ORNL/ER-169/S4

MARTIN MARIETTA

ENVIRONMENTAL RESTORATION PROGRAM

WAG 2 Remedial Investigation and Site Investigation Site-Specific Work Plan/Health and Safety Checklist for the Ecological Assessment Task, Kingfisher Study

V. L. Holt
L. A. Baron

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MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

UCN-17560 (6 7-91)

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Date Issued—May 1994

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
managing the

Oak Ridge K-25 Site
Oak Ridge Y-12 Plant
Oak Ridge National Laboratory
under contract DE-AC05-84OR21400

Paducah Gaseous Diffusion Plant
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-76OR00001

for the
U.S. DEPARTMENT OF ENERGY

WAG 2 REMEDIAL INVESTIGATION AND SITE INVESTIGATION WORK PLAN/HEALTH AND SAFETY CHECKLIST FOR THE ECOLOGICAL ASSESSMENT TASK, KINGFISHER STUDY

APPROVALS

WAG 2 RI&SI Project Safety and Health Officer	Virginia L Hall	5/5/94 Date
WAG 2 RI&SI Project Manager	Stephen E. Hulse	5/5/94 Date
ORNL Industrial Safety Representative	E. A. Ford	5/5/94 Date
ORNL Industrial Hygiene Representative	E. R. Bond Greg Rader	5/5/94 5/4/94 Date
ORNL Fire Protection Representative	R. L. Holley	5/4/94 Date
ORNL Office of Laboratory Protection Representative	J. S. Glenconkner	5/4/94 Date
ORNL Office of Radiation Protection Representative		5-4-94 Date
ORNL HAZWOPER Program Coordinator	Ann W Southstrum	5/4/94 Date
ORNL ER ES&H Manager	Charles Clark L.	5/4/94 Date
ORNL ER Program Manager, DOE Environmental Restoration Division	John D Lawrence	5/6/94 Date

CONTENTS

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
EFPC	East Fork Poplar Creek
ESD	Environmental Sciences Division
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HP	Health Physics
HPC	HAZWOPER Program Coordinator
HSC	health and safety checklist
IH	Industrial Hygiene
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SI	site investigation
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
TLD	thermoluminescent dosimeter
WAG	waste area grouping
WBGT	wet-bulb globe temperature
WOC	White Oak Creek
WP	work plan

EXECUTIVE SUMMARY

This report provides specific details and requirements for the WAG 2 remedial investigation and site investigation Ecological Assessment Task, Kingfisher Study, including information that will contribute to the safe completion of the project.

The report includes historical background; a site map; project organization; task descriptions and hazard evaluations; controls; and monitoring, personal protective equipment, decontamination, and medical surveillance program requirements. The report also includes descriptions of site personnel and their certifications as well as suspected WAG 2 contaminants and their characteristics.

1. INTRODUCTION

This site-specific work plan (WP)/health and safety checklist (HSC) is a supplement to the general health and safety plan (HASP) for Waste Area Grouping (WAG) 2 remedial investigation (RI) and site investigation (SI) activities [*Health and Safety Plan for the Remedial Investigation and Site Investigation of Waste Area Grouping 2 at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-169)] and provides specific details and requirements for the WAG 2 RI&SI Ecological Assessment Task, Kingfisher Study. This WP/HSC identifies specific site operations, site hazards, and any recommendations by Oak Ridge National Laboratory (ORNL) health and safety organizations [i.e., Industrial Hygiene (IH), Health Physics (HP), Fire Protection Engineering, and/or Industrial Safety] that would contribute to the safe completion of the WAG 2 RI&SI.

Together, the general HASP for the WAG 2 RI&SI (ORNL/ER-169) and the completed site-specific WP/HSC meet the health and safety planning requirements specified by 29 CFR 1910.120 and the ORNL Hazardous Waste Operations and Emergency Response (HAZWOPER) Program Manual. In addition to the health and safety information provided in the general HASP for the WAG 2 RI&SI, details concerning the site-specific task are elaborated in this site-specific WP/HSC, and both documents, as well as all pertinent procedures referenced therein, will be reviewed by all field personnel before beginning operations.

2. PRE-ENTRY HEALTH AND SAFETY BRIEFING

The purpose of the pre-entry health and safety briefing is to inform all workers of (1) any and all potential safety and health hazards they may encounter while working on the task identified in the WP/HSC and (2) site-specific emergency response measures. How the work will be accomplished, who should be notified in case of an emergency, and any and all questions will be addressed by the Site Safety and Health Officer (SSHO) at this time. The SSHO will confirm with the technical resources and training section that ORNL personnel accessing the site areas have received the health and safety training that qualifies them to work at this site. (ORNL special access badges may be used as proof of training.) Each potential field person will be required to sign and date a form or designated section within the field logbook stating that he or she has received a pre-entry briefing and has reviewed both the WAG 2 RI&SI general HASP and this site-specific WP/HSC.

The Laboratory Shift Superintendent at ORNL coordinates 24-h emergency response coverage from the Shift Superintendent's Department of the Laboratory Protection Division. The on-duty Laboratory Shift Superintendent, assisted by a well-trained plant emergency squad, directs the response to emergencies such as fires, major equipment failure, hazardous materials releases or spills, natural disasters, and sabotage. All spills must be reported to the Office of Environmental Compliance and Documentation. Should a spill occur during operations, all site personnel will evacuate the area unless the spill can be contained with materials in the immediate work area. A spill control kit will be located on the site. For more details on emergency response actions and telephone numbers, see Sect. 10 of ORNL/ER-169.

3. PROJECT AND SITE DESCRIPTION

3.1 PROJECT OBJECTIVES

The primary objective of the WAG 2 Kingfisher Study is to assess the feasibility of using kingfishers as biological monitors of contaminants on the Oak Ridge Reservation (ORR). This task integrates the monitoring activities of the ORNL Biological Monitoring and Abatement Program with the ecological assessment component of the WAG 2 RI&SI project and the ecological assessment component of the source WAGs. This kingfisher study will focus on a primary pathway for contaminant flux into biota: groundwater and surface water transport to aquatic biota and consumption of contaminated aquatic prey by a piscivorous bird. Kingfisher sample collection will be used to determine the levels of contaminants and degree of bioaccumulation within a common piscivorous bird feeding on contaminated fish from streams on the ORR.

3.2 TASKS TO BE PERFORMED

Tasks to be performed include

- performance of initial site survey to locate burrows by walking down creek embankments [White Oak Creek (WOC), Melton Branch, East Fork Poplar Creek (EFPC), Bear Creek, and Hinds Creek] or by boat (Clinch River, White Oak Lake);
- mapping of burrows using Global Positioning System (GPS); and
- collection of kingfisher feathers, eggs, fecal material, whole bodies, or organs for analysis of contaminants.

