DELINEATION AND REMEDIATION OF CONTAMINATED SOIL, GROUNDWATER AND DEBRIS AT STRYKER BRIGADE CANTONMENT AND FWA-102 AREAS

FIELD SAMPLING PLAN FOR THE COMMUNICATIONS SITE, TAKU GARDENS, FORT WAINWRIGHT, ALASKA

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ACRONYMS

ACM	asbestos containing material
ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
CFR	Code of Federal Regulations
CoC	chain-of-custody
DOE	U.S. Department of Energy
DPW	Directorate of Public Works
DQO	data quality objective
DRO	diesel range organic compounds
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
FM	Field Manager
FSP	Field Sampling Plan
ft	feet
g	gram
gal	gallon
GRO	gasoline range organic compounds
HPLC	high performance liquid chromatography
HWD	hazardous waste determination
ICP/MS	Inductively-Coupled Plasma/Mass Spectrometry
IDW	investigation derived waste
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	Laboratory Information Management System
MEC	munitions and explosives of concern
ml	millimeter

NRC	Nuclear Regulatory Commission
NWI	North Wind, Inc.
OE	ordnance and explosives
oz.	ounce
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PID	photoionization detector
PM	Project Manager
ppm	parts per million
PSE	Preliminary Site Evaluation
QAPP	quality assurance project plan
QC	quality control
QSM	Quality Systems Manual
qt	quart
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RRO	residual range organic compounds
SSHP	Site-Specific Safety and Health Plan
SVOC	semi-volatile organic compound
TCLP	toxic characteristic leaching procedure
USACE	U.S. Army Corps of Engineers
USAGAK	U.S. Army Garrison Alaska
UV	ultraviolet
UXO	unexploded ordnance
VOC	volatile organic compound
VSP	Visual Sample Plan

FIELD SAMPLING PLAN FOR THE COMMUNICATIONS SITE, TAKU GARDENS, FORT WAINWRIGHT, ALASKA

1. INTRODUCTION

This Field Sampling Plan (FSP) establishes the technical approach, procedures, and requirements for conducting a Preliminary Source Evaluation (PSE) at the Taku Gardens Family Housing Project on Fort Wainwright in Fairbanks, Alaska. North Wind, Inc. (NWI) prepared this Work Plan under contract No. W911KB-04-P-0136 for the U.S. Army Corps of Engineers (USACE), Alaska District.

The FSP establishes guidelines and practices to ensure that generated data are scientifically valid, defensible, and of known and acceptable quality. This FSP was prepared in accordance with Engineering Manual (EM) 200-1-3, *"Requirements for the Preparation of Sampling and Analysis Plans"* (USACE 2001). The Quality Assurance Project Plan (QAPP) (NWI 2006e) is a companion document, which when used together with this FSP, meets the requirements of the EM 200-1-3. This FSP incorporates systematic planning, dynamic work strategies, and real-time measurement technologies with the goal of producing effective or decision quality data (i.e., data that are of known quality, that are defensible, and that support the decision that needs to be made) in a manner that is as cost and schedule efficient as possible.

This FSP is considered a dynamic work plan, as described in USACE EM 200-1-2, "*Technical Project Planning Process*" (USACE 1998). That is, data that are obtained during the investigation will be utilized to streamline the sampling program. As information is gathered, it will be used to make decisions about what subsequent activities will best resolve remaining data and decision uncertainties.

2. PROJECT BACKGROUND

Fort Wainwright occupies a 915,000-acre military reservation located west of Fairbanks, Alaska. Fort Wainwright was originally established in 1938 as a cold-weather testing station. The facility was renamed Ladd Army Air Field by the U.S. Army in December 1939. During World War II, it served as a crew-transfer point in the Army Air Corps' lend-lease program. In 1947, the newly established U.S. Air Force took over the facility and renamed it Ladd Air Force Base. It was used as a re-supply and maintenance base for the remote Distant Early Warning Sites and an experimental station in the Arctic Ocean. In 1961, all base operations were transferred back to the U.S. Army and the base was renamed Fort Wainwright. Currently, primary missions at Fort Wainwright include training of infantry soldiers in the arctic environment, testing of equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapid deployment of troops worldwide. Fort Wainwright includes the main post area, a range

complex, and two maneuver areas. On-site industrial activities include use of fixed-wing aircraft, helicopters, and vehicle maintenance and support activities. The site of the current Taku Gardens Family Housing Project has been used for a variety of military operations over the history of the Fort Wainwright installation.

The USAGAK is currently preparing a Preliminary Source Evaluation 1 (PSE 1), which will provide a compilation of available information related to potential waste generating activities conducted previously at the site. The document will be a critical component of the overall investigation as it will support development pf the conceptual site model.

3. PROJECT ORGANIZATION

The U.S. Army Garrison Alaska (USAGAK) is responsible for this investigation with participation from the Alaska Department of Environmental Conservation (ADEC) and the U.S. Environmental Protection Agency (EPA) Region X.

4. PROJECT PURPOSE AND OBJECTIVES

4.1 Project Purpose

The purpose of this project is to investigate a proposed future housing site for contamination and cleanup. In support of this objective, it is necessary to determine whether the site is appropriate for residential use with no further action, or whether removal actions and/or remedial actions would be required in accordance with 40 Code of Federal Regulations (CFR) 300, *National Oil and Hazardous Substances Pollution Contingency Plan*. The USAGAK, in consultation with ADEC and EPA Region X representatives, have determined that a PSE is necessary at this stage of the project.

A PSE is a process of evaluating releases or threatened releases of hazardous substances, pollutants, or contaminants from a source area with the potential to constitute a threat to public health, welfare, or the environment. As defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Fort Wainwright Federal facility Agreement (FFA; EPA et al. 1991), the objective of a PSE is to identify risk-based potential contaminants and the potential extent of contamination at a source area. A PSE is a lead-in investigation to the remedial investigation/feasibility process and is used to evaluate appropriate future activities, if any, for a source area. Additional details regarding the scope of the PSE and technical objectives of this investigation are provided in the QAPP (NWI 2006e).

4.2 Project Data Quality Objectives

Planning for the PSE was conducted by representatives from the ADEC, EPA Region X, USAGAK, USACE Alaska District, and NWI in early summer 2006. Because a significant amount of information related to the site history had been previously compiled by the team, and because initial test pit and debris pile investigations had been completed by NWI in early June 2006, there was sufficient information to support an accelerated planning process.

The planning process used to define the objectives of the PSE is documented in the QAPP in accordance with USACE EM 200-1-3. The seven-step Data Quality Objective (DQO) process (EPA 2000a; EPA 2000b) was followed to provide a convenient approach to document activities and decisions and to communicate the data collection design.

5. NON-MEASUREMENT DATA ACQUISITION

Previous work at this site included employee interviews, historic records search, review of aerial photographs, etc. Although additional non-measurement data acquisition activities are not identified at this time, any new information that becomes available as part of the USAGAK investigation into the site history will be evaluated.

6. FIELD ACTIVITIES BY AREAS OF CONCERN

This FSP is unique in that specific field activity plans will be provided as attachments to this document during the course of the field work. This approach is necessary to streamline the PSE process and to make as much progress as possible within the short field season. It is anticipated that field activity plans will be developed for:

- Buried waste investigation
- Subsurface soils investigation
- Soil stockpile investigation
- Polychlorinated biphenyl (PCB) investigation
- Groundwater investigation.

Other field activities may be identified in the future. These field activity plans will include the rationale behind the required number of field samples; the strategy (statistical, judgmental, and/or random basis) for selecting the particular sampling location; and a summary of the estimated or required number of samples and the type of samples. Where systematic grid patterns are used, a discussion of the grid

dimension and layout will be included. Where appropriate, the decision logic that will be used in conjunction with real time measurement strategies to support in-the-field decision making regarding the progress and direction of subsequent site sampling activities will be included. Planning tools such as Visual Sample Plan (VSP; Hassig et al. 2005) will be used as appropriate to develop specific sampling strategies.

7. FIELD OPERATIONS DOCUMENTATION

The Field Manager (FM) will be responsible for controlling and maintaining all field documents and records. Sample documentation, shipping, and custody procedures for this project are based on EPA-recommended procedures that emphasize careful documentation of sample collection and sample transfer. Any necessary changes to forms, labels, or logbooks will be made by striking out the error with a single straight line and re-entering the correct information. The new entries will be initialed and dated by the person making the change. Under normal conditions, the use of Microsoft® software, with a portable label printer, will be utilized to simplify the identification and labeling of samples, which will ultimately reduce the potential for documentation errors. The following sections describe requirements for maintaining field logbooks, photographs, and chain-of-custody (CoC) records during sampling.

7.1 Field Logbooks

All field logbooks will be constructed from bound, waterproof, serial numbered pages and will be used to record field activities. Typically, one field logbook will be maintained; however, any number of logbooks may be maintained if the need arises and the FM determines it is necessary.

NOTE: *Preprinted field forms, separate from the field logbook, may be used by any member of the field team to record repetitive information (e.g., equipment checklists, sample information, well logs, etc.). Completed field forms may be transcribed into electronic form or simply retained in the NWI project file.*

Only the FM may authorize the start of a new logbook. The project name, project number, FM name, telephone number, and office address will be listed on the inside cover of all field logbooks. The logbook will only be used to document daily field activities in sufficient detail to allow field personnel to reconstruct events that transpired during the project. This document will contain information pertaining to:

- Daily activities and chronology
- Observations made during the environmental investigation

- Equipment calibration results
- Significant events.

Logbook entries must be dated, legible, made in black, indelible, ink, and contain accurate documentation. Language used will be objective, factual, and free of personal opinions. Hypotheses for observed phenomena may be recorded; however, they must be clearly indicated as such and only relate to the subject observation. Corrections to erroneous data will be made by crossing through the entry and entering the correct information. The person making the correction must initial and date where the error occurred. Unused portions of logbook pages will be crossed out, signed, and dated at the end of each workday. Care should be taken to ensure that no lines are skipped on a page. In the event that lines are skipped they should be lined out, signed, and dated.

Only field team members may be in custody of the logbook during field activities. Personnel with custody of a logbook will sign and date the logbook prior to initiation of each day's fieldwork. If it is necessary to transfer custody of the logbook during the course of fieldwork, the person relinquishing the logbook will sign and date the logbook at the time the logbook is transferred, and the person receiving the logbook will do likewise.

7.2 Photographs

Photographs will be used to supplement written descriptions of field activities. Photographs will be recorded on digital media and backed up to secondary media on a daily basis. The first photograph of a new location series will include the site name or location identifier as appropriate. Photographs will be stored as individual JPG files. All photograph files will be named with site name or location identifier, date of photograph, and sequential photo number.

7.3 CoC Documentation

CoC forms will be used to document the transfer of samples from one person's custody to another (e.g., from the sampler to the laboratory) in accordance with ENV-021, *Chain of Custody Documentation* (NWI 2006f) (see Appendix A). Sample information may also be recorded in field logbooks or field forms, and the sample information will be checked to minimize transcription errors prior to sample shipment. Because the CoC is the formal record of sample identification information and custody, the information contained on the CoC will take precedence over other field documentation.

When custody of the samples is transferred, or when samples are relinquished to a common carrier, the sampler will sign, date, and note the time on the form. A separate form will accompany each delivery of

samples to the laboratory. The CoC form will be included inside the cooler used for transport of the samples. In addition to the requirements of ENV-021, the following project specific requirements apply:

- Include the laboratory subcontract number (obtained from NWI contracts department)
- Include the USACE project number (obtained from USACE chemist)
- Include the Location Identifier for purposes of completing the electronic deliverable
- Indicate the sample collection type (e.g., grab vs. composite)
- Use a checklist to verify the accuracy and completeness of the form prior to sample shipment.

Under normal conditions, the CoCs will be generated electronically on a computer and printed for signature. Electronic images or hardcopies of each CoC will be retained by the field team for reference only. In the event that generation of the CoC electronically is not possible or practical, NWI will use a laboratory CoC form, ensuring it complies with the procedures outlined in ENV-021. All entries on the CoC must be recorded in indelible, black ink. Any necessary changes to the CoC will be made by striking out the error with a single straight line and re-entering the correct information. The new entries will be initialed and dated by a sampler.

NOTE: *It is common for multiple NWI personnel to work together to collect, package, and ship samples. In such a case, any single member of the immediate sampling team is considered "the sampler" for purposes of completing CoC forms or other documentation.*

8. FIELD SAMPLING PROCEDURES

The following sections describe procedures to be used for field screening, soil sampling, groundwater sampling, and waste sampling.

8.1 Field Screening Procedures

Field equipment will be calibrated prior to each day's use and documented in the Project Logbook. Calibration will be conducted in accordance with the manufacturer's instructions. Each piece of equipment must be within +/- 10% of manufacturer's standard. If the piece of equipment does not satisfy manufacturer's standard, a second attempt at calibrating the equipment may be conducted; however, upon failing to calibrate the second time, equipment must be removed from service. The following sections discuss use of field screening equipment anticipated to be used on this project.

8.1.1 Photoionization Detector Monitoring Procedures

The photoionization detector (PID) monitor will be used to measure the organic vapor concentrations during field activities. PID monitoring will be conducted according to procedure ENV-019, *MiniRAE Photoionization Detector* (NWI 2006a) (see Appendix B). In general, a portion of each sampling interval will be placed in a plastic bag and allowed to equilibrate so that volatile organic compound (VOC) concentrations in the headspace equal concentrations in the soil sample. In cold weather, the plastic bag will be placed inside a heated vehicle. PID results, including 0.0 parts per million (ppm) instrument-detects, will be recorded in the sampling log and in the field logbook. Soils with elevated VOC measurements may be considered for additional sampling.

8.1.2 Water Quality Monitoring Procedures

Various instruments will be utilized to measure groundwater quality during the purging of monitoring wells prior to sampling. These instruments may be individual sensors or a multi-probe system. Water quality procedures will be conducted in according with Section 5 of procedure ENV-006, *Ground Water Sampling* (NWI 2006d) (see Appendix C). In general, pH, temperature, conductivity, turbidity, Eh, and dissolved oxygen will be monitored to determine when the well has stabilized during purge.

8.1.3 Gross Activity Monitoring Procedures

A Ludlum Model 12 rate meter with a Model 44-9 pancake G-M probe may be used to survey potential radioactive articles (heavy equipment or aircraft instrument panels, gauges, dials, etc.). Radiological screening may also be performed as part of the standard disposal certification process for OE scrap. On days that the Ludlum will be used, a daily operational instrument check will be performed.

NOTE: *The project communications plan requires pre-notification prior to radiological screening activities being conducted.*

The instrument check will be performed off post using a sealed source (Nuclear Regulatory Commission [NRC] license-exempt quantity of Cs-137). Field screening work will be performed by a person qualified as Department of Energy (DOE) Radiological Worker II. The following requirements will apply to handling, storage, and use of this instrument:

- The trained person conducting the radiological surveys will be the source custodian.
- The instrument will be inspected upon receipt and the exempt sealed source will be surveyed (swipe) to ensure integrity.

- The sealed source will be stored in a secure area when not in use. The source and source container will be properly labeled as radioactive material.
- The response check/source check will be performed each day that surveys are conducted.

8.1.4 Immunoassay Field Screening Procedures

Surface and/or subsurface soil sampling will be conducted within the PCB exclusion zone for field screening purposes. Field screening of the soil samples for PCB contamination will be conducted using a Hach Company PCB Test Kit and will be analyzed using the immunoassay method. Sample extracts, calibrators, and reagents are added to curvettes coated with antibodies that are specific for PCB. The concentration of PCB in a sample will be determined by comparing the developed color intensity to that of a PCB calibrator. The Hach Immunoassay Pocket Colorimeter II will be used to provide a digital reading in terms of absorbance that compares the unit of measurement to that of the calibrators. The screening threshold for PCB in soil will be determined to 1 ppm as Aroclor 1260. The soil samples will consist of approximately 8 ounces (oz) of soil placed into re-closable, plastic bags. The bags will be marked with the following information:

- Sample number, as specified in Section 9.1.
- Date
- Time
- Discrete sample depth rounded to nearest foot (e.g., 4 feet [ft] below ground surface [bgs]).

Bagged samples will be placed immediately in coolers with ice. The samples will be transferred in batches to the on-site field test station (located in a field trailer or equivalent). All testing will be conducted according to manufacturer's instructions. Test results and associated sample information will be documented in field forms and/or electronic spreadsheets.

8.2 Soil Sampling Procedures

All personnel handling sampling equipment or opening sample containers will don a new pair of latex gloves prior to collecting each sample. Soil samples will be collected with decontaminated or unused disposable equipment. In general, near-surface soil will be collected with unused disposable spoons and placed into appropriate sample containers. Soil obtained from borings using split spoons or Dual Tube™ tooling will be collected from freshly opened tubes or sleeves. Samples will be collected and placed into appropriate containers using unused disposable spoons. During excavation activities, samples may be

obtained directly from the excavator bucket taking care to obtain soil from the center of the bucket and away from the bucket sides.

Samples to be analyzed for VOCs will be collected first followed by samples to be analyzed for less volatile parameters. There are multiple sample collection methods for VOC analyses. Unless specified in a specific field activity plan (see Section 6), the FM will select the appropriate VOC sampling procedure on a case-by-case basis. In general, EPA Method 8260B with methanol preservation will be used in areas where VOC data is desired to support the PSE; additional sodium bisulfate preserved samples may be collected where low-level VOC contamination is expected. In general, samples will be collected for AK-101 where fuels are suspected (e.g., elevated VOC levels, fuel tanks, etc.). The following procedures will be used to collect soil samples.

8.2.1 VOC Samples, Methanol Preservation

1. Collect samples in one (1) tarred 4 oz glass jar with septa lined lid.
2. Ensure empty jars are weighed with lid and label in place and mark weight on container if not already done so by laboratory.
3. Add entire contents of methanol preservative provided by laboratory (if not already placed in jar by laboratory).

NOTE: *Only use methanol specified for VOC analysis and provided by the appropriate laboratory.*

4. Fill the container approximately 1/4 full of soil using a disposable spoon (soil must be completely submerged). Use caution to not splash preservative.

NOTE: *As with any sampling procedure for volatiles, care must be taken to minimize the disturbance of the sample in order to minimize the loss of the volatile components. The sample should be collected as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere; generally in less than a few minutes at most.*

5. Place lid on sample container (ensure lid and top of jar are free of soil particles).
6. Place container on flat surface and mark meniscus on sample label.
7. Complete sample label.

NOTE: *Do not add custody seal, tape, parafilm, or other material to tarred sample container.*

8.2.2 VOC Samples, Sodium Bisulfate Preservation

1. Collect sample in two (2) 40 millimeter (ml) vials containing sodium bisulfate (provided by the appropriate laboratory).
2. Remove lid from sample container
3. Place approximately 5 grams (g) of soil into container using a disposable spoon.
4. Replace lid on sample container (make sure lid and top of the jar are free of particles).
5. Place container on flat surface and mark meniscus on sample label.
6. Complete sample label.
7. Place container in cooler with ice or refrigerator until it can be packaged for shipment.

8.2.3 Gasoline Range Organic Samples, AK-101 Method

1. Collect samples in one (1) 4 oz glass jar with septa lined lids.
2. Remove lid from a sample container.
3. Fill the container 1/4 full of soil using a disposable spoon.
4. Add entire contents of preservative methanol (provided by the appropriate laboratory).

NOTE: *Only use methanol specified for AK-101 analysis and provided by the appropriate laboratory.*

5. Place lid on sample container (make sure lid and top of jar are free of soil particles).
6. Place container on flat surface and mark meniscus on sample label.
7. Complete sample label.

