Manual Number: 6Q

Manual Title: SRS Emergency Plan/Emergency Management Program Procedures Manual

Revision Log

1.	**Document and Revision Number:** Procedure EMPP 6Q-001, Rev. 10
2.	**Document Title:** Standards for Development and Maintenance of an Emergency Planning Hazards Assessment (EPHA)
3.	**Effective Date:** 11/11/2010
4.	**Document Changes** **1.** Added *S/RID* identifier in **PURPOSE** and S/RID document in **REFERENCE** Section. **2.** Under **Scope** added: For this procedure, the term "EPHA" also includes EPHA addenda developed in accordance with section 5.2.1 of this procedure. **3.** Under **Buffer Zone**: Deleted ~~Barricade 5~~ inserted Site Boundary. Added: Examples of ares meeting this definition include, but are NOT limited : **4.** Updated **Responsibilities** for each position. **5.** Under **4.2 Manager, Emergency Management** added :Ensuring that any deviation from this procedure is clearly stated withing the EPHA, Ensure EPHA and associated EPIP revisions are issued concurrently, and Verify approved EPHAs are transmitted to Document Control and Safety Net. **6.** Under **4.4 Facility/Project Manager** deleted: ~~assigning SMEs for the facility.~~ **7.** Removed Subject Matter Expert (SME) section. **8.** 4.7 Nuclear and Criticality Safety engineering deleted the following bullets: ~~Ensuring development and maintenance of EPHAs are funded by the facility and Tracking progress of EPHA to applicable facility schedules~~ and added the following: Ensuring EPHA Project deliverables are incorporated into line organization schedule and that progress is tracked and updated as appropriate and Integrating the EPHA task with other Safety Basis (SB) documentation. **9.** 5.1.1 Prerequisites added the following: The organization responsible for EPHA development and deleted: ~~document restrictions on team members allotted time for performance of EPHA tasks (i.e., concurrent tasks);~~ from 2nd paragraph~~.~~ **10.** Under **Table 1** made correction for S-Area distance to craker neck 9.40 miles

	11. Under **5.1.4** Step 7 added: According to DOE-HDBK-3010-94, by the time a maximum MAR has been assumed, the DR has been maximized as 1.0, the bounding ARFs and RFs of this document (i.e., DOE-HDBK- 3010-94) have been applied, no leakpath is accounted for, and 95% or greater meteorology has been used for dispersion, the answer obtained is extreme. For the EPHA, the maximum MAR for the facility or container type, the bounding DR (i.e., DR = 1 or as listed in DOE-STD-5506-2007) is used in determining the ST. The worse case meteorology is used in dispersion analysis for consequence assessment modeling. To reduce conservatism or an overestimation of the consequences, median ARF and RF should be used when they are available in references. If median ARF/RF values are not available, bounding ARF/RF values should be assumed. **12.** Under **5.2 Hazards Assessment Format** added: The general format and content of an EPHA is shown below. Some sections may not be applicable, depending on the scope and conclusions of the EPHA. For example, Appendix D would not be required in an EPHA where no accident results in a classifiable emergency. **13.** Updated **5.3 Temporary/Transitory Facility Hazards** to reflect conditions in which the EPHA addenda are to be used. **14.** Under **5.5.1. Review and Approval of the EPHA**: added Nuclear Facilities only. **15.** Under **5.5.2 Revision Control** removed NOTE box ~~NOTE: changes may result from negative USQ Determination because of the bounding nature of most DSA analysis.~~ And removed~~: These reviews shall be documented by the reviewing organization and concurred on by the SS&ES Manager, Emergency Management~~. from #1 sentence. **16.** Under **Step 5.5.2.2** reformat and reworded: At a minimum, EPHAs should be reviewed and revised (if required) in the following situations: • When the facility's Safety Basis is changed, • When a change results in a need to perform a USQE, • When a PISA is declared, • Prior to significant increases in hazardous material inventories, and • Prior to significant changes in processes involving hazardous materials. **17.** N&CSE Area Manager or designee (Nuclear Facilities only added in procedure. **18.** SB abbreviation used for Safety Basis. **19.** Reformatting of procedure to Administrative-Info template. **20.** Spelling and Grammatical changes made throughout. **21.** Attachments renumbered. **22.** Corrected any position titles as needed.
5.	**Training Requirements:** As with any procedure revision, those employees affected by the procedure need to familiarize themselves with the changes. No additional training is required.

1.0 PURPOSE[SRID]

This procedure establishes requirements and methods for development and maintenance of an Emergency Planning Hazards Assessment (EPHA). An EPHA is the technical basis for an Emergency Planning (EP) program, Emergency Action Levels (EALs), and the Emergency Planning Zone (EPZ).

2.0 SCOPE

The provisions of this procedure apply to members of the Performing Entities at Savannah River Site (SRS), and to subcontractors performing work for the Performing Entities when required by subcontract or applicable law.

Instructions provided in this procedure include methods and requirements documenting:

- Development of facility description/boundary,
- Performing hazard characterization,
- Estimating potential event consequences,
- Developing EPZ(s), and
- Documenting and approving the EPHA.

Facilities/activities with hazardous materials that exceed predetermined criteria (as determined by a Hazards Survey performed in accordance with EMPP 6Q-011) must perform an EPHA.

For this procedure, the term “EPHA” also includes EPHA addenda developed in accordance with section 5.3 of this procedure.

3.0 DEFINITIONS AND ABBREVIATIONS

Acute Exposure Guideline Level (AEGL) – An airborne concentration above which adverse health effects are predicted. One-hour Acute Exposure Guideline Level (AEGLs) are the preferred Protective Action Criteria (PAC) for chemical exposures, followed by Emergency Response Planning Guidelines (ERPGs), then Temporary Emergency Exposure Limit (TEELs). AEGLs are as follows:

- AEGL-1 - Airborne concentration above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory 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, and
- 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.

3.0 DEFINITIONS AND ABBREVIATIONS, (cont.)

Aerodynamic Equivalent Diameter (AED) – A diameter of sphere of density 1 g/cm3 that exhibits the same terminal velocity as particle in question.

Alert – An Alert must 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 a site-specific criterion corresponding to either —

      - 10 % of PAC at or beyond the facility boundary; or

      - PAC at or beyond 30 m from the release.

   B. PAC is not expected to be exceeded at or beyond the facility boundary.

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 a Site Area Emergency (SAE) or General Emergency (GE).

Buffer Zone - Thoroughfares within the site boundary that are considered offsite for transportation events because they are not within the controlled area and the public has access. Examples of areas meeting this definition include, but are NOT limited to:

- CSX rail line that traverses the site,
- Road 1 – all,
- Hwy 19 – from south of intersection with Hwy 278 to Barricade 2 (excludes intersection),
- Hwy 125 – from Road 1 to Site Boundary, and
- Hwy 278 – from east of intersection with Hwy 19 to Barricade 3.

This definition is not meant to affect the location or definition of Site Boundary for facility EPZ and classification purposes. It is meant to address transportation events. Non Department of Energy (DOE) related transportation events that occur on uncontrolled roads are by definition offsite.

Committed Effective Dose (CED) – Sum of committed equivalent doses to various tissues or organs, each multiplied by the appropriate tissue weighting factor.

Consequence - The result or effect (especially projected exposure to radiological or chemical hazards) of a release of hazardous materials to the environment.

3.0 DEFINITIONS AND ABBREVIATIONS, (cont.)

Controlled Area - Area for which a DOE security badge is required to gain access.

Documented Safety Analysis (DSA) - A report that documents the adequacy of safety analysis to ensure that a facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable regulations. DSAs are completed according to Procedure Manual 11Q.

Emergency Action Level (EAL) - Specific, predetermined, and observable criteria used to detect, recognize, and classify hazardous material emergencies.

Emergency Classification - Classifies an Operational Emergency involving a hazardous material release by the degree of severity, depending on the actual or potential consequence of the emergency. Classification levels are Alert, SAE, and GE.

Emergency Planning Zone (EPZ) - Area in which planning is needed to assure that prompt and effective protective actions can be taken to protect onsite personnel, public health and safety, and the environment in a major emergency.

Emergency Response Guidebook (ERG) - For transportation events, the U. S. Department of Transportation (DOT) ERG is used as the first step in classification.

The ERG contains five sections highlighted by colored pages. They are:

- White: Instructions on use of the guidebook and a placard listing,
- Yellow: Listing of hazardous materials by ID number,
- Blue: Listing of hazardous materials by name,
- Orange: Emergency Response Guides, and
- Green: Table of Initial Isolation and Protective Action Distances.

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's are as follows:

- **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,
- **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, and
- **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.

3.0 DEFINITIONS AND ABBREVIATIONS, (cont.)

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

Facility Boundary - Boundary, determined by this procedure, which represents the receptor location that differentiates between an Alert and SAE declaration.

General Emergency (GE) - A GE shall be declared when events are predicted, in 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 non-radiological) 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 the applicable PAG or ERPG at or beyond the site boundary, or
- 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.

Hazards Survey - Identifies hazards significant enough to include in an EPHA (see EMPP 6Q-011).

Initial Isolation Distance –[From the Table of Initial Isolation and Protective Action Distances in the Green section of the ERG] Distance within which all persons should be considered for evacuation in all directions from the actual spill. It is a distance (radius) which defines a circle (Initial Isolation Zone) within which persons may be exposed to dangerous concentrations upwind of the source and may be exposed to life threatening concentrations downwind of the source.

Initial Isolation Zone - Area surrounding an incident in which persons may be exposed to dangerous (upwind) and life threatening (downwind) concentrations of material

Lung Absorption Type (F, M, or S) - Classification scheme for inhaled material according to its clearance time, (fast, moderate, or slow) from the pulmonary region of the lung to blood and the GI tract.

Material-At-Risk (MAR) - The amount of hazardous material that is available to be acted on by a given physical stress. Multiply the MAR by the appropriate fraction to determine the source term.

Maximum Inventory - For a process; the maximum quantity of a hazardous material that a process produces during the process cycle. For storage tanks the maximum inventory is equivalent to the capacity of the tank.

3.0 DEFINITIONS AND ABBREVIATIONS, (cont.)

Movement - Transport that occurs only within the area covered by a facility safety basis (typically the facility fence)

Office Of Secure Transportation (OST) Shipment - A shipment of material controlled by the Office of Secure Transportation (formerly Office of Transportation and Safeguards) in the NNSA Service Center in Albuquerque.

Offsite – An area outside the site boundary. For transportation events, thoroughfares on site property to which the public has uncontrolled access are considered offsite (SEE definition of Buffer Zone).

Offsite Shipment - Transport of material that leaves controlled areas of the site.

Onsite - Any area within the boundaries of SRS to which access is controlled.

