NMC
Committed to Nuclear Excellence

DAEC EMERGENCY PLANNING DEPARTMENT PROCEDURE TRANSMITTAL ACKNOWLEDGEMENT MEMO (TAM-106)

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: 11 / 14 / 2003
Effective Date of Change: 11 / 21 / 2003
Return by: 12 / 05 / 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. 17	Rev. 18
EAL EBD-A (PWR: 23185)	Rev. 6	Rev. 7
EAL EBD-DEF (PWR: 23177)	Rev. 1	Rev. 2
EAL EBD-H (PWR: 21937)	Rev. 6a	Rev. 7

PERFORMED BY:

Print Name _____ Sign Name _____ Date _____

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

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

A045

NMC
Committed to Nuclear Excellence

Duane Arnold Energy Center
Operated by Nuclear Management Company, LLC

Friday, November 14, 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-A Abnormal Rad Levels/Radiological Effluent Category
Remove reference to a telemetered perimeter rad monitoring system. Define 200x ODAM limit.

EAL EBD-DEF Definitions
Define Emergency Director, vital area, and safe shutdown area.

EAL EBD-H Hazards and Other Conditions Affecting Plant Safety Category
Various enhancements to ensure consistency with the EAL Table and NEI 99-01 revision 4.

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	3	11/21/2003
	Organization of Basis Information	3	8/5/2003
EBD-A	Abnormal Rad Levels/Radiological Effluent Category	7	11/21/03
EBD-F	Fission Product Barrier Degradation Category	4	10/6/03
EBD-H	Hazards and Other Conditions Affecting Plant Safety Category	7	11/21/03
EBD-S	System Malfunction Category	5	11/3/03
EBD-E	ISFSI Abnormal Events Category	0	8/5/2003

Effective Date: 11/21/03

AC - Alternating Current

Affecting (in regard to events such as fire, flood, or missiles) - Causing degraded equipment performance as determined by physical observation or by indications in the Control Room or at local control stations.

Alert - 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 small fractions of the EPA Protective Action Guide (PAG) exposure levels.

All - Initiating Condition applies to all Technical Specification operating modes as well as defueled operation.

AOP - Abnormal Operating Procedure

APRM - Average Power Range Monitor

ARM - Area Radiation Monitor

ATWS - Anticipated Transient Without Scram

Barrier - Same as "Fission Product Barrier", below.

Barrier Monitoring Ability - This is a judgment factor in determining whether a fission product barrier is lost or potentially lost. Decreased ability to monitor a barrier results from a loss of/lack of reliable indicators, including instrumentation operability concerns, readings from portable instrumentation, and consideration for offsite monitoring results.

Becquerel - A measurement of radioactive decay rate equal to one disintegration per second.

BOP - Balance of Plant

BWR - Boiling Water Reactor

CAM - Continuous Air Monitor

CDE - Committed Dose Equivalent as defined in 10 CFR 20.1003

CEDE - Committed Effective Dose Equivalent as defined in 10 CFR 20.1003

CFM - Cubic Feet per Minute

CFS - Cubic Feet per Second

Cold condition - This refers to the condition where the reactor coolant temperature is less than or equal to 212°F.

Cold shutdown - As defined in Technical Specification Table 1.1-1, the reactor is in the shutdown mode, the reactor coolant temperature is less than or equal to 212°F, and all reactor vessel head closure bolts fully tensioned.

Compensatory non-alarming indications - Information displayed in the main control room including analog and digital parameter displays, trend recorders, the Safety Parameter Display System (SPDS), and the plant process computer.

Confinement Boundary - the barrier (Dry Shielded Canister (DSC)) that separates areas containing radioactive substances, spent nuclear fuel or high-level waste, and the environment.

Control - As applied to remote shutdown capability, this is the ability to manipulate plant parameters without reliance on control room devices or instrumentation using components and methods specified by Abnormal Operating Procedure 915, Shutdown Outside Control Room.

Contiguous - Being in actual contact: touching along a boundary or at a point.

CPS - Counts Per Second

CRD - Control Rod Drive

CSCS - Core Standby Cooling System

CST - Condensate Storage System

Curie (Ci) - A measurement of radioactive decay rate equal to 3.70E+10 disintegration's per second (becquerels).

CW - Circulating Water

DAEC - Duane Arnold Energy Center

DC - Direct Current

DEQ - Dose Equivalent

Dominant accident sequences - These will lead to degradation of all fission product barriers. 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.

DSC – Dry Shielded Canister

DW – Drywell

EAL Threshold Value – A pre-determined, site-specific, observable condition indicating the criteria necessary for declaration of an Emergency Action Level (EAL).

