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PSM Title: n/a

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	REMOVE	INSERT
EAL EBD-ORG (PWR: N/R)	Rev. 1	Rev. 2
EAL EBD-S (PWR: 17644)	Rev. 2	Rev. 3
EAL EBD-H (PWR: 17582)	Rev. 3	Rev. 4
EAL EBD-A (PWR: 17385)	Rev. 3	Rev. 4
EAL MASTER (PWR: -)	Rev. 8	Rev. 9

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A045

PROCEDURE	TITLE	REV #	REV. DATE
	Introduction	1	2/01/2000
	Definitions	1	2/01/2000
	Organization of Basis Information	2	7/12/2002
EBD-A	Abnormal Rad Levels/Radiological Effluent Category	3	8/8/2002
EBD-F	Fission Product Barrier Degradation Category	3	11/20/2000
EBD-H	Hazards and Other Conditions Affecting Plant Safety Category	3	8/8/2002
EBD-S	System Malfunction Category	2	8/8/2002

Effective Date: 8/8/02

The format of the EAL Basis information was developed to address training needs, to facilitate NRC approval, and to facilitate future revisions and 10 CFR 50.54(q) evaluations. Each EAL Basis is organized in the following manner:

1. Emergency Action Level (EAL) Basis Information Organized by Initiating Condition (IC)

Initiating Condition Identifier

For consistency, DAEC has chosen to make its Initiating Condition (IC) identifiers identical to those used in NEI document NUMARC/NESP-007. The EAL Technical Basis information is organized by generic IC identifier number and name. NUMARC/NESP-007 organized the generic information into four Recognition Categories. These are:

A - Abnormal Rad Levels/Radiological Effluent
F - Fission Product Barrier Degradation
H - Hazards and Other Conditions Affecting Plant Safety
S - System Malfunctions

For the A, H, and S recognition categories, all EAL basis information is organized by IC identifier in escalating emergency class order from Unusual Event through General Emergency. For the F recognition category, the initiating conditions are the combinations of fission product barrier losses and potential losses that correspond to each emergency classification level. The individual indicators used on the fission barrier table are separately discussed below. The generic IC identifiers use two letters followed by one number. The first letter corresponds to the event category as shown above. The second letter corresponds to the emergency classification level for the IC:

U - (Notification of) Unusual Event
A - Alert
S - Site Area Emergency
G - General Emergency

The number designates whether the IC is the first, second, third, etc., IC for that recognition category under that emergency classification. For example, SU2 is the designator for the second System Malfunction recognition category IC in the Unusual Event classification, etc. Generic information is used from NEI/NESP-007, Revision 4, dated May, 1999.

Event Type

This is the label of the applicable row for the EAL Tables shown in EPIP Appendix 1. The event type lists the general area of concern and includes Offsite Rad Conditions, Onsite Rad Conditions, Natural Disasters, Fire, Other Hazards and Failures, Security, Control Room Evacuation, EC/OSM Judgment, Loss of Power, RPS Failure, Inability to Maintain Shutdown Conditions, Instrumentation/Communication, Coolant Activity, and Coolant Leak. This structure was chosen to be consistent with the previous EAL presentation which is already familiar to the Emergency Coordinators and Operations Shift Managers. It is also permissible to organize the generic information in this manner based on the response to Question 5 contained in the *NUMARC Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 2 Questions and Answers June 1993.*

Applicable Operating Modes

The applicable operating modes for each Initiating Condition/Emergency Action Level is then listed based on NUMARC/NESP-007 mode descriptions. The DAEC EALs use the operating modes defined in Technical Specifications Table 1.1-1. These are:

1 - Run/Power Operation
2 - Startup
3 - Hot Shutdown[a]
4 - Cold Shutdown[a]
5 - Refueling[b]

[a]All reactor vessel head closure bolts fully tensioned.
[b]One or more reactor vessel head closure bolts less than fully tensioned.

Operating mode applicability of EALs is based on the operating mode that the plant was in immediately before the event sequence leading to entry into the emergency classification. For example, events/conditions addressed by EALs applicable to Run mode are expected to lead to reactor trip which should bring the plant to Hot Shutdown (Mode 3). However, the appropriate emergency classification would still be based on the applicable EALs for Run/Power Operation (Mode 1) for these events/conditions. *If "ALL" operating modes are specified for the EAL, then the EAL applies to all modes identified above plus defueled conditions.*

EAL Threshold Value

The EAL Threshold Value is then listed. This list contains the values, parameters and/or conditions needed for Classification decision making. EAL determination is made from the EAL Threshold Value criteria. When more than one criteria is provided, logic phrasing is used to describe whether several conditions need to be met or only one is necessary.

DAEC EAL Information

This contains the plant-specific information used to implement the generic EALs. This section will also include the basis, as appropriate, for deviation from generic EALs. As appropriate, description of any supporting calculations, their underlying bases and assumptions, and their results are included in this section.

References

The references used to develop the DAEC EAL Information are listed here, as appropriate.

2. Fission Product Barrier Table Indicators

The basis information for the fission barrier table indicators is organized similarly to the other basis information described above. For each barrier - fuel clad, RCS, and primary containment - basis information is organized by "Indicator." The indicator is the name for the row on the fission barrier table and is used for convenient grouping of similar symptoms, similar to the "Event Type" used for the A, H, and S EALs described above. Indicators include Radiation/Core Damage, RPV Level, Leakage, Primary Containment Atmosphere, and EC/OSM Judgment.

After the DAEC Indicator, the applicable generic BWR fission product barrier indicators are then displayed, showing both the generic loss and potential loss conditions, as applicable. Next displayed is the appropriate DAEC information and references. These are displayed in the same manner as the A, H, and S recognition category basis information described above.

EAL BASES DOCUMENT	EBD-A Rev. 4
ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT CATEGORY	PAGE 1 of 26

Effective Date: ~~7-12-02~~ 8/8/02

TECHNICAL REVIEW

Prepared by: Richard C. Flannery Date: 3/20/02

Reviewed by: Lisa A. Gibney Date: 03-21-02
Independent Reviewer

PROCEDURE APPROVAL

I am responsible for the technical content of this procedure and for obtaining the necessary approval from the State and County Emergency Management officials prior to implementation.

Documentation of State and County Emergency Management approval is via NEP- 2002-0030

Approved by: Paul Sullivan Date: 6/21/2
Manager, Emergency Planning

Table of Contents

AU1 Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment That Exceeds Two Times the Offsite Dose Assessment Manual (ODAM) Limit and is Expected to Continue For 60 Minutes or Longer

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3 or 4)

1. A valid reading on radiation monitors that corresponds to a release that is expected to exceed 2X ODAM level for 60 minutes or longer as indicated by:

   Reactor Building or Turbine Building ventilation (Kaman) rad monitor reading above 1 E-3 µCi/cc.

   OR

   Offgas Stack (Kaman) rad monitor reading above 1 E-1 µCi/cc.

   OR

   LLRPSF (Kaman) rad monitor reading above 5 E-4 µCi/cc.

   OR

   GSW rad monitor reading above 3E+3 CPS.

   OR

   RHRSW & ESW rad monitor reading above 8E+2 CPS.

   OR

   RHRSW & ESW Discharge Canal rad monitor reading above 1E+3 CPS.

2. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates with a release duration expected to exceed 60 minutes in excess of 2X ODAM limit.

3. Valid perimeter radiation monitor reading of greater than 0.10 mR/hr above normal background for 60 minutes.

4. Valid dose assessment indicating dose rates beyond the site boundary above 0.1 mR/hr TEDE for a period greater than 60 minutes.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results.

UNPLANNED, as used in this context, 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. The Emergency Director 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. Also, if an ongoing release is detected and the starting time for that release is unknown, the Emergency Director should, in the absence of data to the contrary, assume that the release has exceeded 60 minutes.

The approach taken for calculation of gaseous radioactive effluent EAL setpoints includes use of the ODAM Table 3-2 source term computed by BWR-GALE for the DAEC Base Case. The release is assumed to be from a single release point. Multiple release points would be difficult to present as explicit EAL threshold values and in any case, are addressed by off-site dose assessment by MIDAS, which is the preferred method for determining this condition. The calculation methods for setpoint determination are from ODAM Section 3.4 and are based on Regulatory Guide 1.109 methodology. The table below lists the results of the gaseous effluent EAL calculations. The Kaman extended range capability is used because the General Electric Offgas Stack monitor has a limited range.

AU1

	Gaseous Effluent EALs			
	Offgas Stack Kaman 9/10		Turbine Bldg (Kaman 1/2) and Reactor Bldg (Kaman 3/4, 5/6, 7/8)	
Maximum flow (CFM)	10,000		72,000	
Release Limits	Concentration (µCi/cc)	Release Rate (µCi/sec)	Concentration (µCi/cc)	Release Rate (µCi/sec)
Tech Spec	1.1E-1	5.2E+5	6.2E-4	2.1E+4
Unusual Event (2 x TS)	2.0E-1	1.0E+6	1.2E-3	4.2E+4
Alert (60 x TS)	6.0E+0	3.0E+7	3.7E-2	1.3E+6
	LLRPSF Kaman 12			
Maximum flow (CFM)	99,000			
Release Limits	Concentration (µCi/cc)		Release Rate (µCi/sec)	
Tech Spec	5.9E-4		2.8E+4	
Unusual Event (2 x TS)	1.0E-3		5.6E+4	
Alert (200 x TS)	1.0E-1		5.6E+6	

The off-gas stack is treated as an elevated release and the turbine building and reactor building vents are treated as mixed-mode releases. The ground level setpoints are taken from the default setpoint calculations from the quarterly surveillance tests performed by DAEC Chemistry technicians. Reactor Building, Turbine Building, LLRPSF (Low Level Radwaste Processing and Storage Facility) and Offgas Stack Noble Gas Monitor alarm setpoints are calculated based on achieving the Tech Spec instantaneous release limit, assuming annual average meteorology as defined in the ODAM. The Tech Spec Limit currently corresponds to a reactor building or turbine building ventilation alarm setpoint of 6.2 E-04 µCi/cc. The monitor alarm setpoint can be periodically adjusted but typically does not vary by much. The DAEC EAL therefore addresses valid radiation levels exceeding 2 times the alarm setpoint for greater than 60 minutes. Rounded off, this corresponds to 1 E-3 µCi/cc. The corresponding offgas stack monitor value is 1.1E-1 µCi/cc, rounded off to 1 E-1 µCi/cc. The Tech Spec Limit currently for the LLRPSF building ventilation alarm setpoint is 5.9 E-04 µCi/cc. The DAEC EAL therefore addresses valid radiation levels exceeding 2 times the alarm setpoint for greater than 60 minutes. This corresponds to 1 E-3 µCi/cc.

Technical specification setpoints for radioactive liquid radiation monitors are 10 times the 10 CFR 20 Appendix B, Table 2, Water Effluent Concentration (WEC) limits. It is the policy of DAEC to process all liquid radwaste so that no release of radioactive liquid to the environment is allowed. The radwaste effluent line which could be used as a batch release mechanism has a trip function that prevents exceeding the DAEC release limit, however, an EAL has been provided. The other pathways to the environment (RHRSW - to cooling tower, RHRSW - to discharge canal) have radiation monitors with readouts going to the

AU1

Control Room. These systems could become contaminated if heat exchanger leaks develop; however, historically this has not occurred in the service water systems at DAEC. These monitors are displayed on panels 1C02 and 1C10.

Reactor water is the likely source of contamination through the service water systems as opposed to floor drain, detergent drain, and chemical waste discharge. The floor drain and detergent drains go to Radwaste Processing and would be batch released to the Radwaste effluent discharge line (if such a release were to occur). The chemical discharge sump is normally a radioactivity clean system and is tested by Chemistry to ensure no contamination, prior to discharging to the canal.

The setpoints for the three service water radiation effluent monitors vary because of differences in detector efficiencies and background. Setpoints based on the same reactor water sample are listed below to show the differences. The rounded off readings will be used for the EALs for ease of reading the monitor scales.

Monitor	TS Limit	Reading	UE Level	Alert Level
GSW	1,555 CPS	1.5E+3 CPS	3E+3 CPS	3E+5 CPS
RHRSW & ESW to cooling tower	413 CPS	4E+2 CPS	8E+2 CPS	8E+4 CPS
RHRSW & ESW to Discharge Canal	507 CPS	5E+2 CPS	1E+3 CPS	1E+5 CPS

There are no significant deviations from the generic EALs. However, DAEC does not have a telemetered radiation monitoring system. As an alternative, use of field instruments was considered. It is not practical to establish an EAL based on field survey readings of 0.1 mR/hr for greater than 60 minutes because field instruments in use for emergency response do not have a threshold of detection to meet such criteria.

Hourly Whole Body Dose Corresponding to 2 x ODAM Limit for Gaseous Release

ODAM limit = 500 mrem/year Whole Body Dose

2 x **ODAM** limit = [2 x 500 mrem/year]/8760 hours/year = 0.114 mrem Whole Body in one hour

Rounded off to 0.1 mrem

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE). This is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the

AU1

radiation monitor readings calculated in accordance with the generic methodology. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE could therefore only be determined either by: (1) utilizing MIDAS, or (2) gaseous effluent sampling. DAEC EAL 4 is written in terms of TEDE and the gaseous effluent radiation monitor readings are determined based on ODAM.

REFERENCES:

1. Offsite Dose Assessment Manual Section 6.1.2 and 7.1.2 Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
5. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AU1

AU2 Unexpected Increase in Plant Radiation

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3 or 4)

1. Valid WR GEMAC Floodup indication (LI-4541) coming on scale in the reactor refueling cavity with all irradiated fuel assemblies remaining covered by water or valid field report to Control Room of same.
2. Valid fuel pool level indication (LI-3413) below 36 feet and lowering with all irradiated fuel assemblies remaining covered by water or valid field report to Control Room of same.
3. Valid radiation reading for irradiated spent fuel in dry storage ≥ 0.1mR/hr.
4. Valid Direct Area Radiation Monitor readings increases by a factor of 1000 over normal* levels.

* Normal levels can be considered as the highest reading in the past twenty-four hours excluding the current peak value.

DAEC EAL INFORMATION:

There are no significant deviations from the generic EALs. DAEC does not have a spent fuel transfer canal or on-site dry storage of spent fuel.

Uncontrolled means that the condition is not the result of planned actions by the plant staff in accordance with procedures. *Valid* means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results.

There are three methods to determine water level decreases of concern. The first method is by report to the control room. The other methods include use of the Floodup level indicator and the spent fuel pool level indicator. These are further described below.

During preparation for reactor cavity flood up prior to entry into refuel mode, reactor vessel level instrument LI-4541 (WR GEMAC, FLOODUP) on control room panel 1C04 is placed in service by I&C personnel connecting a compensating air signal after the reference leg is disconnected from the reactor head. Normal refuel water level is above the top of the span of this flood up level indicator. A valid indication (*e.g.*, not due to loss of compensating air

signal or other instrument channel failure) of reactor cavity level coming on span for this instrument is used at DAEC as an indicator of uncontrolled reactor cavity level decrease.

DAEC Technical Specifications require a minimum of 36 feet of water in the spent fuel pool. During refueling, the gates between the reactor cavity and the refueling cavity are removed and the spent fuel pool level indicator LI 3413 is used to monitor refueling water level. Procedures require that a normal refueling water level be maintained at 37 feet 5 inches. A low level alarm actuates when spent fuel pool level drops below 37 feet 1 inch. Symptoms of inventory loss at DAEC include visual observation of decreasing water levels in reactor cavity or spent fuel storage pool, Reactor Building (RB) fuel storage pool radiation monitor or refueling area radiation monitor alarms, observation of a decreasing trend on the spent fuel pool water level recorder, and actuation of the spent fuel pool low water level alarm. To eliminate minor level perturbations from concern, DAEC uses LI 3413 indicated water level below 36 feet and lowering.

