7. Ecological Risk Assessment

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FIGURES

TABLES

7. ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) for WAG 5 represents the second phase of the INEEL ERA process detailed on Figure 7-1. The ERA results provide a site-by-site evaluation of the potential risks to INEEL ecological resources as a result of exposure to radiological and nonradiological contaminants at the WAG level.

An ecological site screening, which is a preassessment or data-gap analysis performed at the WAG level, is performed as the first phase in the ERA process. The screening reduces the number of sites and contaminants addressed in subsequent assessments. Screening is used only as a preassessment tool to (1) better define the extent and nature of individual WAG sites of contamination and identify sites at which no COPCs are found, (2) reduce the number of COPCs addressed in the WAG ERA by eliminating those that clearly pose a low likelihood for risk, (3) identify sites for which further data must be collected, and (4) identify other data gaps. The screening also supports problem formulation and the determination of the media and pathways to be evaluated for WAG ERA assessments. The results of the WAG 5 screening and data gaps analysis are reported in the WAG 5 RI/FS Work Plan (DOE-ID 1997).

The ERA is the second phase in the INEEL ERA process, and provides a site-by-site evaluation of the risks to ecological resources as a result of exposure to radiological and nonradiological contaminants at the WAG level. The assessment was performed using the same basic methodology developed in the *Guidance Manual for Conducting Screening-level Ecological Risk Assessments at the INEL* (VanHorn, Hampton, and Morris 1995). The ERA incorporates a preliminary COPC screening step to eliminate COPCs for which concentrations do not exceed INEEL background and site specific ecologically-based screening levels. The purpose of this step is to further refine sites and contaminants identified in the first phase screening (see Section 7.2.6). The resulting sites and contaminants, in addition to those sites for which inadequate sampling information is available, were analyzed in the WAG ERA. The results of the WAG 5 ERA will be integrated with similar assessments for other INEEL WAGs to support the performance of the OU 10-04 RI/FS (Phase 3). The fourth phase of the process includes the Record of Decision (ROD) and Remedial Decision/Remedial Action (RD/RA) processes under OU 10-04. The four-phased ERA process is discussed in further detail in Section 7.5.

7.1 Objectives

The WAG 5 ERA is performed to achieve the following objectives:

- To determine the potential for adverse effects from site-related contaminants on ecological receptors, including protected wildlife species at the WAG level
- To identify sites and COPCs to be assessed in the INEEL-wide ERA
- To provide input to the data gap analysis for the INEEL-wide ERA.

The INEEL approach for ERAs was specifically designed to follow the direction provided by the EPA *Framework for Ecological Risk Assessment* (EPA 1992) and more recent EPA guidelines (EPA 1996). The EPA approach divides the ERA process into three steps: problem formulation, analysis, and risk characterization.

The goal of the problem formulation step is to investigate the interactions between the stressor characteristics, the ecosystem potentially at risk, and the ecological effects (EPA 1992). The

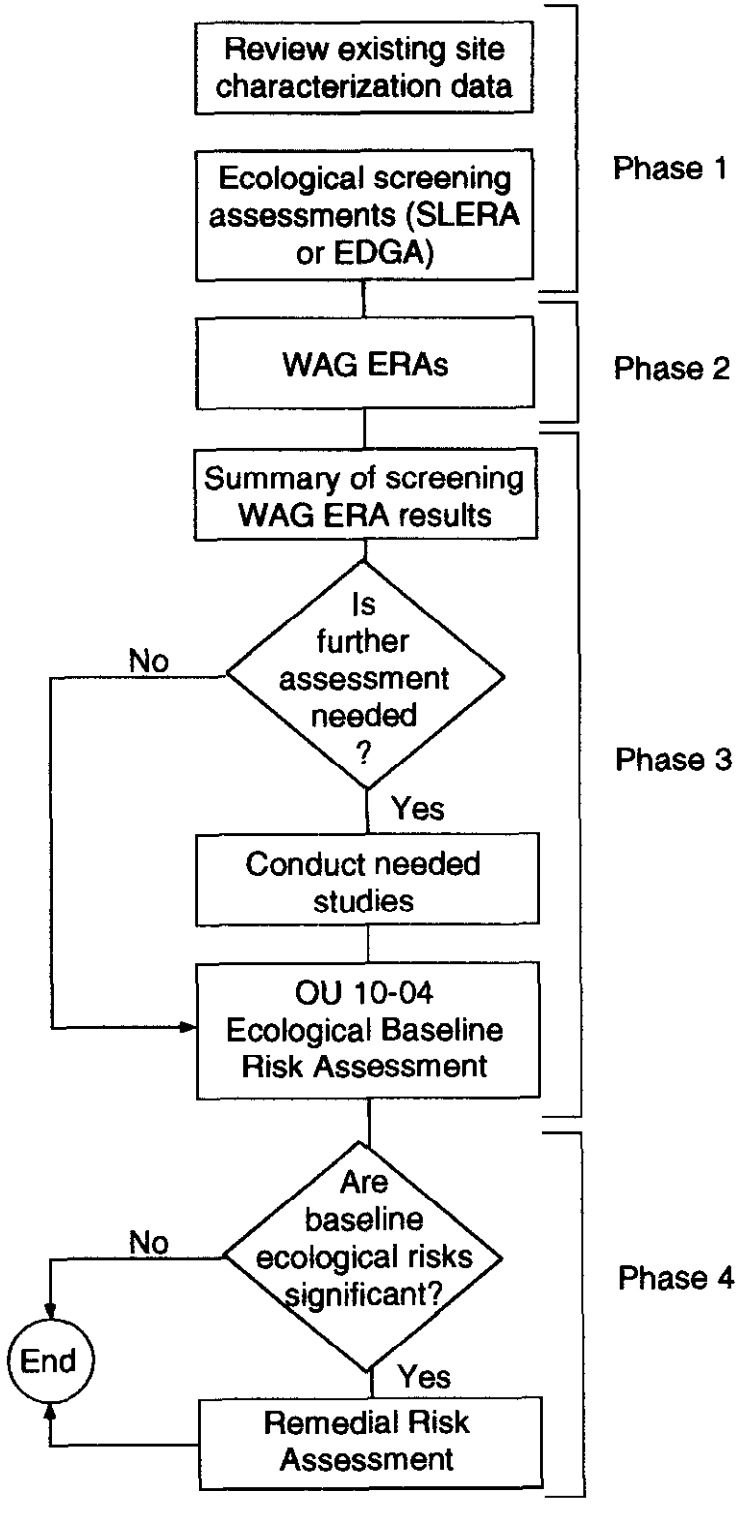

Figure 7-1. Four-phased approach to the INEEL ecological risk assessment.

contaminants, the definition of assessment and measurement endpoints, and the ecological effects will be used to analyze risk using the conceptual site model (CSM). This step of the assessment is presented in Section 7.2.

In the analysis step, the likelihood and significance of an adverse reaction from exposure to stressors were evaluated. The exposure assessment involves relating contaminant migration to exposure pathways for ecological receptors. The behavior and fate of the COPCs in the terrestrial environment were presented in a general manner because no formal fate and transport modeling was conducted for the WAG ERA. The ecological effects assessment consisted of a hazard evaluation and a dose-response assessment. The hazard evaluation involved a comprehensive review of toxicity data for contaminants to identify the nature and severity of toxic properties. The dose from multiple media (surface and subsurface soil and surface water) identified at the INEEL was developed and used to assess the potential risk to receptors. Because no dose-based toxicological criteria exist for ecological receptors, it was necessary to develop appropriate toxicity reference values (TRVs) for the contaminants and functional groups at the INEEL. A quantitative analysis was used, augmented by qualitative information and professional judgment as necessary. This step of the assessment is presented in Section 7.3.

The risk-characterization step has two primary elements (EPA 1992, 1996). The first element is the development of an indication of the likelihood of adverse effects to ecological receptors. The second element is the presentation of the assessment results in a form that serves as input to the risk management process. To determine whether any risk is indicated from the contaminant concentrations, exposure parameters were used to calculate the exposure dose for key functional groups and individual species, including threatened or endangered (T/E) species and other "species of concern" (see Section 7.2.4.3). Hazard quotients (HQs) were then calculated for WAG 5 receptors by dividing the calculated dose by the TRVs. The HQs then were used as indicators of the potential for adverse effects. The risk characterization section of the WAG 5 ERA is presented in Section 7.4.

7.1.1 Statutory and Regulatory Basis

The widespread application of ERAs to hazardous waste site investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (as amended by the Superfund Amendments and Reauthorization Act of 1986) (42 USC § 9601 et seq.) began recently. In December 1988, the EPA began requiring the performance of "thorough and consistent" ecological assessments at all Superfund sites (EPA 1988a). This directive was based on the language in CERCLA and other statutes, which required remediation of hazardous waste sites to protect human health and the environment. The NCP requires that baseline risk assessments characterize current and potential threats to human health and the environment [40 CFR 300.430(d)(4)], and specifies that environmental risk evaluations "assess threats to the environment, especially sensitive habitats and critical habitats of species protected under the Endangered Species Act" [40 CFR 300.430(e)(2)(1)(G)].

Section 121(d)(A) of CERCLA requires that Superfund remedial actions meet federal and state standards, requirements, criteria, and limitations that "are applicable or relevant and appropriate requirements (ARARs)." Applicable or relevant and appropriate requirements are substantive environmental protection requirements promulgated under federal or state laws that, while not legally applicable to the circumstances at a site or facility, address situations sufficiently similar so that their use is well suited to the particular site. The ARARs that are applicable to the WAG 5 ERA are listed in Table 7-1. A further discussion of ARARs is included in the INEEL ERA guidance manual (VanHorn, Hampton, and Morris 1995).

In 1994, DOE published guidance to DOE staff and contractor personnel for incorporating ecological risk assessment into RI/FS work plans and remediation planning and decision making at CERCLA sites (DOE 1994).

Compliance with ARARs is a threshold requirement that a remedial or restoration activity must meet to be eligible for selection as a remedy. ARARs are chemical-, action-, or location-specific, depending on whether the requirement is triggered by the presence or emission of a chemical, a particular action, or a vulnerable or protected location. A list of the definitions of these ARARs follows:

- Chemical-specific: Risk-based numerical values or methodologies that establish an acceptable amount of concentration of a contaminant in the ambient environment
- Action-specific: Technology- or activity-based requirements for remedial or restoration actions
- Location-specific: Restrictions placed on the concentration of hazardous substances or the conduct of activity at a given location.

In the absence of promulgated ecological risk-based criteria for soil contaminants, only location-specific ARARs are applicable to the WAG 5 ERA.

The WAG 5 ERA addresses issues related to all ARARs listed for WAG 5 in Table 7-1, as well as the Wetlands Conservation Act (16 USC 4404). The act is included because wetland habitat at some WAG facilities has appeared on INEEL maps as part of the Fish and Wildlife National Wetlands Inventory (Hampton et al. 1995). These areas generally include waste ponds that are generated solely by facility activities. Preliminary surveys indicate that most do not meet formal wetland classification criteria (ACOE 1987).

However, if future evaluation indicates that the ponds meet formal designation criteria, they will be evaluated based on ARAR considerations. Threatened, endangered, and other species of concern protected by ARARs are discussed in Section 7.2.4.

Table 7-1. Applicable or relevant and appropriate requirements for the WAG 5 ERA.