Onsite Transfer - Transport of material performed in accordance with Procedure Manual 19Q *Transportation Safety Manual* (TSM) that remains within controlled areas of the site. During Onsite Transfer, material typically exits one area and enters another. Onsite Transfer typically terminates when material is unloaded at its final destination.

Operational Emergency (OE) - Major unplanned or abnormal events or conditions that: involve or affect DOE/NNSA facilities and activities by causing or having the potential to cause serious health and safety or environmental impacts; require resources from outside the immediate/affected area or local event scene to supplement the initial response; and, require time-urgent notifications to initiate response activities at locations beyond the event scene. An Operational Emergency involving release of significant quantities of hazardous materials within the SRS Controlled Area may require further classification as an Alert, Site Area Emergency, or General Emergency.

In accordance with DOE O 151.1C, an event must be categorized as an Operational Emergency as promptly as possible, but no later than 15 minutes after event recognition/identification/discovery.

Protective Action (PA) - Physical measures (remain indoors, shelter, evacuation) 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). When using the ERG, precautionary measures taken to isolate the immediate area are not PA; but, protective measures taken either under the EVACUATION heading in the Orange section or using Protective Action Distances in the Green section are PA.

Protective Action Criterion (PAC) - A radiological dose or chemical concentration that acts as a trigger, for a receptor point of interest, to declare an operational emergency and issue or recommend protective actions to protect workers or the public. PAC are:

- For radiological dose, 1 rem Total Effective Dose (TED) or 5 rem Committed Effective Dose (CED) thyroid, and
- For chemical concentration, the AEGL-2, ERPG-2, or, TEEL-2 (in order of preference).

3.0 DEFINTIONS AND ABBREVIATIONS, (cont.)

Protective Action Distance (PAD) - From the Table of Initial Isolation and Protective Action Distances found in the Green section of the ERG - downwind distance from a spill within which Protective Actions should be implemented. In the ERG, PADs are defined only for Toxic Inhalation Hazards (TIH) - materials that are highlighted in the Yellow and Blue sections.

Protective Action Zone -Area downwind from the incident in which persons may become incapacitated and unable to take protective action or incur serious or irreversible health effects. For purposes of this procedure, this includes the Initial Isolation Zone.

Release - Airborne effluent 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 time-urgency of airborne releases. The hazard assessment considers releases to an aquatic or ground pathway having a time-urgent affect on workers or the public (e.g., to a community water supply).

Respirable Fraction - Fraction of airborne particles that can be transported through air and inhaled into the respiratory system; assumed to include particles 10-µm AED and less.

Safety Basis (SB) – The documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment. Reference Procedure 11Q, 1.01 *Generation, Review and Approval of Safety Documents*.

Segment - Demarcation used in hazards assessment where the system, section, building, etc., is not affected by failure of other systems, sections, buildings, etc.

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

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

- 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. The PAC is not expected to be exceeded at or beyond the site boundary,
- 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, or
- 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.

Site Boundary - Perimeter of DOE-owned land at SRS. [From DOE G 151.1: The perimeter enclosing the area where DOE has the responsibility for implementing protective action is the site boundary. With regard to DOE land that lies outside the security fence, DOE assumes responsibility for implementing protective action on all of its property].

3.0 DEFINITIONS AND ABBREVIATIONS, (cont.)

Source Term - Amount of material released to the atmosphere; product of the MAR and its reduction factors (e.g., Damage Ratio, Airborne Release Fraction, Respirable Fraction, and Leak Path Factor).

Special Nuclear Material (SNM) [Atomic Energy Act of 1954] –

(1) Plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the NRC, determines to be special nuclear material, but excludes source material; or

(2) Any material artificially enriched by any of the foregoing, but excludes source material.

Temporary Emergency Exposure Limit (TEEL) - Since AEGLs and ERPGs exist for relatively few chemicals, 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 are as follows:

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

Threshold for Early Lethality (TEL) - Approximate dose / exposure at which sensitive groups within a large population would begin to show an increase in mortality. For radioactive releases, the TEL is a projected dose of 100 rem. For chemical releases, the TEL is a projected 15-minute average concentration of PAC-3 (i.e., AEGL-3 / ERPG-3 / TEEL-3).

Total Effective Dose (TED) – Sum of effective dose (for external exposures) and committed effective dose.

Toxic Inhalation Hazard (TIH) - Gas or volatile liquid known to be so toxic to humans as to pose a transportation health hazard. For the purpose of this procedure, this category includes all of the following DOT material: Toxic Inhalation Hazard material, chemical warfare agents, and Dangerous Water Reactive Material (i.e., produces toxic gas upon contact with water). When dealing with a TIH (highlighted entries in the ERG), isolation and evacuation distances appear in the Green section. The guides (Orange section) also remind the user to refer to the Green section for evacuation-specific information involving highlighted materials.

3.0 DEFINTIONS AND ABBREVIATIONS, (cont.)

Transport - Relocation of material by vehicle such as a truck or railcar.

Type B Packaging - Packaging designed to retain the integrity of containment and shielding required by 49 CFR regulations when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.

Uncontrolled Access – Access to locations within the Site Boundary that does not require a DOE badge (e.g., access to Hwy 125 and CSX railways).

4.0 RESPONSIBILITIES

4.1 Director; Safeguards, Security, and Emergency Services (SS&ES)

The Director, Safeguards, Security, and Emergency Services (SS&ES) is responsible for:

- Supporting DOE-SR in negotiations with Georgia and South Carolina regarding EPZ,
- Developing implementing procedures to be used by facilities in development and approval of EPHAs,
- Reviewing approved deviations for impact on order compliance packages and implementation plans in accordance with Procedure Manual 8B, and
- Providing signature approval of the EPHA.

4.2 Manager, Emergency Management

The Manager, Emergency Management is responsible for:

- Ensuring consistency in the site conduct of operations for EPHA development and implementation,
- Transmitting contractor approved EPHAs to DOE-SR for review and approval,
- Approving deviations from this procedure in the development of an EPHA,
- Ensuring that any deviation from this procedure is clearly stated within the EPHA,
- Coordinating development and maintenance of EPHAs for non-nuclear facilities,
- Resolving programmatic comments generated by the facility, SS&ES, and DOE/NNSA,
- Coordinating periodic reviews of EPHAs for non-nuclear facilities as required by DOE Order 151.1c,
- Maintaining current copies of review letters,
- Providing signature approval of the EPHA,
- Ensuring EPHA and associated EPIP revisions are issued concurrently, and
- Ensuring approved EPHAs are transmitted to Document Control and SafetyNet.

4.3 Facility Emergency Preparedness Coordinator (EPC)

The Facility Emergency Preparedness Coordinator (EPC) is responsible for:

- Reviewing EPHA revisions,
- Determining impact of EPHA changes on the facility's drill program, and
- Initiating changes to affected drill scenarios.

4.4 Facility/Project Manager

The Facility/Project Manager is responsible for:

- Supporting EPHA development in accordance with this procedure and applicable Compliance Schedules, including providing necessary funding,
- Ensuring EPHA is reviewed as required based on facility modification, and
- Providing signature approval of the EPHA.

4.5 Facility Operations Manager

NOTE

Facility Operations Manager review/approval is not required by all facilities, as determined by the Facility/Project Manager. In these cases, the Facility/Project Manager assumes responsibilities listed for Facility Operations Manager.

The Facility Operations Manager is responsible for:

- Providing Operations support for development of the EPHA,
- Ensuring EPHA is reviewed by operations personnel and reflects the current configuration of the facility, and
- Providing signature approval of the EPHA.

4.6 Facility Chief Engineer

The Facility Chief Engineer is responsible for:

- Providing technical support for development of the EPHA,
- Ensuring EPHA is reviewed by Technical Support personnel and reflects current information, and
- Providing signature approval of the EPHA.

NOTE

For facilities not operated by Savannah River Nuclear Solutions (SRNS), the responsibilities for N&CSE below will be filled by personnel assigned by the Facility/Project Manager.

4.7 Nuclear and Criticality Safety Engineering (N&CSE)

Nuclear and Criticality Safety Engineering (N&CSE) is responsible for:

- Developing and maintaining EPHAs for Nuclear Facilities,
- Developing and providing EPHA scope, budget, and schedule estimates to the Facility/Project Manager when EPHA revisions/reviews are required,
- Coordinating periodic reviews of EPHAs for Nuclear Facilities as required by DOE Order 151.1c,
- Ensuring EPHA Project deliverables are incorporated into line organization schedule and that progress is tracked and updated as appropriate,
- Integrating the EPHA task with other Safety Basis (SB) documentation,
- Ensuring that any deviation from this procedure is clearly stated within the EPHA,
- Resolving technical comments generated by the facility, SS&ES, and DOE/NNSA, and
- Providing signature approval of the EPHA.

5.0 PROCEDURE

This procedure is divided into the following subsections:

5.1 Emergency Planning Hazards Assessment

5.2 Hazards Assessment Format

5.3 Temporary/Transitory Facility Hazards

5.4 Quality Assurance

5.5 Hazards Assessment Control

5.1 Emergency Planning Hazards Assessment (EPHA)

The EPHA quantitatively analyzes hazards significant enough to warrant consideration in a facility's operational emergency hazardous material program. The EPHA is the technical basis for the EALs and EPZ.

Classified information identification and protection controls should not restrict the scope of the EPHA. Classify the EPHA accordingly or develop a separate classified section of the EPHA.

5.1.1 Prerequisites

1. Integration with SB documentation

   The organization responsible for EPHA development reviews the schedule for SB documentation development and, where possible, integrates the EPHA with this schedule to increase efficiency and reduce cost.

2. EPHA Team Identification

   The organization responsible for EPHA development should identify the EPHA team after funding is available; and adjust the EPHA completion schedule appropriately.

   Select EPHA team members based upon their experience in hazards assessment work, facility knowledge, and discipline. Personnel assigned to the EPHA team should be assigned for the duration of the schedule to maintain consistency and reduce cost.

   At least one member of the EPHA Team should be experienced in:

   - Dispersion modeling,
   - Facility mission, systems and processes, and
   - Procedure Manual E7.

5.1.2 Facility Description and Operations

1. Summarize a clear written description of the facility and operations that are the subject of the EPHA. Provide sufficient detail to support characterization of hazards and determination of potential consequences.

   The facility description included in current SB documentation or Facility Design Description (FDD) may be sufficient. In this case, write a brief summary description of the facility with a reference to the applicable document that contains further detailed descriptions or copy the entire description into the EPHA.

2. Define the facility boundary. Principal considerations are material processing boundaries and corresponding physical (structural or geographical) boundaries. A facility boundary includes buildings, structures, support equipment, and auxiliary systems that support a common mission. In most cases, boundaries of the facility and operations in question have been previously defined (e.g., a security fence). Examine these boundaries with the objectives of the EPHA in mind.

   Several structures or component units with a common or related purpose may constitute a single facility. For example, the tank farms are defined as one facility because they are composed of a number of units of approximately the same nature and purpose under common management and operational control.

