

DEQ WESTERN REGION
GROUNDWATER OPERATION and MAINTENANCE INSPECTION

Hollingsworth & Vose (former Evanite Facility)
1115 SE Crystal Lake Drive
Corvallis, Oregon 97339
ORD 009 023 466



State of Oregon
Department of
Environmental
Quality

Inspection Date: Thursday, Sept. 26, 2024

DEQ Inspector(s): Fredrick Moore – HW Permit Writer
Spencer Bohaboy – HW Permit Writer
Nancy Sawka, RG – DEQ Cleanup Project Manager

Facility Representative(s): Anita Ragan – Hollingsworth & Vose EH&S Manager
Rawlins Lupoli – Hollingsworth & Vose
Brad Berggren – PNG Consulting
Jay Greifer – PNG Groundwater Technician

Prepared by (dated signature): Fredrick Moore *Fredrick Moore 10/22/24*

Purpose of Inspection

DEQ conducted an announced inspection of Hollingsworth & Vose Company to determine if the facility's environmental contractor was taking groundwater samples that are representative and in compliance with the on-hand sampling and analysis plan

This inspection was conducted at the request of the United States Environmental Protection Agency following a memorandum issued by the Office of Inspector General (OIG) in [September 2023](#). The EPA, or an EPA-authorized state, is responsible for ensuring that land-use controls under the Resource Conservation and Recovery Act (RCRA) continue to prevent human exposure and groundwater contamination at sites where contamination persists. The OIG identified Oregon facilities that lacked recent RCRA groundwater inspection reports which included Hollingsworth & Vose. In the RCRA program there are different types of groundwater inspections. DEQ chose this inspection would be a RCRA Groundwater Operation and Maintenance inspection. From the EPA [Operation and Maintenance Inspection Guide Final March 1988](#) (OSWER 9950-3): (The following is edited from the original text)

EPA has designed the O&M inspection to achieve the following enforcement objectives.

- *Determine that the owner/operator's personnel who collect groundwater samples are collecting them properly:*
 - *In accordance with the owner/operator's Sampling and Analysis Plan*
- *Determine that the owner/operator's sampling devices are in working order and is abiding by maintenance provisions as outlined in the Sampling and Analysis Plan.*

- *Determine that individual monitoring wells continue to yield representative groundwater samples. (pp 1-2)*

There are more itemized items in the guidance. However, DEQ chooses to only evaluate these items due to the pertinent groundwater sampling happening in 2024.

Facility Background

The Evanite facility manufactured specialized glass fibers. At the Evanite Submicro Building, polyethylene-silica separator material was manufactured with trichloroethylene used as a solvent to extract oil as one step in the manufacturing process. In 1978, during circulation of the TCE in the process, the solvent was released in underground soils and groundwater (though sometimes this is called the spill).

At the time, the area contaminated by the release of TCE was treated as a hazardous waste landfill. In 1987, the landfill closed under Oregon hazardous waste regulations and DEQ and EPA jointly issued the post-closure permit in 1990.

In December 2000, DEQ and Evanite decided that the DEQ Cleanup Program would implement corrective action to address remaining soil and groundwater TCE contamination with a Cleanup consent order attached to the hazardous waste permit. DEQ and Evanite signed the consent order in December 2001 and DEQ issued the hazardous waste permit renewal incorporating the order in March 2002. DEQ calls this type of permit incorporating a Cleanup order as a shell permit.

DEQ reissued the shell permit on Oct. 31, 2013. The consent order has undergone four addendums.

Hollingsworth & Vose purchased the Evanite industrial facility in 1997. Evanite changed its name to Hollingsworth & Vose December 2012.

Currently, H&V submitted a permit renewal application in May 2023. H&V and the DEQ Cleanup Program are developing a new consent order to more accurately reflect the progress and current conditions of the TCE remediation.

Permits and Consent Order

DEQ and EPA jointly issued the first RCRA post-closure permit in April 1990 (ID ORD 009 023 466). The permit considered the residual TCE spill as a RCRA landfill and best fit the RCRA regulations into the permit. Eventually, the residual TCE spill and other areas of concern came under corrective action review and implementation came under the DEQ Cleanup Program. The DEQ Cleanup Program issued an Order on Consent dated Dec. 14, 2000 (ID WMCSR-WR-00-19).

In the late 90's, DEQ upper management decided that all RCRA corrective action in Oregon would fall under DEQ Cleanup Program implementation. At the same time DEQ decided to implement this and also keep the RCRA permitting obligation, that RCRA permits would be issued with the DEQ Cleanup orders incorporated into them and maintain RCRA oversight. This resulted in the implementation of the groundwater requirements and review under the Cleanup

orders following DEQ Cleanup rules and policies. In house, DEQ calls these types of permits as shell permits. DEQ issued the Evanite shell permit in April 2001.

Hollingsworth & Vose submitted a permit renewal application in May 2023, prior to permit expiring and was administratively extended. The DEQ Cleanup Program and H&V are negotiating a new judicial instrument to reflect the progress made in remediation and new requirements needed for further progress.

Preliminary Notes

1. The H&V groundwater program, including sampling and analysis, is described in the following three documents:
 - Performance Monitoring Plan, April 4, 2013. Prepared by PNG Environmental, Inc.
 - Sampling and Analysis Plan, March 3, 2009. Prepared by PNG Environmental, Inc.
 - Quality Assurance Project Plan, March 3, 2009. Prepared by PNG Environmental, Inc.
2. In preparation for the groundwater O&M inspection, DEQ requested the current sampling and analysis documentation the facility is currently using and believes to be the latest DEQ-approved sampling and analysis plan. The permittee provided the three documents listed above. Note: The Sampling and Analysis Plan contains highlighted annotations dated 9/6/2024.

As stated before, the DEQ Cleanup Program directs H&V on the elements of the groundwater monitoring program. The RCRA shell permit incorporates and enforces the consent order. The consent order states under its Quality Assurance requirements that: "Respondent shall conduct all sampling, sample transport, and sample analysis in accordance with the Quality Assurance/ Quality Control (QA/QC) provisions approved by DEQ as part of the work plan." See page 11 of the Order. In the ensuing years, as methods in sampling and testing have changed, the facility has submitted changes to DEQ for review and approval. For example, H&V submitted to me before the inspection a January 2015 PNG Environmental memo to DEQ an addendum to the Performance Monitoring Plan suggesting changes.

For purposes of this inspection I accepted the documents listed above as what I should see in the field. I did not conduct a review to ensure that these were the documents most recently approved and therefore enforceable. Instead, the relevant parties decided to provide documents showing how samples are collected, ensure field work conformed with the documents, and if there is any

indication that groundwater sampling has problems, then the next inspection would review what the enforceable sampling and analysis is.

3. This report is Part I of the total inspection. Later, Part II of the inspection will be to review the sampling results. DEQ will review and compare those sampling results with past results and evaluate if sampling results seem consistent. If there are issues, then DEQ will consider a subsequent inspection which could include split samples to both assess precision and accuracy.
4. During the inspection, the groundwater technician stated that field personnel screened all groundwater level and dense non-aqueous phase liquid on the previous Friday. This is consistent with the SAP at Sections 3.1.1 and 3.1.2 which, in part, states, " If multiple wells are to be sampled, all water level measurements will be performed first in as short of timeframe as possible to prevent any fluctuations in water table ..." (p A-3).
5. During the inspection Nancy Sawka, the DEQ H&V Cleanup Project Manager, mentioned that in actuality there is a DEQ H&V Cleanup project team consisting of herself, a hydrogeologist, an engineer and toxicologist. The team routinely reviews the groundwater sampling results that the permittee submits. In a later communication, Nancy stated that from these reviews DEQ has noted no significant issues. So even though the record shows that there are no recent RCRA groundwater reviews, the DEQ Cleanup Program has continuously reviewed the groundwater sampling.
6. During the inspection I learned that the field personnel send groundwater samples to Pace labs in Tennessee. It is important that groundwater samples at DEQ-regulated facilities be sent to ORELAP-accredited labs. From the following information gained online it shows that Pace is so accredited.

Search for ORELAP Labs

Search By: ☐ None ☒ Lab Name ☐ ORELAP ID ☐ State

Search For: X

Search Analytes By: ☒ None ☐ Analyte ☐ Analyte Code ☐ Method Code ☐ Method Reference

Matrix: ☒ Drinking Water ☒ Non-Potable ☒ Solids ☒ Air ☒ Biological

Filter: ☐ Accepts Public Samples ☐ *Comables ☐ **Pesticides

*General toxicology (pesticides) only
**Pesticides only (not general toxicology)

Search Labs

Filter

Lab Name	ORELAP ID	Address	City	State	Zip	Phone	Email	Accreditation
Environmental Science Corporation (aka Pace Analytical National Center for Testing & Innovation)	TN000002	12045 Lebanon Road	Mt. Juliet	TN	37122	615-773-9737	posmy.hunter@paceclubs.com	
Pace Analytical Gulf Coast	4168	7079 Innovation Park Dr	Baton Rouge	LA	70820	225-514-7077	jackie.bondolph@paceclubs.com	
Pace Analytical Services	4161	105 Vantage Point Dr.	West Columbia	SC	29172	803-227-2702	erin.bogd@paceclubs.com	
Pace Analytical Services, LLC - Bakersfield	4032	4100 Atlas Court	Bakersfield	CA	93308	661-327-4911	Sara.guton@paceclubs.com	
Pace Analytical Services, LLC - Minneapolis MN	MN300001	1703 Elm Street SE	Minneapolis	MN	55114-2465	612-607-1700	Liz.Stocks@paceclubs.com	
Pace Analytical Services, LLC - Minneapolis MN	MN200001	1703 Elm Street SE	Minneapolis	MN	55114-2465	612-607-1700	Liz.Stocks@paceclubs.com	

Pre-Inspection Meeting

All parties met at 9 a.m. at the H&V parking lot. We then proceeded into the H&V office building to sign in and were given a health and safety briefing for the inspection.

Facility Inspection



Photo #1

This picture shows the first groundwater monitoring well IMW-35 I witnessed sampling. The groundwater sampling intake was already inserted in the monitoring well. Attached to the intake was the disposable tubing (seen in this photo). This is consistent with the SAP that states "Samples will be collected using dedicated bladder pumps and tubing or when dedicated equipment is not in use, using new LDPE tubing at each well." (SAP §3.1.4, p A-4)

Shown in this picture is disposable tubing.



Photo #2

Seen here is the groundwater technician (field personnel) Jay Greifer. Still drawing groundwater at IMW-35, this picture shows that there is additional disposable tubing that leads to the pump, then tubing that goes to the inline water analyzer then tubing that goes into a graduated plastic tub. In the center of the picture is a black spool with the supply of disposable tubing. Jay is noting the groundwater chemical parameters and monitoring the flowrate.

