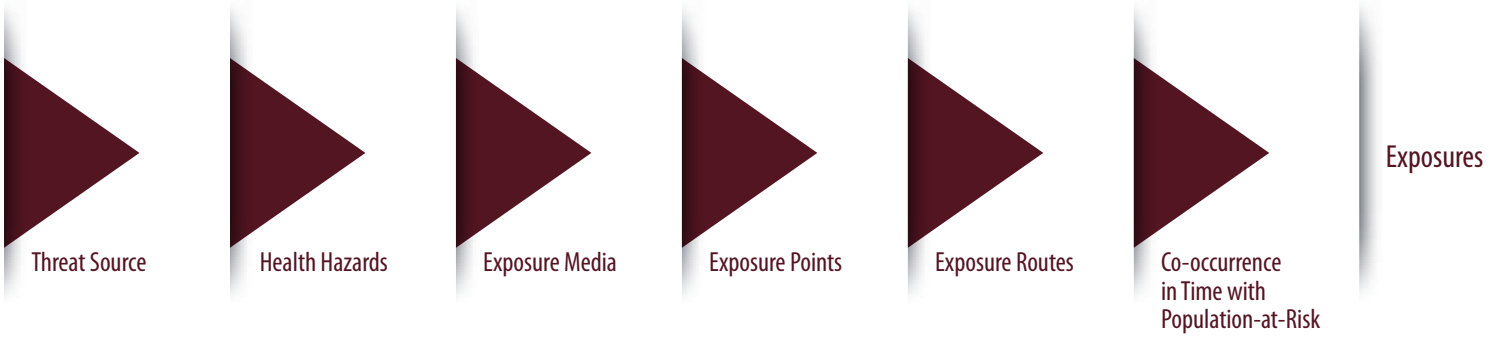
Conceptual Site Model Best Practices and Exposure Pathway Guidance

Supporting Occupational and Environmental Health Site Surveillance at Deployment Locations



Technical Guide 392
September 2022
Approved for public release; distribution unlimited.

APHC
U.S. ARMY PUBLIC HEALTH CENTER

FOREWORD

This guide provides the best practices that were current at the time of publication.

For updates, refer to the Occupational and Environmental Health Site Surveillance support website: https://www.milsuite.mil/book/groups/oehss.

The mention of any non-federal entity and/or its products is not to be construed or interpreted, in any manner, as federal endorsement of that non-federal entity or its products.

CONTENTS

APPENDICES

FIGURES

TABLES

TECHNICAL GUIDE 392
Conceptual Site Model Best Practices and Exposure Pathway Guidance

1. PURPOSE

This document provides guidance and best practices for properly creating a deployment location's conceptual site model of exposure pathways and documenting the relevant information, data, and assessments. These best practices support implementation of multiservice doctrine (DN 2012) which provides the framework for Occupational and Environmental Health (OEH) Site Surveillance at deployment locations.

This guide focuses on OEH Site Surveillance (OEHSS) documentation practices within the environmental health module of the Defense Occupational and Environmental Health Readiness System—Industrial Hygiene (DOEHRS-IH).

2. CONCEPTUAL SITE MODELS AND EXPOSURE PATHWAYS

2.1 Conceptual Site Models

A Conceptual Site Model (CSM) is a graphical, pictorial, and/or tabular depiction of what is known about a site in terms of what, where, when, why, to whom, and how exposures to health hazards may or may not occur. The CSM serves as the blueprint for understanding the situation, designing surveillance and sampling plans, identifying at-risk populations, describing health risks, and prioritizing risk management actions to control unacceptable risks. A CSM represents the compilation of all the exposure scenarios and their exposure pathways that are associated with a site.

Within DOEHRS-IH, what is referred to as a location's CSM is the table of exposure pathways (which is shown in sections to follow) and includes any data and information elements that are part of those exposure pathways. The two types of CSMs for OEHSS that are found within DOEHRS-IH are listed below. Refer to **Figure 1** to learn how to locate these CSMs within DOEHRS-IH.

- **Active CSM.** This is the current CSM and includes all of the actively managed DOEHRS exposure pathways for a location. Any and all data collection, monitoring, and exposure pathway assessments (e.g., health risk assessments) for the pathways should be managed from within the Active CSM.

- **OEHSA CSM.** This CSM represents a "snapshot in time" of all the DOEHRS exposure pathways that have been associated with a specific OEH Site Assessment (OEHSA) Survey. An OEHSA CSM may contain exposure pathways that are not in the Active CSM because they have been stop-dated and are no longer representative of current conditions.

NOTE: **Any and all data collection, monitoring, and health risk assessments for an exposure pathway should be managed from within the Active CSM.** Exposure pathways removed from or added to the **Active CSM** in the time period between two different OEHSA Surveys should be addressed in the newer OEHSA Survey.

2.2 Exposure Pathways

An exposure pathway is traditionally defined as a description of how exposure occurs from a health hazard release from a source into the environment, transports through the environment and within one or more environmental media (air, water, soil, surfaces, etc.), the routes of human exposure (e.g., inhalation, ingestion, skin contact, etc.), and where and when specific personnel come into contact with the hazard (e.g., a specific cohort exposed at the same time or in a similar way). There are six components of an exposure pathway, each of which must be present in order for an actual exposure to occur: (1) source, (2) health hazard, (3) exposure point, (4) exposure medium, (5) route of exposure, and (6) co-occurrence in time with a population-at-risk. A key task in preparing to conduct a risk assessment is to describe the exposure pathways that the risk assessment will need to address.

Within DOEHRS-IH and this guide, it is a best practice to manage information, data, and monitoring activities related to exposure pathways in a way that "bundles" highly related known and potential exposure pathways into a single "exposure pathway" referred to as a "DOEHRS Exposure Pathway." For example, all exposure pathways associated with a water system at a base camp are to be bundled into a single DOEHRS Exposure Pathway for that water system that is displayed in the **Active CSM** and/or **OEHSA CSM**. All of the OEHSS guidance is based on this bundling approach. This operationalization of the exposure pathway concept simplifies documentation requirements, allows flexibility in handling contingencies over time, reduces the need to constantly re-work exposure pathway information, and creates a consistent information structure for communicating exposure monitoring and health risk assessments. Overall, this saves time for Force Health Protection (FHP) personnel involved with OEHSS activities so they can focus on resolving high-priority problems instead of routine documentation tasks.

Table 1 presents a summary view of an **Active CSM** of exposure pathways.

NOTE — From this point forward in the document, "exposure pathway" refers to a "DOEHRS Exposure Pathway."

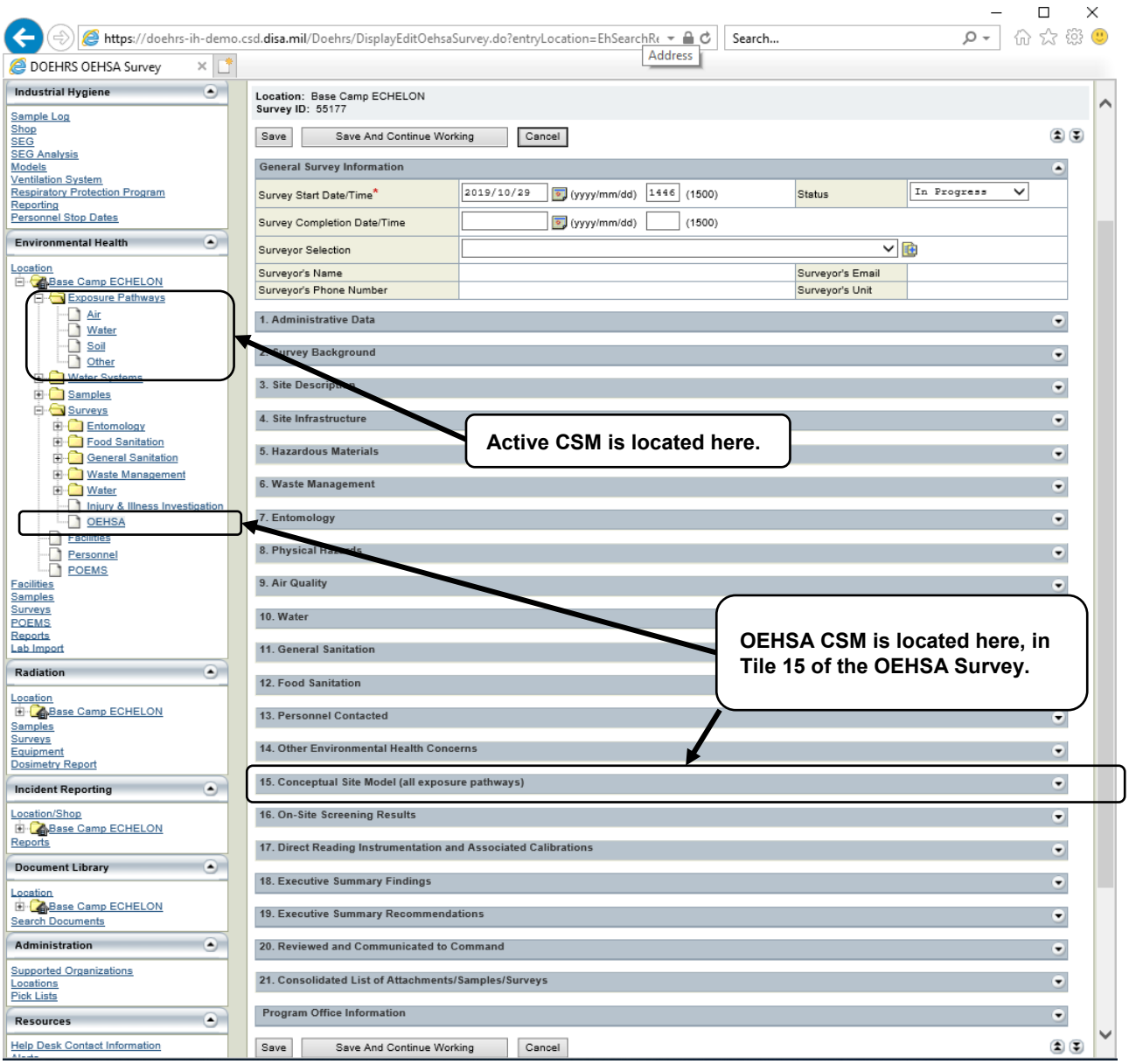


Figure 1. Locations of the Active CSM and OEHSA CSM within DOEHRS-IH

Note: Each section of an OEHSA Survey is numbered (as shown above) and referred to as "tiles." For example, food sanitation information is found in Tile 12.

The hypothetical location described in **Table 1** has no airfield, no active industrial hygiene program, and no active radiation safety program. Solid and hazardous waste is stored and transported off-camp for disposal.

Table 1. Example Active CSM of Exposure Pathways for a Small Base Camp (a Contingency Location)

Exposure Pathway Name	Threat Source (1)	Health Hazards	Exposed Population
Ambient Air	Onsite and local/regional pollution sources	Gases, aerosols, particulate matter	All site personnel
Bottled Water	Bottled water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
Field Water Supply System (260)	Water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
Soil (HazMat Storage Area)	HazMat Storage/Disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials (2)	HazMat Storage Area personnel
Soil (Solid Waste Storage Area)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials (2)	Waste Management personnel
Soil (Vehicle Maintenance Area)	Vehicle maintenance operations	Fuels, petroleum, oils, lubricants, and other contaminants	Maintenance personnel
Soil (Fuel Distribution Area)	Fuel Distribution	Fuels, petroleum, oils, lubricants, and other contaminants	Fuel Distribution personnel
Arthropod Vectors	Arthropod disease vectors	Pathogens and parasites	All site personnel
Arthropod Pests	Arthropod pests	Bites, stings, blisters, allergic reactions, food contamination	All site personnel
Vertebrate Pests	Birds, bats, rodents, feral and wild animals, snakes, and others	Bites, animal-borne diseases, and envenomation.	All site personnel
Workplace Noise	Equipment generated noise	Occupational noise	Workplace personnel
Ambient Noise	Operationally-generated background noise	Ambient noise	All site personnel
Electromagnetic Field Radiation	Electromagnetic radiation generating equipment	Electromagnetic radiation	Workplace personnel
Industrial Device Radiation	Commodities/devices	Ionizing radiation (3)	All site personnel

3. BEST PRACTICES OVERVIEW

Each deployment location must have an **Active CSM** of exposure pathways built and managed through time within the EH module of DOEHRS-IH. For the majority of locations, **Table 1** shows what an **Active CSM** might look like when the best practices within this guide are followed. It is important to understand that there are likely to be unique situations at some deployment locations that will require the addition of unique pathways to the standard set of exposure pathways covered within this guide.

Following are the 12 CSM best practices for exposure pathways.

Preliminary CSM:

1. The creation of a Preliminary CSM is a planning activity best suited for planning the pre-site visit to a new location. Preliminary CSMs do not need to be created within DOEHRS-IH. Refer to **Section 4** for additional detail.

Exposure Pathway Creation (within DOEHRS-IH):

2. Within DOEHRS-IH, create, revise, and update exposure pathways from within the **Active CSM** area of the EH module of DOEHRS-IH. Associate those pathways with specific sections of the OEHSA Survey after the pathways have been created, revised, or updated in the **Active CSM**. All pathways linked to the OEHSA Survey are viewable in the **OEHSA CSM**. Refer to **Section 2** (above) for additional detail.

3. When a deployment location has an active IH program or Radiation Safety program, exposure pathways should not be created within the EH module of DOEHRS-IH for the specific workplaces under the management of those programs. Refer to **Section 5** for additional detail.

4. The creation and subsequent management of exposure pathways over time is a collaborative effort involving on-site FHP teams, their higher-echelon FHP officers, and subject matter experts (SMEs) at the reachback OEH Surveillance Center. Refer to **Section 6** for additional detail.

5. Use standard exposure pathways for a given deployment location. Name each exposure pathway using the naming conventions found in **Section 7** and in the reference tables throughout this guide. Unique situations can be addressed with the use of non-standard pathways.

6. Use the guidance in **Sections 8 through 18** to determine which exposure pathways are required for a location and how to document the details of each exposure pathway within the EH module of DOEHRS-IH.

7. Each exposure pathway requires the selection of a priority level. **Appendix B** presents the doctrinal priority levels, and **Sections 9 through 18** provide guidance for determining the initial priority level at the time an exposure pathway is created.

8. In the rare situation where assigning specific individuals to an exposure pathway is desired, consult the guidance found in **Section 19**.

Exposure Pathway Management:

9. Using the guidance in **Section 20**, ensure that the exposure pathways found in the **Active CSM** at any given time reflect the health hazard exposure conditions at the location. Add new pathways as required, modify existing pathways as new information about them is generated, record risk management decisions and actions taken within the pathway details, and stop-date those pathways that are no longer complete.

10. After exposure pathway health risk assessments or other kinds of exposure pathway assessments are completed, validate or revise the exposure pathway priority level using guidance found in **Section 21.**

11. Document exposure pathway health risk assessments and other kinds of exposure pathway assessments within the exposure pathway using the “exposure pathway assessment” feature in the EH module of DOEHRS-IH. Refer to **Section 22**.

12. Stop-date an exposure pathway using the guidance in **Section 23**.

4. PRELIMINARY CONCEPTUAL SITE MODEL

A key part of the initial planning for the very first OEHSA Survey is to generate a Preliminary CSM of exposure pathways. This CSM should identify all of the probable and potential exposure pathways that might need to be established for the location. These pathways should be based on all the gathered information from the Preliminary Hazard Assessment, Environmental Baseline Survey, and other sources. Exposure pathways should generally not be generated within DOEHRS-IH at this step in the process. Rather, a Preliminary CSM should be crafted and used to structure plans for the site visit. Following are the three key features of Preliminary CSMs:

- Preliminary CSMs are not recorded in DOEHRS-IH. They are a planning tool used to structure FHP team site visit activities and to project the exposure pathways that might eventually be created within DOEHRS-IH.

- Preliminary CSMs do not include all exposure pathway details. They are limited to the type of content shown in the example CSM (**Table 1**); whereby, additional details are not needed at this planning step.