5.1.2 Facility Description and Operations, (cont.)

Step 2, (cont.)

Consider a complex of dissimilar buildings, operations, and equipment as a single facility if they are physically adjacent, under common management, and have a common programmatic mission. For example, Separations facilities with the Canyon and associated Outside Facilities, ventilation buildings, and sand filters.

If a single structure contains several tenant activities or units, such as process lines, hot cells, or hazardous material storage, it may be reasonable to consider the entire structure one facility (e.g., Savannah River National Laboratory) although constituent units may have little interaction.

Refer to DOE G 151.1-2, Chapter 2, *Technical Planning Basis*, Appendix C, *Facility and Site Boundary Guidelines,* for further guidance on defining a facility boundary.

In cases where no physical boundary exists, a default distance of 100 m may be used.

3. To negate the need to calculate a distance from the release to the nearest facility boundary for each release scenario, determine a common distance to facility boundary as follows:

   - Using the Site Atlas, or other approved map, estimate a geometric center of the facility.
   - Estimate the distance from this point to the nearest facility boundary, and
   - Compare this distance to the default of 100 m; select the larger and document in the EPHA.

   For example, for a facility that is a circle with a radius of 150 m, the distance to the facility boundary for all analyzed accidents is 150 m. Justify and document any deviation from this method in the EPHA.

   NOTE

   DOE G 151.1-1 encourages use of a common facility boundary distance for all facilities at a site. Use of a common distance ensures that the relationship between emergency class and consequence is consistent across the site. The distance should not be less than 100 m nor greater than 200 m. If a common distance is determined, it should be used in all EPHAs

4. Identify distances to the Crackerneck Wildlife Management Area, Central Training Facility (CTF) and site boundary. Use the following distances for nearest distances for the areas identified:

5.1.2 Facility Description and Operations, (cont.)

Step 4, (cont.)

Table 1

AREA	Distance to CTF (km)	Distance to Crackerneck (km)	Distance to Site Boundary (km)
A	10.20	3.49	0.67
B	7.80	0.80	5.18
C	5.53	6.17	9.33
D	13.30	3.22	1.66
E	1.75	5.63	10.51
F	3.10	5.90	9.39
H	See Table 2	8.85	11.54
K	9.37	7.51	8.86
L	9.12	9.12	9.16
N	4.84	8.05	10.88
P	9.23	15.00	9.21
R	6.36	15.00	7.92
S	0.57	9.40	10.94
Z	1.44	9.66	9.98

Table 2

H-Area Facilities	Distance to CTF (km)
Tritium	0.37
H-Canyon	0.40
Outside Facility	0.40
HB Line	0.40
H Area Tank Farm	0.70

For areas not identified above, estimate distances using the Site Atlas and document in the EPHA.

5.1.2 Facility Description and Operations, (cont.)

5. Identify independent segments. Segments are independent if barrier failures and human errors in one segment do not affect another segment. Segmentation is helpful during accident analysis in properly estimating inventories released when barriers fail.

   Segmentation may also be used as a work control tool during development of the EPHA. For facilities where segmentation is needed more from a work control standpoint than accident analysis, it is not necessary to prove independence. The accident analysis section of the EPHA must specifically take into account segments that are not independent during source term estimation calculations.

5.1.3 Hazard Characterization

1. Hazards associated with chemical by-products of fire.

   Building fires typically produce toxic by-products from combustion of construction materials and furnishings; however, based upon guidance in the EMG , they will not normally be classified. The toxic impact of smoke from “ordinary” fires is currently managed through standard fire-fighting and Incident Command practices and application of hazardous material models, planning criteria and response practices to ordinary fires would not enhance protection of workers or the public.

   For radionuclides, the chemical form may be changed by fire, but the activity is not. Retain for quantitative analysis significant quantities of radionuclides involved in building fires. Also, consider the chemical form of the radioisotope when deciding which Dose Conversion Factor to choose (i.e., choose the correct Lung Clearance Class).

2. Chemical toxicity of uranium.

   Uranium is chemically toxic to the kidneys and exposure to soluble compounds can result in renal injury. Factors to be considered in determining whether the chemical or radiological hazard is dominant are: enrichment, mode of entry, and solubility. In general, chemical toxicity is more limiting for uranium compounds with higher solubility and lower enrichment. DOE-STD-1136-2004 provides guidance for evaluating when chemical toxicity of uranium should be considered.

3. Equivalent Isotope Calculation

   A. The number of radionuclides carried through the EPHA may be reduced by calculating contribution to dose as follows: Multiply each isotope’s specific activity (e.g., Ci/gal, Ci/g) by the applicable inhalation Dose Conversion Factor (DCF) to obtain the total potential dose (e.g., rem/gal). If the applicable lung absorption type is unknown, use the most restrictive by

      - Determining percent contribution of each radionuclide to total dose,
      - Retaining radionuclides so that $\geq$ 95% of the total dose is included, and
      - Tabulating results and include in the EPHA.

5.1.3 Hazard Characterization, (cont.)

B. In general, when dose is primarily due to inhalation of particulates, analysis should be performed using Pu-238 M as the equivalent radionuclide for the entire inventory (M is the lung absorption type: an indicator of solubility). This provides for ease of comparison of doses between scenarios and even different facilities.

However, when a significant contribution to dose is from external beta/gamma sources, such as submersion or groundshine, consider using a Hotspot mixture file in lieu of an equivalent isotope. A significant contribution to external dose can be determined by summing radionuclides that contribute significant dose from either submersion in a plume or exposure to groundshine. Criticality is an example of significant external dose. If the external dose exceeds 10% of the total dose, these radionuclides should be included in the source term.

Only radionuclides with a common deposition velocity may be combined into an equivalent isotope. If the inventory has noble gas, do not combine it with particulates to form an equivalent radionuclide (use a mixture file instead). A Pu-238eq (Pu-238 Equivalent) is calculated as follows:

$$Pu-238_{eq} = \frac{1}{DCF_{Pu-238(M)}} \sum_{i} (A_i)(DCF_i)$$

where:

Pu-238eq = Pu-238M equivalent activity (Ci)

$DCF_{Pu-238(M)}$ = Dose Conversion Factor for Pu-238M

A_i = number of Curies of the *i*th radionuclide

DCF_i = Dose Conversion Factor for the *i*th radionuclide

Document radionuclides that are incorporated into the 95% equivalent isotope.

Tritium and noble gas, as they often have an ARF/RF of one, should normally be excluded from the equivalent isotope calculation. Otherwise, for some events (e.g., fire) where particulates may have a relatively low ARF/RF, these gases might be excluded from the source term when they could be significant (relative to the particulates). Iodine isotopes should also be excluded from the equivalent isotope calculation as thyroid dose has a unique PAC (5 rem).

4. Special Consideration for Deactivation and Decommissioning (D&D).

During D&D activities, a facility cannot constantly update its EPHA based on decreasing inventories or a changing facility configuration. However, Emergency Management must remain prepared to respond to current hazards. To ensure the EPHA is maintained current, the following guidance is provided:

5.1.3 Hazard Characterization, (cont.)

Step 4, (cont.)

A. Review facility EALs to determine if specific material-at-risk (MAR) threshold inventories are addressed (e.g., curies, gallons, pounds, drums) that trigger emergency classification.

- If threshold criteria exist, they are part of the technical basis for removing the EAL as the facility inventory decreases during D&D activities.
- If threshold criteria do NOT exist, consider revising the EPHA to determine triggers for each level of emergency classification.

B. If a decision is made to NOT revise the EPHA, ensure Emergency Management is involved in preparation of any hazard analysis associated with D&D activities to ensure that impacts to emergency planning are identified and documented.

C. As D&D work progresses, review the EPHA concurrent with reviews of other hazards analyses to determine if facility inventory has decreased below threshold quantities (if present). If the facility's inventory is below a threshold quantity, EALs for higher classification levels can be removed from the EAL set for that facility.

D. If threshold quantities are NOT present, ensure that Emergency Management is involved in periodic reviews of hazards analyses to determine if changes to the emergency planning program are appropriate based on current facility conditions.

- Document inventory changes and impacts to the emergency planning program and ensure that DOE/NNSA concurs with changes, including any changes to the facility's EAL set.

E. Whichever method is used, the EPHA must be revised after completion of D&D activities to accurately reflect any remaining hazards.

5.1.4 Accident Analysis

Using barrier analysis, determine processes (i.e., combinations of events and conditions) that could cause the release of each hazardous material characterized and magnitudes of those releases.

DSA analyses may be an incomplete representation of the spectrum of emergencies for which emergency planning is required by DOE Order 151.1. A DSA may not perform quantitative analysis of higher probability, lower consequence events and beyond design basis events that, from a facility-design standpoint, are incredible. Use of a $<10^{-6}$ frequency or "beyond extremely unlikely" binning for accidents as exclusion criteria in the EPHA is inappropriate. Consider the rest of the accident severity spectrum.

5.1.4 Accident Analysis, (cont.)

1. Initiating Events, Accident Scenarios, and Release Mechanisms

   Evaluate possible initiating events and accident scenarios that could lead to release of hazardous material (e.g., barrier failure, failure of administrative controls, external event, or malevolent act). All potential release mechanisms (e.g., spill, fire, explosion, etc.) should be considered.

   Incorporate contributing events or conditions that could influence progression of the scenario or alter the magnitude or nature of consequences. For example, failure of fire suppression systems to activate following initiation of a fire would change the accident progression. Likewise, different levels of combustible loading in a given area might increase or decrease the magnitude of the fire. Either or both events might affect the possible level of damage to the facility or quantity of hazardous material released.

   For events that take a long time between initiation and barrier failure (e.g., loss of purge flow to a tank resulting in a buildup to a flammable mixture) estimate that time. The time may be used to determine the likely progression of the event. For example, if rapid buildup of flammable gas in a tank vapor space is possible, it is reasonable to postulate that a reaction occurs at the concentration that produces the largest energy release, which could be well above the lower explosive or flammable limit. However, a slower buildup in concentration makes it more likely that the gas will be ignited soon after the lower explosive/flammable limit has been exceeded but before the optimum (stoichiometric) condition is achieved, thus producing a lower energy release. These situations should be noted and factors leading to selection of a release scenario should be justified.

   Events that take a considerable amount of time to develop (e.g., greater than one operating shift), to the point where operator intervention should not be ignored, do not require analysis and are listed in Section 5 of the EPHA along with the justification as to why further analysis is not necessary.

   Assess available information concerning reactive properties of hazardous materials. Include other materials and hazard sources, such as flammable or explosive materials and energy sources in the characterization. Consider their potential for initiating releases of hazardous materials, contributing to dispersal of those materials, or degrading the effectiveness of safety systems.