NOTE: *When working with pre-tarred containers, do not remove sample labels, add sample labels, or cover sample labels with clear tape.*

8. Place container in cooler with ice or refrigerator until it can be packaged for shipment.

8.2.4 Non-Volatile Samples

1. Collect all other soil samples in 8 oz glass amber jars with no preservative.
2. Remove lid from sample container.
3. Fill container completely full of soil using a disposable spoon.
4. Replace container lid (make sure lid and top of jar are free of soil particles).

5. Complete sample label.

6. Place container in cooler with ice or refrigerator until it can be packaged for shipment.

8.3 Monitoring Well Installation Procedures

Groundwater monitoring activities will be performed with the use of direct push and/or hollow stem auger technology. Drilling equipment will be operated under manufactures guidelines, and will be operated by qualified and experienced personnel. Several types of wells may be installed. Monitoring wells will be installed using pre-packed well casings. Upon completion of well installation activities, monitoring wells must be developed. Well development is necessary to restore the aquifer's hydraulic conductivity and remove drilling fluids and fine grained material. Well installation and development procedures will comply with ENV-005, *Design, Installation, and Development of Monitoring Wells* (NWI 2006b) (see Appendix D). Temporary wells may also be installed for groundwater flow determination or to obtain grab samples. Temporary wells do not require development.

8.4 Groundwater Sampling Procedures

Groundwater samples will be collected by use of disposable bailers, peristaltic pumps with disposable tubing. Groundwater sampling activities shall comply with ENV-006 (Appendix C).

8.5 Waste Sampling Procedures

During this investigation, waste (drums or other items) may be encountered that require sampling to support the objectives of the investigation. All waste sampling will be performed by qualified personnel experienced with waste characterization. The SSHP addresses safe handling of drums with unknown contents. Section 11 of the FSP discusses handling of potentially hazardous waste items. The following guidelines will be considered during waste sampling.

- Many waste matrices are not amenable to standard analytical methods. Quality criteria typically applied to environmental media are not applicable to waste analyses.
- Samples collected from drums are considered waste samples. No preservatives should be added since there is a potential reaction of the sample with the preservative.
- Waste samples should be protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.
- Closed drums can be opened manually or remotely. Remote drum opening using heavy equipment is recommended for worker safety. Drum webs are recommended when manually opening open top drums.

- Wide-mouth amber jars with Teflon-lined screw caps are preferred for collection of liquid wastes and sludges. Plastic bags are preferred for solid waste items.
- Oftentimes sufficient sample volume cannot be obtained and the laboratory will have to be given guidance to prioritize analyses.

9. SAMPLE HANDLING

The following sections describe requirements for sample identification, sample containers and preservation, and sample packaging and shipping.

9.1 Sample Identification

Sample labels are required for properly identifying samples. All field samples will be labeled with the label affixed to the container before or shortly after it is filled and prior to transportation to the laboratory. The sample label will include the following information:

- Sample identification number
- Location identification
- Date and time of sample collection
- Initials of person collecting the sample
- Analysis requested
- Preservation method
- Any other information pertinent to the sample.

A sample numbering system will be used to identify each sample collected and submitted for analysis. Samples will be numbered in such a manner as to prevent the laboratory from distinguishing the quality control (QC) samples from other site samples. The sample identification number will be a unique number to which all information pertaining to the sample can be correlated. To ensure each sample receives an unique identifier and that the sample can be directly tied to the sample location, the sample ID will be in the format of AABBCCSDD, where:

- AABBCC is the Loc ID
- AA = the two digit year (i.e., 06 for 2006)
- BB = type of site (e.g., TP = test pit, SP = soil pile, MW = monitoring well, SB = soil boring, TB = trip blank)
- CC = consecutive location number for that type of site
- S = stands for “sample”

- DD = consecutive sample number for that site.

Duplicate samples will be numbered in sequential order. Samples numbers will based on the request for a different analyses.

9.2 Sample Containers and Preservation

Sample container types will be consistent with EPA and ADEC requirements for the specific parameters of interest, and are identified in Tables 1 and 2 for the associated analytical methods. Sample containers will be obtained directly from the analytical laboratory in sealed boxes and will be verified as pre-cleaned by the analytical laboratory with the appropriate certificates. Extra containers will be available in case of breakage, contamination, or collection of additional samples.

All samples collected will be preserved according to EPA and ADEC protocols. Chemical preservatives and chilling will be used for samples, where required. Appropriate measures will be taken to ensure that storage requirements, with respect to temperature, are maintained in the field, during transport to the laboratory, and during storage at the laboratory. Tables 1 and 2 identify required sample container types, preservative requirements, and hold times for soil and groundwater samples, respectively, collected under this project.

9.3 Sample Packaging and Shipping

Sample packaging and shipping will be conducted in accordance with ENV-002, *Sample Handling, Packaging and Shipping* (NWI 2006c) (see Appendix E). NWI will use properly trained samplers to collect, package, and ship all environmental samples. An experienced FM will provide oversight of all sampling activities to ensure that all samples are properly preserved and protected from breakage or loss. Prior to every sampling event, the FM will ensure that the laboratories are aware of the pending shipments and are prepared to meet all requirements of the QAPP. Prior to the end of each sampling event, the FM will review all field documentation to ensure that instructions to the analytical laboratory are clear and complete and that all of the necessary information to interpret the results is properly recorded (a checklist should be used). Guidelines for sample packaging, sample shipping, and sample security are provided in Appendix E.

Table 1. Sample containers, preservation, and holding times for soil samples.

Analysis	Method Number	Container[a]	Preservative	Maximum Holding Times
VOCs	EPA SW8260B	4 oz. septa, tared amber glass or 40mL amber glass	Methanol or Sodium Bisulfate	14 days
Semivolatile Organic Compound (SVOC)	EPA SW8270C	4 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Polynuclear Aromatic Hydrocarbons (PAH)	EPA SW8270C-SIM	4 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Gasoline Range Organic (GRO)	AK101	4 oz. septa, tared amber glass	Methanol, 4°C +/- 2°C	28 days
Diesel Range Organic (DRO)	AK 102	4 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Residual Range Organic Compounds (RRO)	AK103	4 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
PCBs	EPA SW8082A	4 oz. glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Resource Conservation and Recovery Act (RCRA) Metals by Toxicity Characteristic Leaching Procedure (TCLP)	EPA SW6010/7471A	8 oz. glass	4°C +/- 2°C	180 days to analysis; Mercury 28 days
Total RCRA Metals	EPA SW6010/7471A	8 oz. glass	4°C +/- 2°C	180 days to analysis; Mercury 28 days
Total Metals by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) + Strontium	EPA SW6020	8 oz. glass	4°C +/- 2°C	180 days to analysis
Mercury	EPA SW7471A	8 oz. glass	4°C +/- 2°C	28 days
Pesticides	EPA SW8081A	8 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Herbicides	EPA SW8151	8 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Anions by IC	E300.0	8 oz. amber glass	4°C +/- 2°C	None
Nitrate/Nitrite/O-Phosphorous	E353.2	8 oz. amber glass	4°C +/- 2°C	28 days; 48 hours OPO_3
pH	EPA SW9045	8 oz. amber glass	4°C +/- 2°C	ASAP (laboratory protocol dictates analysis within 14 days)
Nitroaromatics and Nitroamines by (HPLC/UV)	EPA SW8330	8 oz. amber glass	4°C +/- 2°C	14 days to extraction, 40 days to analysis
Dioxins/Dibenzofurans	EPA SW8290	8 oz. amber glass	4°C +/- 2°C	30 days to extraction, 45 days to analysis
Radionuclides, Gamma Emitting	HASL 300	250 mL HDPE	None	6 months
Gross Alpha/Gross Beta	EPA SW9310	250 mL HDPE	None	6 months

a. Sample material for multiple non-volatile analyses may be combined as approved by the laboratory.

Table 2. Sample containers, preservation, and holding times for groundwater samples.

Analysis	Method Number	Container	Preservative	Maximum Holding Times
VOCs	EPA SW8260B	Three 40-ml VOA vials	No headspace, HCl to pH < 2; 4°C +/- 2°C	14 days
SVOC	EPA SW8270C	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
PAH	EPA SW8270C-SIM	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
GRO	AK101	Three 40-ml VOA vials	No headspace, HCl to pH < 2; 4°C +/- 2°C	14 days
DRO	AK102	Two 1-L amber jars	HCl to pH < 2; 4°C +/- 2°C	14 days to extraction; 40 days to analysis
RRO	AK103	Two 1-L amber jars	HCl to pH < 2; 4°C +/- 2°C	14 days to extraction; 40 days to analysis
PCBs	EPA SW8082A	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
Total Metals by ICP/MS + Strontium	EPA SW6020	250 ml HDPE	HNO_3 to pH <2; 4°C +/- 2°C	180 days
Mercury	EPA SW7470A	250 ml HDPE	HNO_3 to pH <2; 4°C +/- 2°C	28 days
Pesticides	EPA SW8081A	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
Herbicides	EPA SW8151	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
Anions by IC	E300.0	250 ml HDPE	4°C +/- 2°C	28 days Br, F, Cl, SO_4; 48 Hours NO_3, NO_2, OPO_3
Nitrate/Nitrite	E353.2	250 ml HDPE	4°C +/- 2°C	28 days
pH	E150.1	250 ml HDPE	4°C +/- 2°C	ASAP (laboratory protocol dictates analysis within 14 days)
Nitroaromatics/ Nitroamines	EPA SW8330	Two 1-L amber jars	4°C +/- 2°C	7 days to extraction; 40 days to analysis
Perchlorate	EPA SW6850	500 mL HDPE	4°C +/- 2°C	28 days
Dioxins/Dibenzofurans	EPA SW8290	Two 1-L amber jars	4°C +/- 2°C	30 days to extraction; 45 days to analysis
Radionuclides, Gamma Emitting	EPA 901.1	2 L HDPE	None	6 months
Gross Alpha/Gross Beta	EPA 900.0	2 L HDPE	None	6 months

10. PROJECT CLOSEOUT AND REPORTING

Upon completion of the 2006 field activity, NWI will submit a Site Investigation report. NWI will submit the report in draft, draft final, and final versions. If there are no comments provided on the draft final version within an established review period, then the draft final version will become final by distribution of a notification letter. The report will contain, at a minimum, the following information:

- A detailed description of the site activities performed in support of the investigation
- A photographic log that details site activities
- Maps of soil borings, test pits and groundwater wells
- Maps with soil sample locations and results
- Tables with sample results.

11. INVESTIGATION DERIVED WASTE

Wastes generated during this investigation will include general refuse, groundwater retrieved during well development and sampling activities, and decontamination wastes, including wash water, plastic sheeting, etc., and a variety of waste items that could be removed from test pits or debris piles for investigatory purposes. In general, wastes or environmental media (soil or groundwater) that are suspected or known to be contaminated will be left on site where they are found. Removal of contaminated soil or water for other than investigatory purposes is not authorized under this project. However, when the FM determines that it is not practical or safe to return material to where it was found (e.g. large quantities of scrap steel), the material may be removed and handled as waste. Table 3 summarizes the anticipated waste streams and disposal paths.

Because there is no knowledge at this site that indicates the generated wastes will exhibit a hazardous characteristic or will contain listed wastes, all wastes generated during these investigatory activities will be initially considered to be non-regulated Investigation Derived Waste (IDW) in accordance with existing DPW environmental office procedures. Potentially hazardous waste will be containerized (e.g., 55 gallon [gal] drums, over-packs, supersacks, etc.) or otherwise secured as directed by the installation environmental office. NWI will manage IDW material on the Taku site in accordance with industry standards.

Table 3. Anticipated waste streams and disposal paths.

Waste Stream	Disposition
Refuse	All general refuse such as personal protective equipment, gloves, paper towels, plastic sheeting, scrap metal, etc., that do not have the potential to contain hazardous material will be placed in the dumpster at Building 3489.
Debris	Debris (e.g., scrap metal, wood, concrete, asphalt, rubber, etc.) encountered during the investigation will be visually examined as part of the PSE. In general, debris will be returned to the location from which it originated (debris piles, test pit excavations, etc.). In cases where it is impractical to replace the debris, NWI will transport the material to the installation landfill for disposal.
Asbestos Containing Material (ACM)	ACM or potential ACM that is encountered will be handled only by personnel qualified to handle asbestos in Alaska. The material will be properly bagged, labeled, manifested, and transported by NWI to the installation landfill for disposal.
OE Scrap	OE scrap will be certified for disposal by qualified personnel in accordance with applicable regulations and transported by NWI to the installation landfill for disposal.
Waste water	Waste water from decontamination operations, well development, groundwater sampling, etc., will be containerized and managed on site until analytical results are available after which it will be transferred to the installation environmental office for proper disposal.
Waste items	Waste items that are identifiable (e.g., labeled containers, light ballasts, gas cylinders, batteries, etc.) will be transferred to the installation environmental office for proper disposal. Unknown waste material will be identified by analytical testing or other means before it is transferred to the installation environmental office.
Soil	Soil encountered during excavation, drilling, or other operations, will be replaced to the location from which it originated (e.g., soil piles on site, test pit excavations, boreholes, etc.). If obviously contaminated soil is encountered, (high PID readings, staining, etc.), the installation environmental office will be immediately notified.

At such time that the IDW material is considered to be “known,” (e.g., analytical data are available, container markings are found, etc.), then NWI will notify the installation environmental office and request waste management services to transport the items to an appropriate temporary accumulation area and to arrange for final disposal. NWI is responsible to identify all wastes. The installation environmental office is responsible to make hazardous waste determinations, complete disposal facility profiles, hazardous waste manifests, and to arrange for transportation and disposal.

12. FIELD ASSESSMENT/THREE-PHASE INSPECTION PROCEDURES

QC activities for this project consist of a three-phase control program to ensure that all activities are performed in accordance with project requirements and in conformance to the approved project guidance documents. The control program is implemented prior to initiating each specific field activity and will remain in effect throughout its duration. The three-phase control program includes:

1. A preparatory phase
2. An initial phase
3. A follow-up phase.

The QC process encompasses a review of project activities by a contractor-assigned QC officer at three distinct phases. The QC officer will perform these duties whether or not a government representative is present.

12.1 Preparatory Phase

There are three components to the preparatory phase; a kickoff meeting with the government; a pre-job briefing with the project team; and an inspection of preparatory items. The kickoff meeting is an important component of the QC process whereby contractor and government personnel discuss and agree on the requirements of the job and the government/contractor interrelationship. The scope that needs to be accomplished, including any quality specifications, must be understood and agreed to by all parties up front to minimize redirection and delays during fieldwork.

The preparatory phase pre-job briefing is similar to the kickoff meeting, but held internally with the contractor team. Before beginning work, the PM will conduct the pre-job with all personnel who will be involved in the fieldwork. The workers will be instructed regarding task expectations. This preparatory phase meeting may need to be repeated with the arrival of new field team members. The QC pre-job briefing may be conducted at the same time as the safety pre-job briefing required by the SSHP.

The preparatory phase inspection will be completed by the Project Manager (PM). The following checks are to be completed:

- Required safety equipment are available and in good condition.
- All members of the contractor field team meet the training and medical monitoring requirements, as delineated in the SSHP. Copies of training files are available onsite.

- All required permits and clearances for this task have been obtained (i.e., excavation permits and utilities clearances).
- The necessary subcontractors and suppliers (e.g., testing laboratories, land surveyor, MEC subcontractor, etc.) are under contract and scheduled to provide the necessary on-site services.
- Pre-job briefing with project team has been completed. Construction tolerances and workmanship standards for excavation and restoration activities have been clearly communicated.
- The USACE has been notified at least 24 hours in advance of the start of work.

12.2 Initial Phase

The initial inspections are performed when a representative portion of a task has been completed. The purpose of the initial phase is to ensure that tasks are being executed according to the approved project guidance documents. This phase will include a review of the work performed to complete the task and a check to ensure that the task is being performed according to the guidance documents. The following tasks will be completed during this phase:

- Review the safety and health plan and activity hazard analysis as the work progresses to identify new hazards or changing conditions that could impact the SSHP.
- Inspect field notes to verify that pertinent data are recorded as specified in this FSP.
- Inspect sample documentation to verify that pertinent data are recorded as specified in this FSP.
- Contact the project chemist to verify that sample receipt and analytical work is being performed as required.

12.3 Follow-Up Phase

The contractor will perform follow-up phase inspections on an as-needed basis to ensure continued compliance with contract requirements until completion of that particular feature of work. General procedures and documentation are periodically checked to ensure they are complete, accurate, and consistently executed throughout the duration of the project.

13. NONCONFORMANCE/CORRECTIVE ACTION

While conducting project activities, quality problems may be identified by managers, project personnel, the customer, or subcontractor personnel. When project personnel identify quality problems, safety concerns, or deficiencies from regulations and requirements, they must report them to the PM, and if problems remain uncorrected, to their Line Manager.

NOTE: *All personnel are responsible and obliged to personally stop any work they determine unsafe. Project personnel are also responsible for identifying practices or conditions that are or may be adverse to quality and for recommending cessation of work to a Line Manager, PM, or the Quality Assurance Manager. Line Managers and PMs are responsible for assessing conditions potentially adverse to quality and for taking appropriate action, including stopping work. In all cases, these responsibilities override planning and scheduling considerations.*

Identified problems or concerns will immediately be discussed with the FM, PM, and if necessary, members of the field team. Oftentimes, quality issues can be easily solved with minimal amount of rework by clarifying misunderstandings and/or providing further training. Should onsite efforts between the PM and the FM fail to resolve the problem, the issue will be raised to the Corporate Quality Assurance Manager.

QAP-10-161, *Corrective, Preventive, and Improvement Actions,* (NWI 2005b) establishes a Quality Board to evaluate nonconformance reports on a case-by-case basis. The PM and Corporate Quality Assurance Manager comprise the Quality Board and, depending on the nature of the quality problem, other technical experts may also be included on the Quality Board.

The Quality Board will disposition the quality problem by evaluating the significance of the problem, determining the cause(s) of the problem, and developing a proposed resolution consisting of corrective action and preventive action. This disposition will be documented on the nonconformance report in accordance with QAP-10-151, *Control of Nonconforming Items,* (NWI 2005a).

The Quality Assurance Manager tracks quality problems and corrective and preventive actions from identification through resolution using the Corrective and Preventive Action System in accordance with QAP-10-161. The Quality Assurance Manager verifies completion of the corrective and preventive actions and closes the nonconformance report.

14. REFERENCES

40 CFR 262, Title 40. "Protection of Environment," Part 262, "Standards Applicable to Generators of Hazardous Waste," *Code of Federal Regulations*, Office of the Federal Register.

40 CFR 300, Title 40. "Protection of Environment," Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, Office of the Federal Register.

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USACE, 1998. *Technical Project Planning (TPP) Process,* EM-200-1-2, U.S. Army Corps of Engineers, Engineers Manual, August 1998.

USACE, 2001. *Requirements for the Preparation of Sampling and Analysis Plans,* EM-200-1-3, U.S. Army Corps of Engineers, Engineers Manual, February 2001.

APPENDIX A

ENV-021, CHAIN OF CUSTODY DOCUMENTATION

ENV-021

Chain of Custody Documentation

Revision 2

July 10, 2006

Approved:

Doug Jorgensen *Original signature on file*	07/07/06
Line Manager	Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	02/06/06	All	Baseline Document
1	03/13/06	Title	Changed Title from “ER” to “ENV”
2	07/10/06	4.1	Added information to bullets in section 4.1. Replaced last paragraph in section 4.1.

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Appendix A—Definitions and Acronyms A-1

1. PURPOSE

This procedure establishes the method and responsibilities associated with the maintenance and custody of samples which are to be used to provide data which form a basis for making project related decisions. It outlines the general procedures for maintaining and documenting sample chain of custody from the time of sample collection through sample disposition.

2. SCOPE

This procedure applies to all North Wind, Inc. (NWI) personnel who are responsible for collecting and handling environmental samples. Should specific contracts require use of client-provided chain of custody procedures, then the client-provided procedures shall be used.

