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Revision 3

# Development and Maintenance of Emergency Action Levels

Cognizant Department: Emergency Management

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## TABLE OF CONTENTS

CHANGE HISTORY SUMMARY ..... ii

1.0 INTRODUCTION ..... 1

2.0 RESPONSIBILITIES ..... 1

2.1 Emergency Management Manager ..... 1
2.2 Repository Project Manager ..... 1
2.3 Operations Manager ..... 2

3.0 PROCESS ..... 2

3.1 Development of Categorization and Classification of Operational Emergency Procedures ..... 2
3.2 Event Classification ..... 3
3.2.1 Emergency Classes and Severity Level ..... 3
3.2.2 Emergency Classification of Security Events ..... 5
3.3 Development of EALs ..... 5
3.4 Barrier Analysis for EALs ..... 6
3.5 Symptom-Based and Event-Based EALs ..... 7
3.5.1 Symptom-Based EALs ..... 7
3.5.2 Event-Based EALs ..... 8
3.6 Other Considerations ..... 8
3.6.1 Equipment Availability ..... 8
3.6.2 Facility Operational Modes ..... 9
3.6.3 Supervisory Judgment ..... 9
3.7 Integration of EALs with Normal and Off-Normal Operations ..... 9
3.8 Categorization and Classification of Operational Emergency Procedure Format ..... 9

4.0 TRAINING AND IMPLEMENTATION OF NEW OR REVISED EALS ..... 10

5.0 REFERENCES ..... 10

Attachment 1 - Terms and Definitions ..... 11

Attachment 2 - Abbreviations and Acronyms ..... 17

Attachment 3 - Supervisory Judgment EAL Parameters ..... 18

Attachment 4 - Operational EAL Parameters ..... 19

Attachment 5 - EAL Format ..... 20

## CHANGE HISTORY SUMMARY

| Revision Number | Issued Date | Description of Changes |
|---|---|---|
| 3 | 1/14/11 | Editorial revision to update organizational information. |

## 1.0 INTRODUCTION

The objective of the Waste Isolation Pilot Plant (WIPP) Emergency Action Level (EAL) process is to implement a technically defensible approach for emergency categorization/classification at WIPP that is in compliance with U.S. Department of Energy (DOE) Order 151.1C, *Comprehensive Emergency Management System*.

This document establishes site requirements for the development and approval of the EALs for use in the Categorization and Classification of Operation Emergency Procedure. The facility Emergency Planning Hazards Assessment (EPHA) is the technical basis of EALs developed.

EALs establish classification criteria for Alert, Site Area Emergency (SAE), and General Emergency (GE) in accordance DOE Order 151.1C. The Categorization and Classification of Operation Emergency Procedure used by the site Facility Shift Manager (FSM) and Emergency Response Organization (ERO) captures events called "Operational Emergencies" (OEs) that do not fall within Alert, SAE, or GE classifications but still warrant management attention and possible off-site notifications.

## 2.0 RESPONSIBILITIES

### 2.1 Emergency Management Manager

- Provides support for development of OE categorization and classification procedure, and associated EALs.
- Ensures OE categorization and classification procedure is reviewed by radiological engineering personnel and reflects current radiological information, configuration, alarms, and instrumentation.
- Ensures compliance with applicable Emergency Management program elements.
- Coordinates development of the Categorization and Classification of Operational Emergency Procedure in accordance with this document.
- Coordinates support for development of EALs.
- Ensures that Categorization and Classification of Operational Emergency Procedure is reviewed by operations personnel and reflects current surface facility operations, configuration, alarms, and instrumentation.

### 2.2 Repository Project Manager

- Provides Repository Project support for development of the Categorization and Classification of Operational Emergency Procedure.
- Ensures that Categorization and Classification of Operational Emergency Procedure is reviewed by Repository Development Project personnel and

reflects current underground operations, configuration, alarms, and instrumentation.

### 2.3 Operations Manager

- Provides operations support and approval for development of the Categorization and Classification of Operational Emergency Procedure.
- Ensures that Categorization and Classification of Operational Emergency Procedure is reviewed by Integrated Waste Operations personnel and reflects current surface operations, configuration, alarms, and instrumentation.

## 3.0 PROCESS

### 3.1 Development of Categorization and Classification of Operational Emergency Procedures

DOE Order 151.1C requires that an OE be declared when events occur that represent a significant degradation in the level of safety at a site/facility and that requires time-urgent response. This is the process of *categorizing* an event or condition. Such events or conditions can cause, or have the potential to cause:

- Serious health and safety impacts to workers or the public.
- Serious detrimental effects on the environment.
- Direct harm to people or the environment as a result of degradation of security or safeguards conditions.
- Direct harm to people or the environment as a result of a DOE off-site transportation shipment.
- Loss of control over hazardous material (i.e., toxic chemicals or radioactive materials).
- Once an event or condition is categorized as an OE, and the event involves the loss of control over hazardous materials that is an actual or potential airborne release, it is required to be further *classified.* The Order requires that these events be *classified* as Alert, SAE, and GE, in order of increasing severity, depending upon how far downwind the airborne release is projected to affect. This classification facilitates early decision-making, particularly with respect to response activities, off-site notifications, and protective actions, by making initial decisions during planning rather than during actual response.
- Once an event has been classified, it cannot be downgraded to a lower classification, unless it is terminated first and then reclassified.

