PNL Administrative/Technical Procedures

**Surface Environmental
Surveillance Procedures
Manual**

February 1990

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

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Surface Environmental Surveillance Procedures Manual

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1.0 INTRODUCTION

ENVIRONMENTAL
MONITORING

The Surface Environmental Monitoring Project is maintained by the Pacific Northwest Laboratory, which is operated by Battelle Memorial Institute for the U.S. Department of Energy (DOE). The basic requirement for environmental monitoring is set forth in DOE Order 5400.1, General Environmental Protection Program Requirements. General guidance for the content of the projects is provided in DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements. Guidelines on which the environmental monitoring projects are generally based are found in DOE/EP-0023, A Guide For Environmental Radiological Surveillance at U.S. Department of Energy Installations.

Environmental monitoring data provide a historical record of the levels of radionuclides and radiation present in the Hanford environs as a result of natural sources, worldwide fallout, and Hanford operations. In addition, the data are used in assessing the impact of site operations, demonstrating compliance with applicable guidelines, and verifying the adequacy of the containment and effluent control systems.

MANUAL SCOPE/USE

This manual establishes the procedures for the collection of environmental samples and the performance of radiation surveys and other field measurements. Responsibilities are defined for those personnel directly involved in the collection of samples and the performance of field measurements.

This manual is intended for use by qualified environmental monitoring personnel and their supervision. Project-specific training is required to ensure that representative samples are collected and that environmental radiation surveys are performed in a consistent manner. The samples must be collected and measurements must be performed consistently both from one sample time to the next and between individuals performing the work to ensure that results are comparable between locations and over time.

Concurrence <i>KK Proctor</i>	Date 2-8-90	Approval <i>Michael E. Jorgensen</i>	Date 2-9-90
Prepared by <i>Re Hays</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 1.0	Revision No. 1	Effective Date: 2-90	

MANUAL UPDATE

Procedures will be reviewed annually to allow for corrections and revisions therein that do not warrant complete manual upgrades. This also will ensure that new procedures and major revisions to existing procedures are documented promptly.

To ensure that the procedures are accurate, complete, in the correct format, and, most important, usable, the following requirements must be met before a new or significantly revised procedure is incorporated in this document:

- All new or revised procedures must undergo technical review and approval by appropriate personnel, including, but not limited to, the appropriate project manager, the Environmental Monitoring Supervisor, quality engineer, and the technical staff.
- Interim procedures (i.e., those used before the final new or modified procedures are formally incorporated) must be approved by the project manager at a minimum.
- Appropriate training must be provided to the environmental Radiation Protection Technologists before new or revised procedures are approved or issued. Such training shall be documented in personnel training files.

2.0 RESPONSIBILITIES

INTRODUCTION

Overall responsibilities of staff directly accountable in the collection of environmental samples and the performance of environmental radiation surveys are defined in this section of the manual.

Responsibilities for activities involved with a specific situation are defined in the appropriate procedure.

Project Manager

Responsible for the technical quality and completeness of those procedures associated with the project, and must ensure that:

- an approved procedure is in place for all field activities associated with each specific project
- the manual is reviewed and updated on an annual basis
- requirements for manual updates are fulfilled before final incorporation of a new or revised procedure.

Environmental Monitoring Supervisor

Arrange for sample collection, field surveys, and measurements according to the master schedule, special requests, and, as determined necessary, in emergency or unusual situations.

Ensure that sample collection, surveys, and measurements are performed in accordance with this manual and/or approved interim procedures.

Arrange for the maintenance and calibration of sampling, survey, and measurement instrumentation, as appropriate.

Maintain supplies and equipment necessary to collect samples and to perform environmental measurements.

Provide for the training of environmental monitoring personnel as related to the performance of described work.

Concurrence <i>KK Pines</i>	Date 2-8-90	Approval <i>Richard E. Jorgensen</i>	Date 2-9-90
Prepared by <i>Rw Hays</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 2.0	Revision No. 1	Effective Date: 2-90	

Radiation Protection Technologists

Collect environmental samples, conduct radiation surveys, and perform field measurements in accordance with this manual, approved interim procedures, or as directed by the Environmental Monitoring Supervisor.

Notify Environmental Monitoring Supervisor of the following:

- samples not collected or work not performed due to equipment failure
- unusual conditions observed
- unsafe equipment or procedures
- deviations from procedures in this manual.

Provide suggestions for improvements in procedures, in equipment, or in the operation of the program itself.

Technical Support Task Leader

Ensure that work falling into the scope of routine environmental monitoring is conducted by the appropriate personnel.

Coordinate work requiring the use of environmental monitoring personnel through the Environmental Monitoring Supervisor.

Coordinate modifications or additions to routine environmental sampling, survey equipment, or operations with the Environmental Monitoring Supervisor.

Ensure that environmental monitoring procedures are technically sound, accurate, and complete, and that they are updated to reflect operational changes.

3.0 AIR SAMPLING PROCEDURES

INTRODUCTION

The collection and analysis of air samples are of the utmost importance in environmental monitoring because air is a primary pathway of radionuclides to the public from the Hanford environs. Air sampling provides a means to assess the environmental impact of site operations, to demonstrate compliance with applicable guidelines, to check the effectiveness of containment and effluent control systems, and to evaluate the potential doses to offsite populations from airborne radionuclides.

Air samples are collected continuously at numerous locations, including those on the site, at the site perimeter, and in both nearby and distant communities.

Samples are collected for all or some of the following constituents at each station, depending on its location with respect to potential sources:

- particulate radioactivity (Section 3.1)
- iodine-131 (Section 3.2)
- tritium, as HTO (Section 3.3)
- carbon-14, as CO₂ (Section 3.4)
- krypton-85 (Section 3.5)
- iodine-129 (Section 3.6).

Figure 3.0.1 illustrates the most complex sampling train used at present. Krypton-85 is collected using a separate system.

Concurrence <i>K. Prince</i>	Date 2-8-90	Approval <i>Guilian E. Jurgens</i>	Date 2-9-90
Prepared by <i>Ron Hays</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 3.0	Revision No. 1	Effective Date: 2-90

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Figure 3.0.1. Air Sampling Process

3.1 PARTICULATE AIR SAMPLES

INTRODUCTION

This procedure governs the collection of particulate air samples every two weeks at all air sampling locations. Gross beta and, at selected locations, gross alpha measurements are made on individual filters after a seven-day holding period that allows for the decay of naturally occurring radon and thoron radioactive decay products. Individual filters from locations within well-defined geographic areas are then composited monthly and analyzed for gamma-emitting radionuclides. The monthly composites from each area are combined quarterly for analysis of specific radionuclides, including plutonium, strontium, and uranium.

EQUIPMENT

The following equipment may be needed when collecting particulate samples:

- clean filter-head assemblies
- filter-head holders with plastic jar covers
- extra glass fiber filters
- plastic tubing (3/8- and 1/2-in. ID)
- hose clamps (large and small, plastic and metal)
- spare vacuum pumps
- air flow calibrator with current calibration label
- choke valve
- assorted tools (pliers, screwdriver, etc.)
- clean rags
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Obtain newly loaded filter-head assemblies from United States Testing Company, Inc. (UST).

Ensure that two matched heads (those painted blue) are obtained for each double filter-head^(a) station on the trip schedule.

Calibrate the air sampling system every time you change a filter head, whether it is a scheduled or a special sample change.

Ensure that the calibrator has a current (up to date) calibration label from the Westinghouse Hanford Company Standards Laboratory. Calibrators are to be calibrated semiannually and must not be used if the recalibration date has passed.

(a) Two matched filter heads, each operating at 1.5 ft³/min on one pump drawing 3.0 ft³/min.

AS-FOUND OBSERVATIONS

Note on the trip sheet (also referred to as trip log) any unusual conditions near the sample site that may affect sample results, such as new activities nearby or changes in the immediate surroundings.

Note on the trip sheet any problems with the sampling system (before disturbing it in any way).

If the vacuum pump or the running-time meter is not operating:

- Record pump numbers of bad pump and of replacement pump on the trip sheet.
- Replace pump.
- Record pump numbers in the air sampler log book (located in trip room).
- Describe apparent problem and its cause on trip sheet.

If the system appears to have been operating properly, check the running-time meter:

- If it reads approximately 336 h or less:
 - record the number of hours on the trip sheet
 - record the hours on the time log found at sample location.
- If it reads less than 168 h, in addition to the above:
 - mark trip sheet "No Alpha Beta (AB) Analysis"
 - record any apparent cause for the short sample on the trip sheet
 - notify Environmental Monitoring Supervisor, who will determine if the sample should be submitted.

AS-FOUND FLOW RATES

Before disturbing the station in any way:

Observe the as-found ^3H and ^{14}C flow rates by reading the appropriate in-line rotameters. Ensure that the rotameters are vertical when you read them.

NOTE: If the samples are scheduled for collection, record the flow rates on the sample labels along with the date and time on, date and time off, and

exposure hours. If the samples are not scheduled for collection, record the flow rates in the comments section of the trip sheet.

Measure the as-found flow rate for the particulate sampling loop as an in-line measurement as follows:

- Remove the exposed filter head (or matched head assembly) and install the flow calibrator in its place.
- Reinstall the exposed filter head (or matched head assembly) upstream of the calibrator; that is, in the calibrator inlet.
- Hold the calibrator (base) level and read the flow rate.

Record the flow rate as the "B" or "before" calibration reading on the trip sheet and sample label. Also record the date and time on, date and time off, and exposure hours on the label.

NOTE: The flow rate for a double-head assembly will be the total for both heads. You must divide this number by two when you record the flow rate of each sample on the trip sheet and labels.

Remove the exposed filter head.

CAUTION: Use extreme care to avoid the loss of particulate material from the filter paper while handling the filter heads (so do not place filter heads in pockets, set face down, bump, or expose to the weather).

Examine the exposed filter(s). Record, on the trip sheet, any abnormalities, such as moisture damage, clogging due to snow or ice, wrinkles, or tears, and notify the Environmental Monitoring Supervisor.

Place the exposed filter head(s) in a storage holder and cover it with plastic covers.

CHOKE TEST NECESSARY?

If the as-found flow was greater than 1.0 ft³/min for a single filter-head station, or 2.0 ft³/min for a double filter-head station, proceed to the MAINTENANCE step. If the as-found flow was less, choke test the pump according to the steps described below:

- Install the calibrator in the filter-head holder quick disconnect.

- Turn choke valve fully open.
- Install a choke valve in inlet end of calibrator.

NOTE: The clamshell charcoal-cartridge holder must be closed and contain a cartridge.

- Adjust the pump flow to 1.5 (3.0)^(a) ft³/min, using the control on the front panel of the pump.
- Close the choke valve slowly until the "delta P paper" meter on the pump's front panel reads 4 in. of mercury.
- Observe the flow rate reading on the calibrator (unit must be level).
- If the flow is 1.2 (2.5) ft³/min or greater, the pump is performing satisfactorily. In that case, the remaining steps in the choke test are not necessary and you may proceed to the MAINTENANCE step.
- If the flow is less than 1.2 (2.5) ft³/min at the calibrator, repeat the test by connecting the calibrator directly to the quick disconnect on the front panel of the pump.
- If the flow rate is less than 1.2 (2.5) ft³/min when measured directly at the pump, replace the pump.

NOTE: Record the nature of the problem on the trip sheet and on a note on the pump. As always, record the number of the bad pump and the replacement pump on the trip sheet and in the air sampler log book.

- If the flow rate is less than 1.2 (2.5) ft³/min at the calibrator but is 1.5 (3.0) ft³/min when measured directly at the pump, check the tubing, fittings, and clamshell charcoal-cartridge holder for any restrictions or leaks and repair as necessary. Repeat the choke test with the calibrator and choke valve installed at the filter head (as done in the first step of the choke test) to determine whether the problem has been corrected.

(a) Values in parentheses are for double filter-head units.

MAINTENANCE

Check that the overall sampling system is properly configured (see Figure 3.0.1).

Replace worn, brittle, or cracked tubing.

Check for loose connections, bad disconnects, etc.

Wipe excess dust from the entire system.

**NEW FILTER
INSTALLATION AND
CALIBRATION**

Install the flow calibrator in line with the clean filter in the filter head at the calibrator inlet.

Replace the cartridge if scheduled replacement is indicated on the trip sheet (see Section 3.2).

Adjust the flow in the particle loop to 1.5 (3.0) ft^3/min .

NOTE: In the case of a double filter-head station, the flow must be set in the same manner, but at 3.0 ft^3/min . It may not be possible to achieve a full 3.0 ft^3/min from all pumps; if not, it should be set to the maximum flow possible between 2.5 and 3.0 ft^3/min . If the maximum achievable flow is less than 2.5 ft^3/min , the pump should be replaced.

Remove the calibrator.

Install the new filter head(s).

Record the location, date, and time on the tape on the new filter head.

Ensure that the ^3H and ^{14}C rotameter balls are free to move throughout the length of the scale of the rotameters by adjusting the rotameter needle valve back and forth while the pump is running.

If there is a ^3H loop, adjust its flow to 0.5 ft^3/h .

If there is a ^{14}C loop, adjust its flow rate to 1.0 ft^3/h .

Check the ^{85}Kr rotameter for proper functioning as described by the procedures for this system (same as described for ^3H and ^{14}C above) and set the rotameter to 0.025 ft^3/h .

If a ^{129}I sampler is present at the site, change its paper pre-filter and adjust its flow to 1.5 ft^3/h .

Record on the trip sheet the date on, time on, date off, time off, exposure hours, set flow rates (under "A" for "after"), and any abnormalities observed.

NOTE: You must divide the total measured flow for a double filter-head station by two and enter this value for each of the samples on the trip sheet.

Reset the running-time meter to the zero hour.

Consult the Environmental Monitoring Supervisor on how to handle any questionable samples before submitting them to UST.

Deliver the samples to UST, and have the person receiving them sign the trip sheet.

3.2 IOOINE-131 SAMPLES

INTRODUCTION

Charcoal cartridges, used for the collection of ^{131}I , are present at all air sample locations. However, only cartridges from specially selected locations are routinely analyzed. Those cartridges that are routinely analyzed are collected every other week. The remaining charcoal cartridges are changed monthly and retained for several months. These not routinely analyzed (NRA) samples are processed only if ^{131}I is detected in the samples routinely analyzed.

EQUIPMENT

The following equipment may be needed when collecting ^{131}I samples:

- new charcoal cartridges
- hose clamps
- assorted tools
- extra charcoal-cartridge holders
- extra rubber gaskets for holders
- extra cartridge-positioning rings
- plastic tubing (1/2 in. ID)
- plastic bags
- sample labels
- trip sheet.

PROCEDURE FOR ROUTINELY ANALYZED SAMPLES

Obtain new charcoal cartridges.

NOTE: The charcoal must be tightly packed in the cartridge. Cartridges with loose charcoal must not be used.

Read the running-time meter (RTM) and calculate the exposure hours when the cartridge is exchanged. If the result is less than 168 h, record any apparent cause (e.g., pump or power failure) and notify the Environmental Monitoring Supervisor, who will decide if the sample should be submitted for analysis.

Record the date on, time on, date off, time off, exposure hours, and as-found in-line flow rate on the appropriate sample label.

Remove the exposed charcoal cartridge from holder. Be careful not to lose any charcoal from the cartridge.

Record the location, date, and time on the new cartridge.

Place the exposed cartridge in a plastic bag.

Position the new charcoal cartridge in the holder so that the air flow is from top to bottom, according to the arrow printed on the cartridge. Be sure that the rubber gaskets and positioning ring are in place, and close the holder tightly with thumbscrew.

Record the date on, time on, date off, time off, exposure hours, and flow rate on the trip sheet.

Deliver the routine samples to United States Testing Company, Inc. (UST), and have the person receiving them sign the trip sheet.

PROCEDURE FOR NRA SAMPLES

The NRA samples should be handled exactly as the others, with the following exceptions:

- Place label on side of exposed cartridge.
- Exposure hours must be determined for both the previous biweekly sample period and the current sample period using the RTM time log at the sample hutch and the current meter reading. The total will generally be approximately 672 h. If the RTM time log at the hutch is incomplete or illegible, exposure hours are available on previous trip sheets. Contact the Environmental Monitoring Supervisor prior to delivering the samples.
- Deliver NRA samples to the 2400 Stevens Building and place in appropriate racks in laboratory drawers.

3.3 TRITIUM SAMPLES

INTRODUCTION

Atmospheric tritium (^3H) collection assembly columns are placed at specific locations that could be impacted by site operations. Silica gel is used to collect ^3H in the form of water vapor (HTO). Tritium samples are collected and analyzed on a monthly basis.

EQUIPMENT

In addition to the items listed for the collection of the particulate filter samples (see Section 3.1), the following equipment may be needed to collect ^3H samples:

- fresh silica gel columns, with end caps, identified by the bright blue color of the gel
- plastic tubing (3/8 in. ID)
- hose clamps - metal screw type
- pre-filters
- sample labels
- tape
- trip sheet.

PREPARATION PROCEDURE

Obtain fresh silica gel columns from United States Testing Company, Inc. (UST) the day before sample changes are scheduled.

Ensure that all columns are tightly sealed and capped. Be certain that rubber gaskets are in place and cap is screwed down tightly against them.

Ensure that all fittings on columns are tight.

Ensure that columns are transported in a vertical position.

Obtain trip sheet for previous particulate sample change at each location. Record exposure hours and flow rate for previous sample period on current trip sheet.

SAMPLE COLLECTION PROCEDURE

Observe silica gel column assembly in use. The silica gel at the air inlet should be pink, while that at the outlet should remain blue. Note on trip sheet if this is not the case.

Before disturbing the system in any way, record the as-found flow rate observed on the ^3H rotameter on the trip sheet.

Record total exposure hours using the running-time meter (RTM) time log on the hutch door for total sample period. If the RTM time log at the hutch is incomplete or illegible, exposure hours are available on previous trip

sheets. Contact the Environmental Monitoring Supervisor prior to delivering the samples.

Notify Environmental Monitoring Supervisor if:

- no color change from blue to pink is observed, or
- entire length of all three columns is pink.

If exposure hours are less than approximately 336:

- notify the Environmental Monitoring Supervisor, who will decide if the sample should be submitted to UST.

Record on sample label the date on, time on, date off, time off, and total exposure hours.

Remove existing column assembly from sample system by loosening metal hose clamps and slipping tubing off the columns.

Place rubber caps on assembly inlet and outlet. If caps are not available, seal inlet and outlet with tape.

Record location, date, and time on the tape attached to the fresh silica gel columns.

Install fresh silica gel column assembly so that air flow is from top to bottom in the columns. Attach tubing and fasten hose clamps.

Change the pre-filter.

Remove dust from all system components.

Ensure that:

- hose clamps are reconnected and tight
- columns are in vertical position
- rotameter is in vertical position
- rotameter is set at 0.5 ft³/h.

Record date on, time on, date off, time off, and total exposure hours on the trip sheet. Note any unusual observations under "Comments."

Deliver routine samples to UST, and have the person receiving them sign the trip sheet. Handle special samples as directed by the Environmental Monitoring Supervisor.

3.4 CARBON 14 [CARBON DIOXIDE (CO₂)] SAMPLES

INTRODUCTION

Carbon-14 [carbon dioxide (CO₂)] concentrations are measured every other month at specially selected air sampling locations that could be impacted by site operations. Soda lime is used to collect the ¹⁴C as CO₂.

EQUIPMENT

In addition to the equipment listed for the collection of particulate filter samples (see Section 3.1), the following equipment may be needed to collect ¹⁴C samples:

- fresh soda lime columns, identified by their white color; purple columns are not fresh
- plastic tubing (3/8 in. ID)
- hose clamps - metal screw type
- pre-filters
- sample labels
- trip sheet.

PREPARATION PROCEDURE

Obtain fresh soda lime columns from United States Testing Company, Inc. (UST) the day before the sample changes are scheduled.

Ensure that all columns are tightly sealed and capped. Be certain that rubber gaskets are in place and cap is screwed down tightly against them.

Ensure that all fittings on columns are tight.

Ensure that columns are transported in a vertical position.

SAMPLE COLLECTION PROCEDURE

Before disturbing the system in any way, record the as-found flow rates on the trip sheet.