3. RESPONSIBILITIES

3.1 Project Manager

- Responsible for ensuring that all sample collection activities are conducted in accordance with this procedure and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

- Responsible for assuring proper Chain of Custody (COC) is initiated at the time the sample(s) are collected and maintained throughout the handling and subsequent transportation of the sample(s) to the designated laboratory. Additionally, he/she is the project authority for determining the disposition and fate of sample(s) which have identified deficiencies (e.g., missed holding times, elevated temperature at receipt, etc.).

3.2 Quality Assurance Manager

- Responsible for periodic review of Chain of Custody records are generated documentation associated with this procedure.

- Responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and procedures, variances to Quality Control (QC) sampling requirements, issuing nonconformances, etc.) if problems occur.

3.3 Field Team Leader

- Responsible for maintaining sample *custody* from the time of sample collection until the sample is delivered to the lab.

- Responsible to ensure that custody documentation is accurate and complete.

3.4 Sampling Technician

- Responsible for proper completion of the Chain of Custody documentation, ensuring that all sample information is accurately recorded on the sample label, in the field logbook, and on the chain of custody form.

3.5 Laboratory Personnel

- Responsible for receipt and entry of samples into the laboratory.
- Responsible to properly document and maintain COC from the moment that they take custody of the sample at the laboratory until the sample material is disposed of or is returned to the client.

4. PROCEDURE/PROCESS

To preserve the integrity of environmental samples, the sampler must maintain and document the custody of the samples from the time of sample collection to completion of the analyses. The primary objective of sample custody is to create an accurate, verifiable written record that may be used to trace the possession and handling of the samples from the moment of collection until receipt by the laboratory. A sample is considered to be under a person's *custody* if the sample is in the person's physical possession or direct view, if the sample is secured so that no one can tamper with the sample, or if the sample is secured in an area restricted to authorized personnel only.

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the samples were obtained from the locations stated and that they reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal must be documented to accomplish this. Documentation will be accomplished through a COC form that lists each sample and the individuals performing the sample collection, shipment, and receipt.

4.1 Sample Custody Form

The transfer of samples from one person's custody to another (e.g. from the sampler to the laboratory) will be documented on a chain-of-custody form. When the samples are transferred from one party to another, the individuals will sign, date, and note the time on the form. A separate form will accompany each delivery of samples to the laboratory. The chain-of-custody form will be included in the cooler used for transport of the samples. The sampling technician will retain a copy of the form. The COC form will be completed by the sampler to include the following information:

- Receiving laboratory name, address and phone number

- Sampler's name and point-of-contact name, company, address and phone number
- The name of the courier and the waybill number (if applicable).
- An Unique COC reference number
- Project name and NWI project number
- Unique identification number assigned to each sample
- Sample date/time (must match the time recorded on the sample label)
- Sample matrix description
- Analyses requested for each sample
- Preservation method
- Number and type of containers used
- Any special handling or analysis requirements (e.g. MS/MSD identification)
- Signature of person collecting the samples
- Signature of persons involved in the chain of possession, including data and time.

Under normal conditions, the COCs will be generated electronically on a computer and printed for signature. Electronic images or hardcopies of each COC will be retained by the field team for reference only. In the event that generation of the COC electronically is not possible or practical, NWI will use a laboratory COC form, ensuring it complies with the procedures outlined in this procedure. All entries on the COC must be recorded in indelible, black ink. Any necessary changes to the COC will be made by striking out the error with a single straight line and re-entering the correct information. The new entries will be initiated and dated by a sampler.

NOTE: *It is common for multiple NWI personnel to work together to collect, package, and ship samples. In such case, any single member of the immediate sampling team is considered "the sampler" for purposes of completing COC forms or other documentation.*

4.2 Transfer of Custody

The COC document will be initiated in the field by the person collecting the sample and signed by each individual who has the samples in their possession. Each time that sample custody is transferred, the former custodian must sign over the COC as Relinquished By,

and the new custodian must sign on to the COC as Received By. Each signature must be accompanied by the date, time, and the name of their project or company affiliation.

4.2.1 No Common Carrier

If the sampling technician delivers the samples to the laboratory, transfer of COC occurs as follows:

- The sample collector delivers the samples to the laboratory and relinquishes the sample directly to a laboratory representative.
- The collector signs the COC listing his/her name, affiliation, the date, and time. Any person involved in the collection of the sample may act as the sample custodian.
- The laboratory representative must receive the samples by signing his/her name, affiliation, the date, and time on the COC. The laboratory representative may decline to take receipt of the samples if the COC is not properly completed or if the samples are not properly packaged. All designated laboratory personnel may act as the sample custodian.
- One copy of the COC is given to the sample collector to be returned to the project files and one copy is maintained with the samples at the laboratory.

4.2.2 Common Carrier

If the sampling technician transfer sample(s) to the laboratory utilizing a commercial carrier (e.g. Fed Ex), sampling technician will retain COC responsibility and the common carrier is not responsible for maintaining sample custody. The sample collectors are responsible for packaging the samples in a manner that meets the COC definition criteria, that is, the samples are sealed to prevent tampering. When transferring samples to the courier for transport, COC procedures are maintained as follows:

- The sample collector lists the courier affiliation and waybill number on the COC.
- The sample collector relinquishes custody by signing his name, affiliation, date, and time. The collector keeps a copy of the relinquished COC for the project file.
- The relinquished original COC is sealed in a watertight plastic bag and taped to the inside of the lid of the container used for transportation.
- The transportation container is sealed to prevent tampering and given to the courier for delivery to the laboratory.
- The sample collector obtains a copy of the waybill from the courier for the project file.

- The laboratory representative must receive the samples by signing his/her name, affiliation, the date, and time on the COC. This copy is maintained with the samples at the laboratory.

- The laboratory representative obtains a copy of the waybill from the courier for the project file.

4.3 Analytical Laboratory Custody

Upon receipt at the analytical laboratory, the field generated COC document will be signed, dated, time marked, temperature marked, and laboratory identification will be provided in the appropriate spaces. A cooler receipt form will be completed documenting the condition of the samples upon receipt.

Laboratory receipt personnel will enter the samples into the laboratory by implementing the sample custody procedures addressed within their approved Quality Program Plan.

After completion of analytical testing, sample remnants not consumed during testing may be kept for six months beyond the completion of analysis, unless otherwise specified by a notation on the COC that samples are to be returned to the project site for disposal. Once this time period has elapsed, the samples will be disposed of and the disposal record number will be recorded on the laboratory record copy of the COC.

5. RECORDS

The Project Manager will maintain the following records in accordance with QAP-10-171, Records Control:

- Chain of Custody Form

- Cooler Receipt Form

6. REFERENCES

USEPA, Test Methods for Evaluating Hazardous Waste, (SW-846) Rev.0, Sept. 1994

APPENDIX A

DEFINITIONS AND ACRONYMS

Definitions

custody	A sample is considered to be under a person's *custody* if the sample is in the person's physical possession or direct view, if the sample is secured so that no one can tamper with the sample, or if the sample is secured in an area restricted to authorized personnel only.
Chain of custody	The Chain of Custody (COC) document is the written record that traces the sample possession from the time each sample is collected until its final disposition, sometimes called the "cradle to grave" record, or in the EPA Contract Laboratory Program, a "Traffic Report."
Common carrier	For the purpose of this procedure, the common carrier is any commercial carrier utilized for the transportation of the sample(s) from the field to the laboratory.
Forms-2-Lite	EPA developed software, available at no charge for use on government sponsored projects, that can be used to track all sample information, automating sample labels, COC forms, and SAP tables.

Acronyms

COC	Chain of Custody
EPA	Environmental Protection Agency
NWI	North Wind, Inc.
QA	quality assurance
QC	quality control
QA/QC	Quality Assurance/Quality Control

APPENDIX B

ENV-019, MINIRAE PHOTOIONIZATION DETECTOR

ENV-019

MiniRAE Photoionization Detector

Revision 1

March 13, 2006

Approved:

Doug Jorgensen *Original signature on file* 03/13/06

Line Manager Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	02/06/06	All	Baseline Document
1	03/13/06	Title	Changed Title from “ER” to “ENV”

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Appendix A—Definitions and Acronyms A-1

1. PURPOSE

The purpose of this procedure is to set guidelines for the calibration of the MiniRAE Photoionization Detector (PID) prior use and to give basic instructions of field sampling.

2. SCOPE

This procedure provides instruction for all North Wind Inc. (NWI) personnel who use a PID for organic field screening and waste profiling. Additional requirements or procedures may be provided in project-specific sampling and analysis plans.

3. RESPONSIBILITIES

3.1 Field Geologist/Sampling Technician

The Field Geologist/Sampling Technician is responsible for on-site monitoring and documentation of field screening using a PID. Daily calibration will be conducted using the procedure described in this instruction and recorded in a daily logbook. Headspace analysis of samples taken in the field will be obtained using the general guide in this instruction. Data will be recorded in the field logbook or as required by project-specific work plan documents.

4. PREPARATORY ACTIVITIES

The MiniRAE (RAE) is a programmable PID that measures organic vapors in hazardous environments. It incorporates a sampling pump and data download capabilities for continuous toxic monitoring, site survey, and leak detection. The RAE is intrinsically safe and easy to use.

The RAE can measure double-bonded organic vapors in the range of 0.1 to 10,000 ppm. Note that both 10.6 eV and 11.7 eV gas discharge lamps are available for the RAE. The 10.6 eV lamp is most commonly used, detects the largest number of compounds, and is most durable. However, a number of compounds are detected only with the 11.7 eV lamp (e.g. carbon tetrachloride, chloroform, ethanol, formaldehyde, trichloroethane, etc.) Also be aware that a number of organic compounds cannot be detected by PID (e.g. carbon monoxide/dioxide, ethane, methane, hydrogens, etc.). If unsure, reference the manufacturer's literature to verify that the target analyte is detectable and to select the proper lamp.

The battery on the RAE drains slowly even when turned off. If the unit has not been charged for 4-5 days, the battery voltage will be low. If the unit is left to charge overnight, it will automatically shut itself off when fully charged. Only operate the RAE in the survey mode. The RAE has been pre-set to start automatically in the survey mode.

In addition to the RAE, verify that the following items are available on site: spare lamps, calibration gas, zip-lock bags, logbook/sample forms, waterproof pens, 110 V power supply (generator or 12 V inverter) for charging.

5. OPERATING PROCEDURES

To Turn On the RAE press the [**on**] key. The audio buzzer will beep once and the display will show "HG-x.xx" or "SU-x.xx" to indicate the operating mode and software version number. The unit will **then go through a self-diagnostic routine** to check the key components of the unit. A ".diag.." message will be displayed with a red back light turned on while the self-diagnostic routine is executing. The red LED and backlight will flash once and the buzzer will beep once to ensure that they are functional. The sampling pump will be turned on and start to draw air sample.

To turn Off the RAE press the [**on**] key. The message "off" will flash on the LED display; press the [**enter**] key to confirm and the unit will be turned off. Pressing any other key will return the unit to normal operation.

The RAE can display five different readings: instantaneous gas concentration, STEL, TWA, and peak and battery voltage. Most of these functions have either been pre-set or do not apply to most Branch surveys. Only **press [enter]** to scroll through each display.

Alarm Signal - The built-in microcomputer constantly updates and monitors real time gas concentrations and compares it with the programmed alarm limits. **Whenever the concentration exceeds any of the preset limits 5 parts per million (ppm),** the alarm buzzer and red flashing LED will be activated immediately to warn the user of the alarm condition.

- Whenever the battery voltage falls below 5.5 volt (6.3v or higher is normal) or the UV lamp or sensor module fails, the unit will also activate the buzzer and red LED alarm signal.

- In the Survey Mode, the alarm signal is proportional to the level of the gas concentration. Therefore, when the gas concentration exceeds preset limits (5 ppm), the alarm signal may very from a single beep and a single flash per second to a rapid 7 beeps and 7 flashes per second when the high threshold level has been exceeded. The higher frequency of alarm signal indicates higher gas concentrations.

Back Light - The LCD display is equipped with a red LED back light to assist the readings under poor lighting conditions. This back light can be turned on by pressing the [**up**] key. When the back light is already on, pressing the [**up**] key will turn it off.

Charging the RAE - On the backside of the RAE is a battery-charging jack, which is normally covered by a protective rubber cover. Open the rubber cover and connect the AC adapter (or the automotive DC charging adapter, depending on the power source to

the charging jack). There is a bi-colored LED inside the LED window that will provide an indication of the charging status:

- Red - battery is being charged
- Green - charging is completed
- No light - bad connection or defective battery

Plug in the AC (or DC) adapter, which will turn on the red charge status LED first. If the battery is fully charged, it will turn to green quickly. A completely discharged battery will be charged to its full capacity within 10 hours.

6. CALIBRATION

In the survey mode, the user may re-calibrate the RAE. This is a two-point calibration process using **Zero Gas** and a **Standard Reference Gas**.

- First, a zero gas which contains no detectable organic vapors is used to set the zero point (C0)
- Second, a standard reference gas is used to set the second point of reference (C1)

6.1 Zero Gas Calibration

Use a gas bag (1 liter) and zero concentration gas from your air box.

Fill the gas bag with zero concentration gas. Zero gas calibration option is the 5th menu option. Display shows CO xxx.x where x.xxx is the gas reading based on current calibration of the instrument.

Attach the gas bag to the inlet tube and open the bag so that the instrument can begin pumping the zero concentration gas. The display should be reading zero.

If this reading is not zero, press the [**enter**] key to zero it. If the reading still shows a small value after a few seconds, press the [**enter**] key again to zero it. Repeat this process until the reading is stabilized around zero or 0.1 ppm. This completes the zero gas calibration. **Press the [menu] key to exit zero gas calibration while the bag is still on the instrument**.

6.2 Enter Standard Calibration Gas Value

Enter standard gas value option is the 6th menu option.

If the concentration of the standard calibration gas to be used is the **same** as the displayed value, **press [enter] key 4 times to accept the displayed calibration value one digit at a time and move to the next step**.

If the concentration of the standard calibration gas to be used is **different** from the displayed value, the user needs to enter the new value. Starting from the left most digit of the displayed value, use the [**up**] or [**down**] arrow key to change the digit value and [**enter**] to confirm the digit.

Now the standard calibration gas value is entered.

Display shows a flashing message of "**GAS ON**" to remind the user to turn on the standard calibration gas bottle now. After the gas bottle is turned on, press [**enter**] key to continue the standard calibration procedure.

6.3 Standard Gas Calibration Procedure

Insert the instrument probe into the calibration gas bag (bag should be at least 1 liter) that is filled with toluene.

Display shows a flashing message of "**GAS ON**".

Press the [**enter**] key, the display should show CAL.... for about 30 seconds while the instrument performs calibration. Afterwards, the display shows C1 xxx.x where C1 indicates that this is the standard calibration gas and xxx.x is the actual gas reading in ppm based on the new calibration data.

Note: The reading should be very close to the value of the calibration gas. If the reading is higher or lower than the standard gas value and continues to rise slowly, it means that the calibration gas has not yet stabilized. Wait a few seconds until the reading stabilizes and then press the [**enter**] key again. Every time the [**enter**] is pressed, the instrument measures the current gas concentration and calibrate accordingly.

Press the [**menu**] key to exit the standard gas calibration procedure and move to next menu item.

Disconnect the calibration gas bag.

7. FIELD SCREENING PROCEDURES

The site Geologist/Sampling Technician is responsible for field screening of soil and/or drill cuttings. The sampling schemes for field screening is dependent of site specific needs. Calibration of the MiniRAE will be done each day before field screening takes place, and entered in the daily field logbook entries. Headspace analysis will be conducted as outlined below:

- Don clean latex or nitrile gloves before collecting each individual sample
- Fill a zip lock bag with approximately 8 oz of soil
- Shake the bag for 15 seconds immediately after filling the bag. Warm the bag to a minimum temperature of 40ºF (4ºC) with an optimum temperature of approximately 60ºF (20ºC). If the soil is frozen when inserted in the bag, shake the bag again after the sample has reached 40ºF (4ºC)
- Let the bag sit for at least 10 minutes, but less than 1 hour to allow headspace vapor to accumulate
- Shake the bag for 15 seconds again immediately before taking the PID measurement
- Open one corner of the bag, allowing just enough room to insert the PID intake probe, seal opening around the PID probe. Record the highest PID reading, usually registered within the first 5 seconds of probe insertion, in the field logbook.

8. REFERENCES

None

APPENDIX A

DEFINITIONS AND ACRONYMS

Definitions

None

Acronyms

AC	alternating current
DC	direct current
eV	electron Volt
LED	light emitting diode
NWI	North Wind, Inc.
PID	photoionization detector
ppm	parts per million
RAE	MiniRAE
STEL	short term exposure limit
TWA	time weighted average

APPENDIX C

ENV-006, GROUND WATER SAMPLING

ENV-006

Ground Water Sampling

Revision 0

May 24, 2006

Approved:

Doug Jorgensen *Original signature on file* 05/22/06

Line Manager Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	05/24/06	All	Baseline Document

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APPENDICES

Appendix A—Definitions and Acronyms A-1

1. PURPOSE

The purpose of this Procedure is to set guidelines for the collection of a sample representative of ground water residing in the geologic formation of interest. The purpose of this procedure is to provide a processes to support the reduction of the potential bias caused by the sampling equipment used to obtain the sample.

2. SCOPE

This procedure is applicable to North Wind, Inc. (NWI) projects that specifically reference this procedure in the Project Execution Plan (PEP), Project Work Plan, or Sampling and Analysis Plan (SAP).

This procedure is intended to provide general guidance on sampling of ground water wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. This procedure is designed to be used in conjunction with analyses for the most common types of groundwater contaminants (e.g., volatile and semivolatile organic compounds, pesticides, metals, biological parameters). This is a standard (i.e., typically applicable) operating procedure which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedure employed should be documented and associated with the final report.

3. RESPONSIBILITIES

3.1 Project Manager

- Meet customer's expectations and serve as a primary point of contact with the customer.
- Ensures that the sampler has access to necessary equipment to complete groundwater sampling.
- Ensures that the sampler follows protocol and procedures for completing groundwater sampling task(s).

3.2 Sampling Personnel

- Ensures appropriate preparation and planning is completed prior to groundwater sampling activities to reduce delays in start-up or progress task.
- Ensures all materials and equipment are available for sampling task.

- Communicates on a routine basis with the Project Manager on status of task, any additional needs to complete task, and on any issues related to properly completing task.

- Follows all procedures, plans, and protocols to adequately complete groundwater sampling task.

- Ensures all documentation of groundwater sampling activity is complete and legible.

4. GROUNDWATER SAMPLING

The following outlines standard groundwater sampling procedures and processes that should be used for any groundwater sampling task. Acquiring groundwater samples vary widely from sampling site to sampling site. This procedure should be sued as a general reference to guide field personnel when preparing for and performing groundwater sampling.

4.1 Preparation

Proper sampling preparation and organization is critical to ensure no delays in starting sampling operations and to ensure all materials and equipment have been obtained. The following steps should be considered during preparation of groundwater sampling:

4.1.1 Obtain the following tools, equipment, and supplies, as appropriate, for sampling:

NOTE: *Decontamination or pre-clean equipment, and ensure that it is in working order. Starting sampling operations with decontaminated tools is crucial to ensure quality and reliability of sampling results. Reference Sample Equipment Decontamination procedure (ENV-014).*

- Water level indicator

- Appropriate keys for well cap locks

- Steel brush

- Logbook

- Calculator

- Field data sheets and samples labels

- Chain of custody records and seals

- Sample containers

- Engineer's rule
- Sharp knife (locking blade)
- Tool box (to include at least: screwdrivers, pliers, hacksaw, hammer, flashlight, adjustable wrench)
- Leather work gloves
- Appropriate Health & Safety gear
- 5-gallon pail
- Plastic sheeting
- Shipping containers
- Packing materials
- Ziploc plastic bags
- Containers for evacuation liquids
- Decontamination solutions
- Tap water
- Non phosphate soap
- Several brushes
- Pails or tubs
- Aluminum foil
- Garden sprayer
- Preservatives
- Distilled or deionized (DI) water
- Fire extinguisher
- Bailers or Appropriate pump and tubing
- Control box (if necessary)

- Generator (110, 120, or 240 volt) or 12 volt battery if inaccessible to field vehicle – amp meter is useful
- Absorbent wipes
- Nitrile or latex gloves
- Appropriate work plan documents (e.g., SAP, Health and Safety Plan (HSP), etc.)
- Oil-water interface probe, if appropriate
- Groundwater parameter multi-meter capable of measuring temperature, pH, and conductivity as a minimum. Other parameters, such as oxidation/reduction potential (redox), dissolved oxygen, and turbidity may also be required depending on specifications in the work planning documents.