Increased radiation levels can be detected by the local refueling floor area radiation monitors, the refueling floor Continuous Air Monitor (CAM) alarm, refueling areas radiation monitors, fuel pool ventilation exhaust monitors, and by Standby Gas Treatment (SGBT) System automatic start. Applicable area radiation monitors include those that are displayed on Panel 1C02 and alarmed on Panel 1C04B. The DAEC EAL has also been written to reflect the case where an ARM may go offscale high prior to reaching 1,000 times the normal reading.

NOTE: On Annunciator Panel 1C04B, the indicators listed below are expected alarms during pre-planned transfers of highly radioactive material through the affected area. If an HP Technician is present, sending an Operator is not required. Radiation levels other than those expected should be promptly investigated. The indicators are high radiation alarms from the Hot Laboratory or Administrative Building, the new fuel storage area, and the radwaste building.

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Isolation
2. Technical Specification 3.7.8, Spent Fuel Pool Water Level
3. Emergency Plan Implementing Procedure (EPIP) 3.1, Inplant Radiological Monitoring, Attachment 1, ARM Locations
4. Emergency Operating Procedures (EOP) Basis Document, Breakpoints for RC/L & L
5. Surveillance Test Procedure (STP) 3.0.0.0-01PA, Daily and Shift Instrument Checks
6. Integrated Plant Operating Instruction (IPOI) 8 , Outage and Refueling Operations
7. Fuel & Reactor Component Handling Procedure (F&RCHP) 5, Procedure for Moving Core Components Between Reactor Core and Spent Fuel Pool, Within the Reactor Core, or Within the Spent Fuel Pool
8. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AA1 Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds 200X the Offsite Dose Assessment Manual (ODAM) Limit and is Expected to Continue for 15 Minutes or Longer

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3 or 4)

1. A valid reading on radiation monitors that corresponds to 200X ODAM level as indicated by any of the following:

   Reactor Building or Turbine Building ventilation (Kaman) rad monitor reading above 3 E-2 µCi/cc and expected to last for 15 minutes or longer.

   OR

   Offgas Stack (Kaman) rad monitor reading above 6 E+0 µCi/cc and expected to last for 15 minutes or longer.

   OR

   LLRPSF (Kaman) rad monitor reading above 1 E-1 µCi/cc and expected to last for 15 minutes or longer.

   OR

   GSW rad monitor reading above 3E+5 CPS and expected to last for 15 minutes or longer.

   OR

   RHRSW & ESW rad monitor reading above 8E+4 CPS and expected to last for 15 minutes or longer.

   OR

   RHRSW & ESW Discharge Canal rad monitor reading above 1E+5 CPS and expected to last for 15 minutes or longer .

2. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates with a release duration expected to last for 15 minutes or longer in excess of 200X ODAM limit.

3. Valid site boundary radiation reading of greater than 10 mR/hr above normal background and expected to last for 15 minutes or longer.

4. Valid indication on MIDAS of a release greater than 200X ODAM limit and expected to last for 15 minutes or longer.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results. In a case where data from Kaman readings is being used to determine whether an EAL threshold value has been exceeded, *Valid* means that flow through the associated Kaman Monitor has been verified and does exist as indicated in uCi/sec on SPRAD.

UNPLANNED, as used in this context, 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. The Emergency Director should not wait until 15 minutes has elapsed, but should declare the event as soon as it is determined that the release duration has or will likely exceed 15 minutes. Also, if an ongoing release is detected and the starting time for that release is unknown, the Emergency Director should, in the absence of data to the contrary, assume that the release has exceeded 15 minutes.

Gaseous Effluent EALs					
	Offgas Stack Kaman 9/10		Turbine Bldg (Kaman 1/2) and Reactor Bldg (Kaman 3/4, 5/6, 7/8)		
Maximum flow (CFM)	10,000		72,000		
Release Limits	Concentration (µCi/cc)	Release Rate (µCi/sec)	Concentration (µCi/cc)	Release Rate (µCi/sec)	
Tech Spec	1.1E-1	5.2E+5	6.2E-4	2.1E+4	
Unusual Event (2 x TS)	2.0E-1	1.0E+6	1.2E-3	4.2E+4	
Alert (60 x TS)	6.0E+0	3.0E+7	3.7E-2	1.3E+6	
	LLRPSF Kaman 12				
Maximum flow (CFM)	99,000				
Release Limits	Concentration (µCi/cc)	Release Rate (µCi/sec)			
Tech Spec	5.9E-4	2.8E+4			
Unusual Event (2 x TS)	1.0E-3	5.6E+4			
Alert (200 x TS)	1.0E-1	5.6E+6			

The off-gas stack is treated as an elevated release and the turbine building and reactor building vents are treated as mixed-mode releases. The ground level setpoints are taken from the default setpoint calculations from the quarterly surveillance tests performed by DAEC Chemistry technicians. Reactor Building, Turbine Building, LLRPSF (Low Level Radwaste Processing and Storage Facility) and Offgas Stack Noble Gas Monitor alarm setpoints are calculated based on achieving the Tech Spec instantaneous release limit assuming annual average meteorology as defined in the ODAM. The Tech Spec Limit currently corresponds to a reactor building or turbine building ventilation alarm setpoint of 6.2 E-4 µCi/cc. The monitor alarm setpoint can be periodically adjusted but typically does not vary by much. For the Offgas Stack, Reactor Building and Turbine building KAMAN monitor readings, DAEC chose to multiply the technical specification concentration by a factor of 60 (instead of 200) in order to allow for a logical step progression in monitor setpoints from the AU1 through AA1 to AS1. The DAEC EAL therefore addresses valid radiation levels exceeding 60 times the alarm setpoint for greater than 15 minutes. Rounded down, this corresponds to 3 E-2 µCi/cc. The corresponding offgas stack monitor value is 6.6 µCi/cc, rounded down to 6 E+0 µCi/cc. The Tech Spec Limit currently for the LLRPSF building ventilation alarm setpoint is 5.9 E-04 µCi/cc. The DAEC EAL therefore addresses valid radiation levels exceeding 200 times the alarm setpoint for greater than 15 minutes. This corresponds to 1 E-1 µCi/cc.

Technical specification setpoints for radioactive liquid radiation monitors are 10 times the 10 CFR 20 Appendix B, Table 2, Water Effluent Concentration (WEC) limits. It is the policy of DAEC to process all liquid radwaste so that no release of radioactive liquid to the

environment is allowed: The radwaste effluent line which could be used as a batch release mechanism has a trip function that prevents exceeding the DAEC release limit, and therefore no EAL limits are provided. The other pathways to the environment (RHRSW - to cooling tower; RHRSW - to discharge canal) have radiation monitors with readouts going to the Control Room. These systems could become contaminated if heat exchanger leaks develop; however, historically this has not occurred in the service water systems at DAEC. These monitors are displayed on panels 1C02 and 1C10.

Reactor water is the likely source of contamination through the service water systems as opposed to floor drain, detergent drain, and chemical waste discharge. The floor drain and detergent drains go to Radwaste Processing and would be batch released to the Radwaste effluent discharge line (if such a release were to occur). The chemical discharge sump is normally a radioactivity clean system and is tested by Chemistry to ensure no contamination prior to discharging to the canal.

The setpoints for the three service water radiation effluent monitors vary because of differences in detector efficiencies and background. Setpoints based on the same reactor water sample are listed below to show the differences. The rounded off readings will be used for the EALs for ease of reading the monitor scales.

Monitor	TS Limit	Reading	UE Level	Alert Level
GSW	1,555 CPS	1.5E+3 CPS	3E+3 CPS	3E+5 CPS
RHRSW & ESW to cooling tower	413 CPS	4E+2 CPS	8E+2 CPS	8E+4 CPS
RHRSW & ESW to Discharge Canal	507 CPS	5E+2 CPS	1E+3 CPS	1E+5 CPS

DAEC does not have a telemetered radiation monitoring system. As an alternative, DAEC uses valid field survey readings outside the site boundary greater than 10 mR/hr or greater than 50 mR/hr CDE Thyroid.

Hourly Whole Body Dose Corresponding to 200 x ODAM Limit for Gaseous Release

ODAM limit = 500 mrem/year Whole Body

200 x **ODAM** limit = [200 x 500 mrem/year]/8760 hours/year = 11.4 mrem Whole Body in one hour

Rounded off to 10 mrem

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE). This is somewhat different from whole body dose from

gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in AU1 in accordance with the generic methodology. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE could therefore only be determined either by: (1) utilizing MIDAS, or (2) gaseous effluent sampling. DAEC EAL 4 is written in terms of TEDE and the gaseous effluent radiation monitor readings are determined based on ODAM.

REFERENCES:

1. Offsite Dose Assessment Manual Section 6.1.2 and 7.1.2 Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
5. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
6. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AA2 Major Damage to Irradiated Fuel or Loss of Water Level that Has or Will Result in the Uncovering of Irradiated Fuel Outside the Reactor Vessel

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3 or 4)

1. Any of the following valid radiation monitor readings for the refuel floor area, fuel handling area, and the fuel bridge area:
   - ARM HI RAD alarm for the Refueling Floor North End, Refueling Floor South End, New Fuel Storage Area, or Spent Fuel Storage Area
   - Refueling Floor North End, Refueling Floor South End, or New Fuel Storage Area ARM Reading above 10 mR/hr
   - Spent Fuel Storage Area ARM Reading above 100 mR/hr
2. Report of Visual observation of irradiated fuel uncovered.
3. Water level reading below 450" as indicated on LI4541 (floodup) for the Reactor Refueling Cavity that will result in Irradiated Fuel becoming uncovered or valid field report to Control Room of same.
4. Valid Spent Fuel Pool water level indication (LI-3413) below 16 feet Water Level that will result in Irradiated Fuel being uncovering or valid field report to Control Room of same.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results. Valid alarms are solely due to damage to irradiated fuel or loss of water level that has or will result in the uncovering of irradiated fuel.

There are no significant deviations from the generic EALs. Increased radiation levels can be detected by the local radiation monitors, in-plant radiological surveys, new fuel and spent fuel storage area radiation monitor alarms displayed on panel 1C04B, fuel pool ventilation exhaust monitors, and by Standby Gas Treatment (SBGT) System automatic start. Applicable area radiation monitors include RT 9163, RT 9164, RT 9153, and RT 9178.

These monitors are located in the north end of the refuel floor, the south end of the refuel floor, the new fuel vault area, and near the spent fuel pool, respectively.

Per ARP 1C04B, the applicable area radiation monitor alarms actuate when radiation levels increase above 100 mR/hr in the spent fuel pool area or above 10 mR/hr in the other three areas of concern. If a valid actuation of these alarms were to occur, the refueling floor would be immediately evacuated. Thus, a report of a fuel handling accident with either valid actuation of the fuel area alarms on panel 1C04B or with measured radiation levels in the spent fuel pool or north fuel area are used to address the generic concern consistent with DAEC design and procedures.

During preparation for reactor cavity flood up prior to entry into refuel mode, reactor vessel level instrument LI-4541 (WR GEMAC; FLOODUP) on control room panel 1C04 is placed in service by I&C personnel connecting a compensating air signal after the reference leg is disconnected from the reactor head. Normal refuel water level is above the top of the span of this flood up level indicator. A valid on-scale indication (*e.g.*, not due to loss of compensating air signal or other instrument channel failure) from this instrument can be used to determine uncontrolled loss of water level in the reactor cavity.

During refueling, the gates between the reactor cavity and the refueling cavity are removed and the spent fuel pool level indicator LI 3413 is used to monitor refueling water level. This measures the common water level in the reactor cavity and the fuel pool. The bottom of the fuel transfer slot between the spent fuel pool and the reactor cavity is 16 feet above the bottom of the spent fuel pool. The top of the active fuel in the spent fuel storage racks is slightly less than 13 feet 9 inches above the bottom of the spent fuel pool. Therefore, postulated failures which drain the reactor cavity through the reactor vessel cannot uncover fuel in the spent fuel storage racks. However, valid indication of spent fuel pool level less than 16 feet would indicate that spent fuel in the storage racks may potentially become uncovered.

RFP404 requires that upon a loss of water level situation, that the refueling crew on the refueling floor shall discharge any fuel assembly on the fuel grapple as follows:

- If a fuel assembly is currently being withdrawn from a slot in the core or spent fuel pool, immediately reinsert it into that slot.
- If a fuel assembly is being transferred and is still over or near the core, insert it into the closest available slot in the core.
- If a fuel assembly is being transferred and is over or near the spent fuel pool, insert it into the closest available slot in the spent fuel racks.

Following these actions, the refueling floor is to be evacuated of all personnel. The DAEC EAL is written to address the generic concern that a spent fuel assembly was not fully

covered by water. This can either be by visual observation of an uncovered spent fuel assembly or by trending fuel pool level in the control room if a spent fuel assembly could not be placed in a safe storage location specified by F&RCHP 5 as described above.

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Isolation
2. Technical Specification 3.7.8, Spent Fuel Pool Water Level
3. Emergency Operating Procedures (EOP) Basis Document, Breakpoints for RC/L & L
4. Emergency Plan Implementing Procedure (EPIP) 3.1, Inplant Radiological Monitoring, Attachment 1, ARM Locations
5. Surveillance Test Procedure (STP) 3.0.0.0-01, Daily and Shift Instrument Checks
6. Integrated Plant Operating Instruction (IPOI) 8 , Outage and Refueling Operations
7. Fuel & Reactor Component Handling Procedure RFP404, Procedure for Moving Core Components Between Reactor Core and Spent Fuel Pool, Within the Reactor Core, or Within the Spent Fuel Pool
8. Bechtel Drawing C-492, Reactor Building - Reactor Well, Spent Fuel & Dryer-Separator Pool General Arrangement, Rev. 6
9. Bechtel Drawing C-493, Reactor Building - Spent Fuel Liner Plan Elevations and Details, Sheet 1, Rev. 6
10. Holtec International Drawing No. 1045, Rack Construction - Spent Fuel Storage Racks, Rev. 3
11. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AA3 Release of Radioactive Material or Increases in Radiation Levels Within the Facility That Impedes Operation of Systems Required to Maintain Safe Operations or to Establish or to Maintain Cold Shutdown

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2)

1. Valid area rad monitor (RE9162) reading GREATER THAN 15 mR/hr in the Control Room.

2. Valid area rad monitor (RE9168) reading GREATER THAN 500 mR/hr at the Remote Shutdown Panel, 1C388.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results.

There are no significant deviations from the generic EALs. Per the UFSAR, the control room is the only area that is required to be continuously occupied to achieve and maintain safe shutdown following design basis accidents. The capability exists for plant shutdown from outside the main control room in the event that the control room becomes uninhabitable using remote shutdown panel 1C388. The RB 757 CRD North ARM-9168 is in the vicinity of the Remote Shutdown Panel and is used to monitor radiation levels to determine habitability for that area.

The EC/OSS should determine the cause of the increase in radiation levels and review other EALs for applicability. Expected increases in monitor readings due to controlled evolutions (such as lifting the steam dryer during refueling) do not result in emergency declaration. Nor should momentary increases due to events such as resin transfers or controlled movement of radioactive sources result in emergency declaration. In-plant radiation level increases that would result in emergency declaration, are also *unplanned*, e.g., outside the limits established by an existing radioactive discharge permit.