Calculate and record total exposure hours from the running-time meter (RTM) time log on the hutch door. This total is the sum of the present reading and the hours recorded from the three previous particulate sample periods. If the RTM time log is incomplete or illegible, exposure hours are available on previous trip sheets. Contact the Environmental Monitoring Supervisor prior to delivering the samples.

If the total exposure hours are less than approximately 672, notify the Environmental Monitoring Supervisor, who will decide if the sample should be submitted to UST.

Notify the Environmental Monitoring Supervisor if the entire exposed soda lime column is purple.

Record on the sample label the date on, time on, date off, time off, and total exposure hours.

Remove existing column from sample system by loosening the metal hose clamps and slipping the tubing off the column.

Place rubber caps on inlet and outlet of column. If caps are unavailable, seal the inlet and outlet with tape.

Record location, date, and time on the tape attached to the fresh soda lime column.

Install a new soda lime column so that air flow is from top to bottom in the columns.

Change the pre-filter.

Remove dust from all system components.

Ensure that:

- hose clamps are reconnected and tight
- columns are in vertical position
- rotameter is in vertical position
- rotameter reads 1.0 ft³/h.

NOTE: This setting should be made after the clean particle filter head has been installed and calibrated to its proper operating level.

Record on trip sheet date on, time on, date off, time off, and total exposure hours. Note any unusual observations under "Comments."

Deliver the routine samples to UST, and have the person receiving them sign the trip sheet. Handle special samples as directed by the Environmental Monitoring Supervisor.

3.5 KRYPTON-85 SAMPLES

INTRODUCTION

Ambient air collected at specific locations is analyzed for ^{85}Kr . The ^{85}Kr sampling system (Figure 3.5.1) simply collects air at ambient pressures during the sample period. This air must be transferred from a collection bag into a sample tank at the end of the four-week sampling period.

EQUIPMENT

The following equipment may be needed to collect ^{85}Kr samples:

- sample tanks
- leak-detection fluid - soap solution
- string tags
- portable compressor and stainless steel hose
- sampling pumps
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Obtain helium back-filled sample tanks from United States Testing Company, Inc. (UST). Note that the tanks have been back filled by attaching a string tag to each tank. All tanks must be back filled with helium prior to their use in the field. If any tanks have a tag marked "Leaky Tank" in red, deliver them to the 350 Building for repair.

Open back-filled sample tank. A small amount of helium may be released when the tank is opened.

Connect the sample tank to the outlet side of the compressor using the stainless steel hose. The outlet side has the pressure gauge.

Disconnect the air collection bladder from the sampling pump at the quick disconnect.

Connect the air collection bladder to the compressor inlet.

Plug the compressor into an electrical outlet to initiate air transfer.

Remove the string tag from the sample tank and record date on, time on, date off, and time off on the sample label.

Place the sample label on the sample tank being filled.

Record date on, time on, date off, and time off on the trip sheet.

Check the air collection bladder and its enclosure. Note any signs of degradation or damage on the trip sheet. Be especially alert for signs of animal gnawing and make repairs if necessary.

Observe the air collection bladder closely as it empties. As soon as all the air has been transferred or a pressure of 175 lb has been reached, unplug the compressor.

Observe the pressure gauge on the compressor. Record the pressure on the sample label and the trip sheet. If pressure is less than 100 lb/in.², notify the Environmental Monitoring Supervisor before submitting the sample to UST.

Shut off the sample tank valve, turning it clockwise until it is tight.

Disconnect the stainless steel hose from the sample tank. There will be a sudden release of air when you disconnect the stainless steel hose from the compressor.

Let any remaining air evacuate from the collection bladder.

Disconnect the compressor from the air collection bladder.

Reconnect the air collection bladder to the sampling pump.

Adjust the rotameter flow between zero and full scale several times to ensure that the ball is free and properly indicating the flow. Then adjust the flow rate on the rotameter attached to the sampling pump to 0.025 ft³/h.

Record start date and time on the string tag attached to the air collection bladder.

LEAK TEST PROCEDURE

Leak check the exposed fittings on the sample tank using leak-check solution. Leaks will be indicated by bubbles forming at the joints.

If leaks are present, mark the sample label and the trip sheet "Leaky Tank" in red, notify the Environmental Monitoring Supervisor, and get instructions.

If no leaks are detected, deliver the sample to UST, and have the person receiving it sign the trip sheet.

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Figure 3.5.1. Krypton-85 Air Sampling System

3.6 IODINE-129 SAMPLES

INTRODUCTION

Charcoal-cartridge samples from a few specially selected locations are collected monthly. These monthly samples are then composited for analysis of ^{129}I on a quarterly basis. The charcoal cartridges have been prepared at the 320 Building and are pre-loaded in the cartridge holders for easy deployment in the field. The tandem filter holders are delivered to the 320 Building for ^{129}I analysis following each monthly exposure period.

EQUIPMENT

The following equipment may be needed when collecting ^{129}I samples:

- new charcoal cartridges loaded in tandem filter cartridge holders, labeled by location
- pre-filters
- vacuum pump
- flow calibrator
- plastic bags
- sample labels
- tape
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Obtain new charcoal cartridges, pre-loaded in cartridge holders and sealed in plastic bags, from the 320 Building.

Record the date on, time on, date off, time off, the as-found in-line flow rate, and exposure hours on the trip sheet.

NOTE: The in-line flow rate is measured as described in Section 3.1.

Ensure that the hose clamps are secure.

Remove the exposed charcoal-cartridge holder. Since ^{129}I is easily cross-contaminated, handle the holder carefully. DO NOT OPEN THE CARTRIDGE HOLDER.

Place cartridge holder in plastic bag and seal with tape.

Record on the label the date on, time on, date off, time off, and total exposure hours.

Put label on plastic bag.

NOTE: Pre-filters are to be changed at the midpoint of the ^{129}I exposure period as part of the particulate sampling schedule (see Section 3.1). The exposed pre-filter should be discarded. Pre-filters will already be installed in the tandem filter cartridge heads when they are picked up at the 320 Building. Pre-filters should be left in the heads when samples are returned to the 320 Building.

Install the field calibrator in line, with the new filter holder upstream.

Set the flow rate to 1.5 ft³/min, remove the calibrator, and install the filter holder.

Record the flow rate set on the trip sheet.

Deliver samples to the 320 Building, and have the person receiving them sign the trip sheet.

4.0 SURFACE-WATER SAMPLING PROCEDURES

INTRODUCTION

The collection and analysis of water samples are integral parts of the Surface Environmental Monitoring Project. Water samples are routinely collected from the Columbia River, local irrigation canals, riverbank springs, on-site ponds, and on- and off-site drinking water systems. These samples provide a means of assessing the impact of Hanford operations, determining the compliance status with applicable standards, evaluating the effectiveness of effluent control and monitoring systems, and evaluating the potential dose to the public from waterborne radionuclides.

Three types of water samples are routinely collected:

- Grab samples (Section 4.1) are typically used when the water characteristics are relatively stable; the stream does not flow continuously; information on minimum, maximum, and variability (time or spatial) is desired; or the parameters to be analyzed are likely to change during storage time.
- Composite samples (Section 4.2) are used to determine average concentrations and provide certainty that pollutants did not flow by the sample location between sample dates.
- Continuous samples (Section 4.3) are used in determining average concentrations and allow for the very large volumes of water needed to detect those contaminants present at very low concentrations.

Grab samples are generally collected manually, while the composite and continuous samples are collected using automatic sampling systems.

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COLUMBIA RIVER

The Columbia River is a significant pathway for contaminants associated with liquid effluents resulting from Hanford Site operations to the public. Radiological and nonradiological pollutants enter the river along the Hanford reach as a result of direct effluent discharges and through seepage of contaminated ground water. As such, the river is sampled routinely at several locations, using different collection methods and various frequencies, depending on the specific constituent of interest and the information desired.

Routine sample locations have been established at Priest Rapids Dam, near Vernita Bridge, the 300 Area Water Intake (also known as ACRMS), and the Richland Pumphouse. Grab samples are used primarily for nonradiological water quality analysis and for special studies on the spatial variability in the river. Composite and continuous samples are used to determine the average radionuclide concentrations at the selected locations.

IRRIGATION WATER

Irrigation water, obtained from the Columbia River downstream of Hanford, is routinely sampled during the irrigation season. Irrigation water is identified as a link in the pathway for pollutants in liquid effluents to reach the public.

ON-SITE POND WATER

Waste-water ponds exist on the site as a result of the disposal of large volumes of water from on-site facilities. Grab samples are generally used, since fluctuations in contaminant concentrations are not expected to be significant and the potential for any off-site impact is negligible.

DRINKING WATER

Drinking water samples are collected routinely in accordance with federal and state regulations. Samples are collected from all on-site sanitary water systems, as well as from selected water systems off the site. Grab samples are typically taken at quarterly intervals as specified in applicable guidelines.

4.1 GRAB SAMPLES

INTRODUCTION

Grab samples are discrete samples collected at a single location over a short period of time, typically less than 15 min. Grab samples can be collected manually or by using a suitable sampling device, such as a pump, vacuum, or kemmerer bottle. This type of sample is used to characterize water quality at a single point in time and space. Grab samples also provide information about maximum and minimum concentrations. This type of sample is generally used when the stream does not flow continuously, when the water quality characteristics are relatively constant, or the parameters to be analyzed are likely to change during storage.

Grab samples are collected from the Columbia River, on-site waste-water ponds, riverbank springs, irrigation water canals, and drinking water systems.

EQUIPMENT

The following equipment and/or supplies may be needed for the collection of grab samples:

- sample bottles - see sample label for bottle requirements (size and type)
- rubber boots
- rubber gloves
- portable sample pump
- kemmerer bottle
- Radiation Work Procedure (RWP) and RWP clothing
- Geiger Müller or portable alpha meters
- sample labels
- ice chest and ice
- trip sheet
- boat.

SAMPLE COLLECTION PROCEDURES

Obtain appropriate sample container as defined on sample label.

Proceed to sample location.

Follow requirements of sample collection RWP as appropriate.

Observe sample location and record on the trip sheet any unusual conditions, such as excessive algae growth, heavy surface debris, or extremely dirty water.

Collect sample following these guidelines:

- Collect clean water from approximately mid-depth. This may require some deepening of the stream in the case of riverbank springs.
- Avoid areas of heavy surface debris.
- Avoid hitting or agitating the bottom, which would resuspend the sediments.
- Sampler inlet should face into the current in the river or irrigation canals.
- Rinse sample container thoroughly three times with water to be sampled prior to sample collection.

Fill sample container and tighten cap firmly.

NOTE: Large sample bottles from the Hanford Environmental Health Foundation (HEHF) must be filled completely. Small sample bottles must be filled to within 1/2 in. of the top so that air remains in the bottle.

Dry outside of sample bottle.

Survey sample, following the RWP as appropriate.

Place HEHF samples in ice chest with ice for transport. Samples must be kept cool.

Label sample bottle with date, time, location.

Record on trip sheet the date, time, location, and volume and note any unusual conditions.

Deliver sample to appropriate laboratory, as designated on sample label, and have the person receiving it sign the trip sheet.

4.2 COMPOSITE SAMPLES

INTRODUCTION

Composite samples are formed by mixing discrete samples taken at periodic times or in a continuous portion of the flow. Composite samples are sometimes referred to as integrated or sequential samples. Composite samples can be obtained manually; however, most often, automatic sampling equipment is used. Composite sampling is used to determine average concentrations or to calculate mass/unit time loadings.

The Surface Environmental Monitoring Project uses automatic composite samplers at the following Columbia River monitoring locations: Priest Rapids Dam, 300 Area Water Intake, Richland Pumphouse.

EQUIPMENT

The following equipment and/or supplies may be needed for the collection of composite samples:

- 2.5-gal polyethylene jug
- 1-L plastic sample bottle
- 100-mL graduated cylinder
- stopwatch
- assorted tools
- rubber gloves
- sample label
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Observe the flow diagram of the composite sampler (Figure 4.2.1).

Obtain clean sample bottles from United States Testing Company, Inc. Sample bottles should be permanently marked with specific location and sample number.

Note on trip sheet if condition of sample bottles warrants replacement.

Proceed to sample location.

Observe sample jug in the composite sampler. Bottle should be nearly full.

If sample jug is not half full, the sample aliquot volume may need adjustment.

Remove filled sample jug and tighten cap firmly.

NOTE: At the Richland Pump house, fill a 1-L plastic sample bottle with water from the 2.5-gal polyethylene sample jug. Then firmly tighten the cap on each container.

ALIQOT VOLUME CHECK

Check aliquot volume as follows:

- Turn the function knob to the OFF position.
- Place the graduated cylinder under the outlet tube.
- Turn the function knob to MANUAL CYCLE position.
- Observe the aliquot volume collected in the graduated cylinder. Volume should be 50 to 60 mL.
- If the volume is less than 50 or greater than 60 mL, notify the Environmental Monitoring Supervisor.
- If the volume is 50 to 60 mL, proceed to next step.

SAMPLE JUG PLACEMENT

Place the clean sample jug into the sample housing beneath the sample outlet tube, making sure that the electrodes are inside the sample jug.

Turn the function knob to TIME position.

Record on the trip sheet the date on, date off, time on, time off, location, sample number, and approximate sample volume.

Note any unusual conditions on the trip sheet, such as dirty sample, small volume, or small sample aliquot volume.

Check to be sure that the function knob is on TIME.

Check that the power is ON.

Check the MIN-HRS knob for appropriate setting:

- 1 h for weekly samples (Priest Rapids Dam and Richland Pump house)
- 4 h for monthly sample (300 Area Water Intake).

**SAMPLE ALIQUOT
ADJUSTMENT**

Periodically, the aliquot volume may require adjustment to ensure an adequate sample volume is collected. The volume of the aliquot collected at each time period is adjusted as follows:

- Turn the function knob to the OFF position.
- Remove the wing nuts from the top of the measuring chamber.
- Carefully remove the siphon tube from the chamber.
- Loosen the set screw near the top of the outer spiral tube.
- Adjust the opening in the spiral tube to increase or decrease aliquot volume:
 - to increase, turn counterclockwise
 - to decrease, turn clockwise.

CAUTION: EASY DOES IT! Minor adjustments result in substantial variations in the aliquot volume.

- Tighten the set screw.
- Replace the chamber, being careful not to twist or exclude the O-rings.
- Tighten the wing nuts onto the chamber.
- Recheck the sample aliquot volume (as previously discussed).
- Continue repeating these steps until desired volume (50 to 60 mL) is obtained.
- Once desired volume has been obtained, turn the function knob to TIME position.
- Replace the sample jug beneath the sample outlet tube.
- Record on trip sheet initial aliquot volume and final adjusted aliquot volume.
- Deliver samples to the appropriate laboratory, and have the person receiving the samples sign the trip sheet.

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Figure 4.2.1. Composite Water Sampler Flow Diagram

4.3 CONTINUOUS SAMPLES

INTRODUCTION

Continuous samples are the ultimate form of a composite sample. Water is continuously pumped through a set of filters (roughing sock filter and millipore filter) and a mixed-bed ion-exchange column. The continuous water sampler is commonly called the filter/resin sample. Using the filter/resin arrangement allows for sampling the extremely large volumes of water needed for the detection of some radionuclides present in Columbia River water in very low concentrations.

Continuous (filter/resin) water sample systems are located at Priest Rapids Dam, 300 Area Water Intake, and Richland Pumphouse monitoring stations on the Columbia River.

EQUIPMENT

The following equipment and/or supplies may be needed for the collection of continuous (filter/resin) samples:

- clean "Universal II" resin columns
- clean glass fiber filters
- clean sock filters
- glass fiber filter wrench
- assorted tools
- stopwatch
- 100-mL graduated cylinder
- plastic bags
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Study the flow diagram of the continuous filter/resin sampling system (Figure 4.3.1) and the pump controller keyboard (Figure 4.3.2).

Obtain the new sock and glass fiber filters and the fresh resin columns.

Proceed to the sample location.

Observe the sampling system for proper setup and note any unusual conditions on the trip sheet.

Record the flow rate displayed on the pump controller.

Measure and record the volume of water passing through the system in 1 min, using the 100-mL graduated cylinder and stopwatch.

Press Config key.

Press ▽ (down arrow).

Press ▽ (down arrow).

Press ▽ (down arrow).

Press ▽ (down arrow).

Record the volume displayed on the pump controller.

If 1) sample change date, press CLR key and go to next step

2) not sample change date, go to next step.

Press ▽ (down arrow).

Press CLR key.

If 1) sample change date, go to next step

2) not sample change date: a) If flow measured in 1 min was less than 45 or greater than 55 mL/min, proceed to SYSTEM CALIBRATION. b) If flow is greater than 45 and less than 55 mL/min, record as such and proceed.

Press Start/Stop key on pump controller keyboard.

Record sample time off.

FILTER/RESIN CHANGE-OUT

Disconnect the sock filter holder (if so equipped) and allow to drain.

Remove the used resin column and allow to drain.

Label the resin column with date on, date off, time on, time off, and location.

Observe the color of the resin column. A properly used column should be yellowish nearly to the top. Note on the trip sheet if column is solid yellow or solid purple.

Remove the glass fiber filter cover plate using the millipore filter wrench.

Remove the used glass fiber filter, using care to avoid loss of any filtered material. Forceps, which are available at each location, may be needed.

Fold the filter carefully.

Place the folded filter into the clear plastic bag.

Label the bag with date on, time on, date off, time off, and location.

Clean the filter holder plates by removing any foreign material.

Place a new filter into the filter holder; waffle side down.

Align the inlet plate, using the alignment stud openings, and lower the plate carefully.

Reassemble the filter holder, tightening the opposing handwheels in pairs to obtain a uniform seal.

Install the new resin column, ensuring that the O-rings are in place in the mounting bracket.

Remove the locking clamp on the sock filter holder to change the sock filter.

Remove the sock filter, being careful not to lose any of the collected material.

Place the sock filter into the plastic bag with the glass fiber filter.

Insert the new sock filter into the filter holder. Filters must be turned inside out to make proper seal. Remove and reseal the O-ring on the filter holder, if necessary, for complete sealing.

Fill the filter holder with water from sample intake reservoir prior to closing the holder.

Replace the filter holder top and tighten locking band firmly.

Press Start/Stop key on pump controller keyboard to restart the pump.

Record the start time.

Check that date on, date off, time on, time off, location, and sample volume are recorded on the trip sheet and sample labels.

Allow the system to come to equilibrium, typically 3 to 5 min, and proceed.

SYSTEM CALIBRATION

Press the Start/Stop key on pump controller keyboard.

Press the CLR key.

Press Calib key.

Wait 2 min, allowing the system to drain.

Place the system outlet tube into the graduated cylinder.

Press Start/Stop key; pump will operate for 30 s.

Continue collecting water for 2 min after pump stops.

Measure the volume of water collected.

Record the volume of water collected on the trip sheet.

Enter the volume of water collected into pump controller keyboard. Care must be taken to use units compatible with system setup parameters. This is liters (i.e., 50 mL = 0.050 L).

Press ▽ (down arrow) after entering volume.

Press CLR key to exit calibration mode.

Press Start/Stop key to restart the pump.

Measure and record the volume of water passing through the system in 1 min using the 100-mL graduated cylinder and stopwatch. Repeat 3 times.

Proper flow rate is between 45 and 55 mL/min; ideally, 50 mL/min.

If volume is greater than 55 or less than 45 mL, system needs recalibration, following the above SYSTEM CALIBRATION steps.

Check to see that the water supply to the pump reservoir is adequate but not excessive. The built-in overflow cannot handle an excessive amount. A small stream of water is adequate.

Deliver the samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet.

Figure 4.3.1. Continuous Water Sampler Flow Diagram

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Figure 4.3.2. Pump Controller Keyboard

Figure 4-2.1. Continuous Water Transfer Flow System

Figure 4-2.2. Pump Control (see Appendix)

5.0 SOIL AND VEGETATION SAMPLING PROCEDURES

INTRODUCTION

Soil and vegetation sampling is performed because the primary pathways to the public would be the atmospheric deposition on the ground and foliage surfaces and subsurface uptake.

- Surface soil samples (Section 5.1) are collected from a number of undisturbed, unirrigated locations.
- Vegetation samples (Section 5.2) are collected to assess the uptake of radionuclides from the surface and subsurface environs.