4.1.2 Ensure that appropriate sample bottles are prepared and ready for sample collection.

4.1.3 Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

4.1.4 Perform a general site survey prior to site entry.

4.1.5 Mobilize to the appropriate wellhead. (Start at the least contaminated well, if known).

4.1.6 Don personal protective equipment, as appropriate.

4.2 Well Purging

Select sampling equipment so that disturbance of the actual concentration of the chemical constituents of interest is minimized. The collection methods required for individual investigations will be as defined in the governing data collection plans. Use bailers, low-volume suction pumps, or submersible pumps to remove water from the well.

The following outlines standard procedures, processes, and considerations for purging wells and performing groundwater sampling.

4.2.1 High Flow or Well Volume

4.2.1.1 Lay plastic sheeting around the well to minimize likelihood of contamination of equipment from soil adjacent to the well.

4.2.1.2 Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well until water surface is encountered.

4.2.1.3 Measure distance from water surface to reference measuring point, such as, the top of the steel casing, top of the PVC riser pipe, from the ground surface, or some other position on the well head. If floating organics are of concern, this can be determined by measuring the water level with an oil/water interface probe which measures floating organics.

4.2.1.4 Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on field data sheet.

4.2.1.5 Calculate the volume of standing water in a well using the following generalized equation or per governing data collection plans:

$$V = (h1 - h2)r2(0.163)$$

where

V = static well volume in gallons

h1 = depth of the well in feet, from the top of the casing

h2 = depth to water, in feet, from the top of the casing

r = inside radius of well casing in inches.

4.2.1.6 Purge standing water in the casing so that formation water replaces the stagnant water in the well and filter pack.

NOTE: *Typically three to five times the calculated volume of water in the well is removed in an effort to obtain a representative sample from the aquifer. The actual number of volumes to be removed may also be specified in governing data collection plans. The water standing in a well prior to sampling may not be representative of in-situ groundwater quality.*

4.2.1.7 Measure purge parameters, as appropriate, using an approved instrument and according to the manufacturer's instructions.

4.2.1.8 Continue well purging until the stagnant water volume is removed and/or certain indicator parameters (such as pH, specific conductance, and temperature) are stabilized.

NOTE : *Stabilization of the indicator parameters is satisfied when successive readings meet the following criteria:*

- pH: + 0.1 standard units
- Specific conductance: + 10 micromhos/cm

- Temperature: + 0.5°C.
- Dissolved oxygen: ± 10 percent
- Redox Potential (Eh): ± 50 mV
- Turbidity: ± 10 nephelometric turbidity units (NTUs)

4.2.1.9 Record flowrate and purge water volume in field log book

4.2.1.10 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample and to protect personnel. Change gloves between wells or discrete sampling zones.

4.2.1.11 Collect samples immediately following purge.

4.2.2 Low-Yield Formations

4.2.2.1 When purging a low-yield well (a well that is incapable of yielding three casing volumes), purge the well dry once.

4.2.2.2 Record purge water volume in field log book.

4.2.2.3 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample and to protect personnel. Change gloves between wells or discrete sampling zones.

4.2.2.4 As soon as the well recovers sufficiently (ample water for collection), collect and bottle samples in the order of the parameters' volatilization sensitivity or per sample collection priority.

4.2.3 Low Flow Groundwater Sampling

4.2.3.1 Place a pump at the predetermined sample level.

4.2.3.2 Turn the pump or control box on and slowly adjust the frequency (if possible) until it yields flow of approximately 1 gallon per minute.

4.2.3.3 Measure purge parameters, as appropriate, using an approved instrument and according to the manufacturer's instructions.

4.2.3.4 Purge the well until three volumes of the well discharge line have been removed and certain indicator parameters (such as pH, specific conductance, and temperature) are stabilized.

NOTE : *Stabilization of the indicator parameters is satisfied when successive readings meet the following criteria:*

- pH: + 0.1 standard units
- Specific conductance: + 10 micromhos/cm
- Temperature: + 0.5°C
- Dissolved oxygen: ± 10 percent
- Redox Potential (Eh): ± 50 mV
- Turbidity: ± 10 NTUs

4.2.3.5 Record flowrate and purge water volume in field log book.

4.2.3.6 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample and to protect personnel. Change gloves between wells or discrete sampling zones.

4.2.3.7 Collect samples immediately following purge.

4.3 Sample Collection

4.3.1 Sample collection with a bailer

4.3.1.1 Surround the monitor well with clean plastic sheeting. If using the GPI bailer, insert a vial into the claim and assemble the unit.

4.3.1.2 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample and to protect personnel. Change gloves between wells or discrete sampling zones.

4.3.1.3 Lower the bailer slowly and gently into the well, taking care not to shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

4.3.1.4 Allow bailer to fill and then slowly and gently retrieve the bailer from the well avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer. If using the GPI bailer for collecting volatile organic samples, once at the surface, remove the bailer from the cable. Carefully open the GPI bailer unit and remove the vial. Begin slowly pouring from the bailer, and collect the duplicate samples from the midstream sample.

4.3.1.5 Remove the cap from the sample container and place it on the plastic sheet or in a location where it won't become contaminated.

4.3.1.6 Slowly pour the water from the bailer into the appropriate sample container. Filter and preserve samples as required by sampling plan.

NOTE: *Sample preservation is required for many of the chemical constituents and physiochemical parameters that are not chemically stable but are measured or evaluated in a ground water sampling program. Methods of sample preservation are generally intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods usually include pH control, chemical addition, refrigeration, and protection from light.*

4.3.1.7 Cap the sample container tightly and place prelabeled sample container in a carrier.

4.3.1.8 Log all samples in the site logbook and on field data sheets and label all samples.

4.3.1.9 Replace the well cap; decontamination equipment; store equipment and supplies, and clear area of trash at completion of sample collection.

4.3.1.10 Transport sample to the decontamination zone.

4.3.1.11 Prepare sample for transport to analytical laboratory.

4.3.1.12 Verify that all sampling wastes have been properly stored or disposed.

4.3.1.13 Return keys or any other facility-specific property to appropriate personnel.

4.3.2 Sample collection using pumps

4.3.2.1 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample and to protect personnel. Change gloves between wells or discrete sampling zones.

4.3.2.2 After completing the prescribed purge time, establish an appropriate low-flow stream of groundwater from the sample port into a bucket.

4.3.2.3 Place the sample bottles under the flowing water column to collect samples. Ensure that the sample port does not enter or touch the sample bottle.

NOTE: *Water flow may be increased or decreased during sampling. However, if water flow must be interrupted, reestablish flow before placing the sample bottle under the port for more sample collection.*

4.3.2.4 Filter and preserve samples as required by sampling plan. Wipe water off the sample bottles and place them in a carrier upon collection.

NOTE: *Sample preservation is required for many of the chemical constituents and physiochemical parameters that are not chemically stable but are measured or evaluated in a groundwater sampling program. Methods of sample preservation are generally intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods usually include pH control, chemical addition, refrigeration, and protection from light.*

4.3.2.5 Log all samples in the site logbook and on field data sheets and label all samples.

4.3.2.6 Replace the well cap; decon equipment; store equipment and supplies, and clear area of trash at completion of sample collection.

4.3.2.7 Transport the sample to decontamination zone.

4.3.2.8 Prepare sample for transport to analytical laboratory.

4.3.2.9 Verify that all sampling wastes have been properly stored or disposed

4.3.2.10 Return keys or any other facility-specific property to appropriate personnel.

4.3.2.11 Collecting Field Blanks

NOTE: *Field blanks are collected per the governing documents.*

4.3.2.12 Ensure that the appropriate sample bottles are prepared and ready for sample collection. Record the sample date, collection time, and sampler's initials on the sample labels. Record the label information in the sampler's logbook.

4.3.2.13 Don clean waterproof gloves.

4.3.2.14 Place the field blank bottles on absorbent wipes and fill them with the nano-pure or DI water. Leave the bottles uncapped.

4.3.2.15 Replace the caps on the sample bottles when sampling is completed at the specific location where the field blanks were collected.

4.3.2.16 Wipe water off of the bottles and place them in a carrier.

4.3.2.17 Transport the cooler with samples to the field laboratory for appropriate management.

5. RECORDS

The Project Manager shall maintain the following records in accordance with QAP-10-171, Records Control:

- All sampling activities shall be recorded in the appropriate sample logbooks. Chain-of-custody records will be documented for all samples shipped or transferred to other laboratories for analysis.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to field activities, and they must be decontaminated.

- All information that was generated during the course of the groundwater sampling are to be recorded in the project file. At a minimum, the project file for groundwater sampling projects shall contain:

- Project authorization form and supporting documentation (e.g., contract releases, SOW, schedule, etc.)

- Correspondence

- Quality Assurance documentation including sampling and analysis plans, laboratory results, calculations and methodology of interpreting results.

- Project deliverables and supporting notes, calculations, logbooks, work plans, etc.

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APPENDIX A

DEFINITIONS AND ACRONYMS

Definitions

None

Acronyms

CFR	Code of Federal Regulations
DI	Distilled or Deionized
Eh	Redox Potential
HSP	Health and Safety Plan
NTU	Nephelometric Turbidity Unit
NWI	North Wind, Inc.
PEP	Project Execution Plan
QAP	Quality Assurance Procedure
SAP	Sampling and Analysis Plan
SOW	Statement of Work

APPENDIX D

ENV-005, DESIGN, INSTALLATION, AND DEVELOPMENT OF MONITORING WELLS

ENV-005

Design, Installation, and Development of Monitoring Wells

Revision 1

March 13, 2006

Approved:

Doug Jorgensen *Original signature on file* 03/13/06
Line Manager Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	02/06/06	All	Baseline Document
1	03/13/06	All	Changed title from “ER” to “ENV”

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Appendix C – Example, ENV-005.1, General Well Information Form C-1

1. PURPOSE

The purpose of this procedure is to provide an overview of the methods used for the drilling and installation of groundwater monitor wells. These standards are not intended as a complete manual for monitoring well construction and alteration, maintenance, and abandonment. These standards may be varied or changed as required, dependent on site conditions, state regulations, equipment limitations, or limitations imposed by the procedure themselves.

2. SCOPE

This procedure applies to all North Wind Inc (NWI) personnel who are responsible for installing new groundwater monitoring wells.

Monitor well installations create permanent access for collecting samples to assess groundwater quality and the hydrogeology properties of the aquifer in which contaminants may exist. A monitor well is constructed for the purpose of determining water levels, monitoring chemicals, bacteriological, radiological, or other physical properties of ground water or vadose zone water. Such wells should not alter the medium, which is being monitored.

Most monitor well projects are the results of compliance with the U.S. Environmental Protection Agency (EPA), federal regulations such as the Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund"), or specific state solid and hazardous waste requirements. Guidelines and recommended practices dealing with the installation of monitor wells may be obtained from these agencies, along with guideline regulations from various state and local agencies, and state engineers. American Society for Testing and Materials (ASTM) documents also reference proper procedures and methods used in the drilling and installation of monitor wells.

The Contracts governing monitor well installation are written containing specific requirements as to site location, materials used, sampling procedures and overall objectives. Therefore, specific construction procedures and requirements shall be governed by applicable contracts and regulations providing they meet or exceed state requirements and specifications.

3. RESPONSIBILITIES

3.1 Drilling Subcontractor

- Ensures that field personnel comprising the field crew are properly trained in drilling techniques and construction of ground water monitoring wells.

3.2 Project Manager

- Meets customer's expectations and serves as a primary point of contact with the customer.
- Ensures that field personnel are familiar with the drilling and construction methods of ground water monitoring wells and are properly trained.
- Ensures that support field personnel have access to necessary equipment to complete the monitor well installation project.
- Ensures that the proper protocol and procedures are followed during installation and documentation.

3.3 Field Geologist

- Follows all procedures, plans and protocols to complete the monitor well installation adequately.
- Monitors on-site drilling, including the documentation of drilling activities, problems encountered, borehole conditions and hazards.
- Collects representative samples of drill cuttings, cores or wire line soil samples when required for geologic logging
- Conducts field screening using an appropriate air-monitoring instrument (photo-ionization detector [PID]) to determine the presence of volatile organic compounds.
- Submits water/soil samples to a certified laboratory for analysis as needed, and for archival purposes.
- Generates a geologic log documenting drilling/coring conditions and materials encountered, as well as well construction, with material used and depth of placement. Ensure all documentation is complete and legible.

3.3.1 Equipment

The following equipment is necessary for the field geologist/hydrogeologist:

- Site map
- Clipboard
- Appropriate forms

- Camera
- Engineer's tape (weighted wire tag line > 300 ft, graduated-feet in tenths)
- Folding rule or engineer's tape measure, graduated-feet in tenths
- Portable organic vapor detector (i.e., PID) and calibration equipment
- Electronic water level indicator (>300 ft)
- All required health and safety gear (personal protective equipment) as specified in site-specific Health and Safety Plan
- Strainer/sieve
- Sample collection jars/bags (cooler and ice required when collecting environmental samples)
- Trowels
- Description aids (Munsell color chart, ASTM Standard D 2488-00, Modified United Soil Classification scheme, etc.)
- Sand grain size chart
- Acid bottle containing dilute hydrochloric acid
- Hand lens
- Geological Field Book, straight edge, permanent ink pens and markers.
- Company approved record of drill/core hole log book

The drilling subcontractor normally provides equipment and tools that are used to install wells.

The following equipment is optional for the field geologist/hydrogeologist:

- Copy of drilling contract
- Brunton compass
- Pocket penetrometer
- Surveyor's flagging tape

- Grease pencil/soapstone marker
- Cooler and water bottles
- Flashlight
- Rock hammer
- Sieves

4. PROCEDURE/METHOD

All drilling and well installation programs must be planned and supervised by a professional geologist/hydrogeologist. The planning, selection and implementation of any monitor well installation program should include the following:

- Literature Search-review of existing data on site geology and hydrogeology including publications, water quality data, near by boring logs and existing maps. These may be obtained from local, state or federal agencies
- Initial and Field Reconnaissance-assessment of the site to determine potential access problems for drill rig, locate water supply source, establish equipment storage are, and observe outcrops
- Perform utilities check, note location of underground utilities and of overhead electrical wires
- Preparation of a Site Health and Safety Plan
- Selection of proper drilling, sampling and well development methods
- Determination of well construction specifications (i.e., casing and screen materials, casing and screen diameter, screen length and screen interval, screen slot size, filter pack, grout and seal)
- Determination of the need for containing drill cuttings and fluids and their method of disposal
- Preparation work plan including all of the above
- Preparation and execution of the drilling contract

4.1 Field Preparation

Prior to mobilization, the drill rig and all associated equipment should be thoroughly decontaminated by a steam/pressure washer to remove all oil, grease, mud, etc. Before drilling each boring, all "down-the-hole" drill equipment should be steam cleaned and rinsed with potable water to minimize cross-contamination. Special attention should be given to the threaded section of the casing, and to the drill rods. All drilling equipment should be steam-cleaned at completion of the project to ensure that no contamination is transported to or from the sampling site.

4.2 Drilling Methods

There is no ideal monitor well installation method for all conditions therefore, hydrogeologic conditions at the site as well as project objectives must be considered before deciding which drilling and installation method is appropriate.

The type of equipment required to create a stable, open, vertical borehole for installation of a monitoring well depends upon the site geology, hydrology, and the intended use of the data. Engineering and geological judgment and some knowledge of subsurface geological conditions at the site is required for the selection of the appropriate drilling method(s) utilized for drilling the exploratory soil borings and monitor wells. Appropriate drilling methods for investigating and installing monitor wells at a site may include any one or a combination of several of the following methods:

- Hollow-stem auger
- Direct (mud) rotary
- Direct air-rotary
- Direct rotary, wire-line casing and rotary drive casing advancement
- Dual-wall reverse-circulation, rotary and percussion hammer drive
- Cable-tool
- Various casing advancement methods.

Whenever feasible, it is advisable to utilize drilling procedures that do not require the introduction of water or drilling fluids into the borehole, and that optimize cuttings control at ground surface. Where the use of water or drilling fluid is unavoidable, the selected fluid should have as little impact as possible on the water samples for the constituents of interest. The chemistry of the fluid to be used should be evaluated to determine the potential for water- quality sample alteration. In addition, care should be taken to remove as much drilling fluid as possible from the well and the surrounding

formation during the well development process. It is recommended that if an air compressor is used, it should be equipped with an oil air filter or oil trap to minimize the potential for chemical alteration of ground-water samples collected after the well is installed.

4.3 Sample Preservation, Container, Handling, and Storage

Often, a primary objective of the drilling program is to obtain representative lithologic or environmental samples. The most common techniques for retrieving samples are:

In unconsolidated formations:

- Split soon sampling, carried out continuously or at discrete intervals during drilling
- Shelby tube sampling when an undisturbed sample is required from clayey or silty soils, especially for geotechnical evaluation or chemical analysis
- Cutting collection when a general lithologic description and approximate depths are sufficient

In consolidated formations:

- Rock coring at continuous or discrete intervals
- Cutting collection when a general description and approximate depths are sufficient

When collecting environmental samples, the amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling and storage for air and waste samples are discussed in the specific SOP for the technique selected.

4.4 Monitoring Well Construction

A stable borehole must be constructed prior to attempting the installation of monitoring well screen and riser. Steps must be taken to stabilize the borehole before attempting installation if the borehole tends to cave or blow in, or both. Boreholes that are not straight or are partially obstructed should be corrected prior to attempting the installation procedures described herein. Prior to well installation the borehole needs to be tagged (or logged with down-the-hole instrument, or camera) for total depth.

The well casing material should not interact with the groundwater. Well casings for environmental projects are usually constructed of polyvinyl chloride (PVC), Teflon, fiberglass, or stainless steel.

4.4.1 Bedrock Wells

Wells completed in bedrock will be drilled using the air or mud rotary method. Crystalline rock wells are usually drilled most efficiently with the air rotary method while consolidated sedimentary formations are drilled using either the air rotary or mud rotary method. The compressed air supply will be filtered prior to introduction into the borehole to remove oil or other contaminants. Bedrock wells may be completed as an open-hole, providing that borehole cave-in is not a possibility.

Bedrock well will be advanced with air or mud rotary methods until a minimum of 5 ft of competent rock has been drilled. Minimum borehole diameter will be 8 inches. The drill string will be pulled from the borehole and 6-inch I.D. Schedule 80 or 40 PVC casing inserted. Portland cement/bentonite grout will be pumped into the hole and up the annular space outside the casing. After the grout has set (minimum of 24 hours), the cement will be drilled out and the borehole advanced to the desired depth (Figure 1, Appendix A shows typical details for an open-hole bedrock well).

The preferred method of well completion for the bedrock wells will be open-hole. However, if the open borehole is subject to cave-in, the well(s) will be completed as screened and cased sand-packed wells. For details of completion, see Section 4.4.2.

