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Health and Safety Plan for Waste Area Group 3, Operable Unit 3-13, Group 1 Soils Tank Farm Interim Action

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Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Revision 4

Health and Safety Plan for Waste Area Group 3, Operable Unit 3-13, Group 1 Soils Tank Farm Interim Action

May 2003

Idaho National Engineering and Environmental Laboratory
Idaho Completion Project
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-99ID13727

ABSTRACT

This health and safety plan establishes the procedures and requirements used to eliminate or minimize health and safety risks to personnel at the Waste Area Group 3, Operable Unit 3-13, Group 1 Soils Tank Farm Interim Action project. This health and safety plan follows the requirements of the Occupational Safety and Health Administration standard, 29 Code of Federal Regulations 1926.65, "Hazardous Waste Operations and Emergency Response." It contains information about the hazards involved in performing the work, and the specific actions and equipment that will be used to protect personnel at the project location. This plan has been prepared to comply with the authorized safety basis at the Idaho Nuclear Technology and Engineering Center as defined by the U.S. Department of Energy Order 5480.23.

This health and safety plan contains the safety, health, and radiological hazard assessment for conducting all Waste Area Group 3, Operable Unit 3-13, Group 1 Soils Tank Farm Interim Action tasks. The intent of this document is to identify known hazards and to serve as a plan for mitigating them. Safety and health professionals supporting these activities must determine the most appropriate hazard control and mitigation measures based on project-specific conditions and should make changes to this document as appropriate.

This health and safety plan is intended to give safety and health professionals the flexibility to establish and modify project safety and health procedures throughout the project duration based on the existing and anticipated hazards without changing this document. Minor changes such as name changes in the organizational chart will not require this document to be modified and work may continue.

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ARDC	Administrative Record and Document Control
BBWI	Bechtel BWXT Idaho, LLC
bls	below land surface
CAM	continuous air monitor
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
COC	contaminates of concern
CRC	contamination reduction corridor
CRZ	contamination reduction zone
CWA	controlled work area
dBA	decibel A-weighted
DOE	Department of Energy
DOE-ID	DOE Idaho Operations Office
DWA	designated work area
EC	emergency coordinator
ECA	Environmentally Controlled Area
EDF	engineering design file
EO	environmental operations
EPA	Environmental Protection Agency
ER	environmental restoration
ERO	Emergency Response Organization
ESH&QA	environmental, safety, and health/quality assurance
EZ	exclusion zone
FFA/CO	Federal Facility Agreement and Consent Order
FS	feasibility study
GI	gastrointestinal
HASP	health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high-density polyethylene
HEPA	high efficiency particulate air
HSO	health and safety officer
IARC	International Agency for Research of Cancer
ICDF	INEEL CERCLA Disposal Facility
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission on Radiological Protection
IDHW	Idaho Department of Health and Welfare
IDLH	immediately dangerous to life or health

IH	industrial hygiene or industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
INEL	Idaho National Engineering Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
JSA	job safety analysis
JSS	job site supervisor
LLW	low-level waste
LMITCO	Lockheed Martin Idaho Technologies Company
MCP	management control procedure
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NRR	noise reduction rate
NRTS	National Reactor Testing Station
NTP	National Toxicology Program
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PEL	permissible exposure limit
PM	project manager
PPE	personal protective equipment
QAPjP	Quality Assurance Project Plan
RadCon	Radiological Control
RAM	remote area monitor
RBA	radiological buffer area
RCIMS	Radiological Control and Information Management System
RCM	radiological control manual
RCT	radiological control technician
RE	radiological engineer
RI/FS	remedial investigation/feasibility study
RMA	radioactive material area
ROD	Record of Decision
RWP	radiological work permit
SCBA	self-contained breathing apparatus
SE	safety engineer
SH&QA	safety, health, and quality assurance
SRPA	Snake River Plain Aquifer
STEL	short-term exposure limit
STR	subcontractor technical representative
SWP	safe work permit
SZ	support zone

TLV	threshold-limit value
TPR	technical procedure
TRAIN	Training Records and Information Network
TRU	transuranic
TWA	time weighted average
U.S.	United States
USCG	United States Coast Guard
USQ	unreviewed safety question
UV	ultraviolet
VOC	volatile organic compound
VPP	Voluntary Protection Program
WAG	waste area group
WCC	Warning Communications Center

Health and Safety Plan for Waste Area Group 3, Operable Unit 3-13, Group 1 Soils Tank Farm Interim Action

1. INTRODUCTION

This health and safety plan (HASP) establishes the procedures and requirements used to eliminate and/or minimize health and safety risks to personnel working on Phase I and Phase II of the Waste Area Group (WAG 3), Operable Unit (OU) 3-13, Group 1 Soils Tank Farm Interim Action Project. This HASP meets the requirements of the Occupational Safety and Health Administration (OSHA) standard, 29 Code of Federal Regulations (CFR) 1926.65, "Hazardous Waste Operations and Emergency Response (HAZWOPER)." Its preparation is consistent with information found in the National Institute of Occupational Safety and Health (NIOSH)/OSHA/United States Coast Guard (USCG)/U.S. Environmental Protection Agency (EPA) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH 1985); Bechtel BWXT Idaho, LLC (BBWI) *Safety and Health Manuals*; and Idaho National Engineering and Environmental Laboratory (INEEL) *Radiological Controls Manual* and *Radiation Protection Manual*. This HASP complies with the authorized safety basis detailed in the Idaho Nuclear Technology and Engineering Center (INTEC) safety authorization basis (safety analysis report) as defined in the U.S. Department of Energy (DOE) Order 5480.23, using the unreviewed safety question (USQ) process.

1.1 Purpose

This HASP governs Phase I and Phase II work activities associated with the WAG 3, OU 3-13 Soils Tank Farm Interim Action Project performed by employees of BBWI, subcontractors to BBWI, and employees of other companies or the DOE laboratories. People not normally assigned to work at the project, such as representatives of DOE, the State of Idaho, OSHA, and the EPA are considered visitors who fall under the definition of "occasional site workers" as stated in OSHA 29 CFR 1926.65.

This HASP will be reviewed and revised annually per management control procedure (MCP)-255, "Hazardous Waste, Operations & Emergency Response," to ensure compliance by the health and safety officer (HSO), the subcontractor technical representative (STR), necessary environmental, safety, and health professionals, and Subproject-6 (SP-6) safety, health, and quality assurance (SH&Q) compliance officer.

1.2 INEEL Site Description

The INEEL, formerly the Idaho National Engineering Laboratory (INEL) and the National Reactor Testing Station (NRTS), encompasses 2,305 km^2 (890 mi^2), being located approximately 55 km (34 mi) west of Idaho Falls, Idaho (see Figure 1-1).

The United States Atomic Energy Commission, now the DOE, established the NRTS in 1949 as a site for building and testing a variety of nuclear facilities. The INEEL has also been the storage facility for transuranic (TRU) radionuclides and radioactive low-level waste (LLW) since 1952. At present, the INEEL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs. The DOE Idaho Operations Office (DOE-ID) has responsibility for the INEEL and designates authority to operate the INEEL to government contractors. Bechtel BWXT Idaho, LLC, the current primary contractor for DOE-ID at the INEEL, provides managing and operating services to the majority of INEEL facilities.

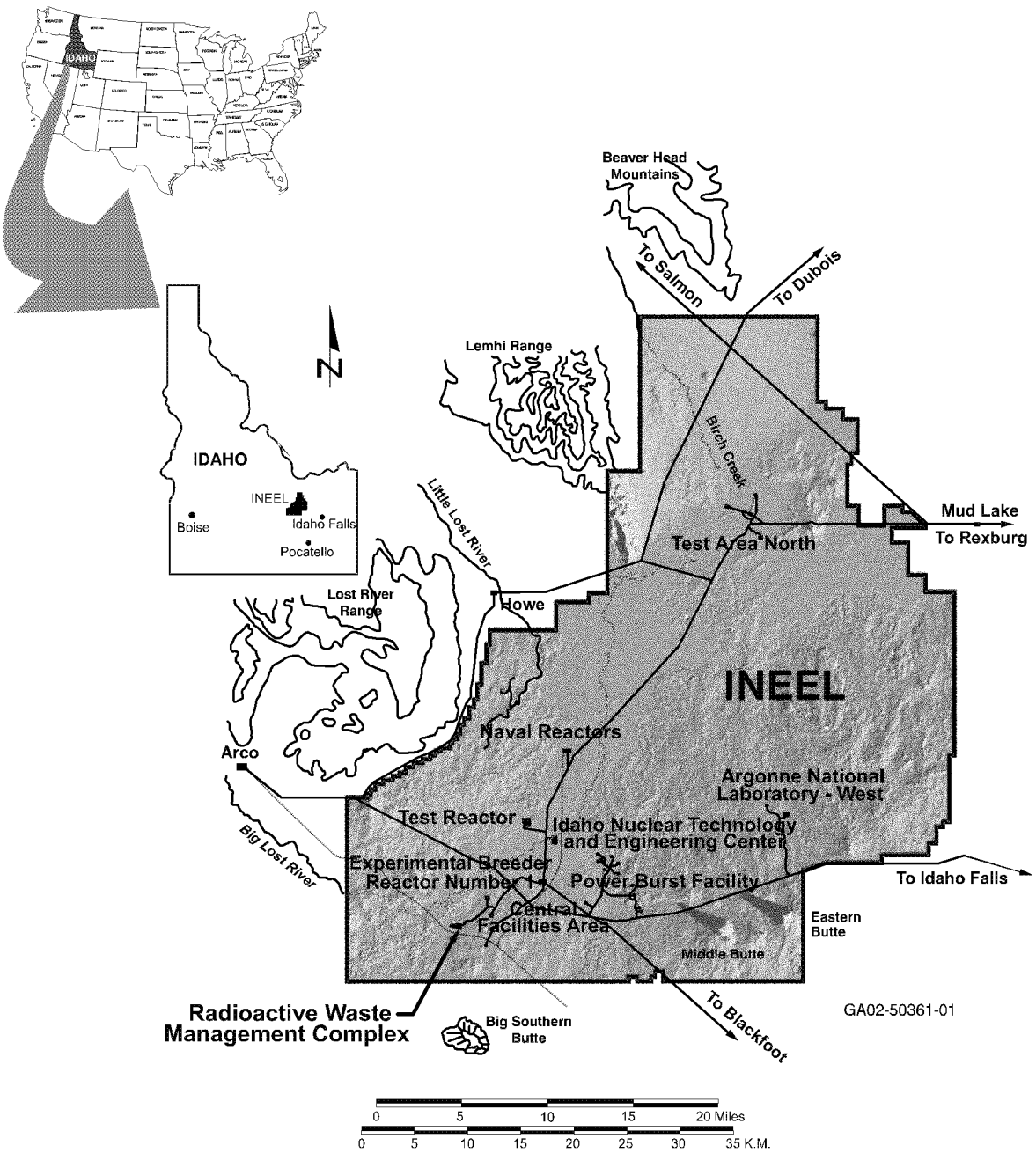

Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory.

2. INTEC SITE DESCRIPTION

The INTEC, formerly known as the Idaho Chemical Processing Plant (ICPP), is located in the south-central area of the INEEL in southeastern Idaho. Operations at INTEC since 1952 have primarily been related to the reprocessing of spent nuclear fuel from defense projects wherein reusable uranium was extracted from the spent fuels. The DOE discontinued reprocessing at the facility in 1992. Liquid waste generated from the activities prior to 1992 is stored in an underground tank farm. Treatment of this waste using a calcining process is ongoing at the facility. This process converts the liquid to a more stable granular form; the calcined solids are then stored in stainless steel bins. Disposition of this waste will be addressed in the "INEEL High Level Waste and Facility Disposition Environmental Impact Statement." The current mission for INTEC is to receive and temporarily store spent nuclear fuel and radioactive waste for future disposition, manage waste, and perform remedial actions.

Both soil and groundwater contamination (see Table 2-1 for potential INTEC radionuclide contaminants) resulted from previous operations at INTEC. Under the Federal Facility Agreement and Consent Order (FFA/CO), the EPA, Idaho Department of Health and Welfare (IDHW), and DOE (herein referred to as the Agencies) are directing cleanup activities to reduce human health and environmental risks to acceptable levels. Under the FFA/CO, the INEEL was divided into 10 WAGs to facilitate the cleanup activities. The INTEC is designated as WAG 3. Within WAG 3, the facility was further divided into OUs made up of individual contaminant release sites.