3.3 HISTORY AND OPERATION OF THE SITE

WAG 2 consists of WOC and its tributaries downstream of ORNL site, White Oak Lake, and WOC Embayment, and the associated floodplain and subsurface environment. The WOC system is the surface drainage for the major ORNL WAGs and has been exposed to a diversity of contaminants from operations and waste disposal activities within ORNL. Water, sediment, soil, and biota in WAG 2 are contaminated and continue to receive contaminants from upgradient WAGs.

Bear Creek Valley is a watershed that drains the area surrounding several closed Oak Ridge Y-12 Plant waste disposal facilities. Past waste disposal practices in Bear Creek Valley resulted in contamination of Bear Creek and consequent ecological damage.

EFPC is another creek that has been contaminated by past waste disposal practices at the Y-12 Plant. It runs off the ORR, through the city of Oak Ridge, and then back onto the ORR.

Hinds Creek is a reference site.

3.4 SITE DESCRIPTION

The site consists of the WOC watershed, WOC and Melton Branch tributaries, White Oak Lake, the Clinch River, EFPC, Bear Creek, and Hinds Creek (reference site). (A site map is included in Appendix A.) The topography includes floodplains and waterways.

4. PROJECT ORGANIZATION

This work will be performed by the WAG 2 RI&SI program team. ORNL IH, Industrial Safety, and Radiation Protection will provide oversight for this project. Figure 1 provides the chain of command for reporting health and safety issues.

Key personnel and their project roles and responsibilities are listed in Table 1.

Table 1. Key project personnel and roles and responsibilities

Title	Name and organization	Telephone no.
WAG 2 RI&SI Project Manager	Steve Herbes, Environmental Sciences Division (ESD)	4-7336
Environmental Restoration Program Environmental, Safety, and Health Manager	Charles Clark	4-8268
Construction Engineer	N/A	N/A
Field Team Leader	Lisa Baron, ESD	4-8780
Alternate Field Team Leader	Tom Ashwood, ESD	6-2373
Site Safety and Health Officer	Virginia Holt, ESD	1-5240
Alternate Site Safety and Health Officer	Lisa Baron, ESD Brent Zeigler, ESD	4-8780 4-8780
ESD Health Physics Contact	George Houser	6-1408
ORNL Radiation Surveillance	Jerry Gray, Office of Radiation Protection	4-6700
ORNL Industrial Hygiene	Ray Barham, ESD	4-7307
ORNL HAZWOPER Program Coordinator	Ann Saulsbury, ORNL	6-5064
ORNL Safety	Ernie Ford, ESD	1-4373
ORNL Fire Protection	Bob Atchley, ORNL	4-6278

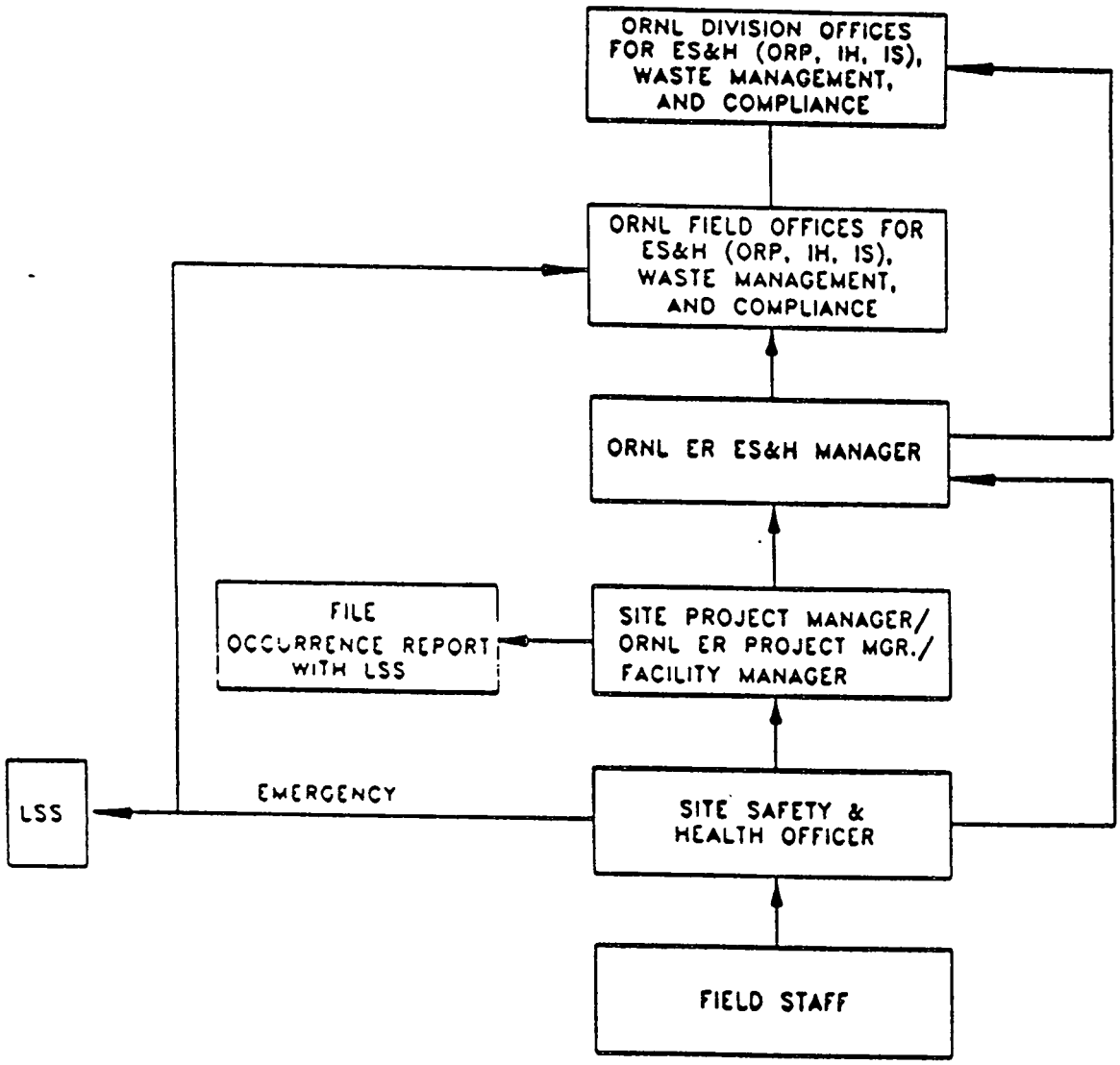

Fig. 1. Chain of command for reporting health and safety issues.