EC - Emergency Coordinator

ECCS - Emergency Core Cooling System

EDE - Effective Dose Equivalent as defined in 10 CFR 20.1003

Emergency Action Level (EAL) - A pre-determined, site-specific, observable threshold for a plant Initiating Condition that places the plant in a given Emergency Class. An EAL can be: an instrument reading, an equipment status indicator, a measurable parameter (on-site or offsite), a discrete observable event, results of analyses, entry into specific emergency operating procedures, or another phenomenon which, if it occurs, indicates entry into a particular Emergency Class.

Emergency Class - Same as "Emergency Classification Level" below.

Emergency Classification Level - These are taken from 10 CFR 50, Appendix E. They are, in escalating order: (Notification of) Unusual Event (UE), Alert, Site Area Emergency (SAE), and General Emergency (GE).

Emergency Director – Individual responsible for overall direction and control of the Emergency Response Organization (ERO). In the Control Room this would be the Operations Shift Manager (OSM) or the Control Room Supervisor (CRS). In the Technical Support Center (TSC) this would be the Emergency Coordinator (EC). In the Emergency Operations Facility (EOF) this would be the Emergency Response and Recovery Director (ER&RD).

EOP - Emergency Operating Procedure

EPA - Environmental Protection Agency

EPIP - Emergency Plan Implementing Procedure

ESF - Engineered Safety Features

ESS - Engineered Safety Systems

Establish - Make arrangements for a stated condition, e.g., establish communications with control room.

ESW - Emergency Service Water

Fission Product Barrier - One of the three principal barriers to uncontrolled release of radionuclides: Fuel Clad, Reactor Coolant System (RCS), and the Primary Containment.

FP - Fuel Pool

Fuel Clad (Barrier) - The zirconium alloy tubes that contain the fuel pellets.

General Emergency (GE) - 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 reasonably be expected to exceed EPA Protective Action Guide (PAG) exposure levels offsite for more than the immediate site area.

GPM - Gallons Per Minute

GSW - General Service Water

Hot shutdown - As defined in Technical Specification Table 1.1-1, the reactor mode switch is in the shutdown position and the reactor coolant temperature is greater than 212°F and all reactor vessel head closure bolts fully tensioned.

HPCI - High Pressure Coolant Injection (system).

HSM – Horizontal Storage Module

Identified Leakage - Identified Leakage shall be:

a. Leakage into the drywell such as that from pump seals or valve packing that is captured and conducted to a sump or collecting tank, or

b. Leakage into the drywell atmosphere from sources that are both specifically located and known not to interfere with the operation of the leakage detection systems.

IDLH - Immediately Dangerous to Life and Health

Inadvertent - Accidental or unintentional, *e.g.*, the event occurred because procedures were not strictly adhered to.

Independent Spent Fuel Storage Installation (ISFSI) - The on site facility where the loaded Dry Shielded Canisters (DSCs) will be stored in Horizontal Storage Modules (HSMs). The installation is intended for interim storage until the spent fuel is removed from the plant site.

Imminent - No turnaround in safety system performance is expected and escalation to a higher emergency classification level is expected to occur within two hours.

Implement - Commence a required program or series of procedures.

In service - A component or system in the appropriate configuration for normal operation and is considered *operable* as defined in the Technical Specifications.

Indicator - The name for the row on the fission barrier table that is used for convenient grouping of similar symptoms.

Initiate - Take action to begin a process

Initiating Condition (IC) - One of a predetermined subset of nuclear power plant conditions where either the potential exists for a radiological emergency or such an emergency has occurred.

IPE - Individual Plant Examination

IPOI - Integrated Plant Operating Instruction

IRM - Intermediate Range Monitor

Isolate - Remove from service by closing off the flow path

ISFSI – Independent Spent Fuel Storage Installation

kV - Kilovolt(s)

LCO - Limiting Condition for Operation

LLRPSF - Low Level Radwaste Processing and Storage Facility

LOCA - Loss of Coolant Accident

LOOP - Loss of Offsite Power

Loss (of a fission product barrier) - A severe challenge to a fission product barrier exists such that the barrier is considered incapable of performing its safety function.

LPCI - Low Pressure Coolant Injection

MCC - Motor Control Center

MCUTL - Maximum Core Uncovery Time Limit

Microcurie (□Ci) - One millionth of a curie, *i.e.*, 3.7E+4 disintegration's per second (becquerels).

MIDAS - Meteorological Information and Dose Assessment System, primary method for detecting and quantifying gaseous releases at the DAEC.

Millicurie (mCi) - One thousandth of a curie, *i.e.*, 3.7E+7 disintegration's per second (becquerels).

Millirem (mrem) - One thousandth of a rem

MPH - Miles Per Hour

mR - milliroentgen, *i.e.*, one thousandth of a roentgen (R)

MSIV - Main Steam Isolation Valve

MSL - Main Steam Line

NEI - Nuclear Energy Institute (formerly NUMARC)

Notification of Unusual Event (NOUE) - Same as "Unusual Event", below.