Several phases of investigation have been performed on the various OUs within WAG 3. A comprehensive remedial investigation/feasibility study (RI/FS) (OU 3-13 RI/FS) was conducted to determine the nature and extent of contamination and corresponding potential risks to human health and the environment under various exposure pathways and scenarios. On the basis of the RI/FS, the INTEC release sites were further segregated into seven groups to allow the development and analysis of remedial action alternatives with the sites grouped by contaminants of concern (COC), accessibility, or geographic proximity.

For each of the seven groups, remedial action alternatives were developed and evaluated in the OU 3-13 Feasibility Study (FS) and FS Supplement Reports. Detailed information on the release sites within each group can be found in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant at the INEEL Part A-RI/BRA Report, Part B—FS and FS Supplement Reports* along with the *Record of Decision for the Idaho Nuclear Technology and Engineering Center OU 3-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997a, DOE-ID 1997b, DOE-ID 1998a, and DOE-ID 1999). Based on the results of the alternative evaluation in the FS and FS Supplement Reports, a remedial alternative was preferred for each group of sites. The preferred alternatives were presented in the Proposed Plan for OU 3-13 (DOE-ID 1998b). This HASP addresses only the Group 1 Soils sites.

The OU 3-13 Group 1 Soils, are soils at INTEC within the tank farm fence in addition to soils within a 150 ft zone surrounding the tank farm. There are several buildings surrounding the tank farm, so the perimeter boundary line is not necessarily drawn exactly at the 150 ft mark. The area within the fence is approximately 200,000 ft^2 (4.60 acres) and the area within the 150 ft perimeter zone is approximately 160,000 ft^2 (3.7 acres).

Table 2-1. Potential INTEC radionuclide contaminants and suspected maximum concentrations.[a]

Radionuclide Contaminants	Background Surface Soil (0–10 cm bls) 95%–95% Upper Tolerance Limit (pCi/g)	Maximum Concentration Term (pCi/g)
Am-241	0.011	3.27
Cs-134	NR[b]	1,450
Cs-137	0.82	21,000
Co-57[b,c]	NR	1.02
Co-60	NR	2,390
Eu-152	NR	35,000
Eu-154	NR	35,000
Eu-155	NR	7,600
Pu-238	0.0005	3.6
Pu-239/240	0.10	12.0
Pu-241	NR	NA[d]
Sr-90	0.49	15,800
Np-237	NR	0.15
U-234	1.44	2.2
U-235	NR	0.039
U-238	1.4	1.7
Ce-144	NR	2,390

a. This table has been extracted from the *Health and Safety Plan for the INTEC Radionuclide Contaminated Soils Removal Action* (INEL 1999).

b. NR = No background data were available to calculate a background value.

c. The half-life for Co-57 is 270.9 days; therefore, any risk due to the presence of this isotope would be minimal.

d. NA = Not applicable.

2.1 Scope of Work, Group 1 Soils Tank Farm Interim Action

The principal threat associated with the tank farm soils are due to direct or potential radiation exposure (see Table 2-1) to workers or the public; and, due to potential leaching and transport of contaminants, to the perched water or the Snake River Plane Aquifer (SRPA), a sole source aquifer. A final remedy for the tank farm soils release sites has been deferred pending further characterization and coordination of any proposed remedial actions with the "Idaho High Level Waste and Facilities Disposition Environmental Impact Statement," currently in preparation. A separate RI/FS, Proposed Plan, and Record of Decision (ROD) will be prepared for the tank farm soils under OU 3-14. Interim actions were evaluated to provide protection until a final remedy is developed and implemented. The selected Tank Farm Soils Interim Action is Institutional Controls with Surface Water Control (Phase I).

The specific remedial action goals are

- Restrict access to control exposure to workers and prevent exposure to the public from soils at the tank farm until implementation of the final remedy under OU 3-14 ROD

- Accommodate a 24-hour storm event once in 25 years with surface water run-on diversion channels

- Minimize precipitation infiltration by grading and surface sealing the tank farm soils sufficient to divert 80% of the average annual precipitation falling on the tank farm soils area

- Improve exterior building drainage to direct water away from the contaminated areas, as promulgated in the OU 3-13 Final Record of Decision.

The Phase I interim action remedial action tasks (see Figure 2-1) include the following:

- Selected storm water collection ditches around the tank farm and out to the discharge point will be graded and lined with concrete.

- Selected culverts around the tank farm and out to the discharge point will be replaced with larger culverts to accommodate the expected increase in storm water flow. The depth of the excavations shall require shoring for safety purposes and reduced impact to the surrounding operating areas.

- Concrete headwalls and endwalls will be constructed as necessary throughout the lined drainage system.

- The storm water collection pond outside the INTEC fence will be lined to collect storm water runoff from the tank farm and other INTEC areas that currently drain into Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) Environmentally Controlled Area (ECA) 37A. The pond is located approximately 400 ft south of the existing sewage treatment plant and 300 ft north of building CPP-698. The pond will be lined with 60-mil high-density polyethylene and will be approximately 15-ft deep, with bottom dimensions approximately 160 × 340 ft. All drainage ditches within the scope of this project will be routed to the pond.

- A lift-station and associated manholes was constructed at the intersection of Beech and Olive Avenue to pump storm water to a location where it will drain freely to the discharge point.

Phase II work scope (see Figure 2-2):

- An impervious covering will be applied over three identified hot spots (CPP-31, CPP-28, and CPP-79) within the tank farm to minimize storm water infiltration into the underlying soils. The ground surface will be graded to create drainage away from the tank farm and into the stormwater collection system. An impervious material will be applied to the three hot spots once the surfaces are graded and sloped to the collection ditches

- Two concrete-lined ditches (approximately 1.5 ft deep × 7.5 ft wide) will be constructed within the tank farm to collect and direct precipitation run-off to the surrounding storm water collection system.

- Unidentified CERCLA wastes may be encountered during grading work. These materials may be identified through sampling activities, traced to their origin or source, controlled to stop leaks, and placed in appropriate containers for proper on-Site or off-Site disposal.

Surveillance and monitoring tasks will commence after the Phase I and Phase II construction activities are completed and the overall system is operational. It is anticipated that by 2007 surveillance

and monitoring activities will be addressed and managed under the OU 3-14 ROD. Surveillance activities are intended to assure the interim actions are functioning adequately to meet the remedial action objectives stated in the OU 3-13 ROD and discussed above. Activities shall include routine inspections of the liner and drainage systems, and monitoring of the evaporation pond liner integrity. Standard maintenance and operating procedures shall be integrated into the INTEC documentation to provide proper maintenance during and after future operations or construction activities within the tank farm interim action area. Continuous system ownership shall be controlled by Clean/Close INTEC SP-6 Management.

The SP-6 and INTEC ESH&QA professionals have assisted in completing the Hazards Screening Profile checklist found in Standard (STD)-101, "Integrated Work Control Process," and the MCP-3562, "Hazards Identification, Analysis, and Control for Operational Activities," prior to work being performed.

2.2 Program Interfaces

The interface agreement between the program and the INTEC (IAG-89) describes the working relationships for activities and programs conducted at the INTEC. The programs at INTEC are being conducted under the regulatory authority of the CERCLA (42 USC 6901 et seq.); the Final ROD for INTEC, Waste Area Group 3, OU 3-13 (DOE-ID 1999); and FFA/CO (DOE-ID 1991). Subproject 6 of the Clean/Close INTEC Project is responsible for Phase I construction and implementation. Phase II of the Tank Farm Interim Action completion and follow-on work is the responsibility of Subproject 5 (SP-5) of the Clean/Close INTEC Project. Both work phase (I and II) activities, hazard identification, and hazard mitigation have been included in this health and safety plan.

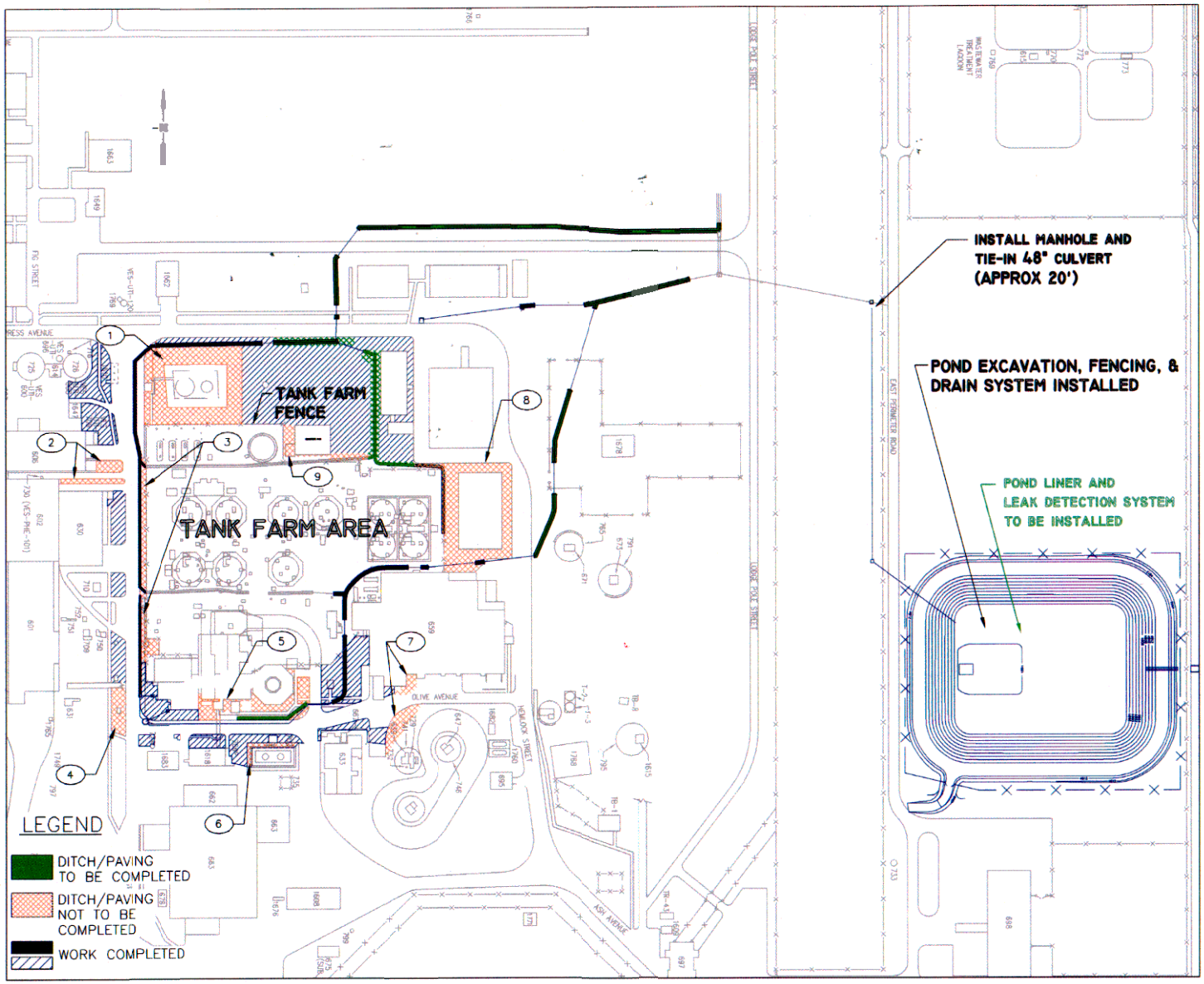

Figure 2-1. WAG-3, OU 3-13, Group 1 Soils Tank F Interim Action, Phase I.