4.4.2 Overburden Well Construction

Any of the drilling methods discussed in this SOP can be used to drill or set a well in the overburden. The hollow-stem method is the preferred choice for shallow (<100 ft.) overburden wells because the well can be constructed inside the augers. Dual wall reverse circulation drilling using high-pressure air and a percussion action top head pile drive hammer is best for overburden well deeper than 100 ft. Details of the construction are provided below (also shown in Figure 2, Appendix A):

1. The screen slot size will be determined by the site geologist/hydrogeologist, based upon sand-pack size. The length of screen used will be site-dependent. Casing sections will be flush-threaded. Screw-threaded bottom plugs will be used. To prevent introduction of contaminants into the well, no glue-connected fittings will be used. Each piece of PVC pipe, screen, and the bottom plug will be steam-cleaned before lowering into the borehole unless covered in protective plastic. The site geologist/hydrogeologist is responsible for the supervision of all stream-cleaning procedures.

2. The annular space between the well screen and the borehole wall will be filled with a uniform gravel/sand pack to serve as a filter media. For wells deeper than approximately 50 feet, or when recommended by the site geologist, the sand pack will be emplaced using tremie pipe. A sand-slurry composed of sand and potable water will be poured/pumped through the tremie pipe into the annulus, if needed,

throughout the entire screened interval, and over the top of the screen. Allowance must be made for settlement of the sand pack.

3. The depth of the top of the sand will be determined using a weighted tag line through the tremie pipe, thus verifying the thickness of the sand pack. Additional sand shall be added if necessary to bring the top of the sand pack to approximately 2 to 3 feet above the top of the well screen. Under no circumstances should the sand pack extend into any aquifer other than the one to be monitored. In most cases, the well design can be modified to allow for a sufficient sand pack without threat of cross-flow between producing zones through the sand pack.

4. In materials that will not maintain an open hole using hollow-stem augers or drill rod annulus with an open-ended bit, the temporary or outer casing/drill rod will be withdrawn gradually during placement of sand pack/grout. For example, after filling 2 feet with sand pack, the outer casing should be withdrawn 2 feet. This step of placing more gravel/sand and withdrawing the outer casing should be repeated until the level of the sand pack is approximately 2 to 3 feet above the top of the well screen. This ensures that there is no locking of the permanent (inner) casing in the outer casing.

5. A bentonite seal of a minimum 2-feet thick will be placed in the annular space above the sand pack, to separate the sand pack from the cement/bentonite grout surface seal. The bentonite will be placed though a tremie pipe or poured directly into the annular space, depending upon the depth, site conditions and if water is standing in the interval of the bentonite plug. The bentonite will be pourable pellets. The geologist/hydrogeologist will record the start and stop times of the bentonite seal, the amount of bentonite that was used, the tagged top of the bentonite seal, and problems encountered. The type of bentonite and the supplier will also be recorded.

6. If a slurry of bentonite is used as annular seal, it is prepared by mixing powdered or granular bentonite with potable waster. The slurry must be of sufficiently high specific gravity and viscosity to prevent its displacement by the grout to be emplaced above it. As a precaution (regardless of depth) and depending on fluid viscosity, a few handfuls of bentonite pellets may be added to solidify the bentonite slurry surface.

7. Cement and/or bentonite grout is placed from the top of the bentonite seal to the ground surface. Only Type I or II cement without accelerator additives may be used. An approved source of potable water must be used for mixing grouting materials. The following mixes are acceptable:

   - Neat cement, a maximum of 6 gallons of water per 94 pound bag of cement

   - Granular bentonite, 1.5 pounds of bentonite per 1 gallon of water

- Cement-bentonite, 5 pounds of pure bentonite per 94 pound bag of cement with 7 to 8 gallons of water

- Cement-bentonite, 6 to 8 pounds of pure bentonite per 94 pound bag of cement with 8 to 10 gallons of water, if water mixed

- Non-expandable cement, mixed at 7.5 gallons of water to one half (1/2) teaspoon of Aluminum Hydroxide, 94 pounds of neat cement (Type I) and 4 pounds of bentonite

- Non-expandable cement, mixed at 7 gallons of water to one half (1/2) teaspoon of Aluminum Hydroxide, 94 pounds of neat cement (Type I and Type II)

8. Grout is pumped through a tremie pipe (normally a 1.25-inch PVC or steel pipe) to the bottom of the annulus until undiluted grout flows from the annulus at the ground surface.

9. In materials that will not maintain an open hole, temporary steel casing should be withdrawn in a manner that prevents the level of grout from dropping below the bottom of the casing.

10. Additional grout may be added to compensate for the removal of the temporary casing and the tremie pipe to ensure that the top of the grout is at or above ground surface. After the grout has set (24 hours), any depression due to settlement is filled with a grout mix similar to that originally placed in the well bore.

11. The protective casing should now be set. Casing may be a 5-foot minimum length of black iron (carbon steel) or galvanized pipe extending about 1.5 to 3 feet above the ground surface, and set in concrete or cement grout. The protective casing diameter should be 4 inches greater than the well casing. A 0.5-inch drain hole may be installed near the ground level. A flush-mount protective casing may also be used in areas of high traffic or where access to other areas would be limited by a well stick-up.

12. A protective steel cap, secured to the protective casing by a padlock, should be installed.

13. Steel guard posts should be installed around the protective casing in areas where vehicle traffic may be a problem. Posts should have a minimum diameter of 3 inches and be a minimum of 4 feet high.

14. All monitor wells should be labeled and dated with paint or steel tags.

4.5 Well Development

Well development is the process by which the aquifer's hydraulic conductivity is restored by removing drilling fluids, and fine-grained formation material from newly installed wells. Two methods of well development that are commonly used are surging and bailing, and overpumping. A well is considered developed when the pH and conductivity of the groundwater stabilizes and the measured turbidity is <50 nephelometric turbidity units.

Surging and bailing will be preformed as follows:

- Measure the total depth of the well and depth to water.
- Using an appropriately sized surge block, surge 5-foot sections of well screen, using 10-20 up/down cycles per section. Periodically remove the surge block and bail accumulated sediment from the well, as required.
- For open-hole wells, a 6-inch surge block will be used inside the cased portion of the well. Sediments will be bailed periodically, as required. Overpumping may be used in combination with surging and bailing for development of bedrock wells. The method(s) used will be based on field conditions encountered, and will be determined by the site geologist/hydrogeologist. However, sediment will initially be removed from the wells by bailing in order to minimize the volume of development water generated.

The pump used must be rated to achieve the desired yield at a given depth. The pump system should include the following:

- A check valve to prevent water from running back into the well when the pump is shut off
- Flexible discharge hose
- Safety cable or rope to remove the pump from the well
- Flow meter monitoring system (measuring bucket or inline flow meter)
- Generator
- Amp meter, to measure electrical current (load)

The amp meter is used to monitor pump performance. If the pump becomes clogged, the current will increase due to stress on the pump. If the water level drops below the intake ports, the current will drop due to decreased resistance on the pump.

5. CALCULATIONS

To maintain an open borehole during rotary drilling, the drilling fluid must exert a pressure greater than the formation pore pressure. Typical pore pressures for unconfined and confined aquifers are 0.433-psi/ft and 0.465-psi/ft respectively.

The relationship for determining the hydrostatic pressure of the drilling fluid is:

Hydrostatic Pressure (psi) = Fluid Density (lb/gal) x Height of Fluid Column (ft) x 0.052

The minimum grout volume necessary to grout a well can be calculated using:

$$V = \pi L\left(r_B^2 - r_C^2\right)$$

Where:

L = length of borehole to be grouted (ft)

r_B = radius of boring (ft)

r_c = radius of casing (ft)

6. QUALITY ASSURANCE/QUALITY CONTROL

The following general QA procedures apply:

- All data must be documented on standard well completion forms, field data sheets or within field/site logbooks. Descriptive logs, pump tests, and well completion date are entered on company approved geologic log boring/coring log forms. These log forms are used to ensure data is collected uniformly by all Site Geologist/Hydrogeologist and provide input to a standardize computer well file. Appendix A contains examples of this form used to record descriptions of geologic samples of lithology.

- All instruments must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and must be documented.

7. HEALTH AND SAFETY

Drilling rigs and equipment present a variety of safety hazards. North Wind Inc. personnel working around drilling rigs should know the position of the emergency "kill" switch. Wirelines and ropes should be inspected and frayed or damaged sections discarded. Swivels and blocks should turn freely. Gages should be operational and controls clearly marked. All underground utilities should be clearly marked, and drillers

should be aware of any overhead hazards such as power lines. Avoid drilling in these areas. Ear protection should be worn when working around drilling equipment for extended periods of time, particularly air rotary equipment. Failure to follow safety procedures or to wear the proper personal protection gear on the part of either the drilling crew of North Wind Inc. personal may result in dismissal from the job.

When working with potentially hazardous materials, follow EPA, OSHA, and corporate health and safety practices (health and safety and job-safety-analysis documents, Material Safety Data Sheet listings for on-the-job chemical use, and company policies specific for the job).

8. REFERENCES

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U.S. EPA. 1987. A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Responses. Washington, D.C. 20460.

U.S. EPA. 1996. *Monitor Well Installation*. Environmental Protection Agency. SOP # 2048. date: 03/18/96, Rev. # 0.0, Washington, D.C. 20460.

9. RECORDS

The Field Geologist will manage the following records in accordance with QAP-10-171, Records Control:

- Field Logbooks
- Boring Logs
- Well Installation Forms

APPENDIX A

Definitions

None

Acronyms

ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
EPA	U.S. Environmental Protection Agency
NWI	North Wind, Inc.
PID	photo-ionization detector
PVC	polyvinyl chloride

APPENDIX B

MONITOR WELL CONSTRUCTION STANDARD

FIGURE 1. Typical Bedrock Well Construction

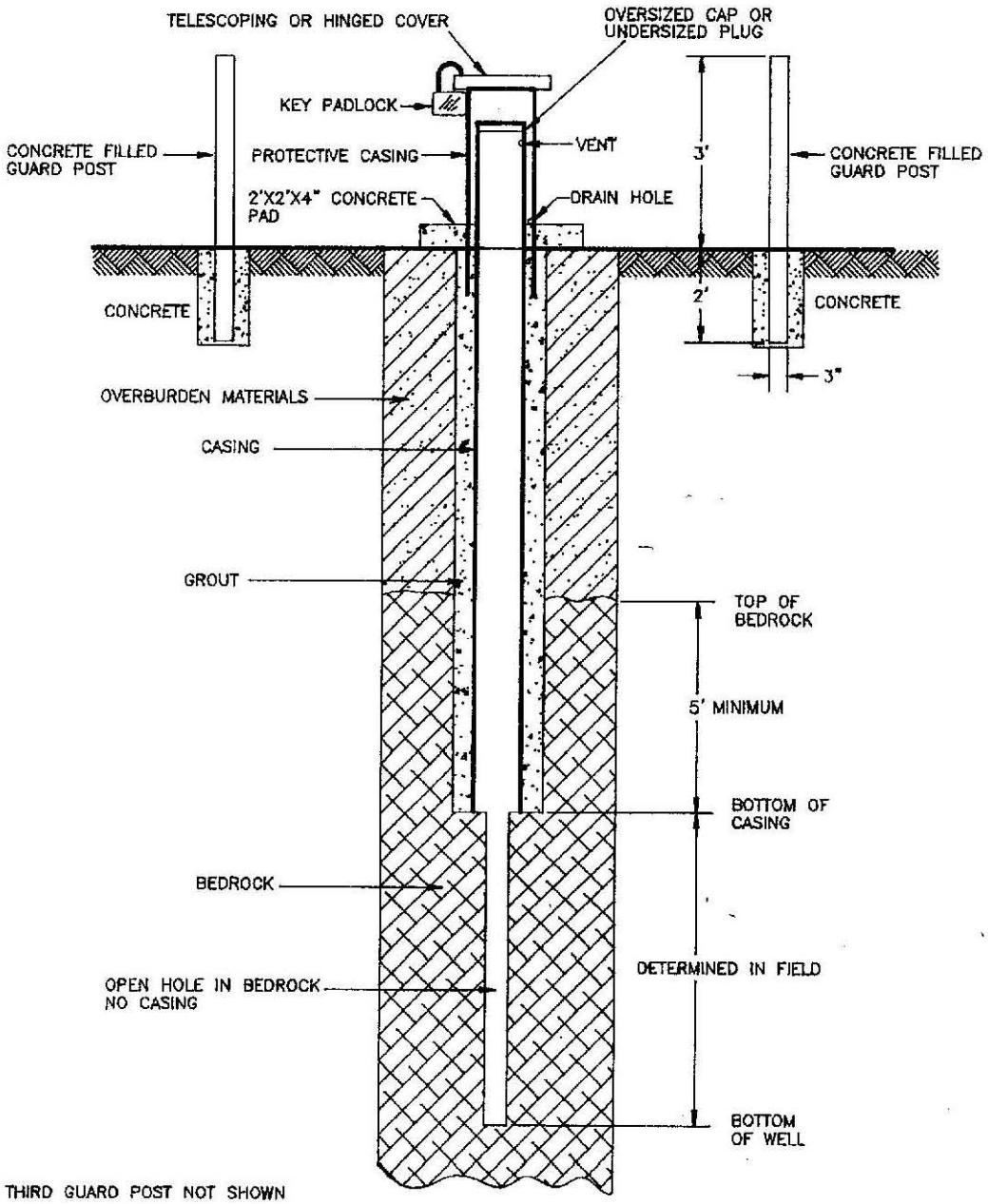
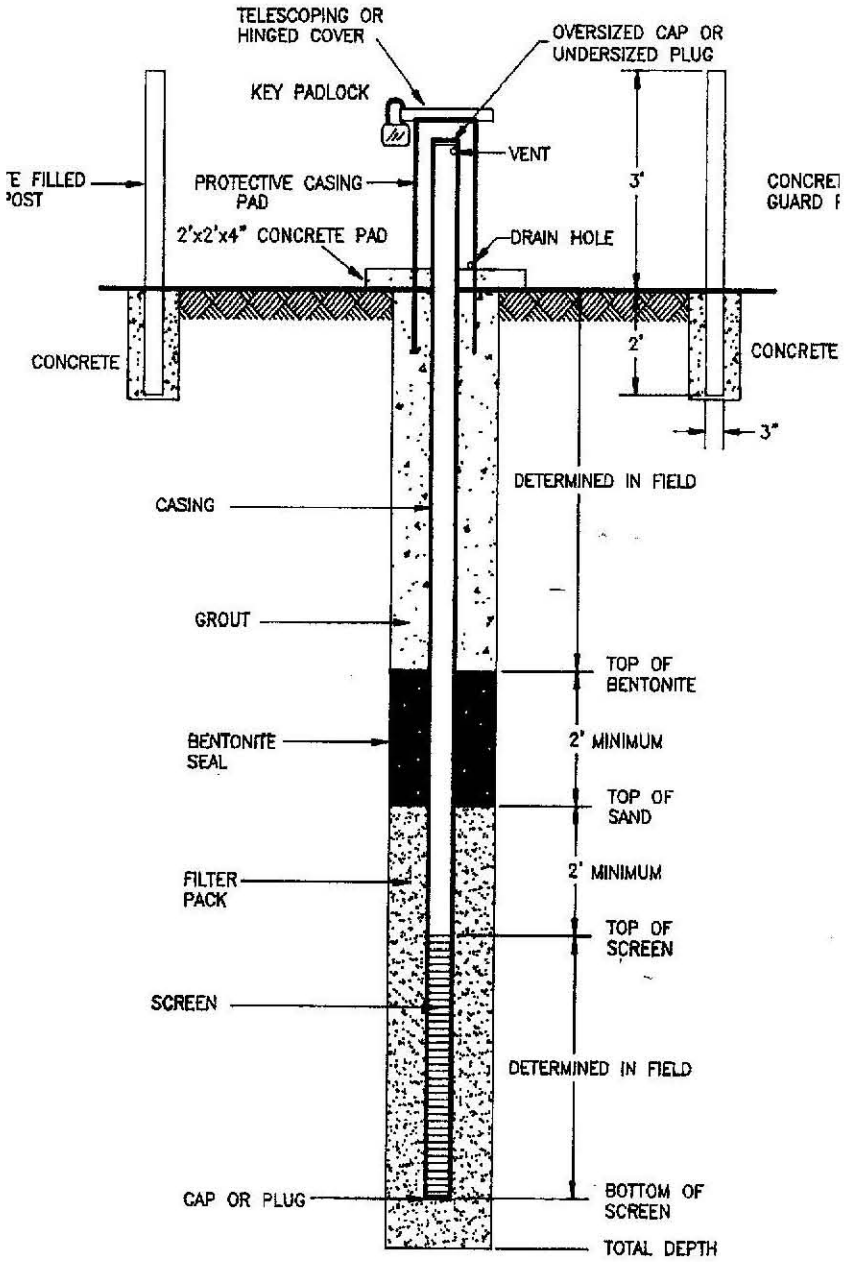


FIGURE 2. Typical Overburden Well Construction



North Wind

LOG OF BORING TB1

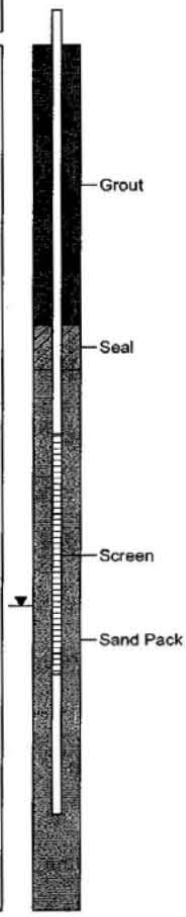
(Page 1 of 1)

Covon Corporation
Central Industrial Center
Site Investigation
Los Angeles, CA
Project # 14455

Date Started	: 2/14/98	Company Rep.	: C. Billbach
Date Completed	: 2/15/98	Northing Coord.	: N 5002.45
Hole Diameter	: 6 5/8 in.	Easting Coord.	: E 4847.81
Drilling Method	: H.S.A.	Survey By	: E. Weston
Sampling Method	: Split Spoon	Logged By	: D. Janike

Well: MW1-36
Elev.: 458.9

Depth in Feet	Surf. Elev. 456.6	USCS	DESCRIPTION	Sample No.	Blow Count	% Finer #200 Sieve	% Recovery
0–3	456–453	SM	SILTY SAND, brown silty sand, no odor very fine, some gray, moist	1	10 12 14 16	65	98
				2	15 15 17 16	40	
4–16	452–441	GW	GRAVEL, Well Graded; cobbles at 10 feet	3	20 21 22 22	40	98
				4	26 27 28	75	
16–17	440–439	ML	SILT, brown, no odor, traces of sand and clay	5	30 35	15	55
18–26	438–431	SW	SAND, dry	6	35 36 38 38	30	
27–34	430–423	ML	SILT, brown, no odor	7	40 45	50	45
35–40	422–417	LS	LIMESTONE, bedrock	8	45		



11-22-2005 C:\Program Files\mtech\2002\acsgeo\Tb1.bor

APPENDIX C

EXAMPLE, ER-005.1, GENERAL WELL INFORMATION FORM

North Wind

GENERAL WELL INFORMATION

REQUIRED INFORMATION

Well Name:		Field Team Leader:	
Facility:		Geologist:	
Well Type:		Drilling Company/Driller:	
Well Status:		Drilling Method:	
Drilling Start Date:		Drill Rig:	
Drilling End Date:		Drilling Fluid(s):	
Total Depth:		Water Level / Date:	
Completion Depth*:		Water Level Access:	

Logbook Number and pages where referenced:

* Completion Depth is the lowest accessible depth in the well.

General Location Description:

WELL COMPLETION

Borehole Segments

Borehole Diameter	Drill Bit Type	Top (From)	Bottom (To)	Borehole Diameter	Drill Bit Type	Top (From)	Bottom (To)

Casing Segments (include stick up) Note – This does not include Screen – place this info in "Screen" segment.