2. Malevolent Acts

   Malevolent acts, including the use of explosives or flammable material, are within the scope of emergency planning. However, not all inventories must be evaluated with malevolent initiators and not all potential malevolent acts must be analyzed and included in the planning basis. In many cases, malevolent acts will produce releases similar to those caused by other initiators. Identifying a malevolent act as a potential initiator does not necessarily mean that a separate analysis of that scenario is needed. For example, a fire/explosion that releases hazardous material may be postulated to result from an aircraft crash. However, if about the same level of damage might also be caused by an act of sabotage, the malevolent act might simply be considered another initiator with a similar release mechanism. In that case, there need be no explicit component in the EAL that reflects the initiator, because the indicator is the

5.1.4 Accident Analysis, (cont.)

Step 2, (cont.)

release mechanism (e.g., fire/explosion) without regard to whether or not the initiator is a malevolent act.

The first step in the selection of malevolent events is identification of the facility Design Basis Threat (DBT). Associated with the DBT is a range of capabilities (e.g., quantity of explosives or flammable material) that suggest potential failure modes. Do not exceed the capabilities of the facility DBT. In general, capabilities of the DBT will be bounded by the worst-case operational event. For example, if the capabilities of a saboteur are no more than a small quantity of accelerants, the DBT should be bounded by a full facility fire.

For additional and more detailed guidance on malevolent acts, refer to Appendix E of DOE G 151.1-2.

3. Identify Primary Barriers

This is generally the barrier closest to the material. In the case of gases or liquids, a tank, cylinder, process piping or other container is usually the primary barrier. For materials that are prevented from being released by their physical form, consider that form as the barrier (e.g., fuel assemblies).

4. Identify Failure Modes of Primary Barriers

The initial step in this analysis is to postulate failure modes of the primary barrier. The second step is to identify possible causes of each primary barrier failure mode. In the example of a tank or container that contains gas or liquid, possible causes of failure might include corrosion, design or manufacturing flaw, over pressure, external impact (missile, forklift, crane load), operator error, excessive temperature, or water hammer.

5. Estimate Magnitude of Release from Primary Barrier

For each cause of failure, develop a quantitative estimate of Material at Risk (MAR). Consider physical properties of the material, such as volatility, viscosity, melting point, vapor pressure, temperature and pressure under which the material is stored, and the postulated mode of failure.

Use the maximum inventory when estimating release from a barrier. If administrative controls limit inventory or concentration, perform the analysis with the administrative controls amount as the maximum inventory.

If multiple containers of the same hazardous material exist in the facility, consider an event causing release of the contents of more than one container (e.g., forklift ramming two or more barrels). This evaluation step estimates the maximum amount of a material released from the primary barrier as a function of time for each event or failure mode, considering the physical, chemical, and thermodynamic properties of that material.

5.1.4 Accident Analysis, (cont.)

6. Assess Effects of Secondary Barriers and Mitigating Features

Assess and document effects of secondary barriers and mitigating features on the maximum amount of material released from the primary barrier. Depending on the hazardous material in question and the storage mode or process, additional barriers or mitigating features may or may not have to be defeated if a release to the atmosphere is to occur.

For example, in the case of an outdoor, free standing acid tank, there are no secondary barriers (although a dike may be assumed to limit the spill size). A breach of the tank discharges acid directly to the environment. In the case of radioactive materials within a glovebox inside a building, glovebox exhaust filters, the glovebox itself, the ventilation system, and the building walls may be barriers and mitigating features of interest.

Characterize the effectiveness of secondary barriers and mitigating features. For example, an exhaust filter may have a rated efficiency for particles of a given size that will apply to all release conditions in which the ventilation system is operating and is the release pathway (e.g., High Efficiency Particulate Air [HEPA] Filters assume a 99.97% efficiency while sand filters assume a 99.5% efficiency). However, building walls may be characterized as either intact, in which case one set of release scenarios applies; or not intact, which lead to a completely different set of release possibilities.

The type of event postulated determines how much mitigation the secondary barriers provide.

7. Estimate Source Term

A. Radiological Source Terms

DOE-HDBK-3010-94 provides Airborne Release Fractions (ARFs), Respirable Fractions (RFs), and Airborne Release Rates (ARRs) applicable to many types of releases. As the maximum inventory/concentration is typically used for MAR, median ARFs/RFs, and ARRs listed in the DOE-HDBK-3010 are typically most appropriate for use. Accident-specific ARFs/RFs and ARRs derived in other SB documents may also be used. The final respirable source term (ST) is typically calculated as follows.

$$ST = (MAR)(DR)(ARF)(RF)(LPF)$$

Or

$$ST = (MAR)(DR)(ARR)(t)(RF)(LPF)$$

where:

ST = Source Term (Ci or Bq)
MAR = Material at Risk (Ci or Bq)
DR = Damage Ratio (fraction)

5.1.4 Accident Analysis, (cont.)

Step 7, (cont.)

ARF =	Airborne Release Fraction
RF =	Respirable Fraction
LPF =	Leak Path Factor (fraction)
ARR =	Airborne Release Rate (fraction/hour)
t =	Release Duration (hours)

Note that it is sometimes necessary to include the contribution of the non-respirable source term. From DOE-HDBK-3010:

> *Although the principal emphasis in this document is directed toward the potential downwind hazard to the populations at some distance from the point of source term generation, airborne particles larger than 10-µm AED released from the facility may constitute an onsite hazard (direct radiation)… If direct shine can be a significant contributor to dose (e.g., fission product release from a criticality), the RF should not be accounted for in evaluating that pathway contributor.*

The Damage Ratio (DR) is the fraction of the MAR actually impacted by accident-generated conditions. A degree of interdependence exists between definitions of MAR and DR. If it is predetermined that certain types of material would not be affected by a given accident, some analysts exclude this material from MAR. The DR is estimated based upon engineering analysis of the response of structural materials and materials-of-construction for containment to the type and level of stress/force generated by the event. Standard engineering approximations are typically used. These approximations often include a degree of conservatism due to simplification of phenomena to obtain a useable model, but the purpose of approximation is to obtain, to the degree possible, a realistic understanding of potential effects.

According to DOE-HDBK-3010-94, by the time a maximum MAR has been assumed, the DR has been maximized as 1.0, the bounding ARFs and RFs of this document (i.e., DOE-HDBK- 3010-94) have been applied, no leakpath is accounted for, and 95% or greater meteorology has been used for dispersion, the answer obtained is extreme. For the EPHA, the maximum MAR for the facility or container type, the bounding DR (i.e., DR = 1 or as listed in DOE-STD-5506-2007) is used in determining the ST. The worse case meteorology is used in dispersion analysis for consequence assessment modeling. To reduce conservatism or an overestimation of the consequences, median ARF and RF should be used when they are available in references. If median ARF/RF values are not available, bounding ARF/RF values should be assumed.

Document in the EPHA the justification for using source reduction factor values other than the bounding values. Include sufficient detail to allow a reviewer to verify the technical validity of the chosen value.

5.1.4 Accident Analysis, (cont.)

Step 7, (cont.)

The LPF can be used to credit holdup of material within some secondary confinement that reduces the final amount of material released to the environment. There can be several LPFs for some accident conditions (e.g., the fraction transported from a package to the cell or enclosure; the fraction leaked from the enclosure, cell, or glovebox to the operating area around the enclosure or room; the fraction leaked from the room to the building; the amount captured in the building exhaust filters). Where multiple leak paths are involved, their cumulative effect is often expressed as one value that is the product of all leak path multiples. The LPF is a calculated, standard, or engineering judgment value based upon (1) established relationships between size of the particulate material, airborne transport mechanisms, and losses by deposition mechanisms; or, (2) specified filtration efficiencies.

Realistic values should be used in developing the DR and LPF for a particular event.

Use the following assumption for radiological accident events involving multiple release mechanisms, (e.g., an instantaneous release followed by a longer-term release):

- Use the dominating release mechanism (e.g., explosion) for the release duration with contributing mechanisms (e.g., spill, resuspension) added to form one source term,
- Estimate the duration of release. As the “release” is to the environment, building exhaust times should be considered in the determination. In lieu of better information, use 30 minutes for fires, 10 minutes for spills, and 3 minutes for explosions. Release duration is a required input for determining downwind consequences, and
- For facilities where criticality accidents are postulated, the inventory of interest is the total fission yield. DOE-HDBK-3010-94, Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities, contains methods to calculate this yield and to determine what fraction can escape to the environment.

B. Chemical Source Terms

EPA 550-B-99-009, *Risk Management Program Guidance For Offsite Consequence Analysis*, may be used to develop worst-case scenarios for chemical source terms. Guidance in EPA 550-B-99-009 defines a worst-case scenario as:

- Release of the largest quantity of a regulated substance from a vessel or process line failure, and

5.1.4 Accident Analysis, (cont.)

Step 7, (cont.)

- Release that results in the greatest distance to the endpoint.

For substances in vessels, assume release of the largest amount in a single vessel. For substances in pipes, assume release of the largest amount in a pipe. The largest quantity should be determined taking into account administrative controls rather than absolute capacity of the vessel or pipe. Passive mitigation (e.g., dikes) may be credited.

If the material is stored in drums, the total amount of material is to be evaluated.

Given the MAR and release scenario, ALOHA (or other approved method) may be used to determine chemical source term and model its dispersion.

8. Conservatism of Analysis

It is expected that EPHA accident analysis will be conservative or worst-case. This may differ from bounding analyses contained in other SB documentation. An example of conservative versus bounding analysis would be the MAR, during a seismic type event, for 1000 waste drums that are banded four to a pallet, stored outside, and stacked three high. A bounding MAR would be the contents of all 1000 drums where a conservative assumption could be contents of 1/4 of the drums. Assumptions based on engineering judgment should be stated in the EPHA.

5.1.5 Estimate Potential Event Consequences

Estimate potential consequences of the hazardous material release scenarios developed in the preceding section to determine the area potentially affected.

1. Document in the EPHA methods and calculation models used in estimating consequences.

2. Release calculations yield a quantitative estimate of consequence (e.g., radiation dose or concentration of a toxic chemical) at each receptor of interest. Consequences at these distances form the bases for emergency planning. Analyze the following under adverse meteorological conditions for each incident occurring within the facility boundary.

   A. Thirty meters from the release. The consequence at this receptor provides a demarcation between an accident that would require classification (e.g., Alert) and one that would not. [Alternatively, the Alert classification may be tied to 10% of PAC at the facility boundary; the Manager, Emergency Management determines which threshold is to be used site-wide.]

   B. Distance from the release to the facility boundary. The facility boundary is the demarcation between the facility and its immediate vicinity and the remainder of the site. Consequences at this receptor provide the demarcation between an Alert and Site Area Emergency.

5.1.5 Estimated Potential Event Consequences, (cont.)

C. Distance from the release to the closest site boundary. The consequence at this receptor is the demarcation for a General Emergency.