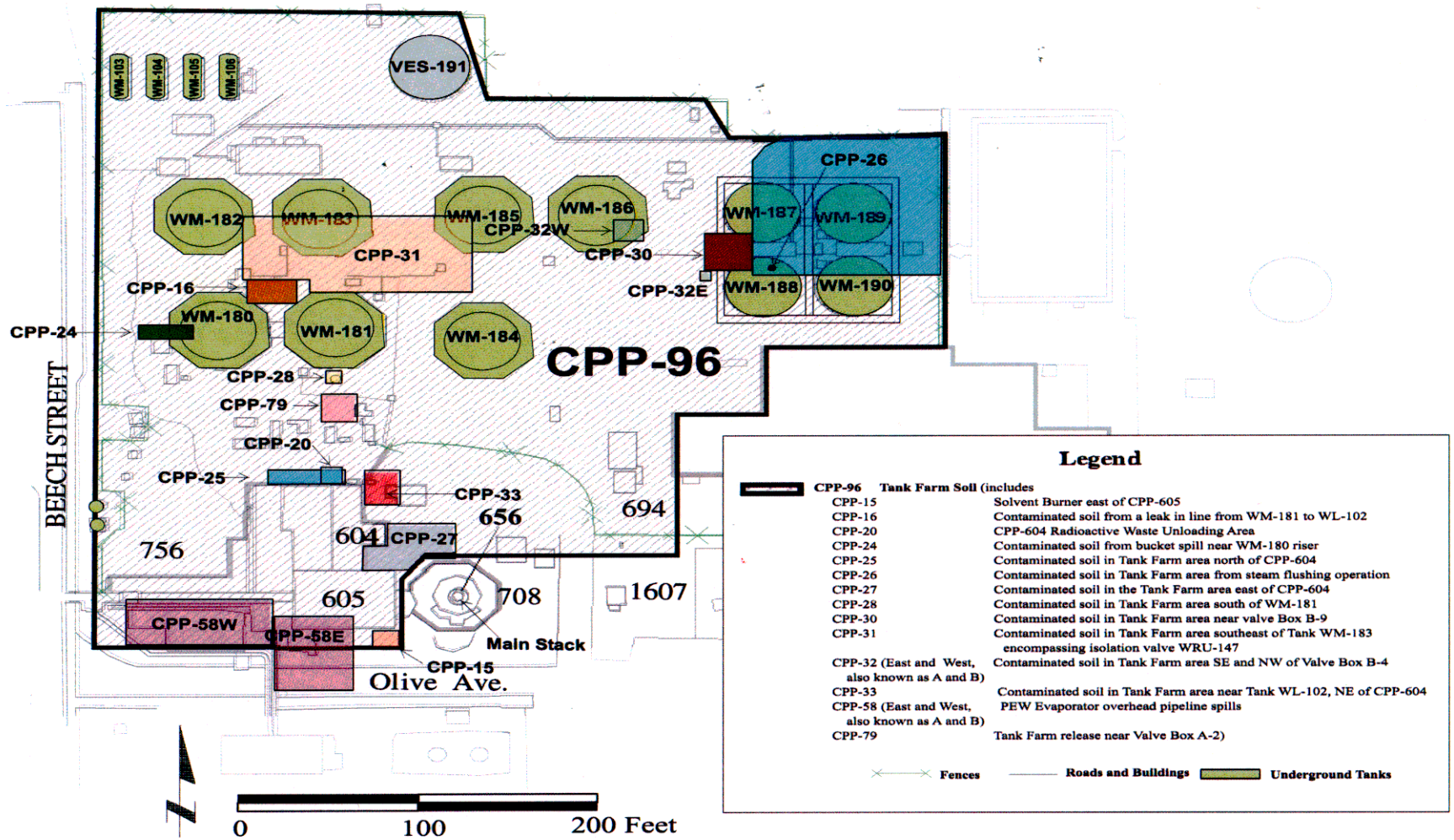

Figure 2-2. Tank Farm Interim Action - Phase II.

3. HAZARD ASSESSMENT

This document contains requirements for both contractor and subcontractor personnel conducting work at the INEEL. Contract personnel normally comply with company wide applicable company policies, procedures, and manuals as well as requirements outlined in work control documents, job safety analyses (JSAs), radiological work permits (RWPs), and this HASP in addition to established safety and health programs and procedures. Subcontractors will be held responsible to follow their company safety and health program and procedures in addition to contract requirements.

3.1 Hazard Evaluation of Project Activities

Personnel may be exposed to safety hazards, or to chemical, radiological, and physical agents while working on both Phase I and Phase II Tank Farm Interim Action Project tasks. Soils outside and inside the INTEC tank farm have historically been contaminated with both chemical and radiological constituents, but work inside the tank farm (Phase II) has a greater potential for personnel exposure. The degree of the hazards posed depends on the nature of contaminants encountered and the specific tasks being performed. Table 3-1 summarizes the anticipated hazards associated with various project activities.

The project activities may involve radiological hazards that will be monitored by on-Site radiological control technicians (RCTs), as they determine necessary. The RCTs will develop RWPs, as needed, in accordance with applicable company manuals. Safe work permits (SWPs) may be prepared using applicable company policies and procedures. For instances where the project/task JSA does not address task hazards, SWP may be used as a temporary means of hazard identification and mitigation until the associated JSA is updated to reflect identified hazards. The RWPs and JSAs will be used in conjunction with this HASP to address hazardous and radiological conditions at the site. These documents will augment this HASP and further detail protective measures, personal protective equipment (PPE), and dosimetry requirements.

Table 3-1. WAG 3, OU 3-13 Group 1 Soils Tank Farm Interim Action activities and the associated hazards.

Activity or Task	Associated Hazards or Hazardous Agent
Mobilization	Heavy equipment mobilization, pinch points, dust, lifting/back strain, heat stress, hazardous noise levels, ultraviolet (UV) exposure
Surveying excavation areas	Uneven/sloped walking and working surfaces, moving equipment, noise hazards, radiation exposure, radiological and chemical/inorganic contamination, lifting/back strain, heat stress, dust, UV exposure
Grade and line with concrete all existing storm water collection ditches	Heavy equipment, uneven walking/working surfaces, safety hazards, radiological and chemical contamination, dust, heat stress, hazardous noise levels, lifting/back strain, UV exposure
Excavating with heavy or light equipment	Moving heavy equipment, working on uneven/unleveled surfaces, manual material handling, confined space entry, excavation hazards, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, noise hazards

Table 3-1. (continued).

Activity or Task	Associated Hazards or Hazardous Agent
Construction of evaporation pond including installing the high density polyethylene (HPDE) liner	Moving heavy equipment, suspended loads, hoisting and rigging considerations, manual material handling, sharp tools, shoring and excavation hazards, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, noise hazards, UV exposure
Excavation of manhole	Moving heavy equipment, manual material handling, walking/working surfaces, confined space entry, shoring and excavation hazards, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, noise hazards, UV exposure
Excavation of trenches deeper than 5 ft	Heavy equipment, manual material handling, confined space entry, shoring and excavation hazards, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, noise hazards
Replace existing culverts	Heavy equipment, demolition and construction safety hazards, dust, heat stress, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, concrete contact with skin, UV exposure
Packaging, loading, or removing soils	Heavy equipment, manual material handling, dust, lifting/back strain, heat stress, radiological and chemical/inorganic contamination, radiation exposure, noise hazards, UV exposure
Install concrete head walls and end walls	Concrete, radiation exposure, radiological and chemical/inorganic contamination, dust, lifting/back strain, heat stress, manual material handling, UV exposure
Phase II - only Surface soils cover with an impermeable material	Moving heavy equipment, suspended loads, hoisting and rigging considerations, manual material handling, sharp tools, shoring and excavation hazards, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, noise hazards, UV exposure
Equipment decontamination (if necessary)	Heavy equipment, radiological and chemical/inorganic contamination, dust, radiation exposure, lifting/back strain, heat stress, hazardous noise levels, pressurized water (steam), UV exposure
Demobilization	Heavy equipment mobilization, pinch points, dust, lifting/back strain, heat stress, hazardous noise levels, UV exposure

The results of this evaluation(s) will determine if an RWP is required for the Phase I and Phase II activities. For Phase II, an RWP will be required for all activities involving soil disturbances that go below 6 in. or the existing tank farm membrane. Radiological control will use existing engineering design files (EDFs) in accordance with the INEEL *Radiological Control Manual* and issue additional EDFs, as needed, during the evaluation of potential airborne radiological exposures.

The SWP and RWP will be used in conjunction with this HASP to address hazardous and radiological conditions at the project. These permits will augment this HASP and further detail the specialized protective equipment and dosimetry requirements.

3.2 Routes of Exposure

Exposure pathways for hazardous materials and radionuclides are directly related to the nature of radionuclide-contaminated soils removal project tasks. Engineering controls (high efficiency particulate air [HEPA] filtration), continuous monitoring, training, and work controls will mitigate potential contact and uptake of these hazards; however, the potential for exposure to soil contaminants still exists. Exposure pathways include

- Inhalation of radionuclide-contaminated organic compounds and fugitive dusts during intrusive activities and decontamination tasks. This contamination form may have trace amounts of inorganic compounds and be contaminated with radionuclides resulting in potential lung deposition.

- Skin absorption and contact with radiological contaminated organic and inorganic compounds during the soils removal action can be absorbed through unprotected skin or corrosion, resulting in chemical burns, uptake through skin absorption and/or skin contamination.

- Ingestion of radionuclide-contaminated organic and inorganic compounds adsorbed to dust particles or waste residues can be taken up through the gastrointestinal (GI) tract, resulting in GI irritation, internal tissue irradiation, and/or deposition to target organs.

- Injection, while handling radionuclide-contaminated organic and inorganic materials, by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

3.3 Environmental and Personnel Monitoring

The potential for exposure to radiological and nonradiological hazards (see Table 3-2) exists during many of the tasks to take place within the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action projects and effects all personnel who work within a controlled work zones. Refinement of work control zones (see Section 7), engineering and administrative controls, worker training, and the use of protective equipment will mitigate most of these hazards to a large degree. Monitoring with direct reading instruments will be conducted to provide Radiological Control (RadCon) and industrial hygiene (IH) personnel with real-time data to assess the effectiveness of these controls.

The IH and RadCon personnel will focus on the activities and monitor with direct reading instrumentation, swipes, and full and partial period air sampling in accordance with the applicable technical procedures and other times as deemed appropriate. Other workers and areas adjacent to any project will also be monitored to verify the integrity of core sample packages, to ensure contamination has not migrated from radionuclide-contaminated material areas or waste containers, and to determine the effectiveness of contamination control and decontamination practices.

Personnel working at the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action Projects (Phase I and Phase II) may be exposed to hazardous materials or hazardous physical agents as already described. Safety hazards and other physical hazards will be monitored and controlled as outlined in Section 3.4 of this HASP. Specific hazardous agent exposures that will be monitored are listed in Table 3-3.

Table 3-2. Evaluation of radiological and nonradiological hazardous chemicals at the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action project.

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
Metals and Inorganic Compounds						
Arsenic 7440-38-2	OSHA PEL—0.01 mg/m^3	Ih, Ig, Con, S	Ulceration of nasal system, dermatitis, gastrointestinal disturbance, peripheral neuropathy, respiratory irritant, hyper-pigmentation of skin	Liver, kidneys, lungs, skin, lymphatic system	No	Low
Hydrogen Fluoride 7664-39-3	ACGIH TLV - 3 ppm OSHA PEL - 3 ppm	Ih, Ig, Con, S	May be fatal if inhaled or ingested, inflammation an edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema, coughing, laryngitis, shortness of breath, headache, nausea, vomiting, shown to have mutagenic effects	Liver, kidneys	No	Low
Organic Compounds						
Benzene 71-43-2	OSHA PEL - 1 ppm STEL - 5 ppm	Ih, Ig, S, Con	Irritant eyes, skin, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow depressant	Eyes, skin, respiratory system, blood, central nervous system, bone marrow (leukemia)	Yes IARC-1 NIOSH OSHA TLV - A2	Low
Carbon disulfide 75-15-0	ACGIH TLV - 10 ppm OSHA PEL - 20 ppm	Ih, Ig, S, Con	Skin irritation, irritating to eyes, mucous membranes, and upper respiratory tract, Damage to kidneys liver and heart, nervous system disturbances, convulsions, mutagenic effects	Eyes, female and male reproductive system, nerves, liver, kidneys, heart	No	Low

Table 3-2. (continued).