- Preliminary CSMs do not include any exposure pathway priority levels. The FHP team will establish the priority levels during the initial site visit, once the team has verified the actual site conditions. Note that when an exposure pathway is created in the **Active CSM** area of DOEHRS-IH, a priority level is required.

5. INDUSTRIAL HYGIENE AND RADIATION SAFETY PROGRAMS

When a deployment location has an ongoing IH program and/or occupational Radiation Safety program, which includes documentation within the IH module or Radiation module of DOEHRS-IH, the exposure pathways aimed to capture exposures and health risks associated with specific workplaces that are part of those programs should not be created.

If such pathways already exist, they should be stop-dated so the exposure and risk information is not captured twice within multiple areas of DOEHRS-IH. Surveillance activities associated with specific IH and radiation safety programs for workplaces within a deployment location, as documented in the IH and Radiation modules of DOEHRS-IH, take precedence over surveillance activities to be documented in the EH module of DOEHRS-IH using exposure pathways discussed herein.

If there is no ongoing IH or Radiation Safety program, use the best practices within this guide for the creation and management of workplace exposure pathways.

NOTE — For a deployment location, the best area in DOEHRS-IH to document the presence of an ongoing IH or Radiation Safety program and the POCs for same is the current OEHSA Survey, specifically, in the “Notes” section of Survey Tile 1 (Administration Data).

6. ROLES AND RESPONSIBILITIES

Good management of CSM exposure pathways is vital to the success of OEH site surveillance documentation and sampling and analysis planning. The creation and subsequent management of exposure pathways over time is a joint collaborative effort involving on-site FHP teams, their higher-echelon FHP officers, and SMEs at the reachback OEH surveillance center.

Field personnel who perform site visits at deployment locations are responsible for gathering all relevant information about actual conditions on the ground and initially documenting them within the EH module of DOEHRS-IH. Higher-echelon FHP officers in coordination with OEH Surveillance Center SMEs are encouraged to assist the field personnel in documenting site conditions and ensuring that best practices are followed when exposure pathway information is prepared and then entered in DOEHRS-IH.

Personnel are assigned to one of two DOEHRS-IH user roles based on their mission and experience level. The DOEHRS-IH program office administrator assigns the user roles, as

indicated in the responsible Service's guidance. **Table 2** presents OEHSA Survey and exposure pathway responsibilities for these user roles.

- **"Standard OEHSA Role" users** (most users). The primary role for these users is to associate OEHSA Survey sections to existing exposure pathways and ensure the information found within the OEHSA Survey is as comprehensive and accurate as possible, relative to actual conditions at the site. These users cannot create or edit exposure pathways within DOEHRS-IH.

- **"OEHSA QA** [quality assurance] **role" users.** These users create and edit exposure pathways, in addition to the tasks described above. OEHSA QA role users are responsible for translating the information obtained from OEHSA Survey documentation and other communications into formal exposure pathway documentation within DOEHRS-IH. These users can also assign personnel to an exposure pathway (refer to **Section 19**).

Table 2. Exposure Pathway Creation and Management Responsibilities

Task	DOEHRS-IH User Type	Typical Responsible Party	Reviewers
OEHSA Survey documentation and association of exposure pathways to specific OEHSA Survey sections or tiles	Standard OEHSA Role	• FHP team	In-theater FHP assets, OEH Surveillance Center, Combatant Command (CCMD)
	OEHSA QA Role	• Experienced FHP personnel* • OEH Surveillance Center	
Exposure pathway creation and revisions**	OEHSA QA Role	• Experienced FHP personnel* • OEH Surveillance Center	FHP team, In-theater FHP assets
Add personnel to an exposure pathway	OEHSA QA Role	• OEH Surveillance Center	FHP team, In-theater FHP assets
* Experienced personnel are defined by the responsible Service's guidance. ** The creation and editing of exposure pathways should be performed from the **Active CSM** (see **Section 2**).			

7. STANDARD EXPOSURE PATHWAYS

It is a best practice to use standard exposure pathways for a given deployment location. Not all of the standard exposure pathways are required at every deployment location; their use will depend on site conditions. The exposure pathway naming convention is important for proper communication and management of the pathways. **Table 3** presents the list of the standard exposure pathways and their pathway naming conventions. These naming conventions are used within the reference tables throughout this document; additional standard exposure pathways may be added in future versions.

Table 3. Standard Exposure Pathways for Deployment Locations (within DOEHRS-IH)

Category	Standard Exposure Pathways and Naming Conventions [(1)(2)]
Outdoor Air	• Ambient Air • Ambient Air (*add subarea 1 label*) • Ambient Air (*add subarea 2 label*) • Workplace Air (*add workplace label*)
Indoor Air	Standard pathways and guidance have not yet been created.
Bottled and Packaged Water	• Bottled Water (*add optional subpopulation label*) • Packaged Field Water (*add optional label*) (#)
Water Systems	• Field Water Supply System (*add optional label*) (#) • Municipal Water System (*add municipal label*) (#) • Untreated Water System (*add water source label*) (#)
Natural Water	• Natural Water (*add specific label*)
Soil	• Soil (HazMat Storage Area) • Soil (Solid Waste Storage Area) • Soil (Fuel Distribution Area) • Soil (Vehicle Maintenance Area) • Soil (Aircraft Maintenance Area) • Soil (Landfill) • Soil (Incinerator) • Soil (Burn barrel) • Soil (Burn pit) • Soil (*add land use area label*) [(3)]
Pests and Entomology	• Arthropod Vectors • Arthropod Pests • Vertebrate Pests
Noise	• Workplace Noise • Ambient Noise • Ambient Noise (Flightline)
Nonionizing Radiation	• Electromagnetic Field Radiation • Laser Radiation

Category	Standard Exposure Pathways and Naming Conventions (1)(2)
Ionizing Radiation Devices and Commodities	• Medical Device Radiation • Industrial Device Radiation • Military Radioactive Commodities
Natural Radioactive Material	• NORM Radiation • TENORM Radiation

Legend:
– The DOEHRS-generated water system ID number is to be inserted at the # symbol inside the parentheses.
NORM – Naturally Occurring Radioactive Material
TENORM – Technologically Enhanced Naturally Occurring Radioactive Material
Notes:
1 – *Italicized words should be replaced with location-specific labels.* Non-italicized words should be used as-is (verbatim).
2 – Additional types of standard pathways may be added in future versions of the publication.
3 – Land use areas (LUAs) within a deployment location can be location-specific (see **Section 24**).

NOTE — There may be situations that will require a unique exposure pathway to be defined, which will by definition not be one of the identified standard pathways. The use of such "non-standard" exposure pathways is acceptable and should be based on guidance from the appropriate OEH Surveillance Center.

8. CHOOSING AND DOCUMENTING EXPOSURE PATHWAYS

Figures 2 and 3 provide a diagram for guiding the creation of an **Active CSM** for a location. More details are provided in **Sections 9 through 18**, which present category-specific guidance for choosing and documenting exposure pathways. The guidance in those sections includes how to initially prioritize each pathway at the time of pathway creation in DOEHRS-IH.

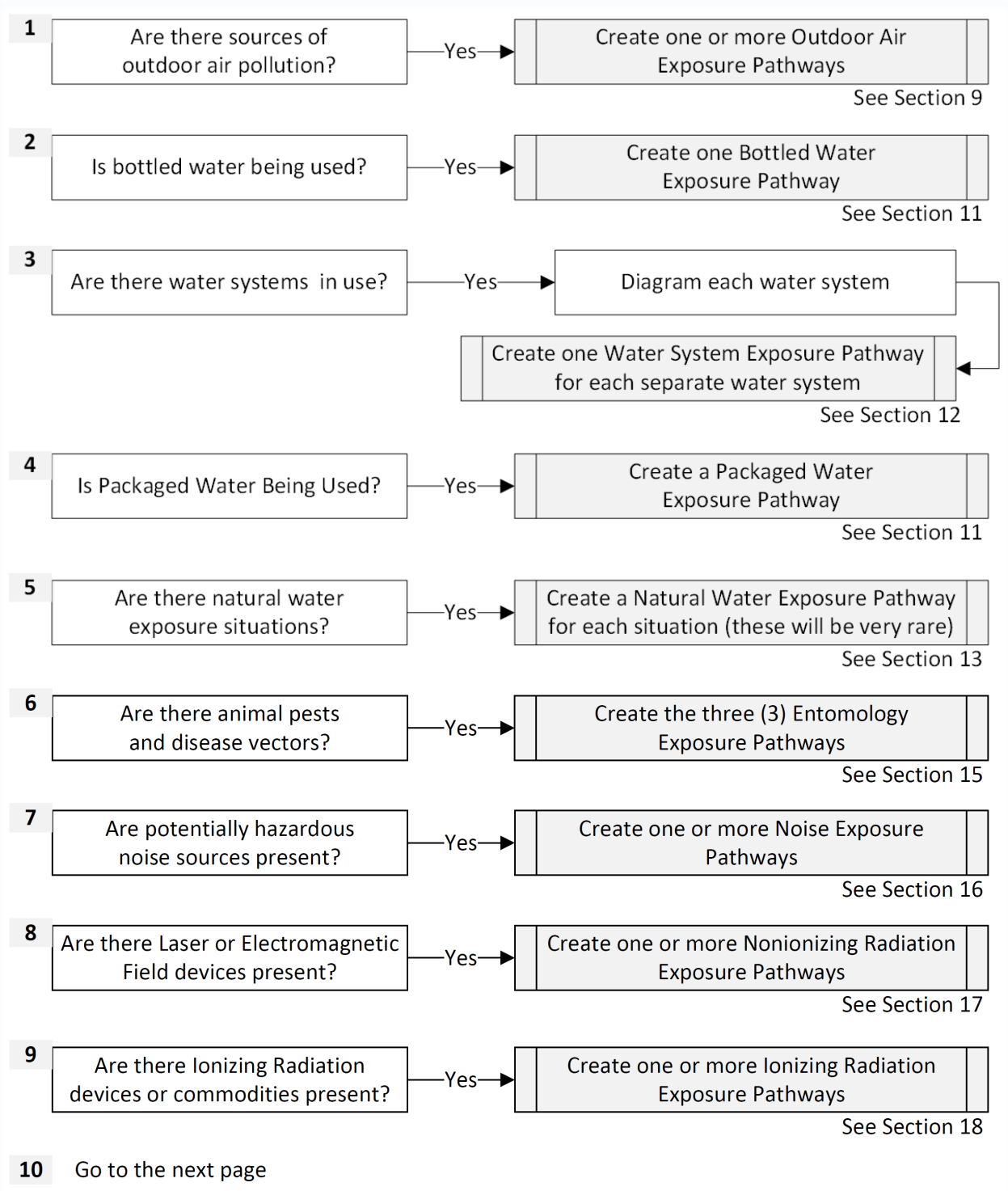


Figure 2. Initial Exposure Pathways Creation Diagram for an Active CSM

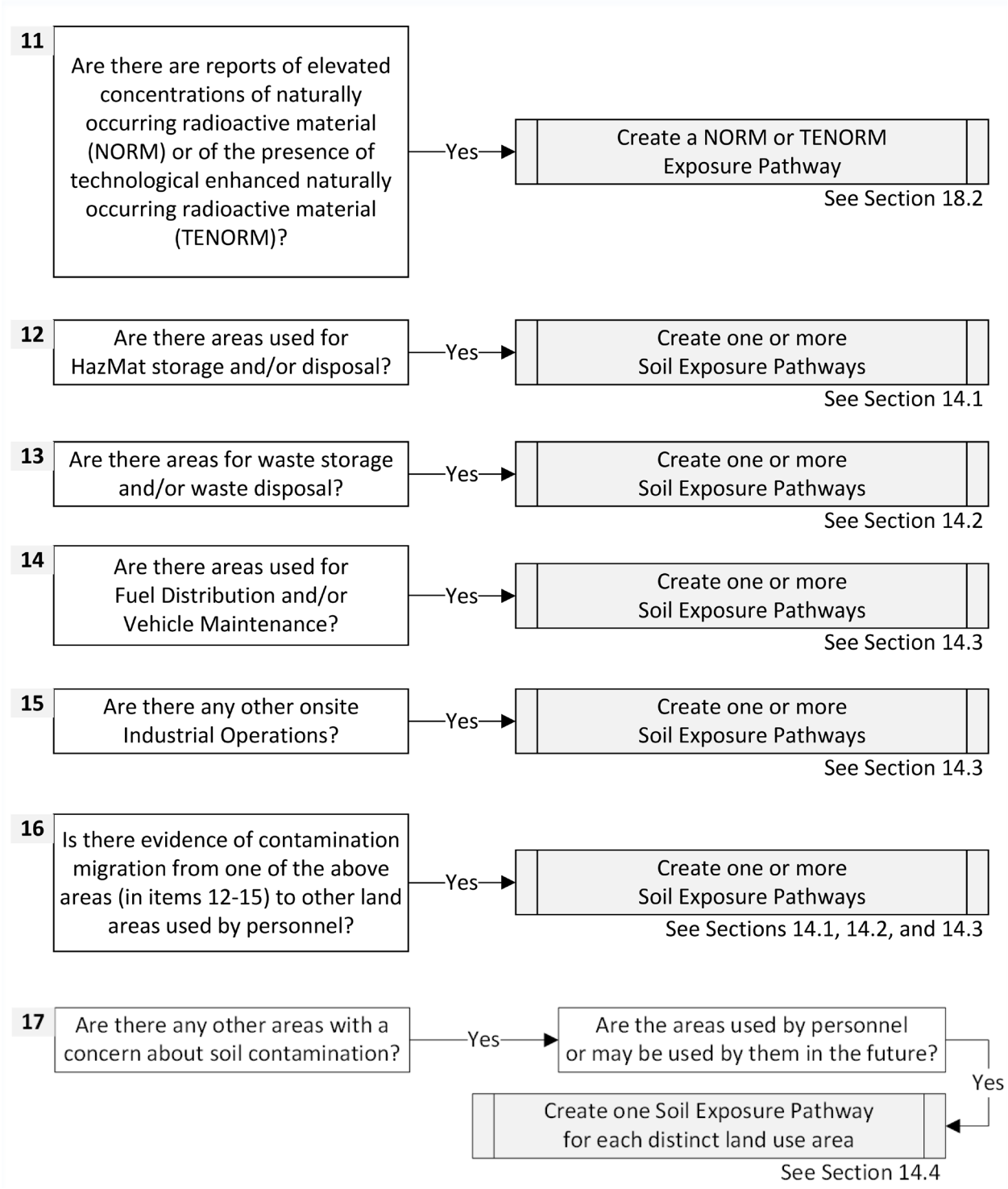


Figure 2. Initial Exposure Pathways Creation Diagram for an Active CSM (continued)

9. EXPOSURE PATHWAYS FOR OUTDOOR AIR

9.1 Pathway Choice and Labeling

Nearly every deployment location will have at least one source of ambient air pollution. Therefore, exposure pathway #1 is the expected outdoor air pollution pathway for nearly all locations. Exceptions to this should be coordinated with a reachback OEH Surveillance Center.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Ambient Air	Onsite and local/regional pollution sources	Gases, aerosols, particulate matter	All site personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

In the rare cases where a deployment location is large enough to justify multiple general ambient air exposure pathways for distinct sub-areas of the location, multiple general pathways can be used. Such an approach presumes that there are significantly different outdoor air exposures for a defined subset of personnel based on where they spend time within a deployment location. However, if it is unlikely that exposure modeling and/or field sampling will produce statistically different exposure estimates for the group, then such an approach is not recommended. Use of this approach should be rare, have strong justification, and only be implemented in collaboration with the reachback OEH Surveillance Center. Exposure pathways #2 and #3 illustrate how such pathways would be rendered and used together.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
2	Ambient Air (*add subarea 1 label*)	Onsite and local/regional pollution sources	Gases, aerosols, particulate matter	All personnel in *[subarea 1 label]*
3	Ambient Air (*add subarea 2 label*)	Onsite and local/regional pollution sources	Gases, aerosols, particulate matter	All personnel in *[subarea 2 label]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

Note: If there are on-site emission sources for which DoD or CCMD policy requires implementation of a specific sampling plan and/or health risk assessment, then these will be captured as Exposure Pathway Assessments associated with the illustrated exposure pathways #1, #2, and #3. (Such policies address all open-air burn pits (DoD 2011) and, within CENTCOM, all thermal waste destruction units (CENTCOM 2019).) When multiple general ambient air pathways are used for a location, include each of these sources in each of the sub-area exposure pathways. Do not create an ambient air exposure pathway just for those particular sources because they will be captured within exposure pathways #1, #2, and #3.