To account for dose contribution from submersion and groundshine, TED at the site boundary must be calculated when both of the following conditions occur:

> **NOTE**
>
> Calculations show that ground shine dose for a pure gamma source could be up to 40% of total dose. Use of 0.6 rem CED, instead of 1 rem TED precludes inadvertent omission of ground shine dose.

- Inhalation dose (CED) at the site boundary exceeds 0.6 rem*; and,
- External dose due to submersion in a cloud or from ground shine is greater than 10 % of the total dose.

D. Determine the dose/concentration at other receptor locations of interest. Other receptors of interest are locations where members of the public may be within a protective action zone; or, adjacent facilities that may have a significant transient population and no emergency response organization.

Examples of receptor locations of interest include:

- The Central Training Facility (766-H), which has a significant transient population, and
- The Crackerneck Wildlife Management Area (WMA), which at times may have members of the public present.

Graphical output, such as dose versus distance, may be included in consequence assessment calculations to determine potential downwind consequences for other receptors of interest.

3. Calculate maximum distances to PAC and TEL.

4. Compare results at the 30-meter, facility boundary, site boundary, and point of maximum dose receptor locations to applicable PAC. Attachment 8.1, Protective Action Criteria for use in facility EPHA, provides an explanation of PAC.

5. If a release exceeds PAC for the adverse meteorological conditions, reanalyze the release in accordance with steps 5.1.5.3.A through 5.1.5.3.D using average meteorological conditions. If a release does not exceed PAC for adverse meteorological conditions, reanalysis of the scenario for average meteorological conditions is not required.

6. Determine the potential emergency class corresponding to each analyzed event.

7. If a release scenario exceeds PAC, calculate the minimum quantity of the material that, if released, would exceed PAC at 30 meters, 100 meters (or facility boundary distance), and the site boundary. Include all of this information in the EPHA.

5.1.5 Estimated Potential Event Consequences, (cont.)

8. Summarize results in tabular form to aid in correlation of potential accident impacts with appropriate event classification criteria (i.e., EALs) and protective response actions. Provide separate tables for average and adverse meteorological conditions as appropriate.

5.1.6 Emergency Planning Zone (EPZ) Determination

A facility-specific EPZ evaluation is performed during the EPHA process.

Steps for developing a technically defensible plume exposure pathway EPZ are as follows.

1. From the results of the consequence assessment, identify the distance at which a threshold for early lethality (TEL) would be exceeded for the most severe analyzed release (excluding those which result from extreme malevolent acts) under adverse meteorological conditions. This distance is the smallest EPZ radius that should be considered.

2. Determine the distance at which PAC would be exceeded under adverse meteorological conditions for the most severe analyzed release (excluding beyond design basis natural phenomena events and events resulting from extreme malevolent acts). This distance or 10 miles, whichever is smaller, is the largest EPZ radius that should be considered.

3. Within the limits of the largest and smallest EPZ radii, consider other factors and adjust the size and shape in accordance with the following principles.

   A. The full spectrum of emergencies that contribute to the facility offsite risk should be considered. Even if a comprehensive Probabilistic Risk Analysis (PRA) has not been done, local knowledge of the probability or risk contribution of the most severe analyzed event relative to the other events that comprise the balance of the site/facility risk may be used in a semi-quantitative way to determine whether the EPZ size should be closer to the maximum or minimum values determined in the previous steps Values are determined by:

      - If the most severe analyzed release would result from a single failure event or is believed to have a relatively high probability of occurrence, an EPZ radius closer to the maximum than the minimum value should be selected, or
      - If the probability of the most severe analyzed release is judged to be extremely low or if it contributes a minor fraction of the total offsite risk from site emergencies, an EPZ radius closer to the minimum than the maximum value is indicated.

   B. The hazards judged to contribute most heavily to the offsite risk should be considered, as follows:

      - If the hazard is radiological, an EPZ radius closer to the minimum than the maximum value should be selected because of the wide margin (a factor of 100) between the thresholds for protective action and early lethality, and

5.1.6 Emergency Planning Zone (EPZ) Determination, (cont.)

Step 3B, (cont.)

- If the hazard is non-radiological, an EPZ radius closer to the maximum than the minimum value should be selected because of the narrower margin (typically a factor of 3 to 10) between the concentration thresholds for protective action and lethality and the potential for severe irreversible effects resulting from exposure to concentrations between the protective action and lethality thresholds.

C. The cost of implementing an EPZ is usually directly related to the geographic size of the EPZ. If creating a larger EPZ means that scarce resources are allocated to the protection of people who are at minimal risk, a larger EPZ may actually be less effective at mitigating overall risk to the population than a smaller one.

D. If distance from the source and the time available to respond are great enough, protective actions carried out on an ad hoc basis will be approximately as effective in reducing risk as those actions that have been planned and prepared in detail. Also, planning and preparedness for the EPZ will provide a basis for more effective response activities outside the EPZ if conditions should warrant.

E. The EPZ should conform to the physical and jurisdictional realities of the site and surrounding area.

F. The EPZ size should give confidence that planning and preparedness will be sufficiently flexible and detailed to deal with a wide range of types and magnitudes of emergency conditions. Four significant considerations that cannot be readily stated as quantitative guidance are presented below in the form of questions to be used as “tests of reasonableness” for the proposed EPZ size. The four considerations are:

- Is the EPZ large enough to provide a credible basis for extending response activities outside the EPZ if conditions warrant?
- Is the EPZ large enough to support an effective response at and near the scene of the emergency (i.e., to preclude interference from uninvolved people and activity, facilitate onsite protective actions; optimize on-scene command, control, and mitigation efforts)?
- Is the EPZ likely to meet the expectations and needs of offsite agencies?
- What enhancement of the facility and site preparedness stature would be achieved by increasing the size of the EPZ? What resources, costs, and liabilities might a larger EPZ engender? Would a larger EPZ result in a large increase in preparedness without correspondingly large increases in cost or other detriment?

5.1.6 Emergency Planning Zone (EPZ) Determination, (cont.)

4. Document the consideration of each of the tests and any adjustments to the EPZ size that was made. The resulting value and its bases provide the beginning point for discussions with state, local, and tribal authorities.

5. Where several facilities are located in close proximity to one another and the nature of the hazards is the same at each; the largest impact from an event at any of the facilities may be used to define the EPZ for the entire area. Though it is possible that under certain conditions (e.g., major earthquake) releases from several facilities might occur at the same time with consequences that are additive, the EPZ size should not be based on concurrent events at separate facilities.

6. Where a number of individual facilities and activities are located in close proximity to one another, a composite EPZ for the group of facilities or the entire site should be defined to simplify communications and offsite interactions.

7. Onsite transportation accidents outside of fixed facilities involving hazardous materials should be handled as follows:

   A. Transportation of hazardous materials within the site is analyzed in a separate EPHA covering all transportation activity on the site outside of fixed facilities.

   B. Emergency plans and procedures should include criteria by which to categorize and classify a range of onsite transportation accidents.

   C. The site EPZ should not be extended beyond the site boundary solely on the basis of potential consequences of a transportation accident if the transportation activity is comparable (in terms of materials, quantities, and mode of shipment) to that normally conducted on public routes.

   D. Further guidance on classification of onsite transportation events is provided in EMPP 6Q 002, Standards for Development and Maintenance of Emergency Action Level (EAL) Procedures.

8. The planning process should recognize and provide for the need to carry out protective actions in limited portions of the EPZ for specific events or conditions. Dividing the EPZ into sectors by direction and radial distance and using natural or jurisdictional boundaries to define protective action zones are suggested ways to provide a finer planning and response structure.

9. Document in the EPHA consideration of each of the previous tests and the resulting EPZ determination. Include in the EPHA a graphical representation of the facility specific EPZ determination.

10. EPZ calculations will provide for potential releases by aquatic or other non-atmospheric pathways if these analyses were performed in the EPHA. Emergency plans and procedures will provide for timely communications with entities in downstream communities, such as health departments or utility companies that draw from an affected river, regarding any release and its implications.

5.1.7 Emergency Action Level (EAL) Development

EALs are developed in accordance with EMPP 6Q-002, "Standards for Development and Maintenance of Emergency Action Level (EAL) Procedures." Section 7 of the EPHA is used to summarize the technical basis, list EAL indicators, and document all EALs resulting from the EPHA process.

Include in each EAL, the maximum distance to PAC for that EAL.

5.2 Hazards Assessment Format

The general format and content of an EPHA is shown below. Some sections may not be applicable, depending on the scope and conclusions of the EPHA. For example, Appendix D would not be required in an EPHA where no accident results in a classifiable emergency.

- Cover Sheet
- Approval Sheet
- Table of Contents
- List of Tables
- Abbreviations

1.0 INTRODUCTION (including a revision history)

2.0 SUMMARY

3.0 FACILITY DESCRIPTION

4.0 HAZARD CHARACTERIZATION

5.0 ACCIDENT ANALYSIS

6.0 CONSEQUENCE ASSESSMENT

7.0 EMERGENCY CLASSES AND EALs

8.0 EPZ DETERMINATION

9.0 REFERENCE

- APPENDICES (as applicable)

(A) Figures

(B) Calculations

(C) EPHA Definitions

> **NOTE**
>
> The Technical Support Room EAL Data Appendix should be arranged as a quick reference that lists all assumptions, explaining the rationale for each EAL. Refer to Attachment 8.2 for template.

(D) Technical Support Room EAL Data

5.3 Temporary/Transitory Facility Hazards

Temporary or transitory hazards, such as short-duration storage of hazardous materials or special process testing within a facility, will be covered by specific updates (as an addendum) to the EPHA and associated EPIP.

EPHA addenda are to be used only in cases that meet the following conditions:

1. Project initiation that impacts the EPHA is within three months of either:

    a. First receipt of material that increases the facility inventory beyond what is identified and analyzed in the current EPHA

    b. Start of field work or processes that changes the facility configuration outside what is described in the current EPHA

- - AND - -

2. The duration of the work is less than six months

- - AND - -

3. Upon expiration of the EPHA addendum:

    a. The facility is returned to the state or configuration described in the current EPHA

- - OR - -

    b. A revision to the facility EPHA incorporating the EPHA addendum has been implemented.

Requests for deviations from the above conditions must be submitted to and approved by the Manager, Emergency Management. Approval will be granted only when there is sufficient justification provided to warrant deviation from the conditions above.

The review and approval of EPHA addenda shall follow the process identified in 5.5.1.To avoid duplication of effort, test plans or other controlling SB documents for such hazards may be configured to serve as temporary addenda to the site or facility EPHA and emergency plans as applicable.

When using other SB documents in lieu of an EPHA, the Manager, Emergency Management will have signature approval of those documents to ensure requirements of this procedure are met.

5.4 Quality Assurance

N&CSE is responsible for ensuring Software Quality Assurance (SQA) requirements are met for models used in EPHA development.