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Isolation
2. Abnormal Operating Procedure (AOP) 913, Fire
3. Abnormal Operating Procedure (AOP) 914, Security
4. Abnormal Operating Procedure (AOP) 915, Shutdown Outside Control Room
5. Surveillance Test Procedure (STP) 3.0.0.0-01, Daily and Shift Instrument Checks
6. Integrated Plant Operating Instruction (IPOI) 8 , Outage and Refueling Operations
7. Emergency Plan Implementing Procedure (EPIP) 3.1, Inplant Radiological Monitoring
8. UFSAR Section 6.4, Habitability Systems
9. Bechtel Calculation DA-4, Project Number 265-002, Control Room Habitability, 9/3/80
10. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AS1 Site Boundary Dose Resulting from an Actual or Imminent Release of Gaseous Radioactivity Exceeds 100 mrem TEDE or 500 mrem CDE Thyroid for the Actual or Projected Duration of the Release

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3)

1. A valid radiation monitor reading which corresponds to an offsite dose of 100 mrem or 500 mrem Thyroid as indicated by the following:

   Reactor Building or Turbine Building ventilation (Kaman) rad monitor reading above 6 E-2 µCi/cc for more than 15 minutes. (Dose assessment not available)

   OR

   Offgas Stack (Kaman) rad monitor reading above 4 E+1 µCi/cc for more than 15 minutes. (Dose assessment not available)

2. Valid MIDAS dose assessment projection indicates dose consequences greater than 100 mrem TEDE or 500 mrem CDE thyroid.

3. Field survey results indicate site boundary dose rates exceeding 100 mrem/hr expected to continue for more than one hour; or analyses of field survey samples indicate CDE thyroid of 500 mrem for one hour of inhalation.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results. In a case where data from Kaman readings is being used to determine whether an EAL threshold value has been exceeded, *Valid* means that flow through the associated Kaman Monitor has been verified and does exist as indicated in uCi/sec on SPRAD.

The preferred method for declaration of AS1 is by means of Dose Assessment using the MIDAS computer model. However, if Kaman monitor readings are sustained for longer than 15 minutes and the required MIDAS dose assessments cannot be completed within this period, then the declaration can be made using Kaman readings PROVIDED the readings

are not from an isolated flow path. If Kaman readings are not valid, field survey results may be utilized.

DAEC's Meteorological Information and Dose Assessment System (MIDAS) was utilized to determine the KAMAN monitor limits. Eight separate combinations of release point, source term, meteorological conditions and equipment status were analyzed. Pathways considered were the offgas stack, the turbine building exhaust vent and a single reactor building exhaust vent. Multiple release points were not considered. In this same vein, it was assumed that only one of the three reactor building vents is on during the release.

The source terms used have been pre-loaded into MIDAS and are the default mixes associated with a loss of coolant accident (LOCA) and a control rod drop (CRD). The LOCA mix was used in conjunction with a release via the offgas stack while the CRD mix was used for releases via the turbine or reactor building vents. The source term for a release via the offgas stack is further impacted by the status of the standby gas treatment system. The status of that system was also taken into consideration.

Based on 1995 data (NG-96-0987), the atmospheric stability was classified as Pascal E 33% of the time. Consequently, both classifications were evaluated. Based on the same report, the most common wind speeds were:

Pascal Class	Altitude	Speed (mph)
D	156'	8 - 12
D	33'	8 - 12
E	156'	8 - 12
E	33'	4 - 7

Though the temperature setting has no impact on the MIDAS calculations, a value must be entered in order for the program to run. Consequently, the temperature was arbitrarily set at 50 F.

The rain estimate was set at zero, to eliminate any on site washout of radioactive material.

For the first MIDAS runs a 1Ci/cc concentration was assumed. The results of these runs were then normalized to the limits, thus generating a theoretical KAMAN limit. Additional MIDAS runs were made with these theoretical limits as input to verify the normalization process.In addition to the total integrated dose, MIDAS calculates a peak whole body DDE rate resulting from the plume and a peak thyroid CDE rate resulting from inhalation. Because the AS1 and AG1 KAMAN limits are to be based on a one hour exposure, establishing concentration limits so these peak values match the NUMARC limits is acceptable.

Initiating Condition	Site Area Emergency AS1	General Emergency AG1
Valid Turbine or Reactor Building ventilation rad monitor (KAMAN) reading for more than 15 minutes above:	0.06 µCi/cc	0.6 µCi/cc

DAEC does not have a telemetered radiation monitoring system. As an alternative, DAEC uses valid field survey readings outside the site boundary to determine if doses are greater than 100 mR/hr TEDE or greater than 500 mR/hr CDE Thyroid.

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE) and Committed Dose Equivalent (CDE) Thyroid. TEDE is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in AU1. These factors can introduce differences that are at least as large as those introduced by using TEDE versus whole body dose. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE and CDE Thyroid could therefore only be determined either by: (1) utilizing the source term mixture in MIDAS, or (2) gaseous effluent sampling. Therefore, DAEC EAL Threshold Value 4 is written in terms of TEDE and CDE Thyroid.

REFERENCES:

1. Offsite Dose Assessment Manual, Section 6.1.2 and 7.1.2, Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. Radiation Engineering Calculation No. 96-007-A, Determination of DAEC Radioactive Release Initiating Conditions for AS1 & AG1 Emergency Classifications, July 3, 1996
5. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
6. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
7. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AG1 Site Boundary Dose Resulting from an Actual or Imminent Release of Gaseous Radioactivity that Exceeds 1,000 mrem TEDE or 5,000 mrem CDE Thyroid for the Actual or Projected Duration of the Release

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3)

1. A valid radiation monitor reading which corresponds to an offsite dose of 1000 mrem or 5000 mrem Thyroid as indicated by the following:

   Reactor Building or Turbine Building ventilation (Kaman) rad monitor reading above 6 E-1 µCi/cc for more than 15 minutes. (Dose assessment not available)

   OR

   Offgas Stack (Kaman) rad monitor reading above 4 E+2 µCi/cc for more than 15 minutes. (Dose assessment not available).

2. Valid MIDAS dose assessment projection indicates dose consequences greater than 1,000 mrem TEDE or 5,000 mrem CDE thyroid.

3. Field survey results indicate site boundary dose rates exceeding 1,000 mrem/hr expected to continue for more than one hour; or analyses of field survey samples indicate CDE thyroid of 5,000 mrem for one hour of inhalation.

DAEC EAL INFORMATION:

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results. In a case where data from Kaman readings is being used to determine whether an EAL threshold value has been exceeded, *Valid* means that flow through the associated Kaman Monitor has been verified and does exist as indicated in uCi/sec on SPRAD.

The preferred method for declaration of AG1 is by means of Dose Assessment using the MIDAS computer model. However, if Kaman monitor readings are sustained for longer than 15 minutes and the required MIDAS dose assessments cannot be completed within this period, then the declaration can be made using Kaman readings PROVIDED the readings are not from an isolated flow path. If Kaman readings are not valid, field survey results may be utilized.

DAEC's Meteorological Information and Dose Assessment System (MIDAS) was utilized to determine the KAMAN monitor limits. Eight separate combinations of release point, source term, meteorological conditions and equipment status were analyzed. Pathways considered were the offgas stack, the turbine building exhaust vent and a single reactor building exhaust vent. Multiple release points were not considered. In this same vein, it was assumed that only one of the three reactor building vents is on during the release.

The source terms used have been pre-loaded into MIDAS and are the default mixes associated with a loss of coolant accident (LOCA) and a control rod drop (CRD). The LOCA mix was used in conjunction with a release via the offgas stack while the CRD mix was used for releases via the turbine or reactor building vents. The source term for a release via the offgas stack is further impacted by the status of the standby gas treatment system. The status of that system was also taken into consideration.

Based of 1995 data (NG-96-0987), the atmospheric stability was classified as Pascal E 33% of the time. Consequently, both classifications were evaluated. Based on the same report, the most common wind speeds were:

Pascal Class	Altitude	Speed (mph)
D	156'	8 - 12
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Though the temperature setting has no impact on the MIDAS calculations, a value must be entered in order for the program to run. Consequently, the temperature was arbitrarily set at 50 F.

The rain estimate was set at zero, to eliminate any on site washout of radioactive material.

For the first MIDAS runs a 1Ci/cc concentration was assumed. The results of these runs were then normalized to the limits, thus generating a theoretical KAMAN limit. Additional MIDAS runs were made with these theoretical limits as input to verify the normalization process.

In addition to the total integrated dose, MIDAS calculates a peak whole body DDE rate resulting from the plume and a peak thyroid CDE rate resulting from inhalation. Because the AS1 and AG1 KAMAN limits are to be based on a one hour exposure, establishing concentration limits so these peak values match the NUMARC limits is acceptable.

Initiating Condition	Site Area Emergency AS1	General Emergency AG1
Valid Turbine or RB ventilation rad monitor (KAMAN) reading for more than 15 minutes above:	0.06 µCi/cc	0.6 µCi/cc
Valid Offgas Stack ventilation rad monitor (KAMAN) reading for more than 15 minutes above:	40 µCi/cc	400 µCi/cc

DAEC does not have a telemetered radiation monitoring system. As an alternative, DAEC uses valid field survey readings outside the site boundary to determine if doses are greater than 1,000 mR/hr TEDE or greater than 5,000 mR/hr CDE to the Thyroid.

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE) and Committed Dose Equivalent (CDE) Thyroid. TEDE is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in AU1. These factors can introduce differences that are at least as large as those introduced by using TEDE versus whole body dose. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE and CDE Thyroid could therefore only be determined either by: (1) utlizing the source term mixture in MIDAS, or (2) gaseous effluent sampling. Therefore, DAEC EAL Threshold Value 4 is written in terms of TEDE and CDE Thyroid.

REFERENCES:

1. Offsite Dose Assessment Manual, Section 6.1.2 and 7.1.2, Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. Radiation Engineering Calculation No. 96-007-A, Determination of DAEC Radioactive Release Initiating Conditions for AS1 & AG1 Emergency Classifications, July 3, 1996
5. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
6. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
7. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*; May 1999.

Effective Date: ~~7/2/02~~ 8/8/02

TECHNICAL REVIEW

Prepared by: _____ Date: 6/21/02

Reviewed by: _____ Date: 4/8/02
Independent Reviewer

PROCEDURE APPROVAL

I am responsible for the technical content of this procedure and for obtaining the necessary approval from the State and County Emergency Management officials prior to implementation.

Documentation of State and County Emergency Management approval is via NEP- 2002-0030

Approved by: _____ Date: 6/21/2
Manager, Emergency Planning

Table of Contents

HU1 Natural and Destructive Phenomena Affecting the Protected Area

EVENT TYPE: Natural Disasters, Other Hazards and Failures

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

Any one of the following phenomena affecting the Protected Area:

1. Valid Amber Design Basis Earthquake (DBE) light and the wailing seismic alarm on Panel 1C35 are both activated indicating an acceleration greater than ± 0.01 gravity.
2. Report by plant personnel of tornado striking within protected area boundary.
3. Assessment by the control room that a destructive event has occurred.
4. Vehicle crash into plant structures or systems within protected area boundary that are determined to be Safe Shutdown Areas.
5. Report by plant personnel of an unanticipated explosion within the protected area boundary resulting in visible damage to permanent structures or equipment required for Safe Shutdown.
6. Report of turbine failure resulting in casing penetration or damage to turbine or generator seals.
7. River flood water levels above 757.0 ft.
8. The Max Normal operating water level exceeding and EOP 3 limits.
9. River water level below 725 ft. 6 in.

DAEC EAL INFORMATION:

EAL Threshold Value 1 addresses earthquakes that are detected in accordance with AOP 901. For DAEC, a minimum detectable earthquake that is indicated on panel 1C35 is an acceleration greater than ± 0.01 Gravity.

DAEC EAL Threshold Value 2 addresses report of a tornado striking within the protected area or within the plant switchyard.

DAEC EAL Threshold Value 3 allows for the control room to determine that and event has occurred and take appropriate action based on personal assessment as opposed to verification. No attempt is made to assess the actual magnitude of the damage. Such damage can be due to collision, tornadoes, missiles, or any other cause. Damage can be indicated by report to the control room, physical observation, or by Control Room/local control station instrumentation. Such items as scorching, cracks, dents, or discoloration of equipment or structures required for safe shutdown are addressed by this EAL.

DAEC EAL Threshold Value 4 addresses a vehicle (automobile, aircraft, forklift, truck or train) crash that may potentially damage plant structures containing functions and systems required for safe shutdown of the plant. This does not include vehicle crashes with each other or damage to office or warehouse structures. Escalation to Alert under HA1 would occur if damage was sufficient to affect the ability to achieve or maintain safe shutdown, *e.g.*, damage made required equipment inoperable or structural damage was observed such as bent supports or pressure boundary leakage.

Safe Shutdown Areas	
Category	Area
Electrical Power	Switchyard, 1G31 DG and Day Tank Rooms, 1G21 DG and Day Tank Rooms, Battery Rooms, Essential Switchgear Rooms, Cable Spreading Room
Heat Sink/ Coolant Supply	Torus Room, Intake Structure, Pumphouse
Containment	Drywell, Torus
Emergency Systems	NE, NW, SE Corner Rooms, HPCI Room, RCIC Room, RHR Valve Room, North CRD Area, South CRD Area
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C56 Area, SBGT Room

DAEC EAL Threshold Value 5 addresses explosions within the protected area. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to near-by structures or equipment. Damage can be indicated by report to the control room, physical observation, or by Control Room/local control station instrumentation. Such items as scorching, cracks, dents, or discoloration of equipment or structures required for safe shutdown are addressed by this EAL. The EC/OSM needs to consider the security aspects of the explosion, if applicable.

DAEC EAL Threshold Value 6 addresses turbine failure causing observable damage to the turbine casing or damage to turbine or generator seals.

DAEC EAL Threshold Value 7 addresses the observed effects of flooding in accordance with AOP 902. Plant site finished grade is at elevation 757.0 ft. Personnel doors and railroad and truck openings at or near grade would require protection in the event of a flood above elevation 757.0 ft. Therefore, EAL 7 uses a threshold of flood water levels above 757.0 ft.

DAEC EAL Threshold Value 8 addresses internal flooding can be due to system malfunctions, component failures, or repair activity mishaps (such as failed freeze seal) that can threaten safe operation of the plant.

Therefore, this EAL is based on a valid indication that the water level is higher than the maximum normal operating limits. The Maximum Normal Operating Limits are defined as the highest values of the identified parameter expected to occur during normal plant operating conditions with all directly associated support and control systems functioning properly. Exceeding these limits is an entry condition into EOP 3, Secondary Containment Control and may be an indication that water from a primary system is discharging into secondary containment. Exceeding the maximum normal operating limit is interpreted as a potential degradation in the level of the safety of the plant and is appropriately treated as an Unusual Event emergency classification. The maximum normal operating water level limits are taken from AOP 902 and EOP 3 and are shown in the table below:

Maximum Operating Limits - Water Levels			
Affected Location	Indicator	Maximum Normal OL	Maximum Safe OL
HPCI Room Area	LI 3768	2 inches	6 inches
RCIC Room Area	LI 3769	3 inches	6 inches
A RHR Corner Room SE Area	LI 3770	2 inches	10 inches
B RHR Corner Room NW Area	LI 3771	2 inches	10 inches
Torus Area	LI 3772	2 inches	12 inches

EAL Threshold Value 9 addresses the effects of low river water level. The intake structure for the safety-related water supply systems (river water, RHR service water, and emergency service water) is located on the west bank of the Cedar River. An overflow-type barrier across the river was designed and constructed in accordance with Seismic Category I criteria to intercept the stream bed flow and divert it to the intake structure. This makes the entire flow of the river available to the safety-related water supply systems. A minimum flow of 13 cubic feet per second (cfs) from a minimum 1000-year river flow of 60 cfs must be diverted. The top of the barrier wall is at elevation 725 ft. 6 in. River water level below this level represents a potential degradation in the level of safety of the plant and is addressed by EAL Threshold Value 9.