An exposure pathway may be desired to characterize outdoor air exposure related to a specific workplace within the base camp (e.g., workplace exposures within a large basecamp fuel farm). This is only recommended when the resources are unavailable for a formal IH program (refer to **Section 5**); these cases should be coordinated with the reachback OEH Surveillance Center. Most small contingency locations will not have an IH program. Exposure pathway #4 presents this type of pathway; in such a situation, there should be a specified population of concern where the individuals can be identified.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
4	Workplace Air (*add workplace label*)	*Add source label*	Gases, aerosols, particulate matter	*Specific workplace population label***

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** A roster of the specific workplace population will need to be compiled and associated with the exposure pathway (see **Section 19**).

9.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level.

Table 4 (next page) presents guidance for how to prioritize an ambient air exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

9.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update the outdoor air exposure pathway information using guidance found in **Table 5**.

.

Table 4. Initial Prioritization Guide for the Ambient Air Exposure Pathway

Air Pollution Conditions Associated with Exposures	Initial Priority of Exposure Pathway
Air pollution exposure results in documented health effects to personnel working or residing at the base camp.	Urgent Priority
1. Local air quality is degraded by chronic haze, reduced visibility (< 5 miles), or persistent odor due to natural or human-made air pollution.[(1)(2)] 2. Local air pollution sources (e.g., power plants, factories, burn pits, natural sources, and any source with visible air pollution emissions) are situated within 2 miles of the fence line.[(3)] 3. There is limited or no regulation of local air pollution sources by the host nation, or local air pollution sources exhibit poor compliance with host nation environmental regulations. 4. The base camp uses burn barrels/boxes, burn pits, or incinerators to manage solid waste.[(4)] 5. Motorized vehicular activity (e.g., wheeled and tracked vehicles, rotary and fixed wing aircraft) creates plumes of road dust and/or vehicular exhaust at the base camp or within 2 miles of the fence line.[(3)] 6. Air pollution sources within or near the base camp have a history of air pollution releases or events resulting in complaints or human health concern.	High Priority (4 or more conditions) Moderate Priority (2 to 3 conditions) Low Priority (0 to 1 condition)[(4)]

Notes:

1 – Chronic haze is defined as occurring for 30 days or more per year, based on EPA Integrated Science Assessments for particulate matter (EPA 2019a).
2 – The 5-mile visibility criterion is based on precautions for healthy adult populations exposed to wildfire smoke when visibility is degraded (EPA 2019b).
3 – The 2-mile source distance criterion is based on air quality and land use guidance from U.S. (CalEPA 2005) and international (ACT Government 2018) environmental authorities. 4 – If condition number 4 is present, then the priority should be at least Moderate, even if this is the only condition present at the location.

Table 5. Best Practices for Standard Outdoor Air Exposure Pathway Information

Form Field		Full Site	Subarea Only
Name*		Ambient Air	Workplace Air (*subarea label*)[1]
Applicable OEHSA Section*		*When creating the pathway, choose* "Ambient (Outside) Air Quality." Note: When performing the OEHSA Survey, first link the exposure pathway from the **Active CSM** to Ambient (Outside) Air Quality within Tile 9 (Air Quality). Then, from within the OEHSA, link the pathway to any of the following additional OEHSA sections, based on the existing site-specific conditions: • Tile 3 (Site Description): Nearby Industrial Facilities. • Tile 4 (Site Infrastructure): Onsite Industrial Operations, Description of Structures, Description of Roads/Hardstands, Description of Power Generation, and/or Contractor Services. • Tile 5 (Hazardous Materials): Petroleum Distribution Points, Hazardous Materials Storage/Unidentified Substances, Hazardous Materials Disposal, and/or Hazardous Materials Migration. • Tile 6 (Waste Management): Solid Waste, Landfills, Incinerators/Burn Pits, and/or Wastewater.	
Threat Source*	Dropdown*	On-site and local/regional pollution sources	
	Free text field	*Identify the main onsite and nearby sources of air pollution. Note whether there is an on-site or nearby burn pit or other open-air burning facility. Use the elements of **Table 4** as a guide.*	
Environmental Media*		Air	
Health Hazard*		*When no specific and comprehensive list of hazards is known:* Gases, aerosols, particulate matter *When a specific and comprehensive list of hazards is known:* *Specific hazard list*	
Route of Exposure*		Inhalation [2]	
Description of Affected Personnel*		All site personnel	*Subpopulation label*
Number of Affected Personnel		*Add site-specific number if not classified. If classified, leave blank.* *If specific individuals will be associated to the pathway, see **Section 19**.*	
Existing Controls and Protective Measures*		*Site-specific description (usually limited to behaviors, e.g., physical training restrictions on bad air days)*	
Supporting Background Information*		*Provide basic description of air quality and whether complaints have been made about it. Describe when and under what conditions the air quality is the most problematic. List all of the conditions from **Table 4** that are present, and indicate the number of conditions that are present. Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*	
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant".	
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily".	
Start Date*		*Site-specific. Indicate the date when the exposures could have first started.*	
Stop Date		See **Section 23.**	

Form Field	Full Site	Subarea Only
Priority	See **Section 9.2** for initial pathway creation and **Section 21** for subsequent adjustments.	
Comments	*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*	

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim).
* Field is required by DOEHRS-IH.
1 – See **Section 9.1** for guidance on when an ambient air subarea pathway is required; it will be extremely rare.
2 – There are cases where airborne hazards may pose a skin contact or ocular (eye) exposure concern. These instances are not as common but may be relevant depending on nearby sources of air pollution.

10. EXPOSURE PATHWAYS FOR INDOOR AIR

Standard exposure pathways and guidance for potential indoor air quality concerns have not yet been generated. After they have been generated, this guide will be updated. It is not a best practice at this time to create standard indoor air exposure pathways. If there is an indoor air concern at a deployment location, then indoor air exposure pathways specific to the facility of concern can be created by applying the style and approaches within this guide.

11. EXPOSURE PATHWAYS FOR BOTTLED AND PACKAGED WATER

11.1 Pathway Choice and Labeling

Bottled water can be addressed by grouping all bottled water manufacturers into one pathway or by creating multiple pathways, that is, one for each different manufacturer. For most deployment locations, it is recommended to group all manufacturers into one bottled water pathway. In some cases it may be preferable to create multiple exposure pathways if there are multiple bottled water manufacturers. These distinctions are discussed below.

When grouping bottled water manufacturers, exposure pathway #1 and/or #2 (next page) is required if one or more bottled water manufacturers are used for all site personnel (pathway #1) and/or if one or more bottled water manufacturers are used for only a subset of the personnel (pathway #2). Note that the decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Bottled Water	Bottled water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
2	Bottled Water (*subpopulation label*)	Bottled water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

When manufacturer-specific bottled water exposure pathways are created, exposure pathways #3 and #4 represent how to define the pathways. Pathway #3 applies if all site personnel at the location use the water, and pathway #4 applies when only a subpopulation at the location uses the water.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
3	Bottled Water (*manufacturer label*)	Bottled water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
4	Bottled Water (*manufacturer label*)	Bottled water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

Exposure pathway #5 and/or #6 is required when a field water system is being used to package water, and that water is being used by all site personnel (pathway #5) or is only being used by a subset of personnel that can be easily labeled, e.g., only used by a specific unit (pathway #6). Note that the decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center. (Packaged water is defined in Technical Bulletin, Medical (TB MED) 577 (DA 2010).)

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
5	Packaged Field Water (#)	Packaged water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
6	Packaged Field Water (*subpopulation label*) (#)	Packaged water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
# The DOEHRS-generated water system ID number is to be inserted at the # symbol inside the parentheses.

11.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level.

Table 6 presents guidance for how to prioritize a bottled water or packaged water exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

11.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update the bottled water and packaged water exposure pathway information using the guidance found in **Table 7**.

Table 6. Initial Prioritization Guide for Bottled and Packaged Water Exposure Pathways

<table>
<tr><th>CSM Exposure Pathway</th><th colspan="2">Conditions and Findings(1)</th><th>Initial Priority</th></tr>
<tr><td rowspan="4">Bottled Water(2)</td><td rowspan="2">Approved vendors</td><td>Does not meet STP or LTP standards or has not yet been tested</td><td>Urgent</td></tr>
<tr><td>Meets STP and LTP standards</td><td>Moderate</td></tr>
<tr><td rowspan="2">Unapproved vendors</td><td>Does not meet STP or LTP standards or has not yet been tested</td><td>Urgent</td></tr>
<tr><td>Meets STP and LTP standards</td><td>High</td></tr>
<tr><td rowspan="2">Packaged Field Water(2) [when intended for potable uses]</td><td colspan="2">Does not meet STP or LTP standards or has not yet been tested</td><td>Urgent</td></tr>
<tr><td colspan="2">Meets STP and LTP standards</td><td>Moderate</td></tr>
<tr><td colspan="4">1 – Short-term potability (STP) and long-term potability (LTP) standards are published in TB MED 577. Initial priorities will normally be based on compliance with STP standards. However, in some cases when the exposure pathway is first added to DOEHRS-IH, other data may be available to compare to LTP standards as well.
2 – The standard bottled water and packaged field water exposure pathways address drinking water consumption. Bottled water and packaged water that are only intended for non-potable uses would need to be documented as non-standard exposure pathways and labeled uniquely. The expectation is that such situations would be very rare.</td></tr>
</table>

Table 7. Best Practices for Standard Bottled and Packaged Water Exposure Pathway Information

Form Field		Bottled Water Source	Packaged Field Water
Name*		Bottled Water or Bottled Water (*subpopulation label*)	Packaged Field Water (#) or Packaged Field Water (*subpopulation label*) (#)
Applicable OEHSA Section*		Bottled Water Sources [(1)]	Water Treatment System [(1)]
Threat Source*	Dropdown*	Bottled water contamination	Packaged water contamination
	Free text field	*Add unique threat concerns, if any.*	
Environmental Media*		Water	
Health Hazard*		*When no specific and comprehensive list of hazards is known:* Chemical/physical contaminants, radionuclides, toxins, pathogens *When a specific and comprehensive list of hazards is known:* *Specific hazard list*	
Route of Exposure*		Ingestion, Skin Contact	Ingestion, Skin Contact
Description of Affected Personnel*		*As appropriate, select the "*All site personnel*" box or provide a site-specific subpopulation label*	
Number of Affected Personnel		*Add site-specific number if not classified. If classified, leave blank.* *If specific individuals will be associated to the pathway, see* ***Section 19****.*	
Existing Controls and Protective Measures*		Approved VS Bottled Water Audit. On-site bottled water distribution and storage practices. *Add additional information if necessary, or replace the above if it is not accurate.*	PM/VS oversight, water packaging system approval, and water quality monitoring. On-site water distribution and storage practices. *Add additional information if necessary, or replace the above if it is not accurate.*
Supporting Background Information*		*(1) List the bottled water brands and/or vendors.* *(2) Describe how personnel use the water. Example: Personnel use this water as their primary drinking water source.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*	*(1) Describe how personnel use the water. Example: Personnel use this water as their primary drinking water source.* *(2) Briefly highlight any information about the water system and its operation that might be relevant for exposure considerations. Refer to the type and information on the treatment and packaging system. Note that details of the water system are to be documented elsewhere within DOEHRS-IH.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*
Duration*		*Site-specific. Under most situations the best selection will be* "Other/Constant." *Also, identify if the water is used as a backup source of drinking water.*	
Frequency*		Other/Daily water consumption (*or replace comment to be more accurate*)	
Start Date*		*Site-specific. Indicate the date when exposures could have first started.*	

Form Field	Bottled Water Source	Packaged Field Water
Stop Date	See **Section 23.**	
Priority*	See **Section 11.2** for initial pathway creation and **Section 21** for subsequent adjustments.	
Comments	*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*	

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is verbatim.
* Field is required by DOEHRS-IH.
# The DOEHRS-generated water system ID number is to be inserted at the # symbol inside the parentheses.
1 – When performing the OEHSA Survey, link the exposure pathway from the **Active CSM** to one of these categories within Tile 10.
VS: Veterinary Services

12. EXPOSURE PATHWAYS FOR WATER SYSTEMS

12.1 Pathway Choice and Labeling

Exposure pathway #1 and/or #2 is required for field water supply systems used by all site personnel (pathway #1) or by only a subset of the personnel (pathway #2). Note that the decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Field Water Supply System (*add optional label***) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
2	Field Water Supply System (*Subpopulation label*) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** Optional labels can help identify the system, especially if there is more than one system at the location. Examples are “Camp Brown Water System,” “New Camp Water System,” or “North-side Water System.”
# The DOEHRS-generated “Water System ID” number is to be inserted at the # symbol inside the parentheses. CAUTION: Do not use the DOEHRS-generated "Water System Component ID" for a "Field Water Treatment System" component.

Exposure pathway #3 (next page) is required if water from a municipal source (without additional military water treatment) will be used as a source of water for all site personnel. Exposure pathway #4 is required if a similar situation is present, but the water will only be used by a subset of personnel that can be easily labeled (e.g., only used by a specific unit). The decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center.

Note: If water from a municipal source is being treated on-location by a field water supply system prior to any personnel use, then exposure pathway #1 or #2 should be used instead.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
3	Municipal Water System (*municipal label*) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
4	Municipal Water System (*municipal label*) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
# The DOEHRS-generated “Water System ID” number is to be inserted at the # symbol inside the parentheses. CAUTION: Do not use the DOEHRS-generated "Water System Component ID" for a "Field Water Treatment System" component.

IMPORTANT – Use of municipal source water without additional military water treatment requires local area medical authority approval. Per TB MED 577, such water would normally be classified as untreated water. Consult the OEH Surveillance Center for assistance, as necessary.

Exposure pathway #5 and/or #6 is required if natural source water is being used without any treatment (including disinfection) by all site personnel or by only a subset of the personnel. Examples include river water being trucked or piped into the camp for washing vehicles, or untreated well water that is used for showering or personal hygiene. The decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
5	Untreated Water System (*water source label*) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
6	Untreated Water System (*water source label*) (#)	Water system contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
# The DOEHRS-generated “Water System ID” number is to be inserted at the # symbol inside the parentheses.

12.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 8** presents guidance for how to prioritize a water system exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 8. Initial Prioritization Guide for Water System Exposure Pathways

CSM Exposure Pathway	Conditions and Findings (1)	Initial Priority
Field Water Supply System [when intended for potable uses]	Does not meet STP or LTP standards or has not yet been tested	Urgent
	Meets STP and LTP standards	Moderate
Municipal Water System (*municipal label*) (2) [when intended for potable uses]	Does not meet STP or LTP standards	Urgent
	Meets STP and LTP standards	High
Untreated Water System or Any water exposure pathway that is only intended for non-drinking water uses (3)	Does not meet water quality standards relevant for use (3) or has not yet been tested	High
	Meets water quality standards relevant for use (3)	Moderate

1 – Short-term potability (STP) and long-term potability (LTP) standards are published in TB MED 577. Initial priorities will normally be based on compliance with STP standards. However, in some cases when the exposure pathway is first added to DOEHRS-IH, other data may be available to compare to LTP standards as well.
2 – Use of municipal water systems requires local area medical authority approval (per TB MED 577). Consult the OEH Surveillance Center for assistance if such a pathway is required.
3 – Note that many water uses other than drinking still require potable water (see TB MED 577). Nonpotable water may or may not meet STP/LTP standards but must be of acceptable quality for the intended use.