All calculations for the EPHA are performed in accordance with Manual E7. Originator/preparer and reviewer signatures are also included as prescribed in Manual E7.

5.5 Hazards Assessment Control

Refer to Attachment 8.4, EPHA Review and Approval Process.

5.5.1 Review and Approval of the EPHA

1. The EPHA undergoes internal review by the EPHA team and selected facility SMEs prior to being routed for formal review and comment. At a minimum, the EPHA development organization and the facility EPHA support organization shall conduct a technical review of the EPHA using Attachment 8.3 as general guidance. An individual knowledgeable in source term calculations should be included in the review process.
2. EPHAs are formally reviewed by:
   - Facility/Project Manager,
   - Facility Chief Engineer,
   - Facility Operations Manager (if required – See Responsibilities Section),
   - N&CSE Area Manager (Nuclear Facilities only),
   - Manager, Emergency Management,
   - Facility Emergency Preparedness Coordinator (EPC),

NOTE
Reviews by DOE-SR/NNSA will occur after the EPHA has been approved by the appropriate facility and SS&ES personnel.

   - DOE-SR/NNSA Assistant Manager/Office Director Representative, and
   - DOE-SR Office of Safeguards, Security, and Emergency Services (OSSES) Representative.

   Allow from two to six weeks for this review cycle depending on the extent of revision.
3. N&CSE and SS&ES respond to and disposition comments as appropriate.
4. Upon completion of the review cycle, the EPHA receives signature approval from:
   - Facility/Project Manager,
   - Facility Chief Engineer,
   - Facility Operations Manager (if required – See Responsibilities Section),
   - N&CSE Area Manager or designee (Nuclear Facilities only),
   - Manager, Emergency Management,
   - Director, SS&ES, and
   - DOE-SR/NNSA-SRSO Manager or designee. (approval documented via letter).
5. To ensure consistency, draft EALs should be reviewed concurrently with the EPHA.
6. Revised EPHAs shall not be transmitted to site document control until the associated EPIP revision is approved.

5.5.2 Revision Control

1. At a minimum, EPHAs should be reviewed and revised (if required) in the following situations:
   - When the facility's Safety Basis is changed,
   - When a change results in a need to perform a USQE,
   - When a PISA is declared,
   - Prior to significant increases in hazardous material inventories, and
   - Prior to significant changes in processes involving hazardous materials.

2. Criteria for determining whether a change is significant enough to require revision of an EPHA are:

   A. Does the proposed change create a new EAL?

   B. Does the proposed change result in a higher potential event classification for an existing EAL?

   C. Does the proposed change increase the EPZ?

3. The EPHA must also be reviewed every three years. A review that will extend beyond the due date requires notification to DOE-SR/NNSA-SRSO and concurrence from the SS&ES Manager, Emergency Management.

   Triennial reviews shall be conducted by the cognizant facility organization and shall consider at a minimum the following:
   - New hazardous material brought into the facility,
   - For existing hazardous material, a significant increase (> 10%) in maximum inventory,
   - Processes involving hazardous material that may have been modified, added, or deleted, and
   - Changes to the facility that may impact EALs (e.g., instrumentation or ventilation)

4. The organization reviewing the EPHA documents the review, which should include the methods used, a listing of documents reviewed, and a summary of review findings.

   The EPHA review must specifically determine if there are any impacts to the facility's emergency planning basis, emergency classification, and protective actions. If the review identifies changes that may impact the technical validity of the EPHA and EALs, an evaluation of the hazard identification, accident analysis, and consequence assessment shall be performed to determine if a revision to the EPHA is required.

   Review documentation shall be approved by the SS&ES Manager, Emergency Management. If the review identifies that a revision to the EPHA is warranted, the review documentation shall propose a completion date for the revision.

5.5.2 Revision Control, (cont.)

Step 4, (cont.)

The review letter should include the following distribution as a minimum:

- Facility Operations Manager,
- Manager, Emergency Management,
- N&CSE Area Manager or designee (Nuclear Facilities only),
- DOE-SR/NNSA Assistant Manager/Officer Director Representative, and
- DOE-SR Office of Safeguards, Security, and Emergency Services Representative.

Triennial review documentation shall be maintained for a minimum of three years or until a revision to the EPHA is approved.

5. Triennial reviews should be coordinated to coincide with reviews of facility SB documents in order to efficiently use resources. Triennial reviews should be identified in the facility integrated operating schedule and should be initiated to allow sufficient time to complete the review by the due date.

6. All revisions of EPHAs shall follow the review and approval process detailed in 5.5.1 above.

6.0 REFERENCES

DOE-G-151.1-2, Technical Planning Basis, U. S. DOE, July 2007

Title 10 Code of Federal Regulations Part 830, Nuclear Safety Management

DOE-HDBK-3010-94, Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities, U. S. DOE, March 2000

EPA (2002). Federal Guidance Report 13. Cancer Risk Coefficients for Environmental Exposure to Radionuclides: CD Supplement, EPA-402-C-99-001, Rev. 1

Nonreactor Nuclear Facilities, J. C. Elder, et. al., dated January 1986

EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, 1991

NFPA HAZ-91, Fire Protection Guide to Hazardous Materials, Tenth Edition, 1991

Procedure Manual 8B, Compliance Assurance Manual

E7, Conduct of Engineering and Technical Support

Procedure Manual 11Q, Facility Safety Document Manual

6.0 REFERENCES, (cont.)

Procedure Manual 6Q 002, Standards for Development and Maintenance of Emergency Action Level (EAL) Procedures

Procedure Manual 6Q-011, *Development and Maintenance of a Hazard Survey*

DOE-STD-1136-2000, Guide to Good Practices for Occupational Radiological Protection in Uranium Facilities, August 2000

SCD-7, *Savannah River Site Emergency Plan*

SCD-11, *Consolidated Hazards Analysis Process*

SRT-ETS-931167, 95% Meteorology for EPHAs.

SRT-ETS-950015, *Minimum Distances to Site Boundary From Various SRS Release Points*, A. A. Simpkins, 1/20/95

Standards/Requirements Identification Document [S/RID], DOE O 151.1C, Comprehensive Emergency Management System, November 2005

7.0 RECORDS

Records generated as a result of implementing this procedure are maintained in accordance with Manual 1B, Procedure MRP 3.31, "*Records Management*."

8.0 ATTACHMENTS

Attachment 8.1	Protective Action Criteria for Use in Facility Hazards Assessment
Attachment 8.2	Technical Support Room EAL Data Appendix Template
Attachment 8.3	EPHA Technical Review Guidelines
Attachment 8.4	EPHA Review and Approval Process

Attachment 8.1. Protective Action Criteria for Use in Facility Hazards Assessment (page 1 of 1)

Introduction

Protective Action Criteria (PAC) used in the EPHA is the same as those used for classification of operational emergencies. PAC includes radiological and non-radiological thresholds.

Radiological PAC

The bases for radiological PAC are EPA Protective Action Guidelines (PAGs):

1. Projected dose of 1 rem total effective dose equivalent (TEDE) to standard man, where the TEDE is the sum of the effective dose equivalent (EDE) from exposure to external sources and the committed effective dose equivalent (CEDE) from inhalation;

- or -

2. A projected committed dose equivalent (CDE) to the adult thyroid of 5 rem;

   The CEDE only accounts for the 50 year committed dose from inhalation of radionuclides. For non-reactor type accidents, as in the non-criticality accidents at SRS, the CEDE is by far the major portion of the TEDE and can be considered equivalent for purposes of the EPHA.

Nonradiological PAC

The bases for non-radiological PAC are DOE Order 151.1 and the DOE Emergency Management Guide.

For chemicals, the protective action criteria, listed in order of preference, must be used: Acute Exposure Guideline Levels (AEGLs) promulgated by the EPA; Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association; and Temporary Emergency Exposure Limits (TEELs) developed by DOE. For these criteria, the exposure level to be used represents no irreversible health effects.

Specific criteria, in order of preference, are:

1. 60-minute AEGL-2
2. ERPG-2
3. TEEL-2

Threshold for Early Lethality (TEL)

The EPZ determination section of the EPHA makes use of the maximum distance at which a facility accident could produce TELs as one element in the determination of EPZ size. The definitions below are intended only for use in the facility hazards assessment process.

TELs are defined as:

For radiological releases:
100 rem TEDE.

For non-radiological releases:

1. 60-minute AEGL-3
2. ERPG-3
3. TEEL-3

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 1 of 7)

Tech Support Room EAL Data for K & L Areas

K & L Area EALs

1.0 - Radiological Release (CATEGORY 1)	
SAE-1.1	Outdoor Spill of Moderator
A-1.1	"
SAE-1.2	Fire in Assembly Area
A-1.2	"

END OF CATEGORY 1

2.0 - Chemical Release (CATEGORY 2)
None

END OF CATEGORY 2

3.0 - Other (CATEGORY 3)	
SAE-3.1	Phase III or IV Security Declaration within the Facility
A-3.1	Phase II Security Declaration within the Facility

END OF CATEGORY 3

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 2 of 7)

Release Designation 1-RD-3 / Outdoor Spill of Moderator

SAE-1.1	Outdoor moderator spill ≥ 250 drums as indicated by: Visual observation of spilled moderator outdoors. Airborne source term = 240 Ci H-3 per drum spilled.

A-1.1	Outdoor moderator spill ≥ 30 drums but < 250 drums as indicated by: Visual observation of spilled moderator outdoors. Airborne source term is 240 Ci H-3 per drum spilled.

Assumptions

Drum Volume = 55 gal
Volumetric Activity = 5.39 Ci/l
Intervention limits duration of evaporation to 120 minutes.
Spill spreads to uniform depth of 1 cm.
Deposition velocity = 1 cm/sec; Terrain = City
Unit conversion factors: 3.785 l/gal
0.108 gal/lb
2.2 lb/kg

Source Term

Using the evaporative source term spreadsheet (Fig. 1) input a spill volume of 55 gallons (1 drum). This results in an evaporative rate of 7.02E-3 kg/s. Converting units gives:
(7.02E-3 kg/s)(3600 s/hr)(2.2 lb/kg)(0.108 gal/lb)(3.785 l/gal) = 23 l/hr

Multiplying the evaporative rate by the volumetric activity:
(23 l/hr)(5.39 Ci/l) = 120 Ci/hr

The release is assumed to terminate after two hours, therefore the total source term per drum is:
(120 Ci/hr)(2 hr) = 240 Ci

Consequence

Iterating on spill size to reach 1 rem at 30 meters resulted in 30 drums (Fig. 2).
(30 drums)(240 Ci/drum) = 7.2E+3 Ci

For the Hotspot run, we need the spill diameter (D):
Spill Area (A) = $\pi r^2 = \pi D^2/4$

A = (30 drums)(55 gal/drum)(3.785 l/gal)(0.001 m^3/l)(1/0.01m) = 625 m^2

Solving for D:
$\Rightarrow D^2 = 4A/\pi \Rightarrow D = 2\sqrt{(A/\pi)} = 2\sqrt{(625/3.14)} = 2\sqrt{199} = 28$ m

EAL Thresholds

A spill of 30 drums (1650 gal) results in a 30 m dose of 1 rem. Similar analysis for the 100 m receptor (SAE threshold) results in a required spill of ~ 250 drums.