By comparing the samples from locations in the prevalent downwind direction with samples collected distant from or upwind of the Hanford Site, the contribution of radionuclides from Hanford Site operations can be assessed.

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5.0 SOIL AND VEGETATION SAMPLING PROCEDURES

INTRODUCTION

Soil and vegetation sampling is performed because the primary goal of the project is to determine the extent of contamination in the ground and foliage surface and subsurface layers.

• Surface soil samples (Section 5.1) are collected from a number of undisturbed, untrampled locations.

• Vegetation samples (Section 5.2) are collected to assess the extent of contamination from the surface and subsurface layers.

By comparing the sampled locations in the proposed remedial action with areas collected during the initial assessment of the site, the contribution of various activities to the contamination can be assessed.

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Prepared By	J. Smith	Date	15-04-2017	Lab. Information	
Approved	[Signature]	Date	15-04-2017	Author	J. Smith

5.1 SURFACE SOIL SAMPLES

INTRODUCTION

Soil samples are collected annually at a number of locations surrounding the Hanford Site and are analyzed for radionuclides. These samples provide an indication of the buildup of radionuclides that may become available in an exposure pathway to man. Samples are collected from undisturbed areas.

EQUIPMENT

The following equipment may be needed to collect soil samples:

- 14- x 17-in. plastic bags
- trowel
- "cookie cutter" sampler
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Select 5 spots that are at least 10 paces apart within the desired sampling area and have a minimum of surface vegetation. If the sample site has come under cultivation or is otherwise disturbed, notify the Environmental Monitoring Supervisor so that an alternate site may be selected. Avoid sampling spots that are wind eroded, rocky, or disturbed significantly by animals.

Place the "cookie cutter" sampler on the spot selected and press it into the soil until its top is level with the soil surface.

Hold the sampler and use the trowel to clear away the soil around it.

Slide the trowel under the sampler to cut the soil even with the bottom edge of the sampler.

Lift the sampler and trowel together, turn them over, and trim excess soil from the sampler.

Pour the sample into a plastic bag.

Repeat for the remaining four samples, putting all the samples from the same area into the same plastic bag.

Seal the bag with tape.

Record the date, location, and sample number on the label. Do NOT remove the back of the label.

Double bag the sample, making sure that the label is in between the bags.

Record the date and time on the trip sheet.

Deliver the soil samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet.

Notify the Environmental Monitoring Supervisor of any deviations from this procedure or if any unusual or noteworthy conditions exist.

5.2 VEGETATION SAMPLES

INTRODUCTION

Vegetation samples are collected annually to establish background concentrations of both naturally occurring and fallout radionuclides and to assess any radionuclide build-up that might be attributable to site operations. Samples of new-growth vegetation are taken.

EQUIPMENT

The following equipment may be needed to collect vegetation samples:

- pruning shears or scissors
- leather gloves
- plastic bags
- masking tape
- portable spring scale
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Select vegetation within the designated area.

Collect samples from the perennial shrubs in approximately the same percentages as they grow at each site. For example, if a site appears to consist of 75% sagebrush and 25% rabbitbrush, then the sample collected should be approximately 75% sagebrush and 25% rabbitbrush.

Collect 2 lb of recent growth. The pieces cut should be no more than 6 in. long.

Put the samples in a plastic bag.

Seal the bag with tape.

Record the date, location, and the sample number on the label. Do NOT remove the back of the label.

Double bag the sample, making sure that the label is in between the bags.

Record the date and time on the trip sheet.

Deliver the vegetation samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet.

Notify the Environmental Monitoring Supervisor of any deviations from this procedure or if any unusual or noteworthy conditions exist.

6.0 FARM PRODUCT SAMPLING PROCEDURES

INTRODUCTION

Several types of farm products are collected periodically from several areas in the vicinity of the Hanford Site:

- milk (Section 6.1)
- crops (Section 6.2)
- animal products (Section 6.3).

Radionuclide concentrations are measured to enable the evaluation of potential transfer pathways to humans via food consumption.

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6.1 MILK SAMPLES

INTRODUCTION

Milk is a sensitive indicator of radioiodine (^{129}I) and radiostrontium (^{90}Sr). Samples are collected at locations near the Hanford Site boundary in a direction generally downwind from site facilities and at locations expected to be representative of background concentrations.

EQUIPMENT

The following equipment may be needed to collect milk samples:

- 1- or 2-1/2-gal disposable sample containers
- ice chest and ice
- funnel
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Obtain a new disposable container for each sample scheduled to be collected.

Collect the fresh raw milk samples from the specified locations. Milk may be provided by the dairy or obtained from the raw milk tank. Use the funnel in taking a sample from the tank.

Record the date on the label, and attach the label to the container.

Record the date, time, and name of the dairy on the trip sheet.

Place the filled sample containers in the ice chest to transport them to the analytical laboratory. Protect milk samples from degradation or spoilage by keeping them in cold storage until you deliver them to the appropriate laboratory.

Samples are delivered twice each year to the 320 Building; all other samples are delivered to United States Testing Company, Inc.

Deliver the samples to the laboratory's sample-receiving areas as soon as practical after collection. If samples cannot be delivered the day they are collected, store them in a refrigerator overnight.

Have the person receiving the samples sign the trip sheet.

Notify the Environmental Monitoring Supervisor of any deviations from this procedure or if any unusual or noteworthy conditions exist.

6.2 CROP SAMPLES

INTRODUCTION

Crops include leafy vegetables, fruit, wheat, and alfalfa. The samples are used to determine if Hanford-originated radionuclides are present in locally produced food or livestock feed. In addition, because fruit, wheat, and alfalfa are major export crops from the Columbia Basin and surrounding areas, sample results enable evaluation of the potential Hanford Site impact on people living in other areas where the crops are consumed.

EQUIPMENT

The following equipment may be needed to collect crop samples:

- plastic bags
- grass clippers or pruning shears
- masking tape
- portable spring scale
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Table 6.2.1 outlines the special procedures to be used for each sample type and size.

Collect the samples as scheduled from designated areas or according to the directions of the Environmental Monitoring Supervisor. All three samples may or may not be from the same farm within the sampling area, but each individual sample should consist of material from a single farm.

Collect an individual sample for each label (generally, you will have three labels per crop per sample area).

Contact the Environmental Monitoring Supervisor if additional sources are needed.

Place the sample into a plastic bag.

Seal the bag with tape.

Record the date, location, and sample number on the label. Do NOT remove the back of the label.

Double bag the sample, making sure the label is in between the bags.

Record the date, name of the farm, and address of the farm on the trip sheet. If the name of the farm is not known, give the specific location of where the sample was collected.

Deliver the samples to the United States Testing Company, Inc., sample-receiving area as soon as practical after collection, and have the person receiving them sign the trip sheet.

Notify the Environmental Monitoring Supervisor of any deviations from this procedure, or if any unusual or noteworthy conditions exist.

Table 6.2.1. Special Instructions for Crop Samples

<u>Sample</u>	<u>Sample Size, lb</u>	<u>Special Instructions</u>
Cherries	3 to 4	Collect fresh, ripe fruit. Sample should not contain dried or spoiled fruit.
Apples	3 to 4	Collect fresh, ripe fruit. Sample should not contain dried or spoiled fruit.
Grapes	3 to 4	Collect fresh, ripe fruit. Sample should not contain dried or spoiled fruit.
Wheat	3 to 4	Grain samples can be obtained from a truck or elevator.
Alfalfa	3 to 4	Use grass clippers to collect samples of cut, field-dried hay.
Leafy vegetables	3 to 4	Collect only edible portions. Do not include roots or dirty leaves. Samples may consist of a mixture <u>or</u> any one of the following: leaf lettuce, spinach, mustard greens, turnip greens, cabbage leaves (not the head), or kale.

6.3 ANIMAL PRODUCT SAMPLES

INTRODUCTION

Animal products include beef, poultry, and eggs. Samples are collected only from locally grown animals. The samples are used to determine whether Hanford Site-originated radionuclides are present in locally grown animals.

EQUIPMENT

The following equipment may be necessary for collecting samples:

- plastic bags
- cartons
- masking tape
- ice chest(s) and ice
- portable spring scale
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Note special procedures for sample type and size in Table 6.3.1.

Collect samples for the areas identified on the labels.

Put the meat samples in plastic bags; eggs in the cartons.

Seal the bag/carton with tape.

Record the date, location, and sample number on the label. Do NOT remove the back of the label.

Double bag the sample, making sure the label is in between the bags.

Record the date, name of the farm, and address of the farm on the trip sheet. If the name of the farm is not known, give the specific location of where the sample was collected.

Carefully place the labeled samples into the ice chest for transport.

Return the samples to the 2400 Stevens Building and prepare the chicken sample, if necessary, by skinning and filleting the breast.

If the samples are not delivered to United States Testing Company, Inc. (UST) on the day of collection, store them in the refrigerator.

Deliver the labeled samples as soon as practical to UST's sample-receiving area, and have the person receiving them sign the trip sheet.

Notify the Environmental Monitoring Supervisor of any deviations from this procedure or if any unusual or noteworthy conditions exist.

DISPOSAL OF WASTE TISSUES

Nonradioactive waste tissues from animal and fish samples processed in the laboratory must be disposed of in the 331 Building pathological incinerator using the procedures outlined below. Sample activity must be less than 2 nCi/g and nondetectable with portable survey instruments to be classified as nonradioactive.

Packaging

Wastes shall be double bagged in 4-mil polyethylene bags and each bag shall be sealed separately with tape. Larger samples can be bagged as described above and placed into waste cartons (Stores catalog #42-1580-130 and lid #42-1580-131). These cartons should not weigh more than 25 lb nor be larger than 12 x 15 x 10 in. The lids shall be taped to the carton.

Labeling

Each waste package shall be labeled with the generator's name and the date. An incinerator waste tag shall be completed and attached to each waste package. Waste packages without completed waste tags shall not be collected for incineration. Waste tags can be obtained from the Environmental Monitoring Supervisor, when needed.

Disposal

Properly labeled packages should be delivered to room C-1 (cold storage room) in the 331 Building. The Environmental Monitoring Supervisor will ensure that Waste Management (376-1631) and the 331 Building Manager (376-7012) are contacted prior to delivery of the materials.

Table 6.3.1. Special Instructions for Animal Product Samples

<u>Sample</u>	<u>Sample Size</u>	<u>Special Instructions</u>
Beef	2 lb	Sample should be ground (i.e., hamburger)
Chicken	1 lb	Meat, with skin removed, should be submitted for analysis
Eggs	1 doz	Large preferred

7.0 WILDLIFE SAMPLING PROCEDURES

INTRODUCTION

Wildlife samples collected annually on or near the Hanford Site include the following:

- fish (Section 7.1)
- game birds (Section 7.2)
- ducks (Section 7.3)
- rabbits (Section 7.4)
- deer (Section 7.5).

The wildlife samples are collected to assess the potential dose impact to the public from both current and past Hanford Site operations, and to reassure the public that Pacific Northwest Laboratory (PNL) is capable of identifying noteworthy changes in the status of the environment.

SAFETY AND SECURITY

Hunting safety measures must be observed at all times. Only those personnel who have completed the PNL gun safety training class shall be issued guns and ammunition. Extreme care must be taken at all times while handling firearms. Any unsafe practice observed should be reported immediately to the Environmental Monitoring Supervisor. Guns shall be cleaned after use, and the guns and ammunition shall be stored in the gun cabinet. The gun cabinet shall be locked at all times, except while removing or returning equipment.

DISPOSAL OF WASTE TISSUES

Nonradioactive waste tissues from animal and fish samples processed in the laboratory must be disposed of in the 331 Building pathological incinerator using the procedures outlined below. Sample activity must be less than 2 nCi/g and nondetectable with portable survey instruments to be classified as nonradioactive.

Packaging

Wastes shall be double bagged in 4-mil polyethylene bags and each bag shall be sealed separately with tape. Larger samples can be bagged as described above and placed into waste cartons (Stores catalog #42-1580-130 and lid #42-1580-131). These cartons should not weigh more than 25 lb nor be larger than 12 x 15 x 10 in. The lids shall be taped to the carton.

Concurrence <i>K R Loren</i>	Date 2-8-90	Approval <i>G. L. L. / E. J. J.</i>	Date 2-9-90
Prepared by <i>Rw Hays</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 7.0	Revision No. 1	Effective Date: 2-90	

Labeling

Each waste package shall be labeled with the generator's name and the date. An incinerator waste tag shall be completed and attached to each waste package. Waste packages without completed waste tags shall not be collected for incineration. Waste tags can be obtained from the Environmental Monitoring Supervisor, when needed.

Disposal

Properly labeled packages should be delivered to room C-1 (cold storage room) in the 331 Building. The Environmental Monitoring Supervisor will ensure that Waste Management (376-1631) and the 331 Building Manager (376-7012) are contacted prior to delivery of the materials.

7.1 FISH SAMPLES

INTRODUCTION

Collecting samples of fish from the Columbia River satisfies three objectives: 1) analyzing potential dose pathways, 2) verifying that the release and storage of radioactive waste materials from Hanford Site facilities are under control, and 3) reassuring the public that sport fish do not provide a means of exposure to harmful levels of radioactive materials of Hanford origin. Samples collected to verify control require that similar samples be collected from background areas away from the influence of Hanford to allow the comparison of data and identification of loss-of-control situations.

EQUIPMENT

The following equipment may be needed to collect fish samples:

- sport fishing tackle: poles, reels, landing nets, and bait or lures
- boat and equipment, including safety gear
- gloves
- portable ice chest and ice
- 8-oz styrene sample jars with lids
- fillet knife
- Geiger-Müller (GM) survey meter
- plastic bags
- masking tape
- valid collection permit
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Collect routine samples as scheduled by the Environmental Monitoring Supervisor

Obtain the fish samples using sport gear and normal, safe fishing procedures.

Survey each fish with a GM survey meter; enter the results on the trip sheet.

Clean the fish and leave the entrails at the site of cleaning.

Put each cleaned fish into a separate plastic bag; seal with tape; label the bag and place it in the ice chest. Take the samples to the 2400 Stevens Building and prepare them for laboratory analysis.

SAMPLE PREPARATION PROCEDURE

Lay out a piece of "diaper" paper and prepare skinless fillets from both sides of each fish.

Rinse the fillets briefly in tap water, blot any excess water with a paper towel, and place the fillets into an 8-oz styrene sample jar. Fill each jar with as much boneless muscle sample as one fish will provide.

Write the collection date on the label, and affix the label to the jar.

Rinse the remainder of the fish (carcass) briefly in tap water, blot any excess water with a paper towel, and put the carcass into an 8-oz styrene sample jar. If there is too much sample, remove the tail and then the head, if necessary. Note on the trip sheet if the tail or head was removed from the carcass sample.

Write the collection date on the label, and affix the label to the jar.

Place each sample jar into a clean plastic bag and seal the end of the bag with masking tape.

Discard all waste tissue as appropriate.

Make sure that you have recorded on the trip sheet the species, time, collection date, and survey meter readings.

Deliver the samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet. If samples cannot be delivered, store them in the refrigerator until delivery.

Clean fishing gear and boat after each use.

7.2 GAME BIRD SAMPLES

INTRODUCTION

Collecting samples of game birds from on-site and off-site locations satisfies three objectives: 1) analyzing potential dose pathways, 2) verifying that the release and storage of radioactive waste materials from Hanford Site facilities are under control, and 3) reassuring the public that game birds do not provide a means of exposure to harmful levels of radioactive materials of Hanford origin.

EQUIPMENT

The following equipment may be necessary to collect game bird samples:

- Radiation Work Procedure (RWP) and RWP clothing
- shotguns and ammunition
- portable ice chest and ice
- 8-oz styrene sample jars with lids
- portable survey meters
- sharp knife or scalpel
- disposable rubber gloves
- plastic bags
- masking tape
- "diaper" paper
- valid collection permits
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Review and comply with applicable RWPs for collecting game bird samples from radiation zones.

Collect the routine samples as scheduled by the Environmental Monitoring Supervisor.

Use normal, safe hunting procedures.

Collect the game bird samples from the designated on-site areas by using a shotgun.

Survey the sample. If the sample is greater than 200 counts/min, RWP requirements apply. Record the reading on the trip sheet, and notify the Environmental Monitoring Supervisor.

While in the field, place the sampled bird on a clean plastic bag or piece of "diaper" paper to remove breast, thighs with bone, and liver.

Wearing disposable gloves, remove skinless pieces of breast muscle and place them in a plastic bag.

Skin and remove both thighs with the bones and place them in the plastic bag with the breast muscle.

Remove the liver and place it in the plastic bag with the breast and thigh.

CAUTION: DO NOT CONTAMINATE the sample with dirt, feathers, gastrointestinal (GI) tract contents, or any other foreign material. Samples shall not contain shot.

Close and seal the bag with masking tape, mark it with the species and location, and place it in the ice chest for transport.

Leave carcasses in the field. Do not remove them from a radiation zone if they were collected within the zone.

Survey the gloves, plastic or "diaper" paper, and other material used to prepare the samples, and place them in a plastic bag for proper disposal. If the survey meter reading is greater than 200 counts/min, notify the Environmental Monitoring Supervisor.

Take the samples to the 2400 Stevens Building, and prepare a sample for laboratory analysis.

GENERAL SAMPLE PREPARATION PROCEDURE

In the laboratory, lay out a piece of "diaper" paper and open a plastic sample bag.

Rinse the breast muscle samples briefly in tap water, blot the excess water with a paper towel, and place the sample into an 8-oz styrene sample jar. Fill the jar with the sample. If the breast muscle is insufficient, add muscle tissue from the thighs.

Write the collection date and species on the trip sheet and the sample label, and affix the label to the sample jar.

Place the styrene jar in a plastic bag. Close and seal the bag with masking tape.

Rinse the remainder of the samples from each bird (thigh and bone, and liver) briefly in tap water, blot the excess water with a paper towel, and put the samples into a plastic bag. Double bag the sample, and close and seal the end with masking tape.

Identify the bag with the sample number of the muscle sample, the species, and the collection date, and store the bag in the freezer. Analyses of these tissues will be necessary only if the ^{137}Cs content of the muscle tissue is determined to exceed 100 pCi/g.

Discard all waste tissue as appropriate.

Deliver the samples to United States Testing Company, Inc. (UST), and have the person receiving them sign the trip sheet, or store them in the refrigerator until delivery.

LIVER SAMPLE PREPARATION PROCEDURE

Obtain the desired sample from the freezer when instructed by the Environmental Monitoring Supervisor.

Place the liver sample in an 8-oz styrene sample jar and attach the lid.

Write the collection date and species on the label, and affix the label to the jar.

BONE SAMPLE PREPARATION PROCEDURE

Carefully remove all muscle tissue from the bone by scraping the surface with a knife or scalpel.

Survey the bone samples with a portable instrument for possible ^{90}Sr contamination. Report results on the trip sheet.

Place the two bone samples in an 8-oz styrene sample jar and attach the lid.

Write the collection date and species on the label, and affix the label to the jar.

Place each sample jar in a clean plastic bag, and seal the end of the bag with masking tape.

Discard all waste tissue as appropriate.

Complete the trip sheet by adding the collection date and species.

Deliver the samples to UST, and have the person receiving them sign the trip sheet.

7.3 WATERFOWL SAMPLES

INTRODUCTION

Collecting samples of waterfowl from on-site ponds, ditches, and trenches and from the Columbia River satisfies three objectives: 1) analyzing potential dose pathways, 2) verifying that the release and storage of radioactive waste materials from Hanford Site facilities are under control, and 3) reassuring the public that waterfowl do not provide a means of exposure to harmful levels of radioactive materials of Hanford origin. Samples collected to verify control require the comparison of results to background samples or an adequate historical record. The historical record will be used in this case.

EQUIPMENT

The following equipment may be necessary to collect waterfowl samples:

- Radiation Work Procedure (RWP) and RWP clothing
- shotguns and ammunition
- pram boat and equipment, including safety gear
- portable ice chest and ice
- 8-oz styrene sample jars with lids
- sharp knife or scalpel
- disposable rubber gloves
- duck traps
- bait
- portable survey meters
- "diaper" paper
- plastic bags
- masking tape
- valid collection permits
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Review and comply with applicable RWPs for collecting waterfowl samples from radiation zones.