12.3 Pathway Form Information

The previous subsections present the key elements, but not all of the elements, of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site specific situation. It is best practice to describe and update water system exposure pathway information using guidance in **Table 9**.

Table 9. Best Practices for Standard Water System Exposure Pathway Information

Form Field		**Untreated Water System**	**Field Water Supply System**	**Municipal Water Source [(1)]**
Name*		Untreated Water System (*water source label*) (#)	Field Water Supply System (*add optional label*) (#)	Municipal Water System (*municipal label*) (#)
Applicable OEHSA Section*		Natural Water Sources [(2)]	Water Treatment System [(2)]	Municipal Water Sources [(2)]
Threat Source*	Dropdown*	Water system contamination		
	Free text field	*Add unique threat concerns, if any.*		
Environmental Media*		Water		
Health Hazard*		*When no specific and comprehensive list of hazards is known:* Chemical/physical contaminants, radionuclides, toxins, pathogens *When a specific and comprehensive list of hazards is known: Specific hazard list*		
Route of Exposure*		*If use is as a drinking water source:* Ingestion, Skin Contact *If use includes showering and/or personal hygiene:* Ingestion, Skin Contact, Inhalation *Otherwise, select the route(s) that are associated with the use of the water.*		
Description of Affected Personnel*		*As appropriate, select "*All site personnel*" or provide a site-specific subpopulation label.*		
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see* ***Section 19****.*		
Existing Controls and Protective Measures*		*Site-specific description*	Water treatment, water quality monitoring, and water system infrastructure surveillance. *Add additional information if necessary, or replace the above if it is not accurate.*	
Supporting Background Information*		*(1) Describe how personnel use the water, and refer to the points of use from the water system diagram. Example: Personnel use this water for showering and personal hygiene, and washing vehicles. (2) Briefly highlight any information about the water system and its operation that might be relevant for exposure considerations. Note that details of the water system are to be documented elsewhere within DOEHRS-IH. (3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*		
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant".		
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily use".		
Start Date*		*Site-specific. The date should reflect when the exposures could have first started.*		
Stop Date		See **Section 23.**		
Priority*		See **Section 12.2** for initial pathway creation and **Section 21** for subsequent adjustments.		
Comments		*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The*		

Form Field	Untreated Water System	Field Water Supply System	Municipal Water Source (1)
	rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.		

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is verbatim. The DOEHRS-generated water system ID number is to be inserted at the # symbol inside the parentheses.
* Field is required by DOEHRS-IH.
# The DOEHRS-generated “Water System ID” number is to be inserted at the # symbol inside the parentheses. CAUTION: Do not use the DOEHRS-generated "Water System Component ID" for a "Field Water Treatment System" component.
1 – Requires local area medical authority approval. Consult OEH surveillance center for assistance if such a pathway is required.
2 – When performing the OEHSA Survey, link the exposure pathway from the **Active CSM** to one of these categories within Tile 10.

13. EXPOSURE PATHWAYS FOR NATURAL WATER CONCERNS

13.1 Pathway Choice and Labeling

Exposure pathway #1 or #2 should be used when a concern has been raised about a natural water exposure and possible health risk. The decision to create a subpopulation exposure pathway can be subjective and can be coordinated with the reachback OEH Surveillance Center.

NOTE – This situation should only occur with natural water exposure situations. Examples include near-shore diving or training activities involving personnel entry into natural bodies of water, such as streams, rivers, ponds, lakes, estuaries, and near-shore waters. If the exposure situation involves water from a water system, then refer to **Section 12**.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Natural Water (*specific label*)	Water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	All site personnel
2	Natural Water (*specific label or subpopulation label*)	Water contamination	Chemical/physical contaminants, radionuclides, toxins, pathogens	*Subpopulation label*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

13.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level.

Table 10 presents guidance for how to prioritize a natural water exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 10. Initial Prioritization Guide for Natural Water Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Natural Water (*specific label*)	Reported or observed health concerns associated with the exposure	Urgent
	Otherwise, prioritize based on rapid assessment of potential sources of water contamination	Low to High

13.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update natural water exposure pathway information using the guidance in **Table 11**.

.

Table 11. Best Practices for Standard Natural Water Exposure Pathway Information

Form Field		**Water Exposure Pathway for Unique Exposures Not Associated with a Water System**
Name*		Natural Water (*add intuitive label for the unique situation*)
Applicable OEHSA Section*		*For most of these unique situations, when creating the pathway choose either* "Water – Natural Water Sources" or "Other Environmental Health Concerns." Note: When performing the OEHSA Survey, first link the exposure pathway from the **Active CSM** to one of the above, within either Tile 10 (Natural Water Sources) or Tile 14 (Other Environmental Health Concerns). Then, also link it to any of the other additional OEHSA sections based on the site-specific conditions that exist. In most cases, there will be no need to link the pathway to other OEHSA sections.
Threat Source*	Dropdown*	Water contamination *(when no specific source of contamination is known)* *Specific contamination source label (when a specific source of contamination is known)*
	Free text field	*Add unique threat concerns, if any.*
Environmental Media*		Water
Health Hazard*		*When no specific and comprehensive list of hazards is known:* Chemical/physical contaminants, radionuclides, toxins, pathogens *When a specific and comprehensive list of hazards is known:* *Specific hazard list*
Route of Exposure*		*In most cases of natural water exposure, select* Ingestion, Skin Contact. *Select all the routes that are associated with the specific water exposure concerns.* [(1)]
Description of Affected Personnel*		*As appropriate, select the "*All site personnel*" box, or provide a site-specific subpopulation label.*
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank.* *If specific individuals will be associated to the pathway, then see* ***Section 19****.*
Existing Controls and Protective Measures*		*Site-specific description*
Supporting Background Information*		*(1) Describe how personnel interact with the water and what activities they perform when they interact with the water. Since this type of pathway is designed for rare and unique situations, be as specific as possible, as these details will help in the assessment of health risk.* *(2) Briefly highlight any information about the water, as well as its current or possible contamination, that might be relevant for exposure considerations.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*
Duration*		*Site-specific*
Frequency*		*Site-specific*
Start Date*		*Site-specific. Indicate when the exposures could have first started.*
Stop Date		See **Section 23.**

Form Field	**Water Exposure Pathway for Unique Exposures Not Associated with a Water System**
Priority*	See **Section 13.2** for initial pathway creation and **Section 21** for subsequent adjustments.
Comments	*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim).
* Field is required by DOEHRS-IH.
1 – Note that natural water exposures such as swimming will nearly always involve some amount of inadvertent water ingestion.

14. EXPOSURE PATHWAYS FOR SOIL CONCERNS

There are a number of land uses that, if present at the location, should lead to the creation of soil exposure pathways if service personnel perform activities within the land use. Additionally, there is a set of triggering conditions that can lead to the creation of additional soil-based exposure pathways. The initial subsections below (**Sections 14.1 through 14.4**) provide guidance on these various types of land uses and situations. The final subsections (**Sections 14.5 and 14.6**) deal with prioritization and exposure pathway form information.

IMPORTANT – If only contractor personnel perform activities within one of the land uses covered within this section, then creation of a soil exposure pathway for that land use area is not recommended. If this may be the case, then it is advisable to document this situation within the current OEHSA Survey.

IMPORTANT – For all of the soil exposure pathways discussed in this section, multiple exposure routes are relevant for contaminated soil, to include incidental ingestion of soil, inhalation of resuspended soil dust, inhalation of chemical vapors from soil, and direct dermal contact on skin.

14.1 Pathway Choice and Labeling for Hazardous Materials Areas

Exposure pathway #1 below is required if hazardous materials (HazMat) storage and disposal areas are present on camp. If the HazMat storage and disposal areas are not adjacent, then treat each area as its own exposure pathway.

If there is evidence that hazardous materials may have migrated from one of the above types of areas and into another base camp land area that is used by personnel, then create a pathway associated with that potentially impacted area where personnel may be exposed. Exposure pathway #2 below represents the general guidance for describing such a pathway.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Soil (HazMat Storage Area)	HazMat Storage/Disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	HazMat Storage Area personnel
2	Soil (*add land use area label*)	HazMat Migration	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Personnel at the *[add land use area label]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** The label “other hazardous materials” is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

14.2 Pathway Choice and Labeling for Waste Storage and Disposal Areas

A soil exposure pathway for each distinct waste management area that exists at the location should be created using the guidance shown for exposure pathways #3 through #7 (next page). If there is evidence that contamination from one of the waste management areas may have migrated into another base camp land area that is used by personnel, then create a pathway associated with that potentially impacted land area where personnel may be exposed. Exposure pathway #8 represents the general guidance for describing such a pathway.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
3	Soil (Solid Waste Storage Area)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Waste management personnel
4	Soil (Landfill)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Waste management personnel
5	Soil (Incinerator)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Waste management personnel
6	Soil (Burn barrel)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Waste management personnel
7	Soil (Burn pit)	Waste storage/disposal	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Waste management personnel
8	Soil (*add land use area label*)	Contamination migration from the [*add above threat source label*]	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Personnel at the *[add land use area label]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** The label “other hazardous materials” is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

14.3 Pathway Choice and Labeling for Fuel Distribution and Maintenance Areas and Other Industrial Operations

Exposure pathway #9 (next page) is required if there is at least one fuel distribution point. If there are multiple fuel distribution areas that are not adjacent to each other, then create a pathway for each one and ensure that their exposure pathway names are intuitive.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
9	Soil (Fuel Distribution Area)	Fuel Distribution	Fuels, petroleum, oils, lubricants, and other contaminants	Fuel Distribution Area personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

Exposure pathway #10 and/or #11 is required if there are land use areas dedicated for Vehicle Maintenance and Aircraft Maintenance where personnel perform activities.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
10	Soil (Vehicle Maintenance Area)	Vehicle maintenance operations	Fuels, petroleum, oils, lubricants, and other contaminants	Motor Pool personnel
11	Soil (Aircraft Maintenance Area)	Aircraft maintenance operations	Fuels, petroleum, oils, lubricants, and other contaminants	Aircraft maintenance personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

Exposure pathway #12 is required for any existing onsite industrial operation that is not covered by one of the other exposure pathways described in this subsection and not included in the guidance for HazMat areas (**Section 14.1**) and waste storage and disposal management areas (**Section 14.2**). Note that each distinct operation should usually have its own exposure pathway.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
12	Soil (*land use area label*)	*Add an industrial operation label*	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Personnel associated with the *[add land use area]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** The label “other hazardous materials” is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

If there is evidence that contamination from one of the above industrial operations areas may have migrated into another base camp land area that is used by personnel, then create a pathway associated with that potentially impacted area where personnel may be exposed. Exposure pathway #13 (next page) represents the general guidance for describing such a pathway.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
13	Soil (*add land use area label*)	Contamination migration from the [*add above source label*]	Fuels, petroleum, oils, lubricants, and other contaminants *– or –* Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Personnel at the *[add land use area label]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** The label “other hazardous materials” is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

14.4 Pathway Choice and Labeling for Unique Situations

Additional soil exposure pathways should be created when one or more specific “triggering” conditions listed in **Table 12** (next page) is present for a land use area not already addressed. Exposure pathway #14 illustrates how to render such a soil pathway.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
14	Soil (*add land use area label*)	*Add triggering condition label*	Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials **	Personnel associated with the *[add land use area]*

Italicized words should be replaced with location-specific labels.
* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** The label “other hazardous materials” is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

Table 12. Triggering Conditions for Justifying Additional Soil-Based Exposure Pathways

Evidence of Probable or Potential Contamination [(1)] in an Area Used by Personnel

- Evidence of improper operations involving hazardous materials, chemicals, or an actual spill. [(2)]
- Contamination incidents due to major accidents or natural disasters. [(3)]
- Evidence of probable contamination from nearby industries (soot, fly ash, other emissions) or previous land uses, especially if the previous land use involved any of the following—
    - Hazardous materials or solid waste operations and/or disposal
    - Industrial facilities or activities, Motor pool/vehicle maintenance
    - Former military facilities or activities (non-US)
    - Utility operations (e.g., power generation facility)
    - Large-scale agriculture
    - Mining operations
- Evidence of probable contamination in areas with unpaved roads, whereby soil dust is resuspended and distributed across the location in areas where personnel spend time.
- Unexplained discoloration of soil from original color or unexplained dead vegetation where healthy vegetation existed before.

Camp Personnel Concerns/Observations

- Personnel report health effects associated with specific areas of potential soil contamination.
- Personnel communicate specific soil quality concerns to PM personnel or Command, especially if on-going soil disturbance activities lead to airborne soil dust resuspension from the area of concern and personnel are exposed to that resuspended dust.

Notes:
1 – Evidence of probable or potential contamination means that there is specific information and/or visual clues that would lead one to believe that soil contamination may be present. The difference between whether the contamination is probable vs. potential is based on the strength of the available evidence.
2 – While an exposure pathway would be created in this situation, soil sampling for the pathway may not be required to address the exposure due to existing spill prevention and response requirements.
3 – Contact the OEH surveillance center for further guidance to address such potential contamination.

14.5 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 13** presents guidance for how to prioritize a soil-based exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 13. Initial Prioritization Guide for Soil-Based Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Soil (*LUA name*)	Known or visible soil contamination in area with personnel contact, or reported health effects associated with specific soil areas of concern.	Urgent
	Contamination incidents due to major accidents or natural disasters, or evidence of probable contamination due to previous land uses.	High
	Evidence of probable soil contamination from nearby industries, or personnel communicate specific soil quality concerns to FHP personnel or Command, especially if on-going soil disturbance activities lead to airborne soil dust resuspension from the area of concern and personnel are exposed to that resuspended dust.	Moderate
	Normal operations; none of above indicators are present (e.g., no visible contamination, no major accidents, no specific disturbances).	Low

14.6 Pathway Form Information

The previous subsections present the key elements, but not all of the elements, of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site specific situation. It is best practice to describe and update the soil-base exposure pathway information using guidance in **Table 14**.

Table 14. Best Practices for Standard Soil Exposure Pathway Information

Form Field		**Soil Exposure Pathway for a Land Use Area**
Name*		Soil (*add land use area label*) [(1)]
Applicable OEHSA Section*		*When creating the pathway* from the **Active CSM,** *choose one of the following, as appropriate:* • Onsite Industrial Operations • Petroleum Distribution Points • Hazardous Materials Storage/Unidentified Sub. • Hazardous Materials Disposal • Solid Waste • Landfills • Incinerators/Burn Pits • Hazardous Materials Migration • Other Environmental Health Concerns Note: When performing the OEHSA Survey, first create the exposure pathway from the **Active CSM** area and select one of the above OEHSA Sections. Then link the pathway to any additional OEHSA sections that are relevant, based on the site-specific conditions that exist.
Threat Source*	Dropdown*	*For onsite soil contamination concerns:* HazMat Storage/Disposal, Waste Storage/Disposal, Fuel Distribution, Vehicle Maintenance, Aircraft Maintenance, *or [add industrial operation label]* *For contamination migration concerns:* Contamination migration from the [*add above source label*] *For unique soil pathways:* Add triggering condition label (refer to **Table 12**)
	Free text field	*Add additional source and/or migration information.*
Environmental Media*		Soil
Health Hazard*		*For fuel distribution and maintenance areas:* Fuels, petroleum, oils, lubricants, and other contaminants *For other kinds of areas:* Chemical contaminants, radionuclides, pathogens and biosolids, other hazardous materials [(2)] *When a specific and comprehensive list of hazards is known:* *Specific hazard list*
Route of Exposure*		Ingestion, Skin Contact, Inhalation [(3)]
Description of Affected Personnel*		*As appropriate, provide a land use area-specific subpopulation label*
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see **Section 19**.*
Existing Controls and Protective Measures*		*Site-specific description*

Form Field	Soil Exposure Pathway for a Land Use Area
Supporting Background Information*	*(1) Describe the concerns about soil contamination in the area. Include information about the specific source (or sources) of the contamination, if known. Describe the location and spatial boundaries of the area where contamination is thought to be present and how much of that area overlaps, or is adjacent to, an area where personnel perform tasks or other activities.* *(2) Describe the activities performed by personnel in the area. Indicate whether the activities involve high or low soil contact. Noticeable soil dust resuspension should be noted as high contact.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*
Duration*	*Site-specific. Under most situations, the best selection will be* "Other/Constant".
Frequency*	*Site-specific. Under most situations, the best selection will be* "Other/Daily".
Start Date*	*Site-specific. Indicate when the exposures could have first started.*
Stop Date	See **Section 23.**
Priority*	See **Section 14.5** for initial pathway creation and **Section 21** for subsequent adjustments.
Comments	*Add notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim).

