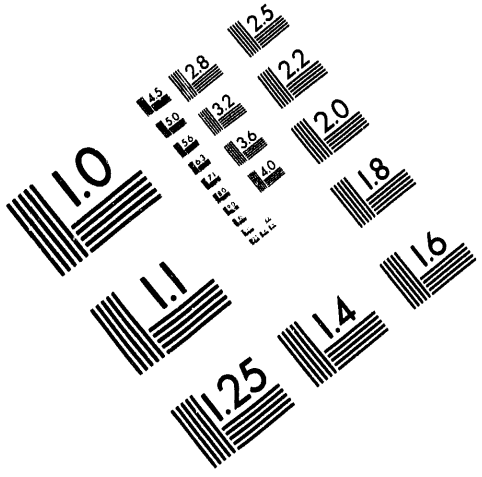

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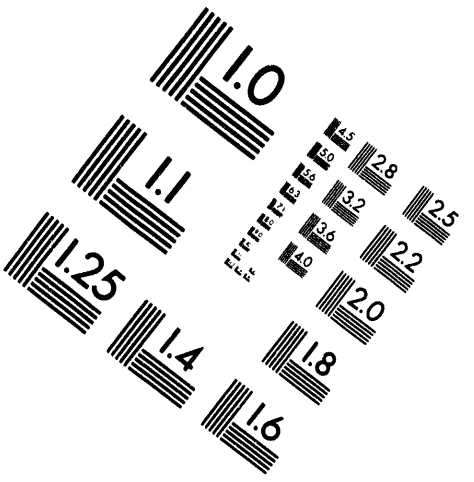

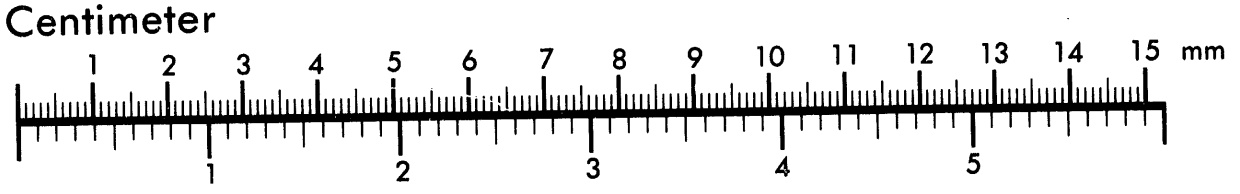

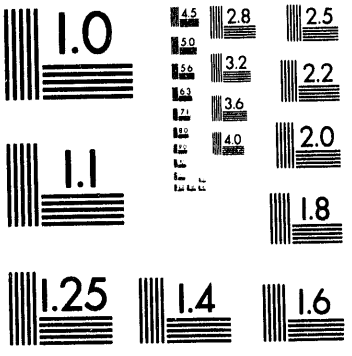

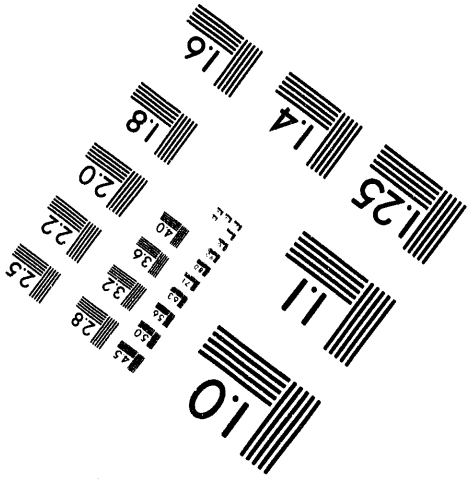

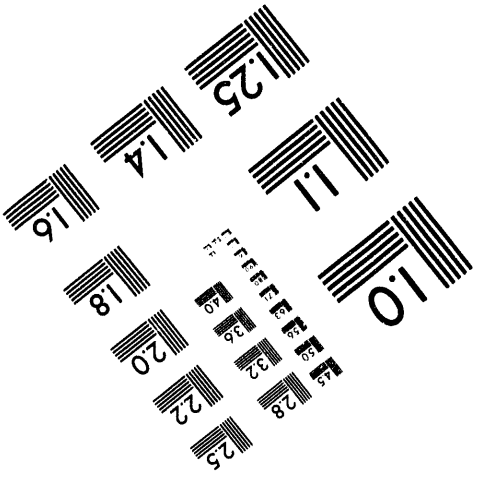

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ORNL Environmental Restoration Program

WAG 2 Remedial Investigation and Site Investigation Site-Specific Work Plan/Health and Safety Checklist for the Soil and Sediment Task

V. L. Holt
B. B. Burgoa

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WAG 2 REMEDIAL INVESTIGATION AND SITE INVESTIGATION WORK PLAN/HEALTH AND SAFETY CHECKLIST FOR THE SOIL AND SEDIMENT TASK

APPROVALS

WAG 2 RI&SI Project Safety and Health Officer	Virginia L. Holt	11/15/93 Date
WAG 2 RI&SI Project Manager	Stephen G. Hecker	11/18/93 Date
ORNL Industrial Safety Representative	E A Fox	11/15/93 Date
ORNL Industrial Hygiene Representative	L. S. Bach	11/15/93 Date
ORNL Fire Protection Representative	R L Ashley	11/15/93 Date
ORNL Office of Laboratory Protection Representative	J S Pleasant	11/16/93 Date
ORNL Office of Radiation Protection Representative	W C Hayes	11/15/93 Date
ORNL HAZWOPER Program Coordinator	Ann W Sandsbury	11/26/93 Date
ORNL ER ES&H Manager	Charles Clark	11/10/93 Date
ORNL ER Program Manager, DOE Environmental Restoration Division	John Sheeran	12/6/93 Date

CONTENTS

PREFACE

This document is a site-specific work plan/health and safety checklist (WP/HSC) for a task of the Waste Area Grouping 2 Remedial Investigation and Site Investigation (WAG 2 RI&SI). Title 29 CFR Part 1910.120 requires that a health and safety program plan that includes site- and task-specific information be completed to ensure conformance with health- and safety-related requirements. To meet this requirement, the health and safety program plan for each WAG 2 RI&SI field task must include (1) the general health and safety program plan for all WAG 2 RI&SI field activities and (2) a WP/HSC for that particular field task. These two components, along with all applicable referenced procedures, must be kept together at the work site and distributed to field personnel as required. The general health and safety program plan is the *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). The WP/HSCs are being issued as supplements to ORNL/ER-169.

The recipients of ORNL/ER-169 are responsible for retaining their copies of it and for binding the suppliments (WP/HSCs) applicable to them with their copies of ORNL/ER-169.

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
CNS	central nervous system
CRZ	contamination reduction zone
CVS	cardiovascular system
DAC	derived air concentration
ER	Environmental Restoration
ESD	Environmental Sciences Division
EPA	Environmental Protection Agency
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HP	Health Physics
HPC	HAZWOPER Program Coordinator
GI	gastrointestinal
IDLH	immediately dangerous to life and health
IH	Industrial Hygiene
LEL	lower explosive limit
MB	Melton Branch
MP	melting point
MSDS	Material Safety Data Sheet
NA	not applicable
NE	not established
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PFD	personal floatation device
REL	recommended exposure limit
SARA	Superfund Amendments and Reauthorization Act
SSHO	Site Safety and Health Officer
STEL	short-term exposure limit
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TWRA	Tennessee Wildlife Resources Agency
WAG	Waste Area Grouping
WAG 2 RI&SI	WAG 2 Remedial Investigation/Feasibility Study and Site Investigation
WBGT	wet-bulb globe temperature
WOC	White Oak Creek
WOCE	White Oak Creek Embayment
WOL	White Oak Lake
WP/HSC	Work Plan/Health and Safety Checklist

1. INTRODUCTION

This site-specific Work Plan/Health and Safety Checklist (WP/HSC) is a supplement to the general health and safety plan (HASP) for Waste Area Grouping (WAG) 2 remedial investigation and site investigation (WAG 2 RI&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 Soil and Sediment task. 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), and/or Industrial Safety (IS)] 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 prior to beginning operations and well be kept on available at the work site during all task activities.