Collect the routine samples by trap or shotgun, as scheduled by the Environmental Monitoring Supervisor.

Use normal, safe hunting procedures.

Collect no more than five ducks per week from B Pond during the sampling period, unless the quota has not been filled by the final week.

Survey each sample. If the sample is greater than 200 counts/min, RWP requirements apply. Record the reading on the trip sheet, and notify the Environmental Monitoring Supervisor.

While in the field, place the sampled bird on a clean plastic bag or piece of "diaper" paper to remove breast, thighs with bone, and liver.

Wearing disposable gloves, remove skinless pieces of breast muscle and place them in a plastic bag.

Skin and remove both thighs with the bones and place them in the plastic bag with the breast muscle.

Remove the liver and place it in the plastic bag with the breast and thighs.

CAUTION: DO NOT CONTAMINATE the sample with dirt, feathers, gastrointestinal (GI) tract contents, or any other foreign material. Samples shall not contain shot.

Close and seal the bag with tape, mark it with the species and location, and place it in the ice chest for transport.

Leave carcasses in the field. Do not remove them from a radiation zone if they are collected within the zone.

Survey the gloves, plastic or "diaper" paper, and other material used to prepare the samples, and place them in a plastic bag for proper disposal. If the survey meter reading is greater than 200 counts/min, notify the Environmental Monitoring Supervisor.

TRAPPING PROCEDURE

Place the traps in water no more than 18 in. deep.

Bait the trap with whole, shelled corn, wheat, or barley.

Prebait the area for two to three days before you open the trap entrance. Use approximately 10 pounds of corn per day per trap site. Do not overbait, since this may attract ducks from off the site.

Set the trap when ducks have obviously been eating the bait.

Make sure the entrance is 5 to 6 in. wide (just enough for a duck to squeeze through). Points of the cut wire on the entrance should point inward, so the duck cannot escape.

Check the traps every morning that they are in use.

Keep only mallard ducks during the first half of the trapping period. If the sampling quota will not be met, other puddle ducks^(a) may be taken during the second half of the period.

GENERAL SAMPLE PREPARATION PROCEDURE

At the laboratory, lay out a piece of "diaper" paper and open a plastic sample bag.

Rinse the breast muscle samples briefly in tap water, blot the excess water with a paper towel, and place the muscle into an 8-oz styrene sample jar. Fill the jar with the sample. If the breast muscle is insufficient, add muscle tissue from the thighs.

Write the collection date and species on the trip sheet and sample label, and affix the label to the sample jar.

Place the styrene jar in a plastic bag. Close and seal the bag with masking tape.

Rinse the remainder of the samples from each duck (thigh and bone, and liver) briefly in tap water, blot the excess water with a paper towel, and place the samples in plastic bags. Double bag the sample, and close and seal the ends with masking tape.

Identify the bags with the sample number of the muscle sample, the species, and the collection date, and store the bags in the freezer. Analyses of these tissues will be necessary only if the ¹³⁷Cs content of the muscle tissue is determined to exceed 100 pCi/g.

Discard all waste tissue as appropriate.

Deliver the samples to United States Testing Company, Inc. (UST), and have the person receiving them sign the trip sheet, or store them in the refrigerator until delivery.

BONE AND LIVER SAMPLE PREPARATION PROCEDURE

Obtain the desired sample from the freezer when instructed by the Environmental Monitoring Supervisor.

Place the liver sample in an 8-oz styrene sample jar and attach the lid.

Write the collection date and species on the label, and affix the label to the jar.

(a) Puddle ducks are mallards, widgeons, gadwalls, pintails, shovelers, blue-winged teals, and green-winged teals.

Carefully remove all muscle tissue from the bone by scraping with a knife or scalpel.

Survey the bone samples with a portable instrument for possible ^{90}Sr contamination. Report results on the trip sheet.

Place the two bone samples in an 8-oz styrene sample jar and attach the lid.

Write the collection date and species on the label, and affix the label to the jar.

Place each sample jar in a clean plastic bag, and seal the end of the bag with masking tape.

Discard all waste tissue as appropriate.

Complete the trip sheet by adding the collection date and species.

Deliver the samples to UST, and have the person receiving them sign the trip sheet.

7.4 RABBIT SAMPLES

INTRODUCTION

Cottontail rabbits and jackrabbits are collected from on-site areas to provide data for verifying that the release and storage of radioactive waste materials from Hanford Site facilities are under control. Verification of control requires the comparison of sample results to background samples or an adequate historical record.

EQUIPMENT

The following equipment may be necessary to collect rabbit samples:

- Radiation Work Procedure (RWP) and RWP clothing
- shotguns, .22 caliber rifle, and ammunition
- portable ice chest and ice
- 8-oz styrene sample jars with lids
- sharp knife or scalpel
- disposable rubber gloves
- portable survey meters
- plastic bags
- masking tape
- valid collection permits
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Review and comply with applicable RWPs for collecting rabbit samples from radiation zones.

Collect the routine samples by using a firearm, as scheduled by the Environmental Monitoring Supervisor.

Use normal, safe hunting procedures.

Survey each sample. If the sample is greater than 200 counts/min, RWP requirements apply. Record the reading on the trip sheet, and notify the Environmental Monitoring Supervisor.

While in the field, place the sampled rabbit on a clean plastic bag or piece of "diaper" paper to remove muscle, bone, and liver.

Wearing disposable gloves, skin and remove the hind legs (excluding the feet) and place the legs in a plastic bag.

Remove the liver and place it in the plastic bag with the legs.

CAUTION: DO NOT CONTAMINATE the samples with dirt, hair, gastrointestinal (GI) tract contents, or any other foreign material. Samples shall not contain bullets.

Close and seal the bag with masking tape, mark it with the species and location, and place it in the ice chest for transport.

Leave carcasses in the field. Do not remove them from a radiation zone if they were collected within the zone.

Survey the gloves, plastic or "diaper" paper, and other material used to prepare the samples, and place them in a clean plastic bag for proper disposal. If the survey meter reading is greater than 200 counts/min, notify the Environmental Monitoring Supervisor.

GENERAL SAMPLE PREPARATION PROCEDURE

At the laboratory, lay out a piece of "diaper" paper and open a plastic sample bag.

Rinse the hind legs briefly in tap water, and blot the excess water with a paper towel.

Remove the muscle tissue from each leg and place it in an 8-oz styrene sample jar.

Write the collection date and species on the sample label, and affix the label to the jar.

Carefully scrape all of the remaining muscle tissue from the thigh bone with a knife or scalpel.

Survey the bone samples with a portable instrument for possible beta contamination. Report results on the trip sheet.

Place the two hind leg or muscle samples in an 8-oz styrene sample jar.

Write the collection date and species on the sample label, and affix the label to the jar.

Rinse the liver briefly in tap water, blot the excess water with a paper towel, and place the liver in an 8-oz styrene sample jar.

Write the collection date and species on the sample label, and affix the label to the jar.

Place each sample jar in a clean plastic bag and seal the end of the bag with masking tape.

Discard all waste tissue as appropriate.

Deliver the samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet, or store them in the refrigerator until delivery.

7.5 DEER SAMPLES

INTRODUCTION

Collecting samples of on-site deer satisfies two objectives of the surveillance program. Samples provide data for 1) analyzing potential dose pathways and 2) verifying that the release and storage of radioactive waste materials from Hanford facilities is under control. Verification of control requires the comparison of sample results to background samples or an adequate historical record.

EQUIPMENT

The following equipment may be necessary to collect deer samples:

- Radiation Work Procedure (RWP) and RWP clothing
- shotguns and ammunition (slugs)
- binoculars
- portable ice chest and ice
- sharp knife or scalpel
- bone saw
- portable survey meters
- "diaper" paper
- disposable rubber gloves
- plastic bags
- masking tape
- valid collection permits
- sample labels
- trip sheet.

SAMPLE COLLECTION PROCEDURE

Once each year, two deer are sampled from the 200-East Area near B Pond. Only adult does are to be taken.

Use normal, safe hunting procedures.

Other samples are to be collected from road-killed deer as specified by the Environmental Monitoring Supervisor.

Survey the sample. If the sample is greater than 200 counts/min, RWP requirements apply. Record the reading on the trip sheet, and notify the Environmental Monitoring Supervisor.

While in the field and wearing disposable gloves and working on "diaper" paper, remove approximately 2 lb of muscle from the hind legs and place it in a plastic bag.

Cut into the gut and locate the liver. Remove 2 lb of the liver and place it in a plastic bag.

For 200-East Area deer, remove two pieces of thigh bone, each approximately 3 in. long, and place them in a plastic bag.

CAUTION: DO NOT CONTAMINATE the samples with dirt, hair, gastrointestinal (GI) tract contents, or any other foreign material. Samples shall not contain slugs.

Close and seal the bags with masking tape, mark them with the species, date of collection, and location, and place them in the ice chest for transport.

Leave carcasses in the field. Do not remove them from a radiation zone if they were collected within the zone.

Survey the gloves, plastic or "diaper" paper, and other material used to prepare the samples, and place them in a plastic bag for proper disposal.

SAMPLE PREPARATION PROCEDURE

At the laboratory, lay out a piece of "diaper" paper and open a plastic sample bag.

Rinse the muscle sample briefly in tap water, blot the excess water with a paper towel, and place the muscle sample in a plastic bag.

Write the collection date and the species on the sample label, and affix the label to the plastic bag.

Rinse the liver sample briefly in tap water, blot the excess water with a paper towel, and place the liver in a plastic bag.

Seal the bag with tape.

Record the date, location, and species on the label. Do NOT remove the back of the label.

Double bag the sample, making sure that the label is in between the bags.

For 200-East Area deer:

- Scrape all muscle tissue from the bone samples with a knife or scalpel. Survey the bone samples with a portable instrument for possible ^{90}Sr contamination. Report the results on the trip sheet.

- Place the two bone samples in a plastic bag. Write the collection date on the label, and affix the label to the plastic bag.

Place each sample bag into another plastic bag and seal the end with masking tape.

Discard all waste tissue as appropriate.

Deliver the samples to United States Testing Company, Inc., and have the person receiving them sign the trip sheet, or store them in the refrigerator until delivery.

8.0 SPECIAL SAMPLING PROCEDURES

INTRODUCTION

A radiological event could involve a number of different environmental conditions requiring a special response, including sampling milk, air, soil, surface water, or ground water. Unless specified otherwise, soil, native vegetation, foodstuffs, and water will be sampled according to the routine procedures described in Sections 3.0 through 7.0 of this manual.

This section includes procedures for special air sampling equipment designated for special responses:

- emergency surface monitoring (Section 8.1)
- maintenance of the emergency environmental monitoring program (Section 8.2)
- emergency thermoluminescent dosimeter exchange (Section 8.3)
- emergency particulate air sampling and analysis using the annular kinetic impactor (Section 8.4)
- emergency radioiodine sampling and analysis (Section 8.5)
- high-volume air samples - filter paper (Section 8.6)
- medium-volume air samples (Section 8.7)
- rapid environmental survey - portable survey meters (Section 8.8)
- emergency aerial monitoring - equipment setup (Section 8.9)
- emergency aerial monitoring - plume tracking (Section 8.10).

Concurrence <i>K.R. Pickett</i>	Date 2-8-90	Approval <i>Arthur E. Jorgensen</i>	Date 2-9-90
Prepared by <i>Rw Hay</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
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8.1 EMERGENCY SURFACE MONITORING

INTRODUCTION

In the event of an accidental radiological release from a Hanford Site facility, the Environmental Monitoring Group will perform surface and aerial radiological monitoring as requested by the Unified Dose Assessment Center (UDAC). Surface monitoring teams monitor off-site locations and assist the event contractor in monitoring on-site locations as requested. Aerial monitoring will be performed in any on-site or off-site locations specified by UDAC.

This procedure serves as a guide for locating a radioactive plume. Actual monitoring techniques are governed by Section 8.8, Rapid Environmental Survey - Portable Survey Meters.

RESPONSIBILITY

The Environmental Monitoring Supervisor will direct field teams and monitoring activities from the 2400 Stevens Building.

The Environmental Monitoring Supervisor will be in direct communication with the Field Team Director in UDAC who coordinates monitoring activities with Westinghouse Hanford Company.

EQUIPMENT

The following equipment may be required for emergency surface monitoring:

- four-wheel-drive vehicle (if available)
- emergency surface monitoring supply kit
- micro-R-meter
- high-volume air sampler (with particulate and iodine filters)
- portable two-way radio as a backup.

PRECAUTIONS

All Hanford safety procedures are applicable.

Respiratory protection shall be worn when there is a potential for exposure to airborne contaminants.

Monitoring personnel are responsible for conducting their activities in a safe and efficient manner. Contamination prevention and dose reduction techniques shall be used at all times. Accumulated exposures shall be tracked by response personnel and reported to the Environmental Monitoring Supervisor on a frequent basis as specified by the Supervisor. Every reasonable attempt not to exceed administrative dose limits shall be made.

After securing an emergency response kit, each person on the monitoring team shall be issued a pocket ionization chamber (pencil dosimeter) that has been zeroed. The time, reading, and serial number shall be recorded on the Emergency Surface Monitoring Data Sheet (Exhibit 8.1.1).

At all times when in the field, the contamination monitor shall be operating with the audible switch in the ON position. A count rate above background would indicate the potential for airborne contaminants that may require respiratory protection.

PLUME MONITORING

Monitoring a radioactive plume is necessary for collecting valuable information for personnel performing assessments and developing protective action recommendations. However, monitoring can be a somewhat hazardous operation, involving both internal and external exposures to monitoring personnel. To minimize risks and keep radiation exposures as low as reasonably achievable, plume monitoring shall be performed using the following guidelines.

PLUME DOSE RATE DETERMINATION

Plume Side Edge Determination

Initial contact with a plume containing gamma emitters should register on the micro-R-meter at a significant distance from the plume. As the plume is approached and entered, a positive open-window reading on the survey meter may be obtained. If the plume has a significant beta component, the difference in the open/closed meter reading will clearly define the plume location.

Dose rate readings shall be taken at waist level outside the vehicle with the meter directed to the horizon. Readings may be taken from the window of a vehicle while stationary or moving. Whenever possible, obtain readings away (greater than 25 ft) from large objects that could cause less than a 4-Pi reading due to shielding effects. Document all readings on the Emergency Surface Monitoring Data Sheet (Exhibit 8.1.1) and note any special conditions that could affect accuracy of the readings. Report readings to the Environmental Monitoring Supervisor.

Plume Leading and Trailing Edge Determination

The leading and trailing edges of the plume are found in much the same way as the side edge (see above discussion). A significant difference is that monitoring of the trailing edge may be complicated because of particle deposition on the ground. This may be determined by taking an open-window reading within inches of the ground and comparing that to an open-window reading six or more feet above the ground with the window pointed away from the ground.

**Plume Centerline
Determination**

If it is determined that the radionuclide concentration in the plume is not hazardous to monitoring personnel, determination of the location and magnitude of the plume centerline is recommended.

To determine centerline location, Radiation Protection Technologists (RPTs) should be directed to monitor a cross section of the plume, preferably on a paved road. As the vehicle traverses the plume, readings are taken in a consistent manner, either with the survey meter on the dashboard of the vehicle with the windows up, or with the survey meter outside an open window. The highest reading on the cross-section traverse indicates the centerline. Document this location and the reading on the data sheet. After the plume has been crossed, remove the respiratory protection equipment and report the findings to the Environmental Monitoring Supervisor.

If the composition of the plume is unknown, a quick air sample in the plume would be valuable in assessing the accident. The sample should be taken in an area that would not cause excessive personnel exposure, but would provide a good indication of what is in the plume. Report to the Environmental Monitoring Supervisor when the sample is obtained. Be prepared to promptly transport the sample to another location for analysis.

GROUND DEPOSITION

During the passage of a plume, some radioactive materials are expected to be deposited on the ground, unless the plume contains primarily radioactive gases. It is important to assessment personnel to know the extent of the remaining ground contamination so that recommendations for public protection may be made. This may be determined in the following steps:

- Using a survey instrument with a pancake probe, test to see that the plume has indeed passed the area. Hold the probe as high as possible above the ground with the window pointed up. The count rate should be basically the same as normal background if the plume has passed. Record the reading.
- Hold the pancake probe away from your body at a 1-m height above the ground. The window should be directed toward the ground. Record the reading. With the probe in the same location, cover the window with a beta shield (piece of thick paper, 1- to 2-mm aluminum, beta shield, etc.) and record the reading.

- Take a reading 1-in. from the ground with the window directed to the ground. Record the reading. With the probe in the same location, cover the probe window with a beta shield. Again, record the reading.

In all cases, be sure to record the conditions under which readings were taken. The pertinent information includes open or shielded window, distance from ground, direction of window, date, time, and location of survey. Return all survey forms to the Environmental Monitoring Supervisor.

AIR SAMPLING

The method of air sampling is described in the following sections in this manual:

- Section 8.4, Emergency Particulate Air Sampling and Analysis Using the Annular Kinetic Impactor
- Section 8.5, Emergency Radioiodine Sampling and Analysis
- Section 8.6, High-Volume Air Samples - Filter Paper
- Section 8.7, Medium-Volume Air Samples.

EMERGENCY SURFACE MONITORING DATA SHEET

[illegible]

Radiation Protection Technologist _____ Date _____

Environmental Monitoring Supervisor

8.2 MAINTENANCE OF THE EMERGENCY MONITORING PROGRAM

INTRODUCTION

The surface and aerial monitoring program for emergency response relies heavily on special monitoring equipment and the performance of assigned staff and technicians. To ensure that appropriate equipment is available and operational when needed, this procedure specifies an inventory and operational check of equipment on a periodic basis. This procedure also specifies a frequency for training and exercising response staff on emergency procedures.

PERSONNEL TRAINING

Environmental Monitoring Group personnel are required to be trained on a periodic basis to maintain proficiency in emergency response duties. At a minimum, each Radiation Protection Technologist (RPT) is required to have two hours of classroom instruction per year on emergency response duties. In addition, these personnel are to participate in at least one emergency response exercise or drill in any two-year period.

RESPONSIBILITY

The Environmental Monitoring Supervisor is responsible for ensuring that periodic inventories are made of the environmental monitoring kits, records of those inventories are maintained, and that RPTs are properly trained.

EQUIPMENT

No equipment is needed except what is being inventoried. A small check source is required for the operation check of radiological instrumentation. Use an appropriate inventory check sheet form (Exhibits 8.2.1 through 8.2.4) to document the results of the inventory.

EQUIPMENT INVENTORY AND FREQUENCY

The following equipment and emergency kits are to be inventoried immediately after each use and at a frequency not exceeding six months:

- Aerial Monitoring Instrument Kit (1) (2400 Stevens)
- Aerial Monitoring Supply Kit (1) (2400 Stevens)
- Emergency Surface Monitoring Supply Kits (9) (Monitoring Vehicles).
- Emergency Air Sampling Kits (4) (3 in Monitoring Vehicles and 1 in 2400 Stevens)

In addition, the above-listed kits and equipment are to be visually inspected on a quarterly basis. Any observed abnormality or broken seal requires a prompt inventory.

PROCEDURE

Obtain a clean copy of the appropriate inventory form (Exhibits 8.2.1 through 8.2.4) for each emergency kit to be inventoried.

Locate the equipment or kit, and designate on the form if the location is as specified in this procedure.

Check the contents of the kit against the inventory sheet.

Items that can be checked for operability (flashlights, radiological instruments, etc.) shall be checked. Items that do not operate satisfactorily shall be replaced or repaired promptly and a notation made on the inventory form.

Spare batteries in the kits shall be replaced on an annual basis.

Equipment (radiological monitoring, air samples, etc.) having calibration due dates prior to the next inventory shall be replaced with equipment that has a valid calibration.

Note any discrepancies or anomalies on the form.

After the inventory is taken, corrected, and completed, place a seal on the latch, such that the seal must be broken to open the kit.

Sign and date the completed inventory form and return it to the Environmental Monitoring Supervisor for review and final disposition.