NPSH - Net Positive Suction Head

NUMARC - Nuclear Utility Management and Resources Council (now NEI)

OBE - Operating Basis Earthquake

ODAM - Offsite Dose Assessment Manual

Operable - A system is considered capable of performing its function in accordance with the applicable Technical Specification requirements. Implicit in this definition is the assumption that all auxiliary equipment required for the system is also operable.

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

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

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

OSS - Operations Shift Supervisor

PAG - Protective Action Guide

Planned - Loss of a component or system due to expected events such as scheduled maintenance and testing activities.

Potential Loss (of a fission product barrier) - A challenge to a fission product barrier exists such that the barrier is considered degraded in its ability to perform its safety function.

Primary Containment (Barrier) - The drywell, the torus, their respective interconnecting paths, and other connections up to and including the outermost containment isolation valves.

Protected Area - Any area encompassed by physical barriers and to which access is controlled.

PSIG - Pounds per Square Inch Gauge

RB - Reactor Building

RBCCW - Reactor Building Closed Cooling Water (system)

RCIC - Reactor Core Isolation Cooling (system)

RCS - Reactor Coolant System

RCS Barrier - The reactor coolant system pressure boundary including the reactor pressure vessel and all reactor coolant system piping up to and including the outermost isolation valves.

Recognition Category - A logical grouping of Initiating Conditions, *e.g.*, System Malfunctions.

Rem - Unit of radiation dose as defined in 10 CFR 20.1004

Required - Action taken (such as entry into emergency operating procedure) is neither optional nor merely suggested; rather, it is imperative based on existing conditions.

RHR - Residual Heat Removal (system)

RHRSW - Residual Heat Removal Service Water (system)

Roentgen (R) - Unit of ionizing radiation energy absorbed in a cubic centimeter of air

RPV - Reactor Pressure Vessel

RWCU - Reactor Water Clean-Up (system)

Safe Shutdown Area – Any area containing equipment, systems or components that are necessary to bring the plant to, and maintain it in a shutdown condition. In the EAL Bases Documents and Tables, Safe Shutdown Area is synonymous with Vital Area.

SBDG - Standby Diesel Generator

SBGT - Standby Gas Treatment (system)

SBLC - Standby Liquid Control (system)

SBO - Station Blackout

S/D - Shutdown

SDC - Shutdown Cooling

SDV - Scram Discharge Volume

Significant transient - (See also, "Transient", below.) Includes response to automatic or manually initiated functions such as scrams, runbacks involving greater than 25% thermal power change, ECCS injections, or undampened thermal power oscillations greater than normal.

Site Area Emergency (SAE) - 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 result in exposure levels which exceed EPA Protective Action Guide (PAG) exposure levels except near the site boundary.

SPDS - Safety Parameter Display System

SRM - Startup Range Monitor

SRO - Senior Reactor Operator

SRV - Safety-Relief Valve

Sustained wind speed - Baseline wind speed measured by meteorological tower that does not include gusts

TAF - Top of Active Fuel (344.5 inches above bottom of RPV)

TEDE - Total Effective Dose Equivalent as defined in 10 CFR 20.1003

Total Leakage - Sum of Identified Leakage and Unidentified Leakage.

Transient - A condition that: (1) is beyond the expected steady-state fluctuations in temperature, pressure, power level, or water level, and (2) is beyond the normal manipulations of the Control Room operating crew, and (3) is expected to require actuation of fast-acting automatic control or protection systems to bring the reactor to a new safe, steady-state condition.

TSC - Technical Support Center

Uncontrolled - Condition is not the result of planned actions by the plant staff in accordance with procedures.

Unisolable - Actions taken from the Main Control Board or locally are not successful in eliminating the leakage path.

Unidentified Leakage - All leakage into the drywell that is not identified leakage.

Unplanned - Used to preclude the declaration of an emergency where a component or system has been removed intentionally from service (e.g., for maintenance and/or testing activities). As used in the context of radioactive releases, "unplanned" includes any release for which a radioactive discharge permit was not prepared, or a release that exceeds the conditions (*e.g.*, minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit.

Unusual Event (UE) - 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.

VAC - Volt(s) Alternating Current

Vital Area – see Safe Shutdown Area.

Vital Equipment - Any equipment, system, device or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation.

VDC - Volt(s) Direct Current

Valid - Indication 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.

WEC - Water Effluent Concentration

Usage Level

Reference Use

Effective Date: 11/21/03

TECHNICAL REVIEW

Prepared by: _____ Date: 11/07/03

Reviewed by: _____ Date: 11-11-03
Independent Reviewer

Reviewed by: _____ Date: 11/10/03
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-2003-0048.

Approved by: _____ Date: 11/14/03
Manager, Emergency Planning

Table of Contents

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

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

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

1. Valid Reactor Building ventilation rad monitor (Kaman 3/4, 5/6, 7/8) or Turbine Building ventilation rad monitor (Kaman 1/2) reading above 1 E-3 µCi/cc and is expected to continue for 60 minutes or longer.

   OR

   Valid Offgas Stack rad monitor (Kaman 9/10) reading above 2.0 E-1 µCi/cc and is expected to continue for 60 minutes or longer.

   OR

   Valid LLRPSF rad monitor (Kaman 12) reading above 1.0 E-3 µCi/cc and is expected to continue for 60 minutes or longer.

   OR

   Valid GSW rad monitor (RIS-4767) reading above 3E+3 CPS and is expected to continue for 60 minutes or longer.

   OR

   Valid RHRSW & ESW rad monitor (RM-1997)reading above 8E+2 CPS and is expected to continue for 60 minutes or longer.

   OR

   Valid RHRSW & ESW Rupture Disc rad monitor (RM-4268) reading above 1E+3 CPS and is expected to continue for 60 minutes or longer.

   OR

2. Confirmed sample analyses for gaseous or liquid releases indicates concentrations or release rates in excess of 2 times ODAM limit and is expected to continue for 60 minutes or longer.

   OR

3. Valid dose assessment indicating dose rates beyond the site boundary above 0.1 mrem/hr TEDE and is expected to continue for 60 minutes or longer.

DAEC EAL INFORMATION:

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

UNPLANNED, as used in this context, includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit. The EC/OSM should not wait until 60 minutes has elapsed, but should declare the event as soon as it is determined that the release duration has or will likely exceed 60 minutes. Also, if an ongoing release is detected and the starting time for that release is unknown, the EC/OSM should, in the absence of data to the contrary, assume that the release has exceeded 60 minutes.

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

GASEOUS EFFLUENT EALS		
	Offgas Stack Kaman 9/10	Turbine Bldg (Kaman 1/2) and Reactor Bldg (Kaman 3/4, 5/6, 7/8)
Maximum flow (CFM)	10,000	72,000

AU1

Release Limits	Concentration (µCi/cc)	Release Rate (µCi/sec)	Concentration (µCi/cc)	Release Rate (µCi/sec)
Tech Spec	1.1E-1	5.2E+5	6.2E-4	2.1E+4
Unusual Event (2 x TS)	2.0E-1	1.0E+6	1.2E-3	4.2E+4
Alert (60 x TS)	6.0E+0	3.0E+7	3.7E-2	1.3E+6
	LLRPSF Kaman 12			
Maximum flow (CFM)	99,000			

Release Limits	Concentration (µCi/cc)	Release Rate (µCi/sec)
Tech Spec	5.9E-4	2.8E+4
Unusual Event (2 x TS/ODAM)	1.0E-3	5.6E+4
Alert (200 x TS)	1.0E-1	5.6E+6

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

Technical specification setpoints for radioactive liquid radiation monitors are 10 times the 10 CFR 20 Appendix B, Table 2, Water Effluent Concentration (WEC) limits. It is the policy of DAEC to process all liquid radwaste so that no release of radioactive liquid to the environment is allowed. The radwaste effluent line which could be used as a batch release mechanism has a trip function that prevents exceeding the DAEC release limit, however, an EAL has been provided. The other pathways to the environment (RHRSW - to cooling tower, RHRSW - to discharge canal) have radiation monitors with readouts going to the Control Room. These systems could become contaminated if heat exchanger leaks develop; however, historically this has not occurred in the service water systems at DAEC. These monitors are displayed on panels 1C02 and 1C10.

AU1

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

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

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

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

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

ODAM limit = 500 mrem/year Whole Body Dose
(10CFR20, Appendix B limit = 50 mrem/year Whole Body Dose)

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

Rounded off to 0.1 mrem/hr

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE). This is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in accordance with the generic methodology. The gaseous effluent radiation monitors can only detect noble gases. The contribution of

iodine's to TEDE could therefore only be determined either by: (1) utilizing MIDAS, or (2) gaseous effluent sampling. DAEC EAL 4 is written in terms of TEDE and the gaseous effluent radiation monitor readings are determined based on ODAM.

REFERENCES:

1. Offsite Dose Assessment Manual Section 6.0, 6.1.2 and 7.1.2 Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
5. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

AU1

AU2 Unexpected Increase in Plant Radiation

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2)

1. Uncontrolled loss of reactor cavity or fuel pool water level with all spent fuel assemblies remaining covered by water as indicated by ANY of the following:

   - Report to the control room.
   - Valid fuel pool level indication (LI-3413) below 36 feet and lowering.
   - Valid WR GEMAC Floodup indication (LI-4541) coming on scale.

OR

2. Unexpected ARM reading offscale high or above 1000 times normal* readings.

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

DAEC EAL INFORMATION:

There are no significant deviations from the generic EALs. DAEC does not have a spent fuel transfer canal.

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

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

During preparation for reactor cavity flood up prior to entry into refuel mode, reactor vessel level instrument LI-4541 (WR GEMAC, FLOODUP) on control room panel 1C04 is placed

in service by I&C personnel connecting a compensating air signal after the reference leg is disconnected from the reactor head. Normal refuel water level is above the top of the span of this flood up level indicator. A valid indication (*e.g.*, not due to loss of compensating air signal or other instrument channel failure) of reactor cavity level coming on span for this instrument is used at DAEC as an indicator of uncontrolled reactor cavity level decrease.

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

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

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

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Isolation
2. Technical Specification 3.7.8, Spent Fuel Pool Water Level
3. Emergency Plan Implementing Procedure (EPIP) 3.1, Inplant Radiological Monitoring, Attachment 1, ARM Locations
4. Emergency Operating Procedures (EOP) Basis Document, Breakpoints for RC/L & L
5. Surveillance Test Procedure (STP) 3.0.0.0-01PA, Daily and Shift Instrument Checks
6. Integrated Plant Operating Instruction (IPOI) 8 , Outage and Refueling Operations
7. Core Alterations, RFP403, Procedure for Moving Core Components Between Reactor Core and Spent Fuel Pool, Within the Reactor Core, or Within the Spent Fuel Pool
8. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

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

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

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

1. Valid Reactor Building ventilation rad monitor (Kaman 3/4, 5/6, 7/8) or Turbine Building ventilation rad monitor (Kaman 1/2) reading above 3 E-2 μCi/cc and is expected to continue for 15 minutes or longer.

   OR

   Valid Offgas Stack rad monitor (Kaman 9/10) reading above 6 E+0 μCi/cc and is expected to continue for 15 minutes or longer .

   OR

   Valid LLRPSF rad monitor (Kaman 12) reading above 1 E-1 μCi/cc and is expected to continue for 15 minutes or longer.

   OR

   Valid GSW rad monitor (RIS-4767) reading above 3E+5 CPS and expected to continue for 15 minutes or longer.

   OR

   Valid RHRSW & ESW rad monitor (RM-1997) reading above 8E+4 CPS and expected to continue for 15 minutes or longer.

   OR

   Valid RHRSW & ESW Rupture Disc rad monitor (RM-4268) reading above 1E+5 CPS and expected to continue for 15 minutes or longer .

   OR

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

   OR

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

OR

4. Valid dose assessment indicating dose rates beyond the site boundary above 10 mrem/hr TEDE and is expected to continue for 15 minutes or longer.

DAEC EAL INFORMATION:

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

UNPLANNED, as used in this context, includes any release for which a radioactivity discharge permit was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm setpoints, etc.) on the applicable permit. The EC/OSM should not wait until 15 minutes has elapsed, but should declare the event as soon as it is determined that the release duration has or will likely exceed 15 minutes. Also, if an ongoing release is detected and the starting time for that release is unknown, the EC/OSM should, in the absence of data to the contrary, assume that the release has exceeded 15 minutes.

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

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

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

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

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

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

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

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

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

ODAM limit = 500 mrem/year Whole Body Dose
(10CFR20, Appendix B limit = 50 mrem/year Whole Body Dose)

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

Rounded off to 10 mrem/hr

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE). This is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in AU1 in accordance with the generic methodology. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE could therefore only be determined either by: (1) utilizing MIDAS, or (2) gaseous effluent sampling. DAEC EAL 4 is written in terms of TEDE and the gaseous effluent radiation monitor readings are determined based on ODAM.

REFERENCES:

1. Offsite Dose Assessment Manual Section 6.0, 6.1.2 and 7.1.2 Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
5. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
6. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

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

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

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

1. Report of either of the following:
   - Valid Refueling Floor North End (RM-9163), Refueling Floor South End (RM-9164), or New Fuel Storage Area (RM-9153) ARM Reading above 10 mr/hr
   - Valid Spent Fuel Storage Area ARM (RM-9178) Reading above 100 mr/hr

   OR

2. Report of Visual observation of irradiated fuel uncovered.

   OR

3. Valid water level reading below 450" as indicated on LI-4541 (floodup) for the Reactor Refueling Cavity that will result in Irradiated Fuel uncovering.

   OR

4. Valid Fuel Pool water level indication (LI-3413) below 16 feet that will result in Irradiated Fuel uncovering.

DAEC EAL INFORMATION:

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

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

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

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

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

RFP403 requires that upon a loss of water level situation, that the refueling crew on the refueling floor shall discharge any fuel assembly on the fuel grapple as follows:

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

Following these actions, the refueling floor is to be evacuated of all personnel. The DAEC EAL is written to address the generic concern that a spent fuel assembly was not fully covered by water. This can either be by visual observation of an uncovered spent fuel

assembly or by trending fuel pool level in the control room if a spent fuel assembly could not be placed in a safe storage location specified by RFP 403 as described above.

REFERENCES:

1. Alarm Response Procedure (ARP) 1C04B, Reactor Water Cleanup and Isolation
2. Technical Specification 3.7.8, Spent Fuel Pool Water Level
3. Emergency Operating Procedures (EOP) Basis Document, Breakpoints for RC/L & L
4. Emergency Plan Implementing Procedure (EPIP) 3.1, Inplant Radiological Monitoring, Attachment 1, ARM Locations
5. Surveillance Test Procedure (STP) 3.0.0.0-01, Daily and Shift Instrument Checks
6. Integrated Plant Operating Instruction (IPOI) 8 , Outage and Refueling Operations
7. Core Alterations, RFP403, Procedure for Moving Core Components Between Reactor Core and Spent Fuel Pool, Within the Reactor Core, or Within the Spent Fuel Pool
8. Bechtel Drawing C-492, Reactor Building - Reactor Well, Spent Fuel & Dryer-Separator Pool General Arrangement, Rev. 6
9. Bechtel Drawing C-493, Reactor Building - Spent Fuel Liner Plan Elevations and Details, Sheet 1, Rev. 6
10. Holtec International Drawing No. 1045, Rack Construction - Spent Fuel Storage Racks, Rev. 3
11. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

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

EVENT TYPE: Onsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2)

1. Valid Control Room Area Radiation Monitor (RM-9162) reading above 15 mr/hr.

OR

2. Valid North CRD Module Area Radiation Monitor (RM-9168) reading above 500 mr/hr, affecting the Remote Shutdown Panel, 1C388.

DAEC EAL INFORMATION:

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

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

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

REFERENCES:

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

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

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3)

1. Valid Reactor Building ventilation rad monitor (Kaman 3/4, 5/6, 7/8) or Turbine Building ventilation rad monitor (Kaman 1/2) reading above 6 E-2 µCi/cc and is expected to continue for 15 minutes or longer. (Dose assessment not available.)

   OR

   Valid Offgas Stack rad monitor (Kaman 9/10) reading above 4 E+1 µCi/cc and is expected to continue for 15 minutes or longer. (Dose assessment not available)

   OR

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

   OR

3. Dose assessment determines integrated accident dose projection outside the site boundary above 100 mrem TEDE or above 500 mrem CDE Thyroid.

DAEC EAL INFORMATION:

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

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

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

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

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

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

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

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

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

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

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

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

Dose assessment using MIDAS is based on the EPA-400 methodology, *e.g.*, use of Total Effective Dose Equivalent (TEDE) and Committed Dose Equivalent (CDE) Thyroid. TEDE is somewhat different from whole body dose from gaseous effluents determined by ODAM methodology which forms the basis for the radiation monitor readings calculated in AU1. These factors can introduce differences that are at least as large as those introduced by using TEDE versus whole body dose. The gaseous effluent radiation monitors can only detect noble gases. The contribution of iodine's to TEDE and CDE Thyroid could therefore only be determined either by: (1) utilizing the source term mixture in MIDAS, or (2) gaseous effluent sampling. Therefore, DAEC EAL Threshold Value 3 is written in terms of TEDE and CDE Thyroid.

REFERENCES:

1. Offsite Dose Assessment Manual, Section 6.0, 6.1.2 and 7.1.2, Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. Radiation Engineering Calculation No. 96-007-A, Determination of DAEC Radioactive Release Initiating Conditions for AS1 & AG1 Emergency Classifications, July 3, 1996
5. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems
6. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
7. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999

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

EVENT TYPE: Offsite Rad Conditions

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE: (1 or 2 or 3)

1. Valid Reactor Building ventilation rad monitor (Kaman 3/4, 5/6, 7/8) or Turbine Building ventilation rad monitor (Kaman 1/2) reading above 6 E-1 µCi/cc and expected to continue for 15 minutes or longer. (Dose assessment not available)

   OR

   Valid Offgas Stack rad monitor (Kaman 9/10) reading above 4 E+2 µCi/cc and expected to continue for 15 minutes or longer. (Dose assessment not available)

   OR

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

   OR

3. Dose assessment determines integrated accident dose projection outside the site boundary above 1,000 mrem TEDE or above 5,000 mrem CDE Thyroid.

DAEC EAL INFORMATION:

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

The preferred method for declaration of AG1 is by means of Dose Assessment using the MIDAS computer model. However, if Kaman monitor readings are sustained for longer than 15 minutes and the required MIDAS dose assessments cannot be completed within this period, then the declaration can be made using Kaman readings PROVIDED the readings are not from an isolated flow path. If Kaman readings are not valid, field survey results may be utilized.
DAEC's Meteorological Information and Dose Assessment System (MIDAS) was utilized to determine the Kaman monitor limits. Eight separate combinations of release point, source term, meteorological conditions and equipment status were analyzed. Pathways considered were the offgas stack, the turbine building exhaust vent and a single reactor building exhaust vent. Multiple release points were not considered. In this same vein, it was assumed that only one of the three reactor building vents is on during the release.

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

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

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

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

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

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

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

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

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

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

REFERENCES:

1. Offsite Dose Assessment Manual, Section 6.1.2 and 7.1.2, Bases
2. Emergency Plan Implementing Procedure (EPIP) 3.3, Dose Assessment and Protective Action
3. Radiation Protection Calculation No. 95-001-C, Emergency Actions Levels Based on Effluent Radiation Monitors, January 24, 1995
4. Radiation Engineering Calculation No. 96-007-A, Determination of DAEC Radioactive Release Initiating Conditions for AS1 & AG1 Emergency Classifications, July 3, 1996
5. UFSAR Section 11.5, Process and Effluent Radiation Monitoring and Sampling Systems

6. EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
7. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007 Revision 4*, May 1999.

EAL BASES DOCUMENT	EBD-H
HAZARDS & OTHER CONDITIONS AFFECTING PLANT SAFETY CATEGORY	Rev. 7 PAGE 1 of 31

Usage Level

REFERENCE USE

Effective Date: 11/21/03

TECHNICAL REVIEW

Prepared and Verified by: Thomas R. Zimmerman Date: 11/7/03

Validated by: Ron A. [illegible] Date: 11-7-03
Emergency Planning Staff

Reviewed by: J M Davis Date: 11-10-03
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- 2003-0048 .

Approved by: Paul D. Allen Date: 11/14/03
Manager, Emergency Planning

Table of Contents

HU1 Natural and Destructive Phenomena Affecting the Protected Area

EVENT TYPE: Natural Disasters and Destructive Phenomena

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Receipt of the Amber .01G Recorders Running Light and the wailing seismic alarm on 1C35

   OR

2. Report of tornado touching down within Plant Protected Area or within switchyard.

   OR

3. Assessment by the control room that a destructive event has occurred.

   OR

4. Vehicle crash into plant structures or systems within Plant Protected Area.

   OR

5. Report of an unanticipated explosion within the Plant Protected Area resulting in visible damage to permanent structures or equipment.

   OR

6. Report of turbine failure resulting in casing penetration or damage to turbine or generator seals.

   OR

7. River level above 757 feet.

   OR

8. Any water level above Max Normal Operating Limit.

   OR

9. River water level below 725 feet. 6 inches.

DAEC EAL INFORMATION:

The Plant Protected Area is the area within the security fence. This includes ISFSI and the Intake Structure. Although the switchyard is included in this EAL, it is not part of the Plant Protected Area.

DAEC 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 Plant Protected Area or within the plant switchyard.

DAEC EAL Threshold Value 3 allows the control room to determine that an 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/Vital 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, CSTs
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C55/56 Area, SBGT Room

DAEC EAL Threshold Value 5 addresses explosions within the Plant Protected Area. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that significantly 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 are addressed by this EAL. The Emergency Director 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 6 uses a threshold of flood water levels above 757.0 ft.

DAEC EAL Threshold Value 8 addresses internal flooding can be due to system malfunctions, component failures, or repair activity mishaps (such as failed freeze seal) that can threaten safe operation of the plant. Therefore, this EAL is based on a valid indication that the water level is higher than the maximum normal operating limits. The Maximum Normal Operating Limits are defined as the highest values of the identified parameter expected to occur during normal plant operating conditions with all directly associated support and control systems functioning properly. Exceeding these limits is an entry condition into EOP 3, Secondary Containment Control and may be an indication that water from a primary system is discharging into secondary containment. Exceeding the maximum normal operating limit is interpreted as a potential degradation in the level of the safety of the plant and is appropriately treated as an Unusual Event emergency classification. The maximum normal operating water level limits are taken from AOP 902 and EOP 3 and are shown in the table below:

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

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

In this EAL, "Vital Area" is defined as plant structures or areas containing equipment necessary for a safe shutdown, i.e., synonymous with Safe Shutdown Area.

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, but shall not be required to verify 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:

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.

   OR

2. Report by Local, County or State Official 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 the plant Protected Area.

   OR

2. Suspected sabotage device discovered outside the Protected Area, in the plant switchyard or ISFSI.

   OR

3. Confirmed tampering with safety related equipment.

   OR

4. A hostage situation that disrupts normal plant or ISFSI operations.

   OR

5. Civil disturbance OR strike which disrupts normal plant or ISFSI operations.

   OR

6. Internal disturbance that is not short lived or that is not a harmless outburst involving one or more individuals within the Protected Area or ISFSI.

   OR

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. 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 if 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.

REFERENCES:

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,* January 2003
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 Emergency Director Warrant Declaration of an Unusual Event

EVENT TYPE: Emergency Director Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the judgment of the Emergency Director indicate that 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.

DAEC EAL INFORMATION:

The EAL addresses conditions that fall under the Notification of Unusual Event emergency classification description contained in NUMARC/NESP-007, NEI 99-01, Rev. 4 January 2003, that is retained under the generic methodology.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. *NEI Methodology for Development of Emergency Action Levels NUMARC/NESP-007, NEI 99-01 Revision 4,* January 2003

HA1 Natural and Destructive Phenomena Affecting the Plant Vital Area

EVENT TYPE: Natural Disasters and Destructive Phenomena

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Receipt of the Amber Operating Basis Earthquake Light and the wailing seismic alarm on 1C35 (± 0.06 gravity).

   OR

2. Report of tornado striking Plant Vital Area.

   OR

3. Report to the control room that damage has affected Safe Shutdown Areas.

   OR

4. Vehicle crash affecting Plant Vital Areas.

   OR

5. Sustained wind speed at or above 95 miles MPH, affecting Plant Vital Areas.

   OR

6. Turbine failure-generated missiles affecting Safe Shutdown Areas.

   OR

7. River level above 767 feet.

   OR

8. Water level above Max Safe Operating Limit in 2 or more areas AND Reactor shutdown is required.

   OR

9. River level below 724 feet 6 inches.

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. The missiles mentioned here can be from any cause, *e.g.*, tornado-generated; turbine, pump or other rotating machinery catastrophic failure; or generated from an explosion.

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 Turbine failure-generated missiles affecting safe shutdown areas. This threshold addresses the threat to safety related equipment from missiles generated by main turbine rotating component catastrophic failures.

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/Vital 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, CSTs
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C55/56 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, i.e., synonymous with Safe Shutdown Area.

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 any of the following 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 was 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.

Systems & Equipment of Concern
• Reactivity Control
• Containment (Drywell/Torus)
• RHR/Core Spray/SRVs
• HPCI/RCIC
• RHRSW/River Water/ESW
• Onsite AC Power/EDGs
• Offsite AC Power
• Instrument AC
• DC Power
• Remote Shutdown Capability

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 Emergency Director 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:

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

   OR

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

DAEC EAL INFORMATION:

This EAL, in addition to EAL HA5, also 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).*

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

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

This EAL is based on gases that have entered plant structures that will affect the safe operation of the plant. These structures include buildings and areas contiguous to plant vital areas and other significant buildings or areas. The intent of this EAL is NOT to include buildings or other areas that are NOT contiguous or immediately adjacent to plant vital areas.

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

Safe Shutdown/Vital 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, CSTs
Other	Control Building, Remote Shutdown Panel 1C388 Area, Panel 1C55/56 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 Confirmed 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.

   OR

2. Sabotage device discovered in the plant Protected Area.

   OR

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

   OR

4. Credible Security Threat of "HI" Severity

DAEC EAL INFORMATION:

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

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,* January 2003
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 Emergency Director Warrant Declaration of an Alert

EVENT TYPE: Emergency Director Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the judgment of the Emergency Director indicate that 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 small fractions of the EPA Protective Action Guideline exposure levels.

DAEC EAL INFORMATION:

The EAL addresses conditions that fall under the Alert emergency classification description contained in NUMARC/NESP-007, NEI 99-01, Rev. 4 January 2003.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operations
2. *NEI Methodology for Development of Emergency Action Levels, NUMARC/NESP-007, NEI 99-01 Revision 4,* January 2003

HS1 Confirmed Security Event in a Plant Vital Area

EVENT TYPE: Security

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

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

   OR

2. A security event that results in the loss of control of any Vital Area (other than the Control Room).

   OR

3. IMMINENT loss of physical control of the facility (remote shutdown capability) due to a security event.

   OR

4. A confirmed sabotage device discovered in a Vital Area.

DAEC EAL INFORMATION:

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

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*, January 2003

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:

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 Emergency Director 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*, January 2003

HS3 Other Conditions Existing Which in the Judgment of the Emergency Director Warrant Declaration of Site Area Emergency

EVENT TYPE: Emergency Director Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

1. Other conditions exist which in the Judgment of the Emergency Director indicate that 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 result in exposure levels which exceed EPA Protective Action Guideline exposure levels beyond the site boundary.

DAEC EAL INFORMATION:

There is no significant deviation from the generic EAL.

The EAL addresses conditions that fall under the Site Area Emergency classification description contained in NUMARC/NESP-007, NEI 99-01, Rev. 4 January 2003.

REFERENCES:

1. Emergency Plan Implementing Procedure (EPIP) 2.5, Control Room Emergency Response Operation
2. *NEI Methodology for Development of Emergency Action Levels, NUMARC/NESP-007, NEI 99-01 Revision 4,* January 2003

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

EVENT TYPE: Security

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

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

   OR

2. Loss of physical control of 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 Emergency Director Warrant Declaration of General Emergency

EVENT TYPE: Emergency Director Judgment

OPERATING MODE APPLICABILITY: All

EAL THRESHOLD VALUE:

Other conditions exist which in the Judgment of the Emergency Director indicate that 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.

DAEC EAL INFORMATION:

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*, January 2003