If a hazardous material release event affects only the immediate area (i.e., less than PAC at 30 m), it may be categorized as an OE only (i.e., less than an Alert [LTA]).

EALs form the link between the severity of a hazardous material OE, as reflected in the event classification system, and facility-specific indicators of the event. For any given type of event, use one or more observable conditions (individually or in combination) as criteria for the event. These criteria relate to an actual release of hazardous material, or to conditions that represent various levels of degradation or loss of ability to control those materials.

The purpose of classifying hazardous material OEs by severity is for implementing specific emergency actions, including those required response activities and notifications commensurate with the degree of hazard presented by the event.

## 3.2 Event Classification

Event classification is applicable only to hazardous material releases and is the process of assessing a particular condition or event to determine if it falls into one of the three hazardous material OE classifications.

### 3.2.1 Emergency Classes and Severity Level

A. Alert

Health and safety impacts for an Alert emergency classification are expected to be confined within the incident facility boundary (100 meters).

An Alert shall be declared when events are predicted, are in progress, or have occurred that result in one or more of the following:

(1) Actual or potential substantial degradation in the level of control over hazardous materials.

(a) The dose from any release to the environment of radioactive material or a concentration in air of other hazardous material is expected to exceed either PAC at or beyond 30 meters from the point of release to the environment; but :

(b) PAC is not expected to be exceeded at or beyond the facility boundary (100 meters).

(2) Actual or potential substantial degradation in the level of safety or security of a nuclear weapon, component, or test device that would not pose an immediate threat to workers or the public.

(3) Actual or potential substantial degradation in the level of safety or security of a facility or process that could, with further degradation, produce an SAE or GE.

B. SAE

An SAE is expected to have significant on-site impacts beyond the incident facility boundary (100 meters). Protective actions for on-site personnel and full mobilization of on-site resources may be needed to deal with the event and its consequences.

The intention of declaring an SAE is to provide for initiation of predetermined protective actions for on-site personnel, as well as notification and assembly of emergency response personnel and equipment.

An SAE shall be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations.

(1) Actual or potential major failure of functions necessary for the protection of workers or the public. The radiation dose from any release of radioactive material or concentration in air from any release of other hazardous material is expected to exceed the applicable PAC beyond the facility boundary (100 meters). The PAC is not expected to be exceeded at or beyond 300 meters.

(2) Actual or potential threat to the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers in the immediate area, but not the public

(3) Actual or potential major degradation in the level of safety or security of a facility or process that could, with further degradation, produce a GE.

(4) For transportation events occurring within WIPP, SAE is the appropriate class if the dose from any release to the environment of radioactive material or a concentration in air of other hazardous material is expected to exceed PAC at or beyond 100 meters from the release but less than PAC at 300 meters.

C. GE

Events or conditions expected to produce consequences that require protective actions for the general public fall within the GE classification. Such conditions require full mobilization of all available WIPP and off-site resources to deal with the event and its consequences.

(1) A GE shall be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations.

(a) Actual or imminent catastrophic reduction of facility safety or security systems with potential for the release of large

quantities of hazardous materials (radiological or nonradiological) to the environment. The radiation dose from any release of radioactive material or a concentration in air from any release of other hazardous material is expected to exceed PAC at or beyond 300 meters.

(b) Actual or likely catastrophic failures in safety or security systems threatening the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers and the public.

(2) GE is the appropriate class for a transportation accident occurring within the boundaries of WIPP if the dose from any release to the environment of radioactive material or a concentration in air of other hazardous material is expected to exceed PAC at or beyond 300 meters.

### 3.2.2 Emergency Classification of Security Events

DOE Order 151.1C requires events associated with malevolent acts be included in hazardous material OE EALs. Moderate malevolent acts could be initiated by an individual using material and tools readily available in the facility, or small quantities of flammables. Use of barrier challenge/failure analysis method for EPHA accident analysis implicitly analyzes most moderate malevolent acts. Extreme malevolent acts are those perpetrated by personnel from outside the facility (i.e., beyond the capabilities of a disgruntled worker). Extreme events are incorporated into EALs as follows. Two types of security events of interest for EAL development, at WIPP, in descending order of severity, are:

- A security event resulting in an actual or imminent catastrophic release of radioactive material. This OE is a GE at WIPP.
- A security event resulting in an actual or imminent degradation in safety systems leading to a release of radioactive material. This OE is an SAE at WIPP.

Whenever security events are in progress where a catastrophic release of radioactive material could occur or a degradation in safety system and release of radioactive material could occur, a corresponding OE may be declared depending on material at risk.

## 3.3 Development of EALs

The EPHA constitutes the technical basis for an emergency planning program. It identifies and characterizes hazards associated with a facility, determines events and conditions that could lead to releases, and quantifies potential consequences of each postulated accident. EALs shall be described for all potential emergencies at the site including radiological, non-radiological, terrorism, sabotage, fire, explosion, security, and natural phenomena.

