

## APPENDIX E

### Richland Operating Procedures

# RICHLAND OPERATING PROCEDURE

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## 1.0 INTRODUCTION

1.1 This procedure shall be used for environmental, air emissions and operational air monitoring for alpha, iodine, gross beta-gamma and tritium activity, if applicable.

## 2.0 EQUIPMENT

2.1 Air samplers with a continuous capacity of 1 to 2.5 cfm and able to be equipped with an iodine vapor cartridge.

2.2 High volume air sampler capable of 4 cfm air (grab samples). Sampler shall have an airflow indicator.

2.3 Scaler instrument(s) capable of counting samples for alpha, iodine and beta-gamma activity.

2.4 High efficiency (99%) particulate air filters.

2.5 Iodine vapor cartridges.

2.6 Silica gel columns for tritium vapor collection.

2.7 Tritium Monitoring media.

2.8 Model 3 or equivalent with appropriate probes.

## 3.0 PRECAUTIONS

3.1 In areas of suspected airborne contamination, use of respiratory equipment shall be evaluated by the Assistant Radiation Protection Manager (ARPM).

3.2 Iodine sampling is required whenever manifested activity meets or exceeds one millicurie.

3.3 Counting system operation (check source and backgrounds) shall be verified at least daily whenever air samples are being counted.

3.4 Casks, liners and packages that were loaded while inside a fuel pool shall be considered potentially contaminated.

## 4.0 PROCEDURE

### 4.1 Air Sampler Calibration

Air samplers shall be calibrated every six months. Calibration shall be performed in accordance with ROP 606.

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### 4.2 Required Air Sample Data

4.2.1 The following information shall be recorded for each air sample taken:

- Location
- Sampler Number
- Sample Type
- Flow rates
- Start and Stop times
- Field analysis data (If results exceed 2000 CPM B/G or 200 CPM Alpha)
- Adjustments greater than 10%

4.2.2 The air filter envelope may be used to initially record this information.

### 4.3 Environmental Air Samples (Taken at the environmental monitoring stations)

4.3.1 Environmental air samples shall be analyzed for the parameters listed in Table 6.1 of the Facility Standards Manual.

4.3.2 Environmental air sampling stations shall be inspected daily and, if required, flow rate adjustments made. Results of this inspection shall be documented on Attachment 701-2 (or equivalent).

4.3.3 Air samplers shall have a minimum capacity of one CFM and be set at 1.5 CFM. A standard 47-millimeter particulate filter shall be installed.

4.3.4 Particulate filters shall be changed weekly such that a minimum of five days (10800 cu. ft.) and a maximum of nine days of collection time have accumulated. At times it may not be possible to meet the target volume due to circumstances such as power failures or loss of sampler draw volume. If this occurs, notify the ARPM and note it on the air sampling log (attachment 701-1) under remarks and in the field log book.

4.3.5 During handling (offload, handling of above ground packages and disposal) of waste packages which equals or exceeds one (1) millicurie of iodine, the downwind air sampler will be used to verify any environmental iodine releases. The downwind iodine vapor cartridges shall be operated at 2.5 CFM for at least one hour.

4.3.5.1 The iodine vapor cartridges shall be operated at 2.5 CFM for at least four (4) hours if one or more mCi of I-129 is present.

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- 4.3.5.2 The downwind air sampler will be operated during working hours when storage levels of iodine activity equals or exceeds one mCi. A new cartridge is installed on the first day of each work week. The previous week's cartridge is analyzed on the first day of the week or when the iodine package(s) are removed from storage.
- 4.3.6 Tritium cartridges, consisting of three silica gel columns in series, shall be installed in stations one, two and five. Each sampler shall be capable of collecting tritium vapors at a rate of 100 to 150 cc of air per minute. The tritium cartridges shall be changed in accordance with the FSM Table 6.1.
- 4.4 Occupational Air Samples
  - 4.4.1 Occupational air samples shall be taken:
    - 4.4.1.1 Whenever personnel may be exposed to airborne radioactivity
    - 4.4.1.2 Inside an active trench in the vicinity of personnel performing waste handling operations in the trench
    - 4.4.1.3 In close proximity when opening closed transport vehicles during waste handling
    - 4.4.1.4 Downwind of waste handling operations
    - 4.4.1.5 In close proximity of cask lid or a cask or package is being opened
    - 4.4.1.6 In close proximity of personnel during, removal of waste from flatbed trailers
    - 4.4.1.7 During Package Inspections
  - 4.4.2 Occupational air samples shall have a minimum flow rate of 2.5 CFM per minute and a minimum run time of 60 minutes.
  - 4.4.3 Occupational air sampling shall include an iodine cartridge whenever the manifested activity (package activity for PIs) meets or exceeds one (1) millicurie of iodine. These cartridges are counted after the waste is disposed, or at the beginning of the following week.
- 4.5 Emission Monitoring
  - 4.5.1 Air samples shall be taken for any evolution with potential to emit airborne radionuclides.
  - 4.5.2 As a minimum, the following evolutions shall be considered to have potential to emit airborne radionuclides
    - 4.5.2.1 Opening a cask that was loaded in the fuel pool

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4.5.2.2 Opening a cask that contains a liner or package that was loaded in the fuel pool

4.5.2.3 Opening any waste package

4.5.2.4 Decontamination of materials, equipment or trailers

4.5.3 Air Emission samples shall be taken during package inspections conducted inside the Inspection Facility.

4.5.3.1 The inside the tent air sample shall routinely be used to determine the emission concentration for activities conducted inside Inspection Facility .

4.5.3.2 The RPM may designate the Vent Exhaust as the emission monitoring sample provided justification of the vent exhaust sample is documented including formal approval by the Facility Manager.

4.5.4 Air emission samples shall have a minimum flow rate of 2.5 CFM and a minimum run time of 60 minutes.

4.5.5 Air emission samples shall include an iodine cartridge whenever the manifested activity of the package activity is equals or exceeds one (1) milliCurie of iodine.

4.5.5.1 Any package containing one (1) milliCurie or more of I-129 requires at least four hours of sample collection time.

4.5.6 Except for above ground storage, air emissions will be based on the down wind sample and run time of the sampler.

4.5.6.1 The RPM shall evaluate storage locations down wind iodine sample results to determine iodine emission (if any) on a case by case basis.

4.5.7 Iodine emissions will be assessed for any air sample above investigation levels.

### 4.6 Grab Air Samples

Grab samples shall be taken when airborne contamination is suspected (e.g. broken container with high loose surface contamination), when required by radiation work procedure, or when required by the RPM/ARPM. At least a 50 ft<sup>3</sup> sample shall be taken through a standard 47 mm particulate filter; flow rate shall be as large as allowed by the sampler's capabilities and still be within the filters acceptable flow rates.

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### 4.7 Tritium Air Samples

4.7.1 Samples are collected for environmental samples per FSM Table 6.1. The samplers use a descant in an air drying column. The samples are sent to the laboratory for tritium in air analysis.

### 4.8 Field Counting of Air Particulate/Iodine Samples

Air filters and iodine cartridges (excluding DW samples) should be initially counted as soon as practical after removal from the sampler with a Model 3 (or equivalent) to determine if an immediate problem may exist.

4.8.1 Notify the ARPM immediately if the filter exceeds 2000 CPM beta/gamma, 200 CPM alpha or the iodine cartridge exceeds 1000 CPM beta gamma.

4.8.2 Store air samples for radon daughter decay. If results exceed the values listed in 4.8.1, proceed to step 4.9 for radon daughter determination.

### 4.9 Quick Radon Daughter Determination

Occasionally short-lived Rn-222 progeny particles cause high initial beta and alpha counts. These elevated results do not represent an actual release of airborne radioactivity from the waste but can be high enough to represent a significant release if the activity was not radon. Therefore, it is advantageous to verify the presence of radon daughters as quickly as possible. The following steps utilize the half-life and alpha/beta characteristics of the short lived Rn-222 daughter to quickly determine if significant radon was present during sampling. It should be noted that radon determination is only an interim step and does not eliminate the need for the decay period detailed in Section 4.10 of this procedure.

4.9.1 Allow the sample to decay for approximately 30 minutes to eliminate Po-218 (3 min half-life-alpha decay) from the air sample.

4.9.2 Count the sample for alpha and beta radiation. (May use either field or lab instruments for radon determination).

4.9.2.1 There should be a significant (approximately a factor of 2) decrease in both alpha and beta count rates - Notify ARPM if decrease not observed.

4.9.2.2 Determine the ratio of alpha to beta disintegration rates.

Note: Filter paper and dust particle shielding of alphas may reduce observed alpha count rates and evaluate the alpha/beta disintegration rate ratio to the following criteria.

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- a Alpha/Beta greater than 75% - release is probably an alpha emitter other than Rn-222 daughters. Notify the ARPM immediately if ratio is greater than 75%.
- b Alpha is less than 75% but greater than 50 % of Beta. May indicate the presence of alpha emitters other than Rn-222 daughters. Notify ARPM, but go to step 4.9.3 for further evaluation.
- c Alpha to beta ratio between 50% to 10%. Significant Rn-222 daughter probably present go to step 4.9.3.
- d Alpha to beta ratio less than 10%. Significant beta emitter other than Rn-222 daughter may be present. Notify ARPM. Go to step 4.9.3.

4.9.3 Allow the sample to decay for another 30 minutes.

4.9.3.1 Count the sample for alpha and beta radiation.

4.9.3.2 Compare decay rates to initial field count rates. There should be better than a factor of two (2) decrease from initial field results. Notify ARPM if decrease not observed.

4.9.3.3 Determine the ratio of alpha to beta disintegration rates.

Note: filter paper and dust particle shielding of alphas may reduce observed alpha count rates and evaluate the alpha/beta disintegration rate ratio to the following criteria.

- a Alpha/Beta ratio greater than 60% - release is probably an alpha emitter other than Rn-222 daughters.
- b Alpha/Beta between 60% - 20%. Activity is most likely Rn-222 daughters.
- c Alpha to beta ratio less than 20%. Significant beta emitter other than Rn-222 daughters is probably present.
- d Notify ARPM of radon determination results. Go to Step 4.10.

4.9.4 ARPM ensure radon determination information is documented with the appropriate Attachment 701-1 when completed.

4.10 Air Sample Analysis

4.10.1 Record the air sample information in appropriate space of Attachment 701-1 (or equivalent).

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4.10.2 Verify backgrounds and check source counts are complete.

4.10.2.1 Alpha/Beta background counts for a 30-minute count time with a clean filter and planchet. Collect additional background counts as required.

4.10.2.2 Iodine background counts will be for 30 minutes, and conducted within 4 hours of the sample analysis. Verify that the 30-minute iodine cartridge background is within  $\pm 10$  CPM of the most recent unused iodine cartridge background obtained for the iodine counter.

4.10.2.3 Iodine cartridges may be reused provided their residual activity is less than 40 CPM (may be based on a count after decay of possible radon daughters). The cartridge is sealed in a plastic bag and the date, instrument serial number and CPM is recorded on the bag. The cartridge may then be used for future iodine sampling.

4.10.2.4 If a counting system is outside of allowed values, notify the ARPM.

4.10.3 Environmental Particulate Samples Analysis

4.10.3.1 Allow the sample to decay for a minimum of 3 days.

4.10.3.2 Count the samples for 30 minutes. Longer counts may be used as directed by the ARPM depending on the instruments efficiency and background.

4.10.3.3 If the first count is above investigation level, notify the ARPM. Decay the sample for an additional 4 days (total 7 days) and recount. Notify the ARPM and RPM if the 7 day recount is above investigation levels.

4.10.3.4 At the end of each quarter, send all air sample filters to the offsite laboratory, and analyze for gross alpha, gross beta and gamma spectroscopy.

4.10.3.5 Environmental iodine samples, if collected, can be counted without a decay period.

4.10.4 Occupational Sample Analysis

4.10.4.1 Allow the sample to decay until the next working day. For weekends and holidays, count the sample on the next day of operations.

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4.10.4.2 Count the samples for 30 minutes. Longer counts may be directed by the ARPM depending on the instruments efficiency and background.

4.10.4.3 If the first count is above investigation level, notify the ARPM. The sample may be decayed for an additional 2 days, or until operations resume after a weekend or holiday. Notify the ARPM and RPM if the analysis completed after 3 days is above investigation levels (e.g. second count or the first count after a weekend or holiday).

4.10.4.4 Occupational iodine sample are counted following collection.

#### 4.10.5 Air Emissions samples

4.10.5.1 These samples may be environmental, occupational, package inspection, grab or other samples.

4.10.5.2 Allow particulate samples to decay for 10 days.

4.10.5.3 Air Emissions iodine samples can be counted the after collection, usually on the following Monday for sample collected for waste in storage.

#### 4.11 Calculate Air Sample Activity

4.11.1 Obtain the Net count by subtracting the background CPMb from sample count CPMs and record this value as net sample CPMnet.

4.11.1.1 Field calculation, use net CPM and enter into equation Assume 10% efficiency. (Field calculations are not a substitute for lab analysis).

4.11.2 Calculate sample activity using the following formula.

$$Activity (\mu Ci / ml) = \frac{CPM_{net} \times 1.59 E - 11}{volume \times efficiency}$$

Where:

1.59 E-11 = Conversion factor - dpm to  $\mu$ Ci and

- cubic feet to cubic centimeters

Volume = Sample volume in cubic feet

Note: If the flow rate changes by more than  $\pm 10$  percent during collection

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of a sample, a correction should be made by averaging the initial and the final flow rates.

#### 4.11.3 Calculate the uncertainty at 95 Percent Confidence.

Calculate the uncertainty or error associated with environmental air samples using the following equation:

$$\text{Error (in cpm)} = 1.96 \times \sqrt{\frac{C}{Tb} + \frac{Cb}{Tb}}$$

Where:

Error in CPM is the uncertainty associated with the sample count and the background count, which is expressed as the Result  $\pm$  Error.

1.96 = Constant associated with the 95 confidence interval

C = CPM (gross) sample

Cb = CPM background

Tb = Time background count

#### 4.11.4 Calculate the Lower Limit of Detection (LLD) and Minimum Detectable Concentration (MDC) using the following equation:

##### 4.11.4.1 Lower limit of detection (LLD), as follows:

$$LLD(\text{in CPM}) = \frac{3.0}{Ts} + 3.29 \times \sqrt{\left(\frac{Cb}{Ts} + \frac{Cb}{Tb}\right)}$$

Where:

Cb = CPM background

Ts = Length of time the sample is counted (minutes)

Tb = Length of time background is counted (minutes)

3.29 = the factor which when multiplied by the standard deviation of the background count, and added to the result of (3.0/Ts), will deliver the estimated lower limit of detection (LLD). The factor assumes a five percent risk of false detection and false non-detection. The factor is equal

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to  $2k$ , where  $k = 1.645$  (one-sided 95% confidence statistic).

$3 = 5\%$  probability that the Poisson distribution will yield a zero count rate.

4.11.4.2 Calculate the minimum detectable concentration (MDC) using the sample activity equation, substituting LLD for CPM net. Ensure the MDC is below the action level for the samples being analyzed.

4.11.5 Record the calculated concentration, error and MDC on Attachment 701-1.

4.11.5.1 The person counting the sample shall initial in the space provided and record the time the sample was counted.

### 4.12 Beta and Alpha Intercomparison

Quarterly, an air sample, or air samples, will be sent to the approved radiological laboratory for a gross alpha, gross beta and a gamma spectroscopy.

4.12.1 Select air sample filter(s) that have the most alpha and/or beta counts. Numerous filters can be sent for one analysis.

4.12.2 Prior to sending the sample filters papers to the lab (within 48 hours), count the air samples for alpha and beta activities. Record on attachment 701-1, or equivalent.

4.12.3 When the results from the lab counts are obtained, compare the counts obtained above with the lab analysis results.

4.12.3.1 Compare the total, net counts from each analysis. The comparison should include radiological decay.

4.12.3.2 A successful comparison is when the lab gross alpha and gross beta is within 5 times the error calculated above (in CPM).

## 5.0 ACTION LEVELS

5.1 Any airborne radioactivity that exceeds the action levels of Table 6.1 of the FSM shall be brought to the immediate attention of the ARPM.

5.2 Notify the ARPM immediately if a field check of the filter exceeds 2000 CPM beta/gamma, 200 CPM alpha or the iodine cartridge exceeds 1000 CPM beta gamma.

5.3 Iodine cartridges can be reused if the residual activity does not exceed 40 CPM.

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### 6.0 RECORDS

- 6.1 Air Sample Log Sheet (Attachment 701-1 or equivalent)
- 6.2 Vendor Report of Environmental Concentration in Air
- 6.3 Environmental Field Log Book

A field log book shall be maintained for environmental air samples and shall contain the following information:

- Location
- Start and stop date and time
- Flow rate
- Total flow
- General weather conditions
- Name of person collecting sample

- 6.4 Environmental Air Sampling Daily Check Form (Attachment 701-2 or equivalent)

### 7.0 BIBLIOGRAPHY

The following documents or portions thereof were used to generate this section.

- 7.1 Washington State Radioactive Material License WN-I019-2.
- 7.2 US Ecology Washington Facility Standards Manual.
- 7.3 Richland Operational Procedure (ROP) No. 106.
- 7.4 Richland Operational Procedure (ROP) No. 606.
- 7.5 Richland Operational Procedure (ROP) No. 602.
- 7.6 Counting Statistics, An Advanced Course, GP Courseware, p. 80-100.
- 7.7 Washington State Radioactive Air Emissions License RAEL-009
- 7.8 ANSI 13.1 Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities
- 7.9 U.S. Nuclear Regulatory Commission Regulatory Guide 8.25 "Air Sampling in the Work Place"
- 7.10 U.S. Nuclear Regulatory Commission NUREG-1400 "Air Sampling in the Work Place"

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### 1.0 INTRODUCTION

1.1 This procedure shall be used for vegetation monitoring. Annual samples shall be taken at environmental monitoring stations and northeast and northwest facility corners and capped trenches.

### 2.0 EQUIPMENT

2.1 Heavy duty plastic bags or other suitable containers capable of holding 300 grams of foliage.

2.2 Clippers or snips to cut foliage.

2.3 Protective gloves (recommended).

### 3.0 PRECAUTIONS

3.1 All foliage must come from live deep- rooted plants.

3.2 Sampling equipment shall be designated for each sampling station, cleaned after sampling and protected from contamination.

3.3 Samples shall not be taken unless quantities of more than 300 grams can be collected. If samples cannot be collected, it shall be noted in the Field Log Book with the reason. The Assistant Radiation Protection Manager (ARPM) shall be informed.

3.4 A single set of clippers may be used for capped trench vegetation sampling provided they are thoroughly cleaned between each sample to prevent cross contamination.

### 4.0 PROCEDURE

4.1 Environmental monitoring stations or northeast or northwest facility corners samples must come from plants within 50 feet of the station or corner.

4.2 Trench vegetation samples shall be taken if vegetation is present in sufficient quantities. Capped trench samples should come from within the boundaries of the trench.

4.3 Cut foliage for sample, noting type and quantity of foliage in each sample. Collect the quantity required by the laboratory (usually about 300 grams).

4.4 Place foliage in container.

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- 4.5 Mark container with date and sample location.
- 4.6 Record location, species and date for each sample in the Field Log Book.
- 4.7 Seal the containers.
- 4.8 If a single set of clippers is to be used to sample various sample points (as in the case of trench vegetation) then they shall be cleaned until all visible foreign matter is removed.
- 4.9 Upon completion of sampling, the sampler shall package the individual samples into a shipping container which can be sealed in such a way as to give evidence in case of any tampering with the contents. After verifying the samples are enclosed, the sampler shall seal the container and apply the security seal. The seal must contain:
  - 4.9.1 The words "US Ecology Seal # \_\_\_\_\_"
  - 4.9.2 The seal number entered in the blank
  - 4.9.3 Typed or printed sampler's name, and the sampler's signature
- 5.0 ACTION LEVELS
  - 5.1 Per the FSM Table 6.1
- 6.0 RECORDS
  - 6.1 Field Log Book

A field log book shall be maintained for vegetation samples and shall contain the following information:

    - 6.1.1 Sample date and time
    - 6.1.2 General weather conditions
    - 6.1.3 Name of sampler
    - 6.1.4 Sample location
    - 6.1.5 Species of vegetation
  - 6.2 Work Request Cover Letter

A work request must accompany the Chain of Custody (C of C) form and the samples. The work request cover letter must contain the following:

    - 6.2.1 Purchase order number
    - 6.2.2 Work order number, issued from the work order log

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- 6.2.3 Within the text of the request, it must refer the vendor to the specifications, and limits set forth in the purchase order
- 6.2.4 Vendor name and current vendor address
- 6.2.5 A request of the work to be performed, with a general description of the samples, shall refer the vendor to the C of C for specific sample numbers
- 6.3 The Chain of Custody Form (Attachment 702-1) will be filled out as follows:
  - 6.3.1 Project Name- line provided after "US Ecology Washington", type in reason in sample, i.e. "grab sample", "annual vegetation", or "annual capped trench vegetation"
  - 6.3.2 Work order number - same as on the cover letter
  - 6.3.3 Sample number
    - 6.3.3.1 For annual vegetation: year-quarter-station, i.e. "2014-3-1", "2014-1-NE"
    - 6.3.3.2 For grab samples: year-quarter-"grab" location, i.e. "2014-3-grab sta.2", "grab 2014-1-T16"
    - 6.3.3.3 For annual capped trench vegetation: year-trench "2014-T4" or"2014-T7"
  - 6.3.4 Date - date of sample
  - 6.3.5 Time - time of sample
  - 6.3.6 Sample location - as specific as possible
  - 6.3.7 Total No. of Cont. - the number of containers for that sample
  - 6.3.8 Analysis/Parameters - check the blocks appropriate to the sample and write in any extra analysis in spare blocks. Normal analysis is as follows:
    - 6.3.8.1 Routine annual - Per FSM table 6.1
    - 6.3.8.2 Annual capped trench - Per FSM table 6.1
    - 6.3.8.3 Grab samples - as directed by ARPM
  - 6.3.9 Security seal number - shall be the work order number
  - 6.3.10 Sampler - signature of person who collected samples
  - 6.3.11 Relinquished by - signature of person who sends samples
  - 6.3.12 Certification of seal and receipt block is to be filled out by vendor upon

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receipt

6.4 Routing of Cover Letter and Chain of Custody

6.4.1 Original with samples to vendor

6.4.2 One copy to the ARPM

6.4.3 One copy to the work order book

7.0 BIBLIOGRAPHY

The following documents or portions thereof were used to generate this section.

7.1 Washington State Radioactive Material License WN-I019-2

7.2 US Ecology Washington Facility Standards Manual

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## 1.0 INTRODUCTION

1.1 Soil samples are taken and analyzed to determine the presence of possible contamination from facility or other operations on the Hanford Reservation. Required sampling frequencies are found in Section 6 of the Facility Standard Manual. This procedure prescribes correct sampling and shipping methods to be used. Samples shall be taken at the environmental monitoring stations and the northeast and northwest site corners.

## 2.0 EQUIPMENT

2.1 Collection containers (as supplied by vendor)

2.2 Small digging utensil

2.3 1/4" Grid (screen)

## 3.0 PRECAUTIONS

3.1 Care should be taken to avoid introducing vegetable or animal matter into the soil sample.

3.2 Sampling equipment shall be designated for each sampling location, cleaned after each sampling, and protected from contamination.

3.3 Samples should be taken within 50 feet of each environmental monitoring station or site corner.

## 4.0 PROCEDURE

4.1 An undisturbed area within the environmental monitoring station shall be selected for sample collection.

4.2 The sample shall be taken from undisturbed soil from an area of 12 inches by 12 inches by one inch deep. Additional areas adjacent to the first may be designated, as required, to obtain required sample volume.

4.3 Pass the sample through a one-quarter inch mesh screen to remove debris of greater size.

4.4 Place sifted soil into sample container(s) and cap.

4.5 Label or mark the container with the location, sample number and date. .

4.6 The sampler shall package the samples for shipment and after verification that all the samples are included, shall apply a security seal to each shipping container

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(per 6.2.2.9) to prevent sample tampering and shall then sign the sampler's block of the Chain of Custody (per 6.2.2.10).

### 5.0 ACTION LEVELS

5.1 Per the FSM Table 6.1

### 6.0 RECORDS

#### 6.1 Field Log Book

A Field Log Book shall be maintained for soil samples and shall contain the following information:

- 6.1.1 Sample date and time
- 6.1.2 General weather conditions
- 6.1.3 Name of sampler
- 6.1.4 Sample location
- 6.1.5 Sample Number

#### 6.2 Work Request Cover Letter

6.2.1 A Work Request Cover Letter must accompany the Chain of Custody (C of C) form and the samples. The work request cover letter and must contain the following:

- 6.2.1.1 Purchase order number
- 6.2.1.2 Work order number, issued from the work order log.
- 6.2.1.3 Within the text of the request, it must refer the vendor to the specifications, and limits set forth in the purchase order
- 6.2.1.4 Vendor name and address.
- 6.2.1.5 A request of the work to be performed with a general description of the samples which refers the vendor to the C of C for specific sample numbers

6.2.2 The Chain of Custody Form (Attachment 703-1) will be filled out as follows:

- 6.2.2.1 Project Name - on line provided after "US Ecology Washington, type in reason for sample (e.g. routine soil, grab soil, etc.)..."
- 6.2.2.2 Work order number - same as on the cover letter.
- 6.2.2.3 Sample number –

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- a For soil, the number will be year-qtr-station i.e. "1992-2-1 ", "1992-1-NE "...
- b For grab samples, the number will be year-qtr-location- i.e. "1992-4-grab station 2 ", "1993-1-grab T16 "...

6.2.2.4 Date - date of sample

6.2.2.5 Time - time of sample

6.2.2.6 Sample location - as specific as possible and write in any extra analysis in spare blocks. Normal analysis is as follows:

6.2.2.7 Total No. of Cont. - the number of containers for that sample.

6.2.2.8 Analysis/Parameters - check the blocks appropriate to the sample and write in any extra analysis in spare blocks. Normal analyses are as follows:

- a Routine - Blocks 1,2,3,4 and 5
- b Grab samples - as directed by Radiation Protection Manager (RPM)

6.2.2.9 Security seal number - Shall be the work order number.

6.2.2.10 Samplers - Signature of person who took the sample(s).

6.2.2.11 Relinquished by - Signature of person who sends samples (verifying that samples have left site enroute to vendor by mail or some other authorized carrier).

6.2.2.12 Certification of seal and receipt block is to be filled out by vendor upon receipt.

6.2.3 Routing of cover letters and C of C's

6.2.3.1 Cover letters:

- a Original with samples to vendor
- b One copy with any additional shipping packages to the vendor (for more than one package)
- c One copy to the ARPM
- d One copy to the work order book

6.2.3.2 Chain of Custody:

- a Original with samples to vendor

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- b One copy with any additional shipping packages to the vendor
- c One copy to the ARPM
- d One copy to the work order book

### 7.0 BIBLIOGRAPHY

The following documents or portions thereof were used to generate this section.

- 7.1 Washington State Radioactive Material License WN-I019-2
- 7.2 US Ecology Washington Facility Standards Manual

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TECHNICAL CONCURRENCE      Signature on File      DATE \_\_\_\_\_

APPROVAL      Signature on File      DATE \_\_\_\_\_

1.0 INTRODUCTION

Groundwater samples are taken and analyzed to determine the presence of possible contamination from facility or other operations on the Hanford Reservation. Required sampling frequencies are found in Section 6 of the Facility Standards Manual (FSM). This procedure prescribes correct sampling, pretreatment, and shipping methods to be used.

Acronyms

VOC - Volatile Organic Chemical, also used VOA

VOA - Volatile Organic Chemical Analysis

TOX - Total Organic Halides

TDS - Total Dissolved Solids

TOC - Total Organic Carbon

Conductivity or cond. - Specific Conductance

Cr+6 - Hexavalent Chromium

S - Siemens, unit of electrical conductivity, synonymous with mho

2.0 EQUIPMENT

The following equipment is required for sampling:

- 2.1 Sample bottles with required labels and preservatives as supplied by the laboratory
- 2.2 For Cr+6 only, lab provided NaOH solution in a dropper bottle if required
- 2.3 Water level measuring tapes, dedicated to each well (if available)
- 2.4 Two-way radio, for immediate communications with the Assistant Radiation Protection Manager (ARPM) or Radiation Protection Manager (RPM)
- 2.5 Portable pH, conductivity and temperature instruments
- 2.6 Security seals

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- 2.7 Field Log Book
- 2.8 Deionized water, provided by vendor
- 2.9 AC power source
- 2.10 Source of regulated compressed air or nitrogen
- 2.11 Ice chests and ice for transport of samples to the laboratory
- 2.12 Variable speed pump controller
- 2.13 Containers for well evacuation water storage
- 2.14 Well evacuation pump discharge hose
- 2.15 Clear glass beaker
- 2.16 Safety glasses and disposable gloves
- 2.17 Combustible gas meter
- 2.18 Dedicated sample line extensions for each well
- 2.19 Sounding tape protection bushing, and
- 2.20 Valve manifold

### 3.0 PRECAUTIONS

- 3.1 Precautions shall be taken to prevent the contamination or cross-contamination of samples. This shall include, but is not limited to using dedicated sampling equipment on each well, and using a new pair of gloves for sampling.
- 3.2 No smoking during well sampling, or in the vicinity of monitoring wells.
- 3.3 The samples can be collected in any order, as operational needs dictate.
- 3.4 Never start the evacuation pump while the evacuation line cap is still in place. Personal injury and/or equipment damage may result.
- 3.5 Chemical samples shall be sent to the appropriate laboratory such that samples can be analyzed in the required time frame.
- 3.6 Do not operate the variable speed pumps at no flow condition, either by closing the discharge valves completely or by reducing the speed to a no flow condition. This will damage the pump.
- 3.7 Do not allow the evacuation or sample hose to contact standing water or debris. A large siphon will be developed if the pump stops, potentially contaminating the well.

### 4.0 PROCEDURE

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- 4.1 Prior to the scheduled sample event, the sampling technician should inspect the sample bottle inventory. If sufficient materials/containers are not on hand, the technician shall order the needed items.
- 4.1.1 Upon receipt, all sample bottles and shipping containers shall be inspected as follows:
- 4.1.2 Check each sample bottle for cleanliness, integrity and presence of preservatives (if required).
- NOTE: Gloves and safety glasses should be worn and proper care taken when handling pre-preserved sample bottles or the preservatives themselves (especially during receipt inspection).
- 4.1.3 Shipping containers must each have an individual trip blank (usually a 40 ml. VOC bottle) which shall not be separated from its shipping container.
- 4.1.4 The results of these inspections shall be logged in the Field Log Book. If extra or replacement containers are ordered they shall also be inspected upon receipt and logged.
- 4.2 Once each sampling evolution, collect a quality assurance sample. The quality assurance samples should be one of:
- 4.2.1 A blank: fill all required bottles with deionized water, and label it as a grab sample.
- 4.2.2 A duplicate: while collecting each sample bottle, fill the normal sample bottle plus an additional sample bottle, and label it as a grab sample.
- 4.3 Prior to sampling the first well of the day, calibrate the pH, conductivity, temperature and combustible gas meter(s) per manufacturer's operating instructions. Record completion results in the Field Sampling Form.
- 4.4 Pre-sample well inspection
- Inspect the well cap and standpipe to ensure that it has not been tampered with or damaged. Remove the security seals, and remove any protective cap or cover. Note in the Groundwater Field Log Book any unusual conditions (for example: if the standpipe has unusual odor) and record the numbers of any seals removed. The air above the well water level shall be sampled in accordance with the manufacturer's instructions of the combustible gas meter to determine the potential for fire or explosion. (See action levels in section 5.0)
- 4.5 Water level measurement
- NOTE: Sounding tape dedicated to each well should be used.
- 4.5.1 Rinse with deionized water any portion of the water level measuring

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device that will come into contact with the well water, and wipe with a clean dry towel. The device may be rinsed in the lab in preparation for sampling, and kept clean (for example: bagged, or under direct control of the sample technician). If these devices are prepared in such a manner it should be logged in the Field Sampling Form, with all other pre-sample preparations.

- 4.5.2 Thread the tape protection bushing on top of the sounding tube.
- 4.5.3 Begin measurement of depth to water (DTW) inside the sounding tube in accordance with the manufacturer's instructions (audible alarm and/or visual display). The distance from the top of the stainless steel coupler to the water is the DTW in feet. Log this level in the Field Sampling Form to the nearest tenth of a foot.

- 4.5.4 During first quarter sampling, a depth to bottom (DTB) reading will be taken using a sounding tape or equivalent instrument.

- 4.5.5 Calculate casing volume (CV) as follows:

DTB - DTW = water casing height (WCH)

CV = either 2.61 or 1.47 x WCH

NOTE: Use 1.47 for wells number 4, 5, 6, 7, 9 and 9A (6" casings). Use 2.61 for wells 3, 8, 10, and 13 (8" casings).

CV X 2 = gallons of water to be evacuated for two casing volume (2 CV) analysis.

CV X 3 = gallons of water to be evacuated for three casing volume (3 CV) analysis.

Record these calculations in the Field Sampling Form.

- 4.6 Well casing evacuation and sample pump operation
  - 4.6.1 Remove evacuation line cap seal and record seal number in the Field Log Book (as applicable). Remove evacuation line cap. This step may be performed concurrently with step 4.3 pre sample well inspection.
  - 4.6.2 Connect the purge hose to discharge fitting and direct the open end to a container to store the water.
  - 4.6.3 Start generator and let it warm up.
  - 4.6.4 Evacuation and sample pump operation (**single speed evacuation** and bladder pumps)
    - 4.6.4.1 Connect pump to the 240 volt power supply with the

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extension cable and start pump using switch inside sampling trailer.

- 4.6.4.2 As the pump is energized, note indication of generator loading (a momentary drop in revolutions per minute). Record pump start time on the Field Sampling Form, then monitor the discharge hose. If no flow occurs within 10 minutes, verify electrical connections and notify the ARPM or RPM if flow cannot be achieved.

NOTE: Collect a small amount of water for wetting the pH probe.

- 4.6.4.3 Pump 2 casing volumes. Using the markings on the collection tank, determine when 2 well casing volumes have been purged.
- 4.6.4.4 Sample discharge with a clean glass beaker. First, inspect the sample for visual clarity, immiscible layers of fluid in the sample, or any odors or colors. If any such abnormalities exist, notify the ARPM or RPM immediately. Record the results in Field Sampling Form.
- 4.6.4.5 Sample discharge water and analyze for pH, conductivity and temperature and record the results on the Field Sampling Form.

If the pH varies more than 1.0 pH unit or conductivity varies more 100  $\mu\text{mhos/cm}$  from the previous quarter's sample results inform the ARPM or RPM immediately.

NOTE: Previous quarter's data is found in the Field Sampling Form.

If a pH is greater than 8.5 or less than 6.0 or conductivity is greater than 1000  $\mu\text{mhos/cm}$ , the ARPM or RPM shall be notified immediately.

- 4.6.4.6 Rinse glassware and probes with deionized water and place sample and rinsate in collection tank.
- 4.6.4.7 Pump a third casing volume, then draw another purge water sample. Analyze for pH, temperature and conductivity and log results.
- If results are within 0.5 pH units and 50  $\mu\text{mhos/cm}$  of the 2 CV sample values, evacuation is complete. If not, resample and call the ARPM or RPM for guidance.

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4.6.4.8 Stop the pump when evacuation is complete. Log the time on the Field Sampling Form.

NOTE: Step 4.5.4.9 and 4.5.4.12 may be performed while well purge is still in progress.

4.6.4.9 Connect the bladder pump pressure regulator to a nitrogen tank and connect the hose from the regulator to the sample trailer at the port marked IN. Connect the tube from the sample pump with the male quick connect fitting to the port marked OUT on the sample Trailer. The other tube is the sample line. Connect the dedicated sample line extension, and direct the line into a container so the sample line water purged prior to sampling can be consolidated with the water collected during well evacuation.

4.6.4.10 Connect the bladder pump logic unit to either the 12 V DC supply cable, or the 110 outlet using the appropriate connections and switch settings. Rotate the charge knob to 25 seconds, and the exhaust knob to 25 seconds. Adjust the pressure regulator to 180 psi. (Caution: Damage to the bladder pump may occur if pressure is greater than 200 psi.).

4.6.4.11 Start bladder pump with the on/off switch. After water begins to flow, the knobs may need to be adjusted (per manufacturer's directions) to obtain maximum flow rate. Log the time the sample pump was started on the Field Sampling Form.

4.6.4.12 Pump at least three gallons of sample line water into a container for consolidation with purge water. Log the time the purge was complete on the Field Sampling Form.

4.6.4.13 Go to [4.7](#) to obtain a sample.

4.6.5 Evacuation and Sample pump operation (for the **variable speed** pumps)

4.6.5.1 Connect motor lead cable from controller to the pump at the well head.

4.6.5.2 Position manifold valve in the evacuation position.

4.6.5.3 Turn on the variable speed pump controller switch located on side of cabinet.

4.6.5.4 Observe controller powering up and look for “SPE” to

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indicate proper pump being used for the controller.

- 4.6.5.5 Press “FWD” button on controller to initiate forward rotation of the motor which will start pump.
- 4.6.5.6 Press arrow up key until 100Hz is achieved. Start at minimum speed and gradually increase to desired speed.
- 4.6.5.7 Record pump start time in the Field Sampling Form, then monitor the discharge hose. If no flow occurs within 10 minutes, verify electrical connections and notify the ARPM or RPM if flow cannot be achieved.

NOTE: Collect a small amount of water for wetting the pH probe.

- 4.6.5.8 Pump 2 casing volumes. Using the markings on the collection tank, determine when 2 well casing volumes have been purged.
- 4.6.5.9 Sample discharge with a clean glass beaker. Inspect the sample for visual clarity, immiscible layers of fluid in the sample, or any odors or colors. If any such abnormalities exist, notify the ARPM or RPM immediately. Record the results in the Field Sampling Form.
- 4.6.5.10 Sample discharge water and analyze for pH, conductivity and temperature and record the results in the Field Sampling Form.

If the pH varies more than 1.0 pH unit or conductivity varies more 100  $\mu\text{mhos/cm}$  from the previous quarter’s sample results inform the ARPM or RPM immediately.

NOTE: Previous quarter's data is found in the Field Sampling Form

If a pH is greater than 8.5 or less than 6.0 or conductivity is greater than 1000  $\mu\text{mhos/cm}$ , the ARPM or RPM shall be notified immediately.

- 4.6.5.11 Rinse glassware and probes with deionized water and place sample and rinsate in collection tank.
- 4.6.5.12 Pump a third casing volume, then draw another purge water sample. Analyze for pH, temperature and conductivity and log results. If results are within 0.5 pH units and 50  $\mu\text{mhos/cm}$  of the 2 CV sample values, evacuation is

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complete. If not, resample and call the ARPM or RPM for guidance.

4.6.5.13 After evacuation has been completed use arrow key down to reduce flow (approximately 82Hz is a trickle on most pumps). Log the time the evacuation was complete on the Field Sampling Form.

4.6.5.14 Switch valve manifold at well head from evacuation position to sample position. Log the purge start time on the Field Sampling Form.

4.6.5.15 Use the Arrow keys up and down to achieve the flow desired.

4.6.5.16 Pump at least 600 ml of sample line water into a container for consolidation with purge water, to purge the sample line. Log the time the purge was complete on the Field Sampling Form.

### 4.7 Obtain Samples

NOTE: For volatile analysis bottle filling (VOC and Cr+6), reduce the sample stream using the pump controller to a velocity that does not cause bubbling or air entrainment.

4.7.1 Carefully fill the sample bottles (VOC bottles shall have zero head space; all others should have minimal head space). See 4.6.2 for Cr+6 sampling. The samples should be pumped directly into each bottle. It is not an acceptable practice to pump samples into a wide-mouth container and transfer them to a sample bottle (except for field blanks). The samples should be taken in the order of their volatility (Cr+6, VOC, TOX, TOC, Phenols and Metals, Cl/Sulfates/Nitrate/TDS/Conductivity, Radionuclides, pH). Cap each sample bottle securely. The following label information shall be noted:

Date of sample

Time of sample

Analysis requested

Sample location

Sample number, a unique number. (i.e. YYYYMMDD; well number (MW06); and aliquot number). Sample numbers generated by the data base are also acceptable;

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Preservatives (If required and not already noted on the label);

4.7.2 If required due to shipping, Cr+6 must be preserved. Use NaOH provided by the lab.

4.7.2.1 Collect the sample.

4.7.2.2 Add NaOH (6-11 drops for ground water samples, 1 drop for deionized water). Close sample bottle and shake.

4.7.2.3 Open sample bottle and check pH with the pH meter. pH must be between 9.3 and 9.7. If the pH is too high, resample. If the pH is too low, repeat adding drops of NaOH until correct pH is reached.

4.7.2.4 Cap the bottle.

4.7.3 Place all samples in an ice chest or a chilling device to cool to 4° C and to maintain sample security. Samples shall be packed to eliminate the chance of breakage during shipment. As the samples are packed, verify the sample type and number have been recorded on the chain of Custody form. When all the samples have been packed, the ice chest shall be security sealed per step 6.5, and the seal number recorded on the chain of custody form. Temporary security seals may be employed if the samples must be left unattended prior to final packing for shipment.

4.7.4 Obtain field instrument readings

4.7.4.1 Fill a glass beaker with well water for pH, conductivity, and temperature readings.

NOTE: If both instruments are automatically temperature compensating, then the temperature result serves only for trend analysis. If either instrument displays the temperature, its reading may be used instead of employing a separate thermometer to obtain the reading. These steps can be completed concurrently if using a multi analysis instrument.

4.7.4.2 Analyze for conductivity a follows:

a Rinse the probe with deionized water. Insert the probe into the sample.

b Hold the probe vertically and at least 1/2" from the surfaces of the beaker. Allow the reading to stabilize and record the results in the Field

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Sampling Form.

- c Remove, rinse, and store the probe.
- 4.7.4.3 Analyze for pH as follows:
  - a Rinse the probe(s) with deionized water and insert the probe(s) into the sample.
  - b Holding the probe(s) vertically and at least one-half inch from all surfaces of the beaker. Allow the reading to stabilize and record the results in the Field Sampling Form.
  - c Rinse the probe(s) in deionized water and store.
- 4.7.4.4 Analyze for temperature (can be performed simultaneously with pH or conductivity measurement).
  - a Rinse the thermometer with deionized water.
  - b Insert the thermometer into the sample.
  - c Record the result in the Field Sampling Form.
  - d Remove, rinse, and store the thermometer.
- 4.7.5 Retain the water collected in Steps 4.6.3 with the sample line purge, and rinse the beaker for the next set of measurements.
- 4.7.6 Perform the steps of 4.6.1- 4.6.5 for four separate sets of analysis with four separate sets of results.
- 4.7.7 Field blank samples are collected after completion of the last well.
  - 4.7.7.1 Field blanks shall consist of deionized water provided by the vendor. The deionized water shall be poured from the original container into the provided sample containers. This shall take place in the field after the last well has been sampled, and before leaving that sample station. They shall then be stored with the actual samples and accompany the samples to the vendor. The lab should not know which samples are QA samples. QA samples should be given fictional well numbers and sample times.
- 4.7.8 When all samples have been collected, stop the sample pumps (see 4.7).
- 4.7.9 Connect waste water hose to fitting on sample trailer. Place discharge end into the purge water collection container and start waste pump by using the starting switch inside sampling trailer.

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NOTE: Waste discharge hose can be connected at any time during sampling.

4.8 Stop the sample pumps, record the time on the Field Sampling Form.

Caution: When stopping the pumps, be sure that the hose end is not submerged in water, or near dirt. A siphon will be produced, sucking any water or debris into the well.

4.8.1 The bladder pump is stopped by:

4.8.1.1 Shutting the gas bottle valve

4.8.1.2 Allow the logic controller to cycle until the pressure is relieved

4.8.1.3 Turning off the logic controller power

4.8.1.4 Disconnecting the gas lines

4.8.2 The single speed evacuation pumps are stopped by switching the power supply switch in the trailer to the off position.

4.8.3 The variable speed evacuation and sample pump is stopped by:

4.8.3.1 Pressing 'stop' on the controller

4.8.3.2 Switching the variable speed pump controller power supply switch in the trailer to the off position

4.9 Cap and security seal the well to assure its integrity for the next sampling. Record seal numbers in field log book.

4.10 Review Field Log Book and Field Sampling Form for completeness prior to moving to the next sample point.

4.11 Assure instrumentation is turned off and probes stored prior to moving to next sampling event.

5.0 ACTION LEVELS

5.1 Field Observation

Parameter	Action Level	Action
Explosive gas	10 % LEL	Move to fresh air, notify ARPM
Oxygen	19.5-20.8 %	Move to fresh air,

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		notify ARPM
Odor	Unusual	Notify the ARPM.
pH	< 6 or >8.5 or change from last of >1.0	Notify ARPM, investigate contamination
Conductivity	>1000 µmho/cm or >100 µmhos/cm from last.	Notify ARPM, investigate contamination

- 5.2 Routine parameters: Explosive gas, odor, pH, specific conductance (conductivity) and temperature.
- 5.3 Lab results - See Table 6.1 of the FSM. If levels of greater than the investigation levels are reported, the ARPM or RPM shall be notified immediately per ROP 106.
- 5.4 Routine parameters: Gross alpha, gross beta, tritium, C-14, total Uranium, Pu 238, Pu 239/240, Co-60, Cs-137, Gamma spec, Phenols, hexavalent Chromium, Metals (Barium, Cadmium, Calcium, Chromium, Iron, Magnesium, Manganese, Mercury, Potassium, Silver, Sodium), TDS, VOC, TOX, TOC, Chloride, Sulfate, and Nitrate.

### 6.0 RECORDS

- 6.1 Field Log Book. Information that is pertinent to the well should be recorded in the Field Log Book. It should be a book which can be easily carried into the field and must have consecutively numbered pages. The Field Log Book(s) shall be maintained and filed chronologically, when full. Standard well sampling log entries shall contain at a minimum the following information (in addition to any entries required to be recorded, as stated elsewhere in this procedure):
- 6.1.1 Location of sampling
  - 6.1.2 Name of collector
  - 6.1.3 Date and time of sampling
  - 6.1.4 Security seal numbers removed
  - 6.1.5 Security seal numbers applied
  - 6.1.6 Field observations - sampling situations vary widely, so no general rule can be given for the amount of information required. The best guideline is

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to record sufficient information, including dates and times, as necessary so that someone could reconstruct the entire sampling event without relying on the collector's memory

- 6.1.7 Any abnormal conditions, such as a security breach, oil in the water, pump problems, sampling problem, should be included in the Field Log Book
- 6.2 Field Sampling Form (Attachment 704-2) The following information should be recorded:
  - 6.2.1 Location of sampling
  - 6.2.2 Metrological data
  - 6.2.3 Date of sampling
  - 6.2.4 Purpose of sampling;
  - 6.2.5 pH, conductivity and temperature readings, and calibration records
  - 6.2.6 Depth to water and depth to bottom reading
  - 6.2.7 2 and 3 casing volumes (CV)
  - 6.2.8 Explosive gas meter readings
  - 6.2.9 Time of sampling
  - 6.2.10 Number and volume of sample(s)
- 6.3 Chain of Custody Record (attachment 704-1 or equivalent)
 

A work request (cover letter) must accompany the Chain of Custody form and the samples. The cover letter must contain the following:

  - 6.3.1 Purchase order number,
  - 6.3.2 Work order number, issued from the work order log,
  - 6.3.3 Within the text of the request, it must refer the vendor to the specifications, and limits set forth in the purchase order,
  - 6.3.4 Current vendor address, including the name of the contact person (if known);
  - 6.3.5 A request of the work to be performed with a general description of the samples which refers the vendor to the C of C for specific sample numbers.
- 6.4 The chain of custody form will be filled out as follows:
  - 6.4.1 In the space provided after "US Ecology Washington Groundwater. Enter

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the reason for sample (i.e. "grab sample" or "quarterly").

- 6.4.2 Work order number -the same as on the cover letter
  - 6.4.3 Sample number - a unique number. (i.e. YYYYMMDD; well number (MW06); and aliquot number). Sample numbers generated by the data base are also acceptable, but they must be unique
  - 6.4.4 Sample date - date of sample
  - 6.4.5 Sample time - time of sample
  - 6.4.6 Sample location - number of well sampled
  - 6.4.7 Total number of containers for that sample
  - 6.4.8 Analysis/parameters - check the blocks appropriate to the sample and write in any extra analysis in "Remarks". Normal analyses are as follows:
    - 6.4.8.1 Routine - FSM Table 6.1
    - 6.4.8.2 Grab samples - as directed by the ARPM or RPM.
  - 6.4.9 Security seal number - shall be the work order number followed by the well number
  - 6.4.10 Samplers - signature of person who took the sample(s)
  - 6.4.11 Relinquished by - signature of person who sends samples, (verifying that samples have left site for delivery to the vendor)
  - 6.4.12 Certification of seal and receipt block is to be filled out by vendor upon receipt
  - 6.4.13 The C of C shall be accessible on the outside of the shipping container so that the receiving party (and in the event of an accident - the shipping handlers) may have access to a complete list of the package contents. This also allows review of the C of C prior to breaking the security seal
- 6.5 Requirements for security seals
- 6.5.1 Each shipping container shall have its own seal. All samples requiring analysis from a single well must be packaged in the same shipping container. Samples for radioactive analysis may be packaged separately from the samples for chemical analysis. More than one well's samples may be placed in a single shipping container so long as shipping weight permits.
  - 6.5.2 The Seal number shall consist of the work order number followed by the well number.

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6.5.3 The sample technician shall sign the seals certifying that all those samples are present and packaged for shipping.

6.6 Routing of Cover Letter and C of C:

6.6.1 Original cover letter and C of C (to be signed and returned to site by vendor) will be sent to the vendor with the samples.

6.6.2 Two copies of the cover letter and C of C will be forwarded to the ARPM for placement in the appropriate log books.

6.6.3 The vendor shall sign and return the C of C. (The vendor may use their own equivalent form in lieu the US Ecology Chain of Custody.)

7.0 BIBLIOGRAPHY

7.1 Washington State Radioactive Material License WN-I019-2.

7.2 US Ecology Washington Facility Standards Manual.



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to shielded location as soon as possible.

4.2.1 In the field, the dosimeters shall be suspended at a height of 1.0 meter  $\pm$  0.3 meter above the ground in a manner that will minimize distortion of the radiation field. dosimeters should be removed as far as possible from large or dense objects that may cause directional anomalies or otherwise perturb the radiation field. Acceptable methods of suspension include hanging from a wire fence, small tree or shrub, or lightweight post.

4.3 Return the exposed dosimeters to the vendor for processing. The control must accompany the dosimeters. Include a chain of custody and work request.

4.4 Upon receiving the vendor's results, the environmental dosimeter graphs and log shall be filled out as follows:

NOTE: Computers may be used for data graphing and storage.

4.4.1 Subtract the background dose (Station 1) from the dose for each location.

4.4.2 Determine the number of days the dosimeters were exposed in the environment (days hanging on the fence) to the nearest day.

4.4.3 Update the graphs for the fenceline doses.

4.4.4 Note any trends. Exposures greater than 90 mrem per quarter should be investigated.

4.4.5 A copy of the vendor's output results shall be sent to the Radiation Program Manager (RPM).

### 5.0 ACTION LEVELS

5.1 Action levels and required actions per Table 6.1 of Facility Standards Manual (FSM).

### 6.0 RECORDS

6.1 Chain of Custody Forms (Attachment 707-1)

6.1.1 A work request must accompany the Chain of Custody Form. The request form is a cover letter and must contain the following:

6.1.1.1 Purchase order number.

6.1.1.2 Work order number issued from the work order log.

6.1.1.3 Within the text of the request, it must refer the vendor to

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the specifications and limits set forth in the purchase order.

6.1.1.4 Current vendor address, including the name of the contact person.

6.1.1.5 A request of the work to be performed with a general description of the dosimeters which refers the vendor to the Chain of Custody for specific dosimeter numbers.

6.1.2 The Chain of Custody Form will be filled out as follows:

6.1.2.1 Fenceline Monitoring: Enter quarterly, or special.

6.1.2.2 Exposure Period: Enter the name or number of quarter or for special samples, enter period as appropriate, i.e., for IF-300 enter IF-300 and bates number.

6.1.2.3 Purchase Order No.: Enter current purchase order.

6.1.2.4 Work Order No.: The number from the accompanying work request and enter it here. Note: Work order number will also serve as seal number.

6.1.2.5 Shipped To: Enter proper name, address, etc. of the dosimeter vendor.

6.1.2.6 Dosimeter Information: Enter dates the dosimeters were posted on and removed on the fenceline. This data can be found in the soil, vegetation and dosimeter field log book. Enter the numbers of all dosimeters being shipped including background, station and corners.

6.1.2.7 Other Block: Enter any additional information, reports of damage to dosimeters being shipped or information for special dosimeters.

6.1.2.8 Sealing Verification: Name, signature and date of person sealing shipping container, attesting that all listed dosimeters are present.

6.1.2.9 Shipping Verification: Enter method used (normally US Mail) name and signature of person relinquishing custody to carrier and date of shipment.

6.1.2.10 Receipt Acceptance: To be signed by person at the vendor who receives and inspects contents of shipping container, seal number is recorded as well as title of receiver, the

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company name and date of receipt/inspection.

### 6.1.3 Routing cover letters and Chain of Custody Forms

#### 6.1.3.1 Cover letters as follows:

- a Original to vendor
- b Copy to billing
- c Copy to work order book

#### 6.1.3.2 Chain of Custody (3 parts) copies are distributed as follows:

- a Original to vendor to be signed and returned to this site
- b Copy two is the Vendor's copy
- c Copy three is removed prior to shipping after "Relinquished By: Signature" and is placed with the environmental dosimeter results to be replaced by original upon its return

6.2 Tables and graphs in the annual environmental report

6.3 Vendor reports

6.4 Environmental Field Log Book

## 7.0 BIBLIOGRAPHY

The following documents or portions thereof were used to generate this section.

7.1 Washington State Radioactive Material License WN-I019-2

7.2 US Ecology Washington Facility Standards Manual

7.3 Performance, testing, and procedural specifications for thermoluminescence dosimetry. (environmental applications) ANSI N545-1975