This is consistent with the SAP that states: "Low-flow methodology is preferred as it minimizes well disturbance. ... During purging, field parameters will be measured to assure adequate purging." (§3.1.3, p A-4)

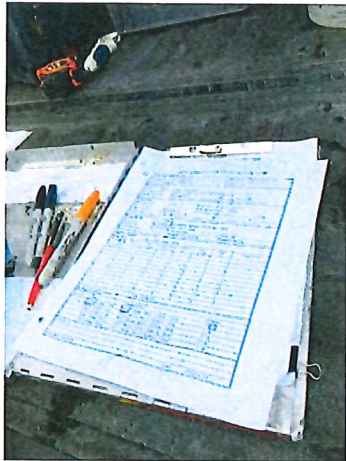


Photo #3

This picture shows the form used while monitoring the groundwater parameters during purging. Not in focus, but also seen is the aluminum clipboard that has lettering indicating the spread the different groundwater parameters must use to indicate stabilized groundwater.

The SAP states: "All measurements will be recorded on the Groundwater Sampling Form (Appendix B)." This form appears consistent with SAP. The SAP also states "During purging, field parameters will be measured to assure adequate purging. Parameters include temperature, specific conductivity, and pH." I witnessed that these parameters are being used. (§3.1.3, p A-4)

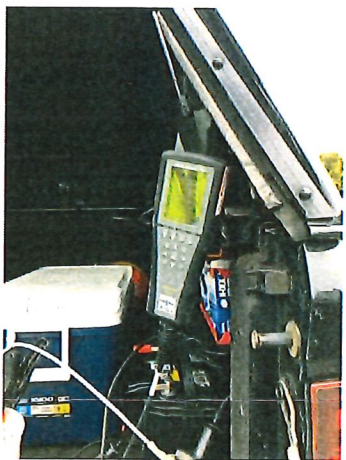


Photo #4

This picture shows the inline groundwater analyzer used to determined when the groundwater parameters are stabilized so that a groundwater sample can be obtained.

At the upper right portion of a red and white tag is seen. This tag shows when the last laboratory calibration was performed. This indicates compliance with Section 6.1.1 Field Calibration of the QAPP (p 11) which states "Calibration procedures, calibration frequency, and standards for measurement will be conducted according to manufacturer's guidelines."



Photo #5

This picture shows an example of the data that the inline groundwater analyzer provides. The screen shows the following parameters are measured: temperature, dissolved oxygen (DO), total dissolved solids (TDS), specific conductivity (C), pH and oxygen reduction potential (ORP). The SAP states that temperature, specific conductivity and pH will be monitored. See SAP Section 3.1.1 p A-4. In addition, the Groundwater Sample Collection Form shows the groundwater volume collected, temperature, conductivity, DO, pH, turbidity and ORP parameters are noted. See PMP, Appendix A, Form G.

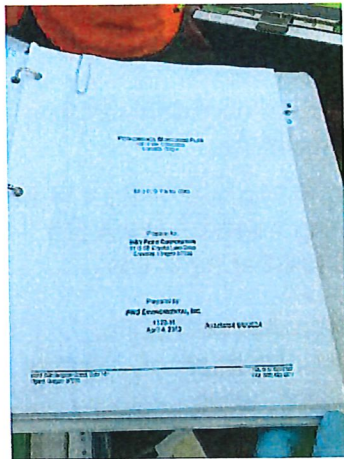


Photo #6

During the inspection I asked the groundwater technician what documentation he brings in the field in case there is a question on how take a groundwater sample.

This picture shows that he does bring the PMP in the field. This PMP is the same edition as H&V provided to me.

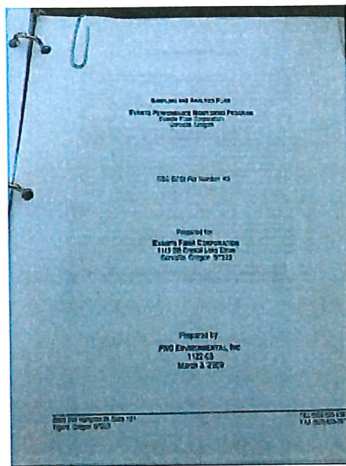


Photo #7

Likewise, the groundwater technician also brings the SAP into the field. This SAP is the same edition as H&V provided to me.

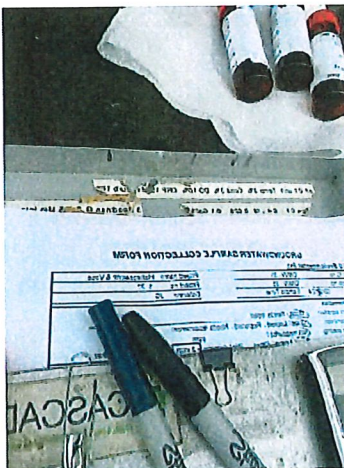


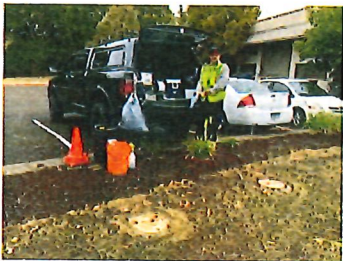
Photo #8

This picture shows that three groundwater samples are taken. It was explained that the extra two vials are backups in case the initial sample has a problem or the bottle gets broken. The two vials are not used as a duplicate, trip blank or other.

The QAPP states that a trip blank is provided by the sampling lab: One trip blank per cooler. See QAPP Section 4, First Bullet, p 7)

The QAPP states that field duplicates are collected and analyzed. One duplicate is collected for every 20 samples. See QAPP Section 4, Third Bullet, p 7)

There was not a duplicate taken for the three wells we witnessed sampling.

	Photo #9 This picture shows the next location of groundwater monitoring wells that we witnessed sampling. These wells are IMW-34 and DMW-34. Some things to note about this picture: 1. A gray trash bag is seen hanging to the technician's right. This is where the disposable piping and PPE is placed showing that dedicated piping is used at each well. 2. Below the gray bag is an orange bucket containing different decontamination solutions. I witnessed different equipment throughout the inspection being decontaminated using different solutions. Decontamination is detailed in PMP. See PMP, Appendix B, SOP 4 p 1.
	Photo #10 This picture shows the continuing sampling at the wells 34 location. I learned that the technician measures the length of the tubing from the truck's tailgate to the top of the monitoring well. This helps in determining where to place the groundwater sample intake. The QAPP requires that the groundwater sample come from the middle of the well's saturated screen. See QAPP, Appendix B, SOP 13, Well Purging, Third Bullet, p 1. As an example, if the middle of the screen is 30 feet below the top of the well, and if the length of the tubing is five feet from tailgate to the top of the well – the technician can draw 6 lengths of the measured five feet of tubing and know that the intake is in the middle of the screen.

Recordkeeping and Reporting

Recordkeeping and reporting are detailed in the PMP at page four. H&V added an annotation that the reporting currently is different in that monthly and quarterly reports are combined in bi-monthly memos. This is an example of how there are some things listed in the documents that H&V provided for this inspection that are not updated.

Inspection Records

As stated below, I will review the next groundwater report and compare the results and documentation to the SAP, PMP, QAPP and previous groundwater reports. This review will, in part, compare the paperwork produced by the sampling event and then reported in the groundwater report to the forms found in the SAP, PMP and QAPP.

Exit Interview

After the third monitoring well sampling I decided we had witnessed a typical sampling event at Hollingsworth & Vose and that further inspection of sampling at groundwater wells would not be much different. We gathered at the H&V business office to sign out. In a brief discussion with H&V and PNG I expressed that I thought sampling was conducted closely with the SAP, PMP and QAPP documents provided.

I did state that the provided documents are somewhat dated and that some of the statements in the documents are no longer relevant. For example, the SAP mentions that the groundwater samples are sent to the CH2M Hill lab in Corvallis. See SAP p 3. In actuality, groundwater samples are sent to a Pace lab in Tennessee.

It was stated to me that with the current discussions between H&V and the DEQ Cleanup Program that a new consent judgment is being worked out that includes the development of a new workplan that will lead to a new SAP to reflect current conditions. The workplan and SAP, once developed, will be submitted to the DEQ for review and approval. I think this is an acceptable process and can certainly serve in lieu of a formal RCRA sampling and analysis plan.

Conclusions and Recommendations

1. From my review of the provided groundwater sampling documents and then witnessing sampling at the H&V facility I conclude that the permittee's contractor conducted such sampling in accordance with the documents. Future review of the submitted groundwater reports will assess if representative groundwater samples were gathered and analyzed accordingly.

Most RCRA inspections assess directly whether the permittee follows regulations or permit conditions. And if not, what enforcement is needed. For purposes of this report, DEQ will first assess if the contractor collects and reports representative groundwater samples and if DEQ notes problems DEQ can evaluate possible future enforcement.

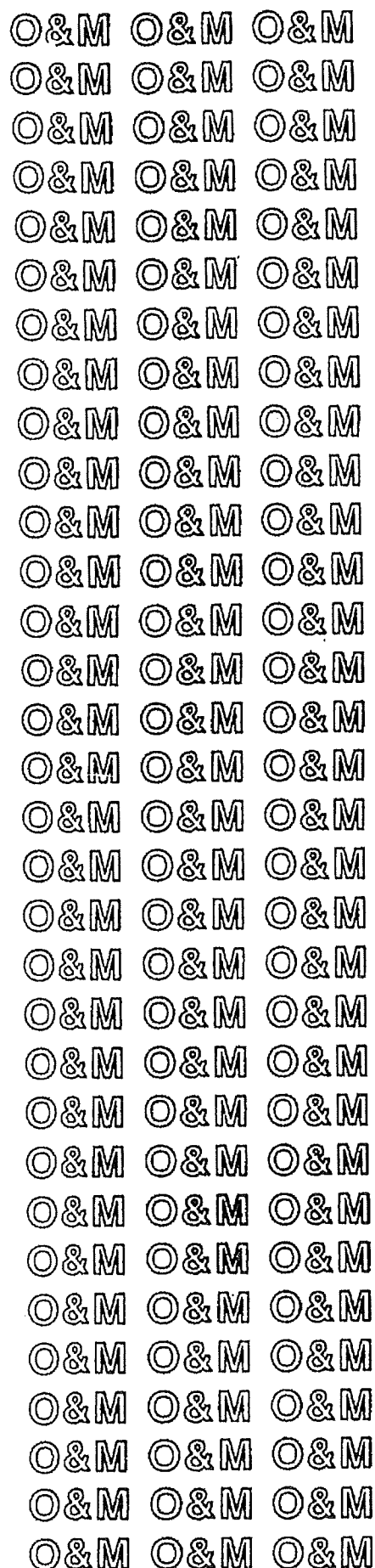
2. Even though this inspection serves as a RCRA Groundwater Operation and Maintenance inspection report, it is the main purpose of this report to begin to assess if H&V are obtaining groundwater samples according to a written plan and if such sampling and analysis reports represent groundwater conditions. This report does not exactly follow the RCRA guidance on O&M inspections. Such guidance is attached to this report for reader review.