Corresponding accident mechanisms, equipment or system failures, event indicators, and contributing events are among the supporting material developed for the identified barrier failure events.

This information is used to identify the specific equipment or other observable methods of detection and recognition for each barrier failure event. These could include an instrument reading, an equipment status indicator, a measurable off-site/on-site parameter, a discrete observable event, results of analyses, or another observed phenomenon.

To the maximum extent possible, the indications selected for use are to be directly observable, unambiguous, and objective.

Results of the EPHA provide a quantitative estimate of consequences for releases at specific receptors. Data for 95 percent adverse meteorological conditions are used in development of EALs.

For detection and recognition methods that yield a correlation to actual or potential consequence, it may be possible to calculate values or conditions that indicate when an emergency class has been reached. Examples of indications or conditions for which values are calculated are installed alarms, direct instrument readings, and indicated status of systems or equipment.

Using PAC as the threshold value, calculated values for installed instruments, sample results, and system status may be used to indicate when the threshold value (under adverse meteorological conditions) is reached at the designated receptor locations. These values may become EAL triggers for determining the potential emergency class. For example: an accident resulting in a release of radioactive material through the stack exceeding the criteria for a GE, with one means of detection being the stack monitor. Instrument readings could be used to calculate the potential doses that could trigger classification as an Alert, SAE, and GE and identified as EAL trigger values. Some accident indicators or symptoms may not be detectable by quantifiable methods or may be indirectly recognized.

In many cases involving the actual or potential release of nonradioactive hazardous material, there will be either minimal or no installed instrumentation designed to detect a release. These EALs are stated in terms of the observable indicators or conditions. Base the resulting event classification on the consequence resulting from the release of the maximum source term determined in the EPHA.

Supervisory Judgment EALs are listed in Attachment 3. These EALs are to be implemented in the Emergency Categorization and Classification procedure. Operational EALs are listed in Attachment 4. These EALs address events that exceed PAC as identified in the facility specific EPHA.

### 3.4 Barrier Analysis for EALs

The accident initiator is not an essential factor in the development of EALs, the end product of an EPHA. Many accident initiators will often produce the same barrier failure

and consequence. How an accident originated may not be decisive in the recognition and categorization of an event. In those cases where the accident initiator has a direct bearing on the source term and the consequences the initiator is identified and described. If events are identified where the only initiator to a release is a malevolent act, it is explicitly stated in the EPHA. The use of the barrier failure analysis method for EPHA accident analysis will implicitly analyze the majority of moderate malevolent acts. The method used to transform inventories of hazardous materials into source terms is as follows:

- Determine barrier failure modes by identifying initiating events.
- For each failure mode, determine mechanisms for release.
- Based on release mechanisms, a quantitative estimate of the material at risk is developed, considering the nature of the material (physical state, vapor pressure, etc.) and the postulated mode of failure.
- Source term is then calculated by applying release fractions for each event.

## 3.5 Symptom-Based and Event-Based EALs

EALs may either be symptom-based or event-based. The distinction arises from the available methods of detecting and recognizing the event initiating conditions.

### 3.5.1 Symptom-Based EALs

Symptom-based EALs are dependent upon one or more observable conditions or parameter values (i.e., symptoms) that are measurable. They are often the same indicators used by operations personnel to monitor routine facility operation.

Train operating staff to:

- Recognize when these indicators begin to show off-normal readings.
- Identify the probable causes.
- Recognize the potential consequences.
- Take corrective actions.

The failure of, or challenge to, the facility's hazardous materials confinement barriers are directly related to the level of severity indicated by these symptoms. The resulting EALs consist of specific quantified values (e.g., alarms, control instrument readings) which require no additional interpretation by the user. The correct potential emergency classification is determined by comparing the observed value to the EALs in the event categorization and classification procedure.

### 3.5.2 Event-Based EALs

Event-based EALs address the occurrence of discrete events with potential safety significance. Determine the level of severity by the degree to which hazardous material confinement barriers are failed or challenged as a result of the event.

Methods available to detect and quantify event-initiating conditions are often limited. The resulting EALs start the overall event descriptor and require a separate definition of what constitutes the event. For example, recognition that an event has occurred may in itself become the EAL.

Event classification requires the interpretation of one or more qualitative conditions or discrete observable indicators to determine if the existing situation matches the descriptions contained in the event classification procedure.

Development of symptom-based EALs is the preferred approach, recognizing that there will usually be some initiating conditions that require an event-based approach.

Subjective (event-based) EALs can often be restated in more quantitative or objective (symptom-based) terms. Table 1 illustrates the difference between a subjective (event-based) EAL statement that requires much interpretation by the user, and an objective (symptom-based) EAL statement for the same condition.