2. PRE-ENTRY HEALTH AND SAFETY BRIEFING

The purpose of the pre-entry health and safety briefing is to inform all workers of (1) potential safety and health hazards they may encounter while working on the Soil and Sediment Task 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). All training records will have been confirmed by the Technical Resources and Training Section. 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 the WAG 2 HASP and the Soil and Sediment Task WP/HSC.

3. PROJECT AND SITE DESCRIPTION

3.1 PROJECT OBJECTIVES

The main objective of the Soil and Sediment task is to determine the natural (physical or chemical) processes that control sediment and contaminant transport within the White Oak Creek (WOC) watershed. The objectives are (1) to quantify and to determine the distribution of contaminants in stream sediments, lake sediments, and the floodplain; (2) to determine sediment sources, erosion rates, and deposition rate; and (3) to determine the relationship between sediment particle size and contaminant concentration.

3.2 TASK TO BE PERFORMED

The tasks to be performed under the Soil and Sediment Task are: (1) a contaminant inventory in the WOC floodplain soils; (2) a contaminant inventory in streams, weirs, and White Oak Lake (WOL) and the WOC Embayment (WOCE); (3) erodibility and erosion rates studies of hillslope, stream beds and banks, WOL, and WOCE; (4) monitoring and tracking of contaminant sources area; and (5) ongoing surveying of WAG 2 to document and evaluate sampling locations.

3.3 HISTORY AND OPERATION OF THE SITE

WAG 2 consists of WOC and its tributaries downstream of ORNL, WOL, and WOCE, 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 the operational and waste disposal activities at ORNL. Water, sediment, soil, and biota in WAG 2 are contaminated and continue to receive contaminants from upgradient WAGs.

3.4 SITE DESCRIPTION

Location:

WOC watershed; WOC and Melton Branch (MB) tributaries, and floodplains. See Appendix A for site maps.

Topography:

Floodplains and waterways.

4. PROJECT ORGANIZATION

This work will be performed by the WAG 2 RI&SI Program team. ORNL IH, IS, and Radiation Protection will provide oversight for this project.

Key personnel and their project roles and responsibilities are listed below.

	Name/Organization	Phone No.
WAG 2 RI&SI Project Manager	Steve Herbes ESD	4-7336
Construction Engineer	N/A	
Field Team Leader	Benali Burgoa ESD	4-6512
Alternate Field Team Leader	Al Hardesty ESD	6-2373
Site Safety and Health Officer	Virginia Holt ESD	6-2373
Alternate Site Safety and Health Officer	Benali Burgoa	4-6512
ESD Health Physics Contact	George Houser ESD	6-1408
ORNL Radiation Protection	Willie Hayes	4-6542
ORNL Industrial Hygiene	Ray Barham	4-7307
ORNL HAZWOPER Coordinator	Ann Saulsbury	6-5064
ORNL Safety	Ernie Ford	1-4373
ORNL Fire Department	Bob Atchley	4-6278
Field Project Personnel	Chris Knight ESD	4-6512
	Amanda Carr ESD	1-3899
	Steve Short ESD	1-3899
	Alan Roberts ESD	4-6512

5. SITE TASK HAZARD EVALUATION

5.1 DESCRIPTION OF TASK TO BE PERFORMED

This section will be completed by the Project Manager, based on knowledge, site history, and site operations, any and all potential hazards that might impact a worker's health and safety, and will describe the tasks to be preformed 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 Descriptions

5.1.1.1 Contaminant inventory in WOC floodplain

Intrusive __X__ Nonintrusive _____

Description: Soil cores will be collected manually following ER/WAG 2-SOP-3106, "Collection of Undisturbed Soil Samples." Site locations will be selected prior to sampling. See Appendix B for Floodplain Soils Sampling Areas. Soil samples will be collected with a 60-cm long soil recovery probe with a plastic or stainless-steel liner. The probe will be driven and pulled out by hand. Liner tubes with soil will be capped at both ends until sectioning. As shown in Appendix B, at least 300 samples will be taken. Soil cores will be sectioned and processed following ER/WAG 2-SOP-3109, "Sectioning, processing, and splitting undisturbed soil cores." The soil core will be extruded from the liner using a wood rod and sectioned into predetermined lengths. Soil subsamples will be transferred to nalgene bottles for future analyses. Equipment will be decontaminated using ER/WAG 2-SOP-3110, "Field Cleaning of Soil and Sediment Sampling Equipment" after each sample is taken and before the equipment is removed from the Contamination Reduction Zone. Note: A penetration permit is not required for manual sampling.

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	(X) Explosive/Flammable	( ) Vibration
( ) Asbestos	( ) Underground	( ) Overhead
( ) Water	( ) Other: _____	( ) Other:

Construction Hazards

( ) Trenching	( ) Excavating	( ) Heavy Equipment
( ) Demolition	( ) High Work	( ) Welding/Cutting
( ) Ladders	( ) Drilling	( ) Overhead
( ) Overhead	( ) Other: _____	( ) Other: _____

Chemical Hazards

(X) Organic Chemical	( ) Inorganic Chemical	( ) Carcinogen
(X) Corrosive	( ) Reactive	( ) OSHA-Specific Substances
( ) Mutagen	( ) Teratogen	( ) Other: _____

Ionizing Radiation Hazards

( ) Internal Exposure	(✓) External Exposure

Nonionizing Radiation Hazards

(✓) UV	( ) Radio Frequency	( ) Microwave
( ) Laser		

Biological/Vector Hazards

(✓) Wildlife	(✓) Plants	( ) Medical Waste
( ) Bacterial	(✓) Parasites	( ) Other: _____

Initial Level of Personal Protective Equipment

Level of Protection:	( ) A	( ) C	(X) Modified (+)
	( ) B	(X) D	
Respirator:	( ) SCBA	( ) Full Face	( ) ½-Face Resp.
	Cartridge: _____		
Protective Clothing:	( ) Encapsulating Suit	( ) Tyvek	
	( ) Saranex	( ) Splash Suit	
	(X) C-zone	(X) Company Clothing (khakis)	
	( ) Other: _____		
Head/eye/ear:	( ) Hard Hat	(X) Safety Glasses	( ) Goggles
	(X) Splash Shield	( ) Ear Plugs	( ) Other: _____

Gloves:	( ) Nitrile	( ) Neoprene	( ) PVC
	( ) Latex	( ) Vinyl	( ) Leather
	(X) Rubber		
Footwear:	(X) Steel-Toed Leather	( ) Chemical Over-Boots	
	( ) Steel-Toed Rubber	(X) Rubber Over-Boots	

Additional Comments:

A splash shield is necessary only during decontamination. Personnel responsible for recording data and chain-of-custody procedures who are not involved in collecting samples shall not be required to wear protective contamination zone clothing.