In this EAL, "Vital Area" is defined as plant structures or areas containing equipment necessary for a safe shutdown.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 901, Earthquake
2. Abnormal Operating Procedure (AOP) 902, Flood
3. Abnormal Operating Procedure (AOP) 903, Tornado
4. Emergency Operating Procedure (EOP)-3, Secondary Containment Control
5. EOP Basis Document, EOP-3, Secondary Containment Control
6. UFSAR Chapter 3, Design of Structures, Components, Equipment, and Systems
7. Bechtel Drawing BECH-M017, Equipment Location - Intake Structure Plans at Elevations, Rev. 6

HU2 Fire Within Protected Area Not Extinguished Within 15 Minutes of Detection

EVENT TYPE: Fire

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Fire in buildings or areas contiguous to any of the following areas not extinguished within 15 minutes of control room notification or verification of a control room alarm:

- Reactor, turbine, control, admin/security
- Intake structure
- Pump house

DAEC EAL INFORMATION:

The purpose of this EAL is to address the magnitude and extent of fires that may be potentially significant precursors to damage to safety systems. This includes such items as fires within the administration building, and security building (buildings contiguous to the reactor building, turbine building and control building), yet, excludes fires in the warehouse or construction support center, waste-basket fires, and other small fires of no safety consequence. 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 notification of a VALID fire detection system alarm. Verification of a fire detection system alarm includes actions that can be taken within the control room or other nearby location to ensure that the alarm is not spurious. A verified 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.

Per AOP 913, the location of a fire can be determined by observing 1C40B alarm messages, Zone Indicating Unit (ZIU) alarms, or fire annunciators on panels 1C40 and 1C40A. The location of a fire can also be determined by verbal report of the person discovering the fire. *Verification* of the alarm in this context means those actions taken to determine that the control room alarm is not spurious.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 913, Fire
2. Abnormal Operating Procedure (AOP) 914, Security

HU3 Release of Toxic or Flammable Gases Deemed Detrimental to Safe Operation of the Plant

EVENT TYPE: Other Hazards and Failures

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

Safe operation of the plant is jeopardized by one of the following:

1. Report or detection of toxic or flammable gases that could enter within the site area boundary in amounts that can affect normal operation of the plant.

2. Report by Local, County or State Officials for potential evacuation of site personnel based on offsite event.

DAEC EAL INFORMATION:

This Threshold Value is based on releases in concentrations within the site boundary that will affect the health of plant personnel or affecting the safe operation of the plant with the plant being within the evacuation area of an offsite event (i.e., tanker truck accident releasing toxic gases, etc.) The evacuation area is as determined from the DOT Evacuation Tables for Selected Hazardous Materials, in the DOT Emergency Response Guide for Hazardous Materials.

For the purposes of this EAL, CO_2 (such as is discharged by the fire suppression system) is not toxic. CO_2 can be lethal if it reduces oxygen to low concentrations that are immediately dangerous to life and health (IDLH). *CO_2 discharge into an area is not basis for emergency classification under this IC unless: (1) Access to the affected area is required, and (2) CO_2 concentration results in conditions that make the area uninhabitable or inaccessible (i.e., IDLH).*

REFERENCES:

1. UFSAR Section 2.2, Nearby Industrial, Transportation, and Military Facilities
2. UFSAR Section 6.4, Habitability Systems

HU4 Confirmed Security Event Which Indicates a Potential Degradation in the Level of Safety of the Plant

EVENT TYPE: Security event with potential loss of level of safety of the plant.

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following:

1. Suspected sabotage device discovered within the Protected Area **AND** outside a plant Vital Area.
2. Suspected sabotage device discovered outside the Protected Area in the plant switchyard.
3. Confirmed tampering with safety related equipment.
4. A hostage situation that disrupts normal plant operations.
5. Civil disturbance **OR** strike which disrupts normal plant operations.
6. Internal disturbance that is not short lived or that is not a harmless outburst involving one or more individuals within the Protected Area.
7. "LO" credible threats as determined by NMC SE-0018, "Security Threat Assessment".

DAEC EAL INFORMATION:

Security events which do not represent at least 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. The term "suspected sabotage device" is used in place of "bomb device" for consistency with the DAEC Safeguards Contingency Plan.

Consultation with Security supervision is required to determine these Threshold Values.

EAL 1 describes a suspected sabotage device discovered within the Protected Area but outside an area that contains safety functions or systems. It is a potential degradation of the level of safety of the plant and is an UNUSUAL EVENT.

EAL 2 describes a suspected sabotage device discovered in the plant switchyard representing a potential degradation of the level of safety of the plant.

EAL 3 is for confirmed tampering and is adapted from the list of security plan contingencies.

EAL 4 identifies a hostage situation that disrupts normal plant operations. A hostage situation is considered to disrupt normal operations if it results in the inability to perform surveillance activities, alters unit operations, or as described in the security plan.

EAL 5 describes a civil disturbance or strike is considered to be a spontaneous activity that disrupts normal plant operations. A civil disturbance or strike is considered to disrupt normal plant operations if it initially disrupts normal ingress or egress to the owner controlled or protected area, or if it requires assistance from the Local Law Enforcement Agencies (LLEA) to control.

EAL 6 deals with suspicious internal disturbances that may have been planned by unauthorized personnel as a diversion to gain entry to the site property.

EAL 7 ensures that appropriate notifications for the security threat are made in a timely manner. The determination of "LO credible threat" or "HI credible threat" is based on information found in NMC SE-0018, "Security Threat Assessment". The emergency response to a "LO" Credible Threat is initiated through AOP 914, "Security Events" and EPIP 2.8, "Security Threat". A "HI credible" threat would escalate this classification to the ALERT status as an HA4. Only the plant to which the specific threat is made need declare the Notification of Unusual Event.

Suspected sabotage devices discovered within the plant Vital Area would result in escalation via other Security EALs.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 914, Security Events
2. NMC SE-0018, "Security Threat Assessment"
3. EPIP 2.8, "Security Threat"

HU5 Other Conditions Existing Which in the Judgment of the EC/OSM Warrant Declaration of an Unusual Event

EVENT TYPE: EC/OSM Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the judgment of the Emergency Director indicate a potential degradation of the level of safety of the plant.

DAEC EAL INFORMATION:

The EAL addresses conditions that fall under the Notification of Unusual Event emergency classification description contained in NUREG-0654, Appendix 1, that is retained under the generic methodology.

> Events are in process or have occurred which indicate a potential degradation of the level of safety of the plant. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

Per EPIP 2.5, the Emergency Coordinator/Operations Shift Manager (EC/OSM) is the title for the emergency director function at DAEC.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. NUREG-0654/FEMA-REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, Revision 1, October 1980, Appendix 1

HA1 Natural and Destructive Phenomena Affecting the Plant Vital Area

EVENT TYPE: Natural Disasters, Other Hazards and Failures

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

Any one of the following phenomena affecting the Protected Area:

1. Valid Amber Operating Basis Earthquake (OBE) light and the wailing seismic alarm on Panel 1C35 are both activated indicating an acceleration greater than ± 0.06 gravity
2. Tornado striking plant vital areas.
3. Assessment by the control room that damage has affected Safe Shutdown Areas.
4. Vehicle crash affecting plant vital areas.
5. Sustained high wind speed of 95 miles per hour or above affecting plant vital areas.
6. Missiles affecting safe shutdown areas.
7. River flood water levels above 767.0 ft.
8. The Max Safe operating water level exceeding and EOP 3 limits in two or more areas AND reactor shutdown is required.
9. River water level below 724 ft. 6 in.

DAEC EAL INFORMATION:

There are no significant deviations from the generic EALs. *For the events of concern here, the key issue is not the wind speed, earthquake intensity, etc., but whether there is resultant damage to equipment or structures required to achieve or maintain safe shutdown, regardless of the cause.* Determination of damage affecting the ability to achieve or maintain safe shutdown can be indicated by reports to the control room, physical observation or by Control Room/local control station instrumentation.

EAL Threshold Value 1 addresses OBE events that are detected in accordance with AOP 901. For DAEC, the OBE is associated with a peak horizontal acceleration of ± 0.06 Gravity.

DAEC EAL Threshold Value 2 addresses report of a tornado striking a plant vital area.

DAEC EAL Threshold Value 3 addresses a report to the control room of damage affecting safe shutdown areas. The reported damage can be from tornadoes, high winds, flooding, missiles, collisions, or any other cause.

DAEC EAL Threshold Value 4 addresses vehicle (automobile, aircraft, forklift, truck or train) confirmed crashes affecting plant vital areas. This does not include vehicle crashes with each other or damage to office or warehouse structures.

DAEC EAL Threshold Value 5 addresses sustained high wind speeds as measured by the 33-Foot or 156-Foot elevations on the Meteorological Tower. *Sustained wind speed* means the baseline wind speed measured by meteorological tower that does not include gusts. The design basis wind speed is 105 miles per hour. However, the meteorological instrumentation is only capable of measuring wind speeds up to 100 miles per hour. Thus the alert level for sustained high wind speed, 95 miles per hour, is selected to be on-scale for the meteorological instrumentation and to conservatively account for potential measurement errors.

DAEC EAL Threshold Value 6 addresses missiles affecting safe shutdown areas. Such missiles can be from any cause, *e.g.*, tornado-generated; turbine, pump or other rotating machinery catastrophic failure; or generated from an explosion.

Per AOPs 913 and 914, the following areas are identified as safe shutdown areas and are shown on the EAL tables. This table is displayed as an aid to the Emergency Coordinator in determining appropriate areas of concern.

Safe Shutdown Areas	
Category	Area
Electrical Power	Switchyard, 1G31 DG and Day Tank Rooms, 1G21 DG and Day Tank Rooms, Battery Rooms, Essential Switchgear Rooms, Cable Spreading Room
Heat Sink/ Coolant Supply	Torus Room, Intake Structure, Pumphouse
Containment	Drywell, Torus
Emergency Systems	NE, NW, SE Corner Rooms, HPCI Room, RCIC Room, RHR Valve Room, North CRD Area, South CRD Area
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C56 Area, SBGT Room

DAEC EAL Threshold Value 7 addresses river water levels exceeding design flood water levels. All Seismic Category I structures and non-seismic structures housing Seismic Category I equipment are designed to withstand the hydraulic head resulting from the "maximum probable flood" to which the site

could be subjected. The design flood water is at elevation 767.0 ft. Major equipment penetrations in the exterior walls are located above elevation 767.0 ft. Openings below the flood level are either watertight or are provided with means to control the inflow of water in order to ensure that a safe shutdown can be achieved and maintained. Consideration has also been given to providing temporary protection for openings in the exterior walls up to flood levels of 769.0 ft. All buildings were also checked for uplift (buoyancy) for a flood level at elevation 767.0 ft, and the minimum factor of safety used was 1.2. Therefore, DAEC EAL 7 uses as its threshold flood water levels above 767 feet.

DAEC EAL Threshold Value 8 addresses internal flooding consistent with the requirements of EOP 3, Secondary Containment Control. If RPV pressure reduction will decrease leakage into secondary containment then this is due to leakage from the primary system, which is addressed by the Fission Barrier Table indicators and System Malfunction EALs, and is not addressed here. Therefore, EAL 8 addresses conditions in which water level in two or more areas is above Maximum Safe Operating Limits and reactor shutdown is *required. Required* means that the reactor shutdown was procedurally mandated by EOP 3 and is not merely performed as a precaution or inadvertently. *Maximum Safe Operating Limits* are defined as the highest parameter value at which neither (1) equipment necessary for safe shutdown of the plant will fail nor (2) personnel access necessary for the safe shutdown of the plant will be precluded. The internal flooding can be due to system malfunctions, component failures, or repair activity mishaps (such as failed freeze seal) that can threaten safe operation of the plant. This includes water intrusion on equipment that is not designed to be submerged (*e.g.*, motor control centers).

The maximum safe operating water level limits are taken from EOP 3 and are shown on the table below:

Maximum Operating Limits - Water Levels			
Affected Location	Indicator	Maximum Normal OL	Maximum Safe OL
HPCI Room Area	LI 3768	2 inches	6 inches
RCIC Room Area	LI 3769	3 inches	6 inches
A RHR Corner Room SE Area	LI 3770	2 inches	10 inches
B RHR Corner Room NW Area	LI 3771	2 inches	10 inches
Torus Area	LI 3772	2 inches	12 inches

DAEC EAL Threshold Value 9 addresses the effects of low river water level. The intake structure for the safety-related water supply systems (river water, RHR service water, and emergency service water) is located on the west bank of the Cedar River. The overflow weir is at elevation 724 feet 6 inches. River level at or below this elevation will result in all river flow being diverted to the safety related water supply systems. The top of the intake structure around the pump wells is at elevation 724 feet. If the river water level dropped to this level, the pump suction would have no continuous supply. Therefore, this EAL uses a threshold of water level below 724 feet 6 inches as a potential substantial degradation of the ultimate heat sink capability.

In this EAL, "Vital Area" is defined as plant structures or areas containing equipment [redacted] for a safe shutdown.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 901, Earthquake
2. Abnormal Operating Procedure (AOP) 902, Flood
3. Abnormal Operating Procedure (AOP) 903, Tornado
4. Abnormal Operating Procedure (AOP) 913, Fire
5. Abnormal Operating Procedure (AOP) 914, Security Events
6. UFSAR Chapter 3, Design of Structures, Components, Equipment, and Systems
7. Bechtel Drawing BECH-M017, Equipment Location - Intake Structure Plans at Elevations, Rev. 6
8. EOP Basis Document, EOP 3 - Secondary Containment Control
   Emergency Operating Procedure (EOP) 3, Secondary Containment Control

HA2 Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown

EVENT TYPE: Fire

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Fire or explosion affecting one of the following systems or areas of concern.

   SYSTEMS
   - Reactivity Control
   - Containment (Drywell/Torus)
   - RHR/Core Spray/SRV's
   - HPCI/RCIC
   - RHRSW/River Water/ESW
   - Onsite AC Power/EDG's
   - Offsite AC Power
   - Instrument AC
   - DC Power
   - Remote Shutdown Capability

   AREAS
   - Reactor, Turbine, Control, Admin/Security
   - Intake Structure
   - Pump House

   AND

2. Affected system parameter indications show degraded performance or plant personnel report VISIBLE DAMAGE to permanent structures or equipment within the specified area.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. Of particular concern for this EAL are fires that may be detected in the reactor building, control building, turbine building, pumphouse, and intake structure as shown in Tabs 1 and 3 of AOP 913. Damage from fire or explosion can be indicated by physical

observation, or by Control Room/local control station instrumentation. *No attempt is made in this EAL to assess the actual magnitude of the damage.*

Per AOP 913, the location of a fire can be determined by observing 1C40B alarm messages, Zone Indicating Unit (ZIU) alarms, or fire annunciators on panels 1C40 and 1C40A.