**Table 1**
**Examples of Event-Based (Subjective) and Symptom-Based (Objective) EAL Statements**

| Initiating Condition | Event-Based (Subjective) EAL Statement | Symptom-Based (Objective) EAL Statement |
|---|---|---|
| Fire | Fire in chemical make-up room of ABC facility beyond incipient stage. | Fire in ABC facility as <u>indicated by</u>:<br>• Fire Alarm Annunciator for Zone 1, 3, **<u>or</u>** 6 - <u>and</u> -<br>• Sprinkler flow indicated on indicator F-100 |
| Radiological Release | Breach of HEPA filter bank resulting in stack release from ABC facility corresponding to off-site dose of 1 rem (Roentgen Equivalent Man) | Confirmed ABC stack alpha monitor reading >3E-8 mCi/s<br>- <u>or</u> -<br>Confirmed criticality alarm on panel A-69 |

## 3.6 Other Considerations

### 3.6.1 Equipment Availability

When matching initiating events to facility equipment to provide a means of detecting the event, recognize that under some accident conditions, the equipment may be nonoperational (e.g., loss of power), be outside its operating limits (e.g., out of range), or in the case of HEPA filtration, plugged.

### 3.6.2 Facility Operational Modes

Consider conditions that exist during different operational modes when developing facility-specific EALs. During one mode of operation, an instrument reading of a specific value provides a clear indication of an accident condition, while in another mode it may not.

Avoid setting an EAL that can be exceeded when no emergency exists. Event categorization/classification personnel are then in a position of having to declare an OE when one does not exist or violate emergency procedures.

### 3.6.3 Supervisory Judgment

To compensate for unforeseen conditions, Supervisory Judgment EALs are to be added for use by the site FSM and ERO to allow declaration of the level of emergency that most closely corresponds to the apparent conditions, regardless of whether it can be determined that a specific EAL has been exceeded. For unanalyzed events that occur within a facility, the FSM or ERO will determine if an OE should be declared using the Supervisory Judgment EALs.

## 3.7 Integration of EALs with Normal and Off-Normal Operations

During the facility EPHA process, various limits to operation of the facility may be included to reduce the hazard (e.g., quantity limits) or provide barriers (e.g., administrative controls) to the hazard. These limits and controls should be incorporated into the appropriate facility operating procedures. Many different indicators and symptoms may be monitored or observed to determine if facility conditions are normal or off normal. The detection of these indicators and the recognition of their significance to the state of the facility are generally a routine function of operations.

To the extent possible, integrate the methods employed for detection and recognition of accident events to make the transition from routine operations to emergency response.

## 3.8 Categorization and Classification of Operational Emergency Procedure Format

Attachment 4 provides a standard format for EAL development. The format categorizes EALs based on the type of event (e.g., radiological, biological, chemical, or security). Within each category, EALs are grouped with the classifiable operational event. For example, for a given event, one or more EALs are grouped in close proximity to aid the review process during an actual emergency.

Number EALs sequentially according to the numbering scheme shown on Attachment 4. The following is the minimum content for an EAL:

- Purpose
- Scope

- Responsibilities
- Procedure Steps/Performance Actions
- References
- Records
- Attachments and Appendices (as applicable)

The EAL matrix and the EALs are normally contained in an attachment or appendix in the procedure.

For a hazardous material release, the default initial *on-site protective action*/*off-site protective action recommendation* is *Remain Indoors*. For additional information regarding protective actions, refer to WP 12-ER4907, Evacuation/Sheltering in Place.

To assist in satisfying this requirement, include the maximum distance at which a protective action criterion is expected to be exceeded in each EAL.

## 4.0 TRAINING AND IMPLEMENTATION OF NEW OR REVISED EALS

Affected personnel are trained on new or revised EALs prior to implementation of the EALs. Training is provided as follows:

- Site FSMs/FESs/CMs/DCMs receive training on WP 12-ER3906 and an overview of the corresponding EPHA.
- All consequence assessment personnel coordinators receive training on WP 12-ER3906 and/or overview of the corresponding EPHA.

## 5.0 REFERENCES

DOE Order 151.1C, *Comprehensive Emergency Management System*, U.S. DOE, July 11, 2007

WP 12-ER3906, Categorization and Classification of Operational Emergencies

WP 12-ER4907, Evacuation/Sheltering in Place

Attachment 1 - Terms and Definitions

**Acute Exposure Guideline Level (AEGL)** – Airborne concentration above which adverse health effects are predicted. One-hour AEGLs (Final or Interim) are the preferred PAC for chemical exposures, followed by ERPGs, then TEELs.

> **AEGL-1** – Airborne concentration above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, effects are not disabling but transient and reversible upon cessation of exposure.
>
> **AEGL-2** – Airborne concentration above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
>
> **AEGL-3** – Airborne concentration above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death.

**Alert** – An Alert is declared when events are predicted, are in progress, or have occurred that result in one or more of the following:

- Actual or potential substantial degradation in the level of control over hazardous materials.

  (a) The radiation dose (1 rem TEDE) from any release to the environment of radioactive material or a concentration in air (AEGL-1, ERPG-2, or TEEL-2) of other hazardous material is expected to exceed a site-specific criterion corresponding to either:

  - Ten percent of PAC at or beyond the facility boundary (100 m), or
  - PAC at or beyond 30 m from the release.