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
Carbon tetrachloride 56-23-5	ACGIH TLV - 100 ppm OSHA PEL - 100 ppm	Ih, Ig, S, Con	Vapor or mist irritating to eyes, mucous membranes and upper respiratory tract, skin irritation, stomach pains, vomiting, diarrhea, nausea, dizziness and headache, damage to eyes, liver and kidneys, carcinogen, may alter genetic material, reproductive disorders	Liver, kidneys, readily absorbed through skin	Yes ACGIH	Low
Ethyl benzene 100-41-4	ACGIH TLV – 100 ppm OSHA PEL – 100 ppm STEL – 150 ppm	Ih, Ig, S, Con	Irritant eyes, skin, nose, respiratory system, excitement, drowsiness, lack of coordination, corneal vacuolization, headache, nausea, staggered gait, anorexia, nausea, vomiting, abdominal pain, dermatitis	Eyes, skin, respiratory system, central nervous system	No	Low
Kerosene 8008-20-6 (VOC)	NIOSH PEL - 14 ppm	Ih, Ig, S, Con	Ulceration of nasal system, dermatitis, gastrointestinal disturbance, peripheral neuropathy, respiratory irritant, hyper-pigmentation of skin	Liver, kidneys, lungs, skin, lymphatic system	No	Low
Chromium (7440-47-3)	ACGIH TLV-05.mg/m^3	Ih, Ig, Con	Irritation of eyes and skin, lung fibrosis (histologic)	Eyes, skin, respiratory tract	No	Low Potential. Source-limited presence determined by initial characterization sampling.

Table 3-2. (continued).

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
Lead (7439-92-1)	ACHIG TLV - 0.05mg/m^3 OSHA PEL – 0.05 mg/m^3	Ih, Ig, Con	Lassitude, weight loss, anemia, nausea, vomiting, paralysis, constipation	GI tract, central nervous system, kidneys, blood, gingival tissue.	A3-BEI	Low Potential Sources include sampling activities, hand excavation, repair, and clean-up work.
Mercury (7439-97-6)	ACGIH TLV—0.025 mg/m^3	Ih, Ig, Con, Abs	Irritation eyes, skin; cough, chest pain, dyspnea, bronchial pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; gastrointestinal disturbance, anorexia, low weight	Eyes, skin, respiratory tract, central nervous system, kidneys	No	Low potential
Polyurea						
Part A						
Methylenebis (4-Cyclohexyl-isocyante)	PEL = 0.01ppm TLV = 0.005ppm	Ih, S	Skin sensitation, respiratory irritant,	Skin, lungs	No	Low
Part B						
Titanium dioxide	ACGIH 10 g/m^3 OSHA 15.0 g/m^3	Ig, S,	Eye irritant, toxic by dermal absorption,	Skin, eyes	No	Low when mixed
Carbon Black	ACGIH 3.5mg/m^3 OSHA 3.5mg/m^3	Ig, S	Eye irritant, toxic by dermal absorption	Skin, eyes	No	Low when mixed

Table 3-2. (continued).

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
Nitric Acid (HNO3) 7697-37-2	NIOSH REL: TWA 2 ppm (5 mg/m^3) ST 4 ppm (10 mg/m^3) NIOSH REL: TWA 2 ppm (5 mg/m^3) ST 4 ppm (10 mg/m^3) IDLH 25 ppm	Ih, Ig, S, Con	Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion.	Eyes, skin, respiratory system, teeth	No	Moderate
Pyridine 110-86-1	ACGIH TLV - 5 ppm OSHA PEL - 5 ppm	Ih, Ig, S, Con	High concentrations are extremely destructive to tissues of the mucous membranes and the upper respiratory tract, burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting, anorexia, dizziness, tachycarida, nervousness, insomnia, skin disorders	Liver, kidneys, nerves, bone marrow	No	Low
Tetrachloroethylene 127-18-4	ACGIH TLV -25 ppm OSHA PEL - 100 ppm	Ih, Ig, S, Con	Causes skin irritation, nausea, dizziness, headache, narcotic effect, damage to liver and kidneys, may alter genetic material, targets the nerves, heart, liver, and kindeys	Liver, kidneys, nerves, heart	Yes ACGIH	Low
Toluene 108-88-3	ACGIH TLV - 50 ppm OSHA PEL - 100 ppm STEL - 150 ppm	Ih, Ig, Con, S	Irritant eyes, nose, fatigue, weak, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis, liver and kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	No	Low

Table 3-2. (continued).

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
1,1,1-Trichloroethane 71-55-6	ACGIH TLV - 350 ppm OSHA PEL - 350 ppm	Ih, Ig, S, Con	High concentrations are extremely destructive to tissues of the mucous membranes and upper respiratory tract, eyes and skin, symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting, narcotic effect, dermatitis, mutagenic effects, damage to the liver and kidneys	Liver, kidneys	No	Low
Trichloroethylene 79-01-6	ACGIH TLV - 5 ppm OSHA PEL - 5 ppm	Ih, Ig, S, Con	High concentrations are extremely destructive to tissues of the mucous membranes and upper respiratory tract, eyes and skin, burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting	Central nervous system, liver, kidneys, heart lungs	Yes AGCIH	Low
Xylene 1330-20-7	ACGIH TLV - 100 ppm STEL - 150 ppm	Ih, Ig, Con, S	Irritant eyes, skin, mucous membranes, headache, dermatitis, narcosis, coma	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	No	Low
Cesium 137	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic, whole body radiation cellular damage to soft issues	Whole Body, spleen, kidney	Yes	Low
Cesium 134	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic, whole body radiation cellular damage to soft issues	Whole Body, spleen, kidney	Yes	Low

Table 3-2. (continued).

Radiological and Chemical Contaminants of Concern	Exposure Limit[a or d] (PEL/TLV)[a] (DAC)[e]	Routes of Exposure[b]	Symptoms of Overexposure (acute and chronic)	Target Organs/System	Carcinogen? (source)[c]	Expected Levels
Strontium 90	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Lungs, red marrow, bone surfaces	Yes	Low
Cobalt 60	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Lungs	Yes	Low
Cerium 144	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Lungs	Yes	Low
Europium 154	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Red marrow and bone surfaces	Yes	Low
Europium 155	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Red marrow and bone surfaces	Yes	Low
Europium 152	4.0 E-8 Ci/mL Lung Retention Class D	Ih, Ig	Carcinogenic, mutagenic	Red marrow and bone surfaces	Yes	Low

a. American Conference of Governmental Industrial Hygienists (ACGIH) 1997 TLV Booklet and OSHA 29 CFR 1910 substance specific standards. *This pertains to the nonradiological chemicals listed within this table.*

b. (Ih) inhalation; (Ig) ingestion; (S) skin absorption; (Con) contact hazard.

c. If yes, identify agency and appropriate designation (ACGIH A1 or A2; NIOSH; OSHA; IARC; NTP, or ICRP 60 (International Commission on Radiological Protection)).

d. 10 CFR 835.209, Occupational Radiation Protection, Appendix A. *This pertains to the radiological constituents listed within this table.*

e. DAC = derived air concentration

f. ICRP 60 (International Commission on Radiological Protection).

PEL = permissible exposure limit

TLV = threshold limit value

STEL = short term exposure limit

IDLH = immediately dangerous to life and health

NTP = National Toxicology Program

VOC = volatile organic compound

IARC = International Agency for Research on Cancer

Material safety data sheets for these chemicals are available at the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action project trailer.

Table 3-3. Evaluation of inorganic and radioactive contaminants.

Material or Chemical (CAS No.)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure [b]	Symptoms of Overexposure[c] (acute and chronic)	Target Organs/System	Carcinogen (source)[d]	Exposure Potential[e] (all routes without regard to PPE)
Metals and Inorganic Compounds						
Bentonite (sodium bentonite) 7631-86-9	10 mg/m^3 (inert nuisance dust)	Ih, Con	Mucous membrane and respiratory tract irritation	Lungs	No	Moderate-high potential
Silica, crystalline (dust) 14464-46-1	0.05 mg/m^3 (respirable fraction)	Ih, Con	Pulmonary fibrosis, silicosis	Respiratory, eyes	No	Moderate-high potential Mixing of silica sand
Silica, crystalline quartz (14464-46-1)	10 mg/m^3 (%SiO2+2) (respirable fraction)	Ih, Con	Pulmonary fibrosis, silicosis	Respiratory, eyes		Moderate-high potential Mixing of silica sand
Chromium (7440-47-3)	ACGIH TLV - 0.5 mg/m^3	Inh, Ing, Con	Irritation of eyes and skin, lung fibrosis (historogic)	Eyes, skin, respiratory tract	No	Low potential
Mercury (7439-97-6)	ACGIH TLV - 0.025 mg/m^3	Inh, Ing, Con, Abs	Irritation eyes, skin; cough, chest pain, dyspnea, bronchial pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; gastrointestinal disturbance, anorexia, low weight	Eyes, skin, respiratory tract, central nervous system, kidneys	No	Low potential
Radioactive contaminants (The dominant radioisotopes are tritium and strontium-90.)						
Radionuclides (whole body exposure)	INEEL- 1.5 rem/yr project ALARA dose limit-per RWP or ALARA Task Posting of radiation areas per INEEL RCM	Whole body	No symptoms expected	Blood forming cells, GI tract, and rapidly dividing cells	Yes	Low potential Low doses from repeated handling of sample cores and from handling water samples

a. American Conference of Governmental Industrial Hygienists (ACGIH) 1997 TLV Booklet and OSHA 29 CFR 1910 substance specific standards.
b. (Inh) inhalation; (Ing) ingestion; (Abs) skin absorption; (Con) contact hazard.
c. (nervous system) dizziness/nausea/lightheadedness; (dermis) rashes/itching/redness; (respiratory) respiratory effects; (eyes) tearing/irritation;
d. If yes, identify agency and appropriate designation (ACGIH A1 or A2; NIOSH; OSHA; IARC; NTP).
e. Estimates (~) of specific compounds from Tables 3-2 and 3-3.

DAC = derived air concentration e
IE = ionization energy
RCM = radiological control manual
V = electron volts
NTP = National Toxicology Program
IARC = International Agency for Research on Cancer
PEL = permissible exposure limit TLV = threshold limit value
Material safety data sheets for these chemicals are available at the OU 3-13 vadose zone trailer.

3.3.1 Industrial Hygiene Monitoring

When there is a potential for the spread of contamination during the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action, monitoring for surface radiological contamination will provide an additional indicator of nonradiological hazards. Various direct reading instruments and other semi-quantitative detection tests will be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing project conditions, direct reading instrument results, observation, and professional judgment. Instruments and sampling methods listed in Table 4-1 will be used by the project IH/RCT as deemed appropriate.

All full and partial period airborne contaminant sampling will be conducted using applicable NIOSH or OSHA methods and in conformance to the INEEL *Safety and Health Manual*. Risk assessments for project personnel will be conducted according to the INEEL *Safety and Health Manual.*

3.3.1.1 Industrial Hygiene Instrument and Equipment Calibration. All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing IH protocol, and in conformance with the INEEL *Safety and Health Manual*. Direct reading instruments will be calibrated, at a minimum, prior to daily use and more frequently as determined by the project IH. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded per Section 3.1.

3.3.2 Radiological Monitoring

Radiological monitoring will be conducted during project operational activities to quantify radiation exposure to workers as stated in the general or task-specific RWP. This will include the use of external dosimetry, radiation and contamination surveys, and bioassays where deemed appropriate to ensure that engineering controls, administrative controls, and work practices are effectively mitigating radiological hazards.

Note: *The INTEC Radiological Department shall establish work controls, initially and as an on-going activity, throughout Phase I while working within the INTEC area but outside of the tank farm. These same work control efforts will be performed when Phase II is performed within the tank farm and will ensure that workers are given adequate protection from potential radiological exposure. The issuance of radiological work permits, the establishing of radiological buffer areas (RBAs), or radiological material areas (RMAs) will be determined during the radiological assessment.*

Based on the unique and distinctive hazards presented by both external and internal radiation sources, they will be evaluated, controlled, and monitored individually (although the detection of any radionuclides will serve to alert for the presence of both). For purposes of this monitoring section, they will be discussed separately and distinguished by their effects as radiation (external) and contamination (internal). Radiological monitoring at the Group 1 Tank Farm Interim Action Project will include area, airborne, equipment, and personnel monitoring. Monitoring will be performed in accordance with the INEEL *Radiological Control Manual.*

The results of this evaluation(s) will determine if an RWP for the Phase I activities is required. For Phase II, an RWP will be required for all activities involving soil disturbances that go below 6 in. of the existing tank farm membrane. Radiological control will use existing engineering design files (EDF) in accordance with the INEEL *Radiological Control Manual* and issue additional EDF, as needed, during the evaluation of potential airborne radiological exposures.