5.1.1.2 Coring in streams, weirs, lake, and the embayment

Intrusive ___X___ Nonintrusive _____

Description: Sediment cores will be collected manually in streams, weirs, WOL, and WOCE. Undisturbed soil samples will be collected following ER/WAG 2-SOP-3102, "Collection of undisturbed aquatic sediment samples." Sediment samples will be collected with a sampling tube (PVC or stainless steel). The tube will be driven and pulled out by hand (or manual winch). The tube will be capped at both ends until sectioning. Site locations will be selected within the WOC waterways; see Sediment Sampling Locations in WAG 2. Nine weirs will be selected for coring. More than 100 cores will be collected in the WOC and tributaries, WOL, and WOCE. Sediment cores will be sectioned and processed following ER/WAG 2-SOP-3107, "Sectioning, compositing, and splitting undisturbed aquatic sediment cores." Sediment cores will be extruded from the tube using a wood rod and sectioned into predetermined lengths. Sediment subsamples will be transferred to nalgene bottles for future analyses. Equipment will be decontaminated using ER/WAG 2-SOP-3110, "Field Cleaning of Soil and Sediment Sampling Equipment" before being removed from the Contamination Reduction Zone. Note: a penetration permit is not required for manual sampling.

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	(X) Explosive/Flammable	( ) Vibration
( ) Asbestos	( ) Underground	( ) Overhead
(✓) Water	(X) Boating Hazard	(X) Hand operated winch

Construction Hazards

( ) Trenching	( ) Excavating	( ) Heavy Equipment
( ) Demolition	( ) High Work	( ) Welding/Cutting
( ) Ladders	( ) Drilling	( ) Overhead
( ) Overhead	( ) Other: _____	( ) Other: _____

Chemical Hazards

(X) Organic Chemical	( ) Inorganic Chemical	( ) Carcinogen
(X) Corrosive	( ) Reactive	( ) OSHA-Specific Substances
( ) Mutagen	( ) Teratogen	( ) Other: _____

Ionizing Radiation Hazards

( ) Internal Exposure

(✓) External Exposure

Nonionizing Radiation Hazards

(✓) UV	( ) Radio Frequency	( ) Microwave
( ) Laser		

Biological/Vector Hazards

(✓) Wildlife	(✓) Plants	( ) Medical Waste
( ) Bacterial	(✓) Parasites	( ) Other: _____

Initial Level of Personal Protective Equipment

Level of Protection:

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

Respirator:

( ) SCBA	( ) Full Face	( ) ½-Face Resp.

Cartridge: _____

Protective Clothing:

( ) Encapsulating Suit	( ) Tyvek
( ) Saranex	( ) Splash Suit
(X) C-zone	(X) Company Clothing (khakis)
( ) Other: _____	

Head/eye/ear:

( ) Hard Hat	(X) Safety Glasses	( ) Goggles
(X) Splash Shield	( ) Ear Plugs	( ) Other: _____

Gloves:	( ) Nitrile	( ) Neoprene	( ) PVC
	( ) Latex	( ) Vinyl	( ) Leather
	(X) Rubber		
Footwear:	(X) Steel-Toed Leather	( ) Chemical Over-Boots	
	( ) Steel-Toed Rubber	(X) Rubber Over-Boots	

Additional Comments:

A splash shield is necessary only during decontamination. Personnel responsible for recording data and chain-of-custody procedures who do not come in direct contact with the sediments shall not be required to wear protective clothing. Personal flotation device (PFDs) are required for personnel working in boats.

5.1.1.3 Erodibility and erosion rate studies

Intrusive _____ Nonintrusive __X__

Description: Erosion, scour, and deposition rates of cohesive soil and noncohesive sediment will be measured following SOP ER/WAG 2-SOP-3209, "Surveying cross-section of waterways" in the WOC watershed (WOC, MB, WOL, and WOCE). Sediment deposition will be determined by surveying a preselected cross-section using surveying equipment (levels and theodolites). All sites will be surveyed during base flow and after any major storm event. Erodibility (shear stress/strength) of cohesive soil and noncohesive soil will be determined using commercial devices as such as a pocket penetrometer, torvane shear device, and hand vane tester (all manual equipment). The methodology described in Watts and Dexter (1993) will be applied.

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	(X) Boating 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

Nonionizing Radiation Hazards

(✓) UV	( ) Radio Frequency	( ) Microwave
( ) Laser		

Biological/Vector Hazards

(✓) Wildlife	(✓) Plants	( ) Medical Waste
( ) Bacterial	(✓) Parasites	( ) Other: _____

Initial Level of Personal Protective Equipment

Level of Protection:	( ) A	( ) C	( ) Modified (+)
	( ) B	(X) D	
Respirator:	( ) SCBA	( ) Full Face	( ) ½-Face Resp.
	Cartridge: _____		
Protective Clothing:	( ) Encapsulating Suit	( ) Tyvek	
	( ) Saranex	( ) Splash Suit	
	( ) C-zone	(X) Company Clothing (khakis)	
	( ) Other: _____		
Head/eye/ear:	( ) Hard Hat	( ) Safety Glasses	( ) Goggles
	( ) Splash Shield	( ) Ear Plugs	( ) Other: _____

Gloves:	( ) Nitrile	( ) Neoprene	( ) PVC
	( ) Latex	( ) Vinyl	( ) Leather
	(X) Rubber		
Footwear:	(X) Steel-Toed Leather	( ) Chemical Over-Boots	
	( ) Steel-Toed Rubber	(X) Rubber Over-Boots	

Additional Comments:

Personnel responsible for recording data and chain-of-custody procedures who do not come in direct contact with the sediments shall not be required to wear protective clothing. PFDs ***are*** required for ***all*** personnel working in boats. Waders will be donned when the water is deeper than 1 ft but less than 3 ft on gravel bottom. Surveying will only performed during base flow conditions (slow current).

5.1.1.4 Monitor and track contaminant source areas

Intrusive _____ Nonintrusive __X__

Description: A stream water survey will be conducted in WAG 2 to monitor contaminant transport. Sites will be located in the WOC tributaries. (See Sediment Sampling Program Table in Appendix B). Ion exchange material will be placed in slotted well casing, capped, and tied to the stream banks at 17 sites associated with key branch points in the drainage system for 4 weeks. After this period, the material will be collected and analyzed. The sampling procedure will be based on that described in Cerling and Spalding (1982).

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: _____	( ) 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

Nonionizing Radiation Hazards

(✓) UV	( ) Radio Frequency	( ) Microwave
( ) Laser		

Biological/Vector Hazards

(✓) Wildlife	(✓) Plants	( ) Medical Waste
( ) Bacterial	(✓) Parasites	( ) Other: _____

Initial Level of Personal Protective Equipment

Level of Protection:	( ) A	( ) C	( ) Modified (+)
	( ) B	(X) D	
Respirator:	( ) SCBA	( ) Full Face	( ) ½-Face Resp.
	Cartridge: _____		
Protective Clothing:	( ) Encapsulating Suit	( ) Tyvek	
	( ) Saranex	( ) Splash Suit	
	( ) C-zone	(X) Company Clothing (khakis)	
	( ) Other: _____		
Head/eye/ear:	( ) Hard Hat	( ) Safety Glasses	( ) Goggles
	( ) Splash Shield	( ) Ear Plugs	( ) Other: _____

Gloves:	( ) Nitrile	( ) Neoprene	( ) PVC
	( ) Latex	( ) Vinyl	( ) Leather
	(X) Rubber		
Footwear:	(X) Steel-Toed Leather	( ) Chemical Over-Boots	
	( ) Steel-Toed Rubber	(X) Rubber Over-Boots	

5.1.1.5 WAG 2 survey, and site location and evaluation for sampling

Intrusive _____ Nonintrusive __X__

Description: These tasks include site location, site flagging, and preparation prior to sampling. Postsampling activities include surveys. These activities will be performed on all sampling sites both in the floodplains and in the waterways.