* Field is required by DOEHRS-IH.

1 – There are several ways to label a soil-based exposure pathway properly. Refer to **Sections 14.1 through 14.4.**

2 – The label "other hazardous materials" is designed to capture hazards such as asbestos and natural or industrial materials not otherwise accounted for within the other labels. This list of the applicable hazards can be reduced if specific knowledge is available.

3 – In the majority of cases, there are multiple routes of exposure for soil, to include incidental soil ingestion, inhalation of resuspended soil dust, inhalation of chemical vapors from contaminated soil, and dermal skin contact. Note that the Soil Military Exposure Guidelines (MEGs) and some other types of risk-based soil screening levels address multiple exposure routes.

15. EXPOSURE PATHWAYS FOR PESTS AND ENTOMOLOGY CONCERNS

15.1 Pathway Choice and Labeling

If the deployment location has arthropods that can vector diseases to personnel, then exposure pathway #1 (next page) is recommended. Examples include mosquitoes, sand flies, ticks, mites, kissing bugs, fleas, and lice.

If the deployment location has arthropods that cause physical injury or nuisance, or whose presence reduces morale, then exposure pathway #2 is recommended. Examples include bed bugs, ants, bees, wasps, biting flies (stable, horse, deer, and midges), scorpions, spiders, blister beetles, filth flies, cockroaches, and food-infesting insects.

If the deployment location has vertebrate pests present, then exposure pathway #3 is recommended. Examples include birds, bats, rodents, feral and wild animals, and snakes. It is recognized that some vertebrates can act as disease vectors, so the “pests” label can be misleading, but in practice most personnel associate animal concerns via their presence as nuisance pests.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Arthropod Vectors	Arthropod disease vectors	Pathogens and parasites	All site personnel
2	Arthropod Pests	Arthropod pests	Bites, stings, blisters, allergic reactions, food contamination	All site personnel
3	Vertebrate Pests	Birds, bats, rodents, feral and wild animals, snakes, and others	Bites, animal-borne diseases, and envenomation.	All site personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

15.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 15** (next page) presents guidance for how to prioritize an entomology exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 15. Initial Prioritization Guide for Entomology Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Arthropod Vectors	A case of arthropod vector-borne disease has been reported on-site.	Urgent
	IDRA Vector-borne Disease Risk is High. (1)	High
	IDRA Vector-borne Disease Risk is Intermediate or on-site concerns identified during the site visit. (1)	Moderate
	IDRA Vector-borne Disease Risk is Low and no on-site concerns identified during the site visit. (1)	Low
Arthropod Pests	Arthropod pests are degrading mission capabilities.	High
	Arthropod pests are of concern, personnel have complained, and/or morale has been impacted.	Moderate
	Arthropod pests are present, but are rare or not a concern.	Low
Vertebrate Pests	A case of animal-borne illness/disease has been reported on-site.	Urgent
	IDRA Animal-contact Disease Risk is High. (1)	High
	IDRA Animal-contact Disease Risk is Intermediate or on-site concerns identified during the site visit. (1)	Moderate
	IDRA Animal-contact Disease Risk is Low and no on-site concerns identified during the site visit. (1)	Low

Notes:
1 – Based on the country-level Infectious Disease Risk Assessment (IDRA) performed by the National Center for Medical Intelligence (NCMI) and available at https://www.ncmi.dodiis.mil/. The highest ranking threat from the IDRA is used to prioritize.

15.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update entomology exposure pathway information using the guidance in **Table 16**.

Table 16. Best Practices for Standard Entomology Exposure Pathway Information

Exposure Pathway Form Field		Arthropod Vectors	Arthropod Pests	Vertebrate Pests
Name*		Arthropod Vectors	Arthropod Pests	Vertebrate Pests
Applicable OEHSA Section*		Vectors Present	Pests Present	Pests Present
Threat Source*	Dropdown*	Arthropod disease vectors	Arthropod pests	Birds, bats, rodents, feral/ wild animals, snakes
	Free text field	*Identify the highest known disease threats from the IDRA, site visits, and site interviews.*		
Environmental Media*		Other		
Health Hazard*		Pathogens and parasites	Bites, stings, blisters, allergic reactions, food contamination	Bites, animal-borne diseases, and envenomation
Route of Exposure*		Skin Contact and Other		
Description of Affected Personnel*		*As appropriate, select the "*All site personnel*" box, or provide a specific subpopulation label.*		
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see* ***Section 19****.*		
Existing Controls and Protective Measures*		Integrated pest management activities such as standard arthropod and feral animal/vertebrate surveillance and inspections, sanitation, personal protective measures, and habitat modification. *Add additional information if necessary, or replace the above if it is not accurate.*		
Supporting Background Information*		*(1) Provide the date that the NCMI IDRA was last accessed for determining the exposure pathway prioritization.* *(2) Describe main concerns, if any. Highlight concerns that have been reported by personnel. Note that details of the threats are to be documented in the OEHSA Survey area within DOEHRS-IH.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*		
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant."		
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily operations."		
Start Date*		*Site-specific. Indicate when the exposures could have first started.*		
Stop Date		See **Section 23.**		
Priority*		See **Section 15.2** for initial pathway creation and **Section 21** for subsequent adjustments.		
Comments		*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*		

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim).
* Field is required by DOEHRS-IH.

16. EXPOSURE PATHWAYS FOR NOISE CONCERNS

16.1 Pathway Choice and Labeling

If the deployment location has one or more areas that generate potentially hazardous noise (defined in last row of table), then one exposure pathway is recommended to cover all the noise-generating workplaces. Exposure pathway #1 represents such a pathway. Example areas that can potentially generate hazardous noise include airfields, flight lines, landing pads, motor pools, equipment maintenance areas, generator farms, weapons firing ranges, and others.

NOTE — Only create such pathways if an IH program is not in place for these workplaces. Refer to **Section 5** for the basis of this recommendation.

If the deployment location has one or more areas that generate potentially hazardous noise (see above), exposures to operational noise should also be evaluated. If the deployment location has an airfield, then exposure pathway #2 is recommended to cover noise exposures near the airfield. Also, it is recommended to create another exposure pathway (#3) to address all non-occupational noise concerns on the camp. Noise-sensitive areas are especially important to address; these include base camp areas for billeting, medical treatment, and worship.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Workplace Noise	Equipment generated noise	Occupational noise	Workplace personnel
2	Ambient Noise (Flightline)	Aircraft and airfield operations	Ambient noise	Airfield area personnel
3	Ambient Noise	Operationally-generated background noise	Ambient noise	All site personnel

HAZARDOUS NOISE is defined in DoDI 6055.12 (DoD 2019) as follows:

- Continuous and intermittent noise (20 to 16,000 hertz (Hz)) at or above 85 decibels A-weighted (dBA) as an 8-hour time-weighted average (TWA).
- Impulse noise sound pressure levels (SPLs) of 140 decibels peak (dBP) sound pressure or greater.
- Ultrasonic noise exposure greater than 10 kilohertz (kHz, One-Third Octave Band Center Frequency).

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

16.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 17** presents guidance for how to prioritize a noise exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

16.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update the noise exposure pathway information using the guidance in **Table 18** (next page).

Table 17. Initial Prioritization Guide for Noise Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Workplace Noise	SLMs nearly always detect hazardous noise levels.	Urgent
	SLMs may routinely detect hazardous noise levels.	High
	SLMs may occasionally detect hazardous noise levels.	Moderate
	Occupational noise may exist but is rare or not a concern.	Low
Ambient Noise or Ambient Noise (Flightline)	SLMs nearly always detect levels considered incompatible with noise-sensitive land uses.	Urgent
	SLMs routinely detect levels considered incompatible with noise-sensitive land uses.	High
	Personnel report annoyance or sleep disturbance from operational noise.	Moderate
	Operational noise may exist but is rare or not a concern.	Low
SLM: sound level meter		

Table 18. Best Practices for Standard Noise Exposure Pathway Information

Form Field		Potentially Hazardous Noise Generating Areas	Noise-Sensitive Areas
Name*		Workplace Noise	*Ambient Noise or Ambient Noise (Flightline)*
Applicable OEHSA Section*		Onsite Industrial Operations or Description of Power Generation (1)	Environmental Noise Sources (2)
Threat Source*	Dropdown*	Equipment-generated noise	*Operational noise sources or aircraft and airfield operations*
	Free text field	*Add unique hazardous noise concerns, if any.*	
Environmental Media*		Air	
Health Hazard*		Occupational Noise	Ambient Noise
Route of Exposure*		Physical	
Description of Affected Personnel*		Workplace personnel	*All site personnel or airfield area personnel*
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see* ***Section 19****.*	
Existing Controls and Protective Measures*		*Site-specific description; describe measures used to control noise exposures.*	
Supporting Background Information*		*(1) Describe the activities that generate the potentially hazardous (or annoying) noise levels.* *(2) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*	
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant."	
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily."	
Start Date*		*Site-specific. Indicate when the exposures could have first started.*	
Stop Date		See **Section 23.**	
Priority*		See **Section 16.2** for initial pathway creation and **Section 21** for subsequent adjustments.	
Comments		*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*	

Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim).
* Field is required by DOEHRS-IH.
1 – Choose one of these sections when creating the pathway in the **Active CSM** area of the DOEHRS-IH Environmental Health Module.
2 – The DOEHRS-IH label of "Environmental Noise Sources" is a misnomer, and there are plans to re-label this section of the survey.

17. EXPOSURE PATHWAYS FOR NONIONIZING RADIATION SOURCES

IMPORTANT: If the deployment location has an active radiation safety program in place, then do not create any of the exposure pathways that are described below. The radiation safety program will document surveys and assessments within the radiation module of DOEHRS-IH.

17.1 Pathway Choice and Labeling

If the deployment location has one or more areas that generate potentially hazardous nonionizing radiation (NIR), defined as hazardous electromagnetic field radiation and/or laser radiation (see definition below), then exposure pathway #1 is recommended to cover all the NIR-generating areas. If one or more areas also generate NIR with laser systems, then those areas should be addressed by exposure pathway #2.

Sources of NIR include radars, radios, satellite communications terminals, electronic countermeasures, lasers (rangefinders, designators, pointers, illuminators, spectrometers, etc.), weapons (dazzlers, high-energy lasers), and high-intensity lamps. Example areas that can potentially generate hazardous NIR include airfields, motor pools, equipment maintenance areas, weapons firing ranges, and laser ranges. Controlled access zones must be established based upon specifications in system manuals.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Electromagnetic Radiation	Electromagnetic radiation generating equipment	Electromagnetic radiation	Workplace personnel
2	Laser Radiation	Laser systems	Laser radiation	Workplace personnel

HAZARDOUS ELECTROMAGNETIC FIELD (EMF) RADIATION is defined in DoDI 6055.11 (DoD 2021a) as follows:

- A level of exposure above the dosimetric reference level (DRL) and/or exposure reference level (ERL) established in the Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1-2345 (IEEE 2014). These protect personnel from electric fields, magnetic fields, EMFs, and contact currents in the frequency range of 0 Hz to 300 Gigahertz (GHz).
- Note that broadband optical exposures are not addressed within DoDI 6055.11. However, DoDI 6055.01 (DoD 2014) instructs the DoD to consider national consensus standards when no DoD or OSHA standard completely covers the workplace hazard. Hazardous broadband optical radiation exposures are currently defined as a level of exposure exceeding the Threshold Limit Values for optical radiation defined by the American Conference of Governmental Industrial Hygienists.

HAZARDOUS LASER RADIATION is defined in DoDI 6055.15 (DoD 2007) as follows:

- A level of laser radiation above the Maximum Permissible Exposure (MPE). The MPE is the level of laser radiation to which a person may be exposed without known hazardous effects or adverse biological changes in the eye or skin per American National Standards Institute (ANSI) Standard Z136.1 (ANSI 2000).

*In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.

17.2 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 19** presents guidance for how to prioritize an NIR exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 19. Initial Prioritization Guide for Nonionizing Radiation Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Electromagnetic Radiation	At least one of the devices has a DANGER label that relates to EMF or broadband optical hazards. (1)	High
	At least one of the devices has a WARNING label that relates to EMF or broadband optical hazards. (1)	Moderate
	The devices in the workplaces only have CAUTION labels that relate to EMF or broadband optical hazards. (1)	Low
Laser Radiation	Laser inventory includes Class 3B or Class 4 laser systems (2)	High
	Laser inventory includes Class 1M, Class 2M, or military-exempt laser systems (2)	Moderate
	Laser inventory includes only Class 1, Class 2, and Class 3R laser systems (2)	Low

Notes:
1 – Electromagnetic radiation exposure pathway priority levels should be established by type of EMF and broad-band optical equipment present at the location. The equipment should already be labeled appropriately, per guidance found in ANSI Z535.2 (ANSI 2011). CAUTION: Sampling or other measurements of EMF or broadband optical hazards should never be attempted outside of a formal radiation safety program or investigation.
2 – Laser radiation exposure pathway priority levels should be established based on the class of laser equipment present at the location. Laser classes are defined by ANSI Z136.1 (re-published in TB MED 524, chapter 4 (DA 2006)). CAUTION: Sampling or other measurements of lasers or potential laser exposures should never be attempted outside of a formal laser safety program or investigation.

EMF: electromagnetic field
MPE: maximum permissible exposure (for laser radiation)
NIR: nonionizing radiation

17.3 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update the NIR exposure pathway information using the guidance in **Table 20**.

Table 20. Best Practices for Standard Nonionizing Radiation Exposure Pathway Information

Exposure Pathway Form Field		Electromagnetic Field Radiation (Workplaces)	Laser Radiation (Workplaces)
Name*		Electromagnetic Field Radiation	Laser Radiation
Applicable OEHSA Section*		Non-ionizing Radiation Sources	
Threat Source*	Dropdown*	EMF-generating equipment	Laser systems
	Free text field	*Add unique threat concerns, if any.*	
Environmental Media*		Other	
Health Hazard*		Electromagnetic fields	Laser radiation
Route of Exposure*		Physical	
Description of Affected Personnel*		*Subpopulation label*	
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see **Section 19**.*	
Existing Controls and Protective Measures*		*Site-specific description of existing physical and administrative controls. Notate the personal protective equipment (PPE) used by personnel working with or near the equipment, or indicate that no PPE is in use.*	
Supporting Background Information*		*(1) Highlight any concerns identified during the site visit and any other concerns that have been reported by site personnel. (2) For workplace exposure pathways, briefly highlight any information about the equipment and systems and their operation that might be relevant for exposure considerations. Note that details of the sources of nonionizing radiation should already have been documented in the OEHSA Survey area within DOEHRS-IH; do not repeat that information here. (3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*	
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant."	
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily operations."	
Start Date*		*Site-specific. Indicate when exposures could have first started.*	
Stop Date		See **Section 23.**	

Exposure Pathway Form Field	Electromagnetic Field Radiation (Workplaces)	Laser Radiation (Workplaces)
Priority*	See **Section 17.2** for initial pathway creation and **Section 21** for subsequent adjustments.	
Comments	*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.*	
Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim). * Field is required by DOEHRS-IH.		

18. EXPOSURE PATHWAYS FOR IONIZING RADIATION SOURCES

18.1 Pathway Choice and Labeling for Devices and Commodities

IMPORTANT: If the deployment location has an active radiation safety program in place, then do not create any of the exposure pathways that are described below. The radiation safety program will document surveys and assessments within the radiation module of DOEHRS-IH.