5. SITE TASK HAZARD EVALUATION

5.1 DESCRIPTION OF TASK TO BE PERFORMED

This section has been completed by the Project Manager based on knowledge, site history, site operations, and any and all potential hazards that might impact a worker's health and safety and describes the tasks to be performed and the associated level of personal protective equipment (PPE) required for those tasks. Specific control measures for the hazards indicated in this section are identified in Sect. 5.2, as are procedures and procedure numbers that will be used in the completion of this task.

5.1.1 Task Description: Kingfisher Survey and Sampling

Intrusive ___ Nonintrusive _X_

Description. A stream water survey will be conducted in WOC, Melton Branch, East Fork Popular Creek, Bear Creek, and Hinds Creek by walking down creek embankments or traveling by boat (on White Oak Lake and the Clinch River) to locate kingfisher burrows. When potential burrows are located, confirmation will be determined by use of the kingfisher probe (innovative equipment designed to videotape the interior of the burrow and collect samples). If eggs, feathers, or other biotic sample materials are observed during the survey, samples will be collected. Burrows will be revisited to map the site using the GPS and to collect additional biota samples.

Checklist summary of site-specific hazards. For the specific hazards listed in this section, a check mark (✓) indicates hazards that are intrinsic to the site locale itself. An "X" indicates hazards associated with task performance and/or the equipment and materials that may be used to accomplish the task.

Physical hazards/agents

(✓) Heat stress	(✓) Cold stress	( ) Noise
( ) Confined space	( ) Enclosed space	( ) Heavy lifting
(✓) Tripping/falling	( ) Electrical	( ) High-pressure water
( ) Oxygen deficient	( ) Explosive/flammable	( ) Vibration
( ) Asbestos	( ) Underground	( ) Overhead
(✓) Water	(✓) Other: Boat Hazard	( ) Other: _____

Construction hazards

( ) Trenching	( ) Excavating	( ) Heavy equipment
( ) Demolition	( ) High work	( ) Welding/cutting
( ) Ladders	( ) Drilling	( ) Overhead
( ) Overhead	( ) Other: _____	( ) Other: _____

Chemical hazards

(✓) Organic chemical	(✓) Inorganic chemical	( ) Carcinogen
( ) Corrosive	( ) Reactive	( ) OSHA-specific substances
( ) Mutagen	( ) Teratogen	( ) Other: _____

Ionizing radiation hazards

(✓) Internal exposure	(✓) External exposure	(✓) Contamination (WAG 2)

Nonionizing radiation hazards

(✓) Ultraviolet	( ) Radio frequency	( ) Microwave
( ) Laser		

Biological/vector hazards

(✓) Wildlife	(✓) Plants	( ) Medical waste
( ) Bacteria	(✓) Parasites	( ) Other: _____

Initial level of personal protective equipment

Level of protection:

( ) A	( ) B	( ) C
(X) D	( ) Modified (+)	

Respirator:

( ) SCBA	( ) Full-face respirator
( ) ½-face respirator	Cartridge: _____

Protective clothing:

( ) Encapsulating suit	( ) Tyvek	( ) Saranex
( ) Splash suit	( ) C-zone	(X) Other: personal flotation devices during boating

(X) Company clothing (khakis)

Head/eye/ear:

( ) Hard hat	(X) Safety glasses	( ) Goggles
( ) Splash shield	( ) Ear plugs	( ) Other: _____

Gloves:

( ) Nitrile	( ) Neoprene	( ) Polyvinyl chloride
( ) Latex	( ) Vinyl	(X) Other: Rubber
( ) Leather		

Footwear:

(X) Steel-toed work shoes ( ) Chemical overboots ( ) Steel-toed rubber boots

(X) Other: Waders or rubber overboots

Additional comments. Surveys and sampling will be performed in shallow streams near base flow conditions. Water depth greater than 1 ft will require waders and a lifejacket. Wading is allowed only if water is below the waist (navel). The rule of 10 will be observed: The product of water velocity (ft/sec) times depth (ft) shall not exceed 10.

Modifications allowed. Gloves may be constructed of other materials if they are waterproof and prevent contamination. Safety glasses will not be required on clean sites free of brush and/or other eye hazards.

5.1.2 Site Control

Site work zones are required to reduce the accidental spread of hazardous substances from contaminated areas to clean areas. Identification of work zones will provide control of operations and flow of personnel. The HAZWOPER Program Coordinator (HPC) will provide signs for posting HAZWOPER requirements at the site. The HP technician will determine the radiological condition of the monitoring site and the radiological postings before site activities commence. Should additional barriers (rope, tape) or signs be required, HP, IH, and Industrial Safety will be consulted. Personnel accessing the zones must meet access requirements, as stated in this plan and posted at the entrance of the zones. The SSHO is responsible for ensuring that all workers and visitors meet site access requirements. Site access requirements are identified in Sect. 8 of the WAG 2 RI&SI HASP. Task-specific training requirements are identified under "Administrative Controls" in Sect. 5.1.3 of this site-specific WP/HSC. Section 10 of this site-specific WP/HSC is a record of the qualifications of personnel involved in this specific task.

Use of the buddy system is required for this project. All field personnel will work with a partner. To ensure worker safety, personnel will (1) maintain internal communications, (2) remain within a line of sight of other workers, and (3) conduct work-party monitoring. The buddy system will be implemented at the points controlling access to the radiological zones. A two-way radio will be maintained on site to ensure communication with the Laboratory Shift Superintendent and emergency, safety, and health support personnel.

The following items must be completed to ensure that required site controls are identified.

Site posted information/notification required? Yes _X_ No ___ N/A ___

Site guard required? Yes ___ No _X_ N/A ___

Access control required? Yes _X_ No ___

(WAG 2 access is controlled through the Melton Valley access badge reader.)

Entry/exit logs required? Yes _X_ No ___

Escape routing/posting required? Yes _X_ No ___

(See evacuation routes and assembly point map, Appendix A.)

5.1.3 Administrative Controls (Required Permits, Training, Etc.)

Training requirements will include 24-h HAZWOPER training [Superfund Amendment Reauthorization Act (SARA)/Occupational Safety and Health Act (OSHA)], Radiation Worker II training (or 24-h HAZWOPER training with an escort who has received Radiation Worker II training), and defensive driving on nonpaved surfaces training.

5.1.4 Sanitation

Task(s): All tasks

Potable water required? Yes _X_ No ___ Not allowed inside the WAGs.

Nonpotable water used? Yes _X_ No ___

Eating, drinking, and use of tobacco products permitted? Yes ___ No _X_

Break location: Environmental Sciences Division (ESD) Bldgs. 1505 and 1506

Toilet facilities required? Yes _X_ No ___

Toilet location and number: ESD Bldgs. 1505 and 1506; five toilet facilities

Washing facilities required? Yes _X_ No ___

Washing facility location: ESD Bldgs. 1505 and 1506; five facilities

Change rooms required? Yes _X_ No ___

Change room locations: ESD Bldgs. 1505 and 1504, two facilities. All personnel should shower at the change rooms at the end of each day before departing for home.