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	(X) Other: Boating Hazards	( ) 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

Nonionizing Radiation Hazards

(✓) UV ( ) Radio Frequency ( ) Microwave
( ) Laser

Biological/Vector Hazards

(✓) Wildlife (✓) Plants ( ) Medical Waste
( ) Bacterial (✓) Parasites ( ) Other: _____

Initial Level of Personal Protective Equipment

Level of Protection: ( ) A ( ) C ( ) Modified (+)
( ) B (X) D

Respirator: ( ) SCBA ( ) Full Face ( ) ½-Face Resp.
Cartridge: _____

Protective Clothing: ( ) Encapsulating Suit ( ) Tyvek
( ) Saranex ( ) Splash Suit
( ) C-zone (X) Company Clothing (khakis)
( ) Other: _____

Head/eye/ear: ( ) Hard Hat ( ) Safety Glasses ( ) Goggles
( ) Splash Shield ( ) Ear Plugs ( ) Other: _____

Gloves: ( ) Nitrile ( ) Neoprene ( ) PVC
( ) Latex ( ) Vinyl ( ) Leather
(X) Rubber

Footwear: (X) Steel-Toed Leather ( ) Chemical Over-Boots
( ) Steel-Toed Rubber (X) Rubber Over-Boots

Additional Comments:

PFDs are required for personnel working in boats. Waders will be donned when the water is deeper than 1 ft but less than 3 ft deep on gravel bottom.

5.1.2 Site Control

Site work zones are required in order 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 Hazardous Waste Operations and Emergency Response (HAZWOPER) Program Coordinator (HPC) will provide signs for posting HAZWOPER requirements at the site. The HP technician will determine radiological postings. 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 Site Safety and Health Officer (SSHO) is responsible for ensuring 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. 5.1.1 of this site-specific Work Plan/Health and Safety Checklist (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 workers will have a partner to work with. To ensure worker safety, personnel will (1) maintain internal communication, (2) remain within a line of sight with 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 in the support zone to ensure communication with the Laboratory Shift Superintendent and emergency, safety, and health support personnel.

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

Site posted information/notification required? Yes _X_ No ___ NA ___

Site guard required? Yes ___ No _X_ NA ___

Access control required? Yes _X_ No ___ WAG 2 access is controlled through 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 C.

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

Training requirements for all tasks: 24-Hour HAZWOPER (SARA/OSHA), Radiation Worker II, in-house documentation of training for sampling personnel on SOP 3109 (Task 5.1.1.1), SOP 3110 (Tasks 5.1.1.1 and 5.1.1.2), SOP 3106 (Task 5.1.1.1), SOP 3102 (Task 5.1.1.2), SOP 3107 (Task 5.1.1.2), SOP 3209 (Task 5.1.1.3). Tasks 5.1.1.2, 5.1.1.3, and 5.1.1.5 require Tennessee Wildlife Resources Agency (TWRA) Boat Safety Training Certification. Support personnel in the field will not require SOP training.

5.1.4 Sanitation

Task(s): All tasks

Potable water required? Yes ____ No _X_

Nonpotable water used? Yes _X_ No ____

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

Location: Breaks: Environmental Sciences Division (ESD) Bldgs. 1505 and 1506.

Toilet facilities required? Yes _X_ No ____

Location and number: ESD Bldgs. 1505 and 1506, five toilet facilities.

Washing facilities required? Yes _X_ No ____

Location: ESD Bldgs. 1505 and 1504, two facilities.

Change rooms/showers required? Yes _X_ No ____

Specify: ESD Bldgs. 1505 and 1504, two facilities. It is recommended that all personnel shower at the change rooms at the end of each day, prior to departing for home.

5.1.5 Safety Equipment

Radio and first aid kit 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:

Task(s): 5.1.1.1 and 5.1.1.2

Are flammable liquids present? Yes _X_ No ____

Description: Methanol for decontamination of equipment.

Location: Sampling site.

Quantity: 2.5 L

Containment/storage method: Plastic vessel will be used for secondary containment.

Compressed gas cylinders? Yes ____ No X

Location: _____

Storage: _____

Additional comments and controls: Methanol shall be used in a well-ventilated area free from sparks or ignition sources. Within the scope of these tasks, methanol will be used outdoors only. See initial level of PPE for task 5.1.1.1 and task 5.1.1.2 for appropriated PPE for splash protection.

Confined Space Entry: N/A

Asbestos: N/A

Electrical Hazards: N/A

Temperature: Yes

Task(s): All

Temperature extremes, hot and cold? Yes X No ____

Average daily high temperature (during work shift) (°F) 70-90

Average daily low temperature (during work shift) (°F) 35-55

Wet-bulb globe temperature (WBGT) will be obtained prior to daily activities as necessary. When WBGT is >80° F (26.7° C), ACGIH work-rest regimen guidelines should be followed.

Work load:

Light _____

Moderate X

Heavy _____

Controls: SSHO will establish appropriate work/rest regiment in accordance with the ACGIH TLV booklet. 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: Yes

Task(s): 5.1.1.2, 5.1.1.3, and 5.1.1.5

Are water hazards present or involved in site tasks? Yes X No ____

Additional comments and controls: TWRA certification required for personnel working from boats. PFDs required for working in water deeper than 1 ft deep.

Other Physical Hazards:

Task(s): All tasks

Hazard: Slips, trips, and falls

Additional comments and controls: Buddy system, visual observation, alertness, and avoidance of uneven or slippery surfaces to the degree possible.

Task(s): 5.1.1.1 and 5.1.1.2

Hazard: Heavy lifting

Additional comments and controls: Personnel will use proper form and sure footing when lifting and will seek help when attempting to lift over 50 lbs.

5.2.2 Construction Hazards

There are no construction hazards related to these tasks.

5.2.3 Chemical Hazards

Chemicals to be brought on site:

Methanol	
10% hydrochloric acid	
10% nitric acid	
Laboratory detergent	

Are MSDSs assembled for chemicals to be brought on site? Yes _X_ No ___ NA ___

Other chemical hazards known or suspected to exist on site: See WAG 2 Contaminant List, Appendix D.

5.2.4 Ionizing Radiation Hazards

Isotope: See WAG 2 Contaminant List in Appendix C.

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

Radiation work permit required: Yes ___ No _X_

Health Physics contacted: Yes _X_ No ___

Health Physics coverage: Task 5.1.1.1 and 5.1.1.2 Yes _X_ No ___

Protective clothing required: Yes _X_ No ___

Additional comments and controls: See PPE section for each task. Pocket dosimeters required when working in Radiation Area. HP will assist SSHO in establishing appropriate oversight of zones for proper donning/doffing and decontamination procedures.

5.2.5 Nonionizing Radiation Hazards

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

Additional comments and controls: Personnel should wear long-sleeved clothing or apply sunblock to exposed skin.

5.2.6 Biological/Vector Hazards

Task(s): All

Hazard: Ticks and chiggers

Comments and controls: Apply insect repellant and visual inspection after site work.

Task(s): All

Hazard: Snakes

Comments and controls: Make noise and do not reach under objects.

Task(s): All

Hazard: Poison Ivy and Poison Oak

Comments and controls: Long-sleeved clothing and gloves will be worn, and field workers will wash exposed skin immediately after site work.

6. MONITORING REQUIREMENTS

This section should be completed with consultation from the IH representative or the HPC and the HP representative.

6.1 DIRECT READING INSTRUMENTS

	Task(s)	Monitoring Frequency	Action Level
LEL meter			
O_2 meter			
Colorimetric indicator tubes			
Photoionization detector (PID)	5.1.1.1	periodically	5 ppm/60 s in breathing zone
Flame ionization detector (FID)			
Alpha meter			
Beta/gamma meter	All tasks	Each sample and prior to exiting CRZ	
Area radiation monitors			
Noise meter			
Other (specify)			

6.2 PERSONAL MONITORING

	Task(s)	Monitoring Frequency	Action Level
Whole-body dosimetry (TLDs)	All tasks	continuously	20 mrem/d
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			

If action guideline is exceeded, stop work and contact the appropriate department (IH or HP) to assess the situation and determine what actions must be taken to resume work safely. Instruments used by the IH representative will be calibrated and maintained in accordance with IH Standard Operating Procedures. Instruments used by the Office of Radiation Protection are calibrated and source-checked in accordance with established HP procedures.