INVENTORY OF AERIAL MONITORING INSTRUMENT KIT

Kit Number _____

Date of Inventory _____

Location of Kit _____

	<u>Okay</u>	<u>Missing</u>	<u>Requires Replacement</u>
(1) Portable scaler rate meter	_____	_____	_____
(1) Compatible cables	_____	_____	_____
(1) Scintillation detector 3 x 3 x 4 in.	_____	_____	_____
(1) Battery-powered strip-chart recorder and supplies (chart paper, ink, pen cleaner)	_____	_____	_____
(3) AA-cell batteries	_____	_____	_____
(4) D-cell batteries	_____	_____	_____
(2) Recorder connecting wires	_____	_____	_____
(1) Portable radio (safety net frequency)	_____	_____	_____
(1) Lead shielding	_____	_____	_____
(1) Surface Environmental Monitoring Procedures Manual (PNL-MA-580)	_____	_____	_____

COMMENTS _____

Inventoried by _____ Date _____

Environmental
Monitoring Supervisor _____ Date _____

INVENTORY OF AERIAL MONITORING SUPPLY KIT

Kit Number _____

Date of Inventory _____

Location of Kit _____

	<u>Okay</u>	<u>Missing</u>	<u>Requires Replacement</u>
(1) Folder with data sheets	_____	_____	_____
(1) Set of maps	_____	_____	_____
(3) Highlight markers	_____	_____	_____
(1) Clipboard with paper	_____	_____	_____
(1) Masking tape (roll)	_____	_____	_____
(3) Self-read dosimeters	_____	_____	_____
(1) Dosimeter charger	_____	_____	_____
(1) Flashlight	_____	_____	_____
(3) Pens	_____	_____	_____
(4) Spare D-cell batteries	_____	_____	_____
(3) Spare AA-cell batteries	_____	_____	_____
(6) Pair of latex disposable gloves	_____	_____	_____
(1) 16-in. ruler	_____	_____	_____
(2) Bottles potassium iodine (KI)	_____	_____	_____

COMMENTS _____

Inventoried by _____ Date _____

Environmental
Monitoring Supervisor _____ Date _____

Exhibit 8.2.2. Check Sheet for Aerial Monitoring Supply Kit

INVENTORY OF EMERGENCY SURFACE MONITORING SUPPLY KITS

Kit Number _____

Date of Inventory _____

Location of Kit _____

	<u>Okay</u>	<u>Missing</u>	<u>Requires Replacement</u>
<u>Protective Clothing</u>			
(2) Coveralls	_____	_____	_____
(2) Canvas boots	_____	_____	_____
(2) Hood	_____	_____	_____
(2) Leather gloves	_____	_____	_____
(2) Rubber gauntlets	_____	_____	_____
(2) Respirator and cartridges	_____	_____	_____
<u>Tools</u>			
(1) Plastic "zip-strip" cable ties (bag)	_____	_____	_____
(1) Compass	_____	_____	_____
(1) Wind meter	_____	_____	_____
(1) Walking stick	_____	_____	_____
(1) Flashlight	_____	_____	_____
(2) Batteries (sets)	_____	_____	_____
(20) 12- x 15-in. plastic bags	_____	_____	_____
(1) Masking tape (roll)	_____	_____	_____
(1) Trowel	_____	_____	_____
(1) Radiation zone rope (100 ft)	_____	_____	_____
(10) 3- x 4-in. radioactive material labels	_____	_____	_____
(1) Wire cutters	_____	_____	_____
(1) Spray paint	_____	_____	_____
<u>Paper Supplies and Other Aids</u>			
(1) Grease pencil	_____	_____	_____
(2) Felt-tip marking pens (red and black)	_____	_____	_____
(1) Mechanical pencil	_____	_____	_____
(1) Clipboard	_____	_____	_____
(1) Paper tablet	_____	_____	_____
(10) Emergency Response Data Sheets	_____	_____	_____

Exhibit 8.2.3. Check Sheet for Emergency Surface Monitoring Supply Kit

Issued: 2-90

Supersedes: New

PNL-MA-580

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- (3) Maps--Franklin and Benton Counties
and Washington-Oregon
- (1) Hanford Site map
- (1) Surface Environmental Monitoring
Procedures Manual (PNL-MA-580 in
vehicle)
- (1) Pocket dosimeter and charger
- (1) Bottles potassium iodine (KI)

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

COMMENTS _____

Inventoried by _____ Date _____

Environmental
Monitoring Supervisor _____ Date _____

Exhibit 8.2.3. (contd)

INVENTORY OF EMERGENCY AIR SAMPLING KIT

Kit Number _____

Date of Inventory _____

Location of Kit _____

	<u>Okay</u>	<u>Missing</u>	<u>Requires Replacement</u>
<u>High-Volume Impactor</u>			
(1) High-volume air sampler	_____	_____	_____
(1) Tripod, including mounting plate and hardware	_____	_____	_____
(1) Kinetic impactor head with rubber gasket	_____	_____	_____
(24) 2-in. counting disks	_____	_____	_____
(1) Bottle of grease	_____	_____	_____
(1) 8- x 10-in. filter-head assembly with rubber gasket	_____	_____	_____
(10) 8- x 10-in. glass fiber filters	_____	_____	_____
(5) High-Volume Air Sample Form (Exhibit 8.6.1)	_____	_____	_____
<u>Medium-Volume Sampler</u>			
(10) 4-in. glass fiber filters	_____	_____	_____
(1) Air sampling hutch	_____	_____	_____
(10) Trip sheets	_____	_____	_____
(1) Rope (15 ft)	_____	_____	_____
(1) Medium-volume air sampler	_____	_____	_____
<u>Low-Volume Sampler</u>			
(1) Low-volume air sample pump (blue unit in kit)	_____	_____	_____
(1) 4-in. filter/cartridge holder	_____	_____	_____
(1) 4-in. particulate filter paper	_____	_____	_____
(1) 2-in. filter/cartridge holder	_____	_____	_____
(10) 2-in. particulate filter papers	_____	_____	_____
(5) Charcoal cartridges	_____	_____	_____
(5) Silver zeolite cartridges	_____	_____	_____
(2) Radioiodine Concentration Form (Exhibit 8.5.1)	_____	_____	_____
(20) 5- x 8-in. air sample envelopes	_____	_____	_____

Exhibit 8.2.4. Check Sheet for Emergency Air Sampling Kit

Miscellaneous

- (1) Wrench
- (1) Masking tape (roll)
- (5) Marking pens
- (5) Plastic bags
- (5) Pencils
- (20) Sample envelopes
- (1) Surface Environmental Monitoring
Procedures Manual (PNL-MA-580 in
vehicle)

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

COMMENTS _____

Inventoried by _____ Date _____

Environmental
Monitoring Supervisor _____ Date _____

Exhibit 8.2.4. (contd)

8.3 EMERGENCY THERMOLUMINESCENT DOSIMETER (TLD) EXCHANGE

INTRODUCTION

In the event of an accident at a Hanford Site facility involving a release of radioactive materials, the collection and prompt processing of environmental thermoluminescent dosimeters (TLDs) may be necessary.

The Environmental Monitoring Supervisor will specify which environmental TLDs are to be collected and processed.

EQUIPMENT

The following equipment may be necessary for collecting and replacing the TLDs:

- replacement TLDs
- Emergency Surface Monitoring Supply Kit
- cutie pie dose rate meter
- trip sheets
- Geiger-Müller (GM) with pancake probe.

PROCEDURE

Obtain the TLDs from the Radiation Calibrations Laboratory in the 318 Building.

Record the TLD number and location on the trip sheet and dosimeter package.

Record the date and time the TLD is placed in the field.

Mount the TLDs 1 m above the ground at established locations.

If TLDs are placed at locations other than the routine sites, they must be mounted consistent with the others at 1 m above the ground.

Using the GM, survey the TLDs removed from the field. Place the TLDs in a plastic bag, and note on the bag and trip sheet if contamination was detected.

Return the TLDs removed from the field to the Radiation Calibrations Laboratory in the 318 Building, and have the person receiving them sign the trip sheet.

8.4 EMERGENCY PARTICULATE AIR SAMPLING AND ANALYSIS USING THE ANNULAR KINETIC IMPACTOR

INTRODUCTION

This procedure provides a quick determination of airborne particulate contamination levels in the environment. An annular kinetic impactor is used to collect particulate samples in a greased planchet without interference from radon or its radioactive decay products.

EQUIPMENT

The following equipment may be necessary for collecting particulate samples:

- Emergency Air Sampling Kit
- Geiger-Müller (GM) with P-11 probe
- cutie pie dose rate meter
- portable alpha meter (PAM).

SAMPLE COLLECTION PROCEDURE

Select a sampling location away from local dust sources (busy roads, operating machinery, etc.).

CAUTION: Do not locate sampler where explosive gases are present or where electrical shock may occur.

Remove the high-volume air sampler and kinetic impactor head from emergency kit.

Ensure that the sample head is tightly sealed against air sample pump and that the rubber gasket is in place.

Remove the tripod, mounting plate, and mounting hardware from emergency kit.

Spread the legs of the tripod open and stand it on a flat surface.

Crank the tripod up to the proper height using the crank lever, and lock into position by turning lever clockwise.

Turn the vertical elevating crank clockwise for approximately 15 turns to ready the tripod for assembling the mounting plate. Turn the crank lock lever clockwise to lock position.

Remove the two assembled mounting bolts and washers from the mounting plate using the wrench.

Place the mounting plate with the side marked "F" on top of the tripod and position it so that the two holes align with the holes on the top of the tripod.

Insert the bolts and washers and tighten with the wrench.

Set the sampler on the tripod so that the sampler head is approximately 4 ft above the ground and 4 ft from any obstruction.

Place a drop of grease on the inside surface of the collecting disk and spread a thin layer with your fingertip.

Inspect the impactor head surface for roughness that could cause an imperfect seal.

Spread a thin coat of grease on the impactor head surface to aid in creating a tight seal with the collecting disk.

Hold the coated side of the collecting disk over the opening on the impactor head and start the sampler after connecting the power cables to the automobile battery (red to positive, black to negative).

Record the flow rate and sampling time. A 15-min sampling time will be used unless instructed by the Environmental Monitoring Supervisor. Do not exceed 20 min per collection disk.

Place an envelope under the collecting disk, turn off the sampler, and permit the collecting disk to drop into the envelope. Avoid contact of greased surface with envelope.

Proceed to next step.

SAMPLE COUNTING AND ANALYSIS PROCEDURE

Hold the GM close (~1 cm) to the greasy side of the planchet to get the gross beta/gamma reading. Do the same against the backside to get the gamma reading. Record these readings on the air sampling form (Exhibit 8.4.1). Calculate and document the net beta and gamma activity as specified on the form, if time permits.

Hold the PAM survey probe against the greasy side of the planchet to get the alpha counts. Record this number on the form. Calculate and document the alpha airborne concentration as specified on the form, if time permits.

Cover the planchet with a clean planchet, face to face, tape together, and place in an air sample envelope. Seal the envelope, and label with sample location, time, date, and other necessary information required from the form.

Retain the sample in a "clean" location until instructed by the Environmental Monitoring Supervisor.

Deliver the sample to United States Testing Company, Inc. or other location as specified by the Environmental Monitoring Supervisor, and have the person receiving it sign the Air Sampling Form.

**FIELD DETERMINATION OF AIRBORNE CONCENTRATION
USING THE KINETIC IMPACTOR AIR SAMPLER**

Time On _____ Flow Rate _____ ft³/min
Time Off _____ Flow Rate _____ ft³/min
Total Time _____ Total Air Volume _____ ft³

ANALYSIS**BETA/GAMMA (GM/PANCAKE PROBE)**

- A. Background Count Rate _____ counts/min
B. Count Rate (Back of Planchet) _____ counts/min
C. Count Rate (Front of Planchet) _____ counts/min

$$\text{Gamma Concentration} = \frac{(B-A)}{\text{Air Volume ft}^3} \times 1.85E-10 = \text{_____ } \mu\text{Ci/cm}^3$$

$$\text{Beta Concentration} = \frac{(C-A-B)}{\text{Air Volume ft}^3} \times 1.86E-10 = \text{_____ } \mu\text{Ci/cm}^3$$

ALPHA (PAM)

- A. Background Count Rate _____ counts/min
B. Count Rate (Front of Planchet) _____ counts/min

$$\text{Alpha Concentration} = \frac{(B-A)}{\text{Air Volume ft}^3} \times 1.96E-10 = \text{_____ } \mu\text{Ci/cm}^3$$

EQUIPMENT DATA

Air Sample Model # _____ Serial # _____

GM Model # _____ Serial # _____

PAM Model # _____ Serial # _____

RPT Initials _____

Date _____ Time _____

8.5 EMERGENCY RADIOIODINE SAMPLING AND ANALYSIS

INTRODUCTION

This procedure provides a quick determination of the magnitude of radioiodine (^{131}I) concentration in a plume. In many accident scenarios, ^{131}I is the critical radionuclide in determining on-site and off-site protective responses. By using a silver zeolite cartridge that preferentially removes only iodines from the air sample stream and a Geiger-Müller (GM) survey meter, a quick determination of iodine concentration can be obtained.

EQUIPMENT

The following equipment may be necessary for collecting radioiodine samples:

- Emergency Air Sampling Kit
- cutie pie dose rate meter
- GM with pancake probe.

SAMPLE COLLECTION PROCEDURE

The general sampling location will be designated by the Environmental Monitoring Supervisor. In selecting a specific location, choose one away from local dust sources.

Load the silver zeolite filter cartridge (referred to as the sampler) and the 4-in. filter into the filter-head assembly. The filter paper is loaded upstream of the cartridge, so that the sampled air is cleaned of particulates before entering the cartridge. Ensure that the assembled sampler head is tightly secured and sealed against the air pump with the rubber gasket in place.

Set the sampler on a secure surface, so that the sampler head is at least 4 ft from any obstruction.

Plug the sampler into a 115-V electrical outlet or connect to automobile battery by use of cables (red to positive, black to negative).

Determine the sample time from the Environmental Monitoring Supervisor's instructions. If possible, try to match one of the sample volumes provided on the graph (Exhibit 8.5.2). Report the total sample volume to the Environmental Monitoring Supervisor.

After the sampler has been started, momentarily test the seal by interrupting the air flow through the filter. Do this by placing your hand over the filter face. A good seal is indicated if the flow indicator drops to zero.

After the appropriate air volume has been filtered, remove the sampler from the head assembly. On the sampler, record the time, date, location, and volume of air sampled. Place the paper filter in an envelope labeled with the same information.

ANALYSIS

Remove the silver zeolite cartridge from the sampler holder and place on a clean, flat surface in a low-background area.

Using a GM meter with a pancake probe, take a background reading in the general area of the sample, being careful not to read any emissions from the sample. Move to a lower background area if the reading exceeds 1000 counts/min. Report this value in units of counts per minute to the Environmental Monitoring Supervisor.

Using the same instrument, take a reading on the upstream side of the sample with the probe approximately 0.5 cm from the sampler face. Be sure the instrument is set for the slowest response time to get the most accurate reading possible. Report this value in units of counts per minute to the Environmental Monitoring Supervisor.

Complete the radioiodine concentration form to the extent possible (it is not necessary to perform calculations).

FIELD DETERMINATION OF RADIOIODINE CONCENTRATION IN THE AIR

EQUIPMENT DATA

Air Sample Model # _____ Serial # _____

GM Model # _____ Serial # _____

Date _____ Time _____

AIR SAMPLING

Time On _____

Flow Rate _____

Time Off _____

Flow Rate _____

Total Time _____

Total Air Volume _____

ANALYSIS

A. Background Count Rate _____ counts/min

B. Sample Count Rate _____ counts/min

C. Net Count Rate (Sample - Background) _____ counts/min

D. ^{131}I Air Concentration [from graph (Exhibit 8.5.2)] _____ $\mu\text{Ci}/\text{cm}^3$

RPT Initials _____

Date _____ Time _____

Exhibit 8.5.1. Radioiodine Concentration Form

Exhibit 8.5.2. Chart of ¹³¹I Air Concentrations

8.6 HIGH-VOLUME AIR SAMPLES - FILTER PAPER

INTRODUCTION

High-volume air samplers are connected to a particulate filter assembly for sampling large volumes of air for particulate matter. Radioactivity measurements (alpha or beta-gamma) are performed directly on the filter.

EQUIPMENT

The following equipment may be necessary to collect a high-volume particulate sample:

- Geiger-Müller (GM) with P-11 probe
- Emergency Air Sampling Kit
- portable alpha meter (PAM).

SAMPLE COLLECTION PROCEDURE

CAUTION: Sampler motor may become hot during use and could cause burns.

Select a sampling location away from local dust sources (busy road, operating machinery, etc.), as directed by the Environmental Monitoring Supervisor.

Ensure that the filter-head assembly is tightly secured and sealed against the air sample pump and that the rubber gasket is in place.

Set the sampler on the tripod, so that the sampler head is approximately 4 ft from any obstruction.

Place a filter over the screen, rough side out.

Set the thumbscrews tightly to prevent air leakage around the filter.

Plug sampler into a 115-V electrical outlet or connect it to the vehicle battery (red to positive, black to negative), depending on sampler type.

Determine sample time according to the Environmental Monitoring Supervisor's instructions.

Remove the filter, but leave the sampler motor running for 5 min to allow it to cool.

**SAMPLE COUNTING
PROCEDURE****Beta-Gamma
Activity**

Hold the GM survey meter's P-11 probe against the filter in several places, record the gross readings, and calculate the average counts per minute. Hold the probe against an unused filter to estimate the background instrument reading. Calculate the net counts per minute by subtracting the background reading from the gross reading. Counting should be done in low-background areas, if possible.

Record the net counts per minute reading, along with the sample flow rate (obtained from calibration curves on the sampler), and other information requested on the air sample form (Exhibit 8.6.1).

Alpha Activity

Hold the PAM to the filter in several places, record the gross reading, and calculate the average counts per minute. Hold the probe to an unused filter to determine the instrument background. Calculate the net disintegrations per minute.

Record the net disintegrations per minute, the sampler flow rate (based on calibration curves attached to the sampler), and any other information requested on the rapid air sample form.

**SAMPLE PREPARATION
PROCEDURE**

Fold the filter in half with the collection surface to the inside, place it in a plastic bag, and seal it with masking tape.

Label the bag with the sample location, time, date, counts, and your name, and record the same information on the rapid air sample form.

Deliver the sample to United States Testing Company, Inc., if instructed, and have the person receiving it sign the air sample form (Exhibit 8.6.1).

HIGH-VOLUME AIR SAMPLE

Date/Time: _____ Name: _____

Sample Location: _____
Laboratory Receipt Signature _____

Sampler No. _____

Sample Volume: _____ Meteorological Conditions (estimated):

Flow Rate _____ ft³/min Wind Out of the _____ at _____ mi/h

Cloud Cover: _____

Sample Duration: _____ min Other: _____

Fill in Appropriate Lines Below:

8- x 10-in. Filter

	<u>Beta-Gamma</u> (GM with P-11 Probe)	<u>Alpha</u> (PAM)
Instrument No:	_____	_____
Gross Reading:	_____ counts/min	_____ disintegrations/min
Bkgd. Reading:	_____ counts/min	_____ disintegrations/min
Net Reading:	_____ counts/min	_____ disintegrations/min
Probe Efficiency*:	_____	_____

* Probe efficiencies are given on a label on the side of each instrument.

Exhibit 8.6.1. High-Volume Air Sample Form

8.7 MEDIUM-VOLUME AIR SAMPLES

INTRODUCTION

The medium-volume air samplers are used primarily to collect particulate filter samples over an extended time following an unexpected atmospheric release from a facility. Because the quantities released may be small, a larger sample volume is necessary for the constituents to be detectable through laboratory analysis.

The air samplers require line power, and because of their size and weight they are not considered portable. The sampler has two motors and can be operated with either one or both running, depending on the flow rate desired. The unit includes a mass flow meter, a brushless motor, control electronics, and a rotary ramp valve that actually measures the sample flow. The electronics unit, referred to as a "controller," compares the sample mass flow rate signal to the setpoint signal originating from the potentiometer mounted on the front panel. If an imbalance in flow rate is detected between the two, the controller compensates by signaling the rotary valve to change its position.

EQUIPMENT

The following equipment may be necessary to collect a medium-volume air particulate sample:

- Emergency Air Sampling Kit
- Geiger-Müller with pancake probe
- cutie pie dose rate meter.