5.1.5 Safety Equipment

A radio and a first aid kit are required on site.

5.2 SITE-SPECIFIC HAZARDS AND CONTROLS

This section provides specific details and control measures for each general hazard identified in Sect. 5.1.

5.2.1 Physical Hazards/Agents

Fire/explosion: N/A

Compressed gas cylinders? Yes ___ No _X_

Confined space entry: N/A

Asbestos: N/A

Electrical hazards: N/A

Temperature:

Task(s): All

Temperature extremes (hot and cold)? Yes _X_ No ____

Average daily high temperature (during work shift): 70°F–90°F during the summer

Average daily low temperature (during work shift): 35°F–55°F during the winter

Wet-bulb globe temperature (WBGT) will be obtained before daily activities as necessary. When WBGT is >80°F (26.7°C), or >77.5°F for unacclimated workers, American Conference of Governmental Industrial Hygienists (ACGIH) work-rest regimen guidelines should be followed.

Work load:

Light ___

Moderate _X_

Heavy ___

Controls: The SSHO will establish the appropriate work/rest regiment in accordance with the ACGIH threshold limit value booklet or obtain guidance from IH. See Sect. 3.3 of the WAG 2 HASP for controls of heat stress and cold stress.

Cooling/heating equipment needed: Clothing appropriate to the season and weather conditions.

Noise hazards: N/A

Underground hazards: N/A

Overhead hazards: N/A

Machinery hazards: N/A

Water hazards: Buddy system, visual observation, alertness, and avoidance of uneven or slippery surfaces to the degree possible.

Other physical hazards:

Task(s): All tasks

Hazard: Boat hazards

Controls: Personnel will follow the training and procedures in the ESD Boat Safety Program.

Task(s): All tasks

Hazard: Slips, trips, falls, and crossing streams

Additional comments and controls: Buddy system, visual observation, alertness, and avoidance of uneven or slippery surfaces to the degree possible. Streams will be crossed in shallow areas near normal base flow conditions, and rubber overboots or waders will be worn.

5.2.2 Construction Hazards

Cutting or welding hazards: N/A

Other construction hazards: N/A

5.2.3 Chemical Hazards

Chemicals to be brought on site: None

Are Material Safety Data Sheets assembled for chemicals to be brought on site?
Yes ___ No ___ N/A _X_

Other chemical hazards known or suspected to exist on site: See WAG 2, EFPC, and Bear Creek contaminant lists in Appendix B. The nonradiological contaminants are not expected to present a health or safety hazard on site because either: (1) they are not expected to volatilize because of environmental media/potential exposure pathways, or (2) concentrations are low.

5.2.4 Ionizing Radiation Hazards

Isotope: See WAG 2, EFPC, and Bear Creek contaminant lists in Appendix B.

Ionizing radiation present? Yes _X_ No ___ (alpha, beta, and primarily gamma)

Radiation work permit required? Yes ___ No _X_

HP contacted? Yes _X_ No ___

HP coverage? Yes ___ No _X_

Protective clothing required: Yes _X_ No ___

Additional comments and controls: None.

5.2.5 Nonionizing Radiation Hazards

High-voltage (>100 kV) electrical transmission lines nearby? Yes ___ No _X_

Radio frequency radiation sources (AM and/or FM broadcast towers, radio frequency sealers) nearby? Yes ___ No _X_

Microwave sources in use on site? Yes ___ No _X_

Lasers in use nearby? Yes ___ No _X_

Are workers potentially exposed to sunlight (ultraviolet radiation)? Yes _X_ No ___

Additional comments and controls: Personnel shall wear long-sleeved clothing. Sunblock may be applied to exposed skin *before* entering posted Radiologically Controlled Areas.

Are ultrasound sources in use on site? Yes ___ No _X_

5.2.6 Biological/Vector Hazards

Task(s): All

Hazard: Ticks and chiggers

Comments and controls: Application of insect repellant *before* entering posted Radiologically Controlled Areas and visual inspection after site work.

Task(s): All

Hazard: Snakes

Comments and controls: Workers should be alert about where they walk, make noise, and avoid reaching under objects.

Task(s): All

Hazard: Poison ivy and poison oak

Comments and controls: Long-sleeved clothing and gloves are recommended, and field workers will wash exposed skin immediately after site work. Workers should be briefed on recognizing these plants and should be attentive to what they touch.

6. MONITORING REQUIREMENTS

6.1 DIRECT READING INSTRUMENTS

Direct reading instrument monitoring requirements are listed in Table 2.

Table 2. Direct-reading instrument monitoring requirements

Equipment	Task(s)	Monitoring frequency	Action level
Lower explosive limit meter	—	—	—
O_2 meter	—	—	—
Colorimetric indicator tubes	—	—	—
Photoionization detector	All	Initial	5 ppm in Breathing Zone for 30 s
Flame ionization detector	—	—	—
Alpha meter	—	—	—
Beta/gamma Geiger-Muller survey meter	All tasks inside the WAGs	Before exiting each sampling location	Readings above background
Area radiation monitors	—	—	—
Noise meter	—	—	—
Personal direct-read dosimeters	All tasks	Work in radiation areas	20 mR/day
Mercury analyzer	All tasks	Initial	0.025 mg/m^3

6.2 PERSONAL MONITORING

Personal monitoring requirements are listed in Table 3. Instruments used by the IH representative will be calibrated and maintained in accordance with IH standard operating procedures (SOPs). Instruments used by the Office of Radiation Protection are calibrated and source-checked in accordance with established HP procedures.

Table 3. Personal monitoring requirements

Test	Task(s)	Monitoring frequency	Action level
Whole-body dosimetry	All tasks	Continuous	20 mrem/day
Extremity dosimetry	—	—	—
Whole-body count	All tasks	Annual	In accordance with internal dosimetry SOP 03-60-16
Urinalysis/bioassay	All tasks	Quarterly	In accordance with internal dosimetry SOP 03-60-16
Chemical air sampling	—	—	—
Radiation air sampling	—	—	—

7. DECONTAMINATION

The purpose of decontamination is to prevent contaminants that may be present on protective clothing and equipment from coming into contact with personnel as they unsuit. Also, decontamination protects workers from hazardous substances that may contaminate and eventually permeate the PPE used on site, and it protects personnel by minimizing the transfer of harmful materials into clean areas. Combining decontamination with the correct sequential method of removing PPE will prevent exposure to personnel leaving the work areas as well as preventing off-site migration of contaminants. Generally, decontamination is accomplished by starting with the most heavily contaminated item and progressing to the least contaminated item.