Requirement	Authority	Trigger
Endangered Species Act	16 U.S. Code 1531 through 1543	Location specific
Threatened Fish and Wildlife	50 CFR Part 227	Location specific
Endangered Fish and Wildlife	50 CFR Part 222	Location specific
Migratory Bird Conservation	16 U.S. Code 715	Location specific
Migratory Bird Treaty Act	16 U.S. Code 703	Location specific
Protection of Bald and Golden Eagles Act	16 U.S. Code 668	Location specific
Idaho Fish and Wildlife Act (Preservation of Fishery Resources)	16 U.S. Code 756 and 757	Location specific
Wetlands Conservation Act	16 U.S. Code 4404	Location specific

7.2 Problem Formulation

The goal of the problem-formulation step of the ERA is to investigate the interactions between the stressor characteristics, the ecosystem potentially at risk, and the ecological effects (EPA 1992). The problem-formulation process begins with a general description of the sites and previous investigations and a characterization of the ecosystem at risk. Next, the potential stressors to the ecosystem are identified, the migration pathways of the identified stressors are modeled, and the potentially affected components of the ecosystem are identified. The ecosystem at risk and the identified stressors with exposure pathways are then integrated to develop the CSM. The problem-formulation step results in the characterization of stressors (i.e., the identification of the COPCs), the definition of the assessment endpoints, and pathway and exposure models that are used to analyze risk using the CSM. The primary elements of the problem-formulation step for the WAG ERA are described in the following sections.

7.2.1 Overview of WAG 5

The ARA facilities (ARA-I, -II, -III, and -IV) were constructed in the 1950s to support the Army Nuclear Program. The Army program was phased out, and the group of facilities became the ARA in 1965. Since then, all reactors have been removed or dismantled. From 1966 to 1989, work at the ARA included a variety of technical support services for INEEL research and development programs that included the metallurgy laboratory, the instrument development laboratory, and the hot cell facility. The ARA has been operationally inactive since 1989. Decontamination and dismantlement has been under way at the ARA facilities for some time. Most structures have been razed, and many of the sites no longer exist.

The PBF area once was the site of the SPERT program and comprises five separate facilities. The SPERT-area facilities were constructed in the late 1950s for experiments involving reactor transient behavior and safety. All SPERT reactors have been removed, and most of the facilities underwent partial or complete D&D. The SPERT experiments ended in 1970. In 1972, the area was converted to PBF. The PBF Reactor was constructed just north of the old SPERT-I facility, and the control area was converted to support the Thermal Fuel Behavior Program. The program examined pressurized water reactor fuel rods under normal and off-normal operating conditions and hypothetical reactor accidents. The program was completed in 1985, and the reactor was placed on standby.

Information gathered during the WAG 5 RI/FS, along with documents from previous WAG 5 investigations (including Track 1, Track 2, Interim Action, and RI documents), were used to guide the comprehensive RI/FS. During the comprehensive WAG 5 investigation, information from previous WAG 5 investigations was assembled, and unevaluated sites were cumulatively and comprehensively investigated to assess the overall risk posed by WAG 5.

7.2.2 Sites of Concern

Sites identified in the FFA/CO (DOE-ID 1991) initially were eliminated from further evaluation in the WAG 5 ERA data gap analysis based on (1) whether the site was uncontaminated (the site contained no contamination source to the environment) or (2) no pathway from the contaminants to ecological receptors existed. All sites at WAG 5 were reviewed in the initial ecological site screening and data-gap identification (DOE-ID 1997, Section 3.2.4) for possible elimination from evaluation in the WAG 5 ERA. Justifications for eliminating sites from further evaluation in the WAG 5 ERA are provided in Table 7-2.

Table 7-2. WAG 5 ecological site screening.

OU	Site	Description	Track[a]	Screening Result[b]	Justification
ARA-I					
5-10	ARA-01	Chemical evaporation pond (ARA-745)	RI/FS	X	
5-07	ARA-02	Sanitary waste leach field and seepage pit (ARA-746)	T2	X	
5-07	ARA-03	Pad near ARA-627 (lead sheeting)	T2	X	
—	ARA-04	Sewage Treatment Facility (ARA-737)	NA		The site received only sanitary waste. There was no evidence of the site receiving hazardous waste. No contamination source was found.
5-01	ARA-05	Evaporation pond to NE (ARA-744)	T1		No waste was generated or disposed of at the site. It received parking lot runoff only.
5-01	ARA-16	Radionuclide tank (ARA-729)	T1	X	
5-01	ARA-17	Drain (ARA-626)	T1		There was no history of hazardous waste being disposed of in the drain. No contamination source was found.
5-12	ARA-25	ARA-1 soils beneath the ARA-626 Hot Cells	New site	X	
ARA-II					
5-05	ARA-06	SL-1 Burial Ground	RI/FS		The site has been capped.
—	ARA-07	Seepage pit to east (ARA-720A)	NA		There was no evidence of hazardous waste entering the system. No contamination source was found.
—	ARA-08	Seepage pit to west (ARA-720B)	NA		There was no evidence of hazardous waste entering this system. No contamination source was found.
—	ARA-09	Septic tank (ARA-738)	NA		The site received only sanitary waste. There was no evidence of hazardous waste. No contamination source was found.
—	ARA-10	Septic tank east (ARA-613)	NA	X	
—	ARA-11	Septic tank west (ARA-606)	NA		The site received only sanitary waste. There was no evidence of hazardous waste. No contamination source was found.
5-01	ARA-19	Detention tank for fuel oil/radionuclides (ARA-719)	T1		The tank was removed, and residual soils were assessed under the comprehensive WAG 5 RI/FS, ARA-23.
5-12	ARA-23	Radiologically contaminated surface soils around ARA-I, II	T1	X	

Table 7-2. (continued).

OU	Site	Description	Track[a]	Screening Result[b]	Justification
ARA-III					
5-06	ARA-12	Radioactive waste leach pond	T2	X	
5-11	ARA-13	Sanitary sewer leach field and septic tank (ARA-740)	T1		Soil sampling indicated no above-background contamination. No contamination source was found.
—	ARA-14	Septic tank and drain field (ARA-739)	NA		There was no evidence of the site receiving hazardous waste. No contamination source was found.
5-01	ARA-15	Radionuclide tank (ARA-735)	T1		The tank and any contaminated soil were removed. No contamination source was found.
5-01	ARA-18	Radionuclide tank (ARA-736)	T1		The tank and any contaminated soil were removed. No contamination source was found.
5-12	ARA-24	ARA-III windblown soils	T1	X	
ARA-IV					
5-06	ARA-20	Test Area contaminated leach Pit 1	T2		The pit is constructed of reinforced concrete to a depth of 5 m (16 ft) with a metal manhole cover. The pit was cleaned up to below acceptable risk-based levels as part of a 1987 D&D effort. Neither a contaminant pathway nor a source was found.
—	ARA-21	Test Area septic tank and leach Pit 2	NA		There was no evidence of the site receiving hazardous waste. No contaminant source was found.
—	ARA-22	Control area septic tank and leach Pit 3 (ARA-617)	NA		There was no record that the site received hazardous constituents. No contaminant source was found.
PBF Control Area					
—	PBF-01	Control area septic tank (PBF-724), seepage pit (PBF-735)	NA		There was no evidence that the site received hazardous constituents. No contaminant source was found.
—	PBF-02	Control area septic tanks (PBF-738, 739), seepage pit (PBF-736)	NA		There was no evidence that the site received hazardous constituents. No contaminant source was found.
—	PBF-03	Control area septic tank for PBF-632 and seepage pits (PBF-745, 748)	NA		There was no evidence that the site received hazardous waste. No contaminant source was found.
5-04	PBF-04	Control area oil tank at PBF-608 (substation) outside PBF fence	T1	X	
5-12	PBF-32	Fuel oil tank (PBF-742)	T1		All remaining contamination at basalt bedrock is at a depth greater than 3 m (10 ft). No contaminant pathway was found.

Table 7-2. (continued).

OU	Site	Description	Track[a]	Screening Result[b]	Justification
PBF Reactor Area (SPERT-I)					
5-08	PBF-05	Warm waste injection well (PBF-301)	T2		The well has a steel casement to a 33.5-m (110-ft) depth. No contaminant pathway was found.
5-03	PBF-06	Blowdown pit for reactor boiler by PBF-621	T1		The pipe from the reactor boiler emptied into the ditch. There was no evidence of hazardous contaminants entering the ditch. No contaminant source was found.
5-03	PBF-07	Oil drum storage (PER-T13)	T1		The drums were formerly stored on a concrete pad. Neither a contaminant source nor a pathway was found.
5-13	PBF-08	Corrosive waste disposal sump brine tank (PBF-731)	IA		An unlined concrete sump extends 5.5 m (18 ft) below ground surface. No contaminant pathway was found.
—	PBF-09	Septic tank and drain field (PBF-728)	NA		There was no evidence that the site received hazardous waste. No contaminant source was found.
5-13	PBF-10	Evaporation pond (PBF-733)	IA	X	
5-08	PBF-11	Seepage pit (PBF-750)	T2		No contaminants were found in concentrations greater than ecologically based screening levels (EBSLs). See EGG-ER-11428 summary report. No contamination source was found.
5-02	PBF-12	Leach pond	T1	X	
5-03	PBF-13	Rubble pit	T1		The site contained construction debris only. The area was cleaned up and backfilled. No contaminant source was found.
5-08	PBF-15	Corrosive waste injection well (PBF-302)	T2		The well has a metal surface pipe, plastic casing, and a 33.4-m (116-ft) depth. No contaminant pathway was found.
5-03	PBF-28	Cooling tower area and drainage ditch	T1		The site received cooling tower effluent only. No contaminant source was found.
5-12	PBF-30	Abandoned septic system	T1		There was no evidence of hazardous constituents being disposed of into the system. No contaminant source was found.
PBF-WEDF (SPERT-II)					
5-04	PBF-14	Inactive fuel oil tank (front of PBF-612)	T1		The contaminated soil was removed when tank was removed. No contaminant source was found.
5-09	PBF-16	Leach pond	T2	X	
—	PBF-17	Septic tank and seepage pit (PBF-725)	NA		The site received only sanitary waste. There was no evidence of hazardous waste. No contaminant source was found.
5-12	PBF-31	Fuel oil tank (PBF-732)	T1		All remaining contamination was at basalt bedrock at a depth greater than 3 m (10 ft). No contaminant pathway was found.

Table 7-2. (continued).

OU	Site	Description	Track[a]	Screening Result[b]	Justification
PBF-WERF (SPERT-III)					
5-04	PBF-19	Inactive fuel oil tank at PBF-609 (west side of WERF)	T1		The contaminated soil was removed when tank was removed in 1986, and the area was paved over. No contaminant source or pathway was found.
5-09	PBF-20	Small leach pond	T2		Soil sampling indicated no contamination above EBSLs. See Hillman-Mason et al. 1994. No contaminant source was found.
5-02	PBF-21	Large leach pond	T1	X	
—	PBF-27	Septic tank (PBF-726) and seepage pit	NA		
—	PBF-29	PBF reactor area abandoned fuel oil tank	T1		No action. No contaminant source was found.
PBF-MWSF (SPERT-IV)					
5-09	PBF-22	Leach pond (PBF-758)	T2	X	
5-03	PBF-24	Blowdown pit (adjacent to PBF-716)	T1		There was no history of hazardous constituents being disposed of into the pit. No contaminant source was found.
—	PBF-25	Septic tank and leach pit (PBF-727 and 757)	NA		The site received only sanitary waste. There was no evidence of hazardous waste. No contaminant source was found.
5-02	PBF-26	Lake (adjacent to PBF-758)	T1	X	

a. The stages in the CERCLA process are as follows:
NA = No Action; an initial investigation determined that a site was uncontaminated and no source was present.
T1 = a Track 1 investigation;
T2 = a Track 2 investigation;
IA = Interim Action.
RI/FS = remedial investigation/feasibility study

b. Sites marked with "X" were not screened out and were retained for evaluation in the WAG 5 ERA.

The final list of sites of concern included in the ERA analysis is presented in Table 7-3. A list of the COPCs identified at each site and a brief description and the size of each site are provided in the table. Sixteen sites were retained for analysis in the WAG 5 ERA. The locations of the individual sites at WAG 5 facilities are illustrated in Figures 2-5 and 2-6 in Section 2. More detailed descriptions of the sites of concern are presented in Sections 3 and 4.