SAMPLE COLLECTION PROCEDURE

Obtain a medium-volume sampler from the storage room in 3745 Building Trailer 3.

Obtain an air sampling hutch.

Select a sampling location near 115-V power, away from dusty roads, heavy machinery, or any other dust-generating sources.

Place the medium-volume sampler inside the hutch, extending the filter head and arm outside one of the hinged doors. With the arm in place, the door must be closed with rope.

Install a clean 4-in. filter on the filter head.

Record the initial time reading on masking tape, and place the tape on the face of the controller.

Start the unit by plugging it into a 115-V source. If both motors are used, 20- or 30-amp service is needed, as they may trip a circuit breaker on 15 amps.

Set the flow rate to that specified by the Environmental Monitoring Supervisor by adjusting the flow rate potentiometer located inside the controller and labeled FLOW ADJ.

Record the date, time, flow rate, and timer readings on the trip sheet.

Once the sample has been collected per the Environmental Monitoring Supervisor's instructions, unplug the unit from the power source.

Remove the 4-in. filter carefully.

Place the exposed filter in a plastic bag. Seal it with masking tape, and use the tape as a label.

Record the final flow rate, timer reading, time, and date on both the label and the trip sheet.

Deliver the sample to the appropriate laboratory (according to Environmental Monitoring Supervisor's instruction), and have the person receiving it sign the trip sheet.

8.8 RAPID ENVIRONMENTAL SURVEYS - PORTABLE SURVEY METERS

INTRODUCTION

Rapid environmental survey procedures are used by personnel performing environmental measurements when a rapid assessment of radiological conditions is required. Surveys are performed using the Bumble Bee Cutie Pie (BBCP) meter, the micro-R-meter, the portable count rate meter with the P-11 probe, or the portable alpha meter (PAM). If these measurements are taken in a standard sequence, the communications necessary between the field teams and the Environmental Monitoring Supervisor can be minimized. Table 8.8.1 describes the sequences and the survey instruments necessary to perform the surveys. Once the type of contamination has been adequately characterized, specific surveys may be requested by the Environmental Monitoring Supervisor.

Table 8.8.1. Measurement Sequences and Necessary Equipment for Rapid Environmental Surveys

Portable Instrument Surveys	Instrument	Measurement	Reporting Units
Dose rate	Micro-R-meter	γ Exposure rate @ 3 ft	μ R/h
	BBCP window closed	γ Exposure rate @ 3 ft	mR/h
	BBCP window open	β , γ Dose rate @ 3 ft	mrads/h
Surface contamination	GM w/P-11 probe	β , γ Count rate at surface	counts/min
	BBCP window open	β , γ Surface dose rate	mrads/h
	PAM	α Surface contamination	disintegrations/min
Particulate activity	Micro-R-meter	γ Particle count	particles/100 ft ²
	Micro-R-meter	γ Particle exposure rate	μ R/h
	BBCP window open	β , γ Dose rate	mrads/h
	BBCP window closed	γ Dose rate	mR/h
	PAM	α Count rate	disintegrations/min

DOSE RATE SURVEYS**Micro-R-Meter -
 γ Exposure Rate at
3 ft ($\mu\text{R/h}$)**

Turn the instrument on and ensure that it is working properly.

Using the slow-response time setting, hold the instrument steady 3 ft above the ground surface and at least 25 ft away from any cars, air samplers, or other devices that may concentrate airborne radioactivity.

Pause for approximately 20 s to allow the instrument to reach a steady state. Take a reading with the range switch set at the lowest range where the needle does not extend to its full scale.

Turn off the instrument.

Record the reading and the range setting on the portable instrument survey form (Exhibit 8.8.1).

If operation of the meter is suspect or if measured exposure rates exceed $1500 \mu\text{R/h}$, perform the same measurement using a BBCP with window closed, as described below.

**BBCP Window Closed -
 γ Exposure Rate at
3 ft (mR/h)**

Turn the instrument on and ensure that it is working properly.

Set the needle gauge at zero.

Hold the instrument steady 3 ft above the ground surface and at least 25 ft from any cars, air samplers, or other devices that may concentrate airborne radioactivity.

Pause for approximately 20 s to allow the instrument to reach a steady state. Take a reading, being certain that the appropriate range is used.

Turn the instrument off and record the reading and the range setting on the portable instrument survey form.

**BBCP Window Open -
 β , γ Dose Rate at
3 ft (mrad/h)**

Follow steps for BBCP window closed (above), but with the BBCP window open.

SURFACE CONTAMINATION SURVEYS

Choose a location representative of the general surrounding area, with no major obstructions nearby.

**GM with P-11 Probe -
 β , γ Count Rate at
Surface (counts/min)**

Turn the instrument on and ensure that it is working properly.

With the audible switch ON and the instrument set for a medium response time, hold the P-11 probe approximately 1 in. above the surface and survey 100 ft² (10 x 10 ft), being certain that the appropriate range is used.

Determine the maximum general surface contamination reading (exclusive of any reading obviously caused by discrete radioactive particles).

Turn the instrument off and record the maximum general reading and the range setting on the portable instrument survey form.

If operation of the meter is suspect or if readings are >10,000 counts/min, perform the same measurement using a BBCP with window open, as described below.

**BBCP Window Open -
 β , γ Surface Dose
Rate (mrad/h)**

Turn the instrument on and ensure that it is working properly.

Hold the instrument, with the end window facing the ground, approximately 2 in. from the surface, and survey an area of 100 ft², being certain that the appropriate range is used.

Determine the maximum dose rate reading and range setting caused by general surface contamination.

Turn the instrument off and record the maximum reading on the portable instrument survey form.

**PAM - α Surface
Contamination (dis-
integrations/min)**

Turn the instrument on and ensure that it is working properly.

Turn the audible switch ON.

Hold the probe next to but not touching the ground surface and survey an area of 100 ft².

Hold the probe for 10 s at the location of highest audible activity and take a reading, being careful to use the appropriate range.

Turn the instrument off and record the reading and the range setting on the portable instrument survey form.

PARTICULATE ACTIVITY

Turn the instrument on and ensure that it is working properly.

**Micro-R-Meter -
 γ Particle Count
(particles/100 ft²)**

Turn the audible switch ON.

Scan the ground, keeping the instrument within 6 in. of the ground surface, and using the fast-response time setting and a low-range setting. (The instrument can be suspended from a strap to allow the surveyor to stand during the survey.)

Observe the number of abrupt changes in the general radiation field (indicating the presence of a discrete radioactive particle) within a 100-ft² area.

Mark the locations of any detectable particles with spray paint. Count the number located within the survey area and record this on the portable instrument survey form.

Perform the measurements described below for the micro-R-meter (particle exposure rate) and BBCP (dose rate) within the area for up to 10 particles per survey area.

**Micro-R-Meter -
 γ Particle Exposure
Rate (μ R/h)**

Turn the instrument on and ensure that it is working properly.

Hold the instrument 6 in. directly above the particle, using the slow-response time, and observe the exposure rate.

Hold the instrument 6 in. above the ground away from the particle to get a background exposure rate. Determine the net exposure rate attributable to the particle by subtracting the background from the particle reading.

Where two particles are apparently side by side, take a reading at the location of maximum observed exposure rate, keeping the instrument 6 in. above the surface.

Record the net maximum observed exposure rate on the portable instrument survey form, providing comments as appropriate concerning other particles and the physical and radioactive characteristics of the particles.

**BBCP Window Open -
 β , γ Dose Rate
(mrad/h)**

Turn the instrument on and ensure that it is working properly.

Holding the BBCP with the window open at a distance of 1 in. from the particle, read the exposure rate indicated on the meter.

**BBCP Window Closed -
γ Dose Rate (mR/h)**

Record the highest observed reading and the range setting on the portable instrument survey form.

Turn the instrument on and ensure that it is working properly.

Holding the BBCP with the window closed at a distance of 1 in. from the particle, read the exposure rate indicated on the meter.

Record the highest observed reading and the range setting on the portable instrument survey form.

**PAM - α Count Rate
(disintegrations/min)**

Turn the instrument on and ensure that it is working properly.

For each particle, hold the alpha probe just above but not touching the ground surface and read the alpha count rate.

Record the reading and the range setting of the highest observed alpha activity on the portable instrument survey form.

Portable Instrument Surveys												Name: _____	
		Dose Rate			Surface Contamination			Particulate Contamination			Date: _____		
Perform surveys in sequence shown.		μR Meter @ 3 ft	CP/WC @ 3 ft	CP/WO @ 3 ft	GM/P11 @ Surface	CP/WO @ Surface	PAM @ Surface	μR Meter Particulate: 100 ft ²	μR Meter Exposure Rate	CP/WO, Dose Rate	PAM, α Count Rate	1. Check instrument operation frequently. Note background readings on this form periodically. 2. Be alert to weak batteries, especially in cold weather. 3. Identify deviations from established procedures. 4. Include meteorological conditions with comments.	
Time	Location	Instrument No. →	$\mu\text{R/hr}$	mR/hr	mrad/hr	cpm	mrad/hr	dpm	# of Part	$\mu\text{R/hr}$	mrad/hr	dpm	

Exhibit 8.8.1. Portable Instrument Survey Form

8.9 EMERGENCY AERIAL MONITORING - EQUIPMENT SETUP

INTRODUCTION

Aircraft charter service may be requested to monitor a release from a Hanford Site facility or from an accident within the U.S. Department of Energy Region 8. This procedure shall be implemented by designated personnel when a radioactive release occurs requiring aerial surveillance.

RESPONSIBILITY

The Environmental Monitoring Supervisor is responsible for implementing this procedure at the request of the Radiological Assessment Manager in the Unified Dose Assessment Center (UDAC).

The aerial charter service will not respond on this contract to persons other than authorized personnel.

AERIAL MONITORING SERVICE

After the decision has been made to perform aerial monitoring, one of the designated persons is to call Bergstrom Aircraft to request the charter service. The 24-h contact number is (509) 547-6271.

Specify that this request is either an actual event or an exercise.

Specify Richland Airport as the meeting location for the aircraft.

Specify a fuel loading for at least 2 h of monitoring.

Specify that the co-pilot seat be removed in the aircraft.

The air charter service may place a return call to confirm the request. Provide a nearby telephone number to the charter service contact so the request can be confirmed.

Notify the Hanford Patrol that an aircraft performing emergency aerial monitoring will penetrate Hanford Site air space.

EQUIPMENT

The aerial monitoring kits are required for performing this task, and are located in Supply Cage #12, second floor, 2400 Stevens Building.

- Aerial Monitoring Instrument Kit
- Aerial Monitoring Supply Kit
- beta-gamma test source
- Geiger-Müller (GM) with pancake probe
- cutie pie dose rate meter
- micro-R-meter (as a backup in the event the primary system fails or is too sensitive for the plume).

The portable scaler rate meter is a self-contained counting instrument designed for operation with scintillation, proportional, or GM detectors. Power is derived from four flashlight batteries or line power. A charger is built in for rechargeable cells. The unit is complete with a charge-sensitive preamplifier, linear amplifier, electronic timer, and high-voltage power supply.

CAUTION: Do not attempt to charge the D-cell alkaline batteries. Only nickel cadmium (NiCad) batteries may be charged in this unit. Alkaline batteries may explode when recharging!

The strip-chart recorder features 24 switch-selectable ranges, 3 built-in chart speeds, and inkless recording. Only the direct-current (DC) volt ranges are used for this application.

EQUIPMENT RESPONSIBILITY

The Radiation Protection Technologist (RPT) shall prepare and use monitoring equipment in accordance with this procedure and as directed by the Environmental Monitoring Supervisor.

PREPARING INSTRUMENTS FOR USE

Instrument preparation should take place on the ground prior to takeoff.

Connect the signal cable to the top of the detector (SHv) and the front of the portable rate meter (MHv).

Plug the 15-pin connector from the strip-chart recorder into the connector on the back of the portable rate meter.

Turn the bottom switch on the portable rate meter to the BAT position.

Turn the Battery Test/Hi Voltage Test/Rate switch to BAT position and confirm that the needle is positioned in the "bat test" portion of the meter.

Turn the same switch to the HV position and confirm that the needle indicates a voltage of approximately 800 V. Also ensure that the high-voltage adjustment pot is positioned as referenced on top of the portable rate meter.

Turn the same switch to the RATE position.

Confirm that the Window On-Off switch is in the OFF position.

Turn the portable rate meter range switch to the 100 position. The needle should indicate approximately 170 (x100) counts/min or less on the meter for normal background with the detector 1 m above ground level.

Move the switch on the top of the chart recorder to the 15-V DC position.

Turn the chart recorder on by moving the switch on the front left side to ON.

To change paper in the strip-chart recorder:

- Push in the locking latches on each side of the base of the instrument, and lift up the hinged upper portion to expose the chart-drive mechanism assembly.
- Gently press down on the plastic spring holding clips on each side of the feed spool and lift out the feed spool.
- Install a new chart roll on the feed spool, with the perforated edge of the paper firmly placed against the flange of the feed spool.
- Reinsert the feed spool and pull off approximately 8 in. of paper from the chart roll.
- Pull the chart guides back and insert the chart so the pins of the drive spool smoothly engage the perforations of the chart paper.
- Tighten the chart paper strip by turning the knurled flange on the feed spool.
- Make sure that the chart paper strip extends beyond the edge of the baseplate of the instrument.

INSTRUMENT USE

This equipment is quite sensitive to gamma and x-ray radiation. A plume containing gamma-emitting radioactive materials should be detectable at quite a distance so that the aircraft and personnel do not have to enter a plume to locate it.

The analyzer provides only a relative reading of the plume and should not be used for personnel protection purposes. The RPT must rely on the CP for personnel protection. The GM survey meter also should be operating while airborne, with the audible switch ON. A portable micro-R-meter will be used as a backup in case the primary instrument proves too sensitive.

The strip-chart recorder should be recording a background between 10% and 30% of full scale. If not, two options are available to get the background reading in this range. The first is to switch ranges on the portable rate meter to the next higher or lower scale. The second is to switch ranges on the recorder (increase or decrease DC volts). Be sure this adjustment is made in a very low-background area.

Using a test source, check the operation of the equipment to ensure a positive indication is received when the radiation field is greater than background. Note the test on the graph paper with date, time, and test indication. When airborne, perform a periodic operation test (~30 min) to ensure proper operation of the equipment. Store the test source in a location that does not affect the background.

The indicator of interest in aerial monitoring is the strip-chart recorder output. The digital scale at the top of the instrument face is used for a timed count and is of no use to this type of monitoring. The meter in the middle of the instrument face provides an indication of detector count rate and is useful in establishing background levels and for locating low-intensity gamma fields. However, even medium-intensity fields will cause an off-scale reading. The strip-chart recorder will continue to read on scale at higher count rates with DC voltage scale adjustment. The recorder also provides a visual indication of steady, increasing, or decreasing count rate.

When a plume is located, the indicator on the portable rate meter will show an up-scale reading. If the indication goes off the scale on the meter and the chart recorder, switch the meter to up scale to achieve an on-scale indication. If this does not work, switch the chart recorder up scale (DC volts) until an on-scale reading is obtained. Keep in mind that the position of the highest reading when traversing the plume indicates the center-line. If a maximum on-scale reading cannot be achieved, more distance (altitude) between the plume and detector may be needed. If the desired information cannot be obtained using this equipment, a micro-R-meter also may be used for plume-location activities.

**MAINTENANCE AND
TROUBLE-SHOOTING**

The battery life of the fully charged portable rate meter is approximately 20 h. Recharge the batteries by attaching the line cord and placing the bottom switch in CHG position. If batteries fail to hold a charge, replace them with long-life NiCad D cells.

The three penlight batteries of the strip-chart recorder have a life of approximately 130 h under continuous use. Replace them by removing the clear plastic plate on the bottom of the recorder.

8.10 EMERGENCY AERIAL MONITORING - PLUME TRACKING**INTRODUCTION**

Aerial monitoring may be conducted during an emergency response to locate and track radioactive releases. This section provides guidance on locating a radioactive plume.

RESPONSIBILITY

The Environmental Monitoring Supervisor is responsible for implementing this procedure at the request of the Radiological Assessment Manager in the Unified Dose Assessment Center (UDAC).

EQUIPMENT

Prior to meeting Bergstrom Aircraft at the Richland Airport, the following equipment is necessary for the monitoring:

- Aerial Monitoring Instrument Kit
- Aerial Monitoring Supply Kit
- cutie pie (CP) dose rate meter
- Geiger-Müller (GM) with pancake probe
- micro-R-meter
- fully charged portable two-way radio (if possible, other than Safety Net Frequency)
- beta and gamma test sources.

**EQUIPMENT LOADING
AND PRE-FLIGHT
PREPARATION**

If the co-pilot seat has not been removed from the aircraft (see Section 8.9), locate the monitoring equipment elsewhere in the aircraft. An option is to place the detector in the storage area behind the passenger seats and place the micro-R-meter and strip-chart recorder in one of the rear seats next to one of the Radiation Protection Technologists (RPTs). The other RPT working as the data recorder could operate from the co-pilot seat.

Work with the pilot to secure the monitoring equipment for the flight.

The detector should be secured as close to the floor as possible and as close to the aircraft center of gravity (fore-aft) as possible. Suggested locations are 1) in the storage area behind the passenger seats and 2) next to the pilot if the co-pilot seat has been removed.

The analyzer must be located where the RPT seated in the rear seat can read the output and manipulate the analyzer controls during the flight.

Source check the operation of all monitoring instruments prior to takeoff. Do not attempt to monitor the plume without both the CP and analyzer working properly. The GM is used only for an audible indication at this time. Contact the Environmental Monitoring Supervisor by radio

or telephone for replacements. After the response test, place the test source in a location that will not interfere with the detector.

Place the CP and the portable two-way radio within reach of one of the RPTs for the flight.

Zero the pencil dosimeters and assign one to each passenger on the aircraft. Be sure to wear your normal Hanford Site dosimeter. Periodically check the pencil dosimeter reading and record all readings.

Communications shall be maintained with the Environmental Monitoring Supervisor or alternate communicator in the 2400 Stevens Building on a portable two-way radio. Ensure the radio operates properly prior to takeoff. If radio communications fail during the flight, the pilot may relay information on the aircraft radio to the Environmental Monitoring Supervisor's telephone.

AERIAL MONITORING

The monitoring instrumentation should be sufficiently sensitive to detect gamma-emitting radionuclides quite a distance from the plume. Aerial monitoring shall be performed in a manner that does not require placing the aircraft in a radioactive plume. The entry of the aircraft into a plume may be detected with an open-window CP reading of 0.5 mR/h or greater.

The analyzer readout indicates relative levels of gamma radiation. Therefore, aerial monitoring will only provide an indication of the plume boundaries (sides, leading and trailing edges) and centerline. The operation of the aerial monitoring system should be checked periodically with a small check source. These instrument checks and any other significant indication should be promptly labeled on the readout with current time, location, and altitude.

ESTABLISH BACKGROUND

Prior to attempting to locate the plume, background levels need to be established at the altitude designated by the Environmental Monitoring Supervisor. To establish background, direct the pilot to fly over flat, open terrain away from any known radioactive sources (e.g., tank farms, burial grounds, facilities, and riverbanks) for 2 to 3 min.

Record the reading on the appropriate aerial monitoring data sheet (Exhibits 8.10.1 or 8.10.2).

This procedure needs to be repeated each time the flying altitude is changed.

**DETERMINATION OF
PLUME POSITION USING
LORAN**

Precise plume location can be obtained with the aid of the long-range navigation (LORAN) equipment installed in the aircraft. The pilot can aid in locating the plume by operating the LORAN equipment.

When monitoring begins, the RPT will receive information from the Environmental Monitoring Supervisor on a likely plume location and an estimation of maximum plume altitude. Instruct the pilot to fly an intercept course approximately 500 ft above the estimated plume altitude.

When instruments indicate contact with the plume (a reading of about twice background), instruct the pilot to store that position in the LORAN until you are able to transmit the coordinates and the course back to the Environmental Monitoring Supervisor. Maintain that course, if possible, and also report the coordinates of the point where the readings decrease to background. This should mark the other side of the plume.

The plume coordinates should be recorded on the appropriate aerial monitoring data sheet and identified by pass number. Aerial monitoring may be simplified by flying a fixed course down either a line of longitude or latitude. This way, the course may be recorded and transmitted prior to contact with the plume. On contact with the plume, only the other number need be recorded and transmitted.