I contend that such RCRA guidance, being from 1988, reflect conditions in the past that are not all relevant now. Site conditions at H&V are well known and the permittee has been remediating contamination conditions with DEQ oversight for the last 30-plus years. Groundwater sampling, through the many national environmental programs, have matured and are standardized and the concerns listed in the RCRA guidance have been addressed.

3. Nancy Sawka from the DEQ Cleanup Program attended the site inspection and no issues came to her attention needing attention.

Appendix: Attachments

1. Operation and Maintenance Inspection Guide, OSWER 9950-3, March 1988.
2. Sampling and Analysis Plan, Prepared by PNG Environmental, Inc., March 3, 2009.
3. Quality and Assurance Project Plan, Prepared by PNG Environmental, Inc., March 3, 2009.
4. Performance Monitoring Plan, Prepared by PNG Environmental, Inc., April 4, 2013.



(RCRA Ground-Water Monitoring Systems)

**RCRA Enforcement Division
Office of Waste Programs Enforcement
U.S. Environmental Protection Agency**

March 1988

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PREFACE

The 1988 RCRA Implementation Plan introduces the Operation and Maintenance Inspection (RCRA Ground-Water Monitoring Systems) as a new type of inspection. This guidance manual has been written for EPA and state enforcement staff. It describes the Operation and Maintenance (O&M) Inspection, explains how it fits into EPA's overall enforcement effort, and explains how to plan and conduct an O&M inspection.

The manual has been organized and written to conform to the steps enforcement officials would follow in planning and conducting O&M inspections.

Section One discusses the regulatory basis for O&M inspections, describes the enforcement objectives underlying O&M inspections, and explains how the O&M inspection relates to EPA's overall RCRA enforcement program.

Section Two explains how to prepare for the O&M inspection. It describes what should be done in the office prior to conducting the field inspection and explores the relationship of the enforcement official and the field inspector.

Section Three describes how to conduct an O&M inspection. A generic O&M field inspection report form is included as an appendix to help the inspector focus field activities and record field observations to support potential enforcement actions.

Section Four describes how to review the inspection report form and decide if there is direct evidence of violations or whether the possibility exists that the owner/operator is in violation of the RCRA requirements.

The Appendices include the generic operation and maintenance inspection form, an example of permit language for operation and maintenance programs, a guide to operation and maintenance of gas displacement bladder pumps, and a list of questions and answers. The reader may wish to refer to the question and answer section (Appendix D) to obtain a quick overview of this guidance manual.

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- Appendix B — Generic Operation and Maintenance Inspection Form**
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- Appendix D — Questions and Answers**

SECTION ONE

OVERVIEW OF THE OPERATION AND MAINTENANCE INSPECTION

1.1 Enforcement Objectives of the Operation and Maintenance Inspection

The 1988 RCRA Implementation Plan introduces the Operation and Maintenance (O&M) Inspection as a new type of inspection. The O&M inspection adds a new perspective and focus to EPA's efforts to ensure the proper implementation of the RCRA ground-water monitoring regulations.

By the end of FY 1988, enforcement officials will have conducted **Comprehensive (Ground Water) Monitoring Evaluations (CMEs)** at all RCRA land disposal facilities. The CMEs conducted to date have focused heavily on site characterization and on the design of ground-water monitoring systems. Enforcement actions have been taken to promote the timely issuance of RCRA land disposal permits. Through these enforcement and/or permitting actions, EPA and the states will have had the opportunity to scrutinize the design of every active ground-water monitoring system regulated under RCRA.

The focus of the enforcement program in FY 1988 and beyond is now shifting from design review to the review of facility operations—particularly those facility operations related to the generation of ground-water monitoring data. In general, the O & M inspection focuses on how owners/operators operate and maintain their ground-water monitoring systems. Specifically, EPA has designed the O&M inspection to achieve the following enforcement objectives.

- Determine that the owner/operator's personnel who collect ground-water samples are collecting them properly:
 - in accordance with the owner/operator's Part 265 (interim status) Sampling and Analysis plan or
 - in accordance with conditions associated with the sampling and analysis section of the owner/operator's RCRA permit.

- Determine that the owner/operator's sampling devices are in working order and that the owner/operator is abiding by maintenance provisions as outlined in the Sampling and Analysis Plan (interim status) or in the RCRA permit (permit status).
- Determine that individual monitoring wells and piezometers/observation wells within a ground-water monitoring system continue to yield representative ground-water samples and reliable ground-water samples and reliable hydrologic data.
- Identify flagrant violations in operation and maintenance programs, and/or trigger a more thorough scrutiny of the owner/operator's ground-water monitoring program (i.e., trigger a Case Development Inspection).
- Identify issues or concerns that the enforcement staff should assess in a future Comprehensive (Ground Water) Monitoring Evaluation.
- Collect ground-water elevation data; determine direction(s) of ground-water flow; and assess, generally the viability of past decisions made by the owner/operator regarding the number and placement of monitoring wells.

1.2 Regulatory Basis for the Operation and Maintenance Inspection

The authority of EPA to require an owner/operator to implement an O&M program and the authority of the enforcement official to take actions against poor O&M programs is firmly rooted in regulations under Sections 265, 264, and 270 of RCRA. Table 1 lists those regulations which give EPA the authority to take enforcement actions related to ground-water monitoring O&M programs.

TABLE 1

SUMMARY OF REGULATIONS RELATED TO OPERATION AND MAINTENANCE PROGRAMS

Interim Status	Description
265.15(b)(1)	"The owner/operator must develop and follow a written schedule for inspecting all monitoring equipment,... and operating and structural equipment... that are important to preventing, detecting, or responding to environmental or human health hazards."
265.15(b)(2)	"He must keep this schedule at the facility."
265.15(b)(3)	"The schedule must identify the types of problems (e.g. malfunctions or deterioration) which are to be looked for during the inspection..."
265.15(b)(4)	"The frequency of inspection...should be based on the rate of possible deterioration of the equipment...."
265.15(d)	"The owner or operator must record inspections in an inspection log or summary. He must keep these records for at least three years from the date of inspection. At a minimum, these records must include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions."
265.73(a)	"The owner or operator must keep a written operating record at his facility."
265.73(b)	"The following information must be recorded, as it becomes available, and maintained in the operating record until closure of the facility:..." (5) "Records and results of inspections..." (6) "Monitoring, testing, or analytical data..."
265.74(a)	"All records, including plans, required under this part must be furnished upon request, and made available at reasonable times for inspection..." "[The owner or operator must report to the Regional Administrator] Ground-water contamination and monitoring data as specified in §265.93 and 265.94..."

TABLE 1

Interim Status	Description
265.90(a)	"...the owner or operator of a surface impoundment, landfill, or land treatment facility ... must implement a ground-water monitoring program capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer..."
265.92(a)	"The owner or operator must obtain and analyze samples from the installed ground-water monitoring system. The owner or operator must develop and follow a ground-water sampling and analysis plan..."
265.92(a)	"...The plan must include procedures and techniques for: (1) Sample collection; (2) Sample preservation and shipment; (3) Analytical procedures; and (4) Chain of custody control.
265.94(a)(1)	"[The owner or operator must] keep records of the received analyses..., the associated ground-water surface elevations..."
265.94(a)(2)	"[The owner or operator must] report the following ground-water monitoring information to the Regional Administrator:" [annual reports of required ground-water monitoring results including ground-water elevation data].
Permit Status	Description
264.15(a)	"The owner or operator must inspect his facility for malfunctions and deterioration, operator errors, and discharges..."
264.15(b)(1)	"The owner or operator must develop and follow a written schedule for inspecting monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment..."
264.15(b)(2)	"He must keep this schedule at the facility."
264.15(b)(3)	"The schedule must identify the types of problems (e.g. malfunctions or deterioration) which are to be looked for during the inspection..."
264.15(b)(4)	"The frequency of inspection...should be based on the rate or possible deterioration or the equipment." "The owner or operator must record inspections in an inspection log or summary. He must keep these records for at least three years from the date of the inspection. At a minimum, these records must include the date and time of the inspection, the name of the inspector, a notation of

TABLE 1

Permit Status	Description
	the observations made, and the date and nature of any repairs or other remedial actions."
264.73(a)	"The owner or operator must keep a written operating record at his facility."
264.73(b)	"The following information must be recorded, as it becomes available, and maintained in the operating record until closure of the facility: "(5) Records and results of inspections... "(6) Monitoring, testing, or analytical data..."
264.74(a)	"All records, including plans, required under this part must be furnished upon request and made available at reasonable times for inspection...."
264.77(c)	"[The owner or operator must report to the Regional Administrator] As... required by Subpart F..."
264.97(a)(2)	"[The ground-water monitoring system must] represent the quality of groundwater passing the point of compliance."
264.97(d)	"The ground-water monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide a reliable indicator of groundwater quality below the waste management area. At a minimum, the program must include procedures and techniques for: (1) Sample collection; (2) Sample preservation and shipment; (3) Analytical procedures; and (4) Chain of custody control."
264.97(e)	"The ground-water monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in ground-water samples."
264.97(f)	"The ground-water monitoring program must include a determination of the groundwater surface elevation each time ground-water is sampled."
264.98(d)	"The owner or operator must determine ground-water quality at each

TABLE 1

Permit Status	Description
	monitoring well at the compliance point at least semi-annually [when conducting a detection monitoring program]..."
264.98(e)	"The owner or operator must determine the ground-water flow rate and direction in the uppermost aquifer at least annually [when conducting a detection monitoring program]."
264.98(f)	"The owner or operator must use procedures and methods for sampling and analysis that meet the requirements of §264.97 (d) and (e).
264.99(d)	"The owner or operator must determine the concentration of hazardous constituents in ground-water at each monitoring well at the compliance point at least quarterly [when conducting a compliance monitoring program]..."
264.99(e)	"The owner or operator must determine the ground-water flow rate and direction in the uppermost aquifer at least annually (when conducting a compliance monitoring program)."
264.100(g)	"The owner or operator must report in writing to the Regional Administrator on the effectiveness of the corrective action program. The owner or operator must submit these reports semi-annually."
270.30(e)	"In conjunction with a corrective action program, the owner or operator must establish and implement a ground-water monitoring program to demonstrate the effectiveness of the corrective action program. Such a monitoring program may be based on the requirement for a compliance monitoring program under §264.99..."
270.30(j)(1)	"The owner or operator must report in writing to the Regional Administrator on the effectiveness of the corrective action program. The owner or operator must submit these reports semi-annually."
270.14(c)(4)	The owner/operator must describe "...any plume of contamination that has entered the ground-water..."
270.30(e)	"Proper operation and maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training...."