Top Depth (From)	Bottom Depth (To)	Diameter OD or ID	Type	Material	Thickness	Hanger Depth	Type	Joint Type

Annular Seal / Filter Pack

Top Depth (From)	Bottom Depth (To)	Material (Be specific as to the type of material)	Placement Method	Mixture / Volume

ER-005.1
Effective 12/20/05

EXAMPLE

North Wind

GENERAL WELL INFORMATION

SCREEN

Diameter of Screen	Top Depth (From)	Bottom Depth (To)	Type Wire mesh or perforated	Material	Slot Size	Joint Type

INSTRUMENTATION

Instrument Type Description	Instrument Name	Instrument Depth	Carrier Pipe Description	Carrier Pipe Top (From)	Carrier Pipe Bottom (To)

WELL DEVELOPMENT

Pump Specifications

Type:	
Manufacture:	
Model No.:	
Top Depth of Pump:	
Bottom Depth of Pump:	
Intake/Inlet Depth:	
Horse Power:	
Flow Rate:	
Head:	
Volts, Amps, KW:	
Phase:	
Motor Leads Submersible Cable:	

Be Sure To Note Access Line Information

Well Development

Date:	Method:
Comments:	

Pump Test

Date:	Specific Capacity:
Comments:	

ER-005.1
Effective 12/20/05

EXAMPLE

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GENERAL WELL INFORMATION

Brass Cap Location (This can be separate but must be from Ken Beard / Bob Sutherland)

Northing Datum 27:		Northing Datum 83:	
Easting Datum 27:		Easting Datum 83:	
Latitude Datum 27:		Latitude Datum 83:	
Longitude Datum 27:		Longitude Datum 83:	
Elevation Datum 29:		Elevation Datum 88:	

Measuring Point Location

Northing Datum 27:		Northing Datum 83:	
Easting Datum 27:		Easting Datum 83:	
Latitude Datum 27:		Latitude Datum 83:	
Longitude Datum 27:		Longitude Datum 83:	
Elevation Datum 29:		Elevation Datum 88:	

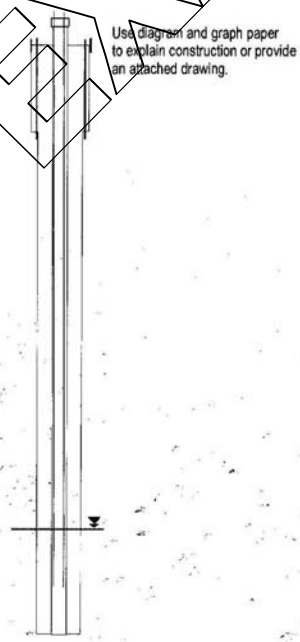
Geophysical Logging

Be sure to turn in Logs so they can be added to the diagrams. Make sure video logs are turned in to the HDR

√	Tool	Date	√	Tool	Date
☐	Gamma Gamma		☐	Natural Gamma	
☐	Neutron		☐	Video	
☐	Caliper		☐	Deviation	

Other Logs and Dates:

Comments:



EXAMPLE

ER-005.1
Effective 12/20/05

APPENDIX E

ENV-002, SAMPLE HANDLING, PACKAGING AND SHIPPING

ENV-002

Sample Handling, Packaging and Shipping

Revision 0

April 7, 2006

Approved:

Doug Jorgensen *Original Signature on File*	04/03/06
Line Manager	Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	04/07/06	All	Baseline Document

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Appendix C—Guidance For Shipping Dangerous Goods

1. PURPOSE

This procedure establishes methods for proper handling, packaging, and shipping of samples (see Appendix A, Definitions) to ensure sample integrity and validity, personal safety, and compliance with applicable regulations.

2. SCOPE

This procedure is applicable to North Wind, Inc. (NWI) projects that specifically reference this procedure in the Project Execution Plan (PEP), Project Work Plan, or Sampling and Analysis Plan (SAP).

This procedure provides instructions for packaging, handling, and shipping samples collected, as directed by North Wind project documents (such as sampling and analysis plans (SAPs), field sampling plans, quality assurance project plans (QAPjP), or other documents). This procedure applies and remains applicable from the time of sample collection until custody (see Appendix A, Definitions) of the sample is transferred to the appropriate destination. Guidance for shipping samples that are considered "environmental samples" and "dangerous goods" is provided in Appendix B and C of this procedure.

3. RESPONSIBILITIES

3.1 Field Team Leader

- Directs and ensures proper sample handling, packaging, and shipping.
- Performs duties of field personnel, as applicable.

3.2 Field Personnel

- Performs sample handling, packaging, and shipping tasks identified in this procedure.
- Identifies and follows appropriate shipping classification (based on DOT regulations).

4. SAMPLE HANDLING, PACKAGING, AND SHIPPING

4.1 Documentation

4.1.1 Follow ENV-021, Chain of Custody (COC) Documentation, for COC form documentation instructions during sample handling, packaging, and shipping.

4.1.2 Maintain all COC forms (see Appendix A, Definitions), records, labels, and documents neatly.

4.1.3 Use indelible ink to record all information.

4.2 Sample Handling

4.2.1 Properly store labeled samples in the custody of the assigned field personnel at all times.

4.2.2 Refer to the project-specific health and safety plan for the proper personal protective equipment required for handling samples.

4.2.3 Inspect sample bottles and associated documentation to ensure the bottles meet the criteria for quality specified in the project documentation.

4.2.4 If samples are temperature sensitive, ensure storage of sample at appropriate temperature.

4.2.5 Arrange for shipping all samples as soon as required after collection to ensure all holding times are met.

4.3 Sample Packaging

4.3.1 Gather the following tools and equipment, which may include, but are not limited to, samples with appropriate labels, field logbook, sample packing and shipping materials that (as applicable to the sample matrix, container type, and analysis) may include:

- hard, plastic-lined metal or plastic cooler or shipping container
- sealable, plastic bags
- absorbent, cushioning material
- tape
- bubble wrap
- foam vial holders
- blue ice packs or double-bagged ice
- indelible ink pen
- trip blanks
- Department of Transportation (DOT) material hazard labels
- clear and regular plastic strapping tape
- plastic garbage bags

- address/return address labels
- “this side up” labels
- “fragile” labels
- scissors or pocket knife

4.3.2 Remove any existing labels from the cooler or shipping container that are not applicable for the current shipment.

4.3.3 Inspect sample bottles for cleanliness or damage. Samples can be packaged if the sample containers are clean, not cracked or broken, and the lids and seals are present and undamaged. Clear tape may be placed over the sample labels, if necessary, to prevent damage. If any problems are detected, notify the Field Team Leader (FTL), dispose of the sample material and container in an appropriate manner, and properly document the occurrence.

4.3.4 Package samples into a cooler or shipping container. Ensure the samples do not leak, spill, or vaporize. The following steps provide a guideline of sample packing:

- Obtain a hard, plastic-lined metal or plastic cooler.
- Tape the inside and outside of the cooler drain with duct/strapping tape.
- Line the cooler with a large plastic bag, or place individual samples in sealable, plastic bags.
- Place a layer of absorbent cushioning material in the bottom of the liner bag, if applicable.
- Place the sample container into a plastic sealable bag. The individual containers can be wrapped with bubble wrap or plastic bags for protection prior to placement in the cooler for shipment.
- Squeeze as much air as possible from the bag before sealing.
- Ensure the container is upright and surrounded with an absorbent cushioning material to prevent contact with other samples, tipping over, breaking, or spilling.
- Fill in around the containers with additional absorbent cushioning material.
- Ensure the cooler contains enough absorbent material to absorb all the sample material contained in the cooler in case of an accident.

- Pull the ends of the liner bag together and twist.
- Tape the top of the liner bag down.
- If sample temperature must be maintained at 4°C, place blue ice packs or double-bagged wet ice around the sides and top of the liner bag or inside the bag and in between samples.

4.3.5 Confirm that all information from the sample labels in the cooler matches the COC forms (see def.) exactly. Ensure the following information accompanies the sample:

- collector's name, mailing address, and telephone number
- laboratory's name, mailing address, and telephone number
- quantity of sample
- date of shipment
- description of sample.

4.3.6 Sign and record the current date and time on the completed corresponding COC form "relinquished by" block.

4.3.7 Remove the back copy of the COC form or make a photocopy of the form for project files.

4.3.8 Place the remaining forms in a large transparent sealable bag and place inside the cooler or shipping container.

4.3.9 Close the lid and latch.

4.3.10 Make a few wraps around the cooler using fiberglass or strapping tape to ensure the lid will remain closed.

4.3.11 Place a complete address label on the lid of the cooler including the name, address, and phone number of the receiving laboratory and a laboratory contact.

4.4 Sample Shipment

4.4.1 Deliver non-hazardous coolers or shipping containers directly to the selected commercial air cargo transporter, rail, or truck for delivery to appropriate location.

4.4.2 If shipping hazardous materials, follow appropriate DOT regulations. Make appropriate arrangements for shipment of hazardous materials.

4.4.3 Notify the laboratory in advance that samples are being shipped to ensure a laboratory custodian will be available for receipt.

5. RECORDS

The Project Manager shall maintain the following records in accordance with QAP-10-171, Records Control:

- Case-specific written procedures used during the shipment of dangerous goods as presented in a controlled document or project logbook;
- Chain-of-custody form(s) for the shipped samples; and,
- Airbill or other package tracking information provided by the courier.

6. REFERENCES

ENV-021, Chain of Custody Documentation

QAP-10-171, Records Control

APPENDIX A

DEFINITIONS AND ACRONYMS

Definitions

Chain of Custody Form — A form used to record the transfer of sample custody.

Custody — A sample is considered in custody if it:

A. is in one's possession,

B. is in one's view after being in possession,

C. was in possession and is now locked up,

D. is secured (such as, sealed with tamper-indicating devices) by the responsible individual so that no tampering can occur,

E. is in a designated secured area.

Sample — Any physical evidence collected from an environmental measuring or monitoring activity. Evidence is anything offered at the time of a legal proceeding as a means of ascertaining the truth. In investigations involving hazardous wastes, physical and documentary evidence is collected to determine if the site poses a potential threat to human health or the environment and if the site complies with applicable regulations.

Acronyms

C	Celsius
COC	Chain of Custody
DOT	Department of Transportation
ENV	Environmental
FTL	Field Team Leader
QAP	Quality Assurance Procedure
QAPjP	Quality Assurance Project Plans
SAP	Sampling and Analysis Plans

APPENDIX B

GUIDANCE FOR SHIPPING ENVIRONMENTAL SAMPLES

Guidance for the shipment of environmental laboratory samples by personnel is provided in a memorandum dated March 6, 1981, subject "Final National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Laboratory Samples." By this memorandum, the shipment of the following unpreserved samples is not regulated:

- Drinking water
- Treated effluent
- Biological specimens
- Sediment
- Water treatment plant sludge
- POTW sludge

In addition, the shipment of the following preserved samples is not regulated, provided the amount of preservative used does not exceed the amounts found in 40 CFR 136.3:

- Drinking water
- Ambient water
- Treated effluent
- Biological specimens
- Sediment
- Wastewater treatment plant sludge
- Water treatment plant sludge

It is the shippers' (individual signing the airway bill) responsibility to ensure that proper amounts of preservative are used. The amounts of preservative used in each container may be checked using the sampling teams field notes and/or chain-of-custody information.

Samples determined by the project leader to be in these categories are to be shipped using the following protocol, which is modified from a procedure developed jointly between

US-EPA, OSHA, and DOT in the "Final National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples."

Untreated wastewater and sludge from POTW's are considered to be "diagnostic specimens" (not environmental laboratory samples). However, because they are not considered to be etiologic agents (infectious) they are not restricted and may be shipped using the procedures outlined below.

APPENDIX C

GUIDANCE FOR SHIPPING DANGEROUS GOODS

Samples collected during field investigations or in response to a hazardous materials incident must be classified prior to shipment, as either environmental or hazardous materials samples. In general, environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, biological specimens, or any samples not expected to be contaminated with high levels of hazardous materials.

Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may require shipment as dangerous goods. Regulations for packing, marking, labeling, and shipping of dangerous goods by air transport are promulgated by the International Air Transport Authority (IATA), which is equivalent to United Nations International Civil Aviation Organization (UN/ICAO). Transportation of hazardous materials (dangerous goods) by EPA personnel is covered by EPA Order 1000. 18.

The Project Leader is responsible for determining if samples collected during a specific field investigation meet the definitions for dangerous goods. If a sample is collected of a material that is listed in the Dangerous Goods List, Section 4.2, IATA, then that sample must be identified, packaged, marked, labeled, and shipped according to the instructions given for that material. If the composition of the collected sample(s) is unknown, and the project leader knows or suspects that it is a regulated material (dangerous goods), the sample may not be offered for air transport. If the composition and properties of the waste sample or highly contaminated soil, sediment, or water sample are unknown, or only partially known, the sample may not be offered for air transport.

In addition, the shipment of pre-preserved sample containers or bottles of preservatives (e.g., NaOH pellets, HCL, etc.) which are designated as dangerous goods by IATA is regulated. Shipment of nitric acid is forbidden on all aircraft. Dangerous goods must not be offered for air transport without contacting the Division dangerous goods shipment designee.

The Project Leader is responsible for the identification of sample packaging and shipping procedures on a case-by-case basis when dangerous goods must be shipped. If the materials to be shipped are identified as dangerous goods, then

- the Field Team Leader must identify specific shipping requirements and procedures to be carried out on a case-by-case basis in accordance with applicable shipping regulations.
- The Field Personnel must pack dangerous goods according to case-specific procedures provided by the project leader.

References for Appendix A and B

Dangerous goods Regulations, International Air Transport Authority (IATA). Current Edition which changes annually.

EPA Order 1000.18, February 16, 1979.

"Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples," Memo from David Weitzman, Work Group Chairman, Office of Occupational Health and Safety (PM-273), US-EPA, April 13, 1981.

40 CFR 136.3. July 1, 2001. See Table 11, Footnote 3

APPENDIX F

ENV-014, SAMPLING EQUIPMENT DECONTAMINATION

ENV-014

Sampling Equipment Decontamination

Revision 0

June 2, 2006

Approved:

Doug Jorgensen *Original signature on file*	05/31/06
Line Manager	Date

REVISION HISTORY

Revision No.	Effective Date	Sections Affected	Description
0	06/02/06	All	Baseline Document

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APPENDICES

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1. PURPOSE

The purpose of this procedure is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 910.120. This procedure does not address personnel decontamination.

2. SCOPE

This procedure is applicable to North Wind, Inc. (NWI) projects that specifically reference this procedure in the Project Execution Plan (PEP), Project Work Plan, or Sampling and Analysis Plan (SAP).

This is a standard operating procedure which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

This procedure is not applicable where new disposal sampling equipment is used. In addition, direct-push drill tooling does not require the extensive decontamination process described in this procedure because the tooling does not directly contact the material being sampled. Only a pressure wash and/or scrubbing is required for direct-push drill casing.

3. RESPONSIBILITIES

This procedure applies to any personnel performing decontamination of sampling equipment.

3.1 Project Manager/Task Lead

- Ensures appropriate and proper decontamination of sampling equipment is completed, per this procedure.
- Ensures sampling personnel have adequately documented the performance of decontamination on sampling equipment before re-use.
- Ensures sampling equipment has adequately been decontaminated prior to re-use.

3.2 Sampling Technician

- Responsible for following this procedure and other procedures, if applicable, for the decontamination of sampling equipment.

4. SAMPLING EQUIPMENT DECONTAMINATION PROCESS

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

5. SAMPLE PRESERVATION CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination and solids generated at a site. This should be determined prior to initiation of site activities.

6. INTERFERENCES AND POTENTIAL PROBLEMS

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

7. EQUIPMENT APPARATUS

Decontamination equipment, materials and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to removed contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children’s wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

7.1 Decontamination Solutions

- Non-phosphate detergent
- Selected solvents (acetone, hexane, nitric acid, etc.)
- Tap water
- Distilled or deionized water

7.2 Decontamination Tools/Supplies

- Long and short handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers (H_20)
- Solvent Sprayers
- Aluminum Foil

7.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash).

7.4 Waste Disposal

- Trash bags
- Trash containers
- 55-gallon drums

- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

8. REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix B) lists solvent rinses which may be required for elimination of particular chemicals. In general, the following solvents are typically utilized for decontamination purposes:

- 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- Acetone (pesticide grade) [(1)]
- Hexane (pesticide grade) [(1)]
- Methanol [(1)]

[(1)] Only if sample is to be analyzed for organics.

9. PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- The number, location, and layout of decontamination stations.
- Decontamination equipment needed.
- Appropriate decontamination methods.
- Methods for disposal of contaminated clothing, equipment, and solutions.
- Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

9.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

9.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

9.1.1.1 Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

9.1.1.2 Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

9.1.1.3 Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

9.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

9.1.2.1 Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

9.1.2.2 High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

9.1.2.3 Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

9.1.2.4 Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

9.1.2.5 Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

9.1.2.6 Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

9.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

9.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

9.2.1.1 Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground. Size will depend on amount of equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

9.2.1.2 Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity. A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

9.2.1.3 Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

9.2.1.4 Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

9.2.1.5 Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer or squeeze bottle with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

9.2.1.6 Station 6: Nitric Acid Sprayers

Fill a spray or squeeze bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

9.2.1.7 Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer or squeeze bottle with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

9.2.1.8 Station 8: Organic Solvent Sprayers

Fill a spray or squeeze bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of

solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

9.2.1.9 Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer or squeeze bottle with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

9.2.1.10 Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

9.2.2 Decontamination Procedures

9.2.2.1 Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

9.2.2.2 Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

9.2.2.3 Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

9.2.2.4 Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

9.2.2.5 Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer or squeeze bottle.

9.2.2.6 Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray or squeeze bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

9.2.2.7 Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer or squeeze bottle.

9.2.2.8 Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

9.2.2.9 Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer or squeeze bottle.

9.2.2.10 Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

9.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.

2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

3. Empty soap and water liquid wastes from basins and buckets and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.

6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.

7. Empty low-pressure sprayer water onto the ground.

8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

10. CALCULATIONS

This section is not applicable to this procedure.

11. QUALITY ASSURANCE/QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

12. DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

13. HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents are banned.

14. RECORDS

The Project Manager will maintain the following records in accordance with QAP-10-171, Records Control:

- List first record

15. REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985

APPENDIX A

DEFINITIONS AND ACRONYMS

Definitions

Acronyms

CFR	Code of Federal Regulations
CRC	Contamination Reduction Corridor
CRZ	Contamination Reduction Zone
DOT	Department of Transportation
EPA	Environmental Protection Agency
EZ	Exclusion Zone
H_2O	Water
HZ	Hot Zone
NIOSH	National Institute for Occupational Safety and Health
NWI	North Wind, Inc.
OSHA	Occupational Safety and Health Administration
PEP	Project Execution Plan
pH	Potential of Hydrogen
QA	Quality Assurance
QC	Quality Control
SAP	Sampling and Analysis Plan
SZ	Support or Safe Zone
USCG	United States Coast Guard

USEPA	United States Environmental Protection Agency

APPENDIX B

TABLE1. SOLUBLE CONTAMINANTS AND RECOMMENDED SOLVENT RINSE

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT[1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Lo-Chain Hydrocarbons Inorganic Compounds Salts Some Organic Acids And Other Polar Compounds
Dilute Acids	Nitric Acid Acetic Acid Boric Acid	Basic (caustic) compounds (e.g., some organic compounds)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent [2]	Hexane	PCBs

[1] Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

[2] WARNING: SOME ORGANIC SOLVENTS CAN PERMEATE OR DEGRADE THE PROTECTIVE CLOTHING.

Attachment 1

PCB Contamination Investigation

For the Field Sampling Plan for the Communications Site, Taku Gardens, at Fort Wainwright, Alaska

Rationale/Design

Purpose

This document serves as an attachment to the *Field Sampling Plan for the Communications Site, Taku Gardens, at Fort Wainwright, Alaska*. Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for Army and regulatory review at different times throughout the course of the investigation.

