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DAEC EMERGENCY PLANNING DEPARTMENT PROCEDURE TRANSMITTAL ACKNOWLEDGEMENT MEMO (TAM-96)

To: NRC-NRR Document Control Desk
US NRC
Washington DC 20555

Re: Entire EAL Basis Document (Table of Contents Rev) (Copy 91)

PSM Title: n/a

Distribution Date: 10 / 27 / 2003
Effective Date of Change: 11 / 03 / 2003
Return by: 11 / 17 / 2003

Please perform the following to your assigned manual. If you have any questions regarding this TAM please contact Don A. Johnson at 319-851-7872.

	REMOVE	INSERT
EAL Table of Contents Revision	Rev. 16	Rev. 17
EAL EBD-S (PWR: 21939)	Rev. 4	Rev. 5

PERFORMED BY:

Print Name _____ Sign Name _____ Date _____

Please return to: K. Dunlap
PSC/Emergency Planning
3313 DAEC Rd.
Palo, IA 52324

A045

To be completed by DAEC EP personnel only:
Date TAM returned: _____
EPTools updated: _____

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Duane Arnold Energy Center
Operated by Nuclear Management Company, LLC

Monday, October 27, 2003

NRC-NRR Document Control Desk
US NRC
Washington, DC 20555

To: NRC-NRR Document Control Desk
From: DAEC Emergency Planning Department

Re: Description of changes to the following documents

EAL EBD-S System Malfunction Category

Procedure Usage level 'Reference Use' has been added.
Provide consistency between the EAL Table and the EBD-S.
For all sections, the reference to NUMARC/NESP-007 has been changed to Rev. 4, January 2003.
SU1, SA1, SS1 AND SG1 have been changed to more closely follow the NEI 99-01, Rev. 4 wording. This provides consistency between the loss of power EALs.
Change EVENT TYPE from 'Inability to Maintain Shutdown Conditions' to 'Inability to Reach and Maintain Shutdown Conditions', to cover all events in this category.
Delete the word 'valid' in the thresholds, since it is a standard operating procedure to validate indications prior to acting on them.
Add information to SU5, RCS Leakage to discuss SRV Leakage. Add new reference, NUMARC/NESP-007, Rev. 2, Questions and Answers, June 1993.
SA2 - In the DAEC Information change EOPs Maximum Subcritical Banked Withdrawal Position from '02' to '00'.
SA3 - Add the word 'SECONDARY' to 'CONTAINMENT CLOSURE' in the second threshold.
SS3 - Remove reference to 250 VDC system since all **vital** DC loads are rendered useless due to the loss of 125 VDC alone.
SS4 - Change the Initiating Condition to 'Complete Loss of Heat Removal' to agree with NEI 99-01, Rev. 4 wording. Reactivity Control is addressed in EALs SA2, SS2 and SG2.
Several Editorial Changes, as needed.

Please contact Paul Sullivan, Manager of Emergency Preparedness at DAEC, (319)851-7191, if you require further information.

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PROCEDURE	TITLE	REV #	REV. DATE
	Introduction	1	2/01/2000
	Definitions	2	8/5/2003
	Organization of Basis Information	3	8/5/2003
EBD-A	Abnormal Rad Levels/Radiological Effluent Category	6	8/29/03
EBD-F	Fission Product Barrier Degradation Category	4	10/6/03
EBD-H	Hazards and Other Conditions Affecting Plant Safety Category	6-A	10/21/03
EBD-S	System Malfunction Category	5	11/3/03
EBD-E	ISFSI Abnormal Events Category	0	8/5/2003

EAL BASES DOCUMENT	EBD-S
SYSTEM MALFUNCTION CATEGORY	Rev. 5 Page 1 of 43

Usage Level

Reference Use

Effective Date: 11-3-03

TECHNICAL REVIEW

Prepared by: _____ Date: 10/12/03

Reviewed by: _____ Date: 10/13/03
Independent Reviewer

Reviewed by: _____ Date: 10/23/03
Operations 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-2003-0044.

Approved by: _____ Date: 10/27/03
Manager, Emergency Planning

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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 exists:

1. Unplanned loss of power to 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 both of the emergency diesel generators have successfully started and energized their respective 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*, January 2003

SU2 Inability to Reach Required Shutdown Within Technical Specification Limits

EVENT TYPE: Inability to Reach or Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following condition exists:

1. Plant NOT brought to required mode within the applicable 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*, January 2003

SU3 Unplanned Loss of Most or 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.

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* include 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.

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*, January 2003

SU4 Fuel Clad Degradation

EVENT TYPE: Coolant Activity

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

One of the following:

1. Pretreat radiation monitor (RM-4104) reading ABOVE 4E+3 mr/hr.

   OR

2. Reactor Coolant sample activity value indicating ABOVE 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 pretreat rad monitor (RM-4104) exceeding 4E+3 mr/hr. The calculation supporting this value is described below. This indication would be validated by ensuring 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 μCi/cc /34 μCi/cc]
= [2.38 E +6 Ci x 1 E+6 μCi /Ci]/ [5.5 E+4 ft^3 x 2.83 E+4 cc/ft^3] X [1.2 μCi/cc /34 μCi/cc]
= 1529 μCi x 0.0353 = 54.0 μCi/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*, January 2003

SU5 RCS Leakage

EVENT TYPE: Coolant Leakage

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

One of the following:

1. Unidentified or pressure boundary leakage ABOVE 10 gpm.
   OR
2. Identified leakage ABOVE 25 gpm.
   OR
3. 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.

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 EAL Threshold 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.