  (b) PAC is not expected to be exceeded at or beyond the facility boundary (100 m).

- Actual or potential substantial degradation in the level of safety or security of a nuclear weapon, component, or test device that would not pose an immediate threat to workers or the public.

- Actual or potential substantial degradation in the level of safety or security of a facility or process that could, with further degradation, produce an SAE or GE.

**Catastrophic failure** – Catastrophic failure is a failure which could result in loss of property, damage to the environment of the user of that technology, and possibly injury or loss of life.

Attachment 1 - Terms and Definitions

**Committed dose equivalent (CDE) ($H_{T,50}$)** – Dose equivalent calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed dose equivalent is expressed in units of rem.

**Committed effective dose equivalent (CEDE) ($H_{E,50}$)** – The sum of the committed dose equivalents to various tissues in the body ($H_{T,50}$), each multiplied by the appropriate weighting factor ($w_T$) - that is, $H_{E,50} = \Sigma\, w_T\, H_{T,50}$. Committed effective dose equivalent is expressed in units of rem.

**Consequence** – Result or effect (especially projected exposure to radiological or chemical hazards) of a release of hazardous materials to the environment.

**Deep dose equivalent (DDE)** – The dose equivalent derived from external radiation at a tissue depth of 1 centimeter in tissue. Deep dose equivalent is expressed in rem.

**Degradation** – Failure of machinery or equipment to function at their design capacity. Failure is characterized as either gradual in its progression or limited in its impact (e.g., small breach of a container, decreased HEPA filter efficiency).

**Effective dose equivalent (EDE) ($H_E$)** – The summation of the products of the dose equivalent received by specified tissues of the body ($H_T$) and the appropriate weighting factor ($w_T$) - that is, $H_E = \Sigma\, w_T\, H_T$. It includes the dose from radiation sources internal and/or external to the body.

**Emergency action level (EAL)** – Specific, predetermined, and observable criteria used to detect, recognize, and classify hazardous material OEs.

**Emergency classification** – Classifies an OE involving a hazardous material release by the degree of severity, depending on the actual or potential consequence of the emergency. The classification levels are Alert, Site Area Emergency (SAE), and General Emergency (GE).

**Emergency planning hazards assessment (EPHA)** – Forms the technical basis for applicable emergency classification procedures

**Emergency response planning guideline (ERPG)** – Estimate of the concentration above which one could reasonably anticipate observing adverse effects, as described in the definitions for ERPG-1, ERPG-2, and ERPG-3, as a consequence of exposure to the specific substance.

> **ERPG-1** – Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

Attachment 1 - Terms and Definitions

**ERPG-2** – Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

**ERPG-3** – Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

**Equivalent isotope** – An analytic technique of summing the dose potential from all the radionuclides of interest in a source term into a single "equivalent" radionuclide in order to facilitate quick consequence assessment of that source term.

**Exclusive Use Area (EUA)** – Defines an area of approximately 290 acres that contains the PPA. It is surrounded by a barbed wire fence and is restricted to use by the DOE only.

**Facility boundary** – Boundary, determined by this document, which represents the receptor that differentiates between an Alert and SAE declaration. For WIPP emergency planning and response, the facility boundary is 100 m.

**General Emergency (GE)** – A GE must be declared when events are predicted or progress, or have occurred that result in one or more of the following situations:

- Actual or imminent catastrophic reduction of facility safety or security systems with potential for the release of large quantities of hazardous materials (radiological or nonradiological) to the environment. The dose from any release of radioactive material, or concentration in air (AEGL-2, ERPG-2, or TEEL-2) from any release of other hazardous material is expected to exceed the applicable PAC at or beyond the 300 m.

- Actual or likely catastrophic failures in safety or security systems threatening the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers and the public.

**Hazardous material** – Any solid, liquid, or gaseous material that is toxic, flammable, radioactive, corrosive, chemically reactive, or unstable upon prolonged storage, in quantities that could pose a threat to life, property, or the environment

**Land Withdrawal Area** – Defines an area of 16 sections totaling 10,240 acres that contains the Off-Limits Area. The Land Withdrawal Area encourages public use. The Land Withdrawal Area defines the site boundary (3,000 meters).

**Off-Limits Area** – Boundary defines an area of approximately 1,450 acres. This area is not fenced and is posted "No Trespassing," but is leased for grazing. Hunting is also allowed in this area.

Attachment 1 - Terms and Definitions

**Operational emergency (OE)** – Major unplanned or abnormal event or condition that occurs that involves or affects DOE/NNSA facilities and activities by causing or having the potential to cause serious health and safety or environmental impacts; requires resources from outside the immediate/affected area or local event scene to supplement the initial response; and requires time-urgent notifications to initiate response activities at locations beyond the event scene. In general, to be considered an OE, an event or condition involving the uncontrolled release of a hazardous material must: immediately threaten or endanger personnel who are in close proximity of the event; have the potential for dispersal beyond the immediate vicinity of the release in quantities that threaten the health and safety of on-site personnel or the public in collocated facilities, activities, and/or off-site; and have a potential rate of dispersal sufficient to require a time-urgent response to implement protective actions for workers and the public. An OE involving release of significant quantities of hazardous materials within the WIPP Controlled Area may require further classification as an Alert, SAE, or GE.