Table 3-4. Action levels and associated responses for anticipated project hazards.

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels Exceeded
Hazardous noise levels	<85 dBA 8-hour TWA, <83dBA 10-hour TWA	No action
	85–114 dBA	Hearing protection is required to attenuate to below 85 dBA 8-hour TWA or 83 dBA for 10-hour TWA (based device NRR).
	(a) >115 dBA (b) >140 dBA	(a) Isolate source, evaluate NRR for single device, double protection, as needed. (b) Control entry, isolate source, wear only approved double protection.
Radiation field	<5 mrem/hr	No action, no posting is required.
	5–100 mrem/hr @ 30 cm (§835.603.b)	Post as "Radiation Area." Required items include radiation worker I training or II training, RWP, personal dosimetry.
	>100 mrem – 500 Rad @ 100 cm (§835.603.b)	Post as "High Radiation Area." Required items include RW II training, RWP, alarming personal dosimetry, dose rate meter, and temporary shielding, as required.
	Exceed remote air monitor alarming set point, if required (fast ringing bell, flashing red light)	Evacuate area immediately, muster at contamination reduction zone (CRZ) and await instruction from radiological control technician (RCT).
Radionuclide contamination	1–100 times company determined limits (§835.603.d)	Post as "Contamination Area." Required items include RW II training, personal dosimetry, RWP, PPE, bioassay submittal, as required.
	>100 times company determined limits (§835.603.d)	Post as "High Contamination Area." Required items include RW II training, personal dosimetry, RWP (with prejob briefing), PPE, bioassay submittal, as required.
Airborne radioactivity	Concentrations (μCi/cc) >30% of DAC value (§835.603.d)	Post as "Airborne Radioactivity Area." Required items include RW II training, personal dosimetry, RWP (with prejob briefing), PPE, bioassay submittal, as required.
	Exceed continuous air monitor alarming set point, (fast ringing bell, flashing red light)	If not in Level B respiratory protection, evacuate upwind to CRZ, await RCT. If in Level B respiratory protection, leave immediate area to upwind location, maintain airline connection and await RadCon instructions.

TWA = time-weighted average
dBA = decibel A-weighted
NRR = Nuclear Reactor Regulation

Based on the unique and distinctive hazards presented by both external and internal radiation sources, they will be evaluated, controlled, and monitored individually (although the detection of any radionuclides will serve to alert for the presence of both). For purposes of this monitoring section, they will be discussed separately and distinguished by their effects as radiation (external) and contamination (internal). Radiological monitoring at the Group 1 Tank Farm Interim Action Project will include area, airborne, equipment, and personnel monitoring. Monitoring will be performed in accordance with the INEEL *Radiological Control Manual.*

3.3.2.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during project activities. Dosimetry requirements will be specified by RadCon personnel in applicable project RWPs and in accordance with the applicable company manuals.

3.3.2.2 Internal Dosimetry. The purpose of internal dosimetry is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. The requirement for bioassays will be based on project activities or specific tasks and will be the determination of the assigned project radiological engineer (RE). If bioassays are deemed appropriate by the RE, requirements will be specified on the RWP and personnel will be responsible for submitting required bioassay samples upon request.

3.4 Physical Hazards Evaluation, Control, and Monitoring

The physical hazards present at the project area and the methods that will be used to monitor and control them are described in this section. It is critical that all personnel are aware and understand the nature of the tasks to be conducted, the equipment to be used, and the controls to be in place to eliminate or mitigate potential safety hazards.

3.4.1 Temperature and Ultraviolet Light Hazards

Project tasks will be conducted during times when there is a potential heat and cold stress that could present a potential hazard to personnel. The IH and HSO will be responsible for obtaining meteorological information to determine if additional heat or cold stress administrative controls are required. All project personnel must understand the hazards associated with heat and cold stress and take preventive measures to minimize the effects. Applicable company policies and procedures guidelines will be followed when determining work-rest schedules or when to halt work activities due to temperature extremes.

3.4.1.1 Heat Stress. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort and unconsciousness to death. In addition, tasks requiring the use of protective equipment or respiratory protection prevent the body from cooling. Personnel must inform the STR or HSO when experiencing any signs or symptoms of heat stress or observing a fellow employee (i.e., buddy) experiencing them. Heat stress stay times will be documented on the appropriate work control document(s), that is, an SWP, prejob briefing form, or other by the HSO in conjunction with the IH (as required) when personnel wear PPE that may increase heat body burden. These stay times will take into account the amount of time spent on a task, the nature of the work (i.e., light, moderate, or heavy), type of PPE worn, and ambient work temperatures. Table 3-5 lists heat stress signs and symptoms of exposure.

Table 3-5. Heat stress signs and symptoms of exposure.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating.	Keep the skin clean, change all clothing daily, and cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps and exhaustion, sometimes with dizziness or periods of faintness.	Move the patient to a nearby cool place. Give the patient half-strength electrolytic fluids; if cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; cold, clammy skin; heavy perspiration; total body weakness; dizziness that sometimes leads to unconsciousness.	Move the patient to a nearby cool place, keep the patient at rest, give the patient half-strength electrolytic fluids, treat for shock, and seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching.	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

NOTE: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. The STR or designee should immediately request an ambulance (777, 526-1515, or 9-911 from cell phones) be dispatched from the Central Facilities Area (CFA)-1612 medical facility and the individual cooled as described above in Table 3-5 based on the nature of the heat stress illness.

3.4.1.2 Low Temperatures and Cold Stress. Personnel will be exposed to low temperatures during fall and winter months or at other times of the year if relatively cool ambient temperatures combined with wet or windy conditions exist.

Additional cold weather hazards may exist from working on snow- or ice-covered surfaces. Slip, fall, and material-handling hazards are increased under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The STR or HSO should be notified immediately if slip or fall hazards are identified at the project locations.

3.4.1.3 Ultraviolet Light Exposure. Personnel exposed to UV light (i.e., sunlight) while conducting project tasks are reminded to protect themselves from sunlight. Sunlight is the main source of UV known to damage the skin and potentially cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. Since UV rays or suntans are unsafe, the following mitigative actions are recommended to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long-sleeve or short-sleeve shirt [no tank tops])
- Use a sunscreen with a minimum sun protection factor (SPF) of 15

- Wear a hat (hard hat where required)
- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible.

3.4.2 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project site (e.g., sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), conditions will be evaluated and a decision made by the HSO with input from other personnel to halt work, employ compensatory measures, or proceed. The STR and HSO will comply with company policies and procedures and facility work control documents that specify limits for inclement weather.

3.4.3 Noise

Personnel working at the task site may be exposed to noise levels that exceed 85 decibels (dBA) for 8-hour time weighted average (TWA) and 83 dBA for 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interfere with communication that would warn of danger.

Noise measurements will be performed by the IH per the applicable company policies and procedures to determine if personnel assigned to the jobs identified are above allowable noise exposure levels. A TLV of 85 dBA (TWA) will be applied to personnel exposed to noise levels over no more than an 8-hour day. This level is based on a 16-hour "recovery" period in a low noise environment. If personnel are required to work longer than 8 hours in a hazardous noise environment, then the TLV will be adjusted to a lower value. The project IH must be consulted regarding modifications to the 85 dBA for an 8-hour TLV and 83 dBA for a 10-hour TWA value.

Personnel, whose noise exposure meets or exceeds the allowable level, will be enrolled in the INEEL Occupational Medical Program (OMP) or subcontractor Hearing Conservation Program. Personnel working on jobs that have noise exposures greater than 85 dBA (83 dBA for 10 hour TWA), will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the IH until directed otherwise.

Individuals having experienced a permanent threshold shift should wear hearing protection at noise levels of 80 dBA or greater. Heavy equipment operations are noisy and hearing conservation should be taken seriously by all exposed persons.

3.4.4 Fire, Explosion, and Reactive Materials Hazards

Fire, explosion, and reactive materials hazards at the task site include potential explosive atmospheres, combustible materials near ignition sources (hot motor or exhaust system), transfer and storage of flammable or combustible liquids in the support zone (SZ), and chemical reaction (reduction, oxidation, exothermic reaction) from incompatible waste materials. Portable fire extinguishers with a

minimum rating of 10A/60BC will be strategically located at the site to combat Class ABC fires. They will be located in all active work areas, on or near site equipment with exhaust heat sources, and near all equipment capable of generating ignition or having the potential to spark. All project field team members will receive fire extinguisher training, as necessary, as part of this HASP training, as listed in Section 7, Table 7-1.

3.4.4.1 Project Equipment Fire Hazards. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. The project fire protection engineer will identify these sources as equipment is brought on the site. The accumulation of combustible materials will be strictly controlled during the project. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles such as trash, cardboard, rags, wood, and plastic will be properly disposed in metal receptacles in the SZ and in appropriate waste containers within the contamination reduction corridor (CRC), contamination reduction zone (CRZ), and exclusion zone (EZ).

Fuels that will be used at the task site for equipment will be safely stored, handled, and used. Only Factory Mutual/Underwriters Laboratories-approved flammable liquid containers, labeled with the content, will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities (trailers) and ignition sources or stored inside an approved flammable storage cabinet. Additional requirements are provided in applicable company policies and procedures. Portable motorized equipment such as generators and light plants will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions prior to refueling to minimize the potential for a fuel fire. Refueling tasks will only be conducted by qualified fuel handling personnel.

3.4.5 Biological Hazards

The INEEL is located in an area that provides habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential exists for encountering nesting materials or other biological hazards and vectors. The hantavirus may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the industrial hygienist will be notified immediately and **no attempt will be made to remove or clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with applicable company policies and procedures.

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) also may be encountered. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear and contact the industrial hygienist or HSO for additional guidance as required.

Insect repellant (DEET or equivalent) may be required. Areas where standing water has accumulated (e.g., evaporation ponds) provide breeding grounds for mosquitoes and should be avoided. In cases where a large area of standing water is encountered, it may be necessary to pump the water out of the declivity (areas other than the evaporation ponds).

3.4.6 Safety Hazards

Industrial safety hazards pose a significant potential threat to personnel who will be performing tasks during this project. Section 6 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

3.4.6.1 Handling Heavy Objects. During the course of any construction project, there are numerous tasks that require handling or moving heavy objects. Manual material handling will be minimized through task design and use of mechanical and/or hydraulic lifts, whenever possible.

3.4.6.2 Powered Equipment and Tools. All power equipment and tools will be properly maintained and used by qualified individuals according to the manufacturer's specifications. Applicable company policies and procedures will be followed for all work performed with powered equipment, including powered steam cleaners.

3.4.6.3 Heavy Equipment and Moving Machinery. The hazards, associated with the operation of heavy equipment, include injury to personnel, equipment damage, and/or property damage. All heavy equipment will be operated in the manner in which it was intended and according to manufacturer's instructions. Only authorized personnel will be allowed in the vicinity of operating heavy equipment and should maintain visual communication with the operator. Worksite personnel will comply with applicable company policies and procedures.

Site personnel working around or near heavy equipment and other moving machinery will comply with the appropriate applicable company policies and procedures. Additional safe practices will include the following:

- Ensure that all heavy equipment has functional backup alarms.
- Prohibit walking directly in back of or to the side of heavy equipment without the operator's knowledge; all precautions will have been taken prior to moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person responsible for providing direct voice contact or approved standard hand signals; in addition, all site personnel in the immediate work area will be made aware of the equipment operations.
- Keep all equipment out of traffic lanes and access ways and storing it so as not to endanger personnel at any time.

3.4.6.4 Electrical Hazards/Energized Systems. Electrical equipment and tools, as well as underground lines, may pose shock or electrocution hazards to personnel. Safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in applicable company policies and procedures and Parts I through III of National Fire Protection Association (NFPA) 70E. In addition, all electrical work will be reviewed and completed under the appropriate work controls (i.e., HASP, SWPs, work orders).

Before beginning any subsurface penetrations, underground utility clearances will be obtained by contacting telecommunications (526-1688 or 526-2512). Subsurface investigation clearance will be obtained in accordance with applicable company policies and procedures. The requirements for advanced 48-hour notice will be met.

3.4.6.5 Personal Protective Equipment. Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear noise that might indicate a hazard and directions. Also, PPE can increase the risk of heat stress. Work activities at the task site will be modified, as necessary, to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with applicable company policies and procedures. The OU 3-13 Post-ROD Monitoring Project PPE levels for each task are described in Section 6 and listed in Table 6-1 of that section.