During the traverse of the plume, record the location of the highest reading on the aerial monitoring data sheet. This should be transmitted back to the Environmental Monitoring Supervisor as soon as time allows. If the primary instrument goes off scale-high on the traverse, try to fix the centerline position using the portable micro-R-meter.

Several traverses may be required to determine plume size, shape, and location. Ground personnel controlling monitoring activities will provide direction on areas that need to be monitored.

**MONITORING STRATEGY
FOR LONG-TERM RELEASE**

A long-term release is one where a plume can be traced back to the point of origin. This greatly simplifies location of the plume.

After the plume centerline has been located, instruct the pilot to fly above the centerline in a downwind direction to determine the location of the leading edge of the plume. Be cautious about staying above the plume, as some plumes tend to increase in altitude the farther they are

from the release point. Thus, as downwind distance increases from the release point, the aircraft altitude also may need to be increased to stay out of the plume.

The leading edge is located when the readout abruptly decreases to background. Report this location to the Environmental Monitoring Supervisor. The width of the plume at the leading edge is also a valuable piece of information. Try to determine the width of the plume on each side of the centerline by passing over the plume perpendicular to the centerline. Be cautious about entering the plume. Report this information to the Environmental Monitoring Supervisor.

MONITORING STRATEGY FOR SHORT-TERM RELEASE

If the release duration is short, the plume will be somewhat spherical in geometry. This type of plume may require more search time to locate because the trailing edge cannot be traced from the release point unless ground deposition is significant. Also, be aware that ground deposition may cause interference with plume location activities, as they may be difficult to distinguish.

Request a best estimate of the location of the plume from the Environmental Monitoring Supervisor. Instruct the pilot to fly over the original release point in a downwind direction at an altitude of approximately 1000 ft. If no contact is made, decrease altitude on a subsequent pass or widen the search area until the monitor provides a positive indication. Parameters that are most important to UDAC staff are location of the leading plume edge, width of the plume, and location of the trailing edge of the plume.

AIRCRAFT RELEASE

After aerial monitoring is terminated, perform a contamination survey (thin-window GM) on yourself, the pilot, all items carried in the aircraft, and the aircraft. If possible, survey the engine air filter. If contamination is found, isolate the affected items and report to the Environmental Monitoring Supervisor for further instructions. Be sure to retrieve all documentation, readouts, and dosimetry prior to leaving the airport.

Release the aircraft for other use as soon as reasonable, as there may be a charge for standby status of the aircraft until it is released.

Return all items to the Environmental Monitoring Supervisor in the 2400 Stevens Building.

ON-SITE AERIAL MONITORING DATA SHEET

Pass Number	Altitude (Feet)	Course (True)	Initial Plume Contact	Highest Plume Contact	Final Plume Contact
—	—	—°	46° __, __ 'N	46° __. __ 'N	46° __, __ 'N
Reading			119° __, __ 'W	119° __, __ 'W	119° __, __ 'W
			counts/min	counts/min	counts/min
—	—	—°	46° __, __ 'N	46° __. __ 'N	46° __, __ 'N
Reading			119° __, __ 'W	119° __, __ 'W	119° __, __ 'W
			counts/min	counts/min	counts/min
—	—	—°	46° __, __ 'N	46° __. __ 'N	46° __, __ 'N
Reading			119° __, __ 'W	119° __, __ 'W	119° __, __ 'W
			counts/min	counts/min	counts/min
—	—	—°	46° __, __ 'N	46° __. __ 'N	46° __, __ 'N
Reading			119° __, __ 'W	119° __, __ 'W	119° __, __ 'W
			counts/min	counts/min	counts/min
—	—	—°	46° __, __ 'N	46° __. __ 'N	46° __, __ 'N
Reading			119° __, __ 'W	119° __, __ 'W	119° __, __ 'W
			counts/min	counts/min	counts/min

Background Reading: _____ counts/min
 Altitude: _____ ft

Time: _____

Background Reading: _____ counts/min
 Altitude: _____ ft

Date: _____

Name: _____

Exhibit 8.10.1. On-Site Aerial Monitoring Data Sheet

PNL-MA-580

AERIAL MONITORING DATA SHEET FOR OFF THE HANFORD SITE

[illegible]

Environmental Monitor _____ Date _____

Environmental Monitoring Supervisor

9.0 MISCELLANEOUS PROCEDURES

INTRODUCTION

Most of these Section 9.0 procedures are not routinely used for sample collection. The exceptions are procedures for the trip sheet and the operation of motor vehicles that are used daily. The procedures contained in this section are the following:

- trip sheets (Section 9.1)
- boat operation (Section 9.2)
- radiation work procedure (Section 9.3)
- unusual findings notification (Section 9.4)
- operation of motor vehicles (Section 9.5).

Concurrence <i>KP</i>	Date 2-9-90	Approval <i>Arthur J. Jorgensen</i>	Date 2-9-90
Prepared by <i>Rw Heng</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 9.0	Revision No. 1	Effective Date: 2-90	

9.1 TRIP SHEETS

INTRODUCTION

The purpose of the environmental trip sheets, also referred to as trip logs, is primarily to document the samples that are collected on a day-to-day basis. Each sample that is submitted to a laboratory must be accounted for on a trip sheet. Samples that are collected but not submitted for analysis also should be documented on the trip sheet. Activities other than sample collection or environmental measurements should be documented on a trip sheet as well.

Trip sheet forms are generated by computer. These forms usually contain the necessary information about the samples that are to be collected. However, trip sheets without sampling information can also be generated, then filled in by hand when the samples are collected. See Exhibits 9.1.1 and 9.1.2 for examples of each type of trip sheet.

Specific survey forms are used in lieu of the trip sheets for road monitoring, railroad monitoring, aerial monitoring, and shoreline dose rate and contamination measurements.

The importance of providing complete and accurate information on the trip sheets cannot be overemphasized. The information found within the trip sheets may be of the utmost importance in analyzing the data, in accounting for anomalies in the data, and in providing historical documentation of the samples being collected.

PROCEDURE

Fill out the trip sheet as completely as possible prior to leaving the trip room. This will include the following at a minimum:

- name
- date
- trip number.

If the samples to be collected are known or the purpose of the trip is defined, the information concerning the sample or task can be completed prior to entering the field as well. This may include such things as:

- location
- sample type
- sample number
- sample on date.

Note on the trip sheet any observations that may influence the sample analysis, such as nearby construction, severely dusty conditions, or other such activities.

Complete all necessary information regarding the sample being collected or the survey being made while at the sample location.

When you deliver the sample to the proper laboratory, have the person receiving it sign the trip sheet.

Issued: 2-90

Supersedes: 7-86

PNL-MA-580

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9.2 BOAT OPERATION

INTRODUCTION

A 20-ft jet boat is used for all river work. Boating involves potential job hazards and, therefore, you must observe safety precautions.

A Coast Guard Auxiliary Boat Safety Certificate is required for anyone operating the boat.

HITCHING BOAT TRAILER TO VEHICLE

Place the socket of the trailer over the ball of the vehicle's trailer hitch and secure it by pushing down the lock catch on the trailer hitch. Be careful not to pinch your fingers.

After securing the trailer to the ball, connect the safety chains, and make sure all connections are tight.

Connect the trailer lights, and check to see that brake, running, and turn signal lights are functioning properly.

Check the following:

- vehicle and trailer tires
- safety chain
- winch lock
- transom tie-down chains/straps
- equipment in boat is securely stowed
- adequate supply of gas and oil
- fire extinguishers
- life jackets (proper number/good condition)
- paddle(s)
- portable two-way radio
- running lights and horn
- bilge pump
- battery charge
- bow line.

If the boat is to be operated on the Hanford reach of the Columbia River, notify the Hanford Patrol by radio before launching, describe the boat, and identify the personnel.

LAUNCHING BOAT

Back the trailer into a favorable position for launching and stop at the water's edge. A second person should assist with and direct maneuvering of the trailer.

Release the bow safety chain. Remove the transom tie-downs. Disconnect the trailer lights.

Back the trailer into the water, release the winch lock, and unhook the winch rope from the bow ring.

Push the boat off the trailer, holding the bow line, and pull the boat to one side.

Pull the trailer out of the water and park the vehicle. Be sure its emergency brake is set.

OPERATING BOAT

Turn on bilge blower and operate it for 5 min to exhaust flammable fumes before starting the boat engine.

Be sure gear shift is in neutral before starting engine. To shift gears, move the tall lever either forward or backward.

Make sure passengers are seated before applying power with the throttle (the short lever).

Proceed at moderate speed until clear of other boats or obstructions.

Turn the key and the battery control knob to OFF to stop the motor.

LOADING BOAT ONTO TRAILER

Back trailer into water at a favorable launching site.

Carefully maneuver boat into position on the trailer. This can be done under low power or using the paddles.

Connect the winch cable to bow ring.

Winch the boat onto the trailer carefully to be sure that the boat comes up level on the trailer.

Attach the bow safety chain.

Pull the trailer out of the water, secure the transom tie-downs, and reconnect the trailer lights.

9.3 RADIATION WORK PROCEDURE

INTRODUCTION

Radiation Work Procedures (RWP) are required for certain tasks in environmental monitoring. Due to the nature and locations of several sample points, RWPs from Westinghouse Hanford Company and Pacific Northwest Laboratory are used.

Inclusion of all the RWPs in this section is impractical, as they are continually being reviewed and modified. Exhibit 9.3.1 serves as an example of a typical RWP.

All current RWPs applicable to present environmental monitoring activities may be found either with the Environmental Monitoring Supervisor or in the environmental monitor's trip books.

Ensure that you have the proper RWPs for the task to be undertaken. A Westinghouse Hanford Company RWP is required for entry into their radiation areas.

[illegible]

* RPE = Respiratory Protection Equipment

Page 1 of 3

A-1200-355 (4-67)

Exhibit 9.3.1. Radiation Work Procedure

Radiation Work Permit #2400-1, Rev. 1
Page 2 of 3

Special Instructions

1. Samples shall be surveyed with appropriate survey instruments.
2. All sample measuring < 100 c/m beta-gamma and/or < 250 d/m alpha per probe area are not considered radioactive and will not fall under the requirements of this RWP.
3. All samples, excluding air particulate filters (See Item 4), measuring > 100 c/m beta-gamma and/or > 250 d/m alpha per probe area above background are considered radioactive and shall meet the requirements of this RWP.
4. All air particulate filters measuring > 1000 c/m beta-gamma and/or > 2000 d/m alpha per probe area at the time of collection shall be considered radioactive and shall meet the requirements for radioactive samples (See Item 5) of this RWP.
 - all air particulate filters shall be rechecked with portable survey instruments at the time of delivery to UST
 - at the time of submittal to UST, all air particulate filters with readings (after decay between time of collection and time of delivery) higher than those listed in Item #3 will be separated from the other filters at the sample receiving area.
5. All shipments of radioactive samples must meet the following criteria:
 - a radioactive material label with the radiation measurement, RPT's name and date will be attached to each container
 - all radioactive samples will be packaged and transported in sealed shipping containers to preclude breaking or leaking
 - outer surfaces of sample containers shall be free of contamination.
 - A. Radioactive shipments to U.S. Testing Company shall be controlled as follows:
 - samples measuring < 5 mrem/h are to be taken directly to a laboratory radiation area and laboratory personnel notified by the Radiation Protection Technologist (RPT).
 - samples measuring > 5 mrem/h require prior approval by U.S. Testing Company and must be shipped on an Off-Site Radioactive Shipment Record.

Exhibit 9.3.1. (contd)

Radiation Work Permit #2400, Rev. 1
Page 3 of 3

Special Instructions (cont)

- B. Radioactive shipments to On-Site contractors shall be controlled as follows:
- samples are to be taken directly to a radiation area laboratory and laboratory personnel notified by the Radiation Protection Technologist (RPT).
 - samples measuring > 50 mrem/h shall be shipped on an On-Site Radioactive Shipment Record.
6. BNW staff shall adhere to the following requirements when entering WHC Radiation areas:
- A. A WHC Radiation Work Permit will provide coverage for all work performed in that contractor's radiation areas.
 - B. At a minimum BNW RP will require that staff members entering a contaminated area, i.e., waste swamps, tank farms, etc., will comply with the marked blocks in the Radiation Protection requirements and Authorized Activities sections.
 - C. Protective equipment requirements may be increased by WHC-OHP if job conditions warrant.
 - D. A personnel survey shall be made periodically and, if skin or clothing is found to be contaminated, an effort shall be made to decontaminate or tie down the contaminate. If the hands are contaminated and water rinse does not decontaminate them, a pair of gloves should be donned to prevent contamination spread. All residual contamination and clothing shall be disposed of at the work site and/or nearest contaminated waste and clothing disposal site.
7. Environmental Monitoring Supervision should be notified immediately of any radioactive samples, personnel or equipment contamination by calling Station-25.
8. Any change (e.g. - procedure, scope of research, equipment, etc.) which may increase the radiological hazards shall be reviewed with the RP Supervisor prior to implementation. A new or modified RWP shall be issued if necessary.

Exhibit 9.3.1. (contd)

9.4 UNUSUAL FINDINGS NOTIFICATION

INTRODUCTION

During routine surveillance activities, unusual findings may be noted. Examples of these include, but are not limited to, burial ground cave-ins, contamination on roadways, external radiation levels higher than normal, higher than normal radiation levels on air filters, and contaminated vegetation, soil, or animals. When these situations arise, contact one of the following people to notify them of unusual findings. Attempt to contact them in the order shown. Telephone or personal contact is preferred. However, you may use the two-way radio to establish initial contact or summon assistance. Minimize discussion of contamination levels or serious problems over the radio.

- E. W. Lusty, Environmental Monitoring Supervisor 376-1033
- R. L. Dirkes, Research Scientist 376-8177
- R. E. Jaquish, Project Manager 376-9751

9.5 OPERATION OF MOTOR VEHICLES

INTRODUCTION

The collection of environmental samples and performance of field surveys require the use of several types of motor vehicles under a wide range of operating conditions. In view of this, and because you may use any one vehicle infrequently, be especially cautious.

This procedure describes the requirements for the operation of government-owned vehicles in travel for business purposes on the Hanford Site, on private property, or on public streets and highways.

This procedure provides material that is directly applicable to environmental monitoring activities. This includes the steps to be taken in the event of an accident.

VEHICLE OPERATOR RESPONSIBILITIES

You must have a valid state driver's license in your possession while operating a government vehicle.

Use of seat belts is mandatory. Properly fasten your seat belt and ensure that all passengers have fastened theirs before operating any vehicle.

If you have an accident, you must comply with the requirements described in this procedure, including appropriate notifications and preparation of accident reports (see VEHICLE ACCIDENTS).

SAFE DRIVING RULES

Do not operate a vehicle that has mechanical defects. Ensure that running lights, etc., are operational. Report defects to the Environmental Monitoring Supervisor.

Look all around the vehicle for obstacles or hazards before moving it. Get help when you are moving trailers or other vehicles that limit your visibility, especially if nearby obstructions restrict your movement.

Operate vehicles only on established roadways unless the vehicle is equipped and authorized for off-road use (see OFF-ROAD TRAVEL).

Obey all local traffic laws and regulations when operating a vehicle on the Hanford Site, private property, or any other location. When operating a vehicle in another state, obey the traffic laws of that state.

Be alert so that you will avoid accident situations caused by others, by poor roads, or by adverse weather conditions. Yield the right of way, if necessary, to avoid accidents.

Be especially alert for pedestrians.

Park vehicles in designated parking areas. Turn the ignition off, set the parking brake, set the transmission selector in park or the lowest gear position, and lock the doors. If the vehicle carries removable equipment, you must park it in a lockable, fenced area.

OFF-ROAD TRAVEL

When you operate vehicles off the road (other than on paved or fully graveled surfaces), use caution to ensure the safety of passengers and vehicles and to prevent fires.

General

Be aware of your vehicle's capabilities, including its ground clearance and ability to move up or across a grade without rolling over.

Keep a sharp look out for hidden hazards. Use common sense; don't take chances.

When going to remote areas, leave a route plan with someone. Have two-way radio communication capability.

All vehicles used off the road must carry the following equipment:

- a working two-way radio that will allow contact with the Hanford Patrol in an emergency
- two fully charged, 10-lb fire extinguishers that are A-B-C-rated dry chemical
- a shovel (at least one)
- a pair of wire cutters.

Fire Prevention

During the summer grass-fire season, the following guidelines for off-road travel are applicable on the Hanford Site. These guidelines shall be adapted to other locations if conditions warrant.

Use vehicles with catalytic converters only on paved or fully graveled roads. Do not use such vehicles on unimproved roads with grass median strips unless you have discussed it with the Environmental Monitoring Supervisor.

Notify the Environmental Monitoring Supervisor of roads routinely used that have grass median strips, need repair, or present other safety hazards.

Driver and passengers should be constantly alert and check to the rear of the vehicle for fire.

Do not park or temporarily stop vehicles, especially those with catalytic converters, except in cleared areas. This may prevent a fire from starting under a vehicle.

CAUTION: Catalytic converters are extremely hazardous because they generate sufficient heat to easily ignite dry vegetation, such as cheatgrass or tumbleweeds. However, fires can be started when dry vegetation comes into contact with hot exhaust pipes, whether the vehicle has a catalytic converter or not.

If a fire starts while you are driving a vehicle off the road:

- make radio contact with the Hanford Patrol immediately and have them contact the appropriate fire department
- notify the Environmental Monitoring Supervisor
- decide whether you can extinguish the fire or if it is more prudent to move away from the fire. Personal safety is your primary concern.

NOTE: Notify the fire department of any fire, even if it has been extinguished.

UTILITY VEHICLES

Slow-moving or unlicensed utility vehicles, such as the road monitor, shall have red triangular warning signs or flashing lights when being operated on all streets and highways.

Ensure that the running lights on trailers are operable before towing the trailer.

VEHICLE ACCIDENTS

If you are involved in an accident, you and your line management shall comply with the appropriate requirements. These requirements are summarized below.

Report all vehicle accidents, including minor damage, to the Battelle Security Control Room by calling 375-2400.

Notify the Environmental Monitoring Supervisor of all vehicle accidents, including minor damage, at the first opportunity.

Notify the police if the accident occurs at any off-site location.

If any accident involves injury to persons or damage to vehicles or other property, you must handle it as described below:

- Do not attempt first aid or other actions unless you are qualified. Remain at the scene and offer aid to injured persons. Do not move an injured person unless there is imminent danger from fire, explosion, etc.
- Exchange names, addresses, driver's license numbers, and vehicle makes, models, years, and license plate numbers with the operators of other vehicles involved in an accident. Obtain names, telephone numbers, and addresses of witnesses.
- Do not admit fault or responsibility or make any statement that could be self incriminating.

Prepare a U.S. Department of Energy Driver's Accident Report (form DOE 54-3000-260R) and submit it to the Environmental Monitoring Supervisor.

In the state of Washington and off the Hanford Site, prepare the appropriate accident report if any person is injured or any person's property sustains damages in excess of \$300. If a police officer is preparing an official police traffic collision report, complete the Motor Vehicle Collision Report (form WSP-AR-175). If the collision was not investigated by a police officer, complete the Motor Vehicle Collision Report (form WSP 161).

If an accident occurs in a state other than the state of Washington, prepare and submit accident reports as required by that state.

Submit copies of accident reports and police reports to the Environmental Monitoring Supervisor.

10.0 RADIATION SURVEY PROCEDURES

INTRODUCTION

External radiation levels are measured at several locations in the Hanford Site environs. Measurements are performed to quantify levels attributed to sources on the Hanford Site, to estimate background, to demonstrate compliance with applicable regulations, and to assess exposure to on-site and off-site populations. Thermoluminescent dosimeters and portable survey equipment are the primary means of measuring external radiation. The procedures contained in this section are the following:

- environmental thermoluminescent dosimeter (Section 10.1)
- pressurized ionization chamber (Section 10.2)
- shoreline dose rate and contamination measurements (Section 10.3)
- road monitor (Section 10.4)
- railroad monitor (Section 10.5)
- aerial monitor (Section 10.6)
- burial ground survey (Section 10.7).