TABLE 1

Permit Status	Description
270.30(h)	"The permittee shall furnish....within a reasonable time... copies of records required to be kept by this permit."
270.30(i)(2)	"Inspection and entry. The permittee shall allow the Director...to...have access to and copy, at resonable times... any records that must be kept under the conditions of this permit."
270.30(j)(1)	"Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity."
270.30(j)(2)	"The permittee shall retain records of all monitoring information, including all calibration and maintenance records,... copies of all reports required by this permit,...for a period of at least three years from the date of the sample...."
	"The permittee shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations for the active life of the facility, and for disposal facilities for the post-closure care period as well."
270.30(j)(3)	"Records for monitoring information shall include: (i) The date, exact place, and time of sampling or measurements; (ii) The individual(s) who performed the sampling or measurements; (iii) The date(s) analyses were performed; (iv) The analytical techniques or methods used; and (v) The results of such analyses."
270.30(l)(1)	"Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility."
270.30 (l)(4)	"Monitoring efforts. Monitoring results shall be reported at the intervals specified elsewhere in this permit."

It is important to note that these regulations should not be read and applied individually. They were written to be applied in a conjunctive manner. Some of the regulations listed in Table 1 are broad in nature whereas some are very specific as to actions or conditions that are required of the owner/operator. When taken as a whole, these regulations require owner/operators to design and implement a comprehensive operation and maintenance program for ground-water monitoring systems. They also give EPA the authority to take action against those owner/operators who fail to do so. Section Five in this guide, describes how these specific regulations relate to "Compliance Decision-making" violations EPA is likely to encounter.

1.3 Relationship of the Operation and Maintenance Inspection to Other RCRA Inspections

There are four types of RCRA compliance inspections that exist in addition to the O&M inspection. They are: the Comprehensive (Ground Water) Monitoring Evaluation (CME); the RCRA Compliance Evaluation Inspection (CEI); the RCRA Case Development Inspection (CDI); and the RCRA Laboratory Audit Inspection (LAI). Each of these inspections (with the exception of the LAI) is described in the FY 1988 RCRA Implementation Plan.

Section 1.1 described, in general, the relationship between the CME and the O&M inspection. The O&M inspection is less resource-intensive than the CME, is conducted more frequently, focuses on less detail than the CME, and often acts as a trigger for additional enforcement actions in the form of a Case Development Inspection. All RCRA land disposal facilities will receive either a CME or an O&M inspection each year. All RCRA land disposal facilities which accept wastes from Superfund sites must receive a CME each year. Up to one-third of the RCRA land disposal facilities in total will receive a CME each year. The rest of the population of land disposal facilities will receive an O&M inspection.

A Case Development Inspection is a comprehensive effort to compile evidence to support litigation or administrative enforcement actions against an owner/operator or to establish the need for such actions. Case Development Inspections are often performed on an as-needed basis in response to the results from other RCRA inspections (e.g., O&M, CEI, CME). The O&M inspection may, thus, act as a trigger for CDI.

A Compliance Evaluation Inspection is an examination of all aspects of a facility's compliance with the RCRA regulations. CEIs are conducted more

frequently than O&M inspections and are more general in their scope and application.

EPA has designed the RCRA Laboratory Audit Inspection (LAI) to ensure that ground-water samples are analyzed properly in the laboratory and that the laboratory produces high quality analytical data. The RCRA O&M inspection focuses heavily on the field performance of the owner/operator's staff in collecting ground-water samples and on the evaluation of the integrity of the owner/operator's monitoring system. Thus, the O&M inspection focuses on those activities and procedures which ensure the collection of representative ground-water samples. The LAI focuses on those activities and procedures which ensure the generation and reporting of high quality analytical data.

1.4 The Operation and Maintenance Inspection Process

The Operation and Maintenance inspection requires the participation of a variety of persons including: field inspectors; enforcement officials (chemists, hydrogeologists, and/or engineers); and enforcement counsel. Table 2 illustrates the generic process regions and states follow in conducting an O&M inspection. It is important to note the regions and states may, in fact, use variants of the generic process. The process is not as limited as illustrated in Table 2.

In Step 1, the field inspector and the enforcement official will meet. The purpose of their meeting is to plan out the field portion of the O&M inspection. They will review the owner/operator's sampling and analysis program, review enforcement and permitting actions taken to date at the facility, review the owner/operator's operation and maintenance program, and prepare a list of site-specific observations the field inspector should make at the facility. In addition to planning out site-specific activities during Step 1, the inspector should make a decision as to the type and level of health and safety protection that is needed during the inspection (refer to the *RCRA Inspection Manual* for guidance). After completion of Step 1, the field inspector will be prepared to conduct the field portion of the O&M inspection.

In Step 2, the field inspector will visit the facility. The field inspector will complete the O&M inspection report form and carry out any special instructions generated during Step 1.

TABLE 2
Overview of the
Operation And Maintenance Inspection

	STEP	WHO	WHAT
1.	Office preparation for field inspection	• Enforcement official • Field inspector	• Review owner/operator's sampling and analysis program • Review enforcement and permitting actions taken to date • Review the owner/operator's O&M program • Prepare site-specific inspection instructions
2.	Field inspection	Field inspector	• Fill out generic O&M inspection report • Carry out special instructions
3.	Post-inspection debriefing	• Enforcement official • Field inspector	• Review O&M inspection report and inspector's observations • Make decision – Initiate a Case Development Inspection – No enforcement action – Go to step 4
4.	Enforcement follow-up	• Enforcement official • Enforcement counsel	• Issue complaint for violations

In Step 3, the field inspector and the enforcement official will meet again. They will review the O&M inspection report form and discuss the inspector's observations. The enforcement official will make a decision to pursue one of the following actions:

- initiate a Case Development Inspection,
- issue a compliant, or
- take no further action.

If enforcement action is warranted, the enforcement official will meet with counsel. They will prepare and issue a complaint to the owner/operator for violations detected through the O&M inspection.

SECTION TWO

OFFICE PREPARATION FOR THE FIELD INSPECTION

The field inspector and the enforcement official work together in preparation for the O&M field inspection. There are four tasks the field inspector and the enforcement official must complete prior to the field inspection. They are:

1. Review and summarize the enforcement and permitting actions taken to date at the facility.
2. Review and summarize owner/operator's sampling and analysis program.
3. Review and summarize owner/operator's O&M program.
4. Prepare site-specific inspection objectives.

The field inspector and the enforcement official will use Part One of the Operation and Maintenance Inspection Form (RCRA Ground-Water Monitoring Systems) to guide them through the tasks listed above. It has been written so that when the field inspector and the enforcement official complete it, they will know:

- the number and location of monitoring wells and piezometers at the facility;
- the procedures and techniques the owner/operator uses to collect ground-water samples;
- the details of the owner/operator's operation and maintenance program in place at the facility; and
- the existence and nature of any permitting or enforcement action which may affect the field inspection.

SECTION THREE

THE FIELD INSPECTION

The field inspector will complete four tasks during the field inspection. They are:

1. Review the operating record to identify evidence of deficiencies in the owner/operator's sampling and/or operation and maintenance program.
2. Visually inspect each well and piezometer for evidence of damage or deterioration.
3. Obtain site data (i.e., depth to water and depth to bottom of well) for each well and piezometer.
4. Visually observe the owner/operator's sampling crew as they collect ground-water samples.

The field inspector will use Part Two of the Operation and Maintenance Inspection Form (RCRA Ground-Water Monitoring Systems) to guide him/her through the tasks listed above. Part Two has been written so when completed, the field inspector will have:

- assessed whether the owner/operator's sampling crew departed from written sampling and analysis procedures contained in the owner/operator's sampling and analysis plan (interim status) or in the owner/operator's RCRA permit (permit status);
- identified deficiencies in the owner/operator's program to ensure ongoing maintenance of sampling devices and monitoring wells/piezometers;
- identified deficiencies in the owner/operator's operating record; and
- collected field data that will allow the enforcement official to construct potentiometric maps and assess the viability of individual wells.

SECTION FOUR

COMPLIANCE DECISION-MAKING

The field inspector and the enforcement official will meet after the field inspection and review Parts One and Two of the Operation and Maintenance Inspection Form (RCRA Ground-Water Monitoring Systems). With the inspector's help, the enforcement official will complete three tasks. The enforcement official will:

1. Construct a potentiometric map using data collected by the field inspector and compare the map to those generated by the owner/operator.
2. Identify violations in the owner/operator's sampling program and/or operation and maintenance program (use table as a guide).
3. Identify wells with siltation problems or other problems which may compromise the integrity of the wells.

After the enforcement official has completed the tasks above, he/she will choose one of following four options:

1. By virtue of the evidence collected by the field inspector, there are sufficient grounds to issue a complaint: work with enforcement counsel to develop and issue the complaint.
2. By virtue of the evidence collected by the field inspector, there may be sufficient grounds to pursue an enforcement action: initiate a Case Development Inspection.
3. The field inspection has not indicated compliance problems at the facility or problems are minor in nature: do not pursue additional enforcement action.
4. There is cause for concern that the owner/operator may need to redesign all or a portion of the monitoring system. Concern is not great enough, however, to prompt the initiation of a Case Development Inspection. Prepare detailed notes for the file describing how the next CME at the facility should be focused.

APPENDIX B

Generic Operation and Maintenance Inspection Form

Part One—Pre-Inspection Planning Guide
Part Two—Field Inspection Guide
Part Three—Compliance Decision Making

APPENDIX B

Part One

Pre-Inspection Planning Guide

PART ONE

The field inspector and the enforcement official will meet and complete four tasks. Those tasks are: 1) review enforcement and permitting actions taken to date at the facility, 2) review the owner/operator's sampling and analysis program, 3) review the owner/operator's O&M program, and 4) prepare site-specific inspection objectives.

1. Facility identification number _____
2. Name of facility contact _____
phone number () _____
3. Address of facility _____

4. Does the facility have:
- Interim Status? (go to 5a)
 - detection monitoring
 - assessment monitoring
 - corrective action (§3008(h))

- Permit Status? (go to 5b)
 - detection monitoring
 - compliance monitoring
 - corrective action

5a. Past actions taken at facility (interim status)

Type

Date(s)

- Operation and Maintenance Inspection _____
- Comprehensive (Ground-Water) _____
- Monitoring Evaluation _____
- Case Development Inspection _____
- RCRA Facility Assessment _____
- Compliance Evaluation Inspection _____
- Ground-Water Task Force Investigation _____

Complete the following questions in regard to the actions listed on the previous page:

- Do you have a copy of completed inspection reports or site studies? Yes ____ No ____
- For each, summarize deficiencies identified in the owner/operator's sampling program and/or the owner/operator's operation and maintenance program.

Go to 6a.

5b. Actions taken at the facility (permit status)

<u>Type</u>	<u>Date</u>
• Permit Issuance	_____
• Operation and Maintenance Inspection	_____
• Comprehensive (Ground-Water)	_____
• Monitoring Inspection	_____
• Case Development Inspection	_____
• Compliance Evaluation Inspection	_____
• Other	_____

Complete the following in regard to the actions listed above:

- Do you have a copy of the permit and copies of inspection reports completed after permit issuance? Yes ____ No ____
- Summarize deficiencies identified after permit issuance regarding the owner/operator's operation and maintenance program.

Go to 6b

6a. Identify enforcement actions issued to the facility in regard to interim status violations.