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 3 of 7)

Figure 1

Evaporative Spreadsheet		
Parameter	**Value**	**Dimensions**
E (Evaporation Rate)	**7.02E-3**	kg/s
MW (Molecular Weight)	18.016	kg/kg-mole
Pv (Vapor Pressure)	4005.3	Pa
Rg (Gas Law Constant)	8314.4	J/kgmole-K
Temperature	25	°C
Volume of Spill	5.50E+1	gal
d (Depth of Pool)	0.01	m
A (Surface Area of Spill)	2.082E+1	m^2
Km (Mass Transfer Coeff)	1.1E-2	m/s
Z (Pool Diameter in Wind Direction)	5.1	m
Sc (Schmidt Number)	0.61	
U (wind speed)	2.5	m/s
nu (kinematic viscosity of air)	1.46E-5	m^2/sec
Dm (Molecular Diffusivity of Solute in Air)	2.4E-5	m^2/sec
D_H20 (Molecular Diffusivity of Water)	2.4E-5	
MW_H20	18.016	kg/kg-mole
mu (viscosity of air)	1.79E-05	Pa-s
rho (density of air)	1.225	kg/m^3
Conversions		
T (Absolute)	298.16	K
V (Volume)	0	m^3
Pv (Vapor Pressure)	30.042	mm Hg
Evaporation Rate	4.21E+2	g/min
Correction		
Volatility Correction Term	1.020	

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 4 of 7)

Figure 2

```
Hotspot Version 2.0 Tritium Release
Nov 12, 2004 12:32 PM
Alert Threshold - Moderator Drum Spill
Source Material      : Tritium
Total Tritium Release   : 7.2000E+03 Ci 100 % Tritium Oxide
Vertical Height      : 0.00E+00 m
Horizontal Width      : 2.86E+01 m
Effective Release Height  : 0.00 m
Wind Speed (h=2 m)     : 1.7 m/s
Distance Coordinates    : All distances are on the Plume Centerline
Stability Class (City)   : E
Respirable Dep. Vel.    : 1.00 cm/s
Non-respirable Dep. Vel.  : 8.00 cm/s
Receptor Height      : 0.0 m
Inversion Layer Height   : 300 m
Sample Time        : 120.000 min
Breathing Rate       : 3.33E-04 m3/sec
Maximum Dose Distance   : 0.010 km
MAXIMUM TEDE        : 3.9 rem
FGR-11 Dose Conversion Data
Note: Dose Results Include HTO Skin Absorption
Note: Dose data in TEDE column includes 4 days of ground shine (100% stay time).
```

DISTANCE km	T E D E (rem)	TIME-INTEGRATED AIR CONCENTRATION (Ci-sec)/m3	GROUND SURFACE DEPOSITION (uCi/m2)	ARRIVAL TIME (hour:min)
Alert Receptor				
0.030	**9.9E-01**	**3.2E+01**	**3.2E+05**	**<00:01**

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 5 of 7)

Release Designation 1-RD-5 / Assembly Area Fire

SAE-1.2	Fuel melt in Assembly Area storage racks as indicated by: Observation of fire in Receiving Bay or Assembly Area lasting > 30 minutes. Maximum respirable source term = 8.8E-2 Ci Pu-238eq (0.088 Ci Pu-238eq)

A-1.2	Fuel melt in Assembly Area storage racks as indicated by: Observation of fire in Receiving Bay or Assembly Area lasting > 15 minutes. Source term = None; based upon potential for release under SAE-1.2

Assumptions

Type B[1] containers are excluded from EP inventories; no release from Type B containers are postulated.
Deposition velocity = 1 cm/sec; Terrain = City

Source Term

The source term was derived from Table 4 of S-CLC-K-00184[2].

Storage Area	Dose at Site Boundary (rem)	Dose at 100 m (rem)
Racks		
Hot fuel	6.5E-4	3.6E-1
Melted fuel	1.3E-2	7.3E0
Process and Handling		
Drums	1.2E-5	6.7E-3
Total[3]	1.4E-2	7.7E0

To determine the source term that results in these consequences, a reference Hotspot run (1 Ci Pu-238) was performed (Fig. 3). Consequences were determined at the site boundary (8.86 km). From this result, a ratio was taken to determine what source term would result in the same consequence from the table above (1.4E-2 rem).

Dose at Site Boundary from Reference 1 (adjusted) = 1.4E-2
Dose at Site Boundary from Hotspot unit curie source = 1.6E-1
Solving for the source term that would result in 1.4E-2 Ci:

(X Ci / 1.4E-2 rem) = (1 Ci / 1.6E-1 rem)
X Ci = (1 Ci) (1.4E-2 rem / 1.6E-1 rem)
X Ci = 8.8E-2 Ci

[1] Because Type B containers are exempt from consideration within the EPHA and therefore not included in the inventory, doses resulting from releases from Type B containers are eliminated and totals reduced accordingly.

[2] Schornhorst, J. R., *Radiological and Chemical Consequences of a Potential Aircraft Impact and Fire in the K-Reactor Assembly Area*, S-CLC-K-00184, Revision 0, June 2002.

Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 6 of 7)

Thus, a respirable source term of 8.8E-2 Ci should result in a dose of about 1.4E-2 rem at the Site Boundary. Therefore, the default source term for the fire in Assembly Area is 8.8E-2 Ci. This source term was then used to perform another Hotspot run (Fig. 4) to estimate dose at all receptors of interest (30 m, Facility Boundary, Site Boundary).

Consequences

Release Designation	Dose at 30 m (rem)	Dose at Fac Boundary (rem)	Dose at Site Boundary (rem)	Probable Emergency Class.
1-RD-5	1.1E+2	1.5E+1	1.4E-2	SAE

EAL Thresholds

- Uncontrolled fire in Assembly Area lasting greater than 30 minutes which impacts a significant quantity of nuclear material. (1-RD-5)

Release Designation	Isotope	Source Term (Ci)
1-RD-5	Pu-238eq	8.8E-02

This source term results in 15 rem at the facility boundary. Event is indicated by direct observation of a large uncontrolled fire (potential initiators are a truck or aircraft) in Assembly Area lasting > 30 minutes.

- Uncontrolled fire in Assembly Area lasting greater than 15 minutes which impacts a significant quantity of nuclear material.

Basis: This EAL is based upon the challenge of the barriers in the Material Storage Area of the Assembly Area (1-RD-5). There is no source term associated with this EAL. If the fire is not brought under control within 30 minutes, an SAE should be declared. The event is indicated by direct observation of a large uncontrolled fire (potential initiators are a truck or aircraft fire) in Assembly Area lasting > 15 minutes.

Figure 3

Reference Run for 1 Ci Pu-238

```
Hotspot Version 2.0 General Plume
Source Material      : Pu-238 W  87.74y
Source Term        : 1.0000E+00 Ci
Vertical Height      : 3.00E+00 m
Horizontal Width      : 3.00E+00 m
Effective Release Height  : 0.00 m
Wind Speed (h=2 m)     : 1.7 m/s
Distance Coordinates    : All distances are on the Plume Centerline
Stability Class (City)   : E
Respirable Dep. Vel.    : 1.00 cm/s
Receptor Height      : 0.0 m
Inversion Layer Height   : 300 m
Sample Time        : 30.000 min

DISTANCE   TEDE
km      (rem)
0.100        1.7E+02
8.860    1.6E-01
```

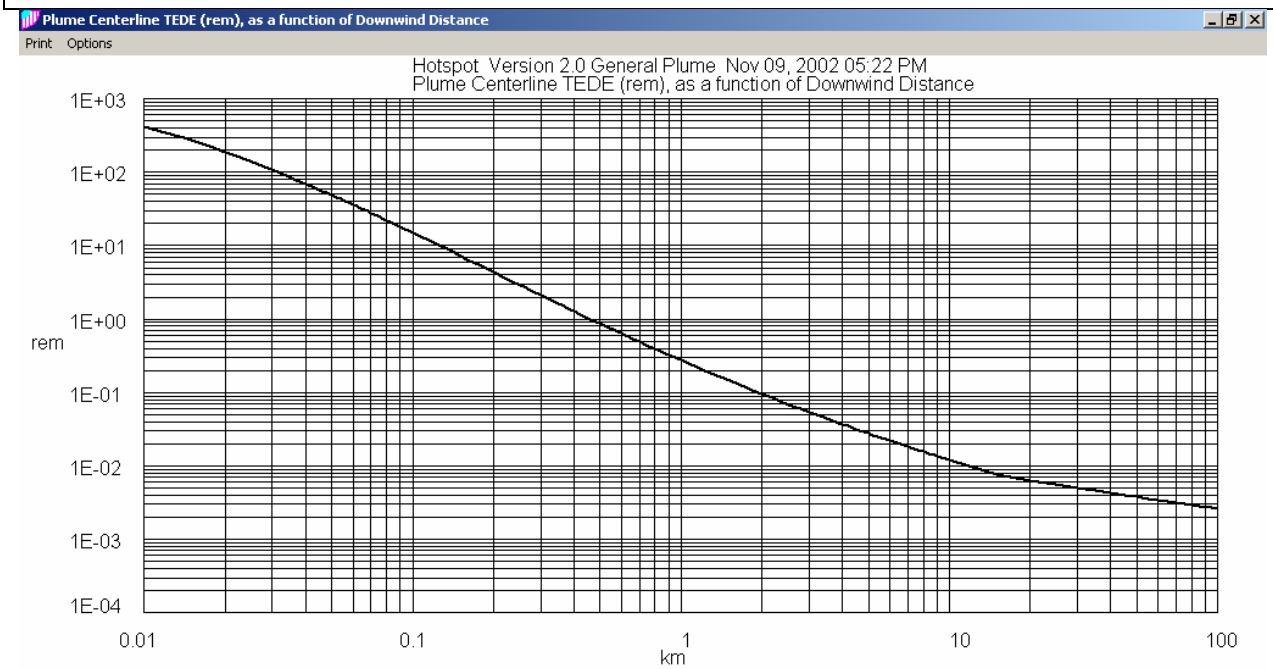
Attachment 8.2 Technical Support Room EAL Data Appendix Template (page 7 of 7)

Figure 4

1-RD-5: Assembly Area Vehicle Fire

```
Hotspot Version 2.0 General Plume
Source Material      : Pu-238 W  87.74y
Source Term        : 8.8000E-02 Ci
Vertical Height      : 3.00E+00 m
Horizontal Width      : 3.00E+00 m
Effective Release Height  : 0.00 m
Wind Speed (h=2 m)     : 1.7 m/s
Stability Class (City)   : E
Respirable Dep. Vel.    : 1.00 cm/s
Receptor Height      : 0.0 m
Inversion Layer Height   : 300 m
Sample Time        : 30.000 min

DISTANCE   TEDE
km    (rem)
0.030    1.1E+02
0.100    1.5E+01
8.860    1.4E-02
```



Source Material	: Pu-238 W 87.74y			
Source Term	: 8.8000E-02 Ci	Resp. Rel. Frac.	:	1.000
Eff. Release Height	: 0.00 m	(Horizontal Width = 3.00E+00 m Vertical Height = 3.00E+00 m)		
Wind Speed (h=2 m)	: 1.7 m/s			
Stability Class (City)	: E (Sample Time: 30.00 min)			
Deposition Velocity	: 1.0 cm/s			
Receptor Height	: 0.0 m	Inversion Layer Height	:	300 m

Attachment 8.3 EPHA Technical Review Guidelines (page 1 of 3)

General Guidelines

1. Reviewer Qualifications:

- Is knowledgeable in the discipline for which they review
- Is capable of performing similar analytical activities
- Has security clearance for access to sufficient information to perform the review

2. The Reviewer shall review the calculations against the guidance provided in this procedure. The Reviewer shall ensure that any spreadsheets, or imbedded calculations have been adequately evaluated for accuracy and verified and validated if necessary.