7.2.3 Ecosystem Characterization

The INEEL is located in a cool desert ecosystem characterized by shrub-steppe vegetative communities typical of the northern Great Basin and Columbia Plateau region. The surface of INEEL is relatively flat with several prominent volcanic buttes and numerous basalt flows that provide important habitat for small and large mammals, reptiles, and some raptors. The shrub-steppe communities are dominated by sagebrush *(Artemisia* spp.) and provide habitat for sagebrush community species such as sage grouse *(Centrocercus urophasianus),* pronghorn antelope *(Antilocapra americana),* and sage sparrows *(Amphispiza belli).* Other communities include rabbitbrush *(Chrysothamnus* spp.), grasses and forbs, salt desert shrubs *(Atriplex* spp.), and exotic or weed species. Juniper woodlands are located near the buttes and in the northwest portion of INEEL. The juniper woodlands provide important habitat for raptors and large mammals. Limited riparian communities exist on the INEEL along intermittently flowing waters of the Big Lost River and Birch Creek drainages. Stream flow that reaches the INEEL flows to the Big Lost River playa or the Birch Creek playa, in which the flow is lost to evaporation and infiltration.

7.2.4 Abiotic Components

Waste Area Group 5 is located in the south-central portion of the INEEL (see Figure 2-4). The ARA and PBF are located on the alluvial plain of the Big Lost River and the topography of the area is relatively flat. Surface materials in the WAG 5 area consist mainly of fine-grained aeolian sediments, interspersed with subordinate alluvial sediments deposited by local runoff. Soils are characterized as sandy loams containing a high percentage of silt and a low percentage of clay (Olson, Jeppesen, and Lee 1995). The area is composed primarily of Malm-Bondfarm-Matheson Complex (432) soils and Coffee-Nargon-Atom (425) soils (see Figure 7-2). The Malm-Bondfarm-Matheson complex (432) consists of moderately deep, well-drained, sandy-loam soils on basalt plains. A calcic horizon is present at a depth of approximately 30 cm (12 in.). Permeability of these soils is moderately rapid, and the erosion hazards for these soils are slight to moderate. The Coffee-Nargon-Atom complex (425) consists of moderately deep to very deep, well-drained, silty clay loam soils on lava plains. Permeability of these soils is moderately slow to moderate, and the erosion hazards for these soils are slight to moderate. The area immediately surrounding the PBF facility is composed of Grassy Butte loamy sand (34J) and Menan silt loam (41) soils. Grassy Butte soils are very deep and very well drained (high permeability). These soils are highly mobile in wind and moderate hazards for water erosion. Menan soils are well drained with moderately low permeability, and the erosion hazard is slight. Further information, including soil maps and descriptions for the WAG 5 areas can be found in Olson, Jeppeson and Lee (1995).

Water table elevation data were obtained from the WAG 5 Work Plan (DOE-ID 1997). Measured water table elevations in the WAG 5 area range from 1,362 m (4,468 ft) above sea level to 1,352 m (4,435 ft) above sea level. Depth to the water table ranges from 189 to 138 m (620 to 453 ft). The water table gradient is not uniform beneath WAG 5. The general gradient is to the south or southwest with a gradient of about 4 ft/mi. However, a fairly steep southeast gradient occurs beneath the PBF area with a gradient of approximately 23 ft/mi. No pathway exists between groundwater and ecological receptors because of the depth to the aquifer at the INEEL (60 to 180 m [200 to 900 ft]) and the large distance to surface springs (more than 160 km [100 mi]). Therefore, the groundwater pathway was not evaluated in the WAG 5 ERA.

Table 7-3. WAG 5 operable units and sites of concern.

Operable Unit	Site	Description	Contaminants of Potential Concern	Contaminated Media
ARA-I				
5-10	ARA-01	Chemical evaporation pond (ARA-745)	Metals, radioisotopes, and volatile organic compounds (VOCs)	Surface and subsurface soil, and bedrock
5-07	ARA-02	Sanitary waste leach field and seepage pit (ARA-746)	Metals, VOCs, radioisotopes, polychlorinated biphenyls (PCBs)	Surface and subsurface soil
5-07	ARA-03	Pad near ARA-627 (lead shooting)	Arsenic above background, metals all below background, and radiation below background (Cs-137 below ecologically based screening levels (EBSLs)	Surface and subsurface soil
5-01	ARA-16	Radionuclide tank (ARA-729)	Radionuclides, VOCs, and semivolatile organic compounds (SVOCs)	Surface and subsurface soil
5-12	ARA-25	ARA-I soils beneath the ARA-626 Hot Cells	Radionuclides, metals and volatile organic compounds	Surface and subsurface soil, and concrete
ARA-II				
—	ARA-10	Septic tank east (ARA-613)	Radioisotopes (gamma-emitting only)	Surface and subsurface soil
5-12	ARA-23	Radiologically contaminated surface soils around ARA I and II	Radioisotopes	Surface and subsurface soil
ARA-III				
5-06	ARA-12	Radioactive waste leach pond	Radionuclides and metals	Surface and subsurface soil
5-12	ARA-24	Windblown soils	Radionuclides	Surface and subsurface soil
PBF Control Area				
5-02	PBF-12	Leach pond	Radionuclides	Surface and subsurface soil
5-04	PBF-04	Control area oil tank at PBF 608 outside fence	Benzene, toluene, ethylbenzene, and xylene	Subsurface soil
PBF Reactor Area (SPERT-I)				
5-13	PBF-10	Evaporation pond (PBF-733)	Metals, organics, radionuclides, and demineralized water	Subsurface soil
PBF-WEDF (SPERT-II)				
5-09	PBF-16	Leach pond	Metals	Surface and subsurface soil
PBF-WERF (SPERT-III)				
5-02	PBF-21	Large leach pond	Radionuclides at a depth of 2.1 to 2.4 m (7 to 8 ft)	Subsurface soil
PBF-MWSF (SPERT-IV)				
5-09	PBF-22	Leach pond (PBF-758)	Aroclor (PCBs)	Surface and subsurface soil
5-02	PBF-26	SPERT-IV lake	Metals, radionuclides (uranium, plutonium, and Cs-137), and PCBs	Surface and subsurface soil

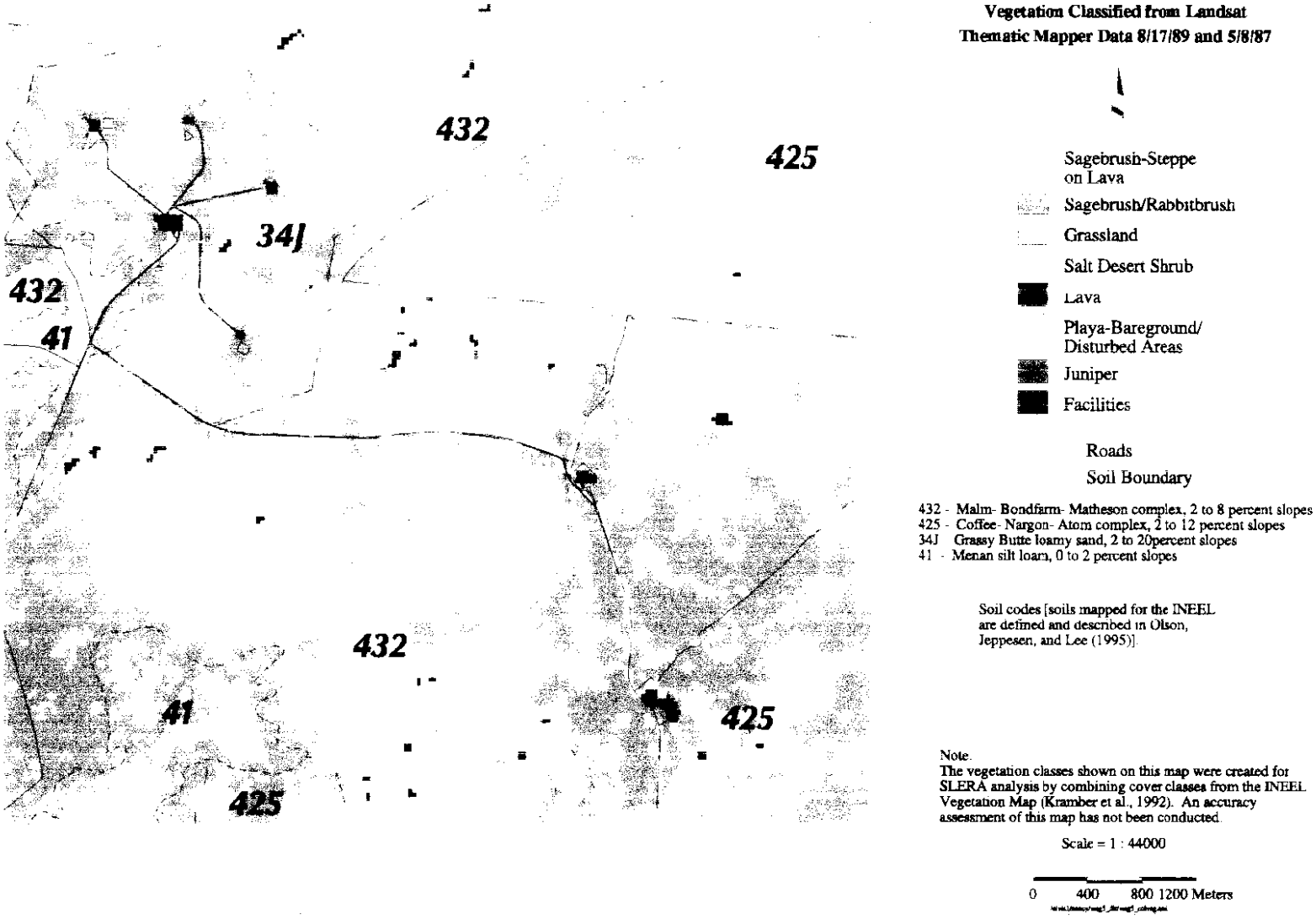

Figure 7-2. Vegetation and soils map of the WAG5 vicinity.

Major stream flows that reach the INEEL terminate at the Big Lost River playas and sinks or the Birch Creek playa, in which most water is lost to evaporation and infiltration. Surface water flow and accumulation are generally limited to spring runoff and intense precipitation events within the INEEL site boundaries, and no major natural drainages occur within WAG 5. Because discharge to the ARA evaporation pond was discontinued in 1988, WAG 5 surface flow has been limited to localized runoff, particularly from the parking lot and driveways of the existing facilities. No surface hydrology exists to support fish or other aquatic species. Because of the absence of surface water features, the surface water pathway and aquatic receptors were not evaluated in the WAG 5 ERA.

See Section 2 for more detailed information on the physical characteristics of WAG 5.

7.2.5 Biotic Components

The flora and fauna existing around the WAG 5 facility are representative of those found across the INEEL (Arthur et al. 1984; Reynolds et al. 1986) and are described in the following subsections. Flora surrounding WAG 5 was determined using a vegetation map constructed for the INEEL using LANDSAT imagery and field measurements from vegetation plots (Kramber et al. 1992). Fauna potentially existing in the WAG 5 area was identified primarily from a 1986 vertebrate survey performed on the INEEL (Reynolds et al. 1986) and from data collected subsequent to the survey. While the flora and fauna present at WAG 5 have not been verified with a comprehensive field survey, the information presented here is supported by previous field surveys and observations as described in Appendix E.

7.2.5.1 Flora. The 15 INEEL vegetation cover classes defined using LANDSAT imagery data (Kramber et al. 1992) have been combined into eight cover classes for the WAGs (VanHorn, Hampton, and Morris 1995). The vegetation surrounding WAG 5, shown in Figure 7-2, represents six vegetation cover classes that contain sagebrush-rabbitbrush, grassland, salt desert shrub, playa-bare ground or disturbed areas, sagebrush-steppe on lava, and lava outcrops. The species composition for each class is summarized in Table 7-4. Sagebrush/rabbitbrush is the predominant vegetation type. The dominant vegetation species within this community are the Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) and green rabbitbrush (*Chrysothamnus viscidiflorus*). Grasslands present in the area consist primarily of wheatgrasses (*Agropyron* spp. and *Elymus* spp.), and many of the disturbed areas at PBF and ARA have little or no vegetation. Lawns and ornamental vegetation are used by a number of species such as songbirds, raptors, rabbits, and mule deer.

