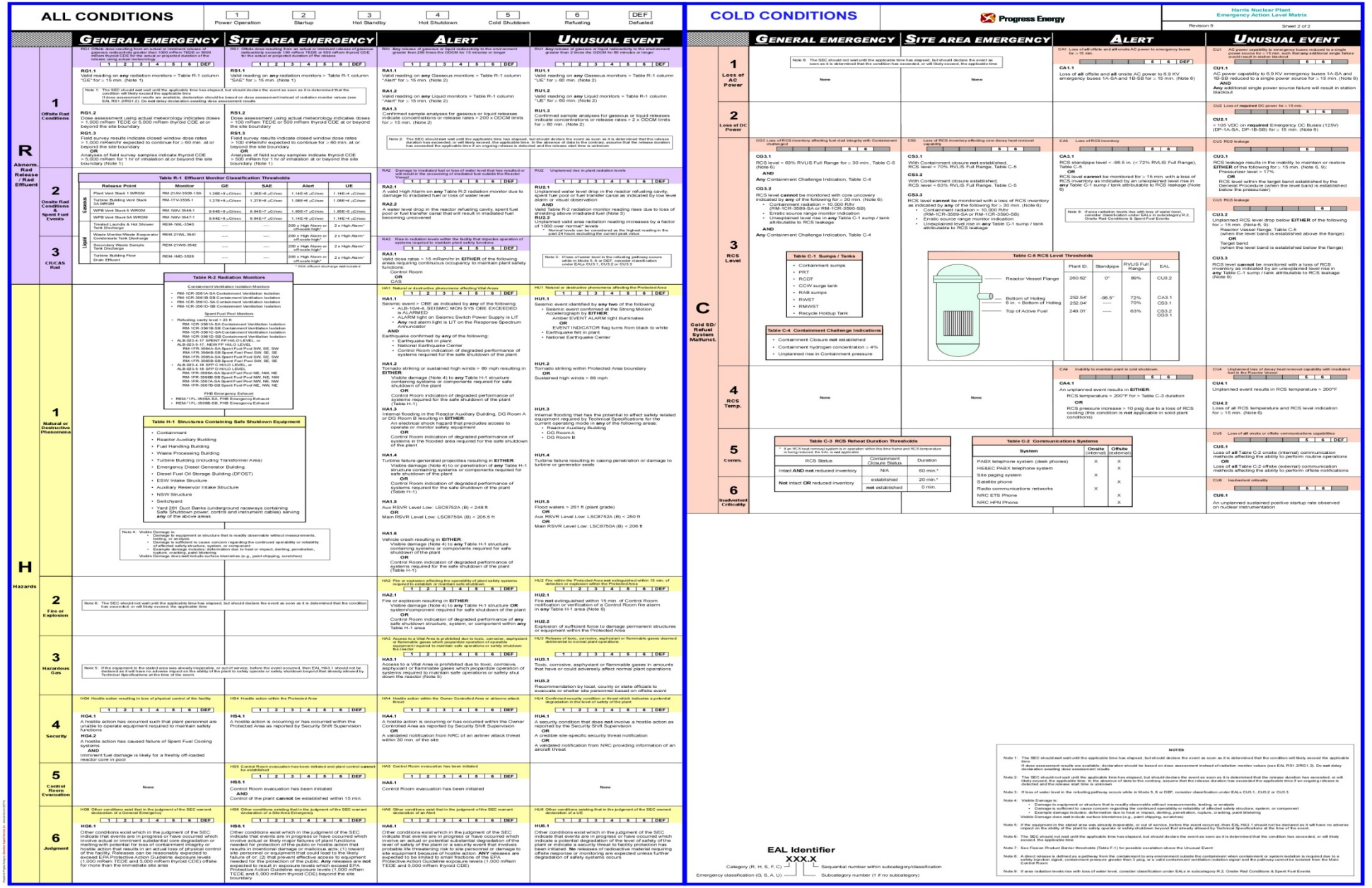
The SEC judgment threshold addresses any other factors relevant to determining if the Containment barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

HNP Basis Reference(s):

None


ALL CONDITIONS
1 Power Operation
2 Startup
3 Hot Standby
4 Hot Shutdown
5 Cold Shutdown
6 Refueling
DEF Defueled
GENERAL EMERGENCY
SITE AREA EMERGENCY
ALERT
UNUSUAL EVENT
R Abnorm. Rad Release / Rad Effluent
1 Offsite Rad Conditions
2 Onsite Rad Conditions Affecting Spent Fuel Events
3 CR/CAS Rad
Table R-1 Effluent Monitor Classification Thresholds
Table R-2 Radiation Monitors
S System Malfunct.
4 Inability to Reach Required Mode Within Technical Specification Limits
5 Inst.
Table S-1 Significant Transients
6 Comms.
Table S-2 Communications Systems
7 Fuel Clad Degradation
8 RCS Leakage
F Fission Product Barriers
H Hazards
1 Natural or Destructive Phenomena
Table H-1 Structures Containing Safe Shutdown Equipment
2 Fire or Explosion
3 Hazardous Gas
4 Security
5 Control Room Evacuation
6 Judgment
HOT CONDITIONS
Progress Energy
Harris Nuclear Plant Emergency Action Level Matrix
Revision 9
Sheet 1 of 2
Table F-1 Fission Product Barrier Matrix
Fuel Clad Barrier
Reactor Coolant System Barrier
Containment Barrier
Table F-2 RVLIS Thresholds
EAL Identifier
XXX.X
Category (R, H, S, F, C)
Emergency classification (G, S, A, U)
Sequential number within subcategory/classification
Subcategory number (1 if no subcategory)