Concurrence <i>K R Pm</i>	Date 2-9-90	Approval <i>Richard E. Jorgensen</i>	Date 2-9-90
Prepared by <i>Ruth</i>	Date 2/12/90	QAD Concurrence <i>DR Dahl</i>	Date 2/15/90
Procedure No. Section 10.0	Revision No. 1	Effective Date: 2-90	

10.1 ENVIRONMENTAL THERMOLUMINESCENT DOSIMETER

INTRODUCTION

Ambient external radiation levels are measured throughout the Hanford Site environs by using a dosimeter consisting of four lithium fluoride chips (thermoluminescent dosimeters) encased in a flat plastic card and covered with 0.002 in. of a tetrafluoroethylene fluorocarbon polymer material. Each card is placed in a plastic dosimeter holder. Three dosimeters are mounted 1 m above the ground at each location and are changed every three months.

EQUIPMENT

The following equipment may be necessary for collecting samples:

- thermoluminescent dosimeters (TLDs)
- plastic "zip-strip" cable ties
- wire cutters
- sample labels
- trip sheet.

SURVEY PROCEDURE

Obtain TLDs from the Radiation Calibrations Laboratory in the 318 Building.

Place the TLDs in the lead "pig" in the trip room laboratory before deploying them into the field.

In the field, remove the exposed TLD from its mounting by cutting the cable tie with the wire cutters.

Record the exposed TLD number and its location on the trip sheet and on the dosimeter package.

Use the cable ties to mount the TLDs 1 m above the ground at the established locations.

Return the exchanged dosimeters to the Radiation Calibrations Laboratory in the 318 Building, and have the person receiving them sign the trip sheet.

10.2 PRESSURIZED IONIZATION CHAMBER

INTRODUCTION

The pressurized ionization chamber is used if a known or suspected low-level radioactive gamma release is occurring and/or will continue to occur over an extended time. The unit is ideal for use near population centers to provide a record of possible dose to the surrounding population.

The instrument is a self-contained unit housed in two cable-connected, weatherproof cases. One case contains a 25-atm pressurized chamber, while the other holds the control circuitry, a strip-chart recorder, a panel meter, and a rechargeable nickel-cadmium (NiCad) battery for powering the entire system for over 200 h of direct-current (DC) continuous operation. A power cable is provided for alternating-current (AC) operation.

EQUIPMENT

The following equipment may be necessary for collecting samples:

- pressurized ionization chamber (sensor)
- control housing (strip-chart recorder)
- connecting cable
- power cable for AC operation
- tripod
- chart paper (roll).

SURVEY PROCEDURE

CAUTION: AC power must be turned off before sensor is connected.

AC Power Operation

Attach the ionization chamber to the tripod and adjust the height to approximately 40 in. (1 m).

Connect the strip-chart recorder to the ionization chamber by connecting the signal cable.

Connect the AC power cable to a power source and flip the AC switch ON.

Open the strip-chart recorder by unscrewing the thumbscrew at the left. Swing the mechanism down and out.

Load the strip-chart recorder with a fresh roll of paper, if required. Loading instructions are located inside the recorder housing.

Close the strip-chart recorder and secure with thumbscrew.

Record the following information on the chart paper at the beginning and the end of each survey:

- date and time
- location
- type of equipment (pressurized ionization chamber)
- equipment identification number
- your initials.

Turn the electrometer switch to ZERO. Verify that the strip-chart recorder is operating, and that the display reads 00.0 $\pm$ 0.1. Leave it in this position for 30 s to record the zero offset on the chart paper.

Turn the electrometer switch to READ position. After a 15- to 30-s delay, the digital panel meter and the strip-chart recorder should show the ambient radiation level (typically 8 to 10 μ R/h, depending on location).

Turn the strip-chart recorder OFF when the survey is finished by following these steps:

- Turn the electrometer switch to OFF.
- Unplug the AC power cord.
- Disconnect the signal cable from the ionization chamber.

CAUTION: Failure to follow these three steps in order may damage the instrument.

DC Power Operation

CAUTION: DC power must be turned off before sensor is connected.

Connect the strip-chart recorder to the ionization chamber by connecting the signal cable.

Connect the DC power cable to a power source, if available.

Open the strip-chart recorder by unscrewing the thumbscrew at the left. Swing the mechanism down and out.

Load the strip-chart recorder with a fresh roll of paper, if required. Loading instructions are located inside the recorder housing.

Close the strip-chart recorder and secure with thumbscrew.

Record the following information on the chart paper at the beginning and end of each survey:

- date and time
- location
- type of equipment (pressurized ionization chamber)
- equipment identification number
- your initials.

Place the mode switch in BATTERY position.

Turn the display switch to ON.

Turn the electrometer switch to ZERO. Wait 60 s and verify that the display reads 00.0 +/- 0.1. Leave it in this position for 30 s to record the zero offset on the chart paper.

Turn the electrometer switch to READ position. After a 30- to 60-s delay, a reading should appear on the digital readout and recorder. Typical ambient background is approximately 8 to 10 $\mu\text{R/h}$.

Turn digital readout to OFF if it is not needed to save battery power. Readings can still be obtained from the recorder.

Turn the strip-chart recorder OFF when the survey is finished by following these steps:

- Turn the display switch to OFF.
- Turn the electrometer switch to OFF.
- Turn the mode switch to OFF.

CAUTION: Failure to follow these three steps in order may damage the instrument.

Keep the batteries charged when they are not in use:

- Plug the charger into a 110-120-V AC line.
- Set the mode switch to CHARGE.

NOTE: When batteries are charged, the red indicator lights should be OFF. If a battery red light stays on while the battery is on CHARGE, the batteries are defective. The charger and the battery must be returned to the 318 Building for service.

10.3 SHORELINE DOSE RATE AND CONTAMINATION MEASUREMENTS

INTRODUCTION

Selected shoreline locations along the Columbia River are designated for quarterly measurement of dose rate and contamination level. Most of these locations are reached by boat.

EQUIPMENT

The following equipment may be necessary for collecting samples:

- boat
- micro-R-meter
- Geiger-Müller (GM) survey meter
- Columbia River shoreline trip sheets (Exhibits 10.3.1 and 10.3.2)
- unexposed thermoluminescent dosimeters (TLDs), if required.

Refer to Section 9.2, Boat Operation, for instruction and safety requirements for operating the boat.

SURVEY PROCEDURE

Beach the boat at the designated shoreline locations.

Measure with the micro-R-meter and record on the shoreline survey form the dose rate 3 ft inland from the water's edge and 3 ft above the surface.

Measure with a GM instrument and record on the shoreline survey form the surface contamination level of the shoreline surface 3 ft from the water's edge.

If necessary, consult the GM and micro-R-meter operating instructions. Typical background readings are encountered in the "x10" decade, which will read 0 to 30 $\mu\text{R/h}$.

Exchange TLDs as described in Section 10.1, Environmental Thermoluminescent Dosimeter, at locations specified on the trip sheet.

Report any unusual conditions observed during the shoreline survey to the Environmental Monitoring Supervisor.

**** ENVIRONMENTAL MONITORING TLD SHORELINE TRIP LOG ****

ROUTE #

On Date:

Off Date:

Monitor: _____

SAMP NUMB	LOCATION	SAMP NUMB	TLD #		Shoreline Rad.		Surv. GM@sur
			OLD	NEW	LLM@3'	GM@3'	
6471	Up River 100 B Area						
6472	Below 100 B Retention Basin						
6135	Coyote Rapids (Submerged)						
6260	Above 100 K Boat Ramp	6132					
6261	Old Ferry Landing opposite 100 D	6241					
6475	Down River 100 D						
6262	Lower End Locke Island	6123					
6476	White Bluff Slough						
6263	White Bluff Ferry Landing	6121					
6264	Below 100 F	6120					
6389	Hanford Powerline Crossing	6118					
6265	Hanford Ferry Landing Muddy Cove	6117					
6266	Hanford R.R. Track	6242					
6479	Savage Island Slough						
6267	Ringold Island	6114					
6268	Powerline Crossing	6113					
6480	North End Wooded Island						
6269	Lower End Wooded Island						
6481	Island 300 Area						
6482	Island Below Bateman Island						
6477	100 F Flood Plain						
6478	Hanford Slough						
1715	Richland Pumphouse						

Comments: _____

Received by: _____ Date: _____

Exhibit 10.3.1. Columbia River Thermoluminescent Dosimeter (TLD) and Shoreline Trip Sheet (Log) for Samples Collected Monthly

*** ENVIRONMENTAL MONITORING RIVER TLD AND SHORELINE SURVEY TRIP LOG ***

ROUTE #

On Date:

Off Date:

Monitor:

SAMP NUMB	LOCATION	SAMP NUMB	TLD #		Shoreline Rad.		Surv. GM@sur
			OLD	NEW	LLM@3'	GM@3'	
6536	20' Downstream Outfall	6483					
6537	Below 100 N Stack	6484					
6538	Upstream tip of Berm	6485					
6390	100 N Trench Springs	6129					

Comments:

Received by:

Date:

Exhibit 10.3.2. Columbia River Thermoluminescent Dosimeter (TLD) and Shoreline Trip Sheet (Log) for Samples Collected Quarterly

10.4 ROAD MONITOR

INTRODUCTION

The road monitor is used to locate gamma-emitting surface contamination in the environs, primarily on road surfaces. The system uses four sodium iodide (NaI) scintillation detectors mounted on the rear bumper of a four-wheel drive vehicle. The detector electronics are mounted in an instrument rack located behind the driver's seat. The electronics include the following:

- four combination amplifier/single-channel analyzer modules (AMP/SCA)
- adjustable rate meter
- high-voltage (HV) power supply.

A strip chart recorder is mounted between the front seats. Four decouplers are mounted behind the seat, and a 115-V power supply is located in the base of the instrument rack. A schematic drawing of the system is provided in Figure 10.4.1.

SAFETY

The revolving beacon on the roof of the vehicle must be operating and the triangular, orange, SLOW MOVING VEHICLE sign must be affixed to the rear of the vehicle where it can be plainly seen by overtaking vehicles when you are road monitoring at slow speeds.

EQUIPMENT

The following equipment may be needed for road monitoring:

- road monitoring vehicle
- Geiger-Müller (GM) with P-11 probe
- micro-R-meter
- chart papers and pens
- fluorescent orange spray paint
- beta-gamma check source
- Road Survey Record (Exhibit 10.4.1).

SURVEY PROCEDURE

Start vehicle engine.

Turn on HV power supply, located in the base of the instrument rack, by flipping the double toggle switch to the ON (up) position. The power supply meter should indicate approximately 115 V and 0.5 to 0.8 amp.

The power supply takes approximately 30 to 60 s to warm up.

Turn on the instrument rack by flipping the rack power switch (lower right corner of instrument rack) to the ON position.

Reset the four AMP/SCA units by depressing the reset buttons on each unit. The AMP/SCA indicator lights will switch from red to green.

Verify that the rate meter is set on 2000 counts/s, full scale. The x2 (times two) scale-multiplier button (these are the 4 gray buttons) should be depressed and the 10^3 range button (these are the 6 tan buttons) should be depressed. The linear-seconds-time-constant (upper black knob on left side of rate meter) should be set to 0.5. Do not adjust any of the other buttons.

Turn on the chart recorder drive by flipping the power switch on its top right to the ON position.

Check that the voltage switch is set on 10 mV and the chart speed is set on 1 cm/min. Background on chart is approximately 30% of scale.

Write the date and the road monitor trip number on the strip chart.

Allow the system to warm up for approximately 15 min before performing the source check. The warm-up period will allow the system to stabilize and produce a constant trace on the chart (one with no drift up or down) and to establish a background level.

Perform the source check by holding the ^{137}Cs source in contact with the lower side face of each detector.

Wait approximately 5 s between testing each detector to spread the chart recorder peaks for each detector.

The chart indications should be between 50% and 80% of full scale. If the response from any detector falls below 50% of full scale, notify the Environmental Monitoring Supervisor.

Proceed to the survey location at normal vehicle speed.

On arrival at the survey location, turn road hazard lights on. Ensure that the slow-moving vehicle sign is visible.

Perform the survey at approximately 10 mi/h. Record all information on the Road Survey Record (Exhibit 10.4.1). Equipment malfunctions or erratic responses must be noted on the log.

Investigate an elevated reading by backing the vehicle over the area to locate the source. The detectors are sensitive to radiation from facilities or from passing radioactive shipments, either of which can give a false indication of surface contamination.

On foot, survey the suspect area with portable survey meters.

If contamination is found, determine its extent and location. Mark it with spray paint. Note the location as accurately as possible on the survey record.

Record the instrument readings on the survey record.

Notify the Environmental Monitoring Supervisor of the contamination as soon as practical. However, do not discuss contamination levels via the radio.

Repeat the source check if, at any time during the survey, there is reason to doubt the performance of the road monitor equipment. A source check must be performed at the end of the survey and marked on the strip chart.

Turn off the chart recorder, instrument rack power, HV supply, and main power supply before stopping the vehicle engine. Failure to turn off the equipment and main power supply before turning the engine off may result in a dead battery.

CAUTION: Turn the vehicle off last!

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Figure 10.4.1. Road Monitor Schematic

* % OF SCALE AT CHECK POINT AND MAXIMUM AND MINIMUM READING BETWEEN POINTS.

Exhibit 10.4.1. Road Survey Record

10.5 RAILROAD MONITOR

INTRODUCTION

The railroad monitor is used to monitor for gamma-emitting surface contamination along the railroad tracks on the Hanford Site. Two sodium iodide (NaI) scintillation detectors are permanently mounted (one on either side) on a small railroad car. Arrangements are made with Westinghouse Hanford Company for a railroad engineer to operate the railroad car when the survey is made.

EQUIPMENT

The following equipment may be needed for monitoring railroads:

- analyzer
- battery pack
- rate meter
- chart recorder
- Geiger-Müller with P-11 probe
- micro-R-meter
- spare chart paper and pens
- spray paint
- portable two-way radio
- beta-gamma check source
- Railroad Survey Record (Exhibit 10.5.1).

SURVEY PROCEDURE

Unplug the battery pack and the chart recorder from their respective chargers. Perform a battery check to verify that the chart recorder is operating correctly before proceeding to the field.

Plug the battery, rate meter, detector, and chart recorder cables into the side of the analyzer as labeled on the unit.

Flip the toggle switch on the analyzer to ON, and check that the rate meter responds and the display lights up.

Flip the power switch on the chart recorder to ON. The background position should be approximately in the middle of the paper.

Set the audible alarm by:

- turning the TIME knob to 200, then pressing the SET and the T,HLD buttons at the same time (200 is the threshold of audible)
- turning the TIME knob to 2, then pressing the SET and SPAN buttons at the same time.

Allow the system to warm up for approximately 5 min before performing a source check. The warm-up period will allow the system to stabilize and produce a constant trace on the chart, establishing a background level.

Perform the source check by placing the ^{137}Cs check source in contact with the lower face of each detector. Wait approximately 5 s between testing each detector to spread the peaks on the chart recorder.

Perform the survey at approximately 10 mi/h. Record all data on the Railroad Survey Record, and make notations directly on the chart paper.

Investigate any spikes by backing the railroad car over the area.

On foot, survey the suspect area with the portable survey meters.

If contamination is found, determine its extent and location and mark it with spray paint.

Record the readings on the chart paper and the survey record.

Return the analyzer and the chart recorder to the 2400 Stevens Building laboratory for storage.

Plug the recorder into the charger and make sure the toggle switch is in the ON position.

Plug the analyzer battery pack into its charger.

Notify the Environmental Monitoring Supervisor of any unusual findings.

Exhibit 10.5.1. Railroad Survey Record

10.6 AERIAL MONITOR

INTRODUCTION

Aerial monitoring equipment is used to identify and define contaminated areas along the Hanford Site perimeter. The perimeter is surveyed on an annual basis, and the aerial monitoring equipment also may be used in the event of a radiological emergency (see Section 8.0, Special Sampling Procedures).

EQUIPMENT

The following equipment may be needed for aerial monitoring:

- Aerial Monitoring Instrument Kit
- Aerial Monitoring Supply Kit
- Geiger-Müller with pancake probe
- micro-R-meter
- beta-gamma source check
- Aerial Survey Record (Exhibit 10.6.1).

EQUIPMENT CHECK PROCEDURE

Load the aerial monitoring equipment on the aircraft. The actual arrangement of the equipment within the aircraft will depend on the type of aircraft used. Place the cylindrical lead shield around the detector.

Strap or otherwise secure the equipment to prevent its movement.

Assemble and operate aerial monitoring equipment in accordance with setup and operating procedure provided within the monitoring equipment.

SURVEY PROCEDURE

Record the time that the survey was started. All surveys are to be flown at an altitude of 500 ft and an indicated air speed of 120 to 130 mi/h.

Record on the strip chart and on the Aerial Survey Record all pertinent information, including the numbered survey points and range changes taken from the aerial monitoring maps. Record time at start and completion of each flight.

If contamination is found, determine its extent and report it to the Environmental Monitoring Supervisor as soon as possible.

Source check the instrument during the flight, if possible, and after completing the survey. All such checks should be plainly identified on the strip chart.

Battelle
 Pacific Northwest Laboratories

ENVIRONMENTAL MONITORING
AERIAL SURVEY RECORD

NAME OF MONITORING

DATE

INSTRUMENT USED

PLANE NO.

INSTR. RESPONSE TO SOURCE

ALTITUDE

CHART SPEED

AIR SPEED

LOCATION OR SURVEY PATTERN	CHECK POINT	% OF SCALE *	SCALE USED	LOCATION OR SURVEY PATTERN	CHECK POINT	% OF SCALE *	SCALE USED
	1				1		
	2				2		
	3				3		
	4				4		
	5				5		
	6				6		
	7				7		
	8				8		
	9				9		
	10				10		

REMARKS:

A-1700-243-12/84

* % OF SCALE AT CHECK POINT AND MAXIMUM AND MINIMUM READING BETWEEN POINTS.

Exhibit 10.6.1. Aerial Survey Record

10.7 BURIAL GROUND SURVEY

INTRODUCTION

Burial grounds are surveyed quarterly, semiannually, or annually, depending on their active or inactive status, to assess the possibility of radioactive contamination escaping to the environment through erosion, vegetation/animal uptake, or leaching.

EQUIPMENT

The following equipment may be needed to survey the burial grounds:

- micro-R-meter
- Geiger-Müller survey meter
- spray can of fluorescent orange paint
- Waste Site Survey form (Exhibit 10.7.1).

SURVEY PROCEDURE

Look over the area to discover any conspicuous problems. If there are none, proceed around the perimeter of the area, taking occasional Geiger-Müller and micro-R-meter readings. Note any abnormalities. A survey inside the perimeter may be necessary at times, in which case pertinent Radiation Work Procedures are to be followed.

If an isolated hot spot is encountered, spray it with the fluorescent orange paint. Note its position and record it on the Waste Site Survey form.

Battelle Pacific Northwest Laboratories Battelle Building Richland, Washington 99361		RADIATION PROTECTION RECORDS ENVIRONMENTAL MONITORING TRIP LOG WASTE SITE SURVEY			
LOCATION: _____ Map Location _____					
STATUS: _____ Frequency _____					
Survey Requirements:					
Inactive Site Only (a)					
Date	Time	Monitor			
Vehicle Used	Mileage	<div style="display: flex; justify-content: space-between;"> Start Finish </div>			
Maximum Instrument Reading at Fence	(a) Maximum Surface Instrument Reading	Vegetative Growth	Animal Scat Instrument Reading (if noted)	Posting & Fencing	Erosion Status, Cave-ins, Digging, Flooding
General Comments: _____					
Is corrective action or further inspection indicated? Yes ☐ No ☐					
If yes, specify: _____					

DISTRIBUTION: White Environmental Monitoring Unit
 Yellow Environmental Monitoring Records

BC-1200-279 (11/77)

Exhibit 10.7.1. Waste Site Survey Form

DISTRIBUTION

No. of
Copies

No. of
Copies

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2 DOE Office of Scientific and
Technical Information

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MS LF-13
State of Washington Department
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Olympia, WA 98504

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Washington Public Power Supply
System
3000 George Washington Way
Richland, WA 99352

DOE Richland Operations Office

Hanford Public Reading Room

18 Pacific Northwest Laboratory

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