7.2.5.2 Fauna. Sagebrush communities surrounding WAG 5 typically support a number of species including sage grouse, sage sparrow, and pronghorn antelope. Rock outcroppings associated with these communities also provide habitat for species such as bats, wood rats (*Neotoma cinerea*), and species of concern such as the pygmy rabbit [*Brachylagus* (= *Sylvilagus*) *idahoensis*]. Nearby grasslands serve as habitat for species including the western meadowlark (*Sturnella neglecta*) and mule deer (*Odocoileus hemionus*).

A comprehensive list of fauna potentially present at and surrounding WAG 5 is presented in Appendix F. This list incorporates the concept of functional grouping as described in detail in INEEL ERA guidance (VanHorn, Hampton, and Morris 1995). The functional grouping approach is designed to group similar species together to aid in analyzing the effects of stressors on INEEL ecosystem components. The primary purpose for functional grouping is to apply existing data from one or more species within the group to assess the risk to the group as a whole. Functional groups are used to perform a limited evaluation of exposures for all potential receptors and provide a mechanism for focusing subsequent analyses on receptors that best characterize potential contaminant effects.

Table 7-4. Vegetation cover class summary for WAG 5 area.

WAG 5 ERA Vegetation Cover Class	INEEL Vegetation Cover Classes	Dominant Species
Grasslands	Steppe Basin wild rye Grassland	*Leymus cinereus* *Descurainia sophia* *Sisymbrium altissimum* *Elymus lanceolatus* *Artemisia tridentata* ssp. *wyomingensis* *Elymus elymoides* *Chrysothamnus viscidiflorus*
Sagebrush-rabbitbrush	Sagebrush-steppe off lava Sagebrush-winterfat Sagebrush-rabbitbrush	*Artemisia tridentata* ssp. *wyomingensis* *Chrysothamnus viscidiflorus* *Bromus tectorum* *Sisymbrium altissimum* *Achnatherum hymenoides*
Sagebrush-steppe on lava	Sagebrush-steppe on lava	*Artemisia tridentata* ssp. *wyomingensis* *Chrysothamnus viscidiflorus* *Achnatherum hymenoides*
Salt desert shrub	Salt desert shrub	*Atriplex nutallii* *Atriplex confertifolia* *Atriplex canescenens* *Krascheninnikovia lanata*
Lava	Lava outcrops	*Artemisia tridentata* ssp. *wyomingensis* *Chrysothamnus nauseosus*
Playa-bare ground and disturbed areas	Playa-bare ground and gravel borrow pits Old fields, disturbed areas, seedlings	*Kochia scoparia* *Salsola kali* *Artemisia tridentata* ssp. *wyomingensis* *Chrysothamnus viscidiflorus*

Functional groups designed to be representative of receptors at WAG 5 have been identified from those species listed in Appendix F. The functional groups evaluated in the WAG 5 ERA were selected based on the assumption that those groups would be conservative indicators of the effects for other similar groups. Species characteristics including trophic level, breeding, and feeding locations were used to construct functional groups for INEEL species. Individual groups were assigned a unique identifier consisting of a one- or two-letter code to indicate taxon (A = amphibians, AV = birds, M = mammals, R = reptiles, and I = insects), and a three-digit code derived from the combination of trophic category and feeding habitats. For example, AV122 represents the group of seed-eating (herbivorous) bird species for which the feeding habitat is the terrestrial surface and understory. The trophic categories (first digit in three-digit code) are as follows: 1 = herbivore, 2 = insectivore, 3 = carnivore, 4 = omnivore, and 5 = detrivore. The feeding habitat codes (second- and third digits in the three-digit code) are derived as follows:

1.0 Air

2.0 Terrestrial

2.1 Vegetation canopy

2.2 Surface/understory

2.3 Subsurface

2.4 Vertical habitat (e.g., facility structures and cliffs)

3.0 Terrestrial and aquatic interface

3.1 Vegetation canopy

3.2 Surface and understory

3.3 Subsurface

3.4 Vertical habitat

4.0 Aquatic

4.1 Surface water

4.2 Water column

4.3 Bottom.

The list of functional groups and associated species potentially present in the vicinity of WAG 5 (see Table F-1 in Appendix F) was developed by updating 1986 data on the relative abundance, habitat use, and seasonal presence of fish, amphibians, reptiles, birds, and mammals recorded on the INEEL (Reynolds et al. 1986) and by communicating with INEEL researchers and personnel conducting ecological studies since 1986. Fauna that are not supported by the existing habitat or that are rare or uncommon or otherwise unlikely to be found in the WAG 5 area were not included in the literature search for species-specific exposure and toxicity data. Functional groups containing only species having abundance codes greater than 4 (Reynolds et al. 1986) were not specifically assessed. Rather, these groups have been represented by evaluation of more common, but similar groups. For example, the avian herbivore group AV121 is represented by evaluation of functional group AV122. Functional groups and species that were not specifically evaluated are listed in Table F-2 in Appendix F.

Species potentially present at WAG 5 represent 15 of 24 INEEL avian functional groups and 10 of 11 INEEL mammalian functional groups. Both reptilian functional groups are represented by species potentially inhabiting the immediate area. No amphibians are known to be present, and no surface hydrology exists to support fish or other aquatic species. Therefore, aquatic functional groups and individual species were not evaluated in the assessment.

Terrestrial invertebrates and microorganisms that are present at WAG 5 are important links in dietary exposure for wildlife and also may function as good indicators for contaminant exposure in soil and vegetation uptake. Microorganisms also play an important role in ecosystem processes. However, a list of terrestrial invertebrates potentially present in and surrounding WAG 5 is not available and these ecosystem components were not quantitatively assessed in the WAG 5 ERA.

The varying behaviors of the wildlife species potentially present at WAG 5 include, but are not limited to, grazing and browsing on vegetation, burrowing and flying, and preying on insects and small

mammals. The complexity of the behaviors is significant when considering the fate and transport of contaminants and the possibility of exposure to contaminants. For example, subsurface contamination can become surface contamination when translocated by burrowing animals or can be introduced into the food web when plants take up contamination and are then ingested by an herbivore. If prey, such as a small mammal, becomes contaminated by ingesting contaminated soil or vegetation, and is then captured by a predator, such as a ferruginous hawk, the contamination can be taken offsite when the hawk returns to its nest to feed nestlings. Scenarios for potential exposure of fauna to WAG 5 contaminants are discussed in Section 7.3. Though some population studies have been conducted for cyclic rabbit and rodent populations, raptors, and several game species (e.g., pronghorn antelope and sage grouse), no recent comprehensive studies have been conducted to assess either WAG-specific or INEEL-wide wildlife population status and trends associated with contaminant effects.

The flora and fauna present in and around WAG 5 have been combined into a simplified food web model shown in Figure 7-3. The variability in environmental conditions such as population sizes or seasons was not considered in the model, and a constant environment was assumed. Terrestrial species, including decomposers, producers (e.g., vegetation), primary consumers or herbivores (e.g., rodents), secondary consumers or carnivores (e.g., snakes), and tertiary or top carnivores (e.g., raptors) were incorporated into the CSM (Section 7.2.8). The dietary relationships between each level of species were simplified to assess direct and indirect exposure to contaminants as discussed later in this section.

7.2.5.3 Threatened, Endangered, and Other Species of Concern. A list of (1) threatened or endangered (T/E) and (2) sensitive species potentially present at the INEEL was compiled from the U.S. Fish and Wildlife Service (USFWS 1997), the Idaho Department of Fish and Game Conservation Data Center for T/E and sensitive species for the State of Idaho (CDC 1994), and Radiological and Environmental Sciences Laboratory (RESL) documentation for the INEEL (Reynolds 1994; Reynolds et al. 1986). Threatened or endangered and sensitive species that may be found on the INEEL are listed in Table 7-5. Those species with a potential presence at WAG 5 are listed in bold text on the table. The USFWS no longer maintains a candidate species (C2) listing but addresses former C2 species as species of concern (USFWS 1996). The C2 designation is retained here to maintain consistency with INEEL ERA assessments conducted before the USFWS change in listing procedures.

No areas of critical habitat, as defined in 40 CFR 300, are known to exist in the WAG 5 vicinity, and no T/E or sensitive plant species have been recorded at or near the facilities. When the screening-level ecological risk assessments (SLERAs) were performed for other INEEL WAGs, oxytheca (*Oxytheca dendroidea*) was listed as a sensitive species with the BLM and the Idaho Native Plant Society (INPS)/Idaho Fish and Game Conservation Data Center. This species has been recorded in the area surrounding WAG 5. However, it has since been found to be more abundant than formerly believed and has been removed from the BLM and INPS lists (INPS 1996). An INPS monitor species, painted milkvetch (*Astragalus ceramicus* var. *apus*), also has been recorded in areas surrounding WAG 5. However, this species also was recently removed from the federal list of species being considered for T/E listing (CDC 1994).

Avian T/E species or species of concern (formerly C2) with a potential for occurrence in the WAG 5 vicinity include the peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), northern goshawk (*Accipiter gentilis*), ferruginous hawk (*Buteo regalis*), loggerhead shrike (*Lanius ludovicianus*), and burrowing owl (*Athene cunicularia*) (USFWS 1997). Three aquatic species of concern, the trumpeter swan (*Cygnus buccinator*), black tern (*Childonias niger*), and white-faced ibis (*Plegadis chihi*) are not likely to occur at WAG 5 because of the absence of surface water impoundments at ARA and PBF. Therefore, these species were not evaluated in the WAG 5 ERA. The bald eagle and peregrine falcon are federally listed species. The remaining avian species are species of concern (formerly C2). A Geographic Information System (GIS) analysis showed that no T/E or C2 raptor species