<u>Action</u>	<u>Date(s)</u>
• §3008(a) complaint/order	_____
• §3013 complaint/order	_____
• §3008(h) complaint/order	_____
• §7003 complaint/order	_____
• Referral for litigation	_____
• Other	_____

Complete the following regarding the actions listed above:

- For each, identify if the enforcement action is focused on the owner operator's sampling and analysis program and/or the owner/operator's operation and maintenance program. Summarize relevant requirements imposed on the owner/operator.

Go to 7

6b. Identify enforcement actions issued to the facility after the permit issuance date.

<u>Action</u>	<u>Date(s)</u>
• §3008(a) complaint/order	_____
• §3013 complaint/order	_____
• §3008(h) complaint/order	_____
• §7003 complaint/order	_____
• Referral for litigation	_____
• Other	_____

Complete the following regarding the actions listed above:

- For each, identify if the enforcement action focused on the owner/operator's sampling and analysis program and/or the owner/operator's operation and maintenance program. Summarize relevant requirements imposed on the owner/operator.

Go to 7

7. Review and summarize the owner/operator's sampling and analysis plan. (Note: Revise or add to the table if permit conditions dictate a different requirement the owner/operator must follow.) Does the Sampling and Analysis Plan:	Y/N
Include provisions for the measurement of static water elevations in each well prior to each sampling event?	
Specify the device to be used for measuring water level elevations?	
Specify the procedure for measuring water levels?	
Provide for the measurement of depth to standing water and depth to the bottom of the well to 0.01 feet?	
Explain whether dedicated or non-dedicated sampling equipment is used and the type of sampling equipment?	
Describe procedures for evacuating wells?	
Provide for the use of sampling devices constructed of inert materials such as fluorocarbon resin or stainless steel?	
Provide for dedicated sampling devices for each well or alternately provide for decontamination of sampling devices and the collection of blanks between wells?	
Provide for the collection and containerization of samples in the order of volatilization potential?	
Identify the preservation methods and sample containers the owner/operator will use?	
Describe procedures for transferring samples to off-site laboratories?	
Describe a chain-of-custody program which includes the use of sample labels, sample seals, field logbooks, chain-of-custody records, sample analysis request sheets, and laboratory logbooks?	
Include provisions for collection of field, trip, and equipment blanks?	
Include an inventory of sampling equipment and sampling devices used as part of the monitoring program?	
Include detailed operating, calibration, and maintenance procedures for each sampling device?	

(Continued)

(Continued from previous page)	Y/N
Include maintenance schedules for sampling equipment? (Refer to Appendix D for discussion of maintenance techniques for gas bladder pumps.)	
Include decision criteria to be used to replace or repair sampling equipment and/or monitoring wells?	
*Describe in detail sample handling procedures in place at the owner/operator's laboratory (refer to RCRA Laboratory Audit Inspection Guide for more detail)?	
*Describe in detail the procedures that will be used to perform analyses in the owner/operator's laboratory (refer to RCRA Laboratory Audit Inspection Guide for more detail)?	
*Describe in detail quality assurance/quality control procedures in place? (refer to RCRA Laboratory Audit Inspection Guide for more detail.)	

***NOTE:** *The RCRA Laboratory Audit Inspection Guide (RCRA Ground-Water Monitoring Systems)* describes the information the owner/operator should include in the Sampling and Analysis Plan regarding the owner/operator's laboratory program. The inspector may want to supplement the checklist in this manual with the checklist in the *RCRA Laboratory Audit Inspection Guide* while planning an operation and maintenance inspection.

Go to 8

COMMENTS ON SAMPLING AND ANALYSIS PLAN

8. Complete the following table. Use a separate entry for each well and piezometer in the monitoring system:

Identification Number	Type of Well Sampling Equipment (pump or bailer)	Depth to Water Last Inspection (if available)	Depth to Bottom Last Inspection (if available)	Notes/Comments
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				

After working through Part One, the enforcement official and the field inspector should know:

- the number and location of monitoring wells and piezometers at the facility;
- the procedures and techniques the owner/operator uses to collect ground-water samples;
- the details of the owner/operator's operation and maintenance program in-place at the facility; and
- the existence and nature of any permitting or enforcement action which may affect the field inspection.

The inspector will need the following equipment to conduct the field inspection:

- facility map with locations of wells and piezometers
- bound field notebook
- camera
- weighted tape measure or electronic water level indicator (made of inert material),
- deionized water, hexane (or laboratory strength cleaner), and sterile, disposable paper towels or gauze for decontamination of tape measure or probe
- surveyor's chain

(Note: additional equipment will be needed if the inspector wishes to obtain a split sample from the owner/operator.)

APPENDIX B

Part Two

Field Inspection Guide

PART TWO

The field inspector will complete four tasks during the field inspection. They are:

- 1) review the operating record to identify evidence of deficiencies in the owner/operator's sampling and/or operation and maintenance programs; 2) visually inspect each well and piezometer for evidence of damage or deterioration; 3) obtain measurements from the operations record of depths of water levels and well depths for each well and piezometer; and 4) visually observe the owner/operator's field crew as they collect ground-water samples.

Name of inspector(s) _____

Date(s) of inspection _____

1. Review the operating record of the facility.	Y/N
Does the operating record:	
Include annual reports of ground-water monitoring results including ground-water level data from each well and piezometer in the monitoring system?	
Include an inventory of all sampling devices and purging equipment in use at the facility and information on model number, serial number and manufacturers name?	
Include detailed operating, calibration and maintenance procedures for each sampling device?	
Describe decision criteria to be used to replace or repair sampling equipment and/or monitoring wells?	
Include schedules for performing operation and maintenance activities related to the ground-water monitoring system?	
Include records for ground-water monitoring which provide information on 1) the date, exact place and time of sampling or measurements; 2) the individual(s) who performed the sampling or measurements; 3) the date(s) analyses were performed; 4) the analytical techniques or methods used; and 5) the results of such analyses?	
Include records of all monitoring information including all calibration and maintenance records?	
Include records of monitoring information including determination of ground-water surface elevations?	
Include a determination of ground-water flow rate and direction(s) in the uppermost aquifer on an annual basis (e.g., prepare a potentiometric map annually using data collected during the year)?	
Provide for more frequent and intensive inspection of wells constructed of non-inert casing such as PVC? (Refer to Appendix A for permit example.)	

COMMENTS ON OPERATING RECORD

2. Visually inspect each well and piezometer and complete the table below (one line entry for each well or piezometer):

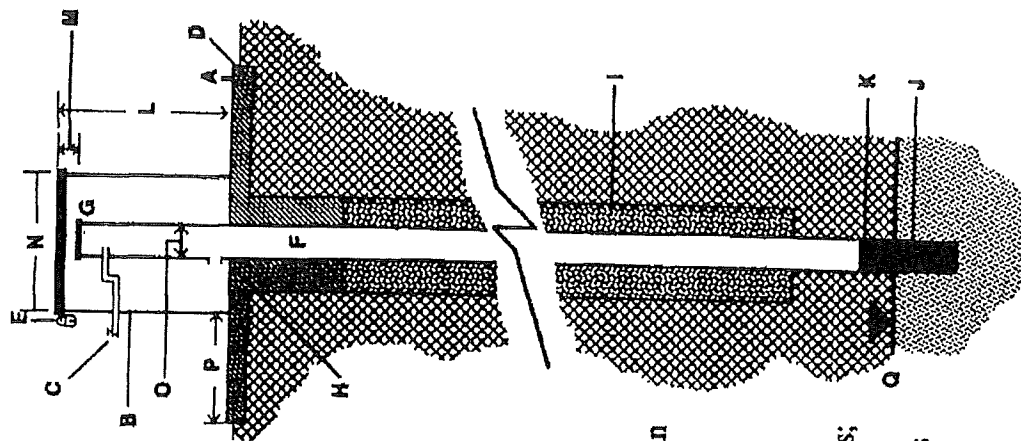
[illegible]

3. Obtain data on depth to standing water and depth to the bottom of each monitoring well and piezometer in the owner/operator's monitoring system. Record depth measurements to the nearest 0.01 feet. Record the measurements

Date	Well/ Piezometer I.D. No.	Depth to Water (0.01")	Depth of Well/ Piezometer (0.01')

Key:

- A - survey elevation mark
- B - protective outer casing
- C - gas vent
- D - concrete apron
- E - fitted lock
- F - primary casing material
- G - cap for primary casing
- H - bore hole seal
- I - annular space seal
- J - well screen
- K - filter pack
- L - height of riser
- M - elevation difference
- N - diameter of outer casing
- O - diameter of primary casing
- P - radius of apron
- Q - water level below surface



1. The field inspector has several options in collecting ground water elevation data.

The inspector may:

- a. obtain past data from the operating record; and/or
- b. take his/her own depth measurements; and/or
- c. obtain data from the owner/operator's sampling crew.

4. Observe the owner/operator's staff as they collect ground-water samples at several wells. Complete the following table for each well (Note: revise or add to the table if permit conditions dictate a different requirement the owner/operator must follow):

Position/Title	Name	Sampling Experience (years and type)

Well Identification Number _____	Y/N	Photograph Taken Y/N
Did the sampling crew measure static water levels in the well and well depths prior to the sampling event?		
Did the sampling crew use a steel tape or electronic device to take depth measurements?		
Did the sampling crew record depths to +/- 0.01 feet?		
Did the sampling crew follow these procedures: 1. remove locking and protective cap; 2. sample the air in the well head for organic vapors; 3. determine the static water level; and 4. lower an interface probe into the well to detect immiscible layers.		
If immiscible samples were collected, were they collected prior to well purging?		
Did the sampling crew evacuate low yielding wells to dryness prior to sampling?		
Did sampling crew evacuate high yielding wells so that at least three casing volumes were removed?		
Did the sampling crew collect the purge water for storage and analysis or for shipment off-site to a RCRA treatment facility?		
Were sampling devices constructed of fluorocarbon resins or stainless steel?		

Well Identification Number _____	Y/N	Photograph Taken Y/N
If the sampling crew used dedicated samplers, did they disassemble and thoroughly clean the devices between samples?		
If samples are collected for organic analyses, did the cleaning procedure include the following steps: 1. non phosphate detergent wash 2. tap water rinse 3. distilled/deionized water rinse 4. acetone rinse 5. pesticide-grade hexane rinse?		
If samples are collected for inorganic analyses, does the cleaning procedure include the following steps: 1. dilute acid rinse (HNO₃ or HCL) 2. distilled/de-ionized water rinse?		
Did the sampling crew take trip blanks, field blanks and equipment blanks?		
If the sampling crew used bailers, were they bottom valve bailers?		
If the sampling crew used bailers, was "teflon" coated wire, single strand stainless steel wire or monofilament used to raise and lower the bailer?		
If the sampling crew used bailers, did they lower the bailer slowly to the well?		
If the sampling crew used bailers, were the bailer contents transferred to the sample container to minimize agitation and aeration?		
Did the sampling crew take care to avoid placing clean sampling equipment, hoses, and lines on the ground or other contaminated surfaces prior to insertion in the well?		
If the sampling crew used dedicated bladder pumps: Was the compressed gas from an oilless compressor certified quality commercial compressed gas cylinder? If not, was a suitable oil removal purification system installed and maintained?		
Was the bladder pump controller capable of throttling the bladder pump discharge flow to 100 ml/min or less for continuous periods of at least 20-30 seconds without restricting liquid discharge?		

