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DAEC EMERGENCY PLANNING DEPARTMENT PROCEDURE TRANSMITTAL ACKNOWLEDGEMENT MEMO (TAM-79)

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 / 01 / 2003
Effective Date of Change: 10 / 06 / 2003
Return by: 10 / 20 / 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. 14	Rev. 15
EAL EBD-F (PWR: 21942)	Rev. 3	Rev. 4
EAL EBD-H (PWR: 22730)	Rev. 5	Rev. 6

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

Wednesday, October 1, 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-F Fission Product Barrier Degradation Category

- Overall, changes were completed to ensure the EAL Bases Document matches the EAL Table.
- EALs FU1, FA1 and FG1 added a statement similar to FS1 providing information about the source of the logic chart and the combinations of LOSSES and POTENTIAL LOSSES used in the EAL Table.
- The term 'valid' was removed from several Threshold values. It is plant policy to validate readings prior to making decisions from them.
- Specific instrument numbers have been added to assist the Decision Makers in making TIMELY and ACCURATE EAL declarations.
- References to fuel damage assessment have the site-specific procedure (PASAP 7.2) added.
- Table footnotes have been rearranged to keep related information together.
- Typographical, format and title changes to ensure consistency with other site specific procedures.

EAL EBD-H Hazards and Other Conditions Affecting Plant Safety Category

Replace reference to ISFSI in HA4. The reference to ISFSI was erroneously placed in the EAL on the last revision. After discussions with Security, it was decided that security events at the ISFSI do not require an ALERT level classification.

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

3313 DAEC Road - Palo, Iowa 52324-9785
Telephone: 319.851.7191 - Fax: 319.851.7364

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	11/20/2000
EBD-H	Hazards and Other Conditions Affecting Plant Safety Category	6	8/5/2003
EBD-S	System Malfunction Category	4	9/30/2002
EBD-E	ISFSI Abnormal Events Category	0	8/5/2003

Usage Level

Information Use

Effective Date: 10-6-03

TECHNICAL REVIEW

Prepared by: Thomas B. Zimmerman Date: 9/25/03

Reviewed by: Paul Sullivan Date: 9/25/03
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-2003-0039.

Approved by: Paul Sullivan Date: 9/26/03
Manager, Emergency Planning

Table of Contents

FU1 Any Loss or Any Potential Loss of Primary Containment Barrier

EVENT TYPE: See Fission Barrier Table

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL Threshold Values:

See the Fission Barrier Table indicators discussed later in this section.

DAEC INFORMATION:

The entry conditions for this Initiating Condition are shown by the logic chart located to the right of the Fission Barrier Table. This logic is simplified from the generic NUMARC/NESP-007 logic based on the following considerations:

1. Human Factors - It is easier to understand and to remember the escalation from Alert to Site Area Emergency to General Emergency using the simpler logic.

2. Comprehensiveness - A comparison was made of the combinations of barrier losses and potential losses between the DAEC logic and the NUMARC/NESP-007 logic. All six generic barrier loss/potential loss combinations are addressed in the DAEC logic that addresses 12 combinations of barrier loss/potential loss. No sequences addressed by the NUMARC/NESP-007 logic are significantly affected by the simplified logic when applied to a BWR.

REFERENCES:

See the Fission Barrier Table indicators discussed later in this section.

FA1 Any Loss or Any Potential Loss of Either Fuel Clad Or RCS Barrier

EVENT TYPE: See Fission Barrier Table

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL Threshold Values:

See the Fission Barrier Table indicators discussed later in this section.

DAEC INFORMATION:

The entry conditions for this Initiating Condition are shown by the logic chart located to the right of the Fission Barrier Table. This logic is simplified from the generic logic based on the following considerations:

1. Human Factors - It is easier to understand and to remember the escalation from Alert to Site Area Emergency to General Emergency using the simpler logic.

2. Comprehensiveness - A comparison was made of the combinations of barrier losses and potential losses between the DAEC logic and the NUMARC/NESP-007 logic. All six generic barrier loss/potential loss combinations are addressed in the DAEC logic that addresses 12 combinations of barrier loss/potential loss. No sequences addressed by the NUMARC/NESP-007 logic are significantly affected by the simplified logic when applied to a BWR.

REFERENCES:

See the Fission Barrier Table indicators discussed later in this section.

FS1 Loss Or Potential Loss of Any Two Barriers

EVENT TYPE: See Fission Barrier Table

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL Threshold Values:

See the Fission Barrier Table indicators discussed later in this section.

DAEC INFORMATION:

The entry conditions for this Initiating Condition are shown by the logic chart located to the right of the Fission Barrier Table. DAEC uses "Loss Or Potential Loss of Any Two Barriers." This logic is simplified from the generic logic based on the following considerations:

1. Human Factors - It is easier to understand and to remember the escalation from Alert to Site Area Emergency to General Emergency using the simpler logic.