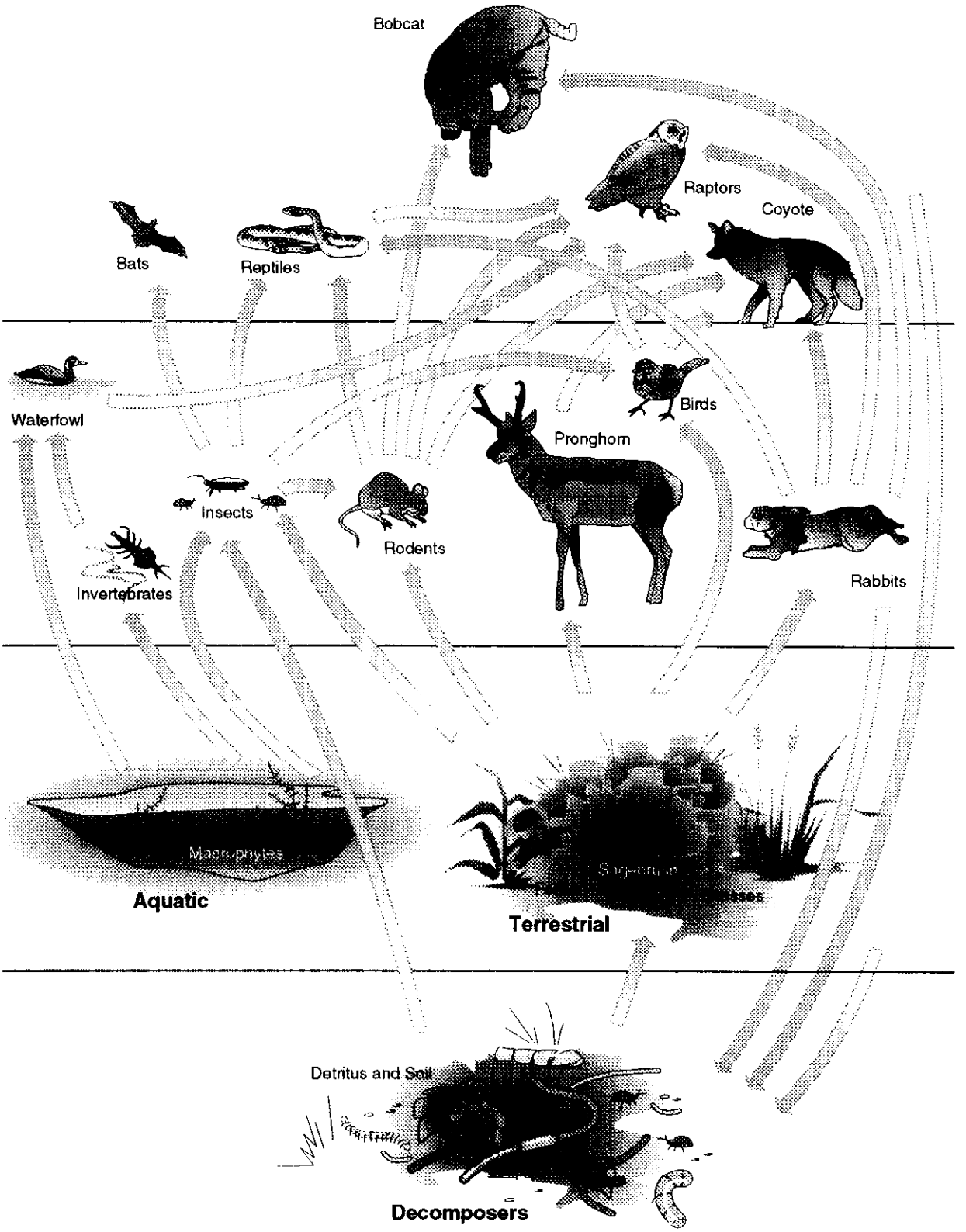

Figure 7-3. Simplified INEEL food web.

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Table 7-5. Threatened or endangered species, sensitive species, and species of concern that may be found on the INEEL.[a]

Common Name	Scientific Name	Federal Status[b,c]	State Status[c]	BLM Status[c]	USFS[f] Status[c]
Plants					
Lemhi milkvetch	*Astragalus aquilonius*	—	S	S	S
Painted milkvetch[e]	*Astragalus ceramicus var. apus*	3c	R	—	—
Plains milkvetch	*Astragalus gilviflorus*	NL	1	S	S
Winged-seed evening primrose	*Camissonia pterosperma*	NL	S	S	—
Nipple cactus[e]	*Coryphantha missouriensis*	NL	R	—	—
Spreading gilia	*Ipomopsis (=Gilia) polycladon*	NL	2	S	—
King's bladderpod	*Lesquerella kingii var. cobrensis*	—	M	—	—
Tree-like oxytheca[e]	*Oxytheca dendroidea*	NL	R	R	—
Inconspicuous phacelia[d]	*Phacelia inconspicua*	C2	SSC	S	S
Ute ladies' tresses[d]	*Spiranthes diluvialis*	LT	—	—	—
Puzzling halimolobos	*Halimolobos perplexa var. perplexa*	—	M	—	S
Birds					
Peregrine falcon	***Falco peregrinus***	**LE**	**E**	—	—
Merlin	*Falco columbarius*	NL	—	S	—
Gyrfalcon	*Falco rusticolus*	NL	SSC	S	—
Bald eagle	***Haliaeetus leucocephalus***	**LT**	**T**	—	—
Ferruginous hawk	***Buteo regalis***	**C2**	**SSC**	**S**	—
Black tern	*Chlidonias niger*	C2	—	—	—
Northern pygmy owl[d]	*Glaucidium gnoma*	—	SSC	—	—
Burrowing owl	***Athene cunicularia***	**C2**	—	**S**	—
Common loon	*Gavia immer*	—	SSC	—	—
American white pelican	*Pelicanus erythrorhynchos*	—	SSC	—	—
Great egret	*Casmerodius albus*	—	SSC	—	—
White-faced ibis	*Plegadis chihi*	C2	—	—	—
Long-billed curlew	*Numenius americanus*	3c	—	S	—
Loggerhead shrike	***Lanius ludovicianus***	**C2**	**NL**	**S**	—
Northern goshawk	***Accipiter gentilis***	**C2**	**S**	—	**S**
Swainson's hawk	*Buteo swainsoni*	—	—	S	—
Trumpeter swan	*Cygnus buccinator*	C2	SSC	S	S
Sharptailed grouse	*Tympanuchus phasianellus*	C2	—	S	S
Boreal owl	*Aegolius funereus*	—	SSC	S	S
Flammulated owl	*Otus flammeolus*	—	SSC	—	S
Mammals					
Gray wolf[g]	***Canis lupus***	**LE/XN**	**E**	—	—
Pygmy rabbit	***Brachylagus (=Sylvilagus) idahoensis***	**C2**	**SSC**	**S**	—
Townsend's Western big-eared bat	***Corynorhinus (=Plecotus) townsendii***	**C2**	**SSC**	**S**	**S**
Merriam's shrew	*Sorex merriami*	—	S	—	—
Long-eared myotis	***Myotis evotis***	**C2**	—	—	—

Table 7-5. (continued).

Common Name	Scientific Name	Federal Status[b,c]	State Status[c]	BLM Status[c]	USFS[f] Status[c]
Small-footed myotis	***Myotis ciliolabrum (=subulatus)***	**C2**	—	—	—
Western pipistrelle[d]	*Pipistrellus hesperus*	NL	SSC	—	—
Fringed myotis[d]	*Myotis thysañodes*	—	SSC	—	—
California myotis[d]	*Myotis californicus*	—	SSC	—	—
Reptiles and amphibians					
Northern sagebrush lizard	***Sceloporus graciosus***	**C2**	—	—	—
Ringneck snake[d]	*Diadophis punctatus*	C2	SSC	S	—
Night snake[e]	*Hypsiglena torquata*	—	—	R	—
Insects					
Idaho pointheaded grasshopper[d]	*Acrolophitus punchellus*	C2	SSC	—	—
Fish					
Shorthead sculpin[d]	*Cottus confusus*	—	SSC	—	—

Species in **bold** indicate species that were individually assessed in the WAG 5 ERA.

a. This list was compiled from a letter from the U.S. Fish and Wildlife Service (USFWS) (1997) for threatened or endangered, and sensitive species listed by the Idaho Department of Fish and Game (IDFG) Conservation Data Center (CDC 1994 and IDFG web site 1997) and Radiological Environmental Sciences Laboratory documentation for the INEEL (Reynolds et al. 1986).
b. The USFWS no longer maintains a candidate (C2) species listing but addresses former listed species as "species of concern" (USFWS 1996). The C2 designation is retained here to maintain consistency between completed and ongoing INEEL ERA assessments.
c. Status codes: INPS=Idaho Native Plant Society; S=sensitive; 2=State Priority 2 (INPS); 3c=no longer considered for listing; M=State of Idaho monitor species (INPS); NL=not listed; 1=State Priority 1 (INPS); LE=listed endangered; E=endangered; T = threatened; XN = experimental population, nonessential; SSC=species of special concern; and C2 = see item b, formerly Category 2 (defined in CDC 1994). BLM=Bureau of Land Management; R = removed from sensitive list (nonagency code added here for clarification).
d. No documented sightings at the INEEL; however, the ranges of these species overlap the INEEL and are included as possibilities to be considered for field surveys.
e. Recent updates that resulted from Idaho State Sensitive Species meetings (BLM, USFWS, INPS, and USFS) - (INPS 1995, 1996, and 1997).
f. U.S. Forest Service (USFS) Region 4.
g. Anecdotal evidence indicates that isolated wolves may occur on the INEEL. However, no information exists to substantiate hunting or breeding on site (Morris 1998).

nest sites have been recorded at WAG 5. However, a review of data collected as part of regularly conducted breeding bird surveys for the area immediately surrounding the PBF facilities, showed that ferruginous hawks, golden eagles (*Aquila chrysaetos*), and other raptors and loggerhead shrikes are commonly observed in the WAG 5 vicinity (Belthoff, Power, and Reynolds 1998). The ARA facilities are not encompassed by current INEEL breeding bird survey routes. Four mammalian C2 species potentially occur at or near the ARA or PBF. These include the pygmy rabbit (*Brachylagus idahoensis*), Townsend's Western big-eared bat [*Corynorhinus (=Plecotus) townsendii*], long-eared myotis (*Myotis evotis*), small-footed myotis [*Myotis ciliolabrum (=subulatus)*] (USFWS 1997). While the presence of the pygmy rabbit at WAG 5 facilities has not been verified, appropriate habitat exists in areas of surrounding WAG 5 facilities (Gabler 1997). The occurrence of the gray wolf on the INEEL is unverified. However, because of anecdotal evidence (Morris 1998) and that the wolf is federally listed, the species is evaluated in the assessment. The sagebrush lizard (*Sceloporous graciosus*) is the only reptile species of concern with a potential presence at WAG 5.

In 1996, field surveys were conducted in the areas surrounding WAG 5 facilities to assess the presence and use of those areas by T/E species or other species of concern (i.e., species formerly designated as C2). The survey findings have been documented in a report that includes (1) survey protocols, (2) results for WAG 5 and other WAGs, and (3) an interpretive summary for the INEEL Site

(OU 10-04) (Morris 1998). The specific information collected and reported for each T/E or species of concern includes the following:

- The dates and conditions under which the surveys were conducted
- The area encompassed by the surveys (global positioning system [GPS] mapping where practical)
- Global positioning system locations for observed habitat, sign, and species sighted (where practicable)
- Habitat description, the proximity to a WAG or site, and an estimate of whether contaminated sites or areas are within the home range of members of the species in question
- Species presence, abundance, current site use, past site use (historical sightings or surveys), and anticipated site use (based on professional judgment)
- An estimated site or area population (where possible).

Surveys for some species also were supported by GIS analyses using recently developed habitat models.

On July 31 and August 20, 1997, field surveys were conducted for individual sites of concern within ARA and PBF facilities that have been or currently are being evaluated as part the WAG 5 ERA. An onsite inspection was conducted and each site of contamination was evaluated for habitat qualities and the potential to support INEEL T/E species or other species of concern. A suite of site habitat attributes was evaluated for the suitability for each species of interest. The attributes evaluated included the following:

- Size
- Substrate (e.g., gravel, asphalt, and lawn)
- Natural or anthropogenic features that entice wildlife (e.g., water or lights)
- Proximity to areas or sites of facility activity
- Presence and availability of food or prey
- Availability of nesting, roosting, or loafing habitat
- Signs of wildlife use
- Prior history and known sightings or use.

Attributes were subjectively rated for positive contributions to overall habitat suitability. A site rating of high, medium, low, or none was assigned based on the positive habitat features and probability that the species of concern may use or use the site. The conventions upon which ratings were assigned for individual habitat attributes are summarized in Table 7-6. Though T/E and sensitive species were of primary consideration, the potential use by big game species and unique populations (spadefoot toad and Merriam's shrew) also was assessed.

Table 7-6. Habitat rating conventions for WAG 5 sites of concern.

Attribute	Examples
Size	Areas having physical dimensions too small to support species of interest were rated "none" unless enhanced by other attributes. Large, unconfined areas adequate to support wildlife were assigned higher ratings.
Substrate	Asphalt = none, gravel = low, lawn, soil = medium-high for some species, disturbed vegetation community = medium to high, natural vegetation community = high.
Natural or anthropogenic features	Water = high (water [permanent or ephemeral] is an important component in desert systems); lights = medium (both attract insects and consequently bats and insectivorous birds [i.e., swallows, nighthawks])
Proximity to areas of activity	Proximity to areas or sites of moderate or heavy activity may reduce desirability. Sites associated with buildings and facilities may be more suitable if abandoned or little used (i.e., bat roosts).
Nesting, roosting, or loafing habitat	Structures such as fence and power poles adjacent to open fields afford perches for, for example, roosting and hunting.
Signs of wildlife use	Signs of wildlife use that qualitatively feed the evaluation. Examples of these signs include observation of animals, tracks, hair, or scat.
Prior history	Documented or reported sightings.