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 of PPE. Monitoring (frisking) of personnel and equipment prior to exiting contaminated areas will be conducted by the SSHO.

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. Downgrades of PPE may be recorded by the SSHO in the project logbook. All upgrades of PPE will require approval from HPC, IH, HP, IS, and a revision of the WP/HSC.

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 the criteria as specified in 1910.120 will be included in the ORNL hazardous waste worker medical surveillance program. All Energy Systems subcontractors 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.

Has the ORNL HPC been contacted? Yes __X__ No ____

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 his or her health or safety. Because of their potential to be exposed 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: No

Biological samples required? Yes __X__ No ____

Biological samples taken: Bioassay semiannually

Additional comments and controls: _____

Nuclide in question: ^{90}Sr

Personnel monitoring device: 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

See Sect. 5.1.3 for task-specific training requirements.

Name: Benali Burgoa Badge no.:624088

Job preformed: Task Leader

Respirator qualified? Yes ___ No X Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___ Expiration date 8/14/94

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

HAZWOPER (SARA/OSHA)
8-h annual refresher? Yes X No ___ Expiration date 8/18/94

HAZWOPER (SARA/OSHA)
8-h annual supervisor training? Yes X No ___ Expiration date 8/18/94

Confined space entry training? Yes X No ___ Expiration date 7/19/95

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes X No ___ Expiration date 8/13/94

Asbestos worker? Yes ___ No X Expiration date ___

Other training: TWRA Boat Safety Certification, Waste Generator Training, X-ray Machine Safety Training, U.S. EPA Hazardous Waste Site Sampling

Name: Al Hardesty Badge no.: 625081

Job preformed: Field Sampling Coordinator

Respirator qualified? Yes ___ No X Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___ Expiration date 2/25/94

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

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

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

Confined space entry training? Yes ___ No X Expiration date ___

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes X No ___ Expiration date 3/24/95

Asbestos worker? Yes ___ No ___ Expiration date ___

Other training: TWRA Boat Safety Training certification

Name: Chris Knight Badge no.: 624904

Job preformed: Field sampling crew

Respirator qualified? Yes ___ No X Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___ Expiration date 1/15/94

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

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

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

Confined space entry training? Yes ___ No X Expiration date ___

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes X No ___ Expiration date 1/29/94

Asbestos worker? Yes ___ No X Expiration date ___

Other training: ___

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

Job preformed: Site Safety and Health Officer (SSHO)

Respirator qualified? Yes ___ No X Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes X No ___ Expiration date 5/25/94

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

HAZWOPER (SARA/OSHA)
8-h annual refresher? Yes X No ___ Expiration date 5/25/94

HAZWOPER (SARA/OSHA)
8-h annual supervisor training? Yes X No ___ Expiration date 5/25/94

Confined space entry training? Yes ___ No X Expiration date ___

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes X No ___ Expiration date 1/29/95

Asbestos worker? Yes ___ No X Expiration date ___

Other training: TWRA Boat Safety Certification, Waste Generator Training, Satellite Accumulation Training

Name: Amanda Carr Badge no.:624509

Job preformed: Field sampling crew

Respirator qualified? Yes ___ No _X_ Expiration date ___

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

HAZWOPER (SARA/OSHA) 24-h training? Yes _X_ No ___ Expiration date 7/20/94

HAZWOPER (SARA/OSHA)
8-h annual refresher? Yes _X_ No ___ Expiration date 7/20/94

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

Confined space entry training? Yes ___ No _X_ Expiration date ___

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes _X_ No ___ Expiration date 9/24/94

Asbestos worker? Yes ___ No _X_ Expiration date ___

Other training: Waste Generator Training

Name: Steve Short Badge no.: 623576

Job preformed: Field sampling crew

Respirator qualified? Yes ___ No _X_ Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___ Expiration date 2/4/94

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

HAZWOPER (SARA/OSHA)
8-h annual refresher? Yes _X_ No ___ Expiration date 2/4/94

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

Confined space entry training? Yes ___ No _X_ Expiration date ___

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes _X_ No ___ Expiration date 8/20/95

Asbestos worker? Yes ___ No ___ Expiration date ___

Other training: TWRA Boat Safety Training certification

Name: Alan Roberts Badge no.: 624962

Job preformed: Field sampling crew

Respirator qualified? Yes ___ No _X_ Expiration date ___

HAZWOPER (SARA/OSHA) 40-h training? Yes _X_ No ___ Expiration date 6/6/94

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

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

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

Confined space entry training? Yes _X_ No ___ Expiration date 11/4/94

Radiation Worker I? Yes ___ No ___ Expiration date ___

Radiation Worker II? Yes _X_ No ___ Expiration date 8/20/95

Asbestos worker? Yes ___ No _X_ Expiration date ___

Other training: TWRA Boat Safety Training certification

REFERENCES

Watts, C. W. and Dexter, A. R. 1993. "A Hand-held Instrument for the *In situ* Measurement of Soil Shear Strength in the Puddled Layer of Paddy Fields," *J. agric. Engng. Res.* **54**, 329-337.

Cerling, T. E. and Spalding, B. P. 1982. "Distribution and Relationship of Radionuclides to Streambed Gravels in a Small Watershed," *Environ. Geol.* **4**, 99-116.