There are many potential sources of radiation other than direct exposure from a radiation dispersal device (RDD), radiation exposure device (RED), improvised nuclear device (IND), and fallout from a nuclear detonation. These other sources are addressed here and can be divided into four broad categories: natural, industrial, medical, and military commodities.

If the deployment location has one or more areas that use or store ionizing radiation (IR) devices, then one exposure pathway is recommended to cover each of the two types of areas shown by exposure pathways #1 and #2 (next page). Example devices that contain radioactive materials include teletherapy units, diagnostic x-ray systems, level gauges, radiographic systems, and moisture density gauges.

If the deployment location has one or more areas that store military radioactive commodities, then one exposure pathway is recommended (#3) to cover all commodities and areas. Example devices that contain radioactive materials include calibration check sources, chemical agent monitors (CAMs), illuminous dials, and depleted uranium components.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
1	Medical Device Radiation	Commodities/ devices	Ionizing radiation **	All site personnel
2	Industrial Device Radiation	Commodities/ devices	Ionizing radiation **	All site personnel
3	Military Radioactive Commodities	Commodities/ devices	Ionizing radiation **	All site personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** Ionizing radiation takes forms of neutrons, alpha particles, beta particles, gamma rays, or x rays.

18.2 Pathway Choice and Labeling for Natural Radioactive Material

If there are reports of elevated concentrations of naturally occurring radioactive material (NORM) or of the presence of technologically enhanced, naturally occurring radioactive material (TENORM), then an exposure pathway should be established for documenting and assessing exposure. Either pathway #4 or #5 should be created in these cases. There are governmental, scientific, and commercial sources of information on the presence of NORM or TENORM; for example, the NCMI, United Nations Scientific Committee on the Effects of Atomic Radiation, North Atlantic Treaty Organization, open scientific literature, and the American Petroleum Institute.

#	Exposure Pathway Name	Threat Source*	Health Hazards	Exposed Population
4	NORM Radiation	Mining and/or mineral/ petroleum extraction	Ionizing radiation **	All site personnel
5	TENORM Radiation	Mining and/or mineral/ petroleum extraction	Ionizing radiation **	All site personnel

* In DOEHRS-IH, the threat source is rendered using two fields; only the main field is shown here.
** Ionizing radiation takes forms of neutrons, alpha particles, beta particles, gamma rays, or x rays.

18.3 Initial Pathway Priority Level

Refer to **Appendix B** for the priority level definitions and general expectations for exposure pathways linked to each priority level. **Table 21** presents guidance for how to prioritize an ionizing devices and commodities exposure pathway when it is being documented for the first time and the exposure pathway is initially being prioritized.

Table 21. Initial Prioritization Guide for Standard Ionizing Radiation Exposure Pathways

CSM Exposure Pathway	Conditions and Findings	Initial Priority
Medical or Industrial Device Radiation and Military Radioactive Commodities and NORM Radiation and TENORM Radiation	No radiation protection program is in place, or no measurements have yet been taken.	Urgent
	Radiation dose rates could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 cm from the radiation source or 30 cm from any surface that the radiation penetrates.(1)	Urgent
	Radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 cm from the radiation source or from any surface that the radiation penetrates. (2) (4)	High
	Radiation levels could result in an individual receiving a dose equivalent in excess of 0.002 rem (0.02 mSv) in 1 hour at 30 cm from the radiation source or from any surface that the radiation penetrates. (3)	Moderate
	Radiation level does not exceed 0.002 rem (0.02 millisievert) in any one hour. (3)	Low

Notes:
1 – Title 10, Code of Federal Regulations, Part 20 (10 CFR 20): high radiation area
2 – 10 CFR 20: radiation area
3 – 10 CFR 20: public dose rate limit
4 – DoDI 6055.08 (DoD 2021b)

Radiation area: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

cm: centimeter
IR: ionizing radiation
mSv: millisievert
rem: roentgen equivalent man

18.4 Pathway Form Information

The previous subsections present the key, but not all, elements of an exposure pathway. While the key elements help in communicating which pathway is being referred to, the remaining elements of a pathway provide the details necessary for understanding the site-specific situation. It is best practice to describe and update the ionizing devices and commodities exposure pathway information using the guidance found in **Table 22**.

Table 22. Best Practices for Standard Ionizing Radiation Exposure Pathway Information

Form Field		Ionizing Radiation Devices and Commodities	Natural Radioactive Material
Name*		Medical Device Radiation or Industrial Device Radiation or Military Radioactive Commodities	NORM Radiation or TENORM Radiation
Applicable OEHSA Section*		Ionizing Radiation Sources	
Threat Source*	Dropdown*	Commodities/ devices	Mining and/or mineral/ petroleum extraction
	Free text field	*Add unique threat concerns.*	*Add specific threat source(s) that are local to the area.*
Environmental Media*		Other	Other
Health Hazard*		Ionizing radiation	
Route of Exposure*		Inhalation, Ingestion, Physical, Skin Contact, Skin Absorption, Other	
Description of Affected Personnel*		All site personnel	
Number of Affected Personnel		*Add the site-specific number if not classified. If classified, leave blank. If specific individuals will be associated to the pathway, then see* ***Section 19****.*	
Existing Controls and Protective Measures*		*Site-specific description of existing physical and administrative controls. Notate the PPE used by personnel working with or near the source, or indicate that no PPE is in use.*	
Supporting Background Information*		*(1) Describe how, when, and where personnel may be exposed. Highlight any other concerns that may have been reported by personnel.* *(2) For commodity and device exposure pathways, briefly highlight any information about the radiation sources and their operation that might be relevant for exposure considerations. Note that details of the sources of ionizing radiation should already have been documented in the OEHSA Survey area within DOEHRS-IH.* *(3) Record the rationale for the initial priority level and subsequent adjustments. Record when the priority level was changed, and by whom.*	
Duration*		*Site-specific. Under most situations, the best selection will be* "Other/Constant."	
Frequency*		*Site-specific. Under most situations, the best selection will be* "Other/Daily operations."	
Start Date*		*Site-specific. Indicate when the exposures could have first started.*	
Stop Date		See **Section 23.**	
Priority*		See **Section 18.3** for initial pathway creation and **Section 21** for subsequent adjustments.	
Comments		*Add additional notes that need to be documented for the record, such as whether specific individuals have been assigned to the pathway. The rationale for stop-dating should be recorded here. State whether an*	

	associated exposure incident report investigation has been initiated; if so, include the report ID number from the Incident Report module of DOEHRS-IH.
Italicized words should be replaced with location-specific information. Non-italicized words should be used as-is (verbatim). * Field is required by DOEHRS-IH.	

19. ASSIGNING SPECIFIC INDIVIDUALS TO AN EXPOSURE PATHWAY

The majority of exposure pathways do not require specific individuals to be assigned to the pathway. In addition to the "all site personnel" exposure pathways, some deployment locations may also need to include one or more exposure pathways that are associated with a subpopulation and not all site personnel. Most of these will also not require the assignment of specific individuals to the pathway. The association of deployed personnel to specific deployment locations for specified time periods is an assumed activity performed by the enterprise and is outside the scope of this guide. This "enterprise-level association" should link personnel to the relevant exposure pathways that were active at the time they were deployed at that specific location.

Nonetheless, there may be a rare situation where the assignment of specific individuals to an exposure pathway is desired by a unit FHP Officer or commander. Such an action can only be pursued when the population is small enough to manage in a personnel roster for the relevant exposure pathway(s). The specific group should be clearly identifiable (e.g., A Company, 3rd Battalion, 42nd Infantry Division), and a point of contact who can provide the roster of the potentially exposed personnel should be established. Once a roster of individuals is available, then the reachback OEH Surveillance Center can perform the tasks involved with assigning individuals to the pathway within DOEHRS-IH. The task of assigning individuals to an exposure pathway requires a series of relatively complicated steps within DOEHRS-IH and is typically best suited for OEH Surveillance Center personnel in support of the FHP team. OEH Surveillance Center personnel with the User Security Administrator (USA) role can, at their discretion, provide an FHP team user the appropriate system permissions to allow them to make the assignments.

CAUTION: Assigning specific individuals to an exposure pathway is not generally recommended for a number of reasons. The decision to do so should consider that the information to be added will contain personally identifiable information and will force administrative burdens on the FHP team and the supporting OEH Surveillance Center in order to ensure adequate data quality and accuracy of exposure times for each individual. It is highly advisable to coordinate with the reachback OEH Surveillance Center when making the decision to assign specific individuals to an exposure pathway.

20. ACTIVE CSM MAINTENANCE OVER TIME

After the initial OEHSA Survey, the **Active CSM** must be managed over time during the Ongoing Site Exposure Monitoring (OSEM) phase of OEH Site Surveillance. This action involves keeping of all of the exposure pathways and their associated information elements up-to-date. The goal of this maintenance is to ensure that the exposure pathways found in the **Active CSM** at any given time reflect the actual health hazard exposure conditions at the location and provide all of the completed assessments of the exposure conditions. This management should involve collaboration between FHP teams who visit the site and their reachback support elements, most notably their OEH Surveillance Center, if required.

NOTE — For FHP teams residing at the deployment location, “CSM maintenance” may be considered a nearly continuous activity instead of a recurring, event-based activity associated with distinct site visits.

CSM maintenance involves the following activities:

- Perform on-site walk-throughs, and note any conditions that have changed.
- Obtain information from credible sources about site changes. Such information sources can be on-site field sanitation teams, engineers, quartermasters, etc.
- Review Environmental Baseline Surveys (EBSs) and/or Environmental Conditions Reports (ECRs) recently completed by the engineers.
- Review all the exposure pathways within the **Active CSM** for accuracy.
- Record recent risk management actions that have been taken. To do this, use the exposure pathway “existing controls and protective measures” data field.
- Add new exposure pathways if warranted by changed site conditions or if new information is discovered.
- Update documentation for existing exposure pathways as new information about them is generated. This documentation includes—
    - New descriptive information about an exposure pathway.
    - Updated priority levels for any of the exposure pathways (see **Section 21**).
    - New exposure pathway health risk assessments and other assessments (see **Section 22**).
    - Stop-date details for those pathways that are no longer relevant (see **Section 23**).

21. EXPOSURE PATHWAY PRIORITY LEVEL REASSESSMENTS

After setting the initial priority level for an exposure pathway based on guidance found in **Sections 9 through 18**, reassessments of the priority level should be performed on a recurring basis as part of **Active CSM** maintenance (see **Section 20**). Reassessments should be performed when the following situations occur:

- At the start of each new OEHSA Survey.
- If conditions at the deployment location change in a way that adds or removes specific health hazard sources or shifts the timing (e.g., duration and/or frequency) of potential exposures. These changes can impact how much and what kinds of exposure may be occurring within the population, thereby increasing or decreasing health risks. Under such circumstances, a priority level change may then drive how exposure monitoring ought to occur moving forward. An example would be when a significant new air pollution source starts to operate in or very near the deployment location. When this occurs, the Ambient Air exposure pathway's priority level may need to be elevated in order to drive a reconsideration of how Ambient Air exposure monitoring is performed.
- After an Exposure Pathway Health Risk Assessment (EP/HRA). These are described in **Section 22**.

The current priority level should always be shown within DOEHRS-IH. The exposure pathway's "Supporting Background Information" field should include documentation of the rationale for the initial priority level and all subsequent changes, the dates of the changes, and who made the priority level change.

22. EXPOSURE PATHWAY ASSESSMENTS

22.1 General Overview

The frequency of exposure pathway assessments should be based on the pathway's priority level and OSEM data generation plans. The frequency may also be influenced by the specific situation and any surveillance findings. When any kind of assessment of the exposure pathway (such as a health risk assessment or an evaluation of the health hazards most likely present) takes place, that assessment should be documented within DOEHRS-IH in the "Exposure Pathway Assessment" area on the Exposure Pathway detail page. A short summary of the findings of the assessment is required when an assessment is added, as is the ability to upload a document. **Table 23** provides general guidance for completing the short summary.

Table 23. Guidance for Summarizing an Exposure Pathway Assessment in DOEHRS-IH

DOEHRS-IH Field (1)	Guidance
Start Date	Use the beginning date for which the assessment applies. This will be the beginning of the exposure period that is evaluated in the assessment.
End Date	Use the last date associated with the assessment's conclusions. This will be the end of the exposure period that is evaluated in the assessment. The assessment's conclusions can be based on sampling data, model-based predictions, and/or qualitative information reports from the field. Note: This cannot be a date in the future.
Health Hazard Assessed	If the assessment evaluates all potential health hazards associated with the pathway, then use the exact language from the "health hazards" field for the pathway. Otherwise, insert the specific sub-set of those hazards that the particular assessment evaluated by adding them to the pick list. Note: This field is a self-populated pick list specific to the exposure pathway, separate from the Health Hazard list in the exposure pathway. When adding a new Assessment, the Health Hazard from the exposure pathway will populate this list by default and be added to the Health Hazard Assessed pick list if it doesn't already exist.
Executive Summary	Provide a brief summary of the purpose, findings, and largest uncertainties of the assessment. Write the summary for the reader who is not an OEH professional. Note that there is a 4,000-character limit.
Acute/Short-term Risks	Use an appropriate methodology and then, based on the assessment's findings, select one of the choices from the drop-down list: Not Evaluated, None, Low Risk, Medium Risk, High Risk, Extremely High Risk, or Mixed Risk Levels. If the assessment did not include a health risk assessment, then select Not Evaluated. If the assessment addressed multiple exposure time periods and found different levels of risk for them, then select Mixed Risk Levels.
Long-term Risks	Use an appropriate methodology and then, based on the assessment's findings, select one of the choices from the drop-down list: Not Evaluated, None, Low Risk, Medium Risk, High Risk, or Extremely High Risk. If the assessment did not include a health risk assessment, then select Not Evaluated.
Force Health Protection Recommendations	Provide a brief summary of the risk management FHP recommendations from the assessment. Note that there is a 4,000-character limit.
FHP – Force Health Protection 1 – These are the form fields in the Exposure Pathway Assessment form in the Exposure Pathway Detail form.	

22.2 Exposure Pathway Health Risk Assessments (EP/HRAs)

After the **Active CSM** has been established as part of the initial OEHSA Survey, decisions will need to be made as to the exposure pathways from which additional data will be collected during OSEM. The initial priority level assigned to each exposure pathway relates to the importance and urgency of collecting additional information and data for that pathway. Once a decision has been made to generate data for a pathway via sampling or other data generation approaches, a sampling and analysis plan (SAP) or other data collection plan should be developed and executed.

A subsequent health risk assessment (either a screening-level assessment or a formal risk assessment) should then be performed using the generated data. The outcome of this data collection and the associated Exposure Pathway Health Risk Assessment (EP/HRA) will drive the need to reassess the priority level of the associated exposure pathway.

The findings of the EP/HRA determine how to adjust the initial exposure pathway priority level, and documentation of such adjustments should be included in the assessment and captured in the EP detail form field called “Supporting Background Information” (see reference tables within **Sections 9 through 18**). **Table 24** provides guidance for how to adjust the priority level based on an EP/HRA.

It is a best practice to use standard methods to perform assessments. However, specific guidance on how to perform an EP/HRA for a given type of exposure pathway is beyond the scope of this document. The following paragraphs provide general guidance for documentation of EP/HRAs as Exposure Pathway Assessments within DOEHRS-IH.

Each exposure pathway should be assessed with one or more EP/HRAs documented as Exposure Pathway Assessments. Normally, there will be a collection of EP/HRAs produced for any given exposure pathway. This is because they should be produced on a recurring basis, and each may also address different health hazards separately. This collection of risk assessments should cover the entire timeframe of the exposure pathway from its start date through to its stop date, and should do so in a way that collectively addresses all the health hazards of concern within the pathway. In general, the longer an exposure pathway exists through time, the more assessments will be generated and documented within DOEHRS-IH.