3.4.6.6 Decontamination. Decontamination procedures for personnel and equipment are detailed in Section 12. The appropriate applicable company policies and procedures provide additional requirements for chemical and radionuclide decontamination requirements.

Decontamination procedures (Section 12) and applicable company policies and procedures must be followed and the appropriate level of PPE worn during decontamination activities. Project RadCon and IH personnel will follow applicable company policies and procedures, and general IH practices.

3.4.6.7 Inclement Weather Conditions. When inclement or adverse weather conditions develop that may pose a threat to people or property at the task site (such as sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), these conditions will be evaluated and a decision made by the STR with input from the HSO, IH, safety engineer (SE), RCT, and other project personnel, as appropriate, to stop work, employ compensatory measures, or to proceed. The STR will comply with company policies and procedures and site work control documents that specify limits for inclement weather.

3.5 Other Site Hazards

Site personnel should continually look for potential hazards and immediately inform the STR or HSO of the hazards so that action can be taken to correct the condition.

The HSO, RCT, and STR will conduct daily inspections of the task site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating on the site. These inspections will be noted in the STR logbook. Health and safety engineers present at the task site may, at any time, recommend changes in work habits to the STR. However, all changes that may affect the project written work control documents (HASP, RWPs, SWPs) must have concurrence from the appropriate project technical discipline representative on-Site and a data analysis report must be prepared, as required.

Personnel working at the task site are responsible for using safe-work techniques, reporting unsafe working conditions, and exercising good personal hygiene and housekeeping habits throughout the course of their job.

3.5.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment may result in employee injury. All lifting and material-handling tasks will be performed in accordance with applicable company policies and procedures. Personnel will not physically lift objects weighing more than 22 kg (50 lb) or 33% of their body weight (whichever is less) alone. Additionally, back strain and ergonomic considerations must be given to material handling and equipment usage. Mechanical and hydraulic lifting devices should be used to move materials whenever possible. The industrial hygienist will conduct ergonomic evaluations of various project tasks to determine the potential ergonomic hazards and provide recommendations to mitigate these hazards. Applicable requirements from company policies and procedures will be followed.

3.5.2 Working and Walking Surfaces

Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. The various work surfaces associated with construction activities present inherent tripping hazards because of uneven ground, equipment in use, and working surfaces. Additionally, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces combined with objects beneath the snow. During the prejob briefing, all personnel will be made aware of tripping hazards that cannot be eliminated. Tripping and slipping hazards will be evaluated during the course of the project in accordance with applicable company policies and procedures.

3.5.3 Elevated Work Areas

Personnel may sometimes be required to work on elevated equipment or at heights above 1.8 m (6 ft). During such work, employees will comply with requirements from applicable company policies and procedures. Where required, a fall protection plan will be written.

3.5.4 Pressurized Systems

Equipment operated on this project utilizes high pressure hydraulic systems. The hazards presented to personnel, equipment, facilities or the environment because of inadequately designed or improperly operated pressure systems include blast effects, shrapnel, fluid jets, release of toxic or asphyxiant materials, contamination, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic, or compressed gas systems. The requirements of applicable company policies and procedures, and the manufacturer's operating and maintenance instructions must be followed. This includes inspection, maintenance, and testing of systems and components in conformance with American National Standards Institute (ANSI), Compressed Gas Association, etc.

All pressure systems will be operated in the designed operating pressure range, which is typically 10 to 20% less than the maximum allowable working pressure. Additionally, all hoses, fittings, lines, gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

3.5.5 Excavation, Surface Penetrations, and Outages

Excavation activities are considered ground penetrations. All surface penetrations and related outages will be coordinated through and will require submittal of an outage request for outages (e.g., road, electrical, and water). The submission of an outage request will not be considered an approval to start the work. Other specific outage requirements are addressed in the special conditions section of the management and operating contract. No surface penetrations will be allowed or conducted until the area has been evaluated and an approved subsurface evaluation documented.

All excavation activities will be conducted and monitored in accordance with applicable company policies and procedures and 29 CFR 1926, Subpart P, "Excavations." The following are some key elements from these requirements:

- The location of utility installations (e.g., sewer, telephone, fuel, electric, water lines, or any other underground installations) that may reasonably be expected to be encountered during excavation work will be determined before opening an excavation.

- Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design. Structural ramps will be inspected in accordance with applicable company forms.

- Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflecting or high-visibility material.

- Daily inspections of excavations, areas adjacent to the excavations, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by the competent person before the start of work and as needed throughout the shift. Inspections also will be made after every rainstorm or other hazard-increasing occurrence.

- Sloping or benching will be constructed and maintained in accordance with the requirements set forth in 29 CFR 1926, Subpart B, Appendix B, for the soil type as classified by the competent person. This classification of the soil deposits will be made based on the results of at least one visual inspection and at least one manual analysis.

3.5.6 Material Handling

The most common type of accident that occurs during material handling is when a load is being handled and a finger or toe is caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can be caught between equipment, stationary structures, materials, and portable power tools.

3.5.7 Hoisting and Rigging of Equipment

All hoisting and rigging of materials will be performed in accordance with applicable company policies and procedures and DOE-STD-1090-2001, "Hoisting and Rigging." Subcontractors shall also comply with hoisting and rigging equipment manufacturer's recommendations and will show evidence of a current inspection (e.g., tag) by qualified personnel. Additionally, the operator or designated person for mobile cranes or boom trucks will perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation

- Crane hooks and latches for deformation, cracks, and wear

- Hydraulic systems for proper oil level

- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage

- Hoist ropes for kinking, crushing, bird caging, and corrosion

- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

NOTE: The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional.

3.6 Site Inspections

Project personnel may participate in site inspections during the work control preparation stage (such as the hazard identification and verification walkdowns), conduct self-assessments or other inspections. Additionally, the HSO, project manager, or STR will perform periodic safety inspections in accordance with applicable company policies and procedures.

Targeted or required self-assessments may be performed during trenching and excavation activities, liner deployment, and other construction activities in accordance with applicable policies and procedures. All inspections and assessments will be documented and available for review by the STR. These inspections may be noted in the project logbook. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the STR.

4. EXPOSURE MONITORING AND SAMPLING

A potential for exposure to radiological, chemical, and physical hazards exists during project tasks including grading and excavation work, pond liner unloading and deployment, and sump system installation which may affect all personnel who work on the WAG 3, OU 3-13, Group 1 Soils Tank Farm Interim Action. Site Control and Security (Section 8) describes the use of engineering and administrative controls, worker training, and wearing PPE to provide the mitigation strategy for these hazards. Monitoring and sampling will be conducted during project tasks to (1) assess the effectiveness of these controls, (2) determine the type of PPE needed for individual tasks, and (3) determine the need for upgrading and downgrading of PPE as described in Section 6. Monitoring with direct-reading instruments will be conducted as deemed appropriate to provide RadCon and IH personnel with real-time data to assess the effectiveness of control measures. Subcontractors are responsible for conducting their employee chemical monitoring and physical agent evaluations.

Table 4-1 lists the tasks and hazards to be monitored, the frequency, and the monitoring instruments. Table 4-2 lists the action levels and associated responses for specific hazards.

4.1 Exposure Limits

Exposure limits are identified in Table 3-3 for specific project tasks. Project tasks will be continually assessed in accordance with applicable company policies and procedures and evaluated by RadCon and IH personnel to ensure engineering control effectiveness. Action limits should be adjusted as required based on changing site conditions, exposure mitigation practices, and PPE levels.

4.2 Action Limits

Action limits are one-half or 50% the exposure limits identified in Table 3-1 to serve as the initial limits for specific INEEL CERCLA Disposal Facility (ICDF) operations. Monitoring results at or above an action limit, identified through exposure monitoring, will initiate additional evaluations including consideration for improved engineering controls, administrative controls, reevaluation of personal protective equipment, and probable need for additional exposure monitoring based on the industrial hygienist's recommendations. Action limits may be adjusted based on changing site conditions, exposure mitigation practices, and PPE levels.

4.3 Environmental and Personnel Monitoring

RadCon and IH personnel will conduct initial and periodic monitoring with direct-reading instruments, collect swipes, and conduct full- and partial-period air sampling, as deemed appropriate, in accordance with the applicable company policies and procedures, OSHA substance-specific standards, and as stated on work permits and other guidelines. New processes or hazards introduced will be evaluated and controlled in accordance with applicable company policies and procedures. Instrumentation listed on Table 4-1 will be selected based on the site-specific conditions and contaminants associated with project tasks. The RCT and IH will be responsible for determining the best monitoring technique for radiological and nonradioactive contaminants respectively. Safety hazards and other physical hazards will be monitored and mitigated as outlined in Section 3.

4.3.1 Industrial Hygiene Area and Personal Monitoring and Instrument Calibration

The project industrial hygienist will conduct full- and partial-period sampling of airborne contaminants and monitoring of physical agents at a frequency deemed appropriate based on direct-reading instrument readings and changing site conditions. When conducted, all air sampling will be conducted using applicable NIOSH, OSHA, or other validated method. Both personal and area sampling and monitoring may be conducted.

Table 4-1. Tasks and hazards to be monitored and monitoring instruments.

Tasks	Hazard(s) to be Monitored	Instrument Category to be Used	Instrument Category No.	Monitoring Instruments Description[a,b]
Excavations, grading activities	Ionizing radiation—(alpha, beta, gamma)	1	1	(Alpha) Count rate—Bicron/NE Electra (DP-6 or AP-5 probe) or equivalent. Stationary—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent.
	Radionuclide contamination—(alpha, beta, gamma)	2		
	Chemical constituents—organic vapors, lead, cadmium	3, 4		(Beta-gamma) Count rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent. Stationary—Eberline RM-25 (HP-360AB probe) or equivalent.
	Respirable dust—silica (area and personal)	3, 5		
	Hazardous noise	6	2	Continuous air monitor (CAM)—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required). CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required). Grab sampler—SAIC H-810 or equivalent.
	Ergonomics, repetitive motion, lifting	7		
	Heat and cold stress	8		
Evaporation pond liner deployment, Tank Farm Hot Spot Cover Deployment	Ionizing radiation—(alpha, beta, gamma)	1		
	Radionuclide contamination—(alpha, beta, gamma)	2	3	(Organic vapor) Direct reading instruments (photo ionization detector, flame ionization detector, or infrared detector) detector tubes or grab samples. Heat stress—wet-bulb globe temperature, body weight, fluid intake. ANSI Type S2A sound level meter or ANSI S1.25-1991 dosimeter (A-weighted scale for time-weighed average dosimetry, C-weighted for impact dominant sound environments).
	Hazardous noise	6		
	Ergonomics, repetitive motion, lifting	7		
	Respirable dust—silica (area)	4, 5		
	Heat and cold stress	8		
				Heat stress—wet-bulb globe temperature, body weight, and fluid intake. Cold stress—ambient air temperature, wind chill charts.

Table 4-1. (continued).

Tasks	Hazard(s) to be Monitored	Instrument Category to be Used	Instrument Category No.	Monitoring Instruments Description[a,b]
Heavy equipment operations	Respirable dust—silica (area and personal)	4, 5	6	ANSI Type S2A sound level meter or ANSI S1.25-1991 dosimeter (A-weighted scale for time-weighed average dosimetry, C-weighted for impact dominant sound environments).
	Hazardous noise	6		
	Ergonomics, repetitive motion, lifting	7		
Decontamination of equipment	Radionuclide contamination—(alpha, beta, gamma)	2		
	Chemical constituents—organic vapors, lead, cadmium	3, 4	7	Observation and ergonomic assessment of activities in accordance with applicable company policies and procedures, and ACGIH threshold limit value.
	Hazardous noise	6	8	Heat stress—wet-bulb globe temperature, body weight, fluid intake.
	Ergonomics, repetitive motion, lifting	7		
	Heat and cold stress	8		Cold stress—ambient air temperature, wind chill charts.

a. Monitoring and sampling will be conducted as deemed appropriate by project IH and RadCon personnel based on specific tasks and site conditions.
b. Equivalent instrumentation other than those listed may be used.

Table 4-2. Action levels and associated responses for the Group 1 Soils Tank Farm Interim Action.