Appendix A

SITE MAPS

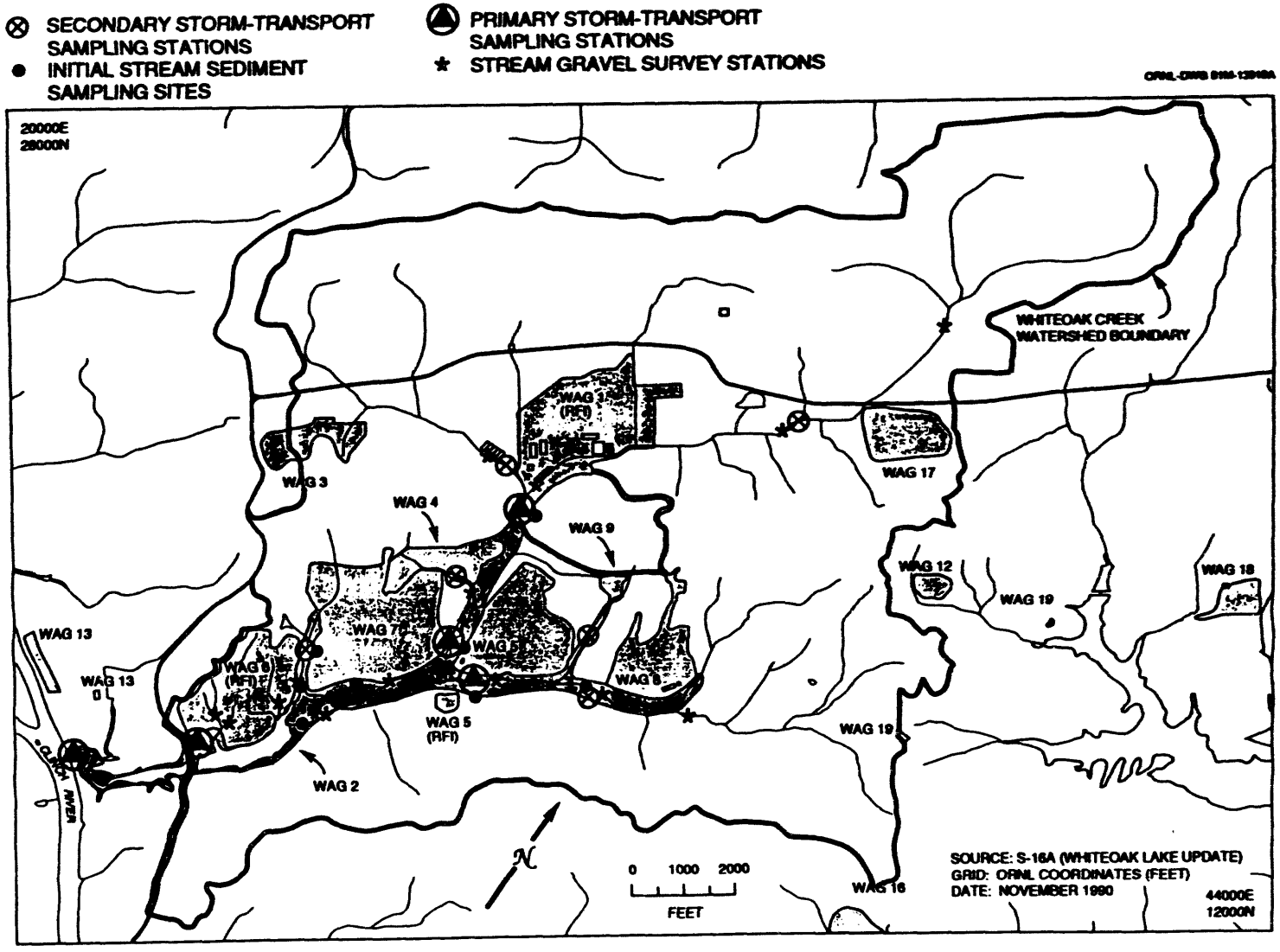

Fig. A.1. Sediment sampling locations in WAG 2.

ORNL-DWG 93M-16482

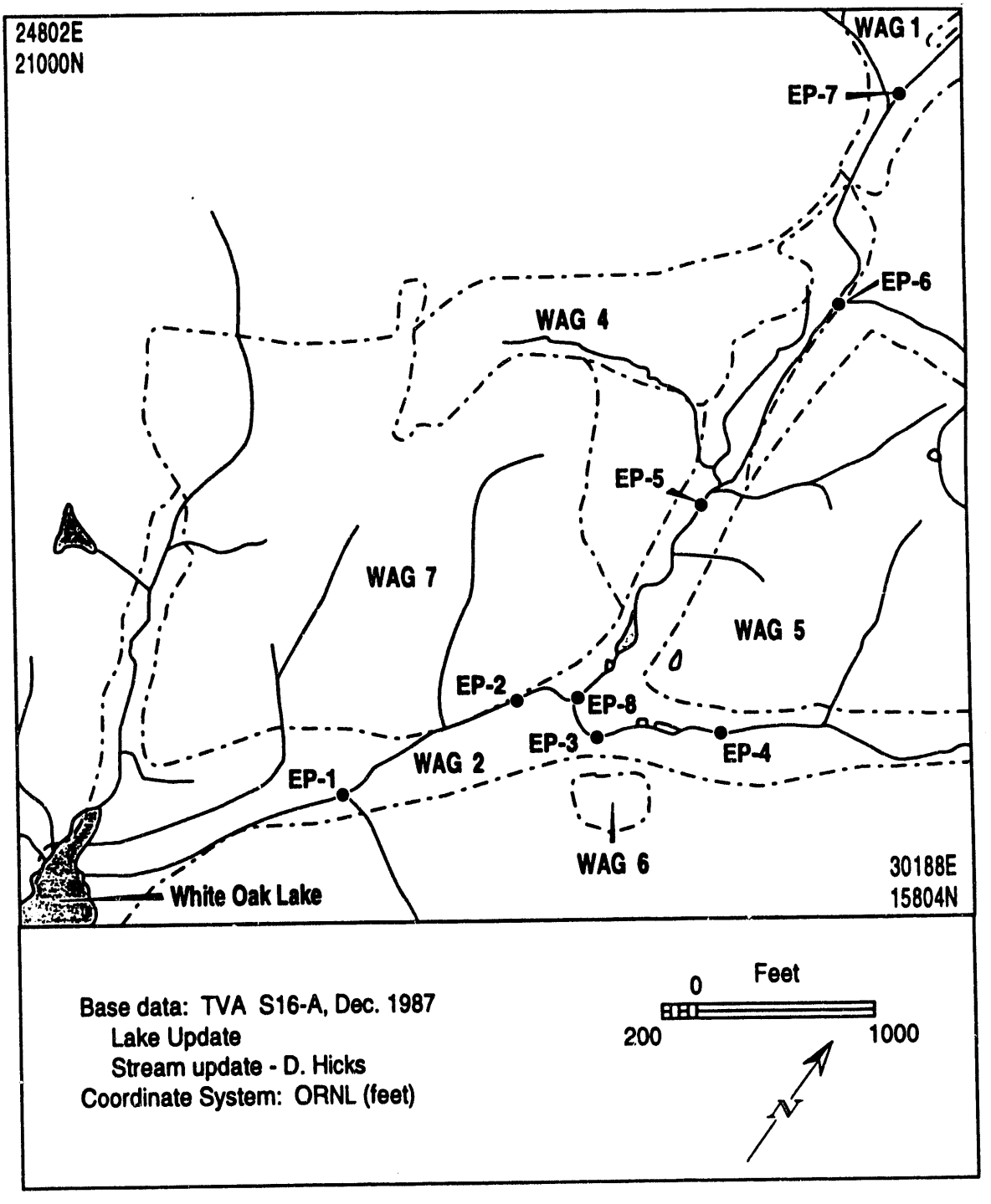

Fig. A.2. White Oak Creek erosion study sites.