(Continued)

Well Identification Number _____	Y/N	Photograph Taken Y/N
Were samples taken from the bladder pump discharge tube, and not from any purge device discharge tube?		
Was the bladder pump discharge flow checked for the presence of gas bubbles before each sample collection, as a test for bladder integrity?		
Was bladder pump flow performance monitored regularly for dropoff in flow rate and discharge volume per cycle?		
Was the bladder pump incorporated in a combination sample-purge pump design which can expose the bladder pump interior and discharge tubing to the pump drive gas? If so, were operating procedures established and followed to prevent at all times the entry of drive gas into the sample flow or into the bladder pump interior?		
Did the sampling crew collect and containerize samples in the order of the volatilization sensitivity of the parameters?		
Did the sampling crew measure the following parameters in the field: pH, temperature; specific conductance?		
Did the sampling crew sample background wells before sampling downgradient wells?		
Did the sampling crew use fluorocarbon resin or polyethylene containers with polypropylene caps for samples requiring metals analysis?		
Did the sampling crew use glass bottles with fluorocarbon resin-lined caps for samples requiring metals analysis?		
If metals were the analytes of concern, did the sampling crew use containers cleaned with nonphosphate detergent and water, and rinsed with nitric acid, tap water, hydrochloric acid, tap water and finally Type II water?		
If organics were the analytes of concern, did the sampling crew use containers cleaned with nonphosphate detergent, rinsed with tap water, distilled water, acetone, and finally pesticide quality hexane?		
Did the sampling crew filter samples requiring analysis for organics?		

COMMENTS ON SAMPLING PROGRAM

After working through Part Two, the field inspector will have:

- assessed whether the owner/operator's sampling crew departed from written sampling and analysis procedures as contained in the owner/operator's sampling and analysis plan (interim status) or in the owner/operator's RCRA permit (permit status);
- identified deficiencies in the way the owner/operator's sampling crew collected ground-water samples;
- identified deficiencies in the owner/operator's program to ensure on-going maintenance of sampling devices and monitoring wells/piezometers;
- identified deficiencies in the owner/operator's operating record (Does the operating record have all the information in it that is required?); and
- collected field data that will allow the enforcement official to construct potentiometric maps and assess the viability of individual wells.

APPENDIX B

Part Three

Compliance Decision-Making

PART THREE

The field inspector and enforcement official will meet after the field inspection and review Parts One and Two. The enforcement official will construct a potentiometric or water table contour map using data collected by the field inspector. The enforcement official will compare ground-water flow directions (as indicated on the potentiometric map) by the owner/operator. (Note: the enforcement official will find owner/operator generated maps in the Part B permit application, in annual reports and/or from on-site records collected by the field inspector.) Significant differences in direction of flow may trigger a closer look at the owner/operator's data. The enforcement official will also identify evidence of violations in the owner/operator's sampling or operation and maintenance program. After completion of this exercise, the enforcement official will take one of the following actions:

- issue a complaint in conjunction with enforcement counsel for violations uncovered by the field inspector;
- initiate a Case Development Inspection to gather additional information;
- take no follow-up action (no evidence of violations); or
- take no follow-up action but prepare instructions to guide a future CME at the facility.

1. Construct a potentiometric (or water level contour) map using water level data collected by the field inspector. Does the direction of ground-water flow match owner/operator generated information? Y/N
 - If yes, go to 2.
 - If no, go to 1a.
- 1a. Use all past water level information generated by the owner/operator and redraw the potentiometric map(s). Does the direction of ground-water flow match information on the owner/operator's map(s)? Y/N
 - If yes, go to 2.
 - If no, consider initiating a Case Development Inspection.
2. Compare well depth information collected by the field inspector to design specifications of each well in the system. Identify wells with siltation problems. For wells with siltation problems, consider issuing an order to the owner/operator requiring the redevelopment or abandonment of the well.
3. Use Table 3 and check violations (or possible violations) uncovered by the field inspector.
4. Choose one of the following options:
 - By virtue of the evidence collected by the field inspector, there are sufficient grounds to issue a complaint. Work with enforcement counsel to develop and issue the complaint. Go to 5.
 - By virtue of the evidence collected by the field inspector, there may be sufficient grounds to pursue an enforcement action. Initiate a Case Development Inspection.
 - The field inspection has not indicated compliance problems at the facility or problems are minor in nature. Do not pursue additional enforcement action.
 - There is cause for concern that the owner/operator may need to redesign all or a portion of the monitoring system. Concern is not great enough, however, to prompt the initiation of a Case Development Inspection. Prepare detailed notes for the file describing how the next CME at the facility should be focused.

Relationship of Technical Inadequacies to Ground-Water Standards

This table illustrates examples of situations which may constitute noncompliance on the part of the owner/operator. The enforcement official should apply this table in determining if an enforcement action is warranted on a site-specific basis.

Regulatory Objectives	Examples of Technical Inadequacies That May Constitute Violations	Regulatory Citations
1. Owner/Operator must follow specified procedures for collecting ground-water samples	• Failure of owner/operator's sampling crew to follow written sampling and analysis plan for collecting ground-water samples (interim status) • Failure of owner/operator's sampling crew to follow permit conditions related to the collection of ground water samples (permit status)	265.92(a) 264.97(d) 264.97(e) 264.98(f) 264.99(g)
2. Owner/Operator must maintain an operating record	• Failure of owner/operator to keep a written operating record • Failure of owner/operator to keep the operating record on- site • Failure of the owner/operator to maintain an operating record which covers all O&M activities for the prior three years (i.e., gaps in the operating record) • Inability of owner/operator to produce a complete operating record at the time of inspections	264.73(a) 265.73(a) 264.73(b) 265.73(b) 270.30(j)(2) 264.73(b) 265.73(b) 270.30(j)(2) 264.74(a) 265.74(a) 270.30(h) 270.30(i)(2)h
3. Owner/Operator must implement a suitable operation and maintenance program for ground-water monitoring systems	• Failure of owner/operator to develop an inventory of all sampling devices and purging equipment in use at the facility including information on model number, serial number and manufacturer's name • Failure of owner/operator to develop detailed operating, calibration and maintenance procedures for each sampling device	265.15(b)(1) 264.15(b)(1) 270.30(j)(2) 264.15(b) 265.15(b) 270.30(e)

Regulatory Objectives	Examples of Technical Inadequacies that May Constitute Violations	Regulatory Citations
3. Owner/operator must implement a suitable operation and maintenance program for ground water monitoring systems (continued)	• Failure of owner/operator to describe decision criteria to be used to replace or repair sampling equipment and/or monitoring wells • Failure of owner/operator to maintain schedules for performing operation and maintenance activities related to the ground-water monitoring system • Failure of the owner/operator to maintain records for ground-water monitoring which provide information on 1) the date, exact place, and time of sampling or measurement; 2) the individual(s) who performed the sampling or measurement; 3) the date(s) analyses were performed; 4) the analytical techniques or methods used; and 5) the results of such analyses • Failure of the owner/operator to maintain records of all monitoring information including all calibration and maintenance records • Failure of the owner/operator to maintain records of monitoring information including determination of ground-water surface elevations • Failure of the owner/operator to assess ground-water flow rate and direction(s) in the uppermost aquifer on an annual basis (e.g., each year draw potentiometric maps(s) using data collected during the year) • Failure of the owner/operator to develop procedures to assess degradation of well casing (refer to Appendix A and question #13 in Appendix D)	270.30(e) 264.15(b)(3) 265.15(b)(3) 264.15(b) 265.15(b) 264.73(b)(6) 264.15(b)(2) 270.30(j)(2) 270.30(j)(3) 265.73(b)(5) 265.73(b)(6) 270.30(j)(2) 270.30(j)(2) 265.73(b) 264.73(b)(6) 265.74(a) 264.74(a) 265.94(a)(1) 264.97(f) 265.94(a)(1) 264.98(e) 264.99(e) 270.30(e) 264.15(b)(1) 265.15(b)(1) 264.15(b)(3) 265.15(b)(3) 264.15(b)(4) 265.15(b)(4)

Regulatory Objectives	Examples of Technical Inadequacies that May	Regulatory Citations
4. Owner/Operator must ensure the continued integrity of individual wells in the monitoring system	• Wells in monitoring system are silted in • Wells in monitoring system are cracked, corroded, or degraded • Wells show high levels of pH • Wells show evidence of frost heaving, subsidence, or collision damage • Wells show evidence of biological fouling • The hydraulic performance characteristic(s) of wells changes • Ground-water elevation data collected by field inspector indicate wells are improperly placed • Owner/operator does not replace wells which have failed	265.91(a) 265.91(c) 264.97(a) 264.97(c)
5. Owner/Operator's ground-water monitoring system must continue to satisfy its design objectives	• Ground-water elevation data collected by field inspector indicate wells are improperly placed • Owner/operator does not replace wells which have failed	270.30(e) 265.91(a) 265.91(c) 264.97(a)
6. Owner/Operator must collect ground-water samples properly	• Failure to evacuate stagnant water from the well before sampling • Failure to sample wells within a reasonable amount of time after well evacuation • Improper decisions regarding filtering or non-filtering of samples prior to analysis (e.g., use of filtration on samples to be analyzed for volatile organics)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)

TABLE 3

Regulatory Objectives	Samples of Technical Inadequacies that May	Regulatory Citations
6. Owner/Operator must collect ground-water samples properly	• Use of an inappropriate sampling device • Use of improper sample preservation techniques • Samples collected with a device that is constructed of materials that interfere with sample integrity • Samples collected with a non-dedicated sampling device that is not cleaned between sampling events • Improper use of a sampling device such that sample quality is affected (e.g., degassing of sample caused by agitation of bailer) • Improper handling of samples (e.g., failure to eliminate headspace from containers of samples to be analyzed for volatiles) • Failure of the sampling plan to establish procedures for sampling immiscibles (i.e., "floaters" and "sinkers") • Failure to follow appropriate QA/QC procedures	(See previous page)

(Continued)

TABLE 3

Regulatory Objectives	Examples of Technical Inadequacies that May	Regulatory Citations
6. Owner/Operator must collect ground-water samples properly	• Failure to ensure sample integrity through the use of proper chain-of-custody procedures • Failure to demonstrate suitability of methods used for sample analysis other than those specified in SW-846 • Failure to perform analysis in the field on unstable parameters or constituents (e.g., pH, Eh, specific conductance, alkalinity, dissolved oxygen) • Use of sample containers that may interfere with sample quality (e.g., synthetic containers used with volatile samples) • Failure to make proper use of sample blanks	(See previous page)

5. Keep the following questions in mind as you write the complaint:
- What specific regulatory violations do you plan to cite in the complaint?
 - Is the evidence (i.e., field observations) collected by the field inspector unassailable?
 - What do you want the owner/operator to change or add to the operation and maintenance program?
 - What do you want the owner/operator to change or add to the sampling program?