Attachment 3 – Harris Nuclear Plant Emergency Action Level Matrix



REVISION SUMMARY

PRR 00400823

Section/Step	Description of Change
All	Major revision – change EAL scheme from NUREG-0654 to NEI 99-01, revision 5. Document was approved by the NRC, except the following listed revisions (PRR# 400823)
Title page	Editorial – changed formatting to HNP standard format and changed title from "Emergency Action Level Technical Basis Document" to Emergency Action Levels
Section 4.0	Visible Damage Definition: Deleted "safety" from definition to read: "… Damage is sufficient to cause concern regarding the continued operability or reliably of affected structure, system, or component…." to be consistent with HA1.2, HA1.4, HA1.6 and HA2.1 changes below.
HA1.1	Added references "AOP-036, Safe Shutdown Following A Fire" and "FSAR 7.4" (PRR 422507)
HA1.2	Replaced the text from "Visible damage (Note 4) to any safety-related structure, system, or component within any Table H-1 area OR Control Room indication of degraded performance of any safety-related structure, system, or component within any Table H-1 area" with "Visible damage (Note 4) to **any** Table H-1 structure containing systems or components required for safe shutdown of the plant **OR** Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)" in the procedure and on the EAL matrix. Replaced Calc HNP-E/ELEC-0001 Appendix 2, Safe Shutdown Equipment List" with "AOP-036, Safe Shutdown Following A Fire" and added "FSAR 7.4" (PRR 422507)
HA1.3	Added references "AOP-036, Safe Shutdown Following A Fire" and "FSAR 7.4" (PRR 422507)
HA1.4	Replaced the text from "Visible damage (Note 4) to any safety-related structure, system, or component within any Table H-1 area OR Control Room indication of degraded performance of any safety-related structure, system, or component within any Table H-1 area" with "Visible damage (Note 4) to or penetration of **any** Table H-1 structure containing systems or components required for safe shutdown of the plant **OR** Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)" in the procedure and on the EAL matrix. Replaced Calc HNP-E/ELEC-0001 Appendix 2, Safe Shutdown Equipment List" with "AOP-036, Safe Shutdown Following A Fire" and added "FSAR 7.4" (PRR 422507)

REVISION SUMMARY

PRR 00400823

HA1.6	Replaced the text from "Visible damage (Note 4) to any safety-related structure, system, or component within any Table H-1 area OR Control Room indication of degraded performance of any safety-related structure, system, or component within any Table H-1 area" with "Visible damage (Note 4) to **any** Table H-1 structure containing systems or components required for safe shutdown of the plant **OR** Control Room indication of degraded performance of systems required for the safe shutdown of the plant (Table H-1)" in the procedure and on the EAL matrix. Added references "AOP-036, Safe Shutdown Following A Fire" and "FSAR 7.4" (PRR 422507)
HU2.1	Replaced Calc HNP-E/ELEC-0001 Appendix 2, Safe Shutdown Equipment List" with "AOP-036, Safe Shutdown Following A Fire" and added "FSAR 7.4" (PRR 422507)
HA2.1	Replaced the text from "Visible damage (Note 4) to any safety-related structure, system, or component within any Table H-1 area OR Control Room indication of degraded performance of any safety-related structure, system, or component within any Table H-1 area" with "Visible damage (Note 4) to **any** Table H-1 structure **OR** system/component required for safe shutdown of the plant **OR** Control Room indication of degraded performance of **any** safe shutdown structure, system, or component within **any** Table H-1 area" in the procedure and on the EAL matrix. Replaced Calc HNP-E/ELEC-0001 Appendix 2, Safe Shutdown Equipment List" with "AOP-036, Safe Shutdown Following A Fire" and added "FSAR 7.4" (PRR 422507)
Table H-1	Changed "safety related" to "safe shutdown" in the procedure and on the EAL matrix
Table F-1	Changed the symbol < with "Less than" in the Containment Barrier (Potential Loss) column number 7 in the procedure and on the EAL matrix
Attachment 2 FPB D.7	Changed the symbol < with "Less than" in Fission Product Barrier D.7 – in the procedure
Attachment 3 EAL Matrix	Editorial – changed initiating condition SU5 to SU7 and initiating condition SU6 to SU8
Attachment 3 EAL matrix	Editorial – changed Note 3 in the Note box at the bottom of the HOT and COLD EAL Matrices from "CU2.1, CU2.2, or CU2.3" to "CU3.1, CU3.2, or CU3.3"