Table 24. Adjusting an Exposure Pathway Priority Level Based on a Health Risk Assessment

EP/HRA Findings (1)	Revised Priority Level (2)
Formal HRA	
Extremely High Risk	Urgent Priority (Potential health risk indicates immediate action as soon as possible and assessment with sampling when appropriate and feasible)
High Risk	High Priority (Potential health risk indicates rapid action and assessment with sampling when appropriate and feasible)
Medium Risk	Moderate Priority (Potential health risk indicates routine assessment with sampling when appropriate and feasible)
Low Risk (to include exposures equal to or less than screening levels)	In general: Low Priority (Potential health risk indicates routine assessment without sampling) Required sampling situations: (3) Moderate Priority (Potential health risk indicates routine assessment with sampling when appropriate and feasible)
Screening-level HRA	
Potential exposure is greater than screening-level guidelines	The priority level should be maintained as originally established unless there is qualitative information to justify a priority upgrade or downgrade.
Potential exposure is equal to or less than screening-level guidelines	In general: Low Priority (Potential health risk indicates routine assessment without sampling) Required sampling situations: (3) Moderate Priority (Potential health risk indicates routine assessment with sampling when appropriate and feasible)
Note: In some cases, a health risk assessment may be initiated but not completed due to insufficient data. In these cases, a risk estimate will not be selected until more data are generated. However, a judgment may be made to validate the initial priority level or to alter it. Such a judgment will need to be made on a case-by-case basis and documented in the exposure pathway assessment.	
EP/HRA – Exposure Pathway Health Risk Assessment 1 – In this context, an EP/HRA is either a screening-level assessment or a formal risk assessment. 2 – Refer to **Appendix B** for priority level expectations. 3 – Some exposure pathways always require sampling, such as most water pathways (for example, see **Table 8**). In these cases, the lowest priority level should not be set to Low.	

It is a best practice to ensure that, for any given exposure pathway, the collection of all the risk assessments has the following attributes.

- All time periods are assessed from the exposure pathway's start date through to its stop date.

- All the health hazards associated with the exposure pathway have relevant assessments that cover all time periods. In other words, there should be no time-gaps where hazard exposure occurred (or likely occurred) for which there is no exposure pathway assessment available.

  NOTE — Any given assessment can address all health hazards together, a specific group of hazards, or a single health hazard. What matters is that each hazard of concern is addressed for relevant time periods throughout the life cycle of the exposure pathway.

- For time periods where there is insufficient measurement or modeling data to estimate exposures, the assessment should be qualitative in nature and/or state that the exposure cannot be evaluated and that a health risk determination cannot be made.

- If an assessment that was produced and documented in the past is later found to be deficient or flawed, then another assessment should be produced and documented in the system. The original assessment should not be deleted from DOEHRS-IH.

23. STOP-DATING AN EXPOSURE PATHWAY

The decision to stop-date a valid exposure pathway should be made only under specific conditions as described below. When an exposure pathway is stop-dated, the rationale for that action should be recorded in the exposure pathway's "Comments" field within DOEHRS-IH.

- **Exposure pathway is blocked or eliminated**. If it can be confidently determined that one or more of the six elements of an exposure pathway (see **Section 2.2**) are no longer present or valid, then the exposure pathway should be stop-dated. Not detecting a health hazard is not sufficient evidence to claim that a hazard is not present due to measurement error problems in deployment environments (see bulleted item below). It is important to note that exposure pathways should always be monitored for the presence of new contamination or pollution. However, note that "monitoring" in this context does not necessarily mean continued sampling. The requirement to sample will be a location-specific decision.

- **Undetectable Health Hazards**. It is not generally recommended to stop-date a pathway if the health hazards are undetectable using field measurements or fixed laboratory analytical measurements. The hazards may still be present but not detected due to a measurement error in sampling and/or analytical measurement techniques. For

example, some arthropod vectors and pests are hard to detect using current surveillance techniques but may be present and transmitting diseases or causing injury. In these cases, the priority level of the pathway can be adjusted lower.

- **Changes Related to the Affected Personnel**. Stop-date the pathway if the type of exposed population changes, for example, a change from a subpopulation to "all site personnel." In this situation, a new exposure pathway for the new population should be established. Also, stop-date the pathway if the population no longer interacts with the water or contaminated soil, as this would constitute an "elimination" of the pathway as per the previous bullet. In other words, stop-date if there is no longer an exposure point, that is, a place where exposure happens.

- **Changes to the Threat Source**. The considerations here depend upon the type of exposure pathway.

    - Outdoor Air Pathways. A change in this factor should not influence the decision to stop-date an exposure pathway because the pathway is designed to address all sources of ambient air pollution.

    - Water Pathways. A change in this factor should not influence the decision to stop-date the exposure pathway because water systems should always be monitored for the presence of new contamination.

    - Soil Pathways for Predefined Areas. A change in this factor should not influence the decision to stop-date the exposure pathway because the activity should always be monitored for the presence of new contamination concerns. Predefined areas are those created for Hazardous Materials Areas, Waste Storage and Disposal Areas, Fuel Distribution and Maintenance Areas, and Other Industrial Operations.

    - Soil Pathways for Unique Situations. Stop-date the pathway if the soil contamination has been removed or mitigated (e.g., sequestered, capped, etc.). Unique-situation soil pathways are those created based on the guidance within **Section 14.4**.

    - Workplace Noise Pathways. Stop-date the pathway if the activity generating the noise has ceased operations entirely.

    - Ambient Noise Pathways. Stop-date the pathway if potentially hazardous noise sources no longer exist at the location.

    - Entomology Pathways. A change in this factor should not influence the decision to stop-date the pathway because it is designed to address all vectors and pests.

    - Nonionizing Radiation Pathways. Stop-date the pathway if the NIR equipment and/or systems have been removed from the location.

  - Ionizing Radiation Pathways (commodities/devices). Stop-date the pathway if the IR commodities and/or devices have been removed from the location.

  - Ionizing Radiation Pathways (NORM/TENORM). A change in this factor should not influence the decision to stop-date the exposure pathway because it is generally too difficult to prove that low level exposure is not occurring, even after remediation occurs. This is related to the undetectable hazards factor described above.

- **Changes to the Water System.** Stop-date the water exposure pathway if the water system is shut down and no longer being used by personnel, or if the water system changes significantly, thus requiring a new water system ID number in DOEHRS. Note that as a location matures, the water system(s) at the location will likely mature, also. This will often lead to the need to add a new water system and associated exposure pathway but not necessarily a concomitant need to stop-date the original water system(s). When water system components are added to a water system, but the exposure pathway name for the water system does not need to change based on guidance in **Section 12.1**, the exposure pathway should not be stop-dated. Rather, the water system diagram and sampling plans will need to be updated, as well as the approach taken in the subsequent EP/HRA assessments. Note that exposure pathway stop-dates should align with the water system stop-dates.

- **Seasonal and Timeframe Factors.** It is not generally advisable to stop-date an exposure pathway if there are variations in the presence of the hazards throughout the year. For entomology-related pathways, for example, it is a best practice to not stop-date a pathway due to seasonal variation in pest and vector populations. These populations naturally fluctuate; they may disappear for months but will reappear when temperature, rainfall, or other factors are favorable again.

- **Changes to Location Layout or Land Use Areas (LUAs).** The considerations here depend upon the pathway.

  - Ambient Air Subarea Pathways. Stop-date such pathways if the layout of the deployment location significantly changes in terms of how the ambient air subareas should be delineated. In this situation, one or more new exposure pathways for the areas may need to be established. Note that these types of subarea exposure pathways are not normally expected for most deployment locations.

  - Soil Pathways for Predefined Areas. Stop-date the pathway if the specific activity ends. Predefined areas are those created for Hazardous Materials Areas, Waste Storage and Disposal Areas, Fuel Distribution and Maintenance Areas, and Other Industrial Operations.

- Soil Pathways for Unique Situations. Stop-date the pathway if the LUA associated with the zone of contamination changes. This change may alter either the exposed population or the activities associated with exposure. In this situation, one or more new exposure pathways for the area(s) may need to be established. Note that unique-situation soil pathways are those created based on the guidance within **Section 14.4**.

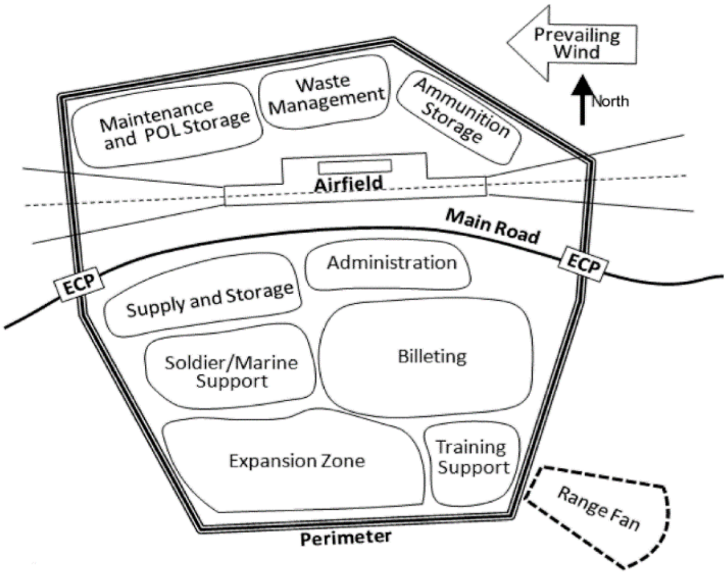
- Workplace Noise Pathways. Stop-date the pathway if all the LUAs that generate potentially hazardous noise cease to operate, and there are no future plans to restart them.

- Ambient Noise Pathways. Stop-date the pathway if all the LUAs that generate potentially hazardous noise cease to operate, and there are no future plans to restart them.

24. DEPLOYMENT LOCATION LAND USE AREAS

Most deployment locations will have a similar set of LUAs within the location. However, the design and layout of the LUAs will be location-specific. For the purpose of OEHSS, LUAs are important because they help to conceptualize where exposures to health hazards might occur, who might be exposed within the LUA, and what activities those personnel are typically performing while within the LUA. This information helps in the assessment of exposure and health risk. **Figure 3** provides a visual understanding of LUAs for a sample Army or Marine Corps base camp. **Figure 4** provides an analogous visual for an understanding of Air Force installation sectors. **Table 25** provides a listing of typical deployment location LUAs. **Table 26** provides guidance on how to associate an LUA to sections during an OEHSA Survey.

[figures on next page]



Legend:

ECP	entry control point	POL	petroleum, oils, and lubricants

Figure 3. Sample Base Camp Layout Showing Land Use Areas

Source: ATP 3-37.10/MC 3-40D.13 (DA 2017)

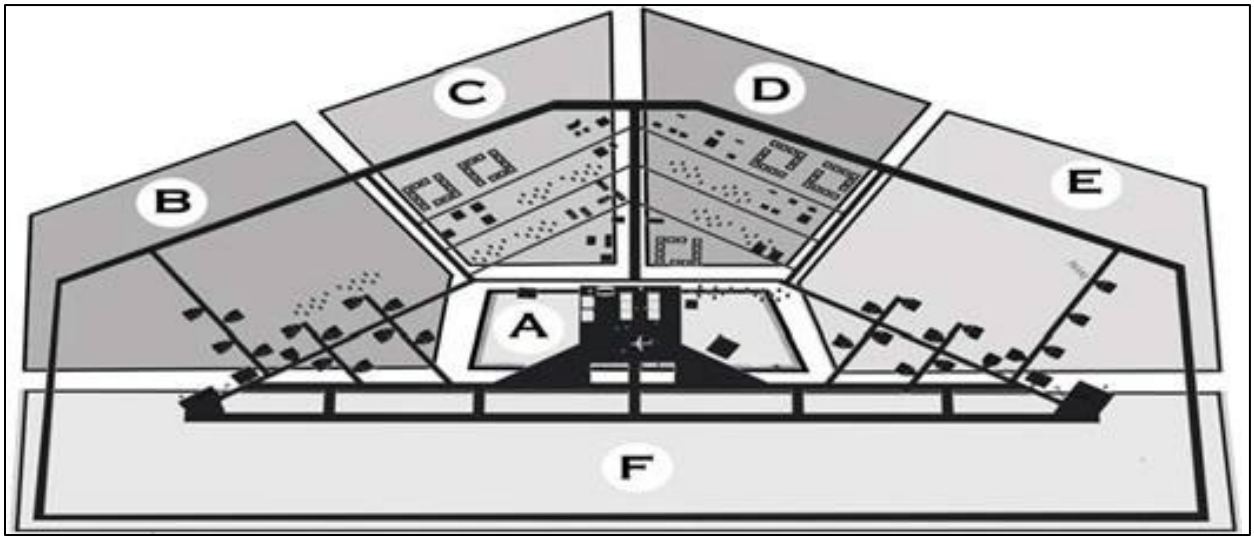


Figure 4. Sample Air Force Installation Sectors or Zones

Source: AFMAN 10-2503 (DAF 2019)

Table 25. Example Base Camp Land Use Areas

Land Use Area Category	Land Use Area Facility Types
Operational	• Airfields • Unmanned aircraft system landing strips • Landing zones
Training support	• Training areas • Weapons-firing ranges
Billeting	• Tent pads, barracks buildings, berthing areas
Administration	• Unit headquarters • Administration buildings • Communication facilities
Personnel support	• Medical treatment facilities (medical, dental, and veterinary services) • Dining facilities • Laundry facilities • Barbershops • Post exchanges and food courts • Morale, welfare, and recreation (MWR) facilities • MWR sports venues and fitness facilities • Chapels • Education centers
Nonhazardous material storage	• Warehouses • Supply storage areas (e.g., construction materials, bulk storage, battery storage, etc.) • Space for the placement of military vans or containers
Hazardous material, hazardous waste	• Petroleum, oil, and lubricant storage areas • Ammunition and explosives storage areas • Hazardous waste accumulation points • Equipment decontamination sites • Compressed gas storage areas
Motor pool/vehicle parking	• Vehicle maintenance facilities • Specific parking areas for nontactical vehicles
Utilities	• Facilities for power and water • Waste management • Latrines and showers • Rights of way or easements (e.g., roads)
Security and defense	• Guard towers/observation posts • Entry control points (ECPs) • Staging areas for response forces with entry and exit points
Note: Land use labels were adapted from ATP 3-37.10/MCRP 3-40D.13 (DA 2017).	

Table 26. Example Base Camp Land Use Areas and Relevant Sections within an OEHSA Survey

OEHSA Survey Section	Relevant Land Use Area (example facilities)
4a. Site Infrastructure – On-site Industrial Operations	Aircraft maintenance area Vehicle maintenance area (motor pool)
4b. Site Infrastructure – Structures	Administration (headquarters, communication facilities) Billeting (tent pads, barracks structures) Warehouse (equipment storage area) Supply storage areas (e.g., bulk storage, battery storage, etc.) Water storage and treatment areas (e.g., water storage farm) Personnel support area (multiple facilities) Personnel support area (gym, sports field)
4c. Site Infrastructure – Roads/Hardstands	Roads Parking areas
4d. Site Infrastructure – Power Generation	Multiple areas (individual or bulk generators)
5a. Hazardous Materials – Petroleum Distribution Points	Petroleum distribution site/point Petroleum, oil, and lubricant (POL) storage area Refueling operations area Pipelines Fuel farm
5b. Hazardous Materials – Hazardous Material Storage/Unidentified Substances (Non-petroleum)	Hazardous waste storage area Hazardous waste accumulation points Ammunition and explosives storage areas Equipment decontamination sites Compressed gas storage areas
6a. Waste Management – Solid Waste	Waste storage and sorting areas Waste composting area
6b. Waste Management – Landfills	Landfill
6c. Waste Management – Incinerators/Burn Pits	Incinerator (solid waste) Incinerator (regulated medical waste) Burn pit Burn box Burn barrel
6d. Waste Management – Waste Water	Latrines, showers, hand-wash stations Laundry facility Multiple areas (wash racks, oil-water separators) Wastewater treatment system or facility Septic drain field Evaporation pond

OEHSA Survey Section	Relevant Land Use Area (example facilities)
14. Other Environmental Health Concerns	All land use areas can be rendered herein; examples include– Operational area (airfield, landing strips/zones) Operational area (Force staging area) Operational area (hot refueling) Training areas Weapons-firing range Operational areas (guard towers, entry control points)

25. TECHNICAL ASSISTANCE

The proponent for this guide is the APHC Risk Assessment Capabilities Branch, the U.S. Navy and Marine Corps Public Health Center (NMCPHC) Expeditionary Platforms Department, and the U.S. Air Force School of Aerospace Medicine (USAFSAM) Occupational and Environmental Health Department. TG 392 was developed in coordination with the Joint Surveillance Assessment and Techniques Subgroup of the Joint Environmental Surveillance Work Group. Numerous SMEs from across the enterprise contributed to the development of the best practices. The expectation is that the best practices will evolve over time as lessons are learned and new situations arise that require the development of new practices.