**Property Protection Area (PPA)** – Boundary defines an area of approximately 35 acres that contains the WIPP surface structures. A chain-linked fence topped with barbed wire surrounds it.

**Protective action (PA)** – Physical measures (remain indoors, shelter, evacuation, relocation) taken to reduce potential health hazards from the plume exposure pathway. This excludes action taken to secure the scene to isolate a hazard (e.g., barricades, roadblocks).

**Protective action criteria (PAC)** – Radiological dose or toxic material concentration level that acts as a trigger, for the receptor of interest, to declare an OE and initiate protective actions for workers or to recommend off-site protective actions. WIPP PAC are:

- For a radiological hazard, 1 rem Total Effective Dose Equivalent (TEDE) or 5 rem Committed Dose Equivalent (CDE) thyroid is used as the trigger for classification of OEs and off-site protective action recommendations.
- For a chemical hazard, AEGL-2 (or ERPG-2, or TEEL-2, in order of preference) is the trigger for classification of OEs and off-site protective action recommendations.

**Release** – An airborne effluent release to the environment as this pathway typically represents the most time-urgent situation. Releases to aquatic and ground pathways in most instances do not have the same time urgency as airborne releases. The hazard assessment considers releases to an aquatic or ground pathway having a time-urgent affect on the workers or the public (e.g., through a community water supply).

**Site** – Area over which the DOE has access control authority. This includes any area that has been designated as a National Security Area.

Attachment 1 - Terms and Definitions

**Site Area Emergency (SAE)** – A Site Area Emergency shall be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations:

- An actual or potential major failure of functions necessary for the protection of workers or the public. The radiation dose (1 rem TEDE) from any release of radioactive material or concentration in air (AEGL-2, ERPG-2, or, TEEL-2) from any release of other hazardous material is expected to exceed applicable PAC beyond the facility boundary (100 m). PAC is not expected to be exceeded at or beyond 300 m.

- An actual or potential threat to the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers in the immediate area, but not the public.

- An actual or potential major degradation in the level of safety or security of a facility or process that could, with further degradation, produce a GE.

**Source term** – The amount of respirable material released to the environment. The source term takes into consideration the Material at Risk, the Damage Ratio (fraction), Airborne Release Fraction, Respirable Fraction, Leak Path Factor (fraction). Airborne Release Rate (fraction/hour), and the Release Duration (hours) may also be used in some cases. There can be both a chemical and a radiological source term.

**Supervisory Judgment** – A decision reached by the FSM or Crisis Manager, with input from cognizant personnel, to identify nonspecific or interpretive EALs. This is a subjective determination relying on experience and institutional knowledge in evaluating event conditions that may be ambiguous or not clearly defined.

**Temporary emergency exposure limit (TEEL)** – Since AEGLs and ERPGs exist for relatively few chemicals, Subcommittee on Consequence Assessment & Protective Actions (SCAPA) developed TEELs so consequence assessments could be conducted. TEELs are an estimate of the concentration above which one could reasonably anticipate observing adverse effects, as described in definitions for TEEL-0, TEEL-1, TEEL-2, and TEEL-3, as a consequence of exposure to a specific substance. SCAPA recommends that for application of TEELs, concentration at the receptor be calculated as the peak 15-minute time-weighted average.

**TEEL-0** – Threshold concentration below which most people will experience no appreciable risk of health effects.

**TEEL-1** – Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

**TEEL-2** – Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or

Attachment 1 - Terms and Definitions

other serious health effects or symptoms that could impair their abilities to take protective action.

**TEEL-3** – Maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects

**Total effective dose equivalent (TEDE)** – Sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). Deep dose equivalent to the whole body may be used as effective dose equivalent for external exposures.

Attachment 2 - Abbreviations and Acronyms

| | |
|---|---|
| AEGL | Acute Exposure Guideline Level |
| CBFO | DOE Carlsbad Field Office |
| CEDE | Committed Effective Dose Equivalent |
| CDE | Committed Dose Equivalent |
| DOE | U.S. Department of Energy |
| EAL | Emergency Action Level |
| EDE | Effective Dose Equivalent |
| EOC | Emergency Operations Center |
| EPHA | Emergency Planning Hazards Assessment |
| ERO | Emergency Response Organization |
| ERPG | Emergency Response Planning Guideline |
| EUA | Exclusive Use Area |
| FSM | Facility Shift Manager |
| GE | General Emergency |
| NNSA | National Nuclear Safety Administration |
| OE | Operational Emergency |
| PAC | Protective Action Criteria |
| PPA | Property Protection Area |
| rem | Roentgen Equivalent Man |
| SAE | Site Area Emergency |
| SCAPA | Subcommittee on Consequence Assessment & Protective Actions |
| TEDE | Total Effective Dose Equivalent |
| TEEL | Temporary Emergency Exposure Limit |
| WIPP | Waste Isolation Pilot Plant |