Sites for which risk to receptors has been calculated (HQ>1) but no positive habitat attributes were observed are unlikely to contribute to wildlife exposures. Sites rated overall as "low" are those having one or two positive attributes and, therefore, potential for incidental use by wildlife. These sites also may be generally discounted as contributing significantly to chronic wildlife contaminant exposures.

The results of the survey and site rating for the WAG 5 sites of concern are summarized on Table 7-7. Potential risks to ecological receptors have been demonstrated for nine WAG 5 sites including ARA-01, ARA-02, ARA-12, ARA-25, PBF-10, PBF-16, PBF-21, PBF-22, and PBF-26 (see Section 7.4) and are discussed for each species of concern in the paragraphs below. Two sites, PBF-12 and ARA-25, were characterized subsequent to this survey and habitat attributes were not evaluated for these sites. The duration and rigor of these surveys were not adequate to verify the presence or frequency of occurrence, but were conducted to allow evaluation of WAG 5 sites of concern in an ecological context. The rankings for sites presented here are subjective, based on professional opinion supported by limited observation.

7.2.5.3.1 Bald Eagle—The bald eagle is federally listed and threatened and has been observed in small numbers on the INEEL (Craig 1979; Hanson 1994). Wintering populations also congregate in areas adjacent to the INEEL northern boundaries and may be particularly concentrated during years in which black-tailed jackrabbit populations are high. Therefore, some potential exists for bald eagles to prey on jackrabbits associated with WAG 5 sites of contamination. No positive habitat features were found at ARA-10, ARA-16, PBF-04, PBF-10, and PBF-20. Concentrations of COPCs for ARA-03, ARA-06, ARA-23, and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Thus, the likelihood is small that exposures to bald eagles will occur as a result of contaminants associated with these sites. The ARA-01, ARA-02, ARA-12, PBF16, PBF-21, PBF-22, and PBF-26 sites pose potential for exposure because these areas all provide perches and open hunting areas adjacent to native communities.

Table 7-7. Threatened and endangered species results.[a]

WAG 5 Site	Burrowing Owl	Ferruginous Hawk	Peregrine Falcon	Loggerhead Shrike	Bald Eagle	Bats	Merriam's Shrew	Pigmy Rabbit	Northern Sagebrush Lizard	Big Game	Comments
ARA-01	**M**	**M**	**M**	**H**	**L**	**L**			**H**	**H**	Leach pond complex, open wire fences, crested wheatgrass and shrubs, posts, adjacent native vegetation
ARA-02	**M**	**M**	**M**	**H**	**L**	**L**			**H**	**H**	See comment for ARA-01
ARA-03	M	M	M	H	L	L			H	H	See comment for ARA-01
ARA-06	M	M	M	M	M	L			H		SL-1, fenced site, large basalt rip-rap surrounded by revegetation
ARA-10	L	L	L	L		L				L	Chain-link fenced area, power poles, weeds, gravel substrate, no activity
ARA-12	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**L**	**H**	**H**	Unfenced area in depression, junipers, willows, good cover, intermittent water, shrike use, basalt cover
ARA-16									M		Buried tank, weedy area surrounding shallow hole, collects water, signs of animal use, fenced w/openings
ARA-23	H	H	H	H	H	H		M	H	H	200-acre windblown, native shrub/grass communities, see isopleths
ARA-24	H	H	H	H	H	H		M	H	H	Plume areas, see isopleths
ARA-25											No survey conducted
PBF-04											Gravel substrate inside substation containment fence, native sagebrush community surrounding
PBF-10										**M**	Unfenced, revegetated with native grasses and forbs
PBF-12											No survey conducted
PBF-16	**H**	**H**	**H**	**H**	**M**				**H**		Juniper, tall sagebrush, shallow depression, roosting/nesting, small mammal sign
PBF-20						M				M	Bermed depression containing grasses and annuals, intermittent water, adjacent roost sites, unfenced
PBF-21	**M**	**M**	**M**	**M**	**M**	**M**		**M**	**H**	**H**	Large open area of native revegetation bordered by native sagebrush community
PBF-22	**H**	**H**	**H**	**H**	**M**	**M**		**L**	**H**	**H**	Tall sagebrush, grasses, rabbitbrush, deep ditch
PBF-26	**H**	**H**	**H**	**H**	**M**	**M**		**L**	**H**	**H**	Low area next to 22, crested wheatgrass planting, adjacent tall sagebrush, basalt outcrops, power poles

a. Sites in **bold** text represent potential risk to ecological receptors. See Section 7.4.

7.2.5.3.2 Burrowing Owl—A burrowing owl habitat survey was conducted at WAG 5 on August 19, 1996. Habitat out to 200 m from the WAG 5 perimeter was included in the survey. No optimal habitat for burrowing owl reproduction was located within 200 m of the WAG 5 perimeter. During habitat surveys, no signs (e.g., droppings and pellet at potential nest burrows) were observed nor were any burrowing owls sighted on the survey areas. Four nesting habitat types were described in the survey protocol. In the 200-m perimeter surrounding PBF, none of the habitat was Type 1, optimal nesting habitat; 14% of the habitat was Type 2, moderate nesting habitat; 0% of the habitat was Type 3, low use nesting habitat; and 86% of the habitat was Type 4, unsuitable nesting habitat. In the 200-m perimeter surrounding ARA, 26% of the habitat was Type 1, optimal nesting habitat; 46% of the habitat was Type 2, moderate nesting habitat; 0% of the habitat was Type 3, low use nesting habitat; and 28% of the habitat was Type 4, unsuitable nesting habitat. No recorded burrowing owl sightings have been documented by breeding bird surveys on the WAG 5 route. No positive habitat features were found at ARA-16, PBF-04, PBF-10, and PBF-20, and ARA-10 provides only limited potential for hunting. Concentrations for COPCs for ARA-03, ARA-06, ARA-23, and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Therefore, there is little likelihood that exposures to burrowing owls will occur as a result of contaminants associated with these sites. Sites ARA-01, ARA-02, ARA-12, PBF-16, PBF-21, PBF-22, and PBF-26 pose potential for exposure because these areas all provide perches and open hunting areas adjacent to native communities.

7.2.5.3.3 Loggerhead Shrike—Loggerhead shrikes have been regularly observed during the breeding bird surveys conducted around WAG 5 from 1985 through 1996. Loggerhead shrikes have both nested and hunted within areas of human occupation and have demonstrated a tendency to use areas at WAG 5. Therefore, it is possible that loggerhead shrikes could be exposed to contaminants at WAG 5. No positive habitat features were found at ARA-16, PBF-04, PBF-10, and PBF-20, and ARA-10 provides only limited potential for hunting. Concentrations of COPCs for ARA-03, ARA-06, ARA-23 and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Therefore, the likelihood is small that exposures to loggerhead shrikes will occur as a result of contaminants associated with these sites. Sites ARA-01, ARA-02, ARA-12, PBF-16, PBF-21, PBF-22, and PBF-26 pose potential for exposure because these areas all provide perches and open hunting areas adjacent to native communities.

7.2.5.3.4 Ferruginous Hawk, Peregrine Falcon, and Northern Goshawk—Recent studies indicated a range of 11 to 15 nesting pairs of ferruginous hawks on the INEEL. One of these nests was within 6 km of WAG 5. Wakeley (1978) observed hunting activity out to 5 to 6 km from ferruginous nest sites in Utah. Thus, ferruginous hawks within this distance of WAG 5 may be hunting near it. Breeding bird survey data indicate that ferruginous hawks observed at WAG 5 have demonstrated a tendency to use the area over a period of several years. Continued use is expected. However, ferruginous hawks tend to avoid areas frequented by humans. For this reason, it is unlikely that ferruginous hawks will nest or hunt at active sites closely associated with facilities. No positive habitat features were found at ARA-16, PBF-04, PBF-10, and PBF-20, and ARA-10 provides only limited potential for hunting. Concentrations of COPCs for ARA-03, ARA-06, ARA-23, and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Therefore, the likelihood of exposures to ferruginous hawks as a result of contaminants associated with these sites is small. Sites ARA-01, ARA-02, ARA-12, PBF-16, PBF-21, PBF-22, and PBF-26 pose potential for exposure because these areas all provide perches and open hunting areas adjacent to native communities. Sightings for the peregrine falcon and northern goshawk on the INEEL have totaled fewer than seven, and most have occurred in the southernmost areas of INEEL. Use of these sites is possible but not likely.

7.2.5.3.5 Pygmy Rabbit—Based on a GIS analysis of vegetation, slope, and geological characteristics, areas surrounding WAG 5, and particularly ARA, demonstrate the appropriate habitat features necessary to support pygmy rabbits (Gabler 1997). The selection criteria were developed based

on characteristics of known pygmy rabbit sites on the INEEL (Gabler 1997). A systematic survey of areas within 250 m of the fences surrounding various buildings was conducted. However, no sign or suitable habitat was observed. Few or no positive habitat features were found at ARA-01, ARA-02, ARA-03, ARA-06, ARA-10, ARA-12, ARA-16, PBF-04, PBF-10, PBF-16, and PBF-20. Concentrations of COPCs for ARA-03, ARA-06, ARA-23, and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Therefore, there is little likelihood that pygmy rabbits are or will be exposed to contaminants associated with these sites. Sites PBF-21, PBF-22, and PBF-26 pose a potential risk because these areas include or are adjacent to native communities meeting GIS model criteria.

7.2.5.3.6 Sagebrush Lizard—Sagebrush lizards are known to inhabit grassland areas, and were observed near the WAG 5 area in similar habitat in 1994. A brief survey for sagebrush lizards was conducted in 1996. The surveyed habitat mainly consisted of mixed grassland communities, with a few scattered sagebrush and rabbitbrush shrubs in certain localities. The north and northeast areas on WAG 5 were the most undisturbed grassland areas around the facility. These areas were searched during 1-hour time-constrained surveys on 2 days. The west and south areas on WAG 5 are disturbed by construction areas, gravel areas, former leach ponds, and borrow pits. These areas were not included in the survey. Though no lizards were observed during the two survey days, it is likely that sagebrush lizards are present and just were not observed during the brief survey period. No positive habitat features were found at ARA-10, PBF-04, PBF-10, PBF-16, and PBF-20. Concentrations of COPCs for ARA-03, ARA-06, ARA-23, and ARA-24 were demonstrated to be below levels at which adverse effects to receptors may be expected (see Section 7.4). Therefore, there is little likelihood that sagebrush lizards will be exposed to contaminants associated with these sites. Sites ARA-01, ARA-02, ARA-12, ARA-16, PBF-16, PBF-21, PBF-22, and PBF-26 pose potential for exposure because these areas all provide open grassy areas adjacent to native communities.

7.2.5.3.7 Townsend's Big-Eared Bat, Long-Eared Myotis and Small-Footed Myotis—Few historical data are available for bat use of habitat at the INEEL. However, bats have been observed hunting over native sagebrush communities and evidence indicates that they are drawn to ponds and lighting in search of drinking water and insect prey. The ARA and PBF facility structures also provide roosting habitat for bats. No bats were detected at WAG 5 during acoustical surveys conducted in 1996 (Morris 1998). Though none of the sites of concern has standing water, open areas adjacent to and including native communities occur at ARA-12, PBF-20, PBF-21, PBF-22, and PBF-26. These sites pose a potential for exposure through contaminated insect prey.

7.2.5.3.8 Gray Wolf—Anecdotal evidence of isolated wolves on the INEEL exists, but it is unlikely that wolves regularly hunt or breed on site (Morris 1998). The gray wolf is a federally listed endangered species and is, therefore, represented in this assessment by functional group M322 as a conservative measure to ensure that all potential receptors having special status have been evaluated.