All OEH Surveillance Centers can provide consultative services related to the implementation and training of the material found in this guide, as well as review and quality control of actual deployment location CSMs.

The points of contact within each of the surveillance centers specific to CSM best practices and exposure pathway guidance are listed below.

APHC:
Environmental Health Risk Assessment Division
Risk Assessment Capabilities Branch
usarmy.apg.medcom-aphc.list.racb@health.mil
DSN 584-2953, Commercial 410-436-2953

NMCPHC:
Expeditionary Platforms Department
usn.hampton-roads.navmcpubhlthcenpors.list.nmcphc-exppltfrmsdpt@mail.mil
DSN 377-0691, Commercial 757-953-0691

USAFSAM:
Environment, Safety, and Occupational Health (ESOH) Service Center
esoh.service.center@us.af.mil
DSN 798-3764, Commercial 937-938-3764

APPENDIX A

REFERENCES

American National Standards Institute (ANSI). 2000. ANSI Standard Z136.1-2000, *Safe Use of Lasers.*
https://www.ansi.org/

ANSI. 2011. ANSI Standard Z535.2-2011, *Environmental and Facility Safety Signs,* Reaffirmed 2017.
https://www.ansi.org/

Australian Capital Territory Government (ACT Government). 2018. *Separation Distance Guidelines for Air Emissions.*
https://files.accesscanberra.act.gov.au/files/air-pollution/Separation-Distance-Guidelines-for-Air-Emissions-Nov+2018+-+FINAL.pdf

California Environmental Protection Agency (CalEPA). California Air Resources Board. 2005. *Air Quality and Land Use Handbook: A Community Health Perspective.*
http://www.aqmd.gov/docs/default-source/ceqa/handbook/california-air-resources-board-air-quality-and-land-use-handbook-a-community-health-perspective.pdf

Code of Federal Regulations, "Standards for Protection against Radiation," Title 10, Part 20 (10 CFR 20).
https://www.govinfo.gov/

Department of the Air Force (DAF). 2019. AFMAN 10-2503, *Operations in a Chemical, Biological, Radiological, and Nuclear (CBRN) Environment.*
https://fas.org/irp/doddir/usaf/afman10-2503.pdf

Department of the Army (DA). 2006. TB MED 524, *Control of Hazards to Health from Laser Radiation.*
https://armypubs.army.mil

DA and Department of the Navy (DN). 2017. ATP 3-37.10/MCRP 3-40D.13, *Base Camps,*
https://armypubs.army.mil

DA, DN, and DAF. 2010. TB MED 577/NAVMED-P-5010-10/AFMAN 48-138_IP, *Sanitary Control and Surveillance of Field Water Supplies.*
https://armypubs.army.mil

DN, DAF, and DA. 2012. NTRP 4-02.9/AFTTP 3-2.82_IP/ATP 4-02.82, *Occupational and Environmental Health Site Assessment.*
http://static.e-publishing.af.mil/production/1/af_sg/publication/afttp3-2.82/afttp3-2.82.pdf

Department of Defense (DoD). 2007. Instruction 6055.15, *DoD Laser Protection Program.* Change 1, August 31, 2018. https://www.esd.whs.mil/DD/

DoD. 2008. Instruction 6055.05, *Occupational and Environmental Health (OEH).* https://www.esd.whs.mil/DD/

Department of Defense (DoD). 2011. Instruction 4715.19, *Use of Open-Air Burn Pits in Contingency Operations,* Change 3, July 3, 2014. https://www.esd.whs.mil/DD/

DoD. 2014. Instruction 6055.01, *DoD Safety and Occupational Health (SOH) Program*, Change 3, April 21, 2021. https://www.eds.whs.mil/DD/

DoD. 2019. Instruction 6055.12, *Hearing Conservation Program (HCP)*. https://www.esd.whs.mil/DD/

DoD. 2021a. Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields*. https://www.esd.whs.mil/DD/

DoD. 2021b. Instruction 6055.08, *Occupational Ionizing Radiation Protection Program*. https://www.esd.whs.mil/DD/

Headquarters, U.S. Central Command (CENTCOM). 2019. Regulation 200-2, *United States Central Command Contingency Environmental Standards.* MacDill Air Force Base, Florida

Institute of Electrical and Electronics Engineers (IEEE). 2014. IEEE Standard C95.1-2345, *Military Workplaces – Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz*. https://www.ieee.org

U.S. Environmental Protection Agency (EPA). 2019a. EPA 600/R-19/188, *Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2019).* https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534

EPA. 2019b. EPA-452/R-19-901, *Wildfire Smoke: A Guide for Public Health Officials*. https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=347791&Lab=NHEERL

APPENDIX B

EXPOSURE PATHWAY PRIORITY LEVELS

All exposure pathways in an **Active CSM** require the establishment of a priority level. The priority of an exposure pathway is based on the judgment of potential health risk posed by health hazards associated with the exposure. The priority level serves as a guide for understanding and communicating a pathway's importance relative to other exposure pathways in determining where, and how quickly, to employ OEH assets and resources, including targeted hazard mitigation.

Table B-1 on the next page defines the four priority levels: Urgent, High, Moderate, and Low. It also provides general expectations for exposure pathways linked to each level. Two important aspects of this framework are that Low priority exposure pathways do not require sampling, and High and Urgent priority exposure pathways should be addressed with a commander's risk acceptance memorandum during each OEHSA Survey iteration.

Table B-1. Conceptual Site Model Exposure Pathway Priority Levels

<table>
<tr><th colspan="2" rowspan="2">Exposure Pathway Priority</th><th colspan="2">Expected Activities</th></tr>
<tr><th>When Initially Prioritizing a Pathway (during the first OEHSA Survey)</th><th>When Subsequently Prioritizing a Pathway (during OSEM activities)</th></tr>
<tr><td>Urgent</td><td>Potential health risk indicates immediate action as soon as possible and assessment with sampling when appropriate and feasible.</td><td rowspan="2">• Recommend risk mitigation actions (e.g., exposure controls and/or access restrictions).
• When appropriate, execute a Rapid-SAP (R-SAP) if equipment is available. Use R-SAP findings to validate or modify the priority level.
• Prepare the commander’s risk acceptance memorandum.*
• Document as indicated in last row.</td><td rowspan="3">• Coordinate the development and execution of an Enhanced-SAP (E-SAP) based on theater priorities.
• Use E-SAP findings to report a health risk estimate and validate or modify the priority level.
• Recommend risk mitigation actions (e.g., exposure controls and/or access restrictions) based on the Commander’s risk guidance.
• Prepare the commander’s risk acceptance memorandum for High and Urgent priority pathways.*</td></tr>
<tr><td>High</td><td>Potential health risk indicates rapid action and assessment with sampling when appropriate and feasible.</td></tr>
<tr><td>Moderate</td><td>Potential health risk indicates routine assessment with sampling when appropriate and feasible.</td><td>• When appropriate, execute a Rapid-SAP if equipment is available. Use R-SAP findings to validate or modify the priority level.
• Document as indicated in last row.</td></tr>
<tr><td>Low</td><td>Potential health risk indicates routine assessment without sampling.</td><td>• Document the exposure concern and include the pathway within the CSM.</td><td>• Qualitatively monitor conditions, and revise the exposure pathway information and priority level as appropriate.</td></tr>
<tr><td colspan="4">OEHSA: Occupational and Environmental Health Site Assessment Survey
OSEM: Ongoing Site Exposure Monitoring (i.e., data generation and health risk assessments)
CSM: Conceptual Site Model
SAP: Sampling and Analysis Plan</td></tr>
<tr><td colspan="4">* Commander’s risk acceptance memoranda should be documented with each iteration of an OEHSA Survey.</td></tr>
</table>

GLOSSARY

Acronyms/Abbreviations

ACGIH
American Conference of Governmental Industrial Hygienists

ACT Government
Australian Capital Territory Government

AFMAN
Air Force Manual

AFTTP
Air Force Tactics, Techniques, and Procedures

ANSI
American National Standards Institute

APHC
U.S. Army Public Health Center

ATP
Army Techniques Publication

CalEPA
California Environmental Protection Agency

CBRN
Chemical, Biological, Radiological, and Nuclear

CCMD
Combatant Command

CCR
U.S. Central Command Regulation

CENTCOM
U.S. Central Command

CFR
U.S. Code of Federal Regulations

Cm
Centimeter(s)

CSM
Conceptual Site Model

DA
Department of the Army

DAF
Department of the Air Force

dB
Decibel(s)

DN
Department of the Navy

DoD
Department of Defense

DoDI
Department of Defense Instruction

DOEHRS-IH
Defense Occupational and Environmental Health Readiness System—Industrial Hygiene

DRL
Dosimetric reference level

ECP
Entry Control Point

EH
Environmental Health

EMF
Electromagnetic field

EP
Exposure Pathway

EPA
U.S. Environmental Protection Agency

EP/HRA
Exposure Pathways Health Risk Assessment

ERL
Exposure reference level

E-SAP
Enhanced Sampling and Analysis Plan

FHP
Force Health Protection

HazMat
Hazardous Material

HRA
Health Risk Assessment

Hz
Hertz

ID
Identification Number

IDRA
Infectious Disease Risk Assessment

IEEE
Institute of Electrical and Electronics Engineers

IH
Industrial hygiene

IR
Ionizing radiation

LTP
Long-term potability

LUA
Land use area

MCRP
Marine Corps Reference Publication

MPE
Maximum permissible exposure

mSv
Millisievert

MWR
Morale, Welfare, and Recreation

NAVMED
Bureau of Medicine and Surgery (U.S. Navy)

NCMI
National Center for Medical Intelligence

NIR
Nonionizing radiation

NMCPHC
Navy and Marine Corps Public Health Center

NORM
Naturally Occurring Radioactive Material

NTRP
Navy Technical Reference Publication

OEH
Occupational and Environmental Health

OEHSA
Occupational and Environmental Health Site Assessment Survey

OEHSS
Occupational and Environmental Health Site Surveillance

OSEM
Ongoing Site Exposure Monitoring

PM
Preventive Medicine

POL
Petroleum, oil, and lubricant

PPE
Personal protective equipment

QA
Quality assurance

rem
Roentgen equivalent man

R-SAP
Rapid Sampling and Analysis Plan

SAP
Sampling and Analysis Plan

SLM
Sound level meter

SME
Subject matter expert

SPL
Sound pressure level

STP
Short-term potability

TB MED
Technical Bulletin, Medical

TENORM
Technologically Enhanced Naturally Occurring Radioactive Material

TG
Technical Guide

TWA
Time-weighted average

U.S.
United States of America

USA
User Security Administrator (DOEHRS-IH)

USAFSAM
U.S. Air Force School of Aerospace Medicine

VS
Veterinary Services

Terms

Conceptual site model (CSM). A graphical, pictorial, and/or tabular depiction of what is known about a site in terms of what, where, when, why, to whom, and how exposures to environmental health hazards may or may not occur. The CSM serves as the blueprint for understanding the situation, designing surveillance and sampling plans, identifying at-risk populations, describing health risks, and prioritizing risk management actions to control unacceptable risks. A CSM represents the compilation of all the exposure scenarios and their exposure pathways that are associated with a site. (Source: this document)

Exposure medium. As an element of an exposure pathway, an exposure medium is the part of the physical environment containing a health hazard with which humans come into contact. Examples include water, soil, air, surfaces, and biological fluids. (Source: this document)

Exposure pathway. A description of how exposure occurs from health hazard release from a source into the environment, is transported through environment within one or more environmental media (air, water, soil, surfaces, etc.), the routes of human exposure (e.g., inhalation, ingestion, skin contact, etc.), and where and when specific personnel come into contact with the hazard (e.g., a specific cohort exposed at the same time or in a similar way as compared). There are six components of an exposure pathway, each of which must be present in order for an actual exposure to occur: (1) source, (2) health hazard, (3) exposure point, (4) exposure medium, (5) route of exposure, and (6) co-occurrence in time with a population-at-risk. (Source: this document)

> Note: Within DOEHRS-IH, it is a best practice to manage information, data, and monitoring activities related to exposure pathways in a way that bundles highly related known and potential exposure pathways into a single pathway referred to as a "DOEHRS Exposure Pathway."

Exposure point. As an element of an exposure pathway, an exposure point is the geospatial location or where a population-at-risk comes into contact with an exposure medium containing a health hazard. (Source: this document)

Health hazard. As an element of an exposure pathway, a health hazard is a chemical or radiological substance, microbiological organism or toxin, or physical condition (e.g., heat, noise) that has the potential to cause adverse health effects within the human body. (Source: this document)

Health risk assessment. A scientific/analytic process used to estimate risk by synthesizing available information to identify sources of OEH threats at a site, identify the health hazards associated with each threat source, identify populations at risk, guide data collection

requirements and plans, describe the magnitude and timing of population exposures, describe the kinds of health effects caused by the exposure, and characterize the risk information in order to effectively communicate to commanders and stakeholders. (Source: this document)

Occupational and environmental health (OEH) site assessment. An FHP survey that formally documents the OEH conditions at a basing location. These surveys are typically updated annually and/or with the rotations of deployed FHP teams into and out of the Area of Operations. (Source: NTRP 4-02.9)

Occupational and environmental health (OEH) site surveillance. OEH surveillance focuses upon health hazards and exposures at a specific military basing site in the operational environment (e.g., base camp, forward operating base). It structures and facilitates exposure monitoring, health risk assessment, and risk management activities at these sites. The OEHSS process is iterative and educates FHP personnel about site environmental conditions, documents those conditions, identifies potential OEH threats and associated specific health hazards, includes OEH data collection and archiving activities and health risk assessments, and documents immediate risk mitigation actions. (Source: this document)

Ongoing site exposure monitoring (OSEM). The collection of OEH monitoring and assessment activities performed for a basing location that includes regular site visits, conceptual site model adjustments, sampling and analysis plans, field sampling, sample shipment, laboratory analyses, health risk assessments, and associated documentation. OSEM activities, which include OEH status briefings, occur between each recurring OEHSA Survey. (Source: this document)

Population-at-risk. As an element of an exposure pathway, this is a group of individuals who are or may be exposed to a health hazard via one or more routes of exposure. (Source: this document)

Route of exposure. As an element of an exposure pathway, an exposure route is the mode by which a health hazard enters or interacts with the human body. Example routes of exposure include, but are not limited to, inhalation of air; ingestion of water or soil; skin contact with water, soil, or air; ocular (eye) contact; puncture wound; physical entry (as for radiation or noise). (Source: this document)

Source. As an element of an exposure pathway, a source, often referred to as a threat source, is traditionally defined as the origin of a health hazard that is released into the environment. Example sources include a field of buried drums, burn pit, bulk chemical storage, incinerator, radio-frequency emitters, fugitive emission from off-site industries, on-site sanding/painting operations, and a transportation route. Sometimes, the source of a hazard will be unknown or not fully specified, such as river water that has been contaminated by multiple upstream sources. Therefore, FHP personnel do not always need to define the source back to the original contaminant release to the environment, but rather can use the source local to the point of exposure as the start of the exposure pathway. (Source: this document)