Personnel will remove any disposable PPE, in the order listed in the WAG 2 RI&SI HASP, Sect. 6.2, and dispose of it in provided containers before leaving the radiological area. The Radiation Protection representative will assist the SSHO in establishing stations and sequence for doffing PPE. The SSHO will monitor (frisk) personnel and equipment before they exit contaminated areas. The areas being entered are not well characterized; therefore, the SSHO must have special training and documentation in accordance with Office of Radiological Protection procedure ORP-SOP-02-50-70. Training is provided by Technical Resources and Training.

Upon job completion, all equipment will be surveyed by ORNL Radiation Protection and tagged accordingly. If contamination is detected on equipment, the equipment will be cleaned with a paper towel. Equipment that cannot be decontaminated will be bagged and disposed of in accordance with instructions from the Radiation Protection representative.

For a more detailed explanation of decontamination, see Sect. 9 of the WAG 2 RI&SI HASP.

8. PERSONAL PROTECTIVE EQUIPMENT

PPE required for each specific job/activity is addressed in Sect. 5.1.1 of this site-specific WP/HSC. For a more detailed description of the recommended levels of PPE, see Sect. 6 of the WAG 2 RI&SI HASP. The recommended levels of PPE shall be determined by the SSHO and the HP technician on a task-by-task basis and shall incorporate recommendations of the appropriate ORNL health and safety organizations. Upgrades of PPE may be recorded by the SSHO in the project logbook. All upgrades of PPE will require approval from the HPC and appropriate health safety disciplines. All downgrades of PPE require notification of the HPC, IH, HP, and Industrial Safety.

9. MEDICAL SURVEILLANCE

9.1 PHYSICAL EXAMINATION

Some WAG 2 RI&SI personnel do not meet the criteria listed in 29 CFR 1910.120 for inclusion in the Hazardous Waste Worker Medical Surveillance Program. If field conditions should change, personnel who meet these criteria will be included in the ORNL Hazardous Waste Worker Medical Surveillance Program. All Energy Systems subcontractors and employees involved in activities that require work in the exclusion zone or the contamination reduction zone shall ensure that their personnel receive medical evaluation as required by OSHA.

9.2 PERSONNEL SAMPLING/BIOLOGICAL MONITORING

This section is to be filled out by the SSHO and the HP or IH technician, in the event a worker has the potential of an exposure to a contaminant that could be detrimental to health or safety. Because of their potential exposure to radioactive contaminants, WAG 2 RI&SI field personnel are participants in the bioassay program.

Chemical in question: N/A

Nuclide in question: ^{3}H

Personnel monitoring device: None

Biological samples required? Yes _X_ No ___

Biological samples taken: bioassay quarterly

Additional comments and controls: ___

Nuclide in question: ^{90}Sr

Personnel monitoring device: thermoluminescent dosimeter (TLD)

Biological samples required? Yes _X_ No ___

Biological samples taken: bioassay annually

Additional comments and controls:

Nuclide in question: ^{137}Cs

Personnel monitoring device: TLD

Biological samples required? Yes ___ No _X_

Biological samples taken:

Additional comments and controls: Whole-body count annually

10. SITE PERSONNEL AND CERTIFICATION

Site-specific training requirements are listed in Sect 5.1.3 of this WP/HSC. Required training and expiration dates shall be verified by the SSHO before personnel are allowed to access the site.

Name: Lisa Baron Badge no.: 623832

Job performed: Task Leader

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Tennessee Wildlife Resources Agency boat safety training certification, access road training, waste generator training

Name: Chris Knight Badge no.: 624904

Job performed: Field sampling crew

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Tennessee Wildlife Resources Agency boat safety training certification

Name: Virginia (Ginny) Holt Badge no.: 615182

Job performed: Site Safety and Health Officer

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes _X_ No ___

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Tennessee Wildlife Resources Agency boat safety certification, waste generator training, satellite accumulation training, and access road training; will be trained on ORP SOP 02-50-70

Name: Amanda Carr Badge no.:624509

Job performed: Field sampling crew

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Waste generator training and access road training

Name: Steve Short Badge no.: 623576

Job performed: Field sampling crew

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No ___

Other training: Tennessee Wildlife Resources Agency boat safety training certification

Name: Alan Roberts Badge no.: 624962

Job performed: Field sampling crew

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes _X_ No ___

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Tennessee Wildlife Resources Agency boat safety training certification and access road training

Name: Brent Zeigler Badge no.: 626157

Job performed: Field sampling coordinator

Respirator qualified? Yes ___ No _X_

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes _X_ No ___

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Access road training

Name: Mark M. McKeever Badge no.: 656024

Job performed: Site Safety and Health Officer and field sampling crew

Respirator qualified? Yes X No ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes X No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes X No ___

Confined space entry training? Yes ___ No X

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes X No ___

Asbestos worker? Yes ___ No X

Other training: Scheduled for access road training and will be scheduled for ORP SOP 02-50-70

Name: Loren K. Demaree Badge no.: 622529

Job performed: Field sampling crew

Respirator qualified? Yes X No ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes X No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No X

Confined space entry training? Yes ___ No X

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes X No ___

Asbestos worker? Yes ___ No X

Other training: Solid low-level waste generator training; scheduled for access road training

Name: Tom M. Touzeau Badge no.: 625818

Job performed: Field sampling crew

Respirator qualified? Yes X No ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes X No X

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No X

Confined space entry training? Yes ___ No X

Radiation Worker I? Yes ___ No X

Radiation Worker II? Yes ___ No X

Asbestos worker? Yes ___ No X

Other training: (Note: Must be escorted by personnel with Radiation Worker II to provide field support; cannot sample or do hands-on work at site until Radiation Worker II trained)

Name: Merrill W. Craig Badge no.: 623845

Job performed: Field sampling crew

Respirator qualified? Yes X No ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes X No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No X

Confined space entry training? Yes ___ No X

Radiation Worker I? Yes ___ No X

Radiation Worker II? Yes ___ No X

Asbestos worker? Yes ___ No X

Other training (Note: Must be escorted by personnel with Radiation Worker II to provide field support. Personnel cannot sample or do hands-on work at site until Radiation Worker II trained.)

Name: Greg Miller Badge no.: 657635

Job performed: Groundwater consultant

Respirator qualified? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 24-h training? Yes ___ No ___

HAZWOPER (SARA/OSHA) 8-h annual refresher? Yes _X_ No ___

HAZWOPER (SARA/OSHA) 8-h supervisor training? Yes ___ No _X_

Confined space entry training? Yes ___ No _X_

Radiation Worker I? Yes ___ No ___

Radiation Worker II? Yes _X_ No ___

Asbestos worker? Yes ___ No _X_

Other training: Solid low-level waste generator training and transuranic waste generator training; scheduled for access road training.