Potential risks associated with contaminant exposures for T/E and C2 species are of interest for both individuals and populations. Therefore, those species most likely to come in contact with WAG 5 sites and contaminants have been evaluated for individual exposures. Other species, considered very rare INEEL-wide (see Table F-2 in Appendix F), and considered unlikely to receive chronic doses through frequenting WAG 5 and the surrounding areas, are represented through evaluation of the functional group with which they are associated.

Threatened or endangered and C2 species that were individually evaluated for exposure to contaminants at WAG 5 are listed in boldface text in Table 7-5. These include the bald eagle, burrowing owl, loggerhead shrike, peregrine falcon, ferruginous hawk, Townsend's Western big-eared bat,

long-eared myotis, small-footed myotis, pygmy rabbit, gray wolf, and sagebrush lizard, all of which were evaluated for direct and indirect exposure to soil contaminants.

7.2.6 Stressor Identification and Characterization

Guidance from DOE (1993) defines a stressor as "any physical, chemical, or biological entity that can induce adverse response." Of primary concern for CERCLA are the effects of chemical stressors. At WAG 5, chemical stressors include a variety of radionuclides, organics, and metals detected in surface and subsurface soils at multiple ARA and PBF sites. In this section, COPCs and sites of concern are screened to determine which sites and contaminants have the potential to cause adverse effects to ecological receptors at WAG 5. These sites and contaminants are retained for further analysis in the subsequent phases WAG 5 ERA.

7.2.6.1 Preliminary Summary of Sites and Data. Sites and contaminants to be considered in the WAG 5 ERA were initially identified by the WAG 5 ecological site screening and data gap identification (DOE-ID 1997). Sites of concern identified in the initial analysis were reviewed and evaluated for inclusion in the WAG 5 ERA (see Tables 7-2 and 7-3). The following 16 sites were initially retained for analysis in the WAG 5 ERA:

- ARA-01
- ARA-02
- ARA-03
- ARA-16
- ARA-10
- ARA-23
- ARA-12
- ARA-24
- ARA-25
- PBF-10
- PBF-04
- PBF-12
- PBF-16
- PBF-21
- PBF-22
- PBF-26.

7.2.6.2 Exposure-Point Concentration Data. Data from the various human health risk assessments at the sites are solely available for the ERA. For the human health assessment, concentration data were divided into 0 to 0.15 m (0 to 0.5 ft), 0 to 1.22 m (0 to 4 ft), and 0 to 3 m (0 to 10 ft) average concentrations. The 0 to 0.15-m (0 to 0.5-ft) concentrations were used to characterize surface soil concentrations for the WAG 5 ERA. The subsurface concentrations, considered to be 15 cm to 3 m (0.5 to 10 ft), are based on the 15 cm to 3-m (0.5 to 10-ft) concentrations. When only 0 to 3-m (0 to 10-ft) concentrations were available for a site, these concentrations also were used to characterize 0 to 15-cm (0 to 0.5-ft) concentrations.

If data were not available from ERIS, source terms were obtained from Track 1 and Track 2 documentation. The maximum concentration from either surface or subsurface concentrations was used in all cases unless noted otherwise (see Tables 7-8 through 7-9). Sites for which Track 1 or 2 data were used include PBF-04 (EG&G 1994) and PBF-26 (EG&G 1993). Only data reported in the Track 2 summary report (Hillman-Mason et al. 1994) were available to evaluate site PBF-16.

Table 7-8. Screening of radionuclide contaminants.[a]

Contaminant	Ag-108m	Am-241	Co-58	Co-60	Cs-134	Cs-137	Eu-152	Eu-154	Mn-54	Pu-238	Pu-239	Ra-226
Background[b]	NA	1.10E-02	NA	NA	NA	8.2E-01	NA	NA	NA	4.9E-03	1.1E-01	NA
EBSL[c]	1.82E+03	3.55E+02	3.66E+03	1.18E+03	1.9E+03	4.95E+03	2.18E+03	2.48E+03	3.53E+03	3.55E+02	3.79E+02	4.08E+02
ARA-01		1.13E-01				1.53E+00				1.47E-02	5.33E-01	3.08E+00
ARA-02 septic tank soils[d]						1.63E+00						
ARA-02 seepage pit[d]						4.5E-01						
ARA-03						7.40E+00						
ARA-10												2.15E+00
ARA-12	6.72E+01	2.00E-01		2.52E+01		4.42E+00				1.40E-01	5.00E-02	
ARA-16	1.49E-01			1.15E+00	3.21E-01	2.01E+02	1.35E+00	4.84E-01	5.49E-02			5.27E+00
ARA-23		3.17E-02				2.14E+03					4.86E-02	1.19E+01
ARA-24		1.00E-02				5.97E-01				1.00E-02		
ARA-25				1.95E+00	1.04E+00	4.49E+02	4.93E+00	2.88E-01				2.97E+01
PBF-04												
PBF-10			2.62E-01			1.75E+01						
PBF-12				3.60E-01		2.33E+01				4.50E+00		
PBF-16												
PBF-21				3.22E+00		1.40E+01					6.50E-02	
PBF-22		4.90E-01				5.90E+00				4.90E-01	2.60E-01	
PBF-26						7.69E+00						

Table 7-8. (continued).

Contaminant	Sr-90	Th-228	Th-230	Th-232	Tl-208	U-234	U-235	U-238	Zr-95
Background[b]	4.9E-01	1.6E+00	1.41E+00	1.60E+00	NA	1.44E+00	NA	1.40E+00	NA
EBSL[c]	3.34E+03	3.61E+02	4.18E+02	4.87E+02	1.13E+03	4.09E+02	4.51E+02	4.64E+02	3.69E+03
ARA-01	6.28E-01					1.09E+00	4.43E-01	9.77E-01	
ARA-02 septic tank soils[d]						7.00E-01		8.02E-01	
ARA-02 seepage pit[d]									
ARA-03									
ARA-10									
ARA-12						3.00E+00		1.80E+00	
ARA-16	1.48E+02								
ARA-23	2.10E+01	1.46E+00	1.53E+00	1.38+00		7.45E-01	4.69E-02	8.67E-01	2.6E-01
ARA-24						1.11E+00		1.08E+00	
ARA-25	7.28E+01								
PBF-04									
PBF-10					3.60E-01				
PBF-12	1.60E+00					1.80E+01	1.10E+00	3.90E+00	
PBF-16									
PBF-21	4.60E-01					1.63E+00	7.50E-02	1.46E+00	
PBF-22		2.70E+00	6.60E+00	2.28E+00		6.60E+00		2.23E+00	
PBF-26						3.40E+00[e]	3.40E+00[e]	3.40E+00[e]	

a. All concentrations are in pCi/g. No concentrations exceed both background and EBSL values. Sites are not evaluated further for radiological contaminants in the WAG 5 ERA (see Section 7.2.6.3).

b. Background values are the 95%/95% UTL for composite samples (Rood, Harris, and White 1996).

c. The lower of the internal and external ecologically based screening levels (EBSLs) (pCi/g) was used.

d. As with the human health risk assessment, ARA-02 was broken into two separate sources, one for septic tank soils and one for the seepage pit. However, for the ERA only the external soils were assessed.

e. Data are for total uranium (EG&G 1993).

Table 7-9. Screening of nonradionuclide organic contaminants.[a]

Contaminant EBSL[b]	1,1,1-Trichloroethane 4.08E+02	1,1-Dichloroethane 6.95E+00	2-Butanone 1.91E+01	4-Methyl-2-pentanone[c] 3.38E+01	Acetone 2.78E-01	Aroclor-1248[d] 1.43E-02	Aroclor-1254 1.43E-02	Benzene 5.50E+00
ARA-01					7.00E-03			
ARA-02 septic tank soils[e]		9.70E-01	1.1E-02					
ARA-02 seepage pit[e]	4.80E-02		1.1E-02		1.1E-02			
ARA-03								
ARA-10								
ARA-12								
ARA-16	3.20E-02		2.00E-03					
ARA-23								
ARA-24								
ARA-25				1.4E-02			**1.60E-01**	
PBF-04[f]								4.00E-01
PBF-10								
PBF-12								
PBF-16								
PBF-21					1.20E-02			
PBF-22						**1.20E-01**	**1.20E-01**	
PBF-26							**1.30E+01**	

Table 7-9. (continued).

Contaminant EBSL[b]	Benzo(a)pyrene 3.34E-02	Bis(2-ethylhexyl) phthalate 2.63E+00	Di-n-butylphthalate 1.54E+01	Di-n-octylphthalate 4.73E+01	Ethylbenzene 2.83E+01	Fluoranthene 1.69E+01	Isophorone[g] (no EBSL)
ARA-01							
ARA-02 septic tank soils[e]							
ARA-02 seepage pit[e]							
ARA-03							
ARA-10							
ARA-12	**5.60E-02**	4.20E-02	8.40E-02				
ARA-16			1.60E-01				
ARA-23							
ARA-24							
ARA-25				4.40E-02	4.00E-03	1.30E-01	2.4E-02
PBF-04[f]					6.00E+00		
PBF-10							
PBF-12							
PBF-16							
PBF-21		1.90E+00					
PBF-22							
PBF-26							

Table 7-9. (continued).

Contaminant EBSL[b]	Methylene Chloride 4.27E-01	Phenol 6.33E+00	Pyrene 2.03E+01	Tetrachloro-ethylene 1.62E+00	Toluene 3.03E+01	Trichloro-ethylene 1.74E+01	Xylene 2.86E-01
ARA-01	2.60E-02				4.00E-03		
ARA-02 septic tank soils[e]				4.00E-03	1.10E-02	7.00E-03	
ARA-02 seepage pit[e]							
ARA-03							
ARA-10							
ARA-12							
ARA-16				2.00E-03	2.00E-03	1.10E-02	
ARA-23							
ARA-24							
ARA-25		1.20E-01	1.10E-01		7.00E-02		
PBF-04[f]					1.20E+01		**6.00E+01**
PBF-10							
PBF-12							
PBF-16							
PBF-21					2.00E-03	2.00E-03	
PBF-22							
PBF-26							

a. All concentrations are in mg/kg. Concentrations shown in **bold** exceed ecologically based screening level (EBSL) values and were evaluated in the WAG 5 ERA (see Section 7.2.6.3). There are no background values for these constituents.
b. The minimum EBSL (mg/kg) is shown for all receptors or functional groups.
c. The EBSL for methyl isobutly ketone is was used for 4-methyl-2-pentanone because these are two names for the same chemical.
d. The TRVs and EBSLs for Aroclor-1254 were used to assess Aroclor-1248.
e. The ARA-02 site was broken into two sources, one for septic tank soils and one for the seepage pit. However, only the external soils were assessed in the ERA.
f. Data for subsurface samples are from the Track 1 investigation (EG&G 1994).
g. A TRV has not been developed for isophorone. However, a review of existing data indicates that it is unlikely that an EBSL would be exceeded by the maximum ARA-25 soil concentration of 0.24 mg/kg. The best available study of the effects of isophorone on animals reports a NOAEL of 150 mg/kg-day (Nor-Am Agricultural Products 1972).

7.2.6.3 Screening of Sites and Contaminants. This section provides a screening of the sites and contaminants identified in Table 7-3 against both background concentrations and ecologically based screening levels (EBSLs). In Tables 7-8 through 7-10, maximum concentrations (except as noted) are compared to the EBSL and background values for radionuclides, organics, and inorganics, respectively.

The background concentrations were the 95%/95% upper tolerance limit (UTL) for composite samples obtained from INEEL background guidance (Rood, Harris, and White 1996). Ecologically based screening levels were calculated specifically for the INEEL as discussed in INEEL ERA guidance (VanHorn, Hampton, and Morris 1995). Ecologically based screening levels are defined as concentrations of contaminants in soil (or other media) that are not expected to produce any adverse effects to selected ecological receptors under chronic exposure conditions. The development of EBSLs is summarized in Appendix I.