2. Comprehensiveness - A comparison was made of the combinations of barrier losses and potential losses corresponding to Site Area Emergency between the DAEC logic and the NUMARC/NESP-007 logic. All six generic barrier loss/potential loss combinations are addressed in the DAEC logic that addresses 12 combinations of barrier loss/potential loss. No sequences addressed by the NUMARC/NESP-007 logic are significantly affected by the simplified logic when applied to a BWR.

REFERENCES:

See the Fission Barrier Table indicators discussed later in this section.

FG1 Loss of Any Two Barriers AND Potential Loss of the Third Barrier

EVENT TYPE: See Fission Barrier Table

OPERATING MODE APPLICABILITY: Run, Startup, Hot Shutdown

EAL Threshold Values:

See the Fission Barrier Table indicators discussed later in this section.

DAEC INFORMATION:

The entry conditions for this Initiating Condition are shown by the logic chart located to the right of the Fission Barrier Table. This logic is simplified from the generic logic based on the following considerations:

1. Human Factors - It is easier to understand and to remember the escalation from Alert to Site Area Emergency to General Emergency using the simpler logic.

2. Comprehensiveness - A comparison was made of the combinations of barrier losses and potential losses between the DAEC logic and the NUMARC/NESP-007 logic. All six generic barrier loss/potential loss combinations are addressed in the DAEC logic that addresses 12 combinations of barrier loss/potential loss. No sequences addressed by the NUMARC/NESP-007 logic are significantly affected by the simplified logic when applied to a BWR.

REFERENCES:

See the Fission Barrier Table indicators discussed later in this section.

FISSION BARRIER: Fuel Clad

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Clad Damage Determination

LOSS – Fuel Damage assessment (PASAP 7.2) indicates at least 5% fuel clad damage.

POTENTIAL LOSS – None

DAEC INFORMATION:

As a site-specific loss indicator, DAEC uses determination of at least 5% fuel clad damage, which is consistent with the containment rad monitor reading indicators described previously. This can be determined per FUEL DAMAGE ASSESMENT, PASAP 7.2.

REFERENCES:

1. Post Accident Sampling and Analysis Procedure (PASAP) 7.2, Fuel Damage Assessment

FISSION BARRIER: Fuel Clad

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Drywell/Torus Radiation Monitoring

LOSS - Drywell Area Hi Range Rad Monitor RIM-9184A or B reading ABOVE 7E+2 R/hr
OR
LOSS - Torus Area Hi Range Rad Monitor RIM-9185A or B reading ABOVE 3E+1 R/hr

POTENTIAL LOSS - None

DAEC 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, coolant sampling or radiological survey results.

There is no significant deviation from the generic "loss" indicator. Per NUMARC/NESP-007, the (site-specific) reading (Drywell/Torus Rad – above) is a value that indicates release into the drywell of reactor coolant with elevated activity corresponding to about 2% to 5% fuel clad damage. This activity level is well above that expected from iodine spiking. *It is intended that determination of barrier loss be made whenever the indicator threshold is reached until such time that core damage assessment is performed, at which time direct use of containment rad monitor readings is no longer required.*

As documented by NG-88-0966, General Electric performed a study to predict dose rate readings from fuel damage calculations for emergency planning. The calculations were performed to obtain gamma ray dose rates at the locations of the containment atmospheric monitoring system radiation detectors in the drywell and torus locations for assumed releases of gap activity from the core. These calculations were based on "nominal" estimates of fuel rod gap fission product inventory fractions, which are considered to be more appropriate for determining a minimum threshold reading than inventory assumptions found in the NRC Regulatory Guides. The Regulatory Guide inventory assumptions applicable to dose assessments are larger and therefore non-conservative for determination of this EAL threshold. Two separate cases were evaluated. In the first case, the released activity was assumed to be contained in the drywell atmosphere. This case is considered representative of conditions following a line break in

which activity is released directly into the drywell. In the second case, the released activity was assumed to be contained in the torus. This could be applied for an event which results in vessel isolation and blowdown to the suppression chamber. The results for each case were provided for each case in the form of gamma ray dose rate versus time profiles for assumed releases of 100% and 20% of the gap activity from the core. The dose rate calculations were carried out independent of any specific information on details of construction or response characteristics of the detector systems. The figures show a drywell reading of about 2.9×10^3 R/hr or a torus reading of about 1.1×10^2 R/hr associated with 20% gap release at two hours after shutdown. Scaling this down to 5% gap release:

Calculation of Drywell and Torus Monitor Readings Assuming 5% Gap Release

NG-88-0966 value 20% Gap Release at 2 hours for drywell = 2.9×10^3 R/hr

Drywell reading = 2.9×10^3 R/hr x [5 % / 20 %] = 7.25×10^2 R/hr, round off as 7 E+2 R/hr

NG-88-0966 value 20% Gap Release at 2 hours for torus = 1.1×10^2 R/hr

Torus reading = 1.1×10^2 R/hr x [5 % / 20 %] = 2.75×10^1 R/hr, round off as 3 E+1 R/hr

The results are rounded off for ease of reading the respective radiation monitors' scales. The two-hour point was picked because it allows ample time for the Technical Support Center to be operational and core damage assessment to begin. These indicators correspond to about 2.5% gap release if they occur immediately after shutdown. Thus, the indicators address the 2%-5% fuel clad damage range of concern described by the generic guidance.