Appendix A

SITE MAP

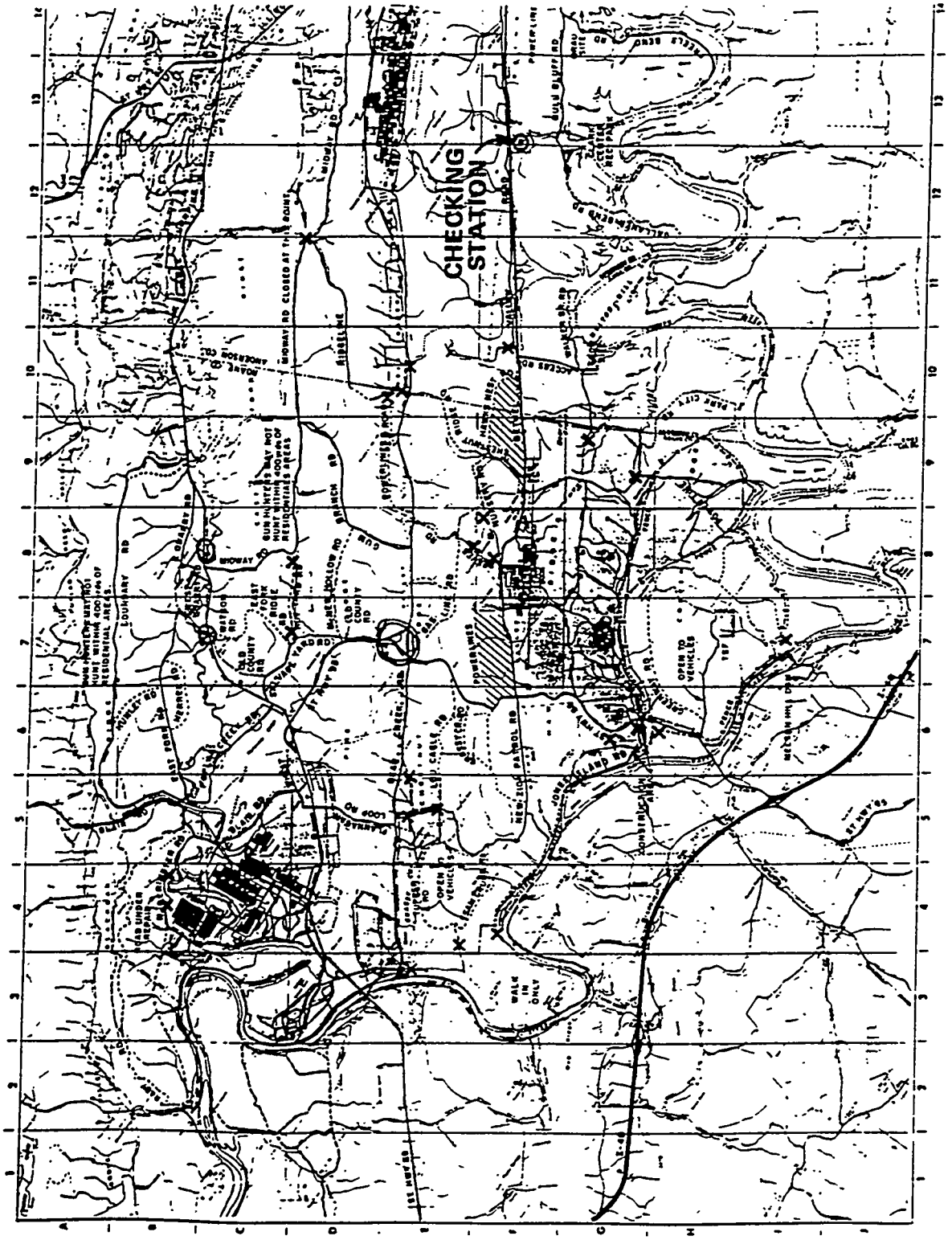

Fig. A.1. Site map for the Environmental Assessment Task, Kingfisher Study.

Appendix B

SUSPECTED CONTAMINANTS AND THEIR CHARACTERISTICS

Table B.1. Suspected WAG 2 contaminants and their characteristics

Contaminant	TLV, PEL, REL, DAC	STEL, IDLH	Health effects, target organs	Physical and chemical properties
2-Pentanone[a] Color: colorless to white	TLV: 150 ppm PEL: 200 ppm REL: NA	STEL: 250 ppm IDLH: 5000 ppm	Irritant to eyes and mucus membrane; headache, dermatitis, narcolepsy, coma	Liquid with characteristic acetone-like odor
Antimony[a] Color: dark gray	TLV: 0.5 mg/m^3 PEL: 0.5 mg/m^3 REL: 0.5 mg/m^3	STEL: NE IDLH: 80 mg/m^3	Irritant to nose, throat, and mouth; causes nausea, dizziness, and cramps	Lustrous powder, insoluble; MP: 1166; LEL: N/A
Arochlor 1254[a] Color: colorless to yellow	TLV: 0.5 mg/m^3 PEL: 0.5 mg/m^3 REL: 1.0 mg/m^3	STEL: NE IDLH: 5.0 mg/m^3	Inhalation, ingestion, skin absorption, eye irritant, liver	Liquid or solid, odorless, insoluble; FIP: N/A
Arsenic[a] Color: Know carcinogen	TLV: 0.2 mg/m^3 PEL: 0.01 mg/m^3 REL: 0.002 mg/m^3	STEL: NE IDLH: 100 mg/m^3	Liver, kidneys, skin lymphatic system, respiratory system, GI tract, irritant	
Beryllium Color: gray-white Suspected carcinogen	TLV: 0.002 mg/m^3 PEL: 0.002 mg/m^3 REL: 0.0005 mg/m^3	STEL: NE IDLH: 10 mg/m^3	Lungs, skin, eyes, respiratory system, mucus membranes; pulmonary fibrosis and heart disease, metal fume fever	Hard brittle metal
^{134}Cs Color:	DAC: 4E-8 $\mu Ci/mL$	STEL: NE IDLH: NE	Respiratory system, total body, GI	Variable
Chloroform[a] Color: colorless Known carcinogen	TLV: 10 ppm PEL: REL:	STEL: IDLH:	Liver, kidneys, heart, eyes, skin; anesthesia, dizziness, mental dullness, nausea, headache, fatigue, irritant	Liquid with pleasant sweet odor; solubility: 0.8%; not combustible
Chromium[a] Color:	TLV: 0.5 mg/m^3 REL:	STEL: IDLH:	Skin, respiratory system irritant; ulceration of nasal septum	Variable, depending on specific compound
Cobalt[a] Color: black Suspected carcinogen	TLV: 0.05 mg/m^3 PEL: 0.05 mg/m^3 REL: 0.05 mg/m^3	STEL: NE IDLH: 20 mg/m^3	Skin, respiratory system, eye irritant; kidney disorders, GI tract disturbances, dermatitis	Odorless solid, strong oxidizer; LEL: N/A
^{60}Co Color: black	DAC:	STEL: NE IDLH: NE	Skin, respiratory system, eye irritant; kidney disorders, GI tract disturbances, dermatitis	Odorless solid, strong oxidizer; LEL: N/A