The decision process for inclusion of a site and contaminant combination in a WAG ERA includes the following steps:

1. If the site concentration of the contaminant does not exceed the 95/95% UTL of the background concentrations for composite samples (Rood, Harris, and White 1996), and if the contaminant concentration at the site does not exceed the minimum EBSL concentration, then the contaminant is not considered in the WAG ERA for that site. This step is completed for inorganics and some radionuclides.

2. As with the human health risk assessment, it is appropriate to screen six inorganic constituents that are not associated with toxicity under normal circumstances. These include aluminum, calcium, magnesium, potassium, iron, and sodium. These will be eliminated if concentration is less than 10 times the INEEL background concentration.

7.2.6.4 Summary of Sites and COPCs Retained for Further Assessment. The EBSL and background screening process (see Tables 7-8 through 7-10) resulted in the elimination of all radionuclide contaminants at all sites. The ARA-02 seepage pit, ARA-10, ARA-23, ARA-24, and PBF-12 sites were completely eliminated from the assessment. The following 12 sites and associated COPCs were retained for further assessment in the subsequent phases of the WAG 5 ERA. Each site is briefly described in the following paragraphs. For more detailed site descriptions, see Sections 3 and 4.

ARA-01
- Antimony
- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

PBF-10
- Chromium

PBF-16
- Lead
- Mercury

PBF-21
- Cobalt
- Copper

ARA-02 septic tank soils

Barium
Chromium
Copper

ARA-03

Arsenic

ARA-12

Arsenic
Benzo(a)pyrene
Cadmium
Chromium
Copper
Lead
Manganese
Mercury
Selenium
Silver
Zinc

PBF-22

Aroclor-1248
Aroclor-1254
Arsenic
Copper
Lead
Mercury
Nickel
Selenium
Silver

PBF-26

Aroclor-1254
Arsenic
Chromium
Copper
Lead
Mercury
Nickel
Silver
Zinc.

7.2.6.4.1 ***ARA-01, ARA-I Chemical Evaporation Pond (ARA-745)***—Site ARA-01 is an unlined surface impoundment that until 1988 received wastewater from the ARA-I Shop and Maintenance Building. This 2,990-m^2 (32,000-ft^2) pond is now dry except during periods of heavy precipitation. The primary vegetation at the site is currently crested wheatgrass and shrubs, and the site is surrounded by open wire fences and native vegetation. Contaminants in surface and subsurface soil at ARA-01 include VOCs, metals, and radionuclides. Twelve metals were retained as COPCs for analysis in the WAG 5 ERA.

7.2.6.4.2 ARA-02 ARA-I Sanitary Waste Leach Field and Seepage Pit—The 223-m^2 (2,400-ft^2) ARA-02 site consists of a sanitary septic system comprising three septic tanks, a seepage pit, and associated piping. The three septic tanks and the seepage pit interiors are not readily accessible to ecological receptors and were not assessed in the ERA. Surface and subsurface soil samples collected exterior to the system were evaluated. As a result, the seepage pit area was eliminated from further evaluation in the ERA and the septic tank soils were retained for analysis of potential ecological risk from barium, chromium, and copper.

7.2.6.4.3 ARA-03, ARA-I Pad Near ARA-627—The ARA-03 site is an 84-m^2 (900-ft^2) area of surface soil contaminated with radionuclides from an unknown source. This area was covered with lead sheeting, which was removed in 1991. Soils were excavated to a depth of 1.1 m (3.5 ft) in a 60-m^2 (676-ft^2) area during a 1994 removal action. The area was subsequently backfilled and seeded. The site is currently covered primarily by crested wheatgrass. Arsenic is the only COPC in surface and subsurface soil.

Table 7-10. Screening of nonradionuclide inorganic contaminants.[a]

Contaminant	Aluminum[d]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium[d]	Chromium(III)[e]	Cobalt
Background[b]	1.60E+04	4.80E+00	5.80E+00	3.00E+02	1.80E+00	2.20E+00	2.40E+04	3.30E+01	1.10E+01
EBSL[c]	4.27E+00	7.67E-01	9.02E-01	1.54E+02	7.34E-01	2.63E-03	NA	1.67E-01	4.67E-01
ARA-01	2.25E+04	**1.68E+01**	**2.58E+01**	2.93E+02	2.20E+00[h]	**3.80E+00**	1.83E+05	**6.90E+01**	1.24E+01[f]
ARA-02 septic tank soils[g]	1.16E+04		7.50E+00[h]	**1.00E+03**	1.70E+00	1.50E+00	1.20E+05	**1.83E+02**	
ARA-02 seepage pit[g]	7.9E+03		5.5E+00	1.81E+02	1.30E+00	1.1E+00	5.35E+04	1.67E+01	
ARA-03			**9.10E+00**	2.03E+02		1.70E+00		1.68E+01	
ARA-10									
ARA-12	1.21E+04		**8.30E+00**		1.60E+00	**8.30E+00**	8.08E+04	**4.69E+02**	9.90E+00
ARA-16	1.01E+04		5.30E+00	2.74E+02	1.10E+00	6.30E-01	7.60E+04	1.84E+01	9.40E+00
ARA-23									
ARA-24									
ARA-25	3.31E+03		**4.06E+01**	5.11E+01	1.96E-01		6.53E+04	**9.84E+01**	**1.04E+02**
PBF-04									
PBF-10								**3.09E+02**	
PBF-12									
PBF-16[i]			2.90E+00			1.20E+00		7.00E+00	
PBF-21	1.00E+04		5.70E+00	1.75E+02	1.10E+00	1.50E+00	9.20E+03	2.32E+01	**1.26E+01**
PBF-22	1.84E+04		**1.22E+01**	2.67E+02	1.90E+00[h]	2.70E+00[j]	7.50E+04	4.80E+01[k]	1.16E+01[l]
PBF-26	1.15E+04		**7.90E+00**	1.93E+02		6.80E-01	4.81E+04	**6.40E+01**	7.50E+00

Table 7-10. (continued).

Contaminant	Copper	Fluoride	Iron[d]	Lead	Magnesium[d]	Manganese	Mercury	Nickel	Nitrate
Background[b]	2.20E+01	NA	2.40E+04	1.70E+01	1.20E+04	4.90E+02	5.00E-02	3.50E+01	NA
EBSL[c]	2.17E+00	3.11E+00	NA	7.17E-02	2.56E+00	1.44E+01	6.13E-03	2.77E+00	3.20E+01
ARA-01	2.55E+01		2.36E+04	4.39E+01	1.95E+04	4.52E+02		3.45E+01	
ARA-02 septic tank soils[g]	2.63E+01		1.83E+04	1.21E+01	1.43E+04	3.48E+02		2.78E+01	
ARA-02 seepage pit[g]	1.73E+01		1.2E+04	1.15E+01	7.21E+03	2.96E+02		2.06E+01	
ARA-03				1.05E+01					
ARA-10									
ARA-12	6.23E+02		1.86E+04	1.58E+02	1.23E+04	5.70E+02	1.40E+00	2.92E+01	
ARA-16	1.50E+01	4.77E+00	1.63E+04	1.39E+01	1.20E+04	3.34E+02		1.93E+01	1.10E+01
ARA-23									
ARA-24									
ARA-25	2.27E+02		3.37E+04	1.43E+03	3.04E+04	1.04E+03	9.70E-02	3.88E+01	
PBF-04									
PBF-10									
PBF-12									
PBF-16[i]				3.20E+01			7.10E-01		
PBF-21	2.33E+01	5.40E-01	1.73E+04	1.66E+01	6.07E+03	4.10E+02		2.79E+01	9.43E+00
PBF-22	4.84E+01		2.09E+04	6.84E+01	9.98E+03	6.02E+02	2.70E-01	4.10E+01	
PBF-26	2.34E+02		1.61E+04	4.30E+01	4.80E+03	3.98E+02	3.40E-01	4.50E+01	

Table 7-10. (continued).

Contaminant	Potassium[d]	Selenium	Silver	Sodium[d]	Sulfate	Thallium	Vanadium	Zinc
Background[b]	4.30E+03	2.20E-01	NA	3.20E+02	NA	4.30E-01	4.50E+01	1.50E+02
EBSL[c]	NA	8.34E-02	1.39E+00	NA	1.77E+01	1.17E-01	2.55E-01	6.37E+00
ARA-01	5.12E+03	**2.77E+01**	**1.27E+01**	2.61E+03		**5.92E+01**	**6.80E+01**	**2.33E+02**
ARA-02 septic tank soils[g]	1.82E+03		7.9E-01	1.44E+03			3.89E+01	7.77E+01
ARA-02 seepage pit[g]	2.22E+03		3.4E-01	4.30E+02			2.51E+01	8.74E+01
ARA-03								
ARA-10								
ARA-12	3.71E+03	**2.70E+00**	**5.70E+00**	1.160+03		2.40E-01	3.02E+01	**3.76E+02**
ARA-16	2.77E+03			1.08E+03	5.95E+00	2.80E-01	2.90E+01	8.35E+01
ARA-23								
ARA-24								
ARA-25	9.04E+02	**6.59E-01**	**7.24E+00**	1.91E+02			**1.04E+02**	**8.55E+02**
PBF-04								
PBF-10								
PBF-12								
PBF-16[i]		< 2E-01	< 2E-01					
PBF-21	2.06E+03				7.28E+00		3.99E+01	7.60E+01
PBF-22	6.54E+03	**1.70E+00**	**1.19E+01**	2.81E+03			4.26E+01	1.64E+02[m]
PBF-26	1.99E+03		**3.70E+01**	1.31E+03			3.40E+01	**2.59E+02**

a. All concentrations are in mg/kg. Concentrations shown in **bold** exceed background concentrations and EBSL values and are evaluated in the WAG 5 ERA (Section 7.6.2.3).
b. Background values are the 95%/95% UTL for composite samples (Rood, Harris, and White 1996).
c. The minimum EBSL (mg/kg) for all receptors and functional groups.
d. As with the human health risk assessment, it is appropriate to screen six inorganic constituents that are not associated with toxicity under normal circumstances. These include aluminum, calcium, magnesium, potassium, iron, and sodium. These will be eliminated if concentration is less than 10 times background.
e. Chromium was assessed as chromium(III) because chromium is not expected to persist in the environment at the INEEL in the chromium(VI) form (Bartlett and Kimble 1976; Rai, Eary, and Zachara 1989). See Section 7.3.4.5.
f. Cobalt at ARA-01 exceeded the background concentration in one of 35 samples (<5%). The contaminant was eliminated from further evaluation.
g. As with the human health risk assessment, ARA-02 was broken into two separate sources, one for the septic tank soils and one for the seepage pit. Only external soils are assessed in the ERA.
h. As discussed in Section 3.4.3, beryllium and arsenic are commonly detected in WAG 5 soils at concentrations slightly higher than background values. However, neither contaminant is associated with waste-producing processes at WAG 5. Therefore, beryllium at ARA-01 and PBF-22 and arsenic at ARA-02 were eliminated from further evaluation.
i. Data for PBF-16 are taken from the Track 2 summary report (Hillman-Mason et al. 1994).
j. Cadmium at PBF-22 exceeded the background concentration in one of 81 samples (<5%) at a concentration of 2.7 mg/kg. The contaminant was eliminated from further evaluation.
k. Chromium at PBF-22 exceeded the background concentration in one of 81 samples (<5%) at a concentration of 48 mg/kg. The contaminant was eliminated from further evaluation.
l. Cobalt at PBF-22 exceeded the background concentration in one of 81 samples (<5%) at a concentration of 11.6 mg/kg. The contaminant was eliminated from further evaluation.
m. Zinc at PBF-22 exceeded the background concentration in one of 81 samples (<5%) at a concentration of 164 mg/kg. The contaminant was eliminated from further evaluation.