SAMPLING AND ANALYSIS PLAN

EVANITE PERFORMANCE MONITORING PROGRAM

Evanite Fiber Corporation
Corvallis, Oregon

DEQ ECSI File Number: 40

Prepared for:

EVANITE FIBER CORPORATION
1115 SE Crystal Lake Drive
Corvallis, Oregon 97333

Prepared by:

PNG ENVIRONMENTAL, INC.
1122-03
March 3, 2009

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Appendix B – Field Forms

- Field Report Form
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- Well Development Data Form
- Groundwater Sample Collection Form
- Chain-of-Custody Form
- Photo Log Form

Appendix C – Quality Assurance Project Plan (QAPP)

1 INTRODUCTION

This document presents the Sampling and Analysis Plan (SAP) for the Performance Monitoring Program at the Evanite Fiber Corporation (Evanite) site located in Corvallis, Oregon (Figure 1). Specific objectives for the performance monitoring program are described in the Evanite Performance Monitoring Report dated December 19, 2008 (PNG 2008c). The Evanite facility has been engaged in continuous remedial action with U.S. Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (DEQ) approval since April 30, 1990. The Evanite Performance Monitoring Program is based on comments provided by DEQ in a letter dated September 22, 2008.

Monitoring of the Evanite hydraulic containment system will be conducted in conjunction with the field activities described in the main text of this SAP. When practical, limited procedural changes can be made to this plan as long they are documented and minimum Quality Assurance/Quality Control (QA/QC) requirements are met. The reason for the change in procedure will be noted in the daily field reports.

1.1 SITE DESCRIPTION AND BACKGROUND

The Evanite site is located at 1115 SE Crystal Lake Drive in Corvallis, Oregon. The history of the site and surrounding area and summaries of previous investigations are presented in the Focused Feasibility Study (FFS) (Kennec 2007).

1.2 SUPPORTING DOCUMENTS

The Evanite Focused Feasibility Study Pilot Test Conceptual Work Plan (PNG 2008a) and Performance Monitoring Program for the Evanite hydraulic containment system (PNG 2008c) provide the overall objectives, approach, and rationale for the performance monitoring program. The FFS (Kennec 2007) provides historic background information and information on previous studies and existing data.

Project-specific Standard Operating Procedures (SOPs) referenced in this SAP are provided in Appendix A. The SOPs describe specific procedures and methods to be used for the field and laboratory activities. Examples of standard field forms to be used during the completion of fieldwork described in the SAP are included in Appendix B.

The Quality Assurance Project Plan (QAPP), which details quality assurance goals, requirements, and guidelines for all sample analyses, is provided as Appendix C.

Prior to implementation of any field activities, the site specific Health And Safety Plan (HASP) will be reviewed and updated if necessary to address possible health hazards that could be encountered during fieldwork and the procedures to be followed to protect personnel. The HASP can be found in the Neighborhood Monitoring Well Installation Work Plan (PNG, 2008b).

2 SAMPLING OBJECTIVES

The Performance Monitoring Plan includes a full discussion of the data needs and objectives for monitoring of the Evanite hydraulic containment system.

The performance monitoring program represents the optimal data collection necessary to document performance of the groundwater, Dense Non-Aqueous Phase Liquid (DNAPL), and offgas systems associated with the long-term or baseline operations. In general, performance monitoring of the active containment system and the groundwater plume with dissolved phase volatile organic compounds (VOCs) is necessary for several reasons:

- Confirmation and optimization of overall hydraulic containment and capture zone.
- Characterization of natural attenuation in specific plume zones.
- Characterization of offsite chlorinated plume(s) migrating onto Evanite.
- Evaluation of dissolved phase plume flushing in intermediate and low concentration areas.
- Evaluation of mass reduction in the source zone related to depleted DNAPL.
- Confirmation of adequate control to prevent discharge of unacceptable contaminant to the rivers.

Performance data includes groundwater quality, hydraulic measurements, remedial system physical parameters, and treatment system engineering and chemical parameter data. This SAP covers all field activities specifically associated with the hydraulic containment system performance monitoring program. Field activities and procedures for additional pilot testing and/or investigation related work, and where not discussed in this SAP, will be addressed in a SAP addendum after scoping of additional work is complete.

A general outline of sampling locations, frequency, and overall data collection needs can be found in the Evanite Performance Monitoring Program Report (PNG 2008c). Data collection is split into quarterly, semi-annual, and annual categories based on historic water quality data, well location, and system parameters.

3 SAMPLING METHODS AND PROCEDURES

Standard operating procedures to be employed during execution of this work plan are included in Appendix A. Sampling methods and procedures that will be used in conjunction with the performance monitoring program include: groundwater monitoring and sampling, well development, decontamination, surveying, and management of investigation-derived wastes (IDW). Details of these procedures are provided below.

3.1 GROUNDWATER MONITORING PROCEDURES

Groundwater monitoring procedures will include the collection of depth to water and immiscible liquid measurements followed by the collection of water samples for chemical analysis. The procedures to perform groundwater monitoring tasks are provided in detail below and outlined in SOPs attached in Appendix A.

3.1.1 Water Level Measurement

Water level monitoring at the site will be done on a quarterly basis at all wells and at individual/groups of wells during any sample collection activities related to the pilot testing program. The well caps will be removed from each monitoring well prior to sampling to allow water levels to equilibrate. Since volatile organics are a target constituent for the site, a PID reading will be recorded from the top of the wellhead level with the well casing. This reading will be recorded along with any breathing zone monitoring on the Daily Safety Monitoring Record Form or Groundwater Sample Collection Form (Appendix B).

Depth to groundwater will be measured in each well using an electronic water level sounder or interface probe as described in SOP 10. Water levels will be recorded on appropriate field documentation forms (Appendix B) for each respective monitoring well. If separate-phase product is encountered, the thickness will be recorded. All instruments will be decontaminated between measurement events. If the relative chemical concentration of any chemicals in the wells is known from earlier sampling events or local groundwater flow conditions, the upgradient or "cleanest" wells will be measured first.

If multiple wells are to be sampled, all water level measurements will be performed first in as short of timeframe as possible to prevent any fluctuations in water table or piezometric surface due to purging. If more than one meter is used for measurements, the instruments will be "calibrated" for accuracy by comparison at the first well.

Periodically, wells will be sounded for verification of accuracy in construction documentation and/or buildup of materials in the sump or well screen. Sounding will be performed with a stainless steel weighted tape or water level sounder fitted with a stainless steel weight. Measurements will be accurate to 0.01 foot.

3.1.2 Dense Non-Aqueous Phase Liquid Screening

Quantitative screening for the presence of dense non-aqueous phase liquids (DNAPL) will be conducted on a quarterly basis within extraction wells, a semiannual basis for downgradient wells, and an annual basis for dissolved plume wells. The groundwater performance monitoring schedule from the Evanite Performance Monitoring Program Report (PNG, 2008c) is included as Table 1. DNAPL screening methods are outlined in SOP 9. The method used for DNAPL screening will change for each individual well

depending on well construction details, well function (e.g. extraction well or monitoring well), and feasibility.

3.1.3 Purging and Field Measurements

The wells will be purged and sampled using dedicated bladder plumps or when dedicated equipment is not available, using low-flow peristaltic, centrifugal, or submersible pumps as described in SOPs 13, 14, 17, and 19. To the extent known, wells with undetected contaminants or the lowest concentrations of contaminants will be sampled first.

Low-flow sampling methodology will be used to obtain formation representative groundwater samples. Low-flow methodology is preferred as it minimizes well disturbance and aggravated colloid transport into samples obtained from monitoring wells, as well as minimizing IDW waters. The purging rate will be no higher than 0.1 gallons per minute (gpm). All measurements will be recorded on the Groundwater Sampling Form (Appendix B). Should groundwater quality parameters fail to stabilize per low-flow methodology the volume of water in each well will be calculated and a minimum of three casing volumes will be extracted prior to sampling. In addition, if sheen is observed during purging, it will be noted on the field form.

During purging, field parameters will be measured to assure adequate purging. Parameters include temperature, specific conductivity, and pH. Purging will continue until the parameters have stabilized. If the wells are turbid, the wells will be purged additional volumes in an effort to obtain non-turbid water prior to sample collection.

3.1.4 Groundwater Sample Collection

Samples will be collected based on the Evanite groundwater performance monitoring schedule (Table 1) from the Performance Monitoring Report (PNG 2008c). Samples will be collected using dedicated bladder pumps and tubing or when dedicated equipment is not in use, using new LDPE tubing at each well. Pumping rates during sampling will be reduced to minimize disturbance. Samples to be tested for volatile organics will be placed directly into the sample vials via the tubing. The vials will be checked for the presence of air bubbles. If an air bubble is visually detected, the vial will be reopened and topped off so the sample is bubble free. SOPs 13, 14, 17, and 19 detail standard groundwater sample collection techniques based on pump type.

3.1.5 Air Stripper Influent Sample Collection

DEQ air discharge guidance states that air discharge loading from a groundwater air stripper must be estimated through routine sampling once system operations begin. In the absence of a soil-vapor extraction (SVE) component, the emissions can be estimated from the influent water quality samples alone, conservatively assuming 100% contaminant removal efficiency. A water sample will be collected quarterly from the air stripper influent during the quarterly events listed in the performance monitoring program (PNG 2008c) for the extraction wells. These quarterly events assume a constant extraction regime; additional sampling of the influent will be conducted after each modification of well yields (i.e., approximately one week after the new extraction scheme is implemented).

3.2 MONITORING WELL DEVELOPMENT/REDEVELOPMENT

Monitoring and extraction wells will be developed and/or redeveloped depending on the evaluation criteria outlined in the Evanite Performance Monitoring Program (PNG 2008c) prior to sampling by surging and pumping techniques. Standard well development techniques including purging and water quality parameter measuring techniques are outlined in SOP 12. The water generated from the well will be handled as described in Section 3.5.

3.3 DECONTAMINATION PROCEDURES

Non-disposable field sampling equipment will be decontaminated to remove possible residual contamination left from previous sampling locations. Equipment decontamination procedures will vary with different sampling equipment used, matrix samples, and anticipated contaminant level. Typical decontamination procedures are presented in SOP 4. All materials generated during sampling, development, and decontamination will be handled as described in Section 3.5.

To protect site workers, all personnel engaged in site investigation and sampling activities will be required to undergo decontamination procedures when leaving contaminated areas. These procedures are detailed in the Site HASPs which accompany each individual pilot test work plan. A recent HASP example can be found in the Neighborhood Monitoring Well Installation Work Plan (PNG 2008b). All personnel engaged in site investigation and sampling activities will have the appropriate training and medical monitoring required under OSHA (29 CFR 1920.120).

3.4 SURVEYING

PNG will contract with a surveyor licensed in the State of Oregon to measure the following features and survey them relative to the nearest City of Corvallis elevation benchmark.