3. At a minimum, the following elements shall be addressed when performing a review:

- Were inputs correctly selected and identified?
- Were assumptions necessary to perform the activity adequately described and reasonable?
- Were engineering judgments identified, technically justified, and supported?
- Was an appropriate analytical method used?
- Were the inputs correctly incorporated into the EPHA?
- Where appropriate, did a mathematical check yield the same results?
- Were the output documents reasonable compared to the inputs?
- Were the necessary input and assumptions specified in the EPHA or in supporting procedures or documentation?

4. The process of extracting data from tables or graphs is not considered to be a calculation. However, the evaluation of the appropriated selection and application of the extracted data is part of the review process.

5. Conduct a review of the EPHA in accordance with the attached checklist or one containing at a minimum the information contained in the checklist. Note any items on the checklist that are not performed in the EPHA or contain errors. Once completed with the review, provide the checklist, calculations, and notations made during the review.

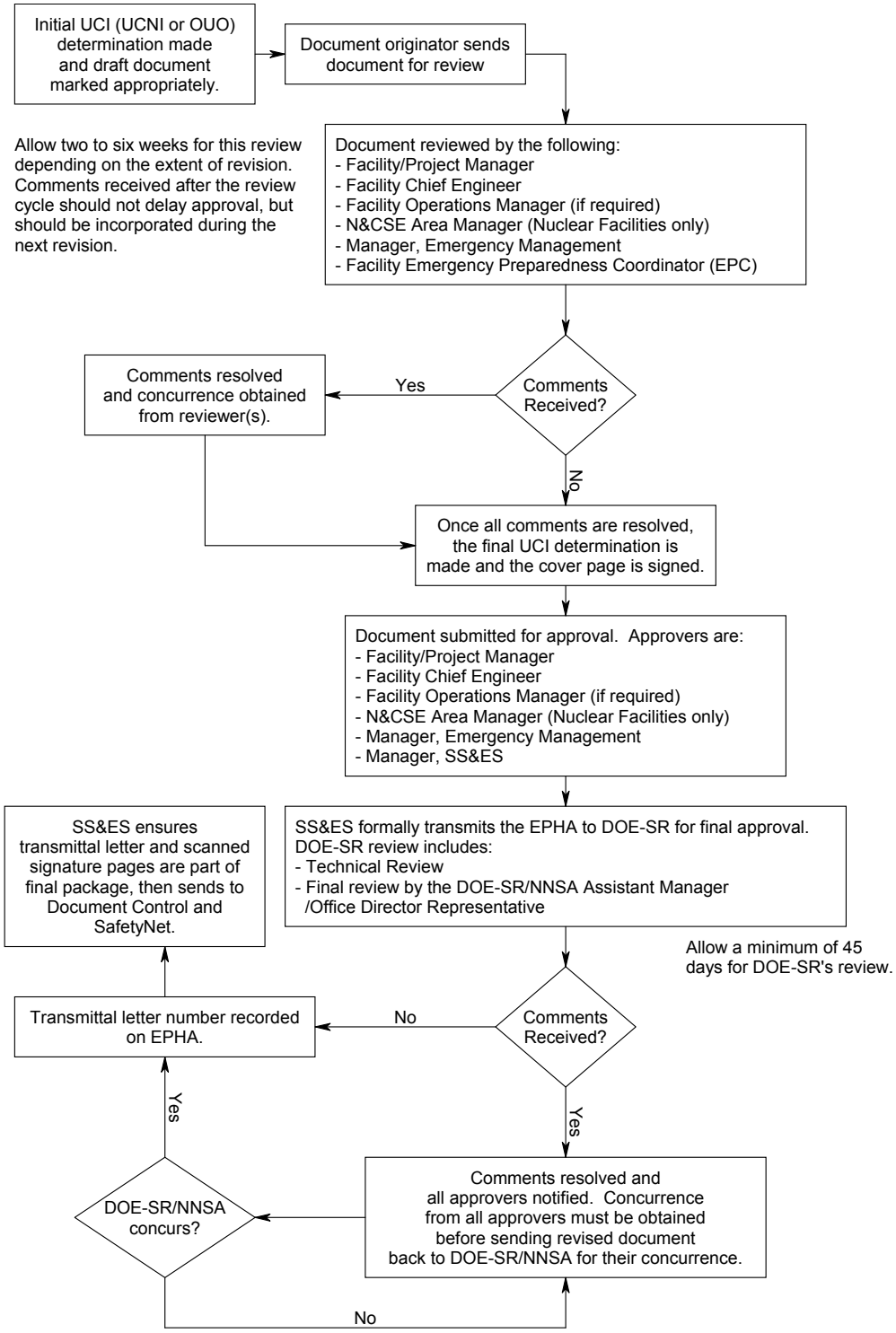
Attachment 8.3 EPHA Technical Review Guidelines (page 2 of 3)

EPHA TECHNICAL REVIEW CHECKLIST	YES	NO
Technical Report Cover Sheet		
Document revision number correct	☐	☐
Document date in agreement with present revisions title page and headers within main document	☐	☐
Technical Report Disclaimer Sheet		
Disclaimer is the current approved WSMS document disclaimer (latest per WSMS Internal Web Page)	☐	☐
Date within the document header is in agreement with title page	☐	☐
Technical Report Approval Sheet		
Signatures are in approved format between the customer and WSMS	☐	☐
Table of Contents		
The pagination is in agreement with the main document	☐	☐
List of Tables		
In agreement with tables used in the main document	☐	☐
List of Acronyms		
In agreement with acronyms used in the main document and appendixes	☐	☐
List of Abbreviations		
In agreement with abbreviations used in the main document and appendixes	☐	☐
1.0 INTRODUCTION		
1.1 Purpose	☐	☐
1.2 Scope	☐	☐
1.3 Background	☐	☐
1.4 *Revision History updated to reflect major items revised*	☐	☐
2.0 SUMMARY		
SECTION 2.0 HAZARDOUS MATERIAL PRESENT IS AGREEMENT WITH SECTION 4.0	☐	☐
Section 2.0 EAL Classification match tables in Section 7.0	☐	☐
3.0 FACILITY DESCRIPTION		
3.1 Process Description	☐	☐
3.2 Facility Boundary Description	☐	☐
Section 3.2 distances include facility boundary, site boundary, and other receptors of interest including CTF and WMA.	☐	☐
3.3 Segment Identification	☐	☐
Section 3.0 EMHA Segmentation in agreement with Section 5 and 6 segmentation	☐	☐
4.0 HAZARD CHARACTERIZATION		
4.1 Chemical		
Material listed agrees with Area Hazards Survey	☐	☐
4.2 Radioactive		
Material listed agrees with Area Hazards Survey	☐	☐
4.3 Reactive Materials		
A list of reactive materials is present.	☐	☐
4.4 Hazardous Materials Remaining for Analysis		
A table is present identifying the hazardous materials remaining for analysis. The materials are in agreement with Sections 4.1 and 4.2.	☐	☐
5.0 ACCIDENT ANALYSIS		
Barriers that maintain control over hazardous material are identified; failure modes considered.	☐	☐
The barrier analyses, its results, and resulting release designations are described in Section 5.0	☐	☐
Source terms have been calculated and agree with source terms in EAL statements. Verify correct source term has been used in all consequence assessment calculations.	☐	☐

Attachment 8.3 EPHA Technical Review Guidelines (page 3 of 3)

EPHA TECHNICAL REVIEW CHECKLIST	YES	NO
6.0 CONSEQUENCE ASSESSMENT		
6.1 Methodology Description	☐	☐
6.2 Results	☐	☐
Section 6.0 tables containing consequence assessment results should be in agreement with consequence radiological and chemical calculations within Appendix B	☐	☐
7.0 EMERGENCY CLASSES AND EALs		
Section 7.0 the emergency classes and action levels should be in agreement with Section 6.0 table of consequence assessment results sorted by accident severity	☐	☐
Section 7.0 the emergency classes and action levels should be in agreement with the EPIP matrix for the facility	☐	☐
Maximum Distance to PAC is listed within each EAL.	☐	☐
Emergency Classification Thresholds have been calculated and documented for each classifiable accident.	☐	☐
8.0 EPZ DETERMINATION		
Section 8.0 should follow the methodology used in determining the EPZ	☐	☐
9.0 REFERENCES		
Reference are updated to reflect the present document name and revision number	☐	☐
References include a comprehensive list of the documents referenced in the EPHA.	☐	☐
APPENDICES (as applicable)		
Appendix-A Figures		
Figures are updated and reflect the present conditions at the facility i.e., facility boundary and/or EPZ boundary	☐	☐
Appendix-B Supporting Calculations		
Source term radiological and chemical calculations	☐	☐
Consequence radiological and chemical calculations	☐	☐
Appendix-C Glossary of Terms		
Glossary is in agreement with facility specific and general EPHA definitions	☐	☐
Appendix-D Technical Support Room EAL Data		
The appendix contains assumptions used to determine the source term, consequences, and EAL thresholds for each release scenario	☐	☐

Technical Reviews Conducted By:

	Print Name	Signature	Date
EPHA Development Organization	_____	_____	_____
	_____	_____	_____
Facility EPHA Support Organization	_____	_____	_____
	_____	_____	_____

Attachment 8.4. EPHA Review and Approval Process (1 of 1)