REFERENCES:

1. Office Memo NG-88-0966, G.E. Fuel Damage Documentation/Dose Rate Calculations, 03/18/88

FISSION BARRIER: Fuel Clad

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Primary Coolant Activity Level

LOSS - Coolant activity ABOVE 300 μCi/gm dose equivalent I-131.

POTENTIAL LOSS - None

DAEC INFORMATION:

There is no significant deviation from the generic indicator. Consistent with the generic methodology, DAEC uses a coolant activity value of 300 μCi/gm I-131 equivalent. This value is well above that expected for iodine spikes and would indicate fuel clad damage has occurred.

REFERENCES:

1. Post Accident Sampling and Analysis Procedure (PASAP) 7.2, Fuel Damage Assessment

FISSION BARRIER: Fuel Clad

DAEC INDICATOR: RPV Level

EAL THRESHOLD VALUE:
Reactor Vessel Water Level

LOSS – RPV Level BELOW –25 Inches that cannot be restored.

POTENTIAL LOSS – RPV Level BELOW 15 Inches that cannot be restored.

DAEC INFORMATION:

The loss indicator is based on a value that corresponds to the minimum value to assure core cooling without further degradation of the fuel clad. DAEC uses the Minimum Steam Cooling RPV Water Level of -25 inches. This is defined to be the lowest RPV water level at which the covered portion of the reactor core will generate sufficient steam to preclude any clad temperature in the uncovered portion of the core from exceeding 1500°F. Consistent with the EOPs, an indicated RPV level below -25 inches that cannot be restored is used.

The potential loss indicator corresponds to the water level at the top of the active fuel (TAF). Consistent with the EOPs, an indicated RPV level below 15 inches that cannot be restored is used.

REFERENCES:

1. Emergency Operating Procedure (EOP)-1, RPV Control, Sheet 1 of 1
2. ATWS Emergency Operating Procedure (EOP)-RPV Control, Sheet 1 of 1
3. Emergency Operating Procedure (EOP) Basis, Curves and Limits, C5, Minimum Steam Cooling RPV Water Level

FISSION BARRIER: Fuel Clad

DAEC INDICATOR: EC/OSM Judgement

EAL THRESHOLD VALUE:
EC/OSM's Judgement

Any condition which in the EC/OSM's judgement indicates loss or potential loss of the fuel clad barrier due to Imminent barrier degradation OR the barrier may be considered lost or potentially lost due to the inability to monitor the barrier.

DAEC INFORMATION:

There is no significant deviation from the generic indicator. Per EPIP 2.5, Control Room Emergency Response Operation, the Emergency Coordinator/Operations Shift Manager (EC/OSM) performs the emergency director function at DAEC.

EC/OSM considerations for determining whether any barrier "Loss" or "Potential Loss" include *imminent* barrier degradation, degraded *barrier monitoring* capability, and consideration of *dominant accident sequences*.

Any condition which in the judgement of the EC/OSM indicates a LOSS or POTENTIAL LOSS of the FUEL CLAD barrier such as, but not limited to:

- Degraded *barrier monitoring* capability from loss of/lack of reliable indicators.
- Consideration for instrumentation operability.
- Portable instrumentation readings.
- Offsite monitoring results.
- Complete loss of 125 VDC.
- Loss of decay heat removal.
- ATWS with failure of Standby Liquid Control.
- Prolonged station blackout.
- Loss of offsite power with early HPCI/RCIC failure

Imminent means that no turnaround in safety system performance is expected and that General Emergency conditions can be expected to occur within two hours. *Imminent* fission barrier degradation must be considered by the EC/OSM to assure timely declaration of a General Emergency and to better assure that offsite protective actions can be effectively accomplished.

Degraded *barrier monitoring* capability from loss of/lack of reliable indicators must also be considered by the EC/OSM when determining if a fission barrier loss or potential loss has occurred.

This assessment should also include consideration for instrumentation operability and portable instrumentation readings.

Offsite monitoring results may be an indication of Fission Product Barrier degradation causing an unmonitored release.

Dominant accident sequences can lead to loss of all Fission Barriers. Based on the IPE, the dominant accident sequences leading to core damage at DAEC include complete loss of 125 VDC, loss of decay heat removal, ATWS with failure of Standby Liquid Control, prolonged station blackout, and loss of offsite power with early HPCI/RCIC failure. The EC/OSM should also consult System Malfunction EALs, as appropriate, to assure timely emergency classification declaration.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. Duane Arnold Energy Center Individual Plant Examination (IPE) November 1992

FISSION BARRIER: RCS

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Drywell Radiation Monitoring

LOSS - Drywell Area Hi Range Rad Monitor RIM-9184A or B reading ABOVE 5 R/hr after Reactor Shutdown

POTENTIAL LOSS - None

DAEC INFORMATION:

There is no significant deviation from the generic indicator. This loss indicator is based on conditions after reactor shutdown to assure that it is not misapplied, *i.e.*, to exclude readings due to N-16 effects which are typically 5 to 8 R/hr at full power conditions.