Attachment 3 - Supervisory Judgment EAL Parameters

| | |
|---|---|
| **CATEGORY 1 – RADIOACTIVE RELEASE** | |
| GE-1.1 | ≥ 1 rem TEDE or 5 rem CDE thyroid (actual or projected) at or beyond 300 meters. |
| SAE-1.1 | ≥ 1 rem TEDE or 5 rem CDE thyroid (actual or projected) at or beyond the facility boundary (100 meters) but < 1 rem TEDE or 5 rem CDE thyroid at 300 meters. |
| A-1.1 | ≥ 1 rem TEDE or 5 rem thyroid (actual or projected) 30 meters from the release to the facility boundary (100 meters), but < 1 rem TEDE or 5 rem thyroid at the facility boundary (100 meters) and beyond. |
| **CATEGORY 2 – CHEMICAL RELEASE** | |
| GE-2.1 | ≥ AEGL-2 (actual or projected) at or beyond 300 meters. |
| SAE-2.1 | ≥ AEGL-2 at or beyond the facility boundary (100 meters) but < AEGL-2 at 300 meters. |
| A-2.1 | ≥ AEGL-2 at 30 meters from the release but < AEGL-2 at the facility boundary (100 meters). |
| CATEGORY 3 – Hazardous Biological Agents or Toxins | |
| GE-3.1 | None identified. |
| SAE-3.1 | None identified. |
| **CATEGORY 4 – OTHER** | |
| GE-4.1 | SUPERVISORY JUDGMENT<br>If you anticipate that GE conditions are imminent, declare a GE. |
| GE-4.2 | A security event involving the transportation of DOE owned or controlled hazardous material within the EUA of the site.<br>AND Attachment 3. Supervisory Judgment EAL Parameters (page 1 of 1)<br>Off-site protective actions are necessary. |
| SAE-4.1 | SUPERVISORY JUDGMENT<br>If you anticipate that SAE conditions are imminent, then declare an SAE. |
| SAE-4.2 | A security event resulting in an actual or imminent catastrophic release of radioactive material (if the highest analyzed event is an GE) or a security event resulting in an actual or imminent catastrophic release of radioactive material or actual or imminent degradation in safety systems (if the highest analyzed event is a SAE) act involving the transportation of DOE owned or controlled hazardous material within the EUA of the site.<br>AND<br>On-site protective actions are necessary > 100 meters from the point of release, but there is no potential to impact off-site populations. |
| A-4.1 | SUPERVISORY JUDGMENT<br>If you anticipate that Alert conditions are imminent, declare an Alert. |
| A-4.2 | A security event (if the highest analyzed event is an Alert) resulting in an actual or imminent catastrophic release of radioactive material or actual or imminent degradation in safety systems involving the transportation of DOE owned or controlled hazardous material within the EUA of the site.<br>AND<br>On-site protective actions are necessary ≥ 30 meters but < 100 meters from the point of release. |

These standard EALs are included in WP 12-ER3906.

Attachment 4 - Operational EAL Parameters

| CATEGORY 1 – RADIOACTIVE RELEASE | |
|---|---|
| GE-1.1 | Radiological release exceeding GE PAC based on Facility EPHA. |
| SAE-1.1 | Radiological release exceeding SAE PAC based on Facility EPHA. |
| A-1.1 | Radiological release exceeding the ALERT PAC based on Facility EPHA. |

| CATEGORY 2 – CHEMICAL RELEASE | |
|---|---|
| GE-2.1 | Chemical release exceeding GE PAC based on Facility EPHA. |
| SAE-2.1 | Chemical release exceeding the SAE PAC based on Facility EPHA. |
| A-2.1 | Chemical release Alert PAC based on Facility EPHA. |

| CATEGORY 3 – Hazardous Biological Agents or Toxins | |
|---|---|
| GE-3.1 | None identified. |
| SAE-3.1 | None identified |

| CATEGORY 4 – OTHER | |
|---|---|
| GE-4.1 | Security event with an actual or imminent catastrophic direct release of radioactive material where the highest analyzed event indicates a GE. |
| SAE-4.1 | Security event with an actual or imminent catastrophic direct release of radioactive material or an actual or imminent degradation in a safety system leading to a direct release of radioactive material where the highest analyzed event indicates an SAE -OR-<br>Security event with an actual or imminent degradation in a safety system leading to a direct release of radioactive material where the highest analyzed event indicates a GE |
| A-4.1 | Security event with an actual or imminent catastrophic direct release of radioactive material or an actual or imminent degradation in a safety system leading to a direct release of radioactive material where the highest analyzed event is an Alert. |

Attachment 5 - EAL Format

**Attachment #**
**Operational EAL Table of Contents**


| RADIOACTIVE RELEASE – CATEGORY 1 | | Page |
|---|---|---|
| GE-1.1 | Classifiable OE Event 1 | 4 |
| SAE-1.1 | Classifiable OE Event 1 | 5 |
| A-1.1 | Classifiable OE Event 1 | 6 |
| SAE-1.2 | Classifiable OE Event 2 | 7 |
| A-1.2 | Classifiable OE Event 2 | 8 |
| A-1.3 | Classifiable OE Event 3 | 9 |