Contaminant/Agent Monitored	Action Level		Response Taken if Action Levels are Exceeded	
Nuisance particulates (not otherwise classified)	>10 mg/m^3 (inhalable fraction) >3 mg/m^3 (respirable fraction)		Move personnel to upwind position of source and close equipment cab windows and doors. Use wetting or misting methods to minimize dust and particulate matter. If wetting or misting methods prove ineffective, then don respiratory protection[a] (as directed by industrial hygienist).	
Hazardous atmosphere	As defined by applicable company policies and procedures or based on one-half or 50% of the individual contaminant exposure limit, lower explosive limit (LEL), oxygen content, etc.		Measure atmosphere prior to initiating operation or personnel entry and verify specific limit or condition has been met (e.g., <LEL). Utilize engineering controls to maintain safe atmosphere/below specified limit. If engineering control fails to control contaminant below safe atmospheric/exposure limit, then stop operation and evacuate personnel until safe atmosphere/specified limit can be achieved.	
Silica (respirable fraction)	Greater than or equal to the OSHA permissible exposure limit of $\frac{10\ mg/m^3}{\%silica + 2}$ (29 CFR 1910.1000 [Z3])		Move personnel to upwind position of source. Use wetting or misting methods to minimize dust and particulate matter during mixing. If wetting or misting methods prove ineffective, then don respiratory protection[a] (as directed by industrial hygienist).	
Hazardous noise levels	<85 dBA 8-hour TWA, <83 dBA 10-hour TWA		No action.	
	85 to 114 dBA		Hearing protection required to attenuate hazard to below 85 dBA 8-hour TWA or 83 dBA for 10-hour TWA (device noise reduction rating [NRR]).	
	(a) >115 dBA	(b) >140 dBA	(a) Isolate source, evaluate NRR for single device, double protection as needed.	(b) Control entry, isolate source, only approved double protection worn.
Radiation field	<5 mrem/hour		No action, no posting required.	
	5 to 100 mrem/hour @ 30 cm (10 CFR 835.603.b)		Post as "Radiation Area"—Required items: Radiological Worker I or II training, RWP, personal dosimetry.	
	>100 mrem to 500 Rad @ 100 cm (10 CFR 835.603.b)		Post as "High Radiation Area"—Required items: Radiological Worker II training, RWP, alarming personal dosimetry, dose rate meter, and temporary shielding (as required).	

Table 4-2. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels are Exceeded
Radionuclide contamination	1 to 100 times company determined limits[b] (10 CFR 835.603.d)	Post as "Contamination Area"—Required items: Radiological Worker II training, personal dosimetry, RWP, don PPE, bioassay submittal (as required).
	>100 x company determined limits[b] (10 CFR 835.603.d)	Post as "High Contamination Area"—Required items: Radiological Worker II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).
Airborne radioactivity	Concentrations (μCi/cc) >30% of and derived air concentration value (10 CFR 835.603.d)	Post as "Airborne Radioactivity Area"—Required items: Radiological Worker II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).

a. Level C respiratory protection will consist of a full-face respirator equipped with a high-efficiency particulate air filter cartridge as prescribed by the project IH and RadCon personnel (based on contaminant of concern). See Section 5 for additional Level C requirements.
b. The project radiological engineer and/or the RCT will define company limits.

Various direct-reading instruments may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, professional judgment, and in accordance with the applicable company policies and procedures.

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing industrial hygiene protocol, and in conformance with the companywide safety and health manuals. Direct reading instruments will be calibrated, at a minimum, before daily use and more frequently as determined by the project industrial hygienist. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 13.

4.3.2 Area Radiological Monitoring and Instrument Calibration

Area radiological monitoring will be conducted during project tasks to ensure that personnel are given adequate protection from potential radiological exposure. Instruments and sampling methods listed in Table 4-1 may be used by the RCT as deemed appropriate and as required by project or task-specific RWPs. When conducted, monitoring will be performed in accordance with applicable company manuals. The data obtained from monitoring will be used by RadCon personnel to evaluate the effectiveness of engineering controls, decontamination methods and procedures, and alert personnel to potential radiation sources.

RadCon personnel will use radiation and contamination detectors and counters listed in Table 4-1 or equivalent instruments to provide radiological information to personnel. Daily operational and source checks will be performed on all portable survey instruments used on this project to ensure they are within the specified baseline calibration limits. Accountable radioactive sources will be maintained in accordance with applicable company policies and procedures. All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, and in conformance with applicable company policies and procedures.

4.3.2.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during project tasks. When dosimetry is required, all personnel who enter the project area will be required to wear personal dosimetry devices, as specified by RadCon personnel and the RWP, and in accordance with the applicable company manuals.

When RWPs are required for project tasks, the Radiological Control and Information Management System (RCIMS) will be used to track external radiation exposures to personnel. Individuals are responsible for ensuring all required personal information is provided to RadCon personnel for entry into RCIMS and logging into RCIMS when electronic dosimeters are used.

4.3.2.2 Internal Monitoring. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. Internal dose evaluation programs will be adequate to demonstrate compliance with 10 CFR 835. The requirement for whole body counts and bioassays will be based on specific project tasks or activities and will be the determination of the radiological engineer. Bioassay requirements will be specified on the RWP and project personnel will be responsible for submitting required bioassay samples upon request.

5. ACCIDENT AND EXPOSURE PREVENTION

Project activities will present numerous safety, physical, chemical, and radiological hazards to personnel conducting these tasks. It is critical that all personnel understand and follow the site-specific requirements of this HASP. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will be implemented to eliminate or mitigate potential hazards and exposures, where feasible. However, all personnel are responsible for the identification and control of work area hazards in accordance with Integrated Safety Management System (ISMS) principals and practices. **At no time will hazards be left unmitigated without implementing some manner of controls (e.g., engineering controls, administrative controls, or the use of PPE)**. Project personnel shall use stop work authority in accordance with applicable company policies and procedures where it is perceived that imminent danger to personnel, equipment, or the environment exists.

This HASP is to be used in conjunction with applicable company policies and procedures. Where appropriate, applicable company policies and procedures, mitigation guidance, JSAs, and RWPs will be incorporated into applicable sections of the HASP.

5.1 Voluntary Protection Program and Integrated Safety Management

The INEEL safety processes embrace the Voluntary Protection Program (VPP) and ISMS criteria, principles, and concepts to identify and mitigate hazards, thereby preventing accidents. All management and workers are responsible for implementing safety policies and programs and for maintaining a safe and healthful work environment. Project personnel are expected to take a proactive role in preventing accidents, ensuring safe working conditions for themselves and fellow personnel, and complying with all work control documents, procedures, and permits.

The **ISMS** is focused on the **system** side of conducting operations and **VPP** concentrates on the **people** aspect of conducting work. Both programs define work scope, identify and analyze hazards, and mitigate the hazards and additional information on these programs is available on the INEEL Intranet. BBWI (current primary management and operating contractor) and its subcontractors participate in VPP and ISMS for the safety of their employees. This document includes all elements of both systems. The five key elements of VPP and ISMS and their corresponding HASP sections are as follows:

VPP	ISMS	HASP Section
	Define work scope	Section 2
Work site analysis	Analyze hazards	Section 3, 4, 6, 8,
Hazard prevention and control	Develop and implement controls	Section 3, 4, 5, 7, 8, 10, 11, 12
Safety and health training	Perform within work controls	Section 7
Employee involvement	Perform work within controls	Section 3, 4, 5
Management leadership	Provide feedback and improvement	Section 5, 10

5.2 General Safe-Work Practices

Sections 1 and 2 defined the project work scope and associated project-specific hazards with mitigation. The following practices are mandatory for all project personnel to further reduce the likelihood of accidents and injuries. All visitors permitted to enter work areas must follow these requirements. Failure to follow these practices may result in permanent removal from the project and other disciplinary actions. The project STR and HSO will be responsible for ensuring the following safe-work practices are adhered to at the project site(s):

- Limit work area access to authorized personnel only, in accordance with applicable company policies and procedures and Section 7 of this document.

- All personnel have the authority to initiate STOP WORK actions in accordance with applicable company policies and procedures.

- Personnel will not eat, drink, chew gum or tobacco, smoke, apply sunscreen, or perform any other practice in CERCLA areas or in areas where there is an increased probability of hand-to-mouth transfer and ingestion of work areas contaminants.

- Be aware of and comply with all safety signs, tags, barriers, and color codes as identified in accordance with applicable company policies and procedures.

- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and spills that may be present. Report all potentially dangerous situations to the STR or HSO.

- Avoid direct contact with hazardous materials and waste. Personnel will not walk through spills or other contamination areas and will avoid kneeling, leaning, or sitting on equipment or potentially contaminated surfaces.

- Be familiar with the physical characteristics of the INTEC facility, including, but not limited to:

  - Prevailing wind direction

  - Location of fellow personnel, equipment, and vehicles

  - Communications at the project site and with INTEC or CFA

  - Area and the type of hazardous materials stored and waste disposal materials

  - Major roads and means of access to and from the project site

  - Location of emergency equipment

  - Warning devices and alarms at INTEC and/or CFA

  - Capabilities and location of nearest emergency assistance.

- Report all broken skin or open wounds to the operations manager, STR, or HSO. An OMP physician must examine all wounds to determine the nature and extent of the injury. If required to enter into a radiological contamination area, a RadCon supervisor will determine whether the wound can be bandaged adequately in accordance with applicable company manuals.

- Prevent releases of hazardous materials. If a spill occurs, personnel must try to isolate the source (if possible and if this does not create a greater exposure potential) and then report it to the STR, or HSO. The Warning Communications Center (WCC) and INTEC shift supervisor will be notified and additional actions will be taken, as described in Section 11. Appropriate spill response kits or other containment and absorbent materials will be maintained at the project site.

- Illumination levels during project tasks will be in accordance with 29 CFR 1910.120 (Table H-120.1, "Minimum Illumination Intensities in Foot-Candles").

- Ground-fault protection will be provided whenever electrical equipment is used outdoors.

- Keep all ignition sources at least 15 m (50 ft) from explosive or flammable environments and use nonsparking, explosion-proof equipment when working on systems containing flammable or explosive liquids, gases, and vapors.

- Follow all safety and radiological precautions and limitation of TPRs and requirements identified in work packages.

5.3 Subcontractor Responsibilities

Subcontractors are responsible for meeting all applicable requirements listed in the completed, applicable company forms, policies, and procedures as well as manuals, and contract general and special conditions. Additionally, subcontractor are expected to take a proactive role in hazard identification and mitigation while conducting project tasks and report unmitigated hazards to the project point of contact and HSO after taking mitigative actions within the documented work controls.

5.4 Radiological and Chemical Exposure Prevention

Exposure to potential chemical, radiological, and physical hazards will be mitigated by using of engineering controls, administrative controls, and PPE as a last means of defense to prevent and minimize exposure where engineering controls are not feasible. All project personnel are responsible for understanding the hazard identification and mitigation measures necessary to prevent exposures.

5.4.1 Radiological Exposure Prevention – As Low as Reasonably Achievable Principles

Radiation exposure of project personnel will be controlled such that radiation exposures are well below regulatory limits and that there is no radiation exposure without commensurate benefit. **Unplanned and preventable exposures are considered unacceptable.** All project tasks will be evaluated with the goal of eliminating or minimizing exposures. All project personnel have the responsibility for following as-low-as-reasonably-achievable (ALARA) principles and practices and personnel working at the site must strive to keep both external and internal radiation doses.

5.4.2 Chemical and Physical Hazard Exposure Avoidance

NOTE: Identification and control of exposures to carcinogens will be conducted in accordance with applicable company policies and procedures.

The TLVs or other occupation exposure limits have been established for numerous chemicals and physical agents (e.g., noise, heat, or cold stress) that may be encountered. These exposure limits provide

guidelines in evaluating airborne, skin, and physical agent exposures. The TLVs represent levels and conditions under which it is believed that nearly all workers may be exposed day after day without adverse health effects. The TLV-TWA is a time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects. Action limits (instantaneous concentrations for short time periods) have been established (Section 3) to further reduce the likelihood of exceeding TLVs.