The 5 R/hr value for this loss indicator corresponds to instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (*i.e.*, within Technical Specifications) into the drywell atmosphere. The reading will be less than that specified for the loss indicator for Radiation/Core Damage that applies to the Fuel Clad barrier. Thus, this indicator would be indicative of a RCS leak only. If the radiation monitor reading increased to that value specified by the Radiation/Core indicator applying to the Fuel Clad barrier, fuel damage would also be indicated.

As documented by NG-88-0966, General Electric performed a study to predict dose rate readings from fuel damage calculations for emergency planning. The calculations were performed to obtain gamma ray dose rates at the locations of the containment atmosphere monitoring system radiation detectors in the drywell and torus locations for assumed releases of gap activity from the core. These calculations were based on "nominal" estimates of fuel rod gap fission product inventory fractions, which are considered to be more appropriate for determining a minimum threshold reading than inventory assumptions found in the NRC Regulatory Guides. The Regulatory Guide inventory assumptions applicable to dose assessments are larger and therefore non-conservative for determination of this EAL threshold. Two separate cases were evaluated. In the first case, the released activity was assumed to be contained in the drywell atmosphere. This case is considered representative of conditions following a line break in which activity is released directly into the drywell. In the second case, the released activity was assumed to be contained in the torus. This could be applied for an event which results in vessel isolation and blowdown to the suppression chamber. The results for each case were

provided for each case in the form of gamma ray dose rate versus time profiles for assumed releases of 100% and 20% of the gap activity from the core. The dose rate calculations were carried out independent of any specific information on details of construction or response characteristics of the detector systems. The figures show a drywell reading of about 2.1×10^4 R/hr associated with a 100% gap release immediately after shutdown. Assuming 99.99% fuel clad integrity (0.01% gap release) and uniform dispersal of radionuclides into the drywell immediately after shutdown, a drywell monitor reading is calculated:

Calculation of Drywell Monitor Reading Assuming 0.01% Gap Release

NG-88-0966 value for 100% Gap Release at 0.01 minutes = 2.1×10^4 R/hr

(2.1×10^4) R/hr x $[(1 \times 10^{-2})$ percent / 100 percent$]$ = $(2.1) \times 10^{4-4}$ R/hr = 2.1×10^0 R/hr = 2 R/hr

To assure an indicator that is readily discernible on the drywell radiation monitor scale, DAEC uses a valid reading above 5 R/hr after reactor shutdown.

REFERENCES:

1. Office Memo NG-88-0966, G.E. Fuel Damage Documentation/Dose Rate Calculations, 03/18/88
2. Technical Specification 3.4.5, Drywell Leak Detection Instrumentation

FISSION BARRIER: RCS

DAEC INDICATOR: RPV Level

EAL THRESHOLD VALUE:
Reactor Vessel Water Level

LOSS – RPV Level BELOW 15 Inches

POTENTIAL LOSS - None

DAEC INFORMATION:

There is no significant deviation from the generic indicator. This loss indicator corresponds to the water level at the top of the active fuel (TAF). In order to provide normal means to cool the fuel, water level must be maintained above the top of active fuel otherwise extraordinary means must be taken to assure that adequate core cooling exists. In certain failure event sequences reactor vessel water level may be procedurally lowered to the top of active fuel and the reactor coolant system depressurized to allow for steam cooling of the core. Even though fuel clad damage is not predicted under these conditions several safety system failures need to have occurred to reach the condition where steam cooling would be procedurally required. Therefore this is indicative of a loss of the reactor coolant system boundary. Water levels below this value indicate a challenge to core cooling which is a precursor to more serious events.

REFERENCES:

1. Emergency Operating Procedures (EOP) Basis, Breakpoints

FISSION BARRIER: RCS

DAEC INDICATOR: Leakage

EAL THRESHOLD VALUE:
RCS Leak Rate

LOSS – None

POTENTIAL LOSS - RCS leakage ABOVE 50 GPM
OR
POTENTIAL LOSS - Unisolable primary system leakage outside drywell as indicated by area temperatures or ARMs exceeding the Max Normal Limits per EOP 3, Table 6.

DAEC INFORMATION:

There are no significant deviations from the generic potential loss indicators applying to RCS leakage and indications of unisolable primary system leakage.

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.* The EC/OSM should also consult SU5, RCS Leakage, to determine if RCS leakage exceeds the threshold required for declaration of an Unusual Event.