NOTE:

Scope of Systems and Equipment of concern established by review of Appendix R Safe Shutdown credited systems. Only those systems directly affecting safe shutdown or heat removal are listed for consideration, due to fire damage. Support Systems and equipment such as HVAC and specific instrumentation, while included in Appendix R analysis is not considered an immediate threat to the ability to shutdown the plant and remove decay heat.

This EAL addresses a FIRE / EXPLOSION and not the degradation in performance of affected systems. System degradation is addressed in the System Malfunction EALs. The reference to damage of systems is used to identify the magnitude of the FIRE / EXPLOSION and to discriminate against minor FIREs / EXPLOSIONs. The reference to safety systems is included to discriminate against FIREs / 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 / EXPLOSION was large enough to cause damage to these systems. Thus, the designation of a single train was intentional and is appropriate when the FIRE / EXPLOSION is large enough to affect more than one component. Lagging fires, fires in waste containers or any miscellaneous fires that may be in the vicinity of safety systems, but do not cause damage to these systems, should NOT be considered for this EAL.

With regard to EXPLOSIONS, *only those EXPLOSIONS of sufficient force to damage permanent structures or identified equipment required for safe operation, should be considered.* As used here, an EXPLOSION is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to near-by structures and materials. The occurrence of the EXPLOSION with reports of evidence of damage (e.g., deformation, scorching) is sufficient for the declaration. *The EC/OSM also needs to consider any security aspects of the EXPLOSIONS, if applicable.*

REFERENCES:

1. Abnormal Operating Procedure (AOP) 913, Fire
2. Abnormal Operating Procedure (AOP) 914, Security Events
3. Abnormal Operating Procedure (AOP) 915, Shutdown Outside Control Room
4. UFSAR Section 6.4, Habitability Systems

HA3 Release of Toxic or Flammable Gases Within a Facility Structure Which Jeopardizes Operation of Systems Required to Maintain Safe Operations or to Establish or Maintain Cold Shutdown

EVENT TYPE: Other Hazards and Failures

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following:

1. Report or detection of toxic gases within a Safe Shutdown Area in concentrations that will be life threatening to plant personnel.

   OR

2. Report or detection of flammable gases within a Safe Shutdown Area in concentrations that will affect the safe operation of the plant.

DAEC EAL INFORMATION:

This EAL, in addition to EAL HA5, also addresse entry of toxic gases that may result in control room evacuation in accordance with AOP 915.

For the purposes of this EAL, CO_2 (such as is discharged by the fire suppression system) is not toxic. CO_2 can be lethal if it reduces oxygen to low concentrations that are immediately dangerous to life and health (IDLH). *CO_2 discharge into an area is not basis for emergency classification under this IC unless: (1) Access to the affected area is required, and (2) CO_2 concentration results in conditions that make the area uninhabitable or inaccessible (i.e., IDLH).*

TOXIC - Exposure to the worker in excess of the limits specified in 29 CFR 1910.1000. In practice, this should be considered for concentrations which are capable of producing incapacitation of the worker.

The source of the release is NOT of immediate concern for these threshold values. The concern is for the health and safety of plant personnel and their ability to maintain the plant in a safe operating condition.

This EAL is based on gases that have entered plant structures that will affect the safe operation of the plant. These structures include buildings and areas contiguous to plant vital areas and other significant

buildings or areas. The intent of this EAL is NOT to include buildings or other areas that are NOT contiguous or immediately adjacent to plant vital areas.

Per AOPs 913 and 914, the following areas are identified as safe shutdown areas. *This table is displayed as an aid to the Emergency Coordinator in determining appropriate areas of concern.*

Safe Shutdown Areas	
Category	Area
Electrical Power	Switchyard, 1G31 DG and Day Tank Rooms, 1G21 DG and Day Tank Rooms, Battery Rooms, Essential Switchgear Rooms, Cable Spreading Room
Heat Sink/Coolant Supply	Torus Room, Intake Structure, Pumphouse
Containment	Drywell, Torus
Emergency Systems	NE, NW, SE Corner Rooms, HPCI Room, RCIC Room, RHR Valve Room, North CRD Area, South CRD Area
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C56 Area, SBGT Room

REFERENCES:

1. Abnormal Operating Procedure (AOP) 913, Fire
2. Abnormal Operating Procedure (AOP) 914, Security Events
3. Abnormal Operating Procedure (AOP) 915, Shutdown Outside Control Room
4. UFSAR Section 6.4, Habitability Systems

HA4 Security Event in a Plant Protected Area

EVENT TYPE: Security

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE

One of the following:

1. Intrusion into plant Protected Area by a hostile force.

2. Any security event of increasing severity that persists for ≥ 30 minutes:
   a. Credible bomb threats
   b. Extortion
   c. Suspicious Fire or Explosion
   d. Significant Security System Hardware Failure
   e. Loss of Guard Post Contact

3. "HI" Credible Threats as determined by NMC SE-0018, "Security Threat Assessment".

DAEC EAL INFORMATION:

EAL 1 is an intrusion of a hostile force into the Protected Area representing a potential substantial degradation of the level of safety of the plant. A civil disturbance, which penetrates the Protected Area, can be considered a hostile force.

EAL 2 security events represent an escalated threat to plant safety above that contained in the Unusual Event. Under this EAL, adversaries within the protected area are not yet affecting nuclear safety systems, engineered safety features, or reactor shutdown capability that are located within the vital area. A security event is considered to be "of increasing severity" if events are **NOT** under control of the security force within 30 minutes. Intrusion into a vital area by a hostile force will escalate this event to a Site Area Emergency.

EAL 3 is the determination of "HI Credible Threat" based on information found in NMC SE-0018, "Security Threat Assessment". The emergency response to a "HI" Credible Threat is initiated through AOP 914, "Security Events" and EPIP 2.8, "Security Threat".

REFERENCES:

1. NMC SE-0018, "Security Threat Assessment"
2. Abnormal Operating Procedure (AOP) 914, Security Events

HA5 Control Room Evacuation Has Been Initiated

EVENT TYPE: Control Room Evacuation

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Entry into AOP 915 and initiation of control room evacuation.

DAEC EAL INFORMATION:

The applicable procedure for control room evacuation at DAEC is AOP 915.

Evacuation of the Control Room represents a potential for substantial degradation of the level of safety of the plant and therefore requires an ALERT declaration. Additional support, monitoring and direction is required and accomplished by activation of the Technical Support Center at the ALERT classification level.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 915, Shutdown Outside Control Room
2. UFSAR Section 6.4, Habitability Systems

HA6 Other Conditions Existing Which in the Judgment of the EC/OSM Warrant Declaration of an Alert

EVENT TYPE: EC/OSM Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the Judgment of the Emergency Director indicate that plant safety systems may be degraded and that increased monitoring of plant functions is warranted.

DAEC EAL INFORMATION:

Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant Any releases are expected to be limited to a small fraction of the EPA Protective Action Guideline exposure levels.

Per EPIP 2.5, the Emergency Coordinator/Operations Shift Manager (EC/OSM) is the title for the emergency director function at DAEC. The EAL addresses conditions that fall under the Alert emergency classification description contained in NUREG-0654, Appendix 1.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operations
2. NUREG-0654/FEMA-REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, Revision 1, October 1980, Appendix 1

HS1 Security Event in a Plant Vital Area

EVENT TYPE: Security

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following:

1. Intrusion into plant Vital Area by a hostile force.
2. A security event which results in the loss of control of any Vital Area (other than the Control Room).
3. IMMINENT loss of physical control of the facility (remote shutdown capability) due to a security event.
4. A confirmed sabotage device discovered in a vital area.

DAEC EAL INFORMATION:

IMMINENT - Mitigation actions have been ineffective and trended information indicates that the event or condition will occur within 2 hours.

This threshold value escalates from the ALERT Protected Area intrusion to a Vital Area intrusion of a hostile force.

A security event is as defined in the Safeguards Contingency Plan.

Loss of physical control of the Control Room **OR** loss of physical control of the remote shutdown capability due to a security event, is to be classified as a GENERAL EMERGENCY per Initiating Condition HG1.

A "confirmed sabotage device" is a determination made by the security force through the Security Plan, Contingency procedures and other guidance documentation.

This class of security events represents an escalated threat to plant safety above that contained in HA4, Security Event in a Plant Protected Area, in that a hostile force has progressed from the Protected Area to the Vital Area. *Under the condition of concern here, the adversaries are considered to be in a position to directly and negatively affect nuclear safety systems, engineered safety features, or reactor shutdown capability.*

REFERENCES:

1. Abnormal Operating Procedure (AOP) 914, Security Events
2. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

HS2 Control Room Evacuation Has Been Initiated and Plant Control Cannot Be Established

EVENT TYPE: Control Room Evacuation

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

The following conditions exist:

1) Control room evacuation has been initiated.

AND

2) Control of the plant cannot be established per AOP 915 within 20 minutes.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. The applicable procedure for control room evacuation at DAEC is AOP 915. Based on the results of the analysis described below, DAEC uses 20 minutes as the site-specific time limit for establishing control of the plant. DAEC has satellite panels associated with the remote shutdown panel at various locations through out the plant. Control of the plant from outside the control room is assumed when the controls are transferred to remote shutdown panel 1C388 in accordance with AOP 915.

The EC/OSM is expected to make a reasonable, informed judgment within the 20 minute time limit that control of the plant from the remote shutdown panel has been established. The intent of the EAL is that control of important plant equipment and knowledge of important plant parameters has been achieved in a timely manner. Primary emphasis should be placed on those components and instruments that provide protection of and information about safety functions. At a minimum, consistent with the Appendix R safe shutdown analysis described above, these safety functions include reactivity control, maintaining reactor water level, and decay heat removal.

General Electric performed analyses to demonstrate compliance with the requirements of 10 CFR 50 Appendix R for DAEC. The evaluation of Reactor Coolant Inventory was performed using the GE evaluation model (SAFE). The SAFE code determines if the reactor coolant inventory is above the TAF during the safe shutdown operation. If core uncovery occurs, the fuel clad integrity evaluation is performed by determining the duration of the core uncovery and the resulting peak cladding temperature (PCT). The PCT calculations were performed by incorporating the SAFE output into the Core Heatup Analysis code (CHASTE). The details of these calculations are provided in Section 4 of the final report for DAEC

Appendix R analyses ("Safe Shutdown Appendix R Analyses for Duane Arnold Energy Center", MDE-44-036).

The required analyses include evaluation of the safe shutdown capability of the remote shutdown system for various control room fire events assuming: (1) no spurious operation of equipment, (2) spurious operation of a safety-relief valve (SRV) for 20 minutes, (3) spurious operation of a SRV for 10 minutes, and (4) spurious leakage from a one-inch line. The analyses show that the worst case spurious operation of SRV or isolation valves on a one-inch liquid line (high-low pressure interface) will not affect the safe shutdown ability of the remote shutdown system for DAEC in case of a fire requiring control room evacuation before the identified time limit for the necessary operator actions at the auxiliary shutdown panels. For the limiting cases of worst case spurious leakage from a one-inch line and spurious operation of a SRV, operator control within 20 minutes would not impact the integrity of the fuel clad, the reactor pressure vessel, and the primary containment.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 915, Shutdown Outside Control Room
2. General Electric Report MDE-44-0386, *Safe Shutdown Appendix R Analysis for DAEC*, March 1986
3. UFSAR Section 6.4, Habitability Systems
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

HS3 Other Conditions Existing Which in the Judgment of the <EC/OSM> Warrant Declaration of Site Area Emergency

EVENT TYPE: EC/OSM Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the Judgment of the Emergency Director indicate actual or likely major failures of plant functions needed for protection of the public.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL.

Per EPIP 2.5, the Emergency Coordinator/Operations Shift Manager (EC/OSM) is the title for the emergency director function at DAEC. The EAL addresses conditions that fall under the Site Area Emergency classification description contained in NUREG-0654, Appendix 1.

Events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public. Any releases are not expected to exceed EPA Protective Action Guidelines beyond the site boundary but could be exceeded onsite.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. NUREG-0654/FEMA-REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, Revision 1, October 1980, Appendix 1

HG1 Security Event Resulting in Loss Of Ability to Reach and Maintain Cold Shutdown

EVENT TYPE: Security

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following:

1. Loss of physical control of the control room due to security event.

OR

2. Loss of physical control of the remote shutdown capability due to security event.

DAEC EAL INFORMATION:

This EAL is an escalation of the SITE AREA EMERGENCY, HS1 declaration for a hostile force intrusion of a Vital Area taking physical control of either the Control Room **OR** taking over the remote shutdown capabilities which results in the loss of physical control of the facility. This also includes areas where any switches that transfer control of safe shutdown equipment to outside the control room are located.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 914, Security Events
2. UFSAR Section 6.4, Habitability Systems

HG2 Other Conditions Existing Which in the Judgment of the EC/OSM Warrant Declaration of General Emergency

EVENT TYPE: EC/OSM Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

Other conditions exist which in the Judgment of the Emergency Director indicate:

1) Actual or imminent substantial core degradation with potential for loss of containment

OR

2) There is a potential for uncontrolled radionuclide releases. These releases can reasonably be expected to exceed EPA PAG plume exposure levels outside the site boundary.

DAEC EAL INFORMATION:

Per EPIP 2.5, the Emergency Coordinator/Operations Shift Manager (EC/OSM) is the title for the emergency director function at DAEC

GENERAL EMERGENCY - Events are in process or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area.

IMMINENT - Mitigation actions have been ineffective and trended information indicates that the event or condition will occur within 2 hours.

POTENTIAL - Mitigation actions are not effective and trended information indicates that the parameters are outside desirable bands and not stable or improving.

This Emergency Action Level allows for classification of events which in the judgment of the Emergency Director warrant the GENERAL EMERGENCY classification but do not fit into any other GENERAL EMERGENCY criteria. Emergency Director judgment is to be based on known conditions and the expected response to mitigating activities within a short time period arbitrarily set at 2 hours. Classification of a GENERAL EMERGENCY is not to be delayed pending an extended evaluation of possiibilities and probabilities. If time allows and the offsite response organizations are active, consultation with the effected state and the NRC is prudent prior to classification.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. NUREG-0654/FEMA-REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, Revision 1, October 1980, Appendix 1
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

DAEC PROCEDURE WORK REQUEST (PWR)

PWR No.: **17582**

PROCEDURE QUALIFICATION IMPACT / NOTIFICATION REVIEW

Evaluate this procedure revision according to the criteria listed below, then indicate which of the following options is applicable:

QUALIFICATION IMPACT REVIEW ..... ☐ (TMAR No:_____) NOTIFICATION ..... ☒ NEITHER ..... ☐

Procedure Owner: _____ Date: _____

QUALIFICATION IMPACT?

If any of the following questions can be answered "yes", a Qualification Impact Review is required.

1. Does this procedure revision incorporate the use of equipment with new or different functions that require new or greater skill(s) by the user or by support personnel?
2. Does this procedure revision add to or change the sequence of steps in a way that could have a significant impact on either plant operation or personnel safety?
3. Is training required by regulation, external agency commitment, or management direction?

If any of the above questions were answered with a "yes", mark the QUALIFICATION IMPACT REVIEW block above and submit a copy of each of the following items to the Training Department for evaluation:

- a copy of the new revision of the procedure and associated PWR(s).
- a properly-completed Training Management Action Request (TMAR).

PROCEDURE NOTIFICATION?

If either of the following questions can be answered "yes", notification of the groups indicated on the list below is required.

1. Does this procedure revision add to or change personnel responsibilities beyond what is currently required?
2. Is a general awareness of this procedure/procedure revision necessary to ensure compliance?