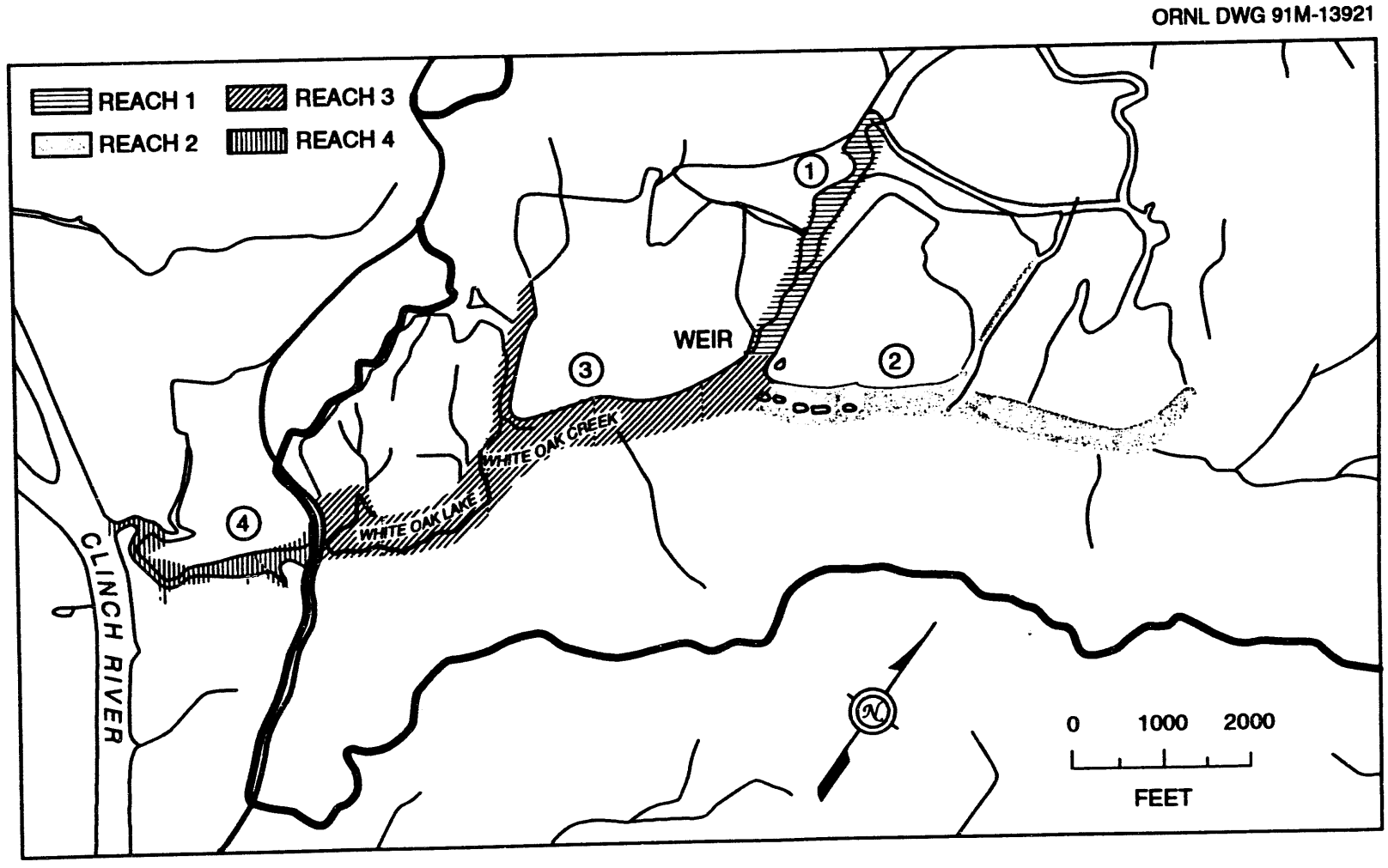

Fig. A.3. Floodplain soils sampling areas.

Appendix B

SEDIMENT SAMPLING PROGRAM

SEDIMENT SAMPLING PROGRAM

Component	Parameter	Method	Sample Type	Collection/ Analysis Freq	Locations
Floodplain Soils	Gamma Scan	4008[1]	Grab	Once	300+[2]
	^{90}Sr	TBD[3]	Grab	Once	100[2]
	Particle-size	USGS-C1 Book 5[4]	Grab	Once	30[2]
	Transuranics	TBD[3]	Grab	Once	20[2]
	^{99}Tc	TBD[3]	Grab	Once	20[2]
	ICP Metals (Ba, Be, B, Co, Cu, Mo, Ag, Sr, V, Zn)	6010[5]	Grab	Once	50[2]
	AA Metals (As, Sb, Cd, Cr, Pb, Hg, Ni, Se, Tl)	7000 Series[5]	Grab	Once	50[2]
	PCBs/Pesticides	8080[5]	Grab	Once	50[2]
	Volatiles	8240[5]	Grab	Once	20[2]
Suspended Sediment Sampling During Storms	Suspended Sediment	4010[1]	Grab/ Composite[6]	5 Storms/1000 samples[7]	8 Storm-Transport Stations[8]
	Grain Size Distribution	4012[1]	Grab/ Composite[6]	5 Storms/350 samples[7]	8 Storm-Transport Stations[8]
	Specific Gravity of Particles	USGS-C1 Book 5[4]	Grab/ Composite[6]	5 Storms/25 samples[7]	8 Storm-Transport Stations[8]
	Gamma Scan	4008[1]	Grab/ Composite[6]	5 Storms/275 samples[7]	8 Storm-Transport Stations[8]
	^{90}Sr	TBD[3]	Grab/ Composite[6]	5 Storms/105 samples[7]	8 Storm-Transport Stations[8]
	ICP Metals (Ba, Be, B, Co, Cu, Mo, Ag, Sr, V, Zn)	6010[5]	Grab/ Composite[6]	5 Storms/84 samples[7]	8 Storm-Transport Stations[8]
	AA Metals (As, Sb, Cd, Cr, Pb, Hg, Ni, Se, Tl)	7000 Series[5]	Grab/ Composite[6]	5 Storms/84 samples[7]	8 Storm-Transport Stations[8]
	PCBs/Pesticides	8080[5]	Grab/ Composite	5 Storms/8 samples[7]	8 Storm-Transport Stations[8]

SEDIMENT SAMPLING PROGRAM

Component	Parameter	Method	Sample Type	Collection/ Analysis Freq	Locations
	Semivolatiles	8270[5]	Grab/ Composite	5 Storms/8 samples[7]	8 Storm-Transport Stations[8]
Bedload Sampling During Storms	Bedload	USGS-C1 Book 5[4]	Grab	5 Storms/420 samples[9]	8 Storm-Transport Stations[8]
	Grain Size Distribution	USGS-C1 Book 5[4]	Grab	2 Storms/84 samples[9]	8 Storm-Transport Stations[8]
	Gamma Scan	4008[1]	Grab	1 Storm/84 samples[9]	8 Storm-Transport Stations[8]
	^{90}Sr	TBD[3]	Grab	1 Storm/16 samples[9]	8 Storm-Transport Stations[8]
	ICP Metals (Ba, Be, B, Co, Cu, Mo, Ag, Sr, V, Zn)	6010[5]	Grab	1 Storm/16 samples[9]	8 Storm-Transport Stations[8]
	AA Metals (As, Sb, Cd, Cr, Pb, Hg, Ni, Se, Tl)	7000 Series[5]	Grab	1 Storm/16 samples[9]	8 Storm-Transport Stations[8]
Preliminary Stream Sediments Sampling at Weirs	Gamma Scan	4008[1]	Composite of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	^{90}Sr	TBD[3]	Composite of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	Transuranics	TBD[3]	Composite of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	^{99}Tc	TBD[3]	Compo site of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	ICP Metals (Ba, Be, B, Co, Cu, Mo, Ag, Sr, V, Zn)	6010[5]	Composite of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	AA Metals (As, Sb, Cd, Cr, Pb, Hg, Ni, Se, Tl)	7000 Series[5]	Composite of $\geq$ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]

SEDIMENT SAMPLING PROGRAM

Component	Parameter	Method	Sample Type	Collection/ Analysis Freq	Locations
	PCBs/Pesticides	8080[5]	Composite of ≥ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
	Semivolatiles	8270[5]	Composite of ≥ 2 Cores	Once/2 Samples	5 Sediment Sampling Sites[10]
Contaminant Inventory in Selected Tributary Sediments	Gamma Scan	4008[1]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	^{90}Sr	TBD[3]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	Transuranics	TBD[3]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	^{99}Tc	TBD[3]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	ICP Metals (Ba, Be, B, Co, Cu, Mo, Ag, Sr, V, Zn)	6010[5]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	AA Metals (As, Sb, Cd, Cr, Pb, Hg, Ni, Se, Tl)	7000 Series[5]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	PCBs/Pesticides	8080[5]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
	Semivolatiles	8270[5]	Composite of ≥ 2 Cores	Once/ 1 sample	4-6 Tributaries[11]
Contaminant Inventory in Stream Sediments	Grain Size Distribution	USGS-C1 Book 5[4]	Grab	Once every 2 to 4 years/100 samples[12]	54[12]
	Gamma Scan	4008[1]	Grab	Once every 2 to 4 years/100 samples[12]	54[12]
	^{90}Sr	TBD[3]	Grab	Once every 2 to 4 years/100 samples[12]	54[12]

SEDIMENT SAMPLING PROGRAM

Component	Parameter	Method	Sample Type	Collection/ Analysis Freq	Locations
Bed Material	Grain Size Distribution	USGS-C1 Book 5[4]	Grab	Once	100 Sites Along WOC and MB[13]
Stream Gravel Survey	Gamma Scan	4008[1]	Composite	Once	20 Key locations[14]
	^{90}Sr	TBD[5]	Composite	Once	20 Key locations[14]

[1] WAG 2 Standard Operating Procedure.