Unisolable primary system leakage is considered a Potential loss of RCS based on RCS leakage outside the drywell. Site-specific RCS leakage is determined from temperature or area radiation alarms (ARMs) exceeding the Max Normal limits listed in Table 6, EOP 3. Unisolable primary system leakage in the areas of the steam tunnel, main turbine generator, RCIC, HPCI, etc., indicates a direct path from the RCS to areas outside primary containment. It should be confirmed that the indicators are caused by RCS leakage. Area temperatures or area radiation alarms above Max Normal limits are the criteria for declaration of an Alert classification. An unisolable leak which is indicated by exceeding Max Safe limits escalates to a Site Area Emergency when combined with Primary Containment Barrier loss (after a containment isolation) and a General Emergency when the Fuel Clad Barrier criteria is also exceeded.

DAEC does not use the generic "loss" indicator for main steam line break. *NUMARC Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 2 Questions and Answers*, June 1993, discloses that the main steam line break

with isolation does not have to be included as a fission barrier table indicator. This event can be appropriately classified in the System Malfunction Recognition Category. This event was classified as a RCS barrier loss indicator in the generic guidance because this event typically results in a puff release with dose consequences greater than 10 millirem whole body, *i.e.*, offsite dose consequences consistent with declaration of an Alert in accordance with AA1, Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds 200 Times Radiological Technical Specifications for 15 Minutes or Longer. However, UFSAR Section 15.6.6, Table 15.6-1, Steam-Line Break - Radiological Effects for Puff Release at 47 Meters, Total Dose, shows a maximum dose of 0.58 mrem (5.8E-04 rem) passing cloud whole body dose using conservative assumptions. Therefore, because this event at DAEC has dose consequences similar to those of AU1, Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds 2 Times Radiological Technical Specifications for 60 Minutes or Longer, it has been added as an Unusual Event EAL in SU5, RCS Leakage.

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Recirculation
2. Alarm Response Procedure (ARP) 1C04C, Reactor Water Cleanup and Recirculation
3. Emergency Operating Procedure (EOP) 3, Secondary Containment Control
4. UFSAR Section 15.6.6, Loss-of-Coolant-Accident
5. *NEI Methodology for Development of Emergency Action Levels Revision 4*, May 1999
6. *NUMARC Methodology for Development of Emergency Action Levels, NUMARC/NESP-007, Revision 2*, Questions and Answers, June 1993

FISSION BARRIER: RCS

DAEC INDICATOR: Primary Containment Atmosphere

EAL THRESHOLD VALUE:
Drywell Pressure

LOSS - Drywell Pressure ABOVE 2 psig and not caused by a loss of DW Cooling

POTENTIAL LOSS - None

DAEC INFORMATION:

There is no significant deviation from the generic indicator. The value for this loss indicator corresponds to the drywell high pressure ECCS initiation signal setpoint of 2.0 psig. DAEC also specifies that drywell cooling is operating to assure that the indicator is not misapplied to conditions that do not indicate RCS leakage into the drywell, *i.e.*, the drywell pressure increase is not due to loss of drywell cooling.

DAEC uses a GE Mark I Containment. During reactor operation, with drywell cooling in operation and the drywell inerted, the normal operating pressure in the drywell is between 0.5 and 1.0 psig. Analysis at the DAEC shows that a 50 gpm RCS leak would result in a 2 to 3 psig pressure rise over a six minute time period. Since a 2 psig rise would place DAEC above the ECCS initiation setpoint, (2 psig) it is necessary to select the DAEC ECCS initiation setpoint of 2 psig to indicate an actual loss of the RCS. Drywell cooling is not isolated at the 2 psig ECCS initiation setpoint, therefore further pressure rise would be indicative of a RCS leak.

REFERENCES:

1. Emergency Operating Procedures (EOP) Bases, Breakpoints
2. Emergency Operating Procedures (EOP) -1, RPV Control
3. Emergency Operating Procedures (EOP) -2, Primary Containment Control

FISSION BARRIER: RCS

DAEC INDICATOR: EC/OSM's Judgement

EAL THRESHOLD VALUE:

Any condition which in the EC/OSM's judgement indicates loss or potential loss of the RCS barrier due to Imminent barrier degradation OR the barrier may be considered lost or potentially lost due to the inability to monitor the barrier.

DAEC INFORMATION:

There is no significant deviation from the generic EAL. Per EPIP 2.5, Control Room Emergency Response Operation, the Emergency Coordinator/Operations Shift Manager (EC/OSM) performs the emergency director function at DAEC. EC/OSM considerations for determining whether any barrier "Loss" or "Potential Loss" include *imminent* barrier degradation, degraded *barrier monitoring* capability, and consideration of *dominant accident sequences.*

Any condition which in the judgement of the EC/OSM indicates a LOSS or POTENTIAL LOSS of the RCS barrier such as, but not limited to:

- Degraded *barrier monitoring* capability from loss of/lack of reliable indicators.
- Consideration for instrumentation operability.
- Portable instrumentation readings.
- Offsite monitoring results.
- Complete loss of 125 VDC.
- Loss of decay heat removal.
- ATWS with failure of Standby Liquid Control.
- Prolonged station blackout.
- Loss of offsite power with early HPCI/RCIC failure

Imminent means that no turnaround in safety system performance is expected and that General Emergency conditions can be expected to occur within two hours. *Imminent* fission barrier degradation must be considered by the EC/OSM to assure timely declaration of a General Emergency and to better assure that offsite protective actions can be effectively accomplished.