If either of the above questions were answered with a "yes", mark the NOTIFICATION block above and indicate by checking as appropriate on the list below which DAEC department(s) is/are to be notified of the new procedure revision:

DAEC
- Safety ☐
- Site Wide ☐
- _____ ☐

OPERATIONS
- Operations ☒
- Other ROs/SROs ☒
- _____ ☐

ENGINEERING
- Program Engineering ☐
- System Engineering ☐
- Project Engineering ☐
- _____ ☐

TRAINING
- Operations Training ☒
- Technical Training ☐
- Administrative ☐
- Emergency Planning ☐
- _____ ☐

MAINTENANCE
- Electrical Maintenance ☐
- Mechanical Maintenance ☐
- I&C Maintenance ☐
- Metrology (M&TE) ☐
- QC ☐
- Civil ☐
- Work Management ☐
- _____ ☐

OPERATIONS SUPPORT
- Reactor Eng ☐
- Procedures ☐
- STAs ☐

RAD PROTECTION
- Radwaste ☐
- Health Physics ☐
- Chemistry ☐
- Decontamination ☐
- Environmental ☐
- _____ ☐

List ERO positions

REG PERFORMANCE
- Licensing ☐
- Quality Assurance ☐
- Security ☐
- _____ ☐

OTHER (list)
- _____ ☐
- _____ ☐

BUSINESS UNIT
- Business Unit ☐
- _____ ☐

NEITHER?

Based on the above criteria, the new procedure revision requires neither a QUALIFICATION IMPACT REVIEW nor NOTIFICATION

EAL BASES DOCUMENT	EBD-S
SYSTEM MALFUNCTION CATEGORY	Rev. 3 Page 1 of 41

Effective Date: ~~7-12-02~~ 8-8-02

TECHNICAL REVIEW

Prepared by: _____ Date: 4/8/02

Reviewed by: _____ Date: 4/18/02
Independent Reviewer

PROCEDURE APPROVAL

I am responsible for the technical content of this procedure and for obtaining the necessary approval from the State and County Emergency Management officials prior to implementation.

Documentation of State and County Emergency Management approval is via NEP-2002-0030.

Approved by: _____ Date: 6/21/2
Manager, Emergency Planning

Table of Contents

SU1 Loss of All Offsite Power to Essential Busses for Greater Than 15 Minutes

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

The following conditions exist:

1. Unplanned loss of power to both Startup (1X3) and Standby (1X4) transformers is expected to last for greater than 15 minutes.

AND

2. Emergency Busses 1A3 and 1A4 are powered by their respective Standby Diesel Generators.

DAEC EAL INFORMATION:

UNPLANNED - The loss of power is not the result of a planned evolution.

This event is a precursor of a more serious Station Blackout condition and is thus considered as a potential degradation of the level of safety of the plant. It is possible to be operating within Technical Specification LCO Action Statement time limits and make a declaration of an Unusual Event in accordance with this EAL.

The intent of this EAL is to declare an UNUSUAL EVENT when offsite power has been lost and at least one of the emergency diesel generators has successfully started and energized at least one ECCS bus.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 301, Loss of Essential Electrical Power
2. UFSAR Section 8.2, Offsite Power System
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU2 Inability to Reach Required Shutdown Within Technical Specification Limits

EVENT TYPE: Tech. Spec. LCO Action Statement Time Limits Expired

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Plant is NOT brought to required operating mode within the Technical Specifications LCO Action Statement Time.

DAEC EAL INFORMATION:

Limiting Conditions for Operations (LCO) require the plant to be brought to a specific condition when an LCO has been entered. Depending on the circumstances this may or may not be an emergency or a precursor to a more serious event. In any case when a plant initiates a shutdown due to having entered an LCO action statement a one hour report must be made under 10CFR50.72(b) non-emergency events. The plant is within its safety envelope when being shutdown within the allowable action statement time of a Technical Specification. An immediate classification of UNUSUAL EVENT should be made when the plant is NOT brought to the required mode within the allowable action statement time of any Technical Specification LCO. Declaration is based on the time at which the LCO Action Statement specified time period elapses and is NOT related to how long a condition may have existed.

REFERENCES:

1. DAEC Technical Specifications
2. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU3 Unplanned Loss of All Safety System Annunciation or Indication in the Control Room for Greater Than 15 Minutes

EVENT TYPE: Instrumentation/Communication

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Unplanned loss of most or all 1C03, 1C04 and 1C05 Annunciators or indicators associated with Critical Safety Functions for greater than 15 minutes.

   AND

2. Compensatory non-alarming indications are available.

   AND

3. In the opinion of the Operations Shift Manager, the loss of annunciators or indicators requires increased surveillance to safely operate the unit.

DAEC EAL INFORMATION:

Control room panels 1C03, 1C04, and 1C05 contain the annunciators associated with safety systems at DAEC. Therefore, the DAEC EAL addresses unplanned loss of most annunciators on these panels. *Compensatory non-alarming indications* includes the plant process computer, SPDS, plant recorders, or plant instrument displays in the control room. *Unplanned* loss of annunciators or indicators excludes scheduled maintenance and testing activities.

Under the conditions of concern , entry into AOP 302.2, Loss of Alarm Panel Power, would be made. The procedure requires alerting operators on shift to the nature of the lost annunciation. It further requires that operators be attendant and responsive to abnormal indications that relate to those systems and components that have lost annunciation. Therefore, the generic criterion related to specific opinion of the Operations Shift Manager that additional operating personnel will be required to safely operate the unit is not included in the DAEC EAL because the concern is addressed by the AOP.

MOST - 75% of safety system annunciators or indicators are lost OR a significant risk that a degraded plant condition could go undetected exists. The use and definition of MOST is not intended to require a detailed count of lost annunciators or indicators but should be used as a guide to assess the ability to monitor the operation of the plant.

Unplanned loss of critical safety function indicators (i.e., EOP/EAL parameters) for greater than 15 minutes may preclude operators from taking actions to mitigate a transient.

Annunciators on 1C03, 1C04, and 1C05 share a common power supply from 125 VDC Division I that is fed through circuit breaker 1D13.

Indications of loss of annunciators associated with safety systems include:

- 125 VDC charger, battery, or system annunciators on control room panel 1C08
- Loss of "sealed in" annunciators at affected panels
- Failure of affected annunciator panels shiftily testing by plant operators
- Expected alarms are not received
- Computer point ID B350 indicates "NSS ANN DC LOSS TRBL." (Loss of DC power to panels 1C03, 1C04, and 1C05)

REFERENCES:

1. Operating Instruction (OI) No. 317.2 Annunciator System
2. Abnormal Operating Procedure (AOP) 302.1, Loss of 125 VDC Power
3. Abnormal Operating Procedure (AOP) 302.2, Loss of Alarm Panel Power
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU4 Fuel Clad Degradation

EVENT TYPE: Coolant Activity

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following:

1. Valid pretreat radiation monitor (RM-4104) reading greater than 4E+3 mR/hr.

OR

2. Reactor Coolant sample activity value indicating greater than 1.2 µCi/ml dose equivalent I-131.

DAEC EAL INFORMATION:

There are no significant deviations from the generic EALs. *These EALs are precursors of more serious fuel clad degradation and are thus considered as indicating a potential degradation of the level of safety of the plant. Thus, it is possible to be operating within Technical Specification LCO Action Statement time limits for iodine spikes and make a declaration of an Unusual Event.* DAEC mode applicability for these EALs are consistent with the Tech Specs.

EAL 1 addresses valid pretreat rad monitor exceeding (RM-4104) above 4E+3 mR/hr. The calculation supporting this value is described below. *Valid* means that the pretreat rad monitor reading is determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or coolant sampling results. This reading would be displayed on Control Room panels 1C-02 and 1C-10 on recorder RR-4104.

As specified in the generic methodology, DAEC EAL 2 addresses coolant samples exceeding technical specification 3.4.6, coolant activity less than or equal to 1.2 µCi/ml dose equivalent I-131.

Radiological Engineering Calculation 94-014A and UFSAR Table 15.4-1 were reviewed to determine a suitable EAL threshold for the pretreat rad monitor reading corresponding to the Tech Spec 3.4.6 coolant activity limit of 1.2 µCi/ml of dose equivalent I-131. Using the condenser noble gas source term for the control rod drop accident of 2.38 E +06 Curies shown on UFSAR Table 15.4-1 and the condenser free volume of 55,000 cubic feet, an initial noble gas concentration in the condenser offgas line is determined. Because the offgas flow rate is very small (about 50 standard cubic feet per minute) compared to the total condenser free volume, dilution of the condenser noble gas concentration due to offgas flow is not considered in the calculation shown below. Decrease in the noble gas source term due to decay of short-lived noble gas radioisotopes and offgas flow dilution effects are addressed by rounding down the value calculated as shown below.

Calculation 94-014A used an exposure rate method based on using a source term consisting of a defined mixture of noble gases and iodine from the control rod drop accident as described in the DAEC UFSAR, Section 15.4. The calculation assumed that the activity is released instantly and immediately reached in equilibrium with the reactor coolant inventory. Using this calculation, using dose correction factors (DCFs) for child thyroid dose from Reg. Guide 1.109, and adjusting for the specific gravity (0.736) of saturated water at 1050 psia (fluid conditions assumed in the calculation) to adjust for standard conditions, the I-131 dose equivalent (in units of µCi/ml assuming 1 cc equals 1 ml) is determined for this event. This result is then linearly scaled for rad monitor readings corresponding to the Tech Spec 3.4.6 allowable primary coolant activity of 1.2 µCi/ml I-131 dose equivalent, *i.e.*, the relative mixture of noble gases and iodine is assumed to remain constant. I-129 is ignored because it has no effect on the calculation result.

Isotope	DCF (mrem/pci)	Concentration (µCi/cc)	Correction Factor $[DCF_{ISOTOPE} / DCF_{I-131}] / 0.736$	I-131 DEQ (µCi/cc)
I-131	4.39 E-03	1.6 E+01	1.4 E+00	2.2 E+01
I-132	5.23 E-05	2.2 E+01	1.6 E-02	3.6 E-01
I-133	1.04 E-03	3.1 E+01	3.2 E-01	1.0 E+01
I-134	1.37 E-05	3.4 E+01	4.2 E-03	1.4 E-01
1-135	2.14 E-04	2.9 E+01	6.6 E-02	1.9 E+00
TOTAL	--	--	--	3.4 E+01

Therefore, for this event, a coolant activity of 34 µCi/cc I-131 dose equivalent is calculated. Scaling the results for 1.2 µCi/cc I-131 dose equivalent, a suitable condenser

source term and corresponding initial concentration in the offgas flow is then determined. This is then converted to a pretreat rad monitor reading by use of the monitor efficiency factor:

Pretreat Rad Monitor (RM-4104) Reading

$NG\ concentration_{clad\ damage} = NG\ concentration_{ROD\ DROP} X [1.2\ \mu Ci/cc / 34\ \mu Ci/cc]$

$= [2.38\ E+6\ Ci \times 1\ E+6\ \mu Ci/Ci] / [5.5\ E+4\ ft^3 \times 2.83\ E+4\ cc/ft^3] X [1.2\ \mu Ci/cc / 34\ \mu Ci/cc]$

$= 1529\ \mu Ci \times 0.0353 = 54.0\ \mu Ci/cc$

Pretreat rad monitor reading = NG concentration X Rad monitor efficiency

Rad monitor efficiency = 89.2 mR/hr / µCi/cc, therefore:
Pretreat rad monitor reading = 89.2 X 54.0 = 4800 mR/hr

To account for isotopic decay and dilution effects of offgas flow, round down to 4E+03 mR/hr.

The calculation results were also reviewed to determine if suitable values for the main steam line (MSL) radiation monitors could be developed. As shown above, the rod drop accident corresponds to coolant activity of 34 µCi/cc I-131 dose equivalent. As determined by the reference calculation, this corresponds to a MSL radiation monitor reading of about 5.7 R/hr. Scaling the results for 1.2 µCi/ml I-131 dose equivalent:

MSL Reading Corresponding to 1.2 µCi/ml I-131 dose equivalent

[[1.2 µCi/cc] / [34 µCi/cc]] X 5.7 R/hr = 0.2 R/hr = 200 mR/hr

200 mR/hr is at the lower end of the normal MSL monitor readings during full power. Because this value is not distinguishable, and hydrogen water chemistry system malfunctions that result in increased production of N-16 can also result in increased main steam line radiation levels, it is not appropriate at DAEC to use the main steam line monitor readings.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 672.2, Offgas Radiation/Reactor Coolant High Activity
2. Technical Specification 3.4.6, Coolant Chemistry
3. Radiological Engineering Calculation No. 94-014A, Main Steam Line Radiation Monitor Setpoint Calculation, August 29, 1994
4. Surveillance Test Procedure (STP) No. 3.4.6-01, Reactor Coolant Gamma and Iodine Activity
5. Annunciator Response Procedure (ARP) 1C03A, Reactor and Containment Cooling and Isolation
6. Annunciator Response Procedure (ARP) 1C05B, Reactor Control
7. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU5 RCS Leakage

EVENT TYPE: Coolant Leak

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown, Cold Shutdown

EAL THRESHOLD VALUE:

One of the following:

1. Unidentified or pressure boundary leakage greater than 10 gpm.

   OR

2. Identified leakage greater than 25 gpm.

   OR

3. Valid indication of Main Steamline Break.

DAEC EAL INFORMATION:

EAL Threshold Values 1 and 2 are precursors of more serious RCS barrier challenges and are thus considered as a potential degradation of the level of safety of the plant. Thus, it is possible to be operating within Technical Specification LCO Action Statement time limits and make a declaration of an Unusual Event in accordance with these EALs. Credit for the action statement time limit should only be given when leakage exceeds technical specification limits but has not yet exceeded the Unusual Event EAL thresholds described above. In addition, indication of main steam line break has been added here as discussed in *NUMARC Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 2 Questions and Answers,* June 1993, Fission Product Barrier-BWR section. This was in response to question 4 which states that the main steam line break with isolation can be classified under System Malfunctions.

Valid means that the reading is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results.

The DAEC Tech Spec Section 3.4.4 coolant system leakage LCO limits are: (1) ≤ 5 gpm unidentified leakage, (2) ≤ 25 gpm total leakage averaged over the previous 24 hour period, and (3) ≤ 2 gpm increase in unidentified leakage within the previous 24 hour period in Mode 1. Total leakage is defined as the sum of identified and unidentified leakage.

DAEC EAL Threshold Value 1 uses the generic value of 10 GPM for unidentified leakage or pressure boundary leakage. The 10 gpm value for the unidentified or pressure boundary leakage was selected as it is observable with normal control room indications. DAEC EALThreshold Value 2 uses identified leakage set at a higher value due to the lesser significance of identified leakage in comparison to unidentified or pressure boundary leakage.

REFERENCES:

1. Technical Specification 3.4.4, Coolant Leakage
2. Surveillance Test Procedure No. (STP) 3.0.0.0-01, Reactor Coolant System Leak Rate Calculation
3. Operating Instruction No. (OI) 920, Drywell Sump System
4. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Recirculation
5. Alarm Response Procedure (ARP) 1C04C, Reactor Water Cleanup and Recirculation
6. UFSAR Section 5.2.5, Detection of Leakage through Reactor Coolant Pressure Boundary
7. UFSAR Section 15.6.6, Loss-of-Coolant-Accident
8. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU6 Unplanned Loss of All Onsite or Offsite Communications Capabilities

EVENT TYPE: Instrumentation/Communication

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

One of the following groups of communication losses:

1. Loss of ALL of the following onsite communication capabilities affecting the ability to perform routine operation:
   - Plant Operations Radio System
   - Plant Paging System
   - In-plant Telephones
   - Sound Power Telephones

OR

2. Loss of ALL of the following offsite communications capability:
   - All telephone lines (commercial)
   - Microwave Phone System
   - FTS-2000 phone system (ENS & HPN)
   - Cellular Phones

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. The communications methods used at DAEC are described in the Emergency Plan. In-plant and external agency telephone communication methods include PABX lines, direct-ring lines, and NRC telephones which are extensions for the Emergency Notification System. There is also a microwave system to provide backup emergency telephone communications.