Controls will be employed to eliminate or mitigate chemical and physical hazards wherever feasible. The hierarchy of controls in order are (1) engineering controls, (2) administrative controls, and (3) PPE. In addition to these controls, use of technical procedures and work orders, hold points, training, and monitoring of hazards will be used as appropriate to reduce exposure potential. Some methods of exposure avoidance include

- Wearing all required PPE, inspecting all pieces before donning, and taping all seams
- Changing PPE if it becomes damaged or shows signs of degrading
- Minimizing time in direct contact with both hazardous material and waste
- Doff PPE following standard practices (i.e., rolling outer surfaces in and down) and follow doffing sequence
- Wash hands and face before eating, drinking, smoking, or engaging in activities that may provide contaminant pathways.

5.5 Buddy System

The two-person or buddy system will be used during project tasks. The buddy system is most often used during project activities requiring the use of protective clothing and respiratory protection where heat stress and other hazards may impede a person's ability to self-rescue. The buddy system requires each employee to assess and monitor his or her buddy's mental and physical well being during the course of the operation. A buddy must be able to perform the following activities:

- Provide assistance if required
- Verify the integrity of PPE
- Observe his or her buddy for signs and symptoms of heat stress, cold stress, or contaminant exposure
- Notify other personnel in the area if emergency assistance is needed.

The buddy system will be administered by the STR in conjunction with the HSO.

6. PERSONAL PROTECTIVE EQUIPMENT

Personnel performing Phase I activities are anticipated to wear modified Level D PPE that will include hardhat, safety glasses with sideshields, sturdy leather boots above the ankle, highly visible reflective vests, and hearing protection in high noise areas. Phase II activities will likely involve contact with potentially contaminated soils and the PPE will be identified on the RWP above and beyond Level D PPE.

This section provides guidance for the selection and use of PPE to be worn for project tasks and contingencies for upgrading and downgrading PPE. Types of PPE are generally divided into two broad categories: (1) respiratory protective equipment and (2) PPE. Both of these categories are incorporated into the standard four levels of protection (Levels A, B, C, and D). Level D PPE is anticipated for all aspects of this project.

The purpose of personal protective clothing and equipment is to shield or isolate individuals from chemical, physical, radiological, biological, and safety hazards encountered during project tasks when engineering and other controls are not feasible or cannot provide adequate protection. It is important to realize that no one PPE ensemble can protect against all hazards under all conditions. Proper work practices and adequate training will serve to augment PPE usage to provide the greatest level of worker protection.

The PPE policy requires field workers to wear, as a minimum, sturdy leather boots above the ankles, safety glass with side shields, and hard hats which is classified as Level D. Safety boots will be required for activities where objects, materials, or equipment have the potential to fall on the feet of workers, occasional workers, visitors, and inspectors. The project HSO or safety professional will determine where and when this requirement will be invoked for each project.

The type of PPE will be selected, issued, used, and maintained in accordance with applicable company policies and procedures. Selection of the proper PPE is based on the following considerations:

- Specific conditions and nature of the tasks
- Potential contaminant routes of entry
- Physical form and chemical characteristics of hazardous materials, chemicals, or waste
- Toxicity of hazardous materials, chemicals, or waste
- Duration and intensity of exposure (acute or chronic)
- Compatibility of chemical(s) with PPE materials and potential for degradation or breakthrough
- Environmental conditions (e.g., humidity, heat, cold, rain)
- The hazard analysis (Section 3) evaluation of this HASP.

The PPE requirement for specific project tasks is identified in Table 6-1. This list may be augmented by the activity JSA and/or RWP. Potential exposures and hazards will be monitored (as discussed in Section 3) during the course of the project to evaluate changing conditions and determine PPE level adequacy and modifications.

Table 6-1. Task-based PPE requirements and modifications.

Task	Initial Level of Personal Protective Equipment	Upgrade Contingency	Downgrade Contingency	Upgrade or Downgrade Criteria	Personal Protective Equipment Modifications and Comments
Mobilization/ demobilization	D	C	D	Upgrade to Level C if airborne concentrations exceed action limits. Downgrade to Level D if contact can be avoided or surveys show no detectable contamination on surfaces.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Leather gloves for all material handling tasks.
Survey activities	D	D+	N/A	Upgrade to Level D+ when attaching or removing straps if contamination is detected on the outside of waste containers.	Level D+ protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves.
Pond liner installation	D	D+	N/A	Upgrade to Level C if airborne levels exceed action limits. Downgrade to Level D if contact with waste containers can be avoided or surveys show no detectable contamination on surfaces.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Leather gloves for all material handling tasks.
Heavy equipment operations	D	D+	N/A	Upgrade to Level D+ if contact with waste material cannot be avoided.	Level D+ protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves.
Concrete/form work	D	D+	N/A	Upgrade to Level C if airborne concentrations exceed the action limits.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Level C protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves for all material handling tasks.

Table 6-1. (continued).

Task	Initial Level of Personal Protective Equipment	Upgrade Contingency	Downgrade Contingency	Upgrade or Downgrade Criteria	Personal Protective Equipment Modifications and Comments
Equipment decontamination	C	C+	D+	Upgrade to Level C+ if splashing during decontamination of lead, cadmium, radiologically contaminated equipment cannot be avoided.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Level C protective clothing consists of Tyvek (or equivalent) hooded coverall. Level C+ protective clothing consists of Saranex (or equivalent coated hooded coverall). Leather gloves over nitrile for equipment and material handling before or after decontamination tasks. Double pair nitrile gloves during decontamination tasks.
				Downgrade to Level D+ for decontamination of small items using spray and wipe decontamination methods.	

6.1 Respiratory Protection

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective will be to prevent atmospheric contamination. This will be accomplished as far as feasible by accepted engineering control measures (e.g., enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators will be selected and used.

Required task-based respiratory protection and protective clothing are listed on Table 6-1. Respirators will not be required for specific project tasks. All personnel required to wear respirators will complete training and be fit-tested before being assigned a respirator in accordance with the training and documentation requirements in Section 6. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in the applicable company policies and procedures, will be followed.

6.2 Personal Protective Equipment Levels

Table 6-2 lists PPE requirements for the two levels of PPE that may be worn during the course of the project. Applicable PPE levels include level D and Level C PPE which will be required for conducting project tasks. Modifications to these levels will be made under the direction of the HSO in consultation with the project IH and RadCon personnel, as appropriate. Such modifications are routinely employed during HAZWOPER site activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health. Level D PPE is the anticipated level of protection for project activities and will be upgraded if warranted by the presence of contaminants above action limits.

6.2.1 Level D Personal Protective Equipment

Level D PPE will only be selected for protective clothing and not on a site with respiratory or skin absorption hazards requiring whole-body protection. Level D PPE provides no protection against airborne chemical hazards, but rather is used for protection against surface contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized as having limited contamination hazards.

6.2.2 Level C Personal Protective Equipment

Level C PPE will be worn when the task site chemical and radioactive contaminants have been well-characterized indicating that personnel are protected from airborne exposures by wearing an air-purifying respirator with the appropriate cartridges, no oxygen-deficient environments exist (less than 19.5% at sea level), and that there are no conditions that pose immediate danger to life or health.

6.3 Personal Protective Clothing Upgrading and Downgrading

The project HSO, in consultation with the project industrial hygienist and RadCon personnel, will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading of PPE based on changing site conditions or activities is a normal occurrence. Action levels listed in Table 6-2 serve as the initial basis for making such decisions. Additional reasons for upgrading or downgrading are listed in the following subsections.

Table 6-2. Levels and options of PPE.

PPE Level	PPE Required	Optional PPE or Modifications
D	Coveralls or standard work clothes (coverall material type based on industrial hygiene determination). Hard hat (unless working indoors with no overhead or falling debris hazards) meeting ANSI Z89.1 requirements. Eye protection (safety glasses meeting ANSI Z87.1 requirements as a minimum). Hand protection (material based on type of work and hazardous materials being handled). Safety footwear (steel or protective toe and shank) meeting ANSI Z41 requirements or sturdy leather above the ankle for construction tasks.	Chemical or radiological protective clothing (Tyvek or Saranex) by industrial hygienist or RCT. Chemically resistant hand and foot protection (e.g., inner and outer gloves and boot liners). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, cryogenic gloves, face shields, welding goggles, and aprons).
C	Level D ensemble with the following respiratory and whole-body protection upgrades:[a] • Full-facepiece air-purifying respirator equipped with a NIOSH-approved high-efficiency particulate air (HEPA) filter or chemical combination cartridge (industrial hygienist to specify cartridge type) OR • An air hood operating at a minimum pressure of 6 cfm or a full-facepiece supplied air respirator with a 10-minute escape bottle, a self-contained breathing apparatus (SCBA) or an escape air-purifying combination HEPA or chemical cartridge (supplied air respirator hose length no more manufacturer's specification and under no circumstances greater than 91 m [300 ft]) • Standard Tyvek (or equivalent) coverall OR • Chemical-resistant coveralls (e.g., Tyvek QC, Tychem 7500, or Saranex-23-P) (industrial hygienist to specify material).	Chemical-resistant outer shoe or boot cover (industrial hygienist or RCT to specify material). Inner chemical-resistant gloves with cotton liners (as determined by the industrial hygienist and RWP). Outer chemical-resistant gloves (as determined by the industrial hygienist). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, welding lens, and aprons).

a. Upgrades are determined by the industrial hygienist in conjunction with other environment, safety, and health professionals.

NOTE: *Personnel must inspect all PPE before donning and entry into any work zone. Items found to be defective or that become unserviceable during use will be doffed and disposed of in accordance with posted procedures and placed into the appropriate waste stream. The PPE inspection guidance is provided in Table 6-1.*

6.3.1 Upgrading Criteria for Personal Protective Equipment

The level of PPE required will be upgraded for the following reasons and work will halt until PPE upgrading has been completed:

- Identification of new, unstable, or unpredictable site hazards
- Temporary loss or failure of any engineering controls
- Contaminants that present difficulty in monitoring or detecting
- Known or suspected presence of skin absorption hazards
- Identified source or potential source of respiratory hazard(s) not anticipated
- Change in the task procedure that may result in an increased contact with contaminants or meeting any of the criteria listed above.

6.3.2 Downgrading Criteria

The level of PPE will be downgraded under the following conditions:

- Elimination of hazard or completion of task(s) requiring specific PPE
- Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazard
- Sampling information or monitoring data that show the contaminant levels to be stable and lower than established action limits
- Elimination of potential skin absorption or contact hazards.

6.3.3 Inspection of Personal Protective Equipment

All PPE ensemble components must be inspected before use and when in use within project work zones. Self-inspection and the use of the buddy system, once PPE is donned, will serve as the principle forms of inspection. If PPE should become damaged or degradation or permeation is suspected, the individual wearing the PPE will inform others of the problem and proceed directly to the work zone exit point to doff and replace the unserviceable PPE. Table 6-3 provides an inspection checklist for common PPE items. Where specialized protective clothing or respiratory protection is used or required, the manufacturer's inspection requirements in conjunction with regulatory or industry inspection practices will be followed. Consult the project industrial hygienist, safety professional, and RCT about PPE inspection criteria.

Table 6-3. Inspection checklist for personal protection equipment.

Personal Protection Equipment Item	Inspection
Respirators (full-facepiece air-purifying and supplied air respirators with escape-only SCBA bottles or escape cartridges)	Before use:
	Ensure airline matches the airline respirator to be used (black hose).
	Inspect airline hose connections (sections of hose) to ensure all are threaded or permanent metal-to-metal connections (no quick disconnect pieces).
	Check condition of the facepiece, head straps, valves, connecting lines, fittings, and all connections for tightness.
	Check cartridge to ensure proper type or combination are being used for atmospheric hazards to be encountered, and inspect threads and O-rings for pliability, deterioration, and distortion.
	Check for proper setting and operation of regulators and valves, check all hose connections back to the breathing-air compressor, check the pressure to the airline station and on individual airline connections to ensure pressure is within required range (in accordance with the manufacturer's specifications).
Level D and C clothing	Before use:
	Visually inspect for imperfect seams, nonuniform coatings, and tears.
	Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks.
	While wearing in the work zone:
	Inspect for evidence of chemical attack such as discoloration, swelling, softening, and material degradation.
	Inspect for tears, punctures, and zipper or seam damage.
	Check all taped areas to ensure they are still intact.
Gloves	Before use:
	Pressurize rubber gloves to check for pinholes: blow in the glove, then roll until air is trapped and inspect. No air should escape.
	Leather gloves:
	Inspect seams and glove surface for tears and splitting and verify no permeation has taken place.