Degraded *barrier monitoring* capability from loss of/lack of reliable indicators must also be considered by the EC/OSM when determining if a fission barrier loss or potential loss has occurred.

This assessment should also include consideration for instrumentation operability and portable instrumentation readings.

Offsite monitoring results may be an indication of Fission Product Barrier degradation causing an unmonitored release.

Dominant accident sequences can lead to loss of all Fission Barriers. Based on the IPE, the dominant accident sequences leading to core damage at DAEC include complete loss of 125 VDC, loss of decay heat removal, ATWS with failure of Standby Liquid Control, prolonged station blackout, and loss of offsite power with early HPCI/RCIC failure. The EC/OSM should also consult System Malfunction EALs, as appropriate, to assure timely emergency classification

For the RCS barrier, the EC/OSM should also consider safety-relief valves (SRVs) open or cycling. If an SRV is stuck open or is cycling and no other emergency conditions exist, an emergency declaration may not be appropriate. 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.* The EC/OSM should also consult SU5, RCS Leakage, to determine if RCS leakage exceeds the threshold required for declaration of an Unusual Event.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. Duane Arnold Energy Center Individual Plant Examination (IPE) November 1992
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

FISSION BARRIER: Primary Containment

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Significant Radioactive Inventory in Containment

LOSS - None

POTENTIAL LOSS – Drywell Area Hi Range Rad Monitor RIM-9184A or B reading ABOVE 3E+3 R/hr
OR
POTENTIAL LOSS – Torus Area Hi Range Rad Monitor RIM-9185A or B reading ABOVE 1E+2 R/hr

DAEC INFORMATION:

There is no significant deviation from the generic indicators. The potential loss (site-specific) indicator value corresponds to at least 20% fuel clad damage with release into the primary containment. This indicator corresponds to loss of both the Fuel Clad and RCS barriers with Potential Loss of the Primary Containment barrier, and would result in declaration of a General Emergency. The basis for the 20% fuel clad damage threshold is described under the 20% core damage assessment indicator. *It is intended that determination of barrier potential loss be made whenever the indicator threshold is reached until such time that core damage assessment is performed, at which time direct use of containment rad monitor readings is no longer required.*

As documented by NG-88-0966, General Electric performed a study to predict dose rate readings from fuel damage calculations for emergency planning. The calculations were performed to obtain gamma ray dose rates at the locations of the containment atmospheric monitoring system radiation detectors in the drywell and torus locations for assumed releases of gap activity from the core. These calculations were based on "nominal" estimates of fuel rod gap fission product inventory fractions, which are considered to be more appropriate for determining a minimum threshold reading than inventory assumptions found in the NRC Regulatory Guides. The Regulatory Guide inventory assumptions applicable to dose assessments are larger and therefore non-conservative for determination of this EAL threshold. Two separate cases were evaluated. In the first case, the released activity was assumed to be contained in the drywell atmosphere. This case is considered representative of conditions following a line break in which activity is released directly into the drywell. In the second case, the released activity was assumed to be contained in the torus. This could be applied for an event which results in vessel isolation and blowdown to the suppression chamber. The results for each case

were provided for each case in the form of gamma ray dose rate versus time profiles for assumed releases of 100% and 20% of the gap activity from the core. The dose rate calculations were carried out independent of any specific information on details of construction or response characteristics of the detector systems. The figures show a drywell reading of about 2.9×10^3 R/hr and a torus reading of about 1.1×10^2 R/hr associated with 20% gap release at two hours after shutdown. These values are rounded to 3 E+3 R/hr and 1 E+2 R/hr , respectively. The two hour point was picked because it allows ample time for the Technical Support Center to be operational and core damage assessment to begin.

REFERENCES:

1. Office Memo NG-88-0966, G.E. Fuel Damage Documentation/Dose Rate Calculations, 03/18/88

FISSION BARRIER: Primary Containment

DAEC INDICATOR: Radiation/Core Damage

EAL THRESHOLD VALUE:
Clad Damage Determination

LOSS – None

POTENTIAL LOSS – Fuel Damage assessment procedures indicate at least 20% fuel clad damage.

DAEC INFORMATION:

As a site-specific "potential loss" indicator, DAEC uses determination of at least 20% fuel clad damage, which is consistent with the level of fuel damage indicated by the drywell and torus radiation monitor readings used earlier with this Indicator. This can be determined using appropriate fuel damage assessment procedures. *Regardless of whether primary containment integrity is challenged, it is possible for significant radioactivity within the primary containment to result in EPA PAG plume exposure levels being exceeded even assuming that the primary containment is within technical specification allowable leakage rates.* With or without primary containment challenge, however, a major release of radioactivity requiring off-site protective actions from core damage is not possible unless a major failure of the fuel clad barrier allows radioactive material to be released from core into the reactor coolant. NUREG-1228 indicates that such conditions do not exist when the amount of fuel clad damage is less than 20%.