The availability of one method of ordinary offsite communication is sufficient to inform state and local authorities of plant problems. *This EAL is intended to be used only when*

extraordinary means (relaying of information from radio transmissions, individuals being sent to offsite locations, etc.) are being utilized to make communications possible.

The DAEC plant operations radio system is a UHF system with consoles located in the Control Room, Technical Support Center, Operational Support Center, and the Central Alarm Station. Hand-held transceivers are used in this system to provide simplex communications within the plant and onsite. The DAEC Radiological Survey Radio System is an 800 MHz trunked/conventional repeater system that provides base-to-portable communications throughout the DAEC EPZ. A secondary high-band system provides back-up capability for the 800 MHz radio. Consoles are located in the Technical Support Center and the Emergency Operations Facility at the IES Tower. The DAEC Security (backup radiological survey) Radio System provides base-to-portable security communication within the plant and with the Linn County Sheriff's Office using a mobile relay (repeater) type base station and two VHF frequencies. Control consoles are located in the Secondary Alarm Station, Central Alarm Station, Security Control Point, Technical Support Center, and Emergency Operations Facility. The DAEC also has a base station licensed for operation in the Police Radio Service on the law enforcement state-wide, point-to-point VHF frequency. The transmitter and one control console are located at the Secondary Alarm Station and in the Central Alarm Station. This station is for communications with Iowa Department of Public Safety radio station, Linn County Sheriff's office, and the Benton County Sheriff's office. This point-to-point channel is also used by the Linn County Emergency Management and other public-safety organizations throughout the state of Iowa.

REFERENCES:

1. Emergency Plan, Section F, Emergency Communications
2. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SU7 Unplanned Loss of Required DC Power During Cold Shutdown or Refuel Mode For Greater Than 15 Minutes

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel

EAL THRESHOLD VALUE:

The following conditions exist:

1. Unplanned loss of Division I (1D1) and Division II (1D2) 125 VDC busses based on bus voltage indications.

   AND

2. Failure to restore power to at least one required DC bus within 15 minutes from time of loss.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. *Unplanned* loss of Div. I and Div. II. 125 VDC busses excludes scheduled maintenance and testing activities. Under the conditions of concern, AOP 302.1, Loss of 125 VDC Power, would be entered. The DAEC EAL's address the loss of both divisions of the 125 VDC systems consistent with AOP 302.1.

The 125 VDC system is divided into two independent divisions - Division I (1D1) and Division II (1D2) - each with separate AC and DC (battery) power supplies. Loss of both 125 VDC Divisions could compromise the ability to monitor and control the removal of decay heat during cold shutdown or refueling operations. These EAL's are intended to be anticipatory in as much as the operating crew may not have necessary indication and control of equipment needed to respond to the loss. If this loss results in the inability to maintain cold shutdown, the escalation to an Alert will be per SA3 "Reactor Coolant temperature to exceed Technical Specification limit of 212 F or UNCONTROLLED temperature rise approaching the Technical Specification limit of 212".

Bus voltage is based on the minimum bus voltage necessary for the operation of safety related equipment and the loss may be indicated by the illumination of annunciators "125 VDC System I Trouble" on 1C08A A-9 and/or "125 VDC System II Trouble" on 1C08B A-4.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 302.1, Loss of 125 VDC Power
2. Abnormal Operating Procedure (AOP) 388, Loss of 250 VDC Power
3. Technical Specification 3.8, Electric Power Systems
4. UFSAR Section 8.3, Onsite Power Systems
5. UFSAR Table 8.3-6, Plant Battery System - DC Power, Instrumentation, and Control, Principle DC Loads (125V)
6. ARP 1C08A A-9
7. ARP 1C08B A-4
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SA1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses During Cold Shutdown Conditions

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel, Defueled

EAL THRESHOLD VALUE:

The following conditions exist:

1. Loss of power to both Startup (1X3) and Standby (1X4) transformers.
   AND
2. Failure of "A" Emergency Diesel Generator 1G-31 and "B" Emergency Diesel Generator to supply power to emergency busses 1A3 and 1A4.
   AND
3. Failure to restore power to at least one emergency bus, 1A3 or 1A4, within 15 minutes from the time of loss of both offsite and onsite AC power.

DAEC EAL INFORMATION:

Under the conditions of concern, entry into AOP 301.1, Station Blackout, would be made under Tab 1. Indications/alarms related to station blackout are displayed on control room panel 1C08 and are listed in the procedure under "Probable Indications."

The loss of both offsite and onsite AC power to the emergency buses when in Cold Shutdown, Refuel or Defueled modes, compromises safety systems required for decay heat removal and is a substantial degradation of the level of safety of the plant. An ALERT is declared in Cold Shutdown and Refueling modes due to the less severe threat to the protection of the health and safety of the public because of the much longer time available to restore power and decay heat removal systems.

15 minutes was selected to exclude transient or momentary power losses.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 301.1, Station Blackout
2. Abnormal Operating Procedure (AOP) 301, Loss of Essential Electrical Power

3. Technical Specifications Section 3.8, Electrical Power Systems
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SA2 Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Scram Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Scram Was Successful

EVENT TYPE: RPS Failure

OPERATING MODE APPLICABILITY: Power Operation, Startup

EAL THRESHOLD VALUE:

The following conditions must exist to declare this EAL:

1. Auto Scram Failure

   AND

2. Operator actions to reduce power are SUCCESSFUL as indicated by either:
   a. ALL Rods Full-In,

      OR

   b. Reactor Shutdown Under All Conditions Without Boron,

      OR

   c. Reactor power below the APRM Downscale Alarm on ALL valid APRM instruments

DAEC EAL INFORMATION:

The condition of concern is failure of the Reactor Protection System (RPS) to scram the reactor when a valid scram signal is present. 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 and thus plant safety has been compromised and design limits of the fuel may have been exceeded.

The EAL evaluation should occur after operators have taken actions from the main control room to insert a manual scram and reduce reactor power. Permissible actions include all actions that can be performed quickly from the main control room by on-shift operators (e.g., use of the Manual Scram pushbuttons, ARI, placing the Mode Switch in Shutdown, individual scram test switches, etc.). It is not appropriate to delay the EAL

evaluation until other time consuming actions are completed such as manual rod insertion or completion of in-plant EOP Support Procedures for rod insertion (e.g., venting the over-piston areas of individual CRDs).

Operator actions are considered successful if any of the following results are achieved:

- All control rods inserted to at least position 02 - this is defined in EOPs as the Maximum Subcritical Banked Withdrawal Position and is the lowest control rod position to which all control rods may be withdrawn in a bank and the reactor will none the less remain shutdown under all conditions, irrespective of reactor coolant temperature and any boron which may have been injected into the RPV.
- Determination that the Reactor is "Shutdown under ALL conditions without boron" - this can be determined by relying on the Technical Specification demonstration of adequate shutdown margin:

  – One control rod is out beyond position 00

  AND

  – All other control rods are at position 00

  For other combinations of rod patterns and boron concentration, reactor engineering will need to perform a shutdown margin calculation.
- Reactor power is below the APRM Downscale Alarm Setpoint on ALL valid APRM instruments.

Note - If the mode switch is in Startup and the rods are fully inserted (i.e., the reactor is shutdown) prior to the automatic signal failure, then declaration of an Alert would not be required. In this case, the event would be reported under 10 CFR 50.72 (b) (2) (I) as a four hour report.

REFERENCES:

1. Integrated Plant Operating Instruction (IPOI) No. 5, Reactor Scram
2. ATWS Emergency Operating Procedure (EOP) - RPV Control
3. Emergency Operating Procedure (EOP) 1 - RPV Control
4. NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4, May 1999

SA3 Inability to Maintain Plant in Cold Shutdown

EVENT TYPE: Inability to Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel

EAL THRESHOLD VALUE:

One of the following:

1. Loss of Decay Heat Removal systems required to maintain Cold Shutdown.

   AND

2. With CONTAINMENT CLOSURE not established, temperature conditions exist that either:

   a. Cause reactor coolant temperature to exceed the Technical Specification limit of 212 °F.

   OR

   b. Result in an UNCONTROLLED temperature rise approaching the Technical Specification limit of 212°F.

DAEC EAL INFORMATION:

Under the conditions of concern for EAL Threshold Value 1, AOP 149, Loss of Decay Heat Removal, would be entered under Tab 1, Loss of Shutdown Cooling. Indications/alarms related to loss of shutdown cooling are displayed on control room panels 1C03 and 1C05 and are listed in the procedure under "Probable Indications." The procedure requires that shutdown cooling be re-established.

The procedure provides curves of maximum water heat up rates which provide an upper bound of the heatup until an estimated time to boil calculation can be completed by Engineering.

The DAEC EAL is written to imply an RCS temperature rise above 212 °F that is not allowed by plant procedures. This corresponds to the inability to maintain required temperature conditions for Cold Shutdown. "Uncontrolled" means that system temperature increase is not the result of planned actions by the plant staff. The wording

is also intended to eliminate minor cooling interruptions occurring at the transition between Hot Shutdown and Cold Shutdown or temperature changes that are permitted to occur during establishment of alternate core cooling so that an unnecessary declaration of an Alert does not occur. The uncontrolled temperature rise is necessary to preserve the anticipatory philosophy of NUREG-0654 for events starting from temperatures much lower than the cold shutdown temperature limit.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 149, Loss of Decay Heat Removal
2. DAEC Technical Specifications
3. Surveillance Test Procedure (STP) 3.4.9-01, Heatup and Cooldown Rate Log
4. NUREG 1449, *Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States*, September 1993
1. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SA4 Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators are Unavailable

EVENT TYPE: Instrumentation/Communication

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Unplanned loss of most or all 1C03, 1C04 and 1C05 Annunciators or indicators associated with Critical Safety Functions for greater than 15 minutes.

AND

1. In the opinion of the Operations Shift Manager, the loss of all annunciators or indicators requires increased surveillance to safely operate the unit.

AND

2. Either of the following conditions exist:

   a. A significant plant transient in progress.

   OR

   b. Loss of all indication needed to monitor criticality, core heat removal, OR Fission Product Barrier status.

DAEC EAL INFORMATION:

Control room panels 1C03, 1C04, and 1C05 contain the annunciators associated with safety systems at DAEC. Therefore, the DAEC EAL addresses unplanned loss of annunciators on these panels. *Compensatory non-alarming indications* includes the plant process computer, SPDS, plant recorders, or plant instrument displays in the control room. *Unplanned* loss of annunciators or indicators excludes scheduled maintenance and testing activities. *Significant transient* includes response to automatic or manually initiated functions such as scrams, runbacks involving greater than 25% thermal power change, ECCS injections, or thermal power oscillations of 10% or greater.

Under the conditions of concern , entry into AOP 302.2, Loss of Alarm Panel Power, would be made. The procedure requires alerting operators on shift to the nature of the lost annunciation. It further requires that operators be attendant and responsive to abnormal indications that relate to those systems and components that have lost annunciation. Therefore, the generic criterion related to specific opinion of the Operations Shift Manager that additional operating personnel will be required to safely operate the unit is not included in the DAEC EAL because the concern is addressed by the AOP.

MOST - 75% of safety system annunciators or indicators are lost **OR** a significant risk that a degraded plant condition could go undetected exists. The use and definition of MOST is not intended to require a detailed count of lost annunciators or indicators but should be used as a guide to assess the ability to monitor the operation of the plant.

Unplanned loss of critical safety function indicators (i.e., EOP/EAL parameters) for greater than 15 minutes may preclude operators from taking actions to mitigate a transient.

Annunciators on 1C03, 1C04, and 1C05 share a common power supply from 125 VDC Division I that is fed through circuit breaker 1D13. Therefore, DAEC does not specify a loss of "most" annunciators as specified in the generic methodology.

Indications of loss of annunciators associated with safety systems include:

- 125 VDC charger, battery, or system annunciators on control room panel 1C08
- Loss of "sealed in" annunciators at affected panels
- Failure of affected annunciator panels shiftily testing by plant operators
- Expected alarms are not received
- Computer point ID B350 indicates "NSS ANN DC LOSS TRBL." (Loss of DC power to panels 1C03, 1C04, and 1C05)

REFERENCES:

1. Operating Instruction (OI) No. 317.2 Annunciator System
2. Abnormal Operating Procedure (AOP) 302.1, Loss of 125 VDC Power
3. Abnormal Operating Procedure (AOP) 302.2, Loss of Alarm Panel Power
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SA5 AC Power Capability to Essential Busses Reduced to a Single Power Source for Greater Than 15 Minutes Such That Any Additional Single Failure Would Result in Station Blackout

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Unplanned loss of power to both Startup (1X3) and Standby (1X4) transformers is expected to last for greater than 15 minutes.

   AND

2. Onsite power capability has been degraded to one train of emergency busses powered from either A Diesel Generator (1G-31) or B Diesel Generator (1G-21), and any additional single failure will result in a Station Blackout.

DAEC EAL INFORMATION:

The DAEC EAL is written to address the underlying concern, *i.e.*, only one AC power source remains and if it is lost, a Station Blackout will occur. Under the conditions of concern, entry into AOP 301, Loss of Essential Electrical Power, would be made under Tab 1, Loss of One Essential 4160V Bus, and/or under Tab 3, Loss of Offsite Power. Indications/alarms related to degraded AC power are displayed on control room panel 1C08 and are listed in AOP 301 under "Probable Indications."

At DAEC, the Essential Buses of concern are 4160V Buses 1A3 and 1A4. Each of these buses feed their associated 480V and 120V AC busses through step down transformers. Onsite power sources at DAEC include the A and B Diesel Generators, 1G-31 and 1G-21, respectively.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 301, Loss of Essential Electrical Power
2. UFSAR Chapter 8 Electrical Power
3. Technical Specifications Section 3.8. Electrical Power Systems

NEI Methodology for Development of EALs NUMARC/NESP-007 Revision 4, May 1999

SS1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Loss of power to both Startup (1X3) and Standby (1X4) transformers.

   AND

2. Failure of both A Diesel Generator (1G-31) **AND** B Diesel Generator (1G-21) to supply power to emergency busses.

   AND

3. Failure to restore power to at least one emergency bus within 15 minutes from the time of loss of both offsite and onsite AC power.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. In accordance with the generic guidance, DAEC is using a threshold of 15 minutes for Station Blackout to exclude transient or momentary power losses.

Under the conditions of concern, entry into AOP 301.1, Station Blackout, would be made under Tab 1. Indications/alarms related to station blackout are displayed on control room panel 1C08 and are listed in the procedure under "Probable Indications."

REFERENCES:

1. Abnormal Operating Procedure (AOP) 301.1, Station Blackout
2. Technical Specifications Section 3.8, Electrical Power Systems
3. UFSAR Chapter 8, Electric Power
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SS2 Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Scram Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Scram Was NOT Successful

EVENT TYPE: RPS Failure

OPERATING MODE APPLICABILITY: Power Operation, Startup

EAL THRESHOLD VALUE:

Failure of automatic scram and actions taken by operators in the Control Room to shut down the reactor **OR** reduce reactor power below the APRM downscales have been INEFFECTIVE.

The following conditions must exist to declare this EAL:

1. In ATWS EOP,

   AND

2. Operator actions to reduce power are UNSUCCESSFUL as indicated by either:

   a. Reactor power above the APRM Downscale Alarm on ANY valid APRM instrument,

   OR

   b. Boron Injection Initiation Temperature (BIIT) Curve (EOP Graph 6) exceeded.

DAEC EAL INFORMATION:

This EAL addresses conditions where failure of an automatic scram has occurred and manual actions performed in the Control Room to reduce reactor power have been unsuccessful.

Under the conditions of concern for this EAL, the reactor may be producing more heat than the maximum decay heat load for which safety systems are designed. A Site Area Emergency is warranted because conditions exist that may lead to the potential loss of the fuel cladding or primary containment. Although this EAL may be viewed as redundant to the Fission Barrier Table, its inclusion is necessary to better assure timely recognition and emergency response.

The purpose of the ATWS EOP is to maintain adequate core cooling, shutdown the reactor and cooldown the RPV to cold shutdown conditions. The ATWS EOP is implemented when it cannot be determined that control rod insertion alone will assure that the reactor will remain shutdown under all conditions.

Reactor power above the APRM downscale setpoint is indicative of power generation above the decay heat levels which primary containment is designed to suppress.

Furthermore, if reactor power is above the APRM downscale setpoint, it is likely that the core bulk boiling boundary would be above that which provides suitable stability margin for operation at high powers and low flows.

Exceeding the Boron Injection Initiation Temperature (BIIT) limit (EOP Graph 6) is an indirect indication that the reactor is at power and that excessive decay heat is being added to the suppression pool.

The higher the reactor power level is, the more heat energy will be rejected to the torus thus requiring a lower torus temperature for initiation of boron injection if the Heat Capacity Limit is not to be exceeded before reactor shutdown is achieved.

As long as the core remains submerged (the preferred method of core cooling), fuel integrity and RPV integrity are not directly challenged even under failure-to-scram conditions. However, a scram failure coupled with an MSIV isolation results in rapid heatup of the torus due to the steam discharged from the RPV via SRVs. The challenge to the primary containment will thus become a limiting factor.

REFERENCES:

1. Integrated Plant Operating Instruction (IPOI) No. 5, Reactor Scram
2. ATWS Emergency Operating Procedure (EOP) - RPV Control
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May1999

SS3 Loss of All Vital DC Power

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following condition exists:

1. Loss of both divisions of the Vital 250/125V DC system based on AOP 302.1 and AOP 388 for greater than 15 minutes.

DAEC EAL INFORMATION:

Under the conditions of concern, AOP 302.1, Loss of 125 VDC Power, would be entered under Tab 3, Complete Loss of 125 VDC. Consequently, the DAEC EAL addresses loss of both divisions of the 125V DC system consistent with AOP.

At DAEC, the 250V/125V DC Systems ensure power is available for the reactor to be shutdown safely and maintained in a safe condition. The 125V System is divided into two independent divisions - Division I and Division II - with separate DC power supplies. These power supplies consist of two separate 125V batteries and chargers serving systems such as RCIC, RHR, EDGs, and HPCI.

Complete loss of both 125V DC Divisions could compromise the ability to monitor and control the removal of decay heat during cold shutdown or refueling operations.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 302.1, Loss of 125 VDC Power
2. Abnormal Operating Procedure (AOP) 388, Loss of 250 VDC Power
3. Technical Specification 3.8, Electrical Power Systems
4. UFSAR Section 8.3, Onsite Power Systems
5. UFSAR Table 8.3-6, Plant Battery System - DC Power, Instrumentation, and Control, Principle DC Loads (125V)
6. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SS4 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown

EVENT TYPE: Inability to Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown.

EAL THRESHOLD VALUE:

1. EOP Graph 4 Heat Capacity Limit is exceeded.

   OR

2. Reactor CANNOT be brought subcritical.

DAEC EAL INFORMATION:

This EAL addresses complete loss of functions, including ultimate heat sink and reactivity control, required for hot shutdown with the reactor at pressure and temperature. Under these conditions, there is an actual major failure of a system intended for protection of the public. The reactivity condition criteria is addressed by maintenance of required shutdown margin. If inadvertent criticality could not be eliminated by performing the actions of AOP 255.1, AOP 255.2, or the ATWS EOP, it corresponds to a failure of a system intended for the protection of the public and thus classification as a Site Area Emergency is warranted.

This EAL represents an escalation from the conditions of concern in SA3, Inability to Maintain Cold Shutdown, because the reactor is at operating pressure and temperature and decay heat levels are higher.

Per DAEC Technical Specifications, the following systems are necessary to achieve or maintain Hot Shutdown conditions:

- Reactor Protection System Instrumentation
- Core and Containment Cooling Systems Instrumentation
- Reactivity Control
- Standby Liquid Control System
- Core and Containment Cooling Systems

- Primary System Boundary
- Auxiliary Electrical Systems

Loss of instrumentation is addressed by SS6, Inability to Monitor a Significant Transient in Progress. The Auxiliary Electrical System is addressed by SS1, Station Blackout, and SS3, Loss of all Vital DC Power and therefore they are not covered here. Failure of the primary system boundary is covered by the Fission Barrier Table and SU5, RCS Leakage.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 149, Loss of Decay Heat Removal
2. Abnormal Operating Procedure (AOP) 255.1, Control Rod Movement/Indication Abnormal
3. Abnormal Operating Procedure (AOP) 255.2, Power/Reactivity Abnormal Change
4. Emergency Operating Procedure (EOP) 1 - RPV Control
5. ATWS Emergency Operating Procedure (EOP) - RPV Control
6. Emergency Operating Procedure ALC - Alternate Level Control
7. Emergency Operating Procedure (EOP) Basis, EOP Breakpoints
8. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SS5 Loss of Water Level in the Reactor Vessel That Has or Will Uncover Fuel in the Reactor Vessel

EVENT TYPE: Inability to Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel

EAL THRESHOLD VALUE:

The following conditions exist:

1. Loss of Reactor Vessel Water Level as indicated by:

   a. Loss of all decay heat removal cooling as determined by AOP 149 under Tab 1, Loss of Shutdown Cooling.

   AND

   b. RPV level below 15 inches indicating that the core is or will be uncovered.

DAEC EAL INFORMATION:

The DAEC EAL is written in terms of the general concern that no cooling water source is lined up or available for injection into the RPV and water level is decreasing below the top of the active fuel (TAF). Under the conditions of concern for EAL Threshold Value 1, AOP 149, Loss of Decay Heat Removal, would be entered under Tab 1, Loss of Shutdown Cooling. Indications/alarms related to loss of shutdown cooling are displayed on control room panels 1C03 and 1C05 and are listed in the procedure. Consistent with the value used in the EOPs, the EAL uses an indicated RPV level of 15 inches for the water level corresponding to TAF.

The conditions address concerns raised by the NRC AEOD Report AEOD/EG09, "BWR Operating Experience Involving Inadvertent Draining of the Reactor Vessel", dated August 8,1986. This report states:

> In broadest terms, the dominant cause of inadvertent reactor vessel draining are related to the operational and design problems associated with the residual heat removal system when it is entering into or exiting from the shutdown cooling mode. During this transitional period water is

drawn from the reactor vessel, cooled by RHR heat exchangers (from the cooling provided by the service water system), and returned to the reactor vessel. **First** there are piping and valves in the residual heat removal system which are common to both the shutdown cooling mode and other modes of operation such as low pressure coolant injection and suppression pool cooling. These valves, when improperly positioned, provide a drain path for the reactor coolant to flow from the reactor vessel to the suppression pool or the radwaste system. **Second**, establishing or exiting the shutdown cooling mode of operation is entirely manual making such evolutions vulnerable to personnel and procedural errors. **Third**, there is no comprehensive valve interlock arrangement for all the residual heat removal system valves that could be activated during shutdown cooling. Collectively, these factors have contributed to the repetitive occurrences of the operational events involving the inadvertent draining of the reactor vessel.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 149, Loss of Decay Heat Removal
2. Emergency Operating Procedure (EOP)-1, RPV Control, Sheet 1 of 1
3. Emergency Operating Procedure (EOP) Basis, EOP Breakpoints
4. NRC AEOD Report AEOD/EG09, "BWR Operating Experience Involving Inadvertent Draining of the Reactor Vessel", August 8, 1986
5. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SS6 Inability to Monitor a Significant Transient in Progress

EVENT TYPE: Instrumentation/Communication

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Significant transient in progress and ALL of the following:

   a. Loss of annunciators on Panels 1C03, 1C04 and 1C05

   AND

   b. Compensatory non-alarming indications are unavailable.

   AND

   c. Indications needed to monitor criticality, OR core heat removal, OR Fission Product Barrier status are unavailable.

DAEC EAL INFORMATION:

The DAEC EAL is written in terms of a *significant transient* in progress with loss of both safety system annunciators and loss of compensatory non-alarming instrumentation. The DAEC EAL structure, which addresses all the key points in the generic EAL, better assures that the condition of concern for this EAL will be readily recognized.

Significant transient includes response to automatic or manually initiated functions such as scrams, runbacks involving greater than 25% thermal power change, ECCS injections, or undamped thermal power oscillations greater than 10%.

Compensatory non-alarming indications include the plant process computer, SPDS, plant recorders, or plant instrument displays in the control room. These indications are needed to monitor (site-specific) safety functions that are of concern in the generic EAL.

Control room panels 1C03, 1C04, and 1C05 contain the annunciators associated with safety systems at DAEC. Annunciators on 1C03, 1C04, and 1C05 share a common power supply from 125 VDC Division I that is fed through circuit breaker 1D13. Therefore, DAEC does not specify a loss of "most" annunciators as specified in the generic methodology.

Indications of loss of annunciators associated with safety systems include:

- 125 VDC charger, battery, or system annunciators on control room panel 1C08
- Loss of "sealed in" annunciators at affected panels
- Failure of affected annunciator panels shiftily testing by plant operators
- Expected alarms are not received
- Computer point ID B350 indicates "NSS ANN DC LOSS TRBL." (Loss of DC power to panels 1C03, 1C04, and 1C05)

REFERENCES:

1. Operating Instruction (OI) No. 317.2, Annunciator System
2. Abnormal Operating Procedure (AOP) 302.1, Loss of 125 VDC Power
3. Abnormal Operating Procedure (AOP) 302.2, Loss of Alarm Panel Power
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

SG1 Prolonged Loss of All Offsite Power and Prolonged Loss of All Onsite AC Power

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Loss of voltage on buses 1A3 and 1A4.

   AND ANY ONE OF THE FOLLWING

   a. Restoration of power to either Bus 1A3 or 1A4 is not likely within 4 hours.

   OR

   b. RPV level is indeterminate.

   OR

   c. RPV level is below +15 inches.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL. Under prolonged Station Blackout (SBO) conditions, fission product barrier monitoring capability may be degraded. Although it may be difficult to predict when power can be restored, it is necessary to give the EC/OSM a reasonable idea of how quickly a General Emergency should be declared based on the following considerations:

- Are there any present indications that core cooling is already degraded to the point where a General Emergency is IMMINENT (*i.e.*, loss of two barriers and a potential loss of the third barrier)?

- If there are presently no indications of degraded core cooling, how likely is it that power can be restored prior to occurrence of a General Emergency?

The first part of this EAL corresponds to the threshold conditions for Initiating Condition SS1, Station Blackout - namely, entry into AOP 301.1, Station Blackout. The second part of the EAL addresses the conditions that will escalate the SBO to General Emergency. Occurrence of any of the following is sufficient for escalation: (1) SBO coping capability exceeded, or (2) loss of drywell cooling that continues to make RPV water level measurements unreliable, or (3) indications of inadequate core cooling. Each of these conditions is discussed below:

1. SBO Coping Capability Exceeded

DAEC has a SBO coping duration of four hours. *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.*

2. RPV Water Level Measurements Remaining Unreliable

Flashing of the reference leg water will result in erroneously high RPV water level readings giving a false indication of actual water inventory and potentially indicating adequate core cooling when it may not exist. EOP Graph 1, RPV Saturation Temperature, defines the conditions under which RPV level instrument leg boiling may occur.

3. Indications of Inadequate Core Cooling

DAEC uses the RPV level that is used for the Fuel Clad "potential loss" condition in the Fission Product Barrier Matrix. This is RPV level below +15 inches.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 301.1, Station Blackout
2. Letter NG-92-0283, John F. Franz, Jr. to Dr. Thomas E. Murley, Response to Safety Evaluation by NRC-NRR "Station Blackout Evaluation Iowa Electric Light and Power Company Duane Arnold Energy Center," February 10, 1992
3. Emergency Operating Procedure (EOP)1 - RPV Control
4. Emergency Operating Procedure (EOP) ALC - Alternate Level Control
5. NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007, Revision 4, May 1999

SG2 Failure of the Reactor Protection System to Complete an Automatic Scram and Manual Scram was NOT Successful and There is Indication of an Extreme Challenge to the Ability to Cool the Core

EVENT TYPE: RPS Failure

OPERATING MODE APPLICABILITY: Power Operation, Startup

EAL THRESHOLD VALUE:

Failure of automatic and manual scrams **AND** conditions exist that no longer assure adequate core cooling or adequate decay heat removal.

The following conditions must exist to declare this EAL:

1. In ATWS EOP

   AND

2. Loss of adequate core cooling or decay heat removal capability as indicated by either:

   a. RPV level cannot be restored and maintained above the Minimum Steam Cooling RPV Water Level (i.e., SAG Entry Required),

   OR

   b. HCL Curve (EOP Graph 4) exceeded.

DAEC EAL INFORMATION:

This EAL addresses conditions where failure of an automatic scram has occurred and manual actions performed in the Control Room to reduce reactor power have been unsuccessful AND a subsequent loss of adequate core cooling or decay heat removal capability occurs. If either of these challenges exist during an ATWS, 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 matrix declaration to permit maximum offsite intervention time.

The purpose of the ATWS EOP is to maintain adequate core cooling, shutdown the reactor and cooldown the RPV to cold shutdown conditions. The ATWS EOP is

implemented when it cannot be determined that control rod insertion alone will assure that the reactor will remain shutdown under all conditions.

If injection with all available Preferred and Alternate ATWS Injection Systems fails to provide sufficient injection to restore and maintain level above -25 inches (Minimum Steam Cooling RPV Water Level), adequate core cooling is threatened and submergence of the core is attempted by flooding the primary containment. This is accomplished by transfer to and implementation of the DAEC Severe Accident Guidelines (SAGs).

The Heat Capacity Limit (EOP Graph 4) is defined to be the highest torus temperature at which initiation of RPV depressurization will not result in exceeding the Primary Containment Pressure Limit (the PCPL is 53 psig at the DAEC) before the rate of energy transfer from the RPV to the primary containment is within the capacity of the containment vent.

Control of torus temperature relative to the Heat Capacity Limit is directed in the Primary Containment Control Guideline, EOP 2. If the actions being taken in EOP 2 to preserve torus heat capacity are inadequate or not effective, RPV pressure must be reduced in order to remain below the Heat Capacity Limit. Therefore, actions in the RPV pressure control section of the ATWS EOP must accommodate these requirements. Failure to do so may lead to failure of the containment or loss of equipment necessary for the safe shutdown of the plant.

REFERENCES:

1. Emergency Operating Procedure ATWS EOP - RPV Control
2. NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4, May1999