This attachment addresses a single objective. That is to determine whether additional source areas (significant release sites) exist at the site. Based on site history, it is suspected that additional PCB source areas may exist in addition to the known hot spot near Building 52. As reported in the draft Preliminary Source Evaluation Narrative Report, a historic power distribution system existed in the western two “rectangles” of the garden plot area, near the current location of buildings 50 and 52, which may be related to the identified PCB contamination. Another suspect area identified by a former site employee near the eastern border of the housing development will also be investigated. Other suspect PCB areas may be identified by anecdotal information, site history, aerial photographs, etc. As these areas are identified, the following approach will be used to verify the presence or absence of PCB contamination, as project constraints allow.

Sample Frequency

1. The primary purpose of sampling at these sites is to determine whether additional PCB source areas exist at Taku.
2. Suspect areas that are expected to be smaller than 10 ft in diameter will require four borings with one boring in the center and three on an approximately 5 ft radius.
3. Larger suspect areas will be sampled using a triangular grid across the area; boring spacing will be developed using VSP considering the potential size of the release and size of the suspect area.

   NOTE: the probability of detecting a source area, or “hot spot,” depends on the size of the grid spacing versus the size of the hot spot. For example, a grid with 50 ft spacing has a 90% probability of detecting a hot spot with a 25 ft radius and a 50% probability of detecting a hot spot with a 18 ft radius.
4. Figure 1 provides the boring plan for investigation of two potential contamination areas. The larger area in the southwestern corner is potentially a former power distribution area. The narrow area along the eastern border of the site is potentially a transformer maintenance area.
5. Boring locations may be adjusted as necessary to avoid damaging subsurface utilities.
6. Samples will be collected starting at the existing ground surface and proceeding downward to a depth of approximately 12 ft bgs.
7. Additional sample locations and or depths may be added as deemed necessary by the field manager to better resolve the extent of any identified contamination.
8. The horizontal sample locations will be recorded with a Trimble Pro XRS or equivalent; approximate sample depths will be recorded in the field logbook or field forms.

Sample Types

All samples collected will be discrete grab samples.

Sample Collection and Analyses

1. Sample collection procedures provided in the FSP will be followed.
2. Direct push sampling system, such as the AMS Dual Tube™ system will be used to collect relatively undisturbed soil cores while minimizing potential cross contamination.
3. Discrete grab samples approximately 8 oz each will be collected from the AMS soil core samplers at locations corresponding to approximately 1, 5, 8, and 12 ft bgs and placed in zip-loc bags.
4. For purposes of identifying PCB source areas, field test kits such as the Hach® SOIL TEST SYSTEM will be used to field screen soils.
5. Samples from 1 and 5 ft bgs will be field screened first. In cases where both are negative, then the deeper samples (8 and 12 ft bgs) will not be tested.
6. Splits will be collected at approximately 10% frequency, biased towards samples showing greatest field screening concentrations, and submitted to SGS for definitive analysis by SW 846 8082. Archived soil samples may be analyzed for Dioxins/Dibenzofurans by SW8290 if significant concentrations of PCBs are detected.
7. Should PCB contamination be identified consistently at depth (i.e. 12 ft bgs), additional samples may be collected and analyzed using a discrete interval sampling method to evaluate the potential for cross contamination during drilling.

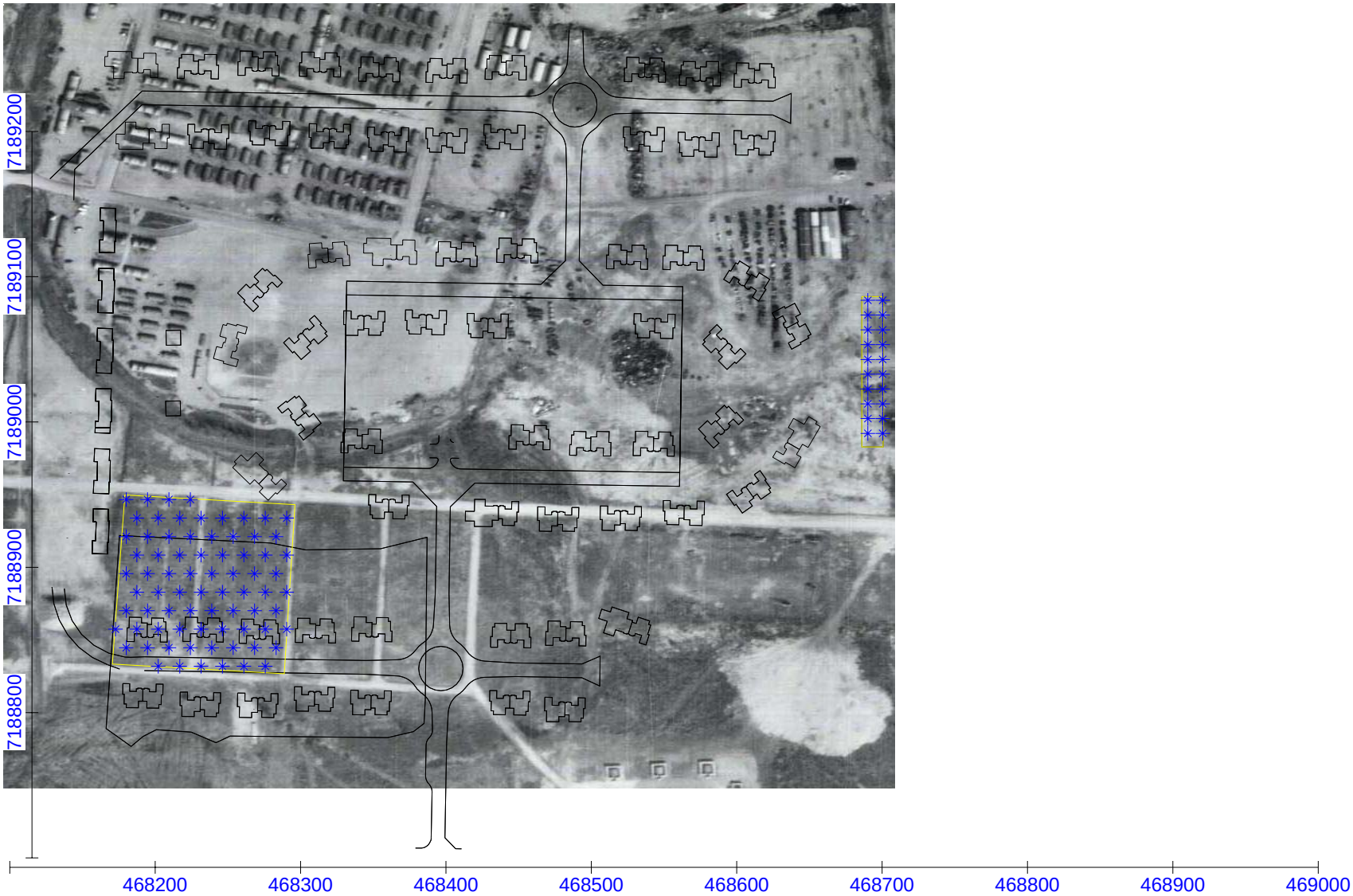


Figure 1. Planned PCB investigation areas. Approximate overlay of 1956 photo with current housing plan.

Attachment 2

SOIL STOCKPILES

For the *Field Sampling Plan for the Communications Site, Taku Gardens, at Fort Wainwright, Alaska*

Soil Stockpiles Rationale/Design

Purpose

This document serves as an attachment to the *Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska*. Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for team review at different times throughout the course of the investigation.

This attachment addresses characterization of soil stockpiles in the PCB exclusion zone and at the DRMO yard. There are approximately 20 small stockpiles (approximately 10 – 200 cubic yards each) inside and around the PCB exclusion zone and three large stockpiles (approximately 1000 cubic yards each) located at the DRMO yard. Other stockpiles requiring characterization may be identified in the future.

NOTE: There are numerous soil and/or debris piles that were created during construction at Taku and are currently located throughout the housing development. Although many of these piles were inspected by North Wind to address scientific objectives of the site investigation, full characterization of these construction related stockpiles is not addressed in this plan.

Sample Frequencies

18 AAC 78.605(c). *Soil Sample Number and Location*, specifies a volume-based sample frequency for untreated stockpiled soil. Although this site is not considered an Underground Storage Tank or petroleum site in general, the frequency specified in 18 AAC 78.605 is sufficient to characterize the numerous small stockpiles located in the PCB exclusion zone. A statistically based approach will be used to characterize the stockpiles located at the DRMO yard.

Small Stockpiles

1. The decision unit for each stockpile is no less than the volume of the stockpile itself
2. Sample results will be used to compare the average concentration of contaminants in each stockpile to a fixed threshold.
3. Stockpiles do not have any known spatial distribution patterns for COPCs. Therefore no one location is considered to be more representative than another (i.e. samples collected from the top, bottom, interior, exterior, front, back, etc. are equally representative.). Confidence in estimation of mean of the population is related to variability in data. Should initial sampling indicate significant heterogeneity, then additional sampling may be necessary depending on decisions being made.
4. At least two grab samples will be collected from stockpiles of 50 cubic yards or less, with at least one additional sample collected from each additional 50 cubic yards of soil or portion thereof over the initial 50 cubic yards.

DRMO Stockpiles

1. The decision unit for each stockpile is no less than the volume of the stockpile itself
2. Stockpiles do not have any known spatial distribution patterns for COPCs. Therefore no one location is considered to be more representative than another (i.e. samples collected from the top, bottom, interior, exterior, front, back, etc. are equally representative.). Confidence in estimation of mean of the population is related to variability in data.

Should initial sampling indicate significant heterogeneity, then additional sampling may be necessary depending on decisions being made.

3. Sample results will be used to compare a mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the mean value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the mean value is less than the threshold.
4. VSP was used to estimate that 10 samples will be required to reject the null hypothesis in favor of the alternative one based on a Student's t-test. Given a normalized action level of 10, inputs to the sample frequency calculation are:

Parameter	**Value**
S	3
Δ	3
α	5%
β	10%
$Z_{1-\alpha}$	1.64485 [a]
$Z_{1-\beta}$	1.28155 [b]

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

5. Should the mean for any given contaminant fall within the region of the grey area, additional sampling will be conducted, or the stockpile will conservatively be considered to be contaminated.
6. Should the standard deviation of the sample results exceed the estimated value, additional sampling will be conducted, or the stockpile will conservatively be considered to be contaminated.

Locations

Samples will be located using a systematic procedure as follows:

1. Randomly select a point around the circumference of the pile and mark that point with a pin flag
2. For small stockpiles, estimate sample spacing by dividing the circumference of the stockpile base by the required number of samples. Starting at the first sample location, step off the spacing between samples and place a pin flag at each sample location
3. For the large DRMO stockpiles, mark 10 sample locations on an approximately 10 x 30 ft rectangular grid oriented with the long axis of the each stockpile (see Figure 1 below).
4. At each marked location, measure up approximately 5 ft from the base of the pile and auger into the pile at an approximately 45° angle from ground surface. (For any stockpiles less than 5 ft in height, samples will be collected near the base of the pile.)
5. Collect the necessary soil volume from a point as deep as is practical using a hand auger
6. Record horizontal sample locations with a Trimble Pro XRS or equivalent at the point that the auger entered the pile; record the approximate depth that the auger was advanced into the pile.

Note: The *Underground Storage Tanks Procedures Manual* (ADEC 2002) states that stockpiled soils must be characterized by using field screening in conjunction with grab samples. However, for this project, not all potential contaminants are expected to be associated with hydrocarbons with ionization potential less than 10.6 eV, such as those compounds detected with a PID.

Therefore sample locations will not be biased using a photoionization detector or other field screening instruments.

Sample Types

All samples collected will be discrete grab samples.

Sample Collection and Analyses

Sample collection procedures provided in the FSP will be followed.

Because soils at this site may have been contaminated by a number of processes, a relatively large suite of analyses will be conducted. Table 1 lists the analytical methods that will be requested for stockpile soil samples.

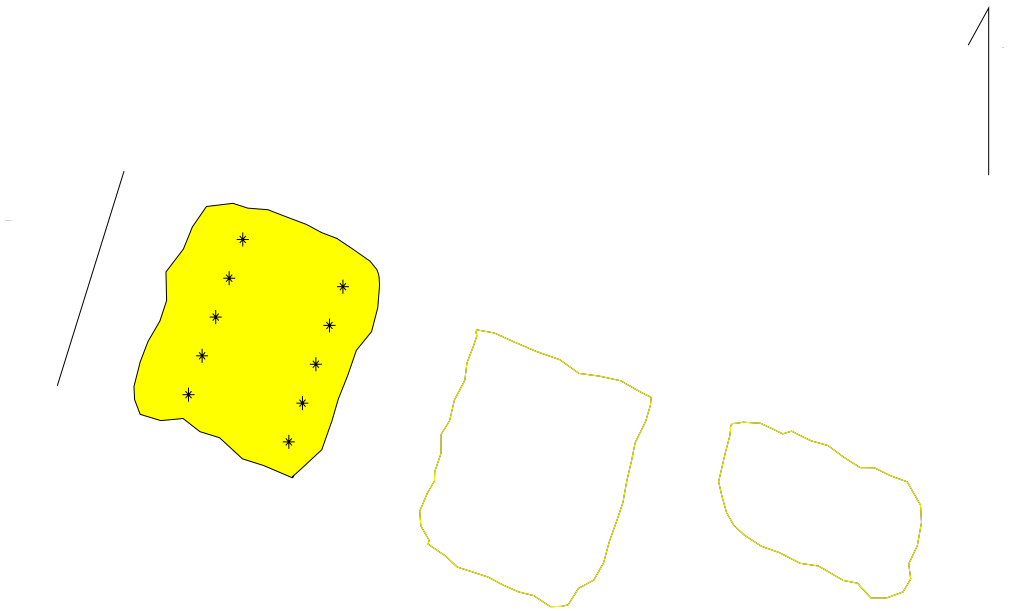


Figure 1. Example sample spacing for DRMO stockpiles (scale bar on left is ~60 ft). Three stockpiles totaling approximately 3500 cubic yards, are located at the DRMO yard near the South East corner of Ft. Wainwright.

Table 1. Analytical methods for stockpile soil samples.

Analysis	Method Number	Container	Preservative	Maximum Holding Times
VOCs	EPA SW8260B	4 oz. septa, tared amber glass	Methanol	14 days
SVOC	EPA SW8270C	4 oz. amber glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
PCBs	EPA SW8082A	8 oz. glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
Total Metals by ICP/MS	EPA SW6020	8 oz. glass	4°C +/- 2ºC	180 days to analysis
GRO	AK101	4 oz. septa, tared amber glass	Methanol, 4°C +/- 2ºC	28 days
DRO	AK 102	4 oz. amber glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
RRO	AK103	4 oz. amber glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
Mercury	EPA SW7471A	8 oz. glass	4°C +/- 2ºC	28 days
Pesticides	EPA SW8081A	8 oz. amber glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
Nitroaromatics and Nitroamines	EPA SW8330	8 oz. amber glass	4°C +/- 2ºC	14 days to extraction, 40 days to analysis
Dioxins/Dibenzofurans	EPA SW8290	*	4°C +/- 2ºC	30 days to extraction, 45 days to analysis

* The laboratory will be instructed to archive the excess soil volume from PCB samples. Should PCBs be detected, then the laboratory will be requested to analyze the archived soil for Dioxins/Dibenzofurans.

Attachment 3

SUBSURFACE SOILS INVESTIGATION

For the Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska

Subsurface Soil Rationale/Design

Purpose

This document serves as an attachment to the *For the Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska.* Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for team review at different times throughout the course of the investigation.

This attachment addresses characterization of subsurface soils to support the preliminary site investigation. In the Work Plan Addendum, numerous areas associated with the various buildings on the Taku Garden site were identified as suspect areas, based on a number of lines of evidence. Approximately 30 of these areas have been or will be investigated using excavated trenches or test pits. The remaining areas, located primarily outside of buried debris areas, will be investigated using subsurface boring and sampling techniques. This document describes the rationale and design for subsurface soil sampling.

Sample Frequencies

1. A statistically based approach will be used to investigate suspect areas.
2. In the absence of any additional information regarding the location or distribution of contaminants, suspect areas identified in the Work Plan Addendum will be represented by rectangular areas approximately 30 x 80 ft. These areas will each be considered a decision unit. The areas of the decision units are dependent upon the available spacing between utilities, and length of buildings along the longest axis.
3. A parametric, random sampling approach is used to determine the number of samples. (Assumptions about normality of the data distribution will be examined in post-sampling data analysis and nonparametric methods will be considered as necessary.)
4. The number of samples required is based on a Student's t-test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample mean is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected. The following assumptions were used to estimate the required number of samples, utilizing a normalized action limit of 10:

Parameter	Value
S	2
Δ	3
α	10%
β	10%
$Z_{1-\alpha}$	1.28155 [a]
$Z_{1-\beta}$	1.28155 [b]

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

5. A summary of the sampling design and estimated number of samples required is provided below:

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean to a fixed threshold
Type of Sampling Design	Parametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The mean value at the site exceeds the threshold
Formula for calculating number of sampling locations	Student's t-test
Calculated total number of samples	4
Number of samples on map	4
Number of selected sample area	1
Specified sampling area	348.81 m^2

6. Because each decision unit is divided into two strata, a total of 8 samples will be collected from each decision unit.
7. Should the mean for any given contaminant fall within the region of the grey area, unit will conservatively be considered to be contaminated.
8. Should the standard deviation of the sample results exceed the estimated value, the unit will conservatively be considered to be contaminated.

Locations

1. Suspect areas identified in the Work Plan Addendum will be prioritized by the planning team. It is expected that 3 areas could be investigated during the 2006 field season.
2. Sample locations will be identified by drawing individual decision units over the identified suspect areas. The decision units will typically be oriented with the long axis aligned with the associated building and no closer than 5 ft from any building foundation.

   NOTE: Review of structural drawings, as well as current information from WCC and USACE indicates that excavations extended a minimal distance beyond building footers to accommodate a 4 ft wide foam board skirt. However, in cases where substantial debris was encountered, the building excavations may have been extended laterally. The interface between WCCs original excavation wall and undisturbed ground should fall somewhere within the planned sampling area 5 to 35 ft from the buildings.
3. Using VSP, 4 random locations will be plotted within each decision unit (Figure 1 provides an example decision unit).
4. Sample location coordinates generated by VSP will be downloaded into a GPS capable of submeter accuracy for marking in the field. Sample locations may be adjusted as necessary to avoid damaging subsurface utilities.
5. Discrete grab samples will be collected from each boring location. One sample will be collected from upper 4 ft interval, and one or more deeper samples will be biased as appropriate (PID, odor, etc.); otherwise deeper samples will be located at randomly selected depths.