DAEC EAL Threshold Value 3, indication of main steam line break, is 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.

The Main Steamline Break indication would be validated by ensuring 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.

A stuck open or cycling SRV 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. If an SRV is stuck open or is cycling and no other emergency conditions exist, an emergency declaration may not be appropriate. *RCS leakage inside the drywell excludes Safety-Relief Valve (SRV) discharge through the SRV discharge piping into the torus below the water line.* However, *if the fuel is damaged and the SRV is allowing fission products to escape into primary containment, a loss of RCS should be determined as having occurred.*

Abnormal operating procedures (AOPs) or technical specifications may require the plant to shut down when an SRV is stuck open or cycling. For cycling SRVs, technical specifications for suppression pool temperature and /or level, and SRV operability, may drive operators to shut down the plant. This is within the analyzed operating envelope of the plant and does not represent degradation in the level of safety. This also does not represent a significant precursor to further plant degradation.

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*, January 2003
9. *NUMARC Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 2, Questions and Answers,* June 1993 Fission Product Barrier-BWR section

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
   - In-plant Telephones
   - Sound Power Telephones
   - Plant Paging System

   OR

2. Loss of ALL of the following offsite communications capability:

   - All telephone lines (commercial)
   - Microwave Phone System
   - FTS-2001 phone system (ENS & HPN)
   - Cellular Phones
   - Police Radio
   - Rad Survey Radio systems

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 Alliant 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*, January 2003

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 Div 1 and Div 2 125 VDC busses based on bus voltage BELOW 105 VDC indicated.

   AND

2. Failure to restore power to at least one required 125 VDC 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 exclude scheduled maintenance and testing activities. Under the conditions of concern, AOP 302.1, Loss of 125 VDC Power, would be entered. The DAEC EALs 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 EALs 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*, January 2003

SA1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses During Cold Shutdown or Refuel 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 Startup (1X3) and Standby (1X4) transformers.
   AND
2. Failure of A Diesel Generator (1G-31) and B Diesel Generator (1G-21) 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*, January 2003

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: Run, 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 00 - 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, January 2003

SA3 Inability to Maintain Plant in Cold Shutdown

EVENT TYPE: Inability to Reach or Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel

EAL THRESHOLD VALUE:

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

   AND

2. With SECONDARY 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 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
5. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, January 2003

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 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

2. Either of the following conditions exist:

   a. A significant plant transient in progress.

   OR

   b. Loss of compensatory non-alarming indications.

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.

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*, January 2003

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 condition exists:

Only one AC power source remains available to supply Bus 1A3 or Bus 1A4 for greater than 15 minutes AND if it is lost, a Station Blackout will occur.

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
4. NEI Methodology for Development of EALs, NUMARC/NESP-007 Revision 4, January 2003

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 Startup (1X3) and Standby (1X4) transformers.

   AND

2. Failure of A Diesel Generator (1G-31) and B Diesel Generator (1G-21) to supply power to emergency busses 1A3 and 1A4.

   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*, January 2003

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: Run, 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 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).

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 EALs NUMARC/NESP-007 Rev 4*, January 2003

SS3 Loss of All Vital DC Power

EVENT TYPE: Loss of Power

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL THRESHOLD VALUE:

The following conditions exist:

1. Loss of Div 1 **AND** Div 2 125V DC busses based on bus voltage BELOW 105 VDC indicated.

   AND

2. Failure to restore power to at least one required 125V DC bus within 15 minutes from time of loss.

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 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*, January 2003

SS4 Complete Loss of Heat Removal Capability

EVENT TYPE: Inability to Reach or Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown.

EAL THRESHOLD VALUE:

EOP Graph 4 Heat Capacity Limit is exceeded.

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.

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. SS1, Station Blackout, and SS3, Loss of all Vital DC Power address the Auxiliary Electrical System and the Core and Containment Cooling Systems; therefore they are not covered here. The Fission Barrier Table and SU5, RCS Leakage cover failure of the primary system boundary. Reactivity Control, including Standby Liquid Control System, is addressed in EALs SA2, SS2 and SG2.

REFERENCES:

1. Abnormal Operating Procedure (AOP) 149, Loss of Decay Heat Removal
2. Emergency Operating Procedure (EOP) 1 - RPV Control
3. ATWS Emergency Operating Procedure (EOP) - RPV Control
4. Emergency Operating Procedure ALC - Alternate Level Control
5. Emergency Operating Procedure (EOP) Basis, EOP Breakpoints
6. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, January 2003

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

EVENT TYPE: Inability to Reach or Maintain Shutdown Conditions

OPERATING MODE APPLICABILITY: Cold Shutdown, Refuel

EAL THRESHOLD VALUE:

The following conditions exist:

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

   AND

2. Loss of all decay heat removal.

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*, January 2003

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 most or all annunciators on Panels 1C03, 1C04 and 1C05

   AND

   b. Loss of compensatory non-alarming indications.

   AND

   c. Loss of indicators needed to monitor criticality, OR core heat removal, OR Fission Product Barrier status.

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.

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 required 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.

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*, January 2003

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

   AND

2. Failure of A Diesel Generator (1G-31) and B Diesel Generator (1G-21) to supply power to emergency busses 1A3 and 1A4.

   AND

3. **<u>ANY</u> ONE OF THE FOLLOWING:**

   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. <u>SBO Coping Capability Exceeded</u>

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. <u>RPV Water Level Measurements Remaining Unreliable</u>

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, January 2003

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: Run, 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 maintained above –25 inches.

   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 exists 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, January 2003