- The surface elevation of each flush-mounted monument lid.
- The top surface of each PVC well casing at the inscribed reference mark.

Elevation data will be measured vertically to within 0.01 foot. The survey data will be imported onto a revised site base map and used for future groundwater monitoring data (see Section 3.1.1).

3.5 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Investigation-derived wastes for this project are expected to include:

- Purge water from well development and groundwater sampling activities.
- Sediments derived from well development and purging.
- Wash water from decontamination activities.

Solid wastes derived during performance monitoring activities will be placed in containers and held temporarily for proper disposal pending receipt of laboratory analysis. These materials will typically be placed in bulk containers or Department of Transportation (DOT) approved 55-gallon steel drums and stored on the Evanite site. The exact area for temporary storage will be determined prior to field activities. All drums will be labeled as to media (i.e., soil, water), date, origin, and generator. Disposal of solid wastes will be arranged pending receipt of characterization analysis. IDW water

is permissible to be treated through the existing air stripper at the Evanite treatment plant. Approval can be found from the EPA through Evanite's US Resource Conservation and Recovery Act (RCRA) Post Closure Permit, located in paragraph III.A.5.b on Page 29 of permit 009023466, March 23, 1990.

4. DOCUMENTATION

Data collected in the field will be recorded on standard environmental field forms (Appendix B). These forms consist of the following:

- Daily Field Activity Report.
- Daily Safety Monitoring Record.
- Well Development Form.
- Groundwater Sampling Form.
- Chain-of-Custody Form.
- Photo Log Form.

4.1 DAILY FIELD ACTIVITY REPORT

The daily field activity report will contain logistical information about the site conditions (weather, access problems, etc.), names of people on the site and the time they are there, and a general chronological narrative of the events. Instrument readings for health and safety will be recorded on this form.

4.2 DAILY SAFETY MONITORING RECORD

The daily safety monitoring record provides a table for documenting safety equipment calibration and routine monitoring during field exploration.

4.3 WELL DEVELOPMENT FORM

The well development form documents data collected during surging and pumping activities associated with development or redevelopment of a monitoring well. The data recorded during well development procedures include pumping rates and volumes, and indicator parameters such as water temperature, pH, specific conductivity, and turbidity (or visual observation of water clarity). If a single well recovery test is being performed concurrent with development, this form is supplemented with an aquifer testing record.

4.4 GROUNDWATER SAMPLE COLLECTION FORM

The groundwater sample collection form will document groundwater sampling procedures and well performance for each well sampling event. The data will include sample location, sample name, date and time collected, and sampler's initials. The form will also include well and monument conditions, water level measurements, casing volume calculations, purge methods and rates, field parameter measurements (pH, temperature, and specific conductance), number and type of bottles filled, and other pertinent field data. A critical data element often observed is the sustainable yield of the well during purging. For many shallow wells with relatively low yield, this data is useful in future planning of remedial alternatives for groundwater.

4.5 CHAIN-OF-CUSTODY FORM

The Chain-of-Custody (COC) form will be used to document the sample number, date and time collected, number of bottles submitted for each sample, name of the analytical methods to be conducted, and custody of the samples. This document in triplicate also

serves as the work order for the analytical laboratory and often contains special instructions for analytical services.

4.6 PHOTO LOG FORM

A photo log form will be used to document all photographs taken during the field activities. The form will include the photo number, date and time the photo was taken, a description of the photograph and the initials of the photographer. Each roll of film will be numbered or, when digital photography is used, the photographs will be electronically filed according to project task. The photographs will be labeled by roll number and then by the number of photograph taken on each respective roll (i.e., the third photo taken on the first roll of film will be labeled photograph number 1-3).

5 SAMPLE HANDLING AND ANALYSIS

This section discusses the sampling handling and analysis methods to be used. The information presented includes sampling containers, packaging and shipping procedures, sample designation, QA/QC samples, and requests for analysis.

5.1 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Sample container requirements for groundwater samples are based on the type of samples to be collected and the analytical methods to be performed on the samples. Samples containers, preservation and handling requirements, and holding times for applicable analytical methods are summarized in Table 2.

Sample containers will be obtained from the laboratory that will be conducting the analyses. Sample containers will be pre-preserved when necessary as a precaution to prevent cross-contamination of the sample containers during field preparation.

5.2 SAMPLE PACKAGING

All samples shipped off site for analysis will be packaged according to applicable regulations and as outlined in SOP 5. Sampling containers will remain in their original packing in a cooler prior to filling. After filling, the containers will be placed in a chilled cooler. Ice will be placed in each sample cooler in double bagged zip top-type bags to prevent leakage if punctured. If possible, highly contaminated samples (based on field screening) will be separated into a separate cooler from relatively unaffected samples. Trip blanks should be placed with the highly contaminated samples.

Samples will be delivered by courier to CH2M Hill Applied Sciences Laboratory, located in Corvallis, Oregon (or equivalent laboratory).

5.3 SAMPLE DESIGNATION

Samples submitted for laboratory analysis will be assigned a unique sample location identifier including time and date of sample collection. The identifier will typically include the name of the sample location, such as MW-1 for Monitoring Well 1.

QA/QC samples (i.e., duplicates, trip blanks, and rinsate blanks) will be assigned similar sample designations. Duplicate samples will be identified so that the laboratory will not be able to distinguish the QA/QC samples from actual samples.

5.4 REQUESTS FOR ANALYSIS

Sample custody will be tracked from point of origin through final analysis and disposal using a COC document form. The COC form will be completed with the appropriate sample/analytical information as soon as possible after samples are collected. For purposes of this work, custody will be defined as follows:

- In view of a PNG field representative.
- Inside a cooler which is in view of a PNG field representative.
- Inside any locked space such as an office, vehicle, or storage unit under the control of the PNG field representative.

Sample possession will be recorded on a COC form. The following items will be recorded on the COC document:

- Project name.
- Project number.
- PNG project manager.
- Sampler's name.
- Sample number, date and time collected, media, number of bottles submitted.
- Requested analyses for each sample.
- Shipment method.
- Type of data package required.
- Turnaround requirements.
- Signature, printed name, organization name, date, and time of transfer of all persons having custody of samples.
- Additional instructions or considerations that would affect analysis.

Persons in possession of the samples will be required to sign and date the COC documentation whenever samples are transferred between individuals or organizations. The COC document will be included in the shipping containers with the samples, and the containers will be sealed with a laboratory custody seal. The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

In general, samples will be packed in shipping containers, and a custody seal will be placed on the container to reduce the potential for tampering. Proper shipping insurance will be requested and the top two copies of the COC documentation will accompany the samples. The person shipping the samples will retain a third copy of the COC document and shipping forms to allow sample tracking. The COC documentation will accompany the samples from point of origin in the field to the laboratory.

5.5 ANALYTICAL METHODS

Chemical analysis of groundwater and air (soil gas) samples for target VOCs will utilize standard analytical methods. Groundwater samples will be analyzed using EPA Method 8260B for volatile organic compounds. Air samples will be analyzed using Modified EPA Method TO-15-SIM.

5.6 FIELD QUALITY ASSURANCE SAMPLES

Blanks and duplicate samples will be used for Quality Assurance (QA) evaluation during the investigation. The following types of QA samples will be used.

5.6.1 Trip Blanks

Trip blanks are water samples prepared by the laboratory by filling a water sample container with laboratory-grade, distilled, deionized water in the laboratory. Trip blanks will be prepared at the same time and location as the sample containers for a particular sampling event. Trip blanks will accompany the sample containers to and from the event, but at no time will they be opened or exposed to the atmosphere. One trip blank for VOCs will be included per VOC shipping event or two-day sampling event.

5.6.2 Equipment Rinsate Blanks

Equipment rinsate blanks are another type of field blank for water samples. They will be obtained after non-dedicated sampling equipment is decontaminated, and will involve passing laboratory grade water (i.e., equivalent to trip blanks) through the sampling equipment and transferring the water into an appropriate sample container. Distilled water commonly obtained from a retail store will not be used for blanks without prior testing by the analytical laboratory.

Rinsate blanks will not be collected if single-use or dedicated equipment (e.g., bailers or tubing) is used for sampling. Rinsate blanks will be analyzed to determine whether decontamination of sampling equipment is adequate. One equipment rinsate blank will be collected for every 20 samples collected with non-dedicated equipment, with at least one rinsate blank per each sampling event.

5.6.3 Field Duplicates

A duplicate water sample will be collected to assess the precision of groundwater sampling and analytical procedures. During each sampling event, at least one blind duplicate sample will be collected from a monitoring well at the same time as the regular sample. Duplicate samples will be obtained by alternately filling like sample bottles for the two sample sets (original and duplicate). One field duplicate sample will be collected for every 20 samples collected with at least one field duplicate per each sampling event with less than 20 samples.

5.6.4 Laboratory Quality Control Samples

Matrix spike/spike duplicates (MS/MSD) quality control samples will be analyzed by the laboratory at a rate of one per 20 samples or sample group per matrix, or as indicated by the analytical method.

6 REFERENCES

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(SOPS)

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-FIELD FORMS

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

Evanite Fiber Corporation
Corvallis, Oregon

DEQ ECSI File Number: 40

Prepared for:

EVANITE FIBER CORPORATION

1115 SE Crystal Lake Drive
Corvallis, Oregon 97333

Prepared by:

PNG ENVIRONMENTAL, INC.

1122-01
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Table C-3 – Sample Containers and Preservation Requirements

1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, and specific quality assurance (QA) and quality control (QC) associated with the Sampling and Analysis Plan (SAP) for the Performance Monitoring Program at the Evanite Fiber Corporation (Evanite) site located in Corvallis, Oregon. The specific objectives for the Performance Monitoring Program are described in the Performance Monitoring Program (PMP) summary report and the SAP. This work is being conducted under the oversight of Mr. Seth Sadofsky at the Oregon Department of Environmental Quality (DEQ).

1.1 PROJECT BACKGROUND

Trichloroethene (TCE) use at Evanite was predominant from the period between 1975 and 1996 when it was used in the manufacturing process for polyethylene-silica battery separator material. Historic spills/releases resulted in a dense non-aqueous phase liquid (DNAPL) source zone located in the former process area at the Submicro building, with a dissolved phase volatile plume migrating north and northeast towards the Willamette and Mary's rivers. An upgradient offsite residual plume to the south, that has been substantially remediated, migrated into the edges of an adjacent residential neighborhood; likely in response to localized residential pumping. This residual plume comingled with one or more offsite, upgradient chlorinated plumes that continue to migrate through the neighborhood and onto Evanite property.

Evanite has been engaged in continuous remedial action with Environmental Protection Agency (EPA) and DEQ since April 30, 1990. Contamination at the site includes chlorinated solvents, primarily TCE, that occur as DNAPL in soil and groundwater. Hydraulic containment through groundwater pumping at up to six site wells has been active since 1991, with over 357 million gallons of groundwater extracted and treated. DNAPL recovery has been active through both direct pumping and total fