Duane Arnold Energy Center EAL Classification Matrix

COLD CONDITIONS (Modes 4, 5, and Defueled)

		GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
R Abnormal Rad Levels / Rad Effluent	**1** Rad Effluent	Release of gaseous radioactivity resulting in offsite dose greater than 1,000 mrem TEDE or 5,000 mrem thyroid CDE [pg. 35] 1 2 3 4 5 DEF □ **RG1.1** Reading on **ANY** Table R-1 effluent radiation monitor greater than column "GE" for 15 minutes or longer. □ **RG1.2** Dose assessment using actual meteorology indicates doses greater than 1000 mrem TEDE or 5000 mrem thyroid CDE at or beyond the SITE BOUNDARY. [Preferred] □ **RG1.3** Field survey results indicate **EITHER** of the following at or beyond the SITE BOUNDARY: • Closed window dose rates greater than 1000 mR/hr expected to continue for greater than or equal to 60 min. • Analyses of field survey samples indicate thyroid CDE greater than 5000 mrem for 60 min. of inhalation.	Release of gaseous radioactivity resulting in offsite dose greater than 100 mrem TEDE or 500 mrem thyroid CDE [pg. 32] 1 2 3 4 5 DEF □ **RS1.1** Reading on **ANY** Table R-1 effluent radiation monitor greater than column "SAE" for 15 minutes or longer. □ **RS1.2** Dose assessment using actual meteorology indicates doses greater than 100 mrem TEDE or 500 mrem thyroid CDE at or beyond the SITE BOUNDARY. [Preferred] □ **RS1.3** Field survey results indicate **EITHER** of the following at or beyond the SITE BOUNDARY: • Closed window dose rates greater than 100 mR/hr expected to continue for greater than or equal to 60 min. • Analyses of field survey samples indicate thyroid CDE greater than 500 mrem for 60 min. of inhalation.	Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE [pg. 27] 1 2 3 4 5 DEF □ **RA1.1** Reading on **ANY** Table R-1 effluent radiation monitor greater than column "ALERT" for 15 minutes or longer. □ **RA1.2** Dose assessment using actual meteorology indicates doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond SITE BOUNDARY. [Preferred] □ **RA1.3** Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond the SITE BOUNDARY for one hour of exposure. □ **RA1.4** Field survey results indicate **EITHER** of the following at or beyond the SITE BOUNDARY: • Closed window dose rates greater than 10 mR/hr expected to continue for 60 minutes or longer. • Analyses of field survey samples indicate thyroid CDE greater than 50 mrem for one hour of inhalation.	Release of gaseous or liquid radioactivity greater than 2 times the ODAM limits for 60 minutes or longer [pg. 23] 1 2 3 4 5 DEF □ **RU1.1** Reading on **ANY** Table R-1 effluent radiation monitor greater than column "NOUE" for 60 minutes or longer. □ **RU1.2** Reading on ANY effluent radiation monitor greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. □ **RU1.3** Sample analyses for a gaseous or liquid release indicates a concentration or release rate greater than 2 times the ODAM limits for 60 minutes or longer.
	2 Irradiated Fuel Event	Spent fuel pool level cannot be restored to at least the top of the fuel racks for 60 minutes or longer [pg. 37] 1 2 3 4 5 DEF □ **RG2.1** Spent fuel pool level cannot be restored to at least 16.36 feet for 60 minutes or longer.	Spent fuel pool level at the top of the fuel racks [pg. 34] 1 2 3 4 5 DEF □ **RS2.1** Lowering of spent fuel pool level to 16.36 feet.	Significant lowering of water level above, or damage to, irradiated fuel [pg. 29] 1 2 3 4 5 DEF □ **RA2.1** Uncovery of irradiated fuel in the REFUELING PATHWAY □ **RA2.2** Damage to irradiated fuel resulting in a release of radioactivity from the fuel as indicated by a Hi Rad alarm for **ANY** of the following ARMS: • Spent Fuel Pool Area, RI-9178 • North Refuel Floor, RI-9163 • New Fuel Vault Area, RI-9153 • South Refuel Floor, RI-9164 OR Reading greater than 5 R/hr on **ANY** of the following radiation monitors (in Mode 5 only): • NW Drywell Area HI Range Rad Monitor, RIM-9184A • South Drywell Area Hi Range Rad Monitor, RIM-9184B □ **RA2.3** Lowering of spent fuel pool level to 25.17 feet.	Unplanned loss of water level above irradiated fuel [pg. 25] 1 2 3 4 5 DEF □ **RU2.1** a. UNPLANNED water level drop in the REFUELING PATHWAY as indicated by **ANY** of the following: • Report to control room (visual observation) • Fuel pool level indication (LI-3413) less than 36 feet and lowering • WR GEMAC Floodup indication (LI-4541) coming on scale **AND** b. UNPLANNED rise in area radiation levels as indicated by **ANY** of the following radiation monitors. • Spent Fuel Pool Area, RI-9178 • North Refuel Floor, RI-9163 • New Fuel Vault Area, RI-9153 • South Refuel Floor, RI-9164 • NW Drywell Area Hi Range Rad Monitor, RIM-9184A • South Drywell Area Hi Range Rad Monitor, RIM-9184B
	3 Area Radiation Levels			Radiation levels that impede access to areas necessary for normal plant operation, [pg. 31] 1 2 3 4 5 DEF □ **RA3.1** Dose rate greater than 15 mR/hr in **ANY** of the following areas: • Control Room (RM-9162) • Central Alarm Station (by survey)	
E ISFSI	**1** Confinement Boundary			Table E-1 Cask On-Contact Dose Rates 61BT DSC 3 feet from HSM Surface / Outside HSM Door – C/L of DSC / End Shield Wall Exterior: 800 mrem/hr / 200 mrem/hr / 40 mrem/hr	Damage to a loaded cask CONFINEMENT BOUNDARY [pg. 61] 1 2 3 4 5 DEF □ **E-HU1.1** Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by an on-contact radiation reading greater than the values shown on Table E-1 on the surface of the spent fuel cask.
H Hazards	**1** Security	HOSTILE ACTION resulting in loss of physical control of the facility [pg. 96] 1 2 3 4 5 DEF □ **HG1.1** A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the DAEC Security Shift Supervision. **AND** EITHER of the following has occurred: 1. **ANY** of the following safety functions cannot be controlled or maintained • Reactivity control • RPV water level • RCS heat removal OR 2. Damage to spent fuel has occurred or is IMMINENT	HOSTILE ACTION within the PROTECTED AREA [pg. 92] 1 2 3 4 5 DEF □ **HS1.1** A HOSTILE ACTION is occurring or has occurred within the PROTECTED AREA as reported by the DAEC Security Shift Supervision.	HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes [pg. 88] 1 2 3 4 5 DEF □ **HA1.1** A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the DAEC Security Shift Supervision. □ **HA1.2** A validated notification from NRC of an aircraft attack threat within 30 minutes of the site.	Confirmed SECURITY CONDITION or threat [pg. 78] 1 2 3 4 5 DEF □ **HU1.1** A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the DAEC Security Shift Supervision. □ **HU1.2** Notification of a credible security threat directed at DAEC. □ **HU1.3** A validated notification from the NRC providing information of an aircraft threat.
	2 Seismic Event				Seismic event greater than OBE level [pg. 80] 1 2 3 4 5 DEF □ **HU2.1** Seismic event greater than Operating Basis Earthquake (OBE) as indicated by receipt of the Amber Operating Basis Earthquake Light and the wailing seismic alarm on 1C35.
	3 Natural or Tech. Hazard				Hazardous event [pg. 81] 1 2 3 4 5 DEF □ **HU3.1** A tornado strike within the PROTECTED AREA □ **HU3.2** Internal room or area flooding of a magnitude sufficient to require manual or automatic electrical isolation of a SAFETY SYSTEM component needed for the current operating mode. □ **HU3.3** Movement of personnel within the PROTECTED AREA is impeded due to an offsite event involving hazardous materials (e.g., an offsite chemical spill or toxic gas release). □ **HU3.4** A hazardous event that results in on-site conditions sufficient to prohibit the plant staff from accessing the site via personal vehicles. □ **HU3.5** River level above 757 feet. □ **HU3.6** River Water Supply (RWS) pit low level alarm.
	4 Fire			Table H-1 Fire Areas • 1G31 DG and Day Tank Rooms • 1G21 DG and Day Tank Rooms • Battery Rooms • Essential Switchgear Rooms • Cable Spreading Room • Torus Room • Intake Structure • Pumphouse • Drywell • Torus • NE, NW, SE Corner Rooms • HPCI Room • RCIC Room • RHR Valve Room • North CRD Area • South CRD Area • CSTs • Control Building • Remote Shutdown Panel 1C388 Area • Panel 1C55/56 Area • SBGT Room	FIRE potentially degrading the level of safety of the plant [pg. 83] 1 2 3 4 5 DEF □ **HU4.1** A FIRE is **not** extinguished within 15 min. of **ANY** of the following FIRE detection indications: • Report from the field (i.e., visual observation) • Receipt of multiple (more than 1) fire alarms or indications • Field verification of a single fire alarm **AND** The FIRE is located within **ANY** Table H-1 plant rooms or areas □ **HU4.2** Receipt of a single fire alarm with no other indications of a FIRE **AND** The FIRE is located within ANY Table H-1 plant rooms or areas **AND** The existence of a FIRE is not verified within 30 minutes of alarm receipt. □ **HU4.3** A FIRE within the plant or ISFSI PROTECTED AREA not extinguished within 60 minutes of the initial report, alarm or indication. □ **HU4.4** A FIRE within the plant or ISFSI PROTECTED AREA that requires firefighting support by an offsite fire response agency to extinguish.
	5 Control Room Evacuation		Inability to control a key safety function from outside the Control Room [pg. 94] 1 2 3 4 5 DEF □ **HS5.1** An event has resulted in plant control being transferred from the Control Room to the Remote Shutdown Panel (1C388). **AND** Control of **ANY** of the following key safety functions is not reestablished within 20 minutes • Reactivity control • RPV water level • RCS heat removal	Control Room evacuation resulting in transfer of plant control to alternate locations [pg. 90] 1 2 3 4 5 DEF □ **HA5.1** An event has resulted in plant control being transferred from the Control Room to the Remote Shutdown Panel (1C388).	
	6 ED Judgment	Other conditions existing that in the judgment of the Emergency Coordinator warrant declaration of General Emergency [pg. 98] 1 2 3 4 5 DEF □ **HG6.1** Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area.	Other conditions existing that in the judgment of the Emergency Coordinator warrant declaration of Site Area Emergency [pg. 95] 1 2 3 4 5 DEF □ **HS6.1** Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts, (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels beyond the site boundary.	Other conditions existing that in the judgment of the Emergency Coordinator warrant declaration of an Alert [pg. 94] 1 2 3 4 5 DEF □ **HA6.1** Other conditions exist which, in the judgment of the Emergency Director, indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.	Other conditions existing that in the judgment of the Emergency Coordinator warrant declaration of a UE [pg. 88] 1 2 3 4 5 DEF □ **HU6.1** Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of SAFETY SYSTEMS occurs.

Table R-1 - Effluent Monitor Classification Thresholds

	Monitor	GE	SAE	Alert	NOUE
Gaseous	Reactor Building ventilation rad monitor (Kaman 3/4, 5/6, 7/8)	1.0E+00 uci/cc	1.0E-01 uci/cc	1.0E-02 uci/cc	1.0E-03 uci/cc
Gaseous	Turbine Building ventilation rad monitor (Kaman 1/2)	1.0E+00 uci/cc	1.0E-01 uci/cc	1.0E-02 uci/cc	1.0E-03 uci/cc
Gaseous	Offgas Stack rad monitor (Kaman 9/10)	4.5E+03 uci/cc	4.5E+02 uci/cc	4.5E+01 uci/cc	2.0E-01 uci/cc
Gaseous	LLRPSF rad monitor (Kaman 12)	---	1.0E-01 uci/cc	1.0E-02 uci/cc	1.0E-03 uci/cc
Liquid	GSW rad monitor (RIS-4767)	---	---	2.0E+04 cps	2.0E+03 cps
Liquid	RHRSW & ESW rad monitor (RIM-1997)	---	---	1.0E+04 cps	8.0E+02 cps
Liquid	RHRSW & ESW Rupture Disc rad monitor (RM-4268)	---	---	2.0E+04 cps	1.0E+03 cps

Modes: 1 Power Operation | 2 Startup | 3 Hot Shutdown | 4 Cold Shutdown | 5 Refueling | DEF Defueled

		GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
C Cold SD/ Refueling System Malfunct.	**1** RCS Level	Loss of RCS inventory affecting fuel clad integrity with Containment challenged [pg. 57] 4 5 □ **CG1.1** a. RPV level less than +15 inches for 30 minutes or longer. **AND** b. **ANY** indication from the Secondary Containment Challenge Table C-1. □ **CG1.2** a. RPV level cannot be monitored for 30 minutes or longer. **AND** b. Core Uncovery is indicated by **ANY** of the following:: • Drywell Monitor (9148A/B) reading greater than 5.0 R/hr • Erratic source range indication • UNPLANNED level rise in Drywell/Reactor Building Equipment or Floor Drain sump, or Suppression Pool of sufficient levels to indicated core uncovery. **AND** c. **ANY** indication from the Secondary Containment Challenge Table C-1.	Loss of RCS inventory affecting core decay heat removal capability [pg. 55] 4 5 □ **CS1.1** a. CONTAINMENT CLOSURE not established. **AND** b. RPV level less than +64 inches. □ **CS1.2** a. CONTAINMENT CLOSURE established. **AND** b. RPV level less than +15 inches. □ **CS1.3** a. RPV level cannot be monitored for 30 minutes or longer. **AND** b. Core Uncovery is indicated by **ANY** of the following:: • Drywell Monitor (9148A/B) reading greater than 5.0 R/hr • Erratic source range indication • UNPLANNED level rise in Drywell/Reactor Building Equipment or Floor Drain sump, or Suppression Pool of sufficient levels to indicated core uncovery.	Loss of RCS inventory [pg. 46] 4 5 □ **CA1.1** Loss of RPV inventory as indicated by level less than 119.5 inches. □ **CA1.2** a. RPV level cannot be monitored for 15 minutes or longer **AND** b. UNPLANNED level rise in Drywell/Reactor Building Equipment or Floor Drain sump, or Suppression Pool due to a loss of reactor vessel/RCS inventory.	UNPLANNED loss of RCS inventory for 15 minutes or longer [pg. 39] 4 5 □ **CU1.1** UNPLANNED loss of reactor coolant results in RPV level less than **ANY** of the following for 15 minutes or longer: a. In Mode 4, RPV water level less than 170" **OR** b. In Mode 5, if RPV level band is established above the RPV flange and RPV water level drops below the RPV flange. **OR** c. In Mode 5, if RPV level band is established below the RPV flange and RPV water level drops below RPV level band. □ **CU1.2** RPV level cannot be monitored **AND** UNPLANNED level rise in Drywell/Reactor Building Equipment or Floor Drain sump, or Suppression Pool.
	2 Loss of Emergency AC Power			Loss of all offsite and all onsite AC power to essential buses for greater than 15 minutes [pg. 50] 4 5 DEF □ **CA2.1** Loss of **ALL** offsite and **ALL** onsite AC Power to 1A3 and 1A4 for 15 minutes or longer.	Loss of all but one AC power source to essential buses for 15 minutes or longer [pg. 41] 4 5 DEF □ **CU2.1** AC power capability to 1A3 and 1A4 is reduced to a single power source for 15 minutes or longer. **AND** Any additional single power source failure will result in loss of **ALL** AC power to SAFETY SYSTEMS.
	3 RCS Temp.			Inability to maintain plant in cold shutdown [pg. 51] 4 5 □ **CA3.1** UNPLANNED increase in RCS temperature to greater than 212°F for greater than the duration specified in Table C-2. □ **CA3.2** UNPLANNED RCS pressure increase greater than 10 psig due to a loss of RCS cooling.	UNPLANNED increase in RCS temperature [pg. 43] 4 5 □ **CU3.1** UNPLANNED increase in RCS temperature to greater than 212°F □ **CU3.2** Loss of **ALL** RCS temperature and RPV level indication for 15 minutes or longer.
	4 Loss of Vital DC Power				Loss of vital DC power for 15 minutes or longer [pg. 45] 4 5 □ **CU4.1** Indicated voltage is less than 105 VDC on **BOTH** Div 1 and Div 2 125 VDC buses for 15 minutes or longer.
	5 Loss of Comm.				Loss of all onsite or offsite communications capabilities [pg. 46] 4 5 DEF □ **CU5.1** Loss of **ALL** of the following onsite communication methods: • Plant Operations Radio System • In-Plant Phone System • Plant Paging System (Gaitronics) □ **CU5.2** Loss of ALL of the following offsite response organization communications methods: • DAEC All-Call phone • All telephone lines (PBX and commercial) • Cell Phones (including fixed cell phone system) • Control Room fixed satellite phone system • FTS Phone system □ **CU5.3** Loss of **ALL** of the following NRC communications methods: • FTS Phone system • All telephone lines (PBX and commercial) • Cell Phones (including fixed cell phone system) • Control Room fixed satellite phone system
	6 Hazardous Event Affecting Safety Systems		Table C-3 Hazardous Events • Seismic event (earthquake) • Internal or external flooding event • High winds or tornado strike • FIRE • EXPLOSION • River level above 757 feet • River Water Supply (RWS) pit low level alarm • Other events with similar hazard characteristics as determined by the Shift Manager or Emergency Director	Hazardous event affecting a SAFETY SYSTEM needed for the current operating mode [pg. 53] 4 5 □ **CA6.1** a. The occurrence of **ANY** of the Table C-3 hazardous events: **AND** b. 1. Event damage has caused indications of degraded performance in one train of a SAFETY SYSTEM needed for the current operating mode. **AND** 2. **EITHER** of the following: • Event damage has caused indications of degraded performance to a second train of the SAFETY SYSTEM needed for the current operating mode, **OR** • The event has resulted in VISIBLE DAMAGE to the second train of a SAFETY SYSTEM needed for the current operating mode, **OR** • Loss of the safety function of a single train SAFETY SYSTEM.	

Table C-1 Secondary Containment Challenge

- CONTAINMENT CLOSURE not established *
- Drywell Hydrogen or Torus Hydrogen greater than 6% **AND** Drywell Oxygen or Torus Oxygen greater than 5%
- UNPLANNED increase in containment pressure
- Secondary containment radiation monitors above max safe operating limits (MSOL) of EOP 3, Table 6

* If CONTAINMENT CLOSURE is re-established prior to exceeding the 30-minute time limit, then declaration of a General Emergency is not required.

Table C-2 RCS Heat-up Duration Thresholds

RCS Integrity	Containment Closure Status	Heat-up Duration
Intact	N/A	60 min.*
Not intact	Established	20 min.*
	Not established	0 min.

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

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