Other indicators were also considered. No other reliable indicators for Primary Containment "loss" or "potential loss" could be determined.

REFERENCES:

1. Post Accident Sampling and Analysis Procedure (PASAP) 7.2, Fuel Damage Assessment
2. NUREG-1228, *Source Term Estimations During Incident Response to Severe Nuclear Power Plant Accidents,* October 1988

FISSION BARRIER: Primary Containment

DAEC INDICATOR: RPV Level

EAL THRESHOLD VALUE:
Reactor Vessel Water Level

LOSS - None

POTENTIAL LOSS - RPV level BELOW –39 inches and no injection source is available.

DAEC INFORMATION:

The underlying concern for this indicator is a threshold that represents significant uncovering of the core and *imminent* core damage. *Imminent* means that no turnaround in safety system performance would be expected and that General Emergency conditions would be expected within two hours.

Consistent with the underlying concern, the DAEC indicator addresses conditions where the water level is below the Minimum Zero-Injection RPV Water Level of -39 inches with no injection source available. The Minimum Zero-Injection RPV Water Level is defined to be the lowest RPV water level at which the covered portion of the reactor core will generate sufficient steam to preclude any fuel clad temperature in the uncovered portion of the core from exceeding 1800 °F. The Minimum Zero-Injection RPV Water Level is utilized to preclude significant fuel clad damage and hydrogen generation for as long as possible when no sources of RPV makeup water are available.

Thus, for RPV water level below -39 inches, if no source of injection water was available, water levels would continue to decrease and the fuel clad temperature would be expected to continue to rise. Due to large uncertainties in severe accident progression, it should be assumed that severe core melt is *imminent* if this condition were to occur. It would not be acceptable to delay the declaration of the General Emergency and issuance of Protective Action Recommendations beyond this point.

REFERENCES:

1. Emergency Operating Procedure (EOP) RPV/F - RPV Flooding
2. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

FISSION BARRIER: Primary Containment

DAEC INDICATOR: Leakage

EAL THRESHOLD VALUE:
Containment Isolation Valve Status After Containment Isolation Signal

LOSS - Failure of both valves in any one line to close AND a downstream pathway to the environment exists.
OR
LOSS - Unisolable primary system leakage outside the drywell as indicated by area temps or ARMs exceeding the Max Safe Limits per EOP 3, Table 6, when Containment Isolation is required.
OR
LOSS – Primary containment venting in progress per EOPs.

POTENTIAL LOSS - None

DAEC INFORMATION:

The "loss" indicators used at DAEC directly correspond to the generic indicators. Venting of the primary containment can be performed in accordance with EOP 2 irrespective of the offsite radioactivity release rate that will occur and by defeating isolation interlocks as necessary. The consequences of not doing so may be the loss of primary containment integrity, core damage, and an uncontrolled radioactive release much greater than might otherwise occur. Primary containment venting is performed only as necessary to reduce and then maintain torus pressure below the Primary Containment Pressure Limit (PCPL) of 53 psig.

This EAL is intended to cover the inability to isolate the containment when containment isolation is required. In addition, the presence of area radiation or temperature alarms above the Max Safe limits listed in Table 6, EOP 3 after a containment isolation, indicate an unisolable primary system leakage outside the drywell. The indicators should be confirmed to be caused by RCS leakage. Also, an intentional venting of primary containment for pressure control per EOPs to the secondary containment and/or the environment is considered a loss of containment. Containment venting for temperature or pressure when not in an accident situation should not be considered.

REFERENCES:

1. Emergency Operating Procedure (EOP) 2, Primary Containment Control
2. Emergency Operating Procedure (EOP) 3, Secondary Containment Control

3. Emergency Operating Procedures (EOP) Bases, Breakpoints

Primary Containment Barrier Leakage

FISSION BARRIER: Primary Containment

DAEC INDICATOR: Primary Containment Atmosphere

EAL THRESHOLD VALUE:
Drywell Pressure/Atmosphere

LOSS – Rapid unexplained decrease following initial increase in pressure.
OR
LOSS – Drywell pressure response not consistent with LOCA conditions.
OR
POTENTIAL LOSS – Torus Pressure reaches 53 PSIG.
OR
POTENTIAL LOSS – Drywell or Torus H_2 CANNOT be determined to be below 6% **AND** Drywell or torus O_2 CANNOT be determined to be below 5%.

DAEC INFORMATION:

There are no significant deviations from the generic indicators. The "loss" indicators used at DAEC directly correspond to the generic indicators.

The first "potential loss" indicator is torus pressure of 53 psig, which is the Primary Containment Pressure Limit (PCPL) used in the EOPs. The second "potential loss" indicator is based on determination of explosive mixture in accordance with the SAGs. DAEC SAGs require control of drywell and torus atmosphere gas concentrations to less than 6% H_2 and less than 5% O_2 to assure that an explosive mixture does not exist. This "potential loss" indicator is written to be consistent with the SAGs.