END OF CATEGORY 1

| CHEMICAL RELEASE – CATEGORY 2 | | Page |
|---|---|---|
| SAE-2.1 | Classifiable OE Event 1 | 10 |
| A-2.1 | Classifiable OE Event 1 | 11 |
| GE-2.2 | Classifiable OE Event 2 | 12 |
| SAE-2.2 | Classifiable OE Event 2 | 13 |
| A-2.2 | Classifiable OE Event 2 | 14 |
| A-2.3 | Classifiable OE Event 3 | 15 |

END OF CATEGORY 2

| Hazardous Biological Agents or Toxins – CATEGORY 3 | | Page |
|---|---|---|
| GE-3.1 | None Identified | 16 |
| SAE-3.1 | None Identified | 16 |
| A-3.1 | None Identified | 16 |

END OF CATEGORY 3

| OTHER - CATEGORY 4 | | Page |
|---|---|---|
| GE-3.1 | Classifiable OE Event 1 | 17 |
| SAE-3.1 | Classifiable OE Event 2 | 18 |
| A-3.1 | Classifiable OE Event 3 | 19 |

END OF CATEGORY 4

Attachment 5 - EAL Format

**Attachment #**
**ABC Facility Operational EAL Parameters**

CATEGORY 1 – RADIOLOGICAL RELEASE

| **GENERAL EMERGENCY** | |
|---|---|
| GE-1.1 | Classifiable Operational Emergency Event 1 (1-RD-2a)<br><br><u>Event Description</u><br>Describe the event. Include methods available for detecting and recognizing the event (e.g., instrument indicators, alarm set points, instrumentation tag numbers).<br><br><u>Source Term</u><br>Provide specific source term data calculated in the EPHA to allow real-time assessment of downwind consequences. Include sample time and stack height used for consequence assessment.<br><br><u>Default Initial Protective Action</u><br>For a hazardous material release, the default initial *protective action* is *Remain Indoors*. For additional information regarding protective actions, refer to WP 12-ER4907, Evacuation/Sheltering in Place.<br><br><u>Maximum Distance to PAC</u><br>Provide the maximum distance to PAC calculated in the EPHA. |
| **SITE AREA EMERGENCY** | |
| SAE-1.1 | Classifiable Operational Emergency Event 1 (1-RD-2b)<br><br><u>Event Description</u><br>Describe the event. Include methods available for detecting and recognizing the event.<br><br><u>Source Term</u><br>Provide specific source term data calculated in the EPHA to allow real-time assessment of downwind consequences. Include sample time and stack height used for consequence assessment.<br><br><u>Default Initial Protective Action</u><br>For a hazardous material release, the default initial *protective action* is *Remain Indoors*. For additional information regarding protective actions, refer to WP 12-ER4907, Evacuation/Sheltering in Place.<br><br><u>Maximum Distance to PAC</u><br>Provide the maximum distance to PAC calculated in the EPHA. |

Attachment 5 - EAL Format

| ALERT | |
|---|---|
| A-1.1 | Classifiable Operational Emergency Event 1 (1-RD-2c)<br><br><u>Event Description</u><br>Describe the event. Include methods available for detecting and recognizing the event.<br><br><u>Source Term</u><br>Provide specific source term data calculated in the EPHA to allow real-time assessment of downwind consequences. Include sample time and stack height used for consequence assessment.<br><br><u>Default Initial Protective Action</u><br>For a hazardous material release, the default initial *protective action* is *Remain Indoors*. For additional information regarding protective actions, refer to WP 12-ER4907, Evacuation/Sheltering in Place.<br><br><u>Maximum Distance to PAC</u><br>Provide the maximum distance to PAC calculated in the EPHA. |

Attachment 5 - EAL Format

Sample EAL

Below is a sample EAL

CATEGORY 1 – RADIOLOGICAL RELEASE

SAE-1.4
CH waste containers crushed (4-RD-3b, 4-RD-4b)
Event potentially indicated by:
Observation, Report, Alarm, CAM Alarm, and/or other indications of a release from CH containers being crushed
AND

- Loss of HEPA U/G
  **OR**
- Loss of U/G ventilation
  **OR**
- Report or other indication of unsuccessful shift to U/G filtration
  **OR**
- Shift did not occur soon enough to prevent environmental discharge (five minutes)
  Default Maximum Source Term: ## PE Ci

Default Protective Action: Remain indoors
Maximum Distance to PAC: 295 meters

Event should be modeled as a 10-minute ground level release.

| Container | SAE Threshold Inventory (containers) | Maximum Inventory (PE Ci) | Maximum Source Term (PE Ci) |
|---|---|---|---|
| Drum (4-RD-3b) | ≥34 | 2700 | 4.8E-1 |
| SWB (4-RD-4b) | ≥18 | 6200 | 2.6E-2 |

End of Category 1