INTEGRATED DISPOSAL FACILITY
APPENDIX DB
SAMPLING PROTOCOL

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number

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INTEGRATED DISPOSAL FACILITY
APPENDIX DB
SAMPLING PROTOCOL

DRAFT

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DRAFT

APPENDIX DB
SAMPLING PROTOCOL

TABLE OF CONTENTS

DRAFT

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DRAFT

TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
IATA	International Air Transport Association
~~NTU~~	~~Nephelometric turbidity unit~~
QA	Quality assurance
QC	Quality control
RCRA	*Resource Conservation and Recovery Act of 1976*

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DB.1 INTRODUCTION

Groundwater monitoring at the Hanford Site, as defined by the *Resource Conservation and Recovery Act of 1976* (RCRA) and implemented in Washington Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*, has been conducted since the mid-1980s. Hanford Site groundwater sampling methods contain sampling precautions to be taken; identify equipment and its use; cleaning and decontamination practices; records and documentation; and sample collection, management, and control activities. Together, Appendices A and B discuss the sampling and analysis elements for the groundwater monitoring plan: sample collection, sample preservation and holding times, chain-of-custody control, analytical methods, and field and laboratory quality assurance (QA)/quality control (QC).

This appendix provides elements of the sampling protocols and techniques used for the groundwater monitoring plan. The main text of the groundwater monitoring plan identifies the monitoring wells that will be sampled, constituents to be analyzed, and sampling frequency for the groundwater monitoring at the dangerous waste management unit.

DB.2 SAMPLING METHODS

Sampling may include, but is not limited to, the following methods:

- Field screening measurements.
- Groundwater sampling.
- Water-level measurements.

Groundwater samples will be collected according to the current ~~revision of applicable operating methods~~ and applicable field practices. Groundwater samples are collected after field measurements of purged groundwater have stabilized as follows:

- **pH** – two consecutive measurements agree within 0.2 pH units.
- **Temperature** – two consecutive measurements agree within 0.2°C (0.4~~36~~°F).
- **Conductivity** – two consecutive measurements agree within 10% of each other.
- **Turbidity** – less than 5 nephelometric turbidity units ~~(NTUs)~~ prior to sampling (or ~~project scientist's~~the recommendation by staff assigned by the Prime Contractor Project Manager at the time of collection).

Dissolved oxygen ~~if included in the main text of the groundwater monitoring plan~~ will also be measured in the field. Dissolved oxygen is not required to be stable prior to sample collection.

Environmental-grade electric submersible pumps will typically be used for well purging and sample collection in existing wells with a flow rate not exceeding 7.6 L/min (2 gal/min). In the event a well exhibits insufficient productivity to support purging and sampling using the environmental-grade electric submersible pumps, adjustable-rate bladder pumps with typical flow rates of 0.1 to 0.5 L/min (0.026 to 0.13 gal/min) may be employed. As environmental-grade electric submersible pumps are replaced when they reach the end of their service lives due to age, normal wear or failure, they will be replaced with adjustable-rate bladder pumps. The same purge protocol described for environmental-grade electric submersible pumps will be used for the adjustable-rate bladder pumps.

Dedicated pumps (i.e., submersible pumps placed semi-permanently in monitoring wells) may be used for well purging and sampling. In all wells using dedicated pumps, the depth to the water table will be determined at each well, and the placement of the pump intake will be in the upper portion of the unconfined aquifer (e.g., within 3.1 m [10 ft] of the measured water table depth). Pump depths will be confirmed before purging and sample collection. Dedicated pumps will be reset as needed to maintain the pump intake depth within the upper portion of the unconfined aquifer. Groundwater monitoring wells will

DRAFT

be purged and sampled using ~~low-flow~~ techniques and selected pump placement that are representative of ~~to represent~~ groundwater conditions near ~~to~~ the observed water table at the time of sampling.

The use of purge and sample techniques with a flow rate not exceeding 7.6 L/min (2 gal/min) allows ~~Samples will be collected using submersible electric pumps wherever possible. At each sample event, the depth to water in each well will be measured and the pump intake placed at a depth no more than 1.5 m (5 ft) below the measured water table depth. The use of low-flow purge and sample techniques will allow~~ collection of representative samples of groundwater near the water table in wells that have been constructed using longer screens (e.g., up to 9.1 m [30 ft]) than typically used for water table monitoring. The use of longer screens for RCRA groundwater monitoring wells contributes to a longer service life for wells in areas where declining water table elevations have historically rendered wells unusable after relatively short periods of time.