REFERENCES:

1. Emergency Operating Procedure (EOP) 2, Primary Containment Control
2. Severe Accident Guideline – 3 (SAG-3), Hydrogen Control

FISSION BARRIER: Primary Containment

DAEC INDICATOR: EC/OSM Judgement

EAL THRESHOLD VALUE:

Any condition which in the EC/OSM's judgement indicates loss or potential loss of the primary containment barrier due to Imminent barrier degradation OR the barrier may be considered lost or potentially lost due to the inability to monitor the barrier.

DAEC INFORMATION:

There is no significant deviation from the generic indicator. Per EPIP 2.5, Control Room Emergency Response Operation, the Emergency Coordinator/Operations Shift Manager (EC/OSM) performs the emergency director function at DAEC. EC/OSM considerations for determining whether any barrier "Loss" or "Potential Loss" include *imminent* barrier degradation, degraded *barrier monitoring* capability, and consideration of *dominant accident sequences.*

Any condition which in the judgement of the EC/OSM that indicates LOSS or POTENTIAL LOSS of the Primary Containment Barrier such as, but not limited to:

- Degraded *barrier monitoring* capability from loss of/lack of reliable indicators.
- Consideration for instrumentation operability.
- Portable instrumentation readings.
- Offsite monitoring results.
- Complete loss of 125 VDC.
- Loss of decay heat removal.
- ATWS with failure of Standby Liquid Control.
- Prolonged station blackout.
- Loss of offsite power with early HPCI/RCIC failure

Imminent means that no turnaround in safety system performance is expected and that General Emergency conditions can be expected to occur within two hours. *Imminent* fission barrier degradation must be considered by the EC/OSM to assure timely declaration of a General Emergency and to better assure that offsite protective actions can be effectively accomplished.

Degraded *barrier monitoring* capability from loss of/lack of reliable indicators must also be considered by the EC/OSM when determining if a fission barrier loss or potential loss has occurred.

This assessment should also include consideration for instrumentation operability and portable instrumentation readings.

Offsite monitoring results may be an indication of Fission Product Barrier degradation causing an unmonitored release.

Dominant accident sequences can lead to loss of all Fission Barriers. Based on the IPE, the dominant accident sequences leading to core damage at DAEC include complete loss of 125 VDC, loss of decay heat removal, ATWS with failure of Standby Liquid Control, prolonged station blackout, and loss of offsite power with early HPCI/RCIC failure. The EC/OSM should also consult System Malfunction EALs, as appropriate, to assure timely emergency classification

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. Duane Arnold Energy Center Individual Plant Examination (IPE) November 1992

Usage Level
REFERENCE

Effective Date: 10-6-03

TECHNICAL REVIEW

Prepared and Verified by: Don A. Johnson Date: 9/25/2003

Validated by: Thomas R. Zimmerman Date: 9/25/03
Emergency Planning Staff

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-2003-0039.

Approved by: Paul Sullivan Date: 9/25/03
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
RHR Corner Room NW Area	LI 3771	2 inches	10 inches
orus 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

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Suspected sabotage device discovered within plant Protected Area.
2. Suspected sabotage device discovered outside the Protected Area in the plant switchyard or ISFSI.
3. Confirmed tampering with safety related equipment.
4. A hostage situation that disrupts normal plant or ISFSI operations.
5. Civil disturbance OR strike which disrupts normal plant or ISFSI operations.
6. Internal disturbance that is not short lived of that is not a harmless outburst involving one or more individuals within the Protected Area or ISFSI.
7. Credible Security Threat of "LO" Severity

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 or ISFSI 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 or ISFSI 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 or ISFSI 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 a Credible Security Threat of "LO" or "HI" Severity is based on information found in NMC SE-0018, "Security Threat Assessment". The emergency response to a Credible Security Threat of "LO" Severity is initiated through AOP 914, "Security Events" and EPIP 2.8, "Security Threat". A Credible Security Threat of "HI" Severity 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.

EFERENCES:

1. Abnormal Operating Procedure (AOP) 914, Security Events
2. NMC SE-0018, "Security Threat Assessment"
3. EPIP 2.8, "Security Threat"
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 NEI 99-01 Revision 4,* May 1999/September 2002
5. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 NEI 97-03* August 1997

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 lescription 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 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. 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

   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 addresses 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).*

<u>TOXIC</u> - 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

1. Intrusion into plant Protected Area by a hostile force.
2. Sabotage device discovered in the plant Protected Area.
3. 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
4. Credible Security Threat of "HI" Severity

DAEC EAL INFORMATION:

EAL 1 is an intrusion of a hostile force into the Protected Area representing a potential for a 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 is the discovery of a sabotage device in the Plant Protected area.

EAL 3 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 4 is the determination of "Credible Security Threat of HI Severity" based on information found in NMC SE-0018, "Security Threat Assessment". The emergency response to a "Credible Security Threat of HI Severity" 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
3. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 NEI 99-01 Revision 4,* May 1999/September 2002
4. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 NEI 97-03* August 1997

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.

AEC 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 ssification 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.

AEC 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 possibilities 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