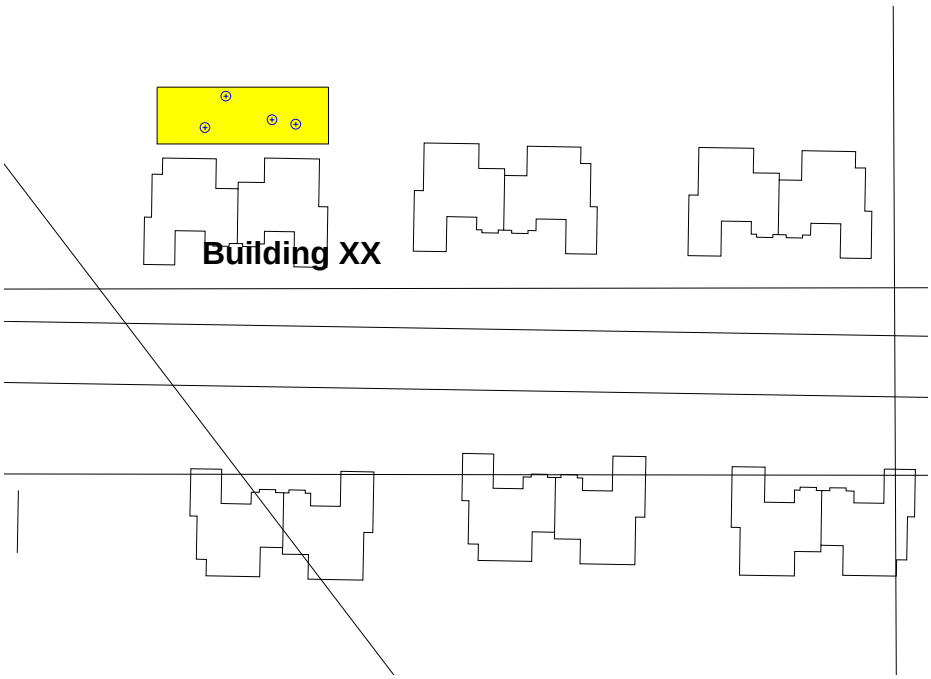


Figure 1. Example decision unit and random sample locations.

Sample Types

All samples will be discrete grab samples.

Sample Collection and Analyses

1. Sample collection procedures provided in the FSP will be followed.
2. Samples will be collected using AMS Dual Tube™ system or similar to minimize potential cross contamination.
3. The following set of analyses at a minimum will be requested for subsurface soil samples.

Table 1. Requested analyses for subsurface soil samples.

Analysis	Method Number	Analysis	Method Number
VOCs	EPA SW8260B	Pesticides	EPA SW8081A
Semivolatile Organic Compounds (SVOC)	EPA SW8270C	Herbicides	EPA SW8151
Total Metals by ICP/MS	EPA SW6020	pH	EPA SW9045
Mercury	EPA SW7471A	Nitroaromatics	EPA SW8330

4. Requested analyses may be adjusted based on professional judgment. Information presented in the Work Plan Addendum will be evaluated for each site. The original field notes from Shannon-Wilson and results of test pitting and soil coring work will also be reviewed as they become available. The requested analyses may be adjusted by the FM based on site specific conditions, observations made in the field, results of geophysical work, or results of PID field screening.

Attachment 4

Groundwater Investigation

Groundwater Investigation Rationale/Design

Purpose

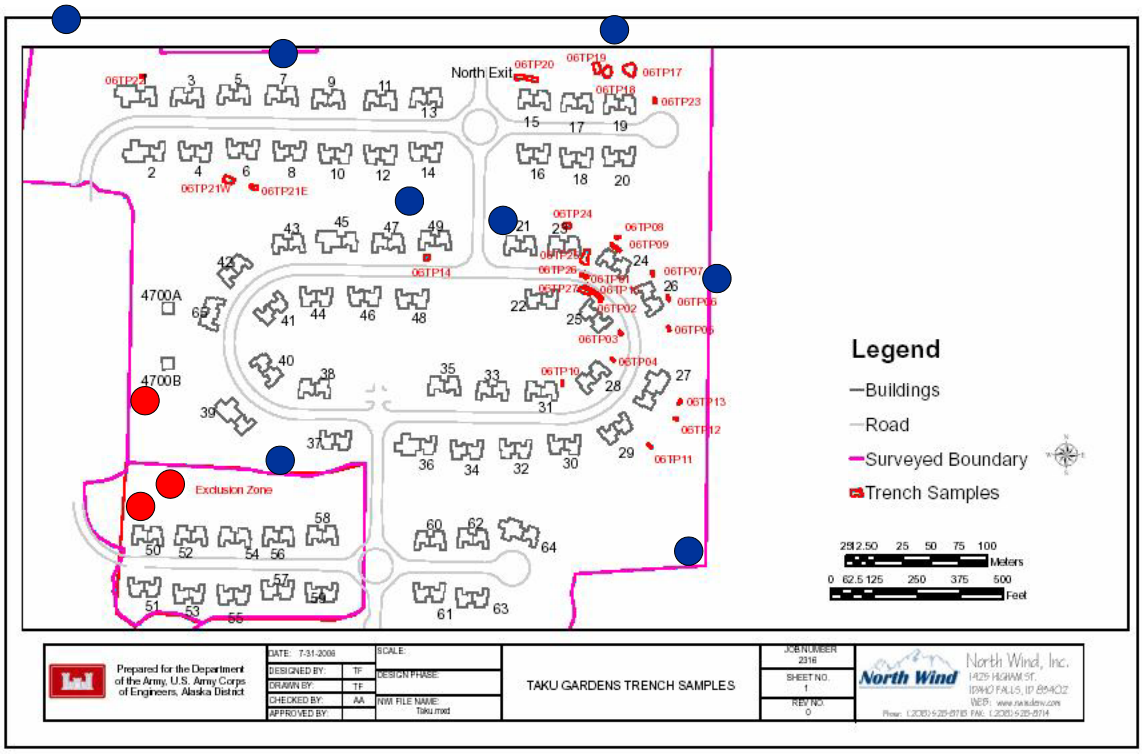
This document serves as an attachment to the *Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska.* Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for team review at different times throughout the course of the investigation.

This document describes installation of permanent groundwater monitoring wells. The new well locations were planned in consultation with DPW, EPA, ADEC, and USACE on August 7, 2006. Considering that local groundwater flow is North to Northwest, the planned well locations provide for two wells upgradient, two wells cross gradient near the border of the site, and two wells down gradient. The plan also provides for a number of interior wells located immediately downgradient of known or suspected contamination areas.

Locations

Locations for new groundwater monitoring wells are indicated by blue dots on the figure below. (Approximate locations of existing wells are indicated by red dots.) Wells will be located to avoid damage to existing site utilities. Final well locations will be recorded by a State licensed professional land surveyor.

The wells will be constructed of 2 in PVC following standard monitoring well construction and development procedures. Because the water table fluctuates significantly, a relatively large screened interval (10 ft) will be used. The screen center will be at or below the water level at time of construction.



Sample Frequencies

Sampling frequency will be determined by the agencies after well installation and the initial round of sampling.

Sample Collection and Analyses

Groundwater samples will be collected using low flow sampling procedures in accordance with the FSP.

At least for the initial round of sampling, the full suite of groundwater analyses as identified in the FSP will be performed. Analyses for future sampling rounds will be determined by the Army, in consultation with the regulatory agencies.

Attachment 5

TEST PIT INVESTIGATION

For the Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska

Test Pit Rationale/Design

Purpose

This document serves as an attachment to the For the Field Sampling Plan for the Communications Site, Taku Gardens, Fort Wainwright, Alaska. Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for team review at different times throughout the course of the investigation.

During the construction at this site, the contractor encountered areas with significant amounts of buried debris. It is estimated that approximately 100 – 150 dump truck loads of debris were excavated during the installation of subsurface utilities and building foundations (personal communication A. Armstrong, NWI and R. Jorgensen, WCC July 2006). Observations made during the construction work (field notes and photographs) indicated that potential chemical or physical hazards may be associated with the buried debris.

A judgmental sampling approach has been selected to determine whether chemical or physical hazards are associated with the buried debris (see Work Plan Addendum). It should be noted that judgmental sampling schemes do not support estimation of population parameters (mean concentrations vs. action levels, presence of hot spots, etc.) nor do they allow quantification of confidence levels. Judgmental sampling is appropriate to screen known or suspected areas for the presence or absence of contamination, however, if contamination is found, follow-up sampling is likely to involve one or more statistical sampling designs to defensibly establish the nature and extent.

This attachment addresses investigation of buried waste throughout the Taku housing area by means of excavated test pits as prescribed by the Work Plan Addendum.

Sample Frequencies

1. The number of test pits to be completed is largely dependent on the type and density of buried waste encountered. Based on test pit work done in early June 2006, it is anticipated that approximately 30 test pits in total can be completed during the 2006 field season.
2. Because the objective of excavating a test pit is to obtain a representative sample of the buried waste, the size of the pit does not affect the DQOs. In general, each pit will be large enough to allow unobstructed access to the waste for visual inspection and sampling.
3. The number of soil samples required is not predetermined. In general, one or two soil samples will be collected from each test pit depending on the items and materials encountered.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Determine presence of chemical or physical hazards in buried debris
Type of Sampling Design	Judgmental
Sample Placement (Location) in the Field	Biased based on visual, olfactory, PID or other
Working (Null) Hypothesis	NA
Formula for calculating number of sampling locations	NA
Estimated total number of samples	60
Estimated number of test pits	30

Locations

1. The initial 15 test pits excavated in June 2006 were generally located near buildings as identified in the work plan addendum. That approach was found to be inefficient at locating buried waste. Therefore, areas where geophysical anomalies (electromagnetic and magnetic) were generally located in the past will be resurveyed using high resolution geophysical techniques. The results of the high resolution surveys will be used to identify target test pit areas. Both areas with large and small geophysical anomalies will be targeted.
2. Significant underground utilities exist at this site. Final test pit locations will be adjusted as necessary to avoid damage to utilities. Any particular test pit location may be moved or eliminated from the sampling plan as necessary when the density of subsurface utilities precludes safe digging, or where digging would significantly impact ongoing construction activities.
3. Individual sample locations will be biased within each test pit to target soil that is most likely to be contaminated. In general, samples will be collected from under or inside of containers, under or within debris items. Visual and olfactory clues and/or PID readings will also be used to bias sample locations as appropriate. In test pits where there is no indication of potential contamination, samples may be located at the mid-point and/or bottom of the excavation.

Sample Types

- Metal debris encountered will be removed from the excavation and visually inspected by qualified UXO technicians to identify MEC related items.
- PID measurements will also be taken in and around debris items (drums, etc.) to identify areas with fuels and other volatile compounds with ionization potential less than 10.6 eV.
- Instrument panels or dials from aircraft or heavy equipment with the potential to contain Ra-226 will be field screened with a gross activity meter. Proper notification (as per communication plan) will commence prior to any field screening activities.
- Soil samples collected for chemical analysis will be discrete grab samples.

Sample Collection and Analyses

1. Sample collection procedures provided in the FSP will be followed.
2. Requested analyses will be indicated on the chain of custody (CoC) form for each sample submitted to the laboratory.
3. Requested analyses will be identified based on professional judgment, in consideration of the types of buried debris encountered and any observations made during the test pitting work. Information presented in the work plan addendum will also be evaluated for each site, including the original field notes from Shannon-Wilson. Results of test pitting and soil coring work may also influence the decisions. The requested analyses may be adjusted by the FM based on site specific conditions, observations made in the field, results of geophysical work, results of field screening with PID, and any other available information. For example, if MEC items are identified, the associated soil will be tested for explosives compounds; if partially intact containers are found, organic and pesticide methods will be run. If particular analyses consistently yield non-detect results, the frequency of future analyses may be reduced. Reporting changes or unusual circumstances during test pit activities is discussed in the FSP. In general, the analyses will be requested per the guidelines provided in Figure 1.

	SW8260B	SW8270C	AK101	AK 102	AK103	SW8082A	SW6020	SW8081A	SW8151	E300.0	SW9045	SW8330	SW8290	SW 9310	SW 901.1
	VOCs	SVOC	GRO	DRO	RRO	PCBs	Total Metals	Pesticides	Herbicides	Common Anions	pH	Nitroaromatics and Nitroamines	Dioxins/Dibenzofurans[a]	gross alpha/beta[b]	gamma spec[b]
Soil with no contamination or debris evident	X	X				X	X				X				
Soil with elevated organic vapor, staining or odor	X	X	X	X	X	X	X	X	X		X				
Soil with anthropogenic material (powders, liquids, fragments, etc.)	X	X					X			X	X	X			
Soil with intact containers (drums, bottles, etc.)	X	X				X	X	X	X		X	X			
Soil with elevated activity (3 X background)														X	X
Soil with metal debris		X					X					X			
Soil with evidence of burning													X		

a. secondary analyses, may be run on archived samples if warranted based on initial results.

b. special transporation requriemetns may apply.

Figure 1. Guidelines for requesting sample analyses.

Attachment 6

SUBSURFACE SOIL VAPOR INVESTIGATION

For the Field Sampling Plan for the Communications Site, Taku Gardens, at Fort Wainwright, Alaska

Subsurface Soil Vapor Rationale/Design

Purpose

This document serves as an attachment to the *For the Field Sampling Plan for the Communications Site, Taku Gardens, at Fort Wainwright, Alaska*. Due to the dynamic nature of this project and unique schedule constraints, the rationale and design for each distinct element of the field activities may be developed and submitted for team review at different times throughout the course of the investigation.

This attachment addresses characterization of subsurface soil vapor to support the preliminary site investigation. Subsurface soil vapors will be qualitatively sampled in the POL area located in the Northwest corner of the Taku Garden site and near the suspect drum burial site located near Building 48/49 at the Taku Garden site. This document describes the rationale and design for subsurface soil gas sampling.

Soil Vapor Sampling Design

The type of sampling to be conducted is passive soil gas sampling, in which small packets of material that sorb VOCs are placed in shallow boreholes in the areas of interest, allowed to equilibrate with the surrounding soil gas, retrieved, and shipped to a laboratory for further processing. In the laboratory, VOCs are stripped from the sorbent packets and analyzed. Concentrations of VOCs measured in different sorbent samplers are compared to each other (they do not provide quantitative results for each point), and samplers with elevated relative concentrations of VOCs are identified as soil gas 'hot spots'. These hot spots are assumed to correspond with areas where elevated concentrations of VOCs are present in the subsurface.

Samplers will be deployed at approximately 7 feet below land surface. This depth is sufficient to isolate the samplers from atmospheric effects, yet is shallow enough to detect surface to shallow subsurface VOC sources (i.e. large spill or disposal sites or .

- Two samplers will be installed in an uncontaminated area to determine background concentrations of VOCs in soil gas.
- Approximately 30 samplers will be deployed in the northwest area of the Taku Site to evaluate soil vapor within the "POL area" and suspect drum disposal areas near Buildings 48 and 49 (Figure 1).
- Samplers will be installed on a uniform grid pattern across the areas of interest. Spacing will be adjusted as necessary to work around existing buildings and construction activities. Samplers should be spaced as uniformly as possible to support concentration mapping.

Soil Vapor Sampling Procedures

1. Borehole Advancement: All boreholes will be installed prior to emplacing sorbent packages. The rationale is to have all samplers exposed to soil gas for approximately the same length of time. At each location, use direct push technology to install 1.0-inch diameter Schedule 40 polyvinyl chloride (PVC) pipe (or similar), with a 2 foot slotted section at the bottom with an open end (or similar). Backfill the lower 3 feet of the annulus with silica sand and the upper 4 feet with dry granular bentonite. Add water sufficient to hydrate the bentonite. Seal the top of the casing to prevent above-ground air from entering the hole. NOTE: Materials such as duct tape that contain VOCs will not be used for completing boreholes or sealing wells. Manufacturer-supplied plugs, PVC pipe fittings, or aluminum foil are the preferred materials for sealing boreholes.

2. Installation of Protective Equipment. In order to prevent damage to the sampler and injury to personnel, the top of the borehole will be clearly marked. To accomplish this, install a survey stake (lath) near the borehole and flag the top of the stake
3. Borehole Location Documentation. Record the final horizontal position of the borehole in the GPS data logger
4. Sampler Emplacement. After installing all boreholes, install all samplers in as short an elapsed time from the first sampler to the last sampler as possible with a single crew. The rationale is to have all samplers exposed to soil gas for as close to the same length of time as is practical. Install a sampler into a cased hole according to the manufacturer's procedure. In general, this entails lowering the sampler to the bottom of the hole using the supplied tether, securing the tether to a cap supplied by the manufacturer, and recording the sampler identifier, date, and time of emplacement in the field notes. Cap the top of the casing to prevent air from above ground surface from entering the borehole or casing.
5. Equilibration Time. Allow approximately 7-14 days for the samplers to equilibrate.
6. Retrieval. After the equilibration time has elapsed, recover each sampler and prepare for shipment to the analytical laboratory in accordance with the manufacturer's procedure. Record the sampler identification, removal time, and date for each sampler. Handle trip blanks as specified by the manufacturer. Ship samples and trip blanks to the analytical laboratory in accordance with the manufacturer's instructions.
7. Borehole Abandonment. Abandon each borehole by removing the PVC casing, allowing the sand and bentonite to collapse into the borehole. Fill the remaining upper portion of the hole with native soil.
8. Soil Gas Data Interpretation. Interpret soil gas data by comparing measured concentrations to background concentrations and to concentrations measured at all other sample locations. Identify soil gas VOC hotspots as areas with anomalously high concentrations.

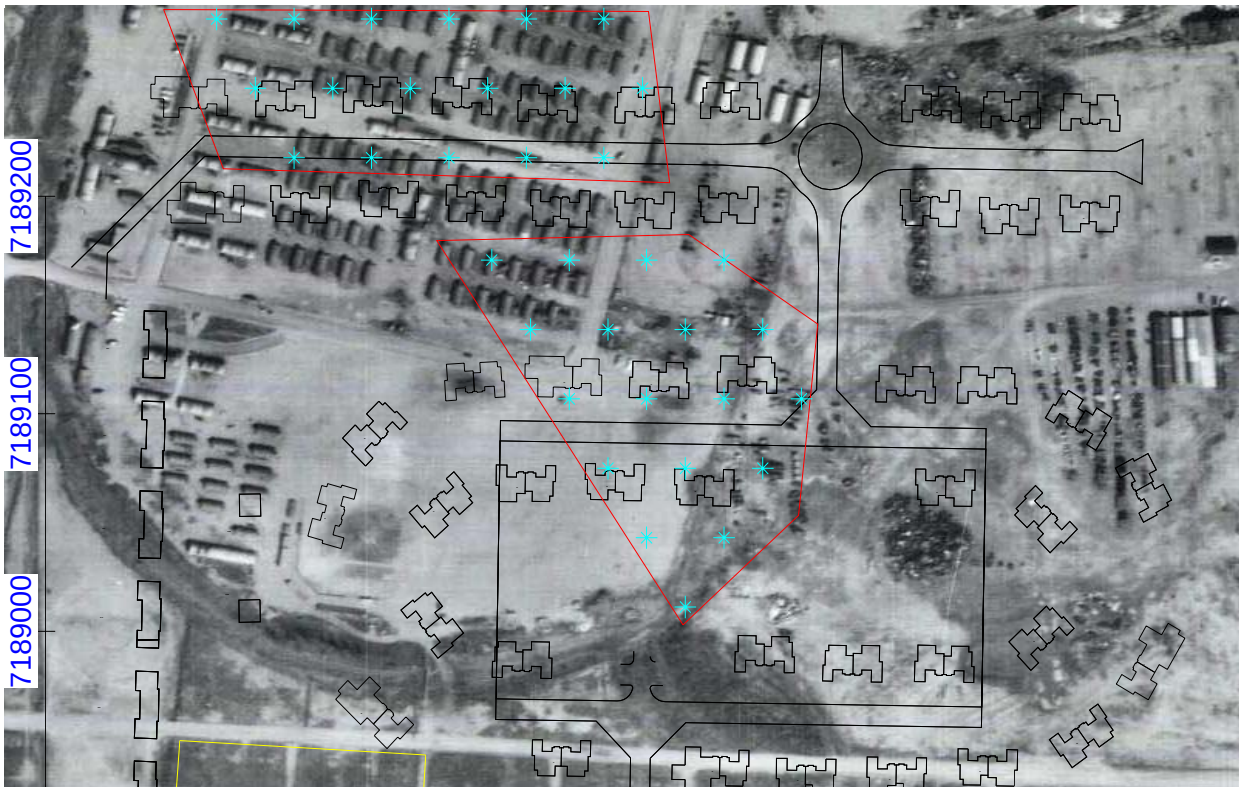


Figure 1. Example layout for soil gas samplers.