Table B.1 (continued)

Contaminant	TLV, PEL, REL, DAC	STEL, IDLH	Health effects, target organs	Physical and chemical properties
^{154}Eu Color:	DAC: 8E-9 μCi/mL	STEL: NE IDLH: NE	GI, lower large intestines, lungs	Half-life: 16 years; beta and gamma emitter
^{155}Eu Color:	DAC: 4E-8 μCi/mL	STEL: NE IDLH: NE	GI, lower large intestines, kidneys, bone	Beta emitter
Hexane[a] Color: colorless	TLV: 1 ppm PEL: 5 ppm REL: N/A	STEL: NE IDLH: NE	Body tissue	Liquid with acetone-like odor
^{3}H Color:	DAC: 2E-5 μCi/mL	STEL: NE IDLH: NE	Body tissue	Colorless, odorless, tasteless gas; soluble in water; burns as a pale blue flame in the presence of oxygen; critical pressure: 12.4 atm; half-life: 12.2 years; beta emitter
Methylene chloride[a] Color: colorless Known carcinogen	TLV: 50 ppm PEL: 500 ppm REL: NE	STEL: NE IDLH: 3000 ppm	Eyes, skin, liver, CVS, CNS irritant, numbness, tingling, vertigo, angina	Liquid with chloroform-like odor; LEL: 12%; solubility: 2%
Selenium[a] Color: dark red to blue-black	TLV: 0.2 mg/m^3 PEL: 0.2 mg/m^3 REL: 0.2 mg/m^3	STEL: NE IDLH: NE	Kidneys, respiratory system, eyes, liver, blood, skin, mucous membrane irritant; cold-like symptoms	Amorphous solid; insoluble
^{90}Sr Color:	TLV: PEL: REL:	STEL: NE IDLH: NE	Skeletal system, respiratory system	Variable
Thallium[a] Color:	TLV: 0.1 mg/m^3 PEL: 0.1 mg/m^3 REL: 0.1 mg/m^3	STEL: NE IDLH: 20 mg/m^3	Eyes, skin, CNS, lungs, liver, kidneys, GI tract, body hair	Appearance, odor, and properties vary depending on the specific organic compound

Table B.1 (continued)

Contaminant	TLV, PEL, REL, DAC	STEL, IDLH	Health effects, target organs	Physical and chemical properties
^{234}U Color: silvery-white	TLV: NE PEL: NE DAC: NE	STEL: NE IDLH: NE	Radioactive; poisonous if ingested or inhaled	Malleable metallic element; half-life: 2.5 E5 years; alpha and gamma emitter
^{238}U Color: silvery-white	TLV: 0.5 mg/m^3 PEL: 0.05 mg/m^3 REL: 0.05 mg/m^3	STEL: 0.6 mg/m^3 IDLH: 30 mg/m^3	Highly toxic, radioactive, skin, bone marrow, lymphatic system, respiratory system	Metallic element; insoluble; half-life: 4.5 E9 years; alpha and gamma emitter

[a]These chemicals are not expected to present a health and safety hazard on the site because either (1) the environmental media/potential exposure pathways are not expected to allow volatilization or (2) their concentrations are low.

Abbreviations: CNS = central nervous system; CVS = cardiovascular system; DAC = derived air concentration; GI = gastrointestinal; IDLH = immediately dangerous to life and health; LEL = lower explosive limit; MP = melting point; NE = not established; PEL = permissible exposure limit; REL = recommended exposure limit; STEL = short-term exposure limit; TLV = threshold limit value

Table B.2. Characteristics of possible contaminants in Bear Creek Valley

Contaminant	TLV, PEL, REL, DAC (mg/m^3)	STEL, IDLH (mg/m^3)	Health effects, target organs	Physical and chemical properties
Arochlor 1221[a] Color: none	TLV: NE PEL: NE REL: 0.001 DAC:	STEL: NE IDLH: NE	Liver, CNS, respiratory tract, and mucous membrane irritation	Mobile liquid; solubility in water: 0.59 ppm
Arochlor 1254[a] Color: yellow or none	TLV: 0.5 PEL: 0.5 REL: 1 DAC:	STEL: NE IDLH: 5	Inhalation, ingestion, skin absorption, eye irritant, liver	Liquid or solid, odorless, insoluble; FIP:?
Arochlor 1260[a] Color: yellow or none	TLV: 0.5 PEL: 0.5 REL: 1 DAC:	STEL: NE IDLH: 5	Inhalation, ingestion, skin absorption, eye irritant, liver	Liquid or solid, odorless, insoluble; FIP:?
Cadmium[a] Color: silver-white Known carcinogen	TLV: 0.05 PEL: 0.2 REL: DAC:	STEL: NE IDLH: 50	Affects respiratory system, kidneys, prostate, and blood; causes cough, headache, chills, muscle aches, nausea, vomiting, and anemia	Lustrous, odorless metal; noncombustible solid in bulk form; combustible in powder form; emits toxic gases when heated
Copper[a] Color:	TLV: 1 PEL: 1 REL: 1 DAC:	STEL: NE IDLH: NE	Respiratory system, skin, mucous membrane, liver, GI, eyes, and blood: irritant, anemia	Odorless solid; LEL: N/A
Lead[a] Color: soft gray	TLV: 0.15 PEL: 0.05 REL: 0.1 DAC:	STEL: NE IDLH: 700	Affects GI system, CNS, kidneys, blood, and gums; causes insomnia anemia, tremors, wrist and ankle paralysis, and abdominal pain; eye irritant	Heavy, ductile, noncombustible solid in bulk form
Lithium[a] Color: off-white	TLV: 0.025 PEL: 0.025 REL: 0.025 DAC:	STEL: NE IDLH: 55	Respiratory system, skin, eye irritant; blurred vision, mental confusion, burns to mucous membranes	Odorless, translucent solid that darkens when exposed to sunlight; solubility: reacts; LEL: N/A; BP: decomposes

Table B.2 (continued)

Contaminant	TLV, PEL, REL, DAC (mg/m^3)	STEL, IDLH (mg/m^3)	Health effects, target organs	Physical and chemical properties
Nickel[a] Color: white Known carcinogen	TLV: 1.0 PEL: 0.1 REL: 0.015 DAC:	STEL: NE IDLH: NE	Nasal cavities, lungs, irritant; skin, nose, and throat; metal fume fever, nickel itch, some evidence for carcinogenicity	Variable with compound; may be lustrous solid; insoluble
Silver[a] Color: white	TLV: 0.1 PEL: 0.01 REL: 0.01 DAC:	STEL: NE IDLH: NE	Nasal septum, skin, eyes	Metal; lustrous solid; insoluble; LEL: N/A; ionization potential: N/A
Uranium Color: white	TLV: 0.2 PEL: 0.5/0.2 REL: 0.2/0.5 DAC:	STEL: 0.6 IDLH: 30	Highly toxic, radioactive; skin, bone marrow, lymphatics	Heavy metallic element, insoluble
Zinc[a] Color: white	TLV: 10 PEL: 5 REL: 5 DAC:	STEL: 10 IDLH: NE	Respiratory system	Fine, odorless particulate; insoluble; LEL: N/A

[a]These chemicals are not expected to present a health and safety hazard on the site because either (1) the environmental media/potential exposure pathways are not expected to allow volatilization or (2) their concentrations are low.

Abbreviations: CNS = central nervous system; CVS = cardiovascular system; DAC = derived air concentration; GI = gastrointestinal; IDLH = immediately dangerous to life and health; LEL = lower explosive limit; MP = melting point; NE = not established; PEL = permissible exposure limit; REL = recommended exposure limit; STEL = short-term exposure limit; TLV = threshold limit value

Table B.3. Characteristics of possible contaminants at East Fork Poplar Creek

Contaminant	TLV, PEL, REL, DAC (mg/m^3)	STEL, IDLH (mg/m^3)	Health effects, target organs	Physical and chemical properties
Cadmium[a] Color: silver-white Known carcinogen	TLV: 0.05 PEL: 0.2 REL: DAC:	STEL: NE IDLH: 50	Affects respiratory system, kidneys, prostate, and blood; causes cough, headache, chills, musle aches, nausea, vomiting, and anemia	Lusterous, odorless metal; noncombustible soid in bulk form; combustible in powder form; emits toxic gases when heated
Lead[a] Color: soft gray	TLV: 0.15 PEL: 0.05 REL: 0.1 DAC:	STEL: NE IDLH: 700	Affects GI system, CNS, kidneys, blood, and gums; causes insomnia anemia, tremors, wrist and ankle paralysis, and abdominal pain; eye irritant	Heavy, ductile, noncombustible solid in bulk form
Mercury Color: silver-white	TLV: 0.05 PEL: 0.05 REL: 0.05 DAC:	STEL: NE IDLH: 28	Afects skin, respiratory system, CNS, and eyes; causes cough, chest pain, dyspnea, tremors, insomina, headache, fatigue, and GI distrubances; eye and skin irritant	Heavy, oderless liquid; noncumbustible; insoluble
Arochlor 1254[a] Color: yellow or none	TLV: 0.5 PEL: 0.5 REL: 1 DAC:	STEL: NE IDLH: 5	Inhalation, ingestion, skin absorption, eye irritant, liver	Liquid or solid, odorless, insoluble; FIP:?
Arochlor 1260[a] Color: yellow or none	TLV: 0.5 PEL: 0.5 REL: 1 DAC:	STEL: NE IDLH: 5	Inhalation, ingestion, skin absorption, eye irritant, liver	Liquid or solid, odorless, insoluble; FIP:?
Methylene chloride[a] Color: none Known carinogen	TLV: 50 ppm PEL: 500 ppm REL: NE DAC:	STEL: NE IDLH: 3000 ppm	Eye, skin, liver, CVS, CNS irritant; numbness, tingling, vertigo, angina	Liquid with chloroform-like odor; LEL: 12%; solubility: 2%
Uranium Color: white	TLV: 0.2 PEL: 0.5/0.2 REL: 0.2/0.5 DAC:	STEL: 0.6 IDLH: 30	Highly toxic, radioactive; skin, bone marrow, lymphatics	Heavy metallic element, insoluble

Table B.3 (continued)

Contaminant	TLV, PEL, REL, DAC (mg/m^3)	STEL, IDLH (mg/m^3)	Health effects, target organs	Physical and chemical properties
Antimony[a] Color: dark gray	TLV: 0.5 PEL: 0.5 REL: 0.5 DAC:	STEL: NE IDLH: 80	Nose, throat, and mouth; nausea, dizziness, and cramps	Lustrous powder, insoluble; MP: 1166; LEL: N/A
Arsenic[a] Color: Known carcinogen	TLV: 0.2 PEL: 0.01 REL: 0.002 DAC:	STEL: NE IDLH: 100	Liver, kidney, skin, lymphatic system, respiratory system, and GI tract irritant	?????
Beryllium[a] Color: gray-white Suspected carcinogen	TLV: 0.002 PEL: 0.01 REL: 0.002 DAC:	STEL: NE IDLH: 10	Lungs, skin, eye, respiratory system, mucous membranes; pulmonary fibrosis, heart disease, metal fume fever	Hard brittle metal
Phenol[a] Color: colorless to pink	TLV: 5 ppm PEL: 5 ppm REL: 5 ppm DAC:	STEL: NE IDLH: 250 ppm	Liver, kidneys, skin	Crystaline solid, sweet acrid odor; solubility: 9%; LEL: 1.8%
Arochlor 1221[a] Color: none	TLV: NE PEL: NE REL: 0.001 DAC:	STEL: NE IDLH: NE	Liver, CNS, respiratory tract, and mucous membrane irritation	Mobile liquid; solubility in water: 0.59 ppm

Table B.3 (continued)

Contaminant	TLV, PEL, REL, DAC (mg/m^3)	STEL, IDLH (mg/m^3)	Health effects, target organs	Physical and chemical properties
Thallium[a] Color:	TLV: 0.1 PEL: 0.1 REL: 0.1 DAC:	STEL: NE IDLH: 20	Eyes, skin, CNS, lungs, liver, kidneys, GI tract, body hair	Appearance, odor, and properties vary depending on the specific organic compound
Chromium[a] Color:	TLV: 0.5 PEL: REL: DAC:	STEL: IDLH:	Skin, respiratory system irritant; ulceration of nasal septum	Variable, depending on specific compound

[a]These chemicals are not expected to present a health and safety hazard on the site because either (1) the environmental media/potential exposure pathways are not expected to allow volatilization or (2) their concentrations are low.

Abbreviations: CNS = central nervous system; CVS = cardiovascular system; DAC = derived air concentration; GI = gastrointestinal; IDLH = immediately dangerous to life and health; LEL = lower explosive limit; MP = melting point; NE = not established; PEL = permissible exposure limit; REL = recommended exposure limit; STEL = short-term exposure limit; TLV = threshold limit value

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