[2] Results from the radiological walkover will be used to select the sample locations. In order to determine the relationship between the walkover data and the subsurface samples, as well as the three dimensional distribution of radiological contaminants, three hundred or more samples will be analyzed for gamma emitters and one hundred for Strontium 90. Fewer metals and organics samples will be collected for correlation with the radiological contaminants.

[3] No standardized EPA methods exist for this analysis/media. Methods will be provided by contracting laboratories and reviewed by WAG 2 personnel.

[4] Selection of sieving or settling analysis depends on particle size. See Guy 1969.

[5] EPA SW-846 methods.

[6] In order to provide sufficient sediment for analysis several grab samples may need to be composited.

[7] Two summer storms and three winter storms will be sampled. Samples will be collected at regular time intervals (i.e. 15 minutes). Discharge information will be used to select which samples will be analyzed.

[8] There are currently five primary (permanent) stations and six secondary stations (See map of Sediment Sampling Locations). The first three secondary stations will be monitored until a small (e.g. 1-2 year) flood is sampled. The next three secondary sites will then be monitored. Other secondary stations will be added if necessary.

[9] Because bedload is more important during large storms the analysis of grain size, radionuclides, and metals will only be performed on large storms.

[10] Samples will be collected at the four principle weirs (WOC, MB1, MB2, WC7500) and in WOC just above WOL (See map of Sediment Sampling Locations).

[11] Tributaries will be selected based on the existence of known contamination upgradient (i.e. burial grounds) or results from other sampling components.

[12] A riffle and pool upstream of White Oak Lake and a riffle and pool in upper WAG 2 will be intensively sampled (i.e. 12 core samples in each riffle and 12 in each pool). Fifty core samples will also be collected from White Oak Creek and Melton Branch. These 98 samples will be used for extrapolation to stream reach inventories. Sampling will be repeated every two to four years to determine changes in upgradient sources.

SEDIMENT SAMPLING PROGRAM

[13] Based on the needs of the erosional model White Oak Creek and Melton Branch will be divided into reaches of approximately 200 meters. Samples will be collected from each reach and analyzed for grain size distribution.

[14] See map of Sediment Sampling Locations.

Appendix C

EVACUATION ROUTES AND ASSEMBLY POINT MAP

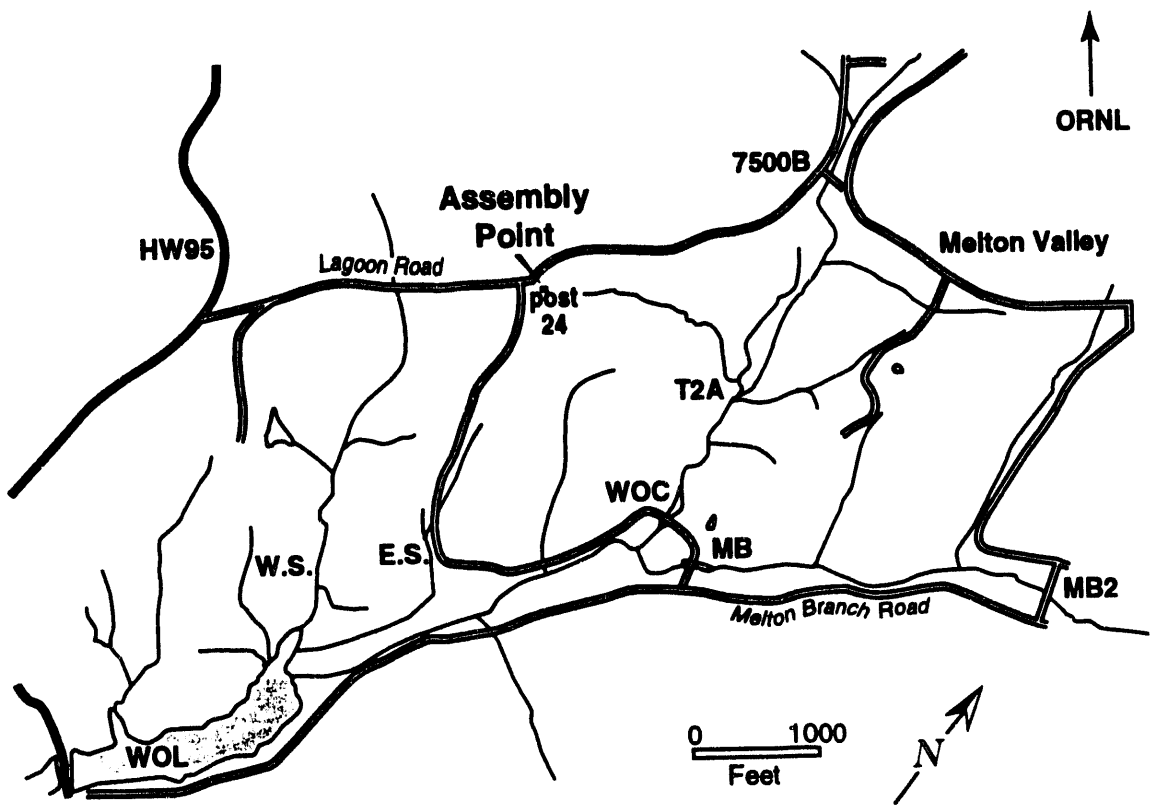

Fig. C.1. Evacuation routes and assembly point.

Appendix D

SUSPECTED WAG 2 CONTAMINANTS AND THEIR CHARACTERISTICS

Table D.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 Suspected carcinogen	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
Arochlor 1254[a] Color: colorless to yellow Suspected carcinogen	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
Arsenic[a] Color: NE 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	NE
Beryllium[a] Color: gray-white	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: NE	DAC: 4E-8 $\mu Ci/mL$	STEL: NE IDLH: NE	Respiratory system, total body, GI	Variable, half-life: 2.06 years; beta and gamma emitter
Chloroform Color: colorless Known carcinogen	TLV: 10 ppm PEL: NE REL: NE	STEL: NE IDLH: NE	Liver, kidneys, hear, eyes, skin; anesthesia, dizziness, mental dullness, nausea, headache, fatigue, irritant	Liquid with pleasant sweet odor; solubility: 0.8%; not combustible; recommended reproductive exposure limit: 0.4 ppm
Chromium Color: NE	TLV: 0.5 mg/m^3 REL: NE	STEL: NE IDLH: NE	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
^{60}Co Color: black	DAC: 6E-8 $\mu Ci/mL$	STEL: NE IDLH: NE	Skin, respiratory system, eye irritant, kidney disorders, GI tract disturbances, dermatitis	Odorless solid, strong oxidizer; half-life: 5.27 years; beta and gamma emitter

Table D.1 (continued)

Contaminant	TLV, PEL, REL, DAC	STEL, IDLH	Health effects, target organs	Physical and chemical properties
^{154}Eu Color: NE	DAC: 8E-9 μCi/mL	STEL: NE IDLH: NE	GI, lower large intestines, lungs	Half-life: 8.6 years; beta and gamma emitter
^{155}Eu Color: NE	DAC: 4E-8 μCi/mL	STEL: NE IDLH: NE	GI, lower large intestines, kidneys, bone	Half-life: 4.7 years; beta and gamma emitter
Hexane[a] Color: NE	DAC: 2E-5 μCi/mL	STEL: NE IDLH: NE	Body tissue	Liquid with acetone-like odor
^{3}H Color: NE	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 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: NE	TLV: NE PEL: NE REL: NE	STEL: NE IDLH: NE	Skeletal system, respiratory system	Variable; half-life: 29.1 years; beta emitter
Thallium Color: NE	TLV: NE 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 D.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) their toxicity in nature depends on the elements with which they are bonded or (2) the published exposure limits are based on occupational exposures to the chemicals that will not take place in the environment.

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

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