Unless special directions are provided by the staff assigned by the Prime Contractor Project Manager ~~project scientists~~ at the time of sample collection, wells are typically~~will be~~ purged at a flow rate not to exceed 7.6 L/min (2 gal/min). Purging will continue until stable readings of selected field water quality parameters are achieved (as described above).

Field measurements (except for turbidity) are typically obtained using an instrumented flow-through cell located at the well~~-~~head. Groundwater is pumped directly from the well to the flow-through cell. At the beginning of the sample event, field crews attach a clean stainless steel sampling manifold to the riser discharge. The manifold has two valves and two ports: one port is used only for purgewater, and the other port is used to supply water to the flow-through cell. Probes are inserted into the flow-through cell to measure pH, temperature, specific conductance, and dissolved oxygen, if required by the main text. Turbidity is measured by collecting an aliquot of water from the purgewater valve and inserting the sample vial into a turbidimeter. Purgewater, including the water passing through the flow-through cell, is then discharged to a tank on ~~the~~a purgewater truck.

Collection of the field measurement data will commence when a volume of water equal to the volume of the pump riser pipe has been extracted and discharged to ~~the~~a purgewater truck,~~. Once~~ field measurements have stabilized, the hose supplying water to the flow-through cell is disconnected, and a clean stainless steel drop leg is attached for sampling collection. The flow rate does not exceed 7.6 L/min (2 gal/min) during sampling to minimize the loss of volatiles (if any) and prevent overfilling the bottles. Sample bottles are filled in a sequence designed to minimize loss of volatiles (if any). If both filtered and unfiltered samples are required (see Table D-6 in Addendum D), filtered samples are collected after collection of the unfiltered samples.

Samples may be filtered in the field, using a 0.45 µm filter, as noted on the chain-of-custody form. Unfiltered samples are collected in conjunction with filtered samples ~~for select analysis~~ to determine if metal constituents being monitored (excluding hexavalent chromium, if one of the monitored constituents) occur as both suspended and dissolved phases, or in only one state. The evaluation of suspended and dissolved metals provides supporting information for groundwater geochemical characteristics, as well as indication of well integrity such as the presence of dislodged well encrustation, well corrosion products, or failure of the well screen filter pack.

~~Environmental-grade electric submersible pumps will typically be used for well purging and sample collection. In the event a well exhibits insufficient productivity to support purging and sampling using the electric submersible pumps, adjustable-rate bladder pumps with typical flow rates of 0.1 to 0.5 L/min (0.026 to 0.13 gal/min) may be employed. The same purge protocol described above will be used for these pumps.~~

~~Dedicated pumps (i.e., submersible pumps placed semi-permanently in monitoring wells) may be used for well purging and sampling. In all wells using dedicated pumps, however, the depth to water table will be determined at each well and the placement of the pump intake within 1.5 m (5 ft) of the water table will~~

DRAFT

~~be confirmed before purging and sample collection. Dedicated pumps will be reset as needed to maintain the pump intake depth within 1.5 m (5 ft) of the water table.~~

For certain types of samples, preservatives are required. ~~Preservatives, b~~Based on the analytical methods used, preservatives are generally added to the collection bottles before their use in the field. Sample preservation and holding times for groundwater samples are provided in Appendix DA (Table DA-5) and are based on the analytical method identified in Appendix DA (Table DA-2). Container types, preservatives, and volumes will be identified on the chain-of-custody form. This groundwater monitoring plan defines a sample as a filled sample bottle for purposes of starting the clock for holding time restrictions.

Holding time is the maximum allowable period between sample collection and analysis. Exceeding holding times could result in changes in constituent concentrations due to volatilization, decomposition, or other chemical alterations. Holding times depend on the constituent and are listed in analytical method compilations such as APHA/AWWA/WEF, ~~2012,~~ *Standard Methods for the Examination of Water and Wastewater*; SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*~~, Third Edition; Final Update VI~~; and the EPA/600 Method series (e.g., EPA/600/4-79/020, *Methods for Chemical Analysis of Water and Wastes*).

DB.2.1 Decontamination of Drilling and Sampling Equipment

Drilling of wells is not addressed by this groundwater monitoring plan. Therefore, a discussion of the decontamination of drilling equipment is not included.

Sampling equipment will be decontaminated in accordance with sampling equipment decontamination methods. To prevent potential contamination of the samples, care should be taken to use decontaminated equipment for each specific sampling activity.

Special care should be taken to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers.
- Contaminating the equipment or sample bottles by setting the equipment/sample bottle on or near potential contamination sources (e.g., uncovered ground).
- Handling bottles or equipment with dirty hands or gloves.
- Improperly decontaminating equipment before sampling or between sampling events.

Decontamination of sampling equipment and pumps is typically performed using high-purity water[1] in each step. ~~In general, t~~Three rinse cycles are performed to decontaminate sampling equipment: detergent rinse, acid rinse, and water rinse. During the detergent rinse, equipment is washed in a phosphate-free detergent solution, followed by rinsing with water in three sequential containers. After the third water rinse, equipment that is stainless steel or glass is rinsed in a 1 M nitric acid solution (pH less than 2). Equipment is then rinsed with water in three sequential containers (the water rinses following the acid rinse are conducted in separate water containers that are not used for detergent rinse). Following the final water rinse, equipment is rinsed in hexane and then placed on a rack to dry. Dry equipment is loaded into a drying oven. The oven is set at approximately 50°C (122°F) for items that are not metal or glass or at approximately 100°C (212°F) for metal or glass. Once reaching temperature, equipment is baked for approximately 20 minutes and then cooled. Equipment is then removed from the oven and enclosed in clean unused aluminum foil using surgical gloves. The wrapped equipment is stored in a custody locked, controlled access area. Water-level measurement tapes (portion that came in contact with groundwater) are decontaminated using a high purity water rinse and dried with disposable towels.

[1] High-purity water~~ that~~ is generally defined as water that has been distilled, deionized, or any combination of distillation, deionization, reverse osmosis, activated carbon filtration, ion exchange, particulate filtration, or other polishing techniques.

DRAFT

To decontaminate sampling pumps that are not permanently installed, the pump cowling is first removed, washed (if needed) in phosphate-free detergent solution, and then reinstalled on the pump. ~~Typically, t~~The pump is then submerged in phosphate-free detergent solution, and 11.4 L (3 gal) of solution is pumped through the unit and disposed. Detergent solution is then circulated through the submerged pump for 5 minutes. The pump is removed from solution and rinsed with water. The pump is submerged in water, and 30.3 L (8 gal) of water is pumped through the unit and disposed. The pump is removed from the water, and the intake and housing are covered with plastic sleeving. Cleaning is documented on a tag that is affixed to the pump with the following information:

- Date of pump cleaning.
- Pump identification.
- Comments (if any).
- Signature of person performing decontamination.

DB.2.2 Water Levels

Each time a sample is obtained, measurement of the groundwater surface elevation at each monitoring well is required by WAC 173-303-645(8)(f), *Releases from regulated units*. Using a calibrated depth measurement tape, the depth to water is recorded in each well prior to sampling. When two consecutive measurements are taken that agree within 6 mm (0.24 in), the final determined measurement is recorded, along with the date and time for the specific event. The depth to groundwater is subtracted from the elevation of a reference point (usually the top of the casing) to obtain the water-level elevation. The top of the casing is a known elevation reference point because it has been surveyed to local reference data.

DB.3 DOCUMENTATION OF FIELD ACTIVITIES

Logbooks for field activities are identified with a unique project name and number. The individual(s) responsible for logbooks will be identified in the front of the logbook, and only authorized persons may make entries in logbooks. Logbook entries will be reviewed by the sampling Field Work Supervisor, cognizant scientist/engineer, or other responsible manager; the review will be documented with a signature and date. Logbooks will be permanently bound, waterproof, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous data with a single line, entering the correct data, and initialing and dating the changes.

Data forms for field activities are also identified with a unique project name and number. Data forms may be used to collect field information; information recorded on data forms is the same as for logbooks. The data forms are referenced in the logbooks.

The following information is recorded in logbooks or on data forms:

- Day and date; time task started; weather conditions; and names, titles, and organizations of personnel performing the task.
- Purpose of visit to the task area.
- Details of field tests that were conducted, and references to forms that were used and methods followed in conducting the activity.
- Details of field calibrations and surveys that were conducted, and references to forms that were used, other data records, and methods followed in conducting the calibrations and surveys.
- Details of samples collected and the preparation (if any) of splits, duplicates, or blanks.
- Time, equipment type, serial or identification number, and methods followed for decontaminations and equipment maintenance performed (reference the page number[s] of any logbook where detailed information is recorded).

DRAFT

- Equipment failures or breakdowns that occurred, with a brief description of replacements.

DB.4 CALIBRATION OF FIELD EQUIPMENT

On-site environmental instruments are calibrated in accordance with the manufacturer's operating instructions, internal work processes, and/or field instructions that provide direction for equipment calibration or verification of accuracy by analytical methods. Calibration records will include the raw calibration data, identification of the standards used, associated reports, date of analysis, and analyst's name or initials. Results from instrument calibration activities are recorded.

Field instrumentation calibration and QA checks will be performed as follows:

- Prior to initial use of a field analytical measurement system.
- At a minimum, at the frequency recommended by the manufacturer or methods, or as required by regulations.
- Upon failure to meet specified QC criteria.
- Daily calibration checks will be performed and documented for each instrument used (these checks will be made on standard materials sufficiently like the matrix under consideration for direct comparison of data; analysis times will be sufficient to establish detection efficiency and resolution).
- Using standards for calibration that are traceable to a nationally recognized standard agency source or measurement system (manufacturer's recommendations for storage and handling of standards, if any, will be followed).

DB.5 SAMPLE HANDLING

Sample handling and transfer methods preclude loss of identity, damage, deterioration, and loss of sample. Custody seals or custody tape will be used to verify that sample integrity has been maintained during sample transport. The custody seal will be inscribed with the sampler's initials and date.

A sampling and analytical database is used to track samples from the point of collection through the laboratory analysis process.

DB.5.1 Containers

Samples will be collected, where and when appropriate, in break-resistant containers. The field sample collection record will indicate the lot number of the bottles used in sample collection. When commercially precleaned containers are used in the field, the name of the manufacturer, lot identification, and certification will be retained for documentation.

Containers will be capped and stored in an environment that minimizes the possibility of sample container contamination. If contamination of the stored sample containers occurs, corrective actions will be implemented to prevent reoccurrences. Contaminated sample containers cannot be used for a sampling event. Container sizes may vary depending on laboratory specific volumes/requirements for meeting analytical detection limits. Container types and sample amounts/volumes are identified on the chain-of-custody form.

DB.5.2 Container Labeling

Each sample is identified by affixing a standardized label or tag to the container. This label or tag will contain the sample identification number. The label will identify or provide reference to associate the sample with the date and time of collection, preservative used (if applicable), analysis requested, and collector's name or initials. Sample labels may be either preprinted or handwritten in indelible or waterproof ink.

DRAFT

DB.5.3 Sample Custody

Sample custody protocols maintain~~ed~~ sample integrity throughout the analytical process. Chain-of-custody protocols will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. A chain-of-custody record will be initiated in the field at the time of sampling and will accompany each set of samples shipped to any laboratory.

Shipping requirements will determine how sample shipping containers are prepared for shipment. The analyses requested for each sample will be indicated on the accompanying chain-of-custody form. Each time the responsibility for custody of the sample changes, new and previous custodians will sign the record and note the date and time. ~~The field sampling team will make a copy of the signed record before sample shipment and transmit the copy to the Sample Management and Reporting group.~~

The following minimum information is provided on a completed chain-of-custody form:

- Project name.
- Collectors' names.
- Unique sample number.
- Date, time, and location (or traceable reference thereto) of sample collection.
- Matrix.
- Preservatives.
- Chain-of-possession information (i.e., signatures and printed names of each individual involved in the transfer of sample custody and storage locations, and dates/times of receipt and relinquishment).
- Requested analyses (or reference thereto).
- Shipped to information (i.e., analytical laboratory performing the analysis).

Sample custody will be maintained within subcontract laboratories in accordance with laboratory QA plan.

DB.5.4 Sample Transportation

Packaging and transportation instructions will comply with applicable transportation regulations and U.S. Department of Energy (DOE) requirements. Regulations for classifying, describing, packaging, marking, labeling, and transporting hazardous materials, hazardous substances, and hazardous wastes are enforced by the U.S. Department of Transportation (DOT). Carrier specific requirements, defined in the current edition of International Air Transport Association (IATA) *Dangerous Goods Regulations*, will also be considered when preparing sample shipments conveyed by air freight providers.

Samples containing hazardous constituents will be considered hazardous material in transportation and transported according to DOT/IATA requirements. If the sample material is known or can be identified, then it will be classified, described, packaged, marked, labeled, and shipped according to the specific instructions for that material.

DB.6 MANAGEMENT OF WASTE

Waste materials generated during sample activities, including purgewater and decontamination fluids, will be collected and managed in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* as authorized under Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order Action Plan*, Milestone M-024, and the waste control plan or waste management plan associated with the applicable groundwater operable unit.

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For waste designation purposes, wells listed in the main text of the monitoring plan may be surveyed in the Hanford Environmental Information System, and the maximum concentration for each analyte within the most recent 5 years will be evaluated for use in creating a waste profile, if necessary.

Packaging and labeling during waste storage and transportation will meet WAC 173-303, DOE, and DOT requirements, as appropriate.

Off-site analytical laboratories are responsible for the disposal of unused sample quantities and wastes generated during analytical processes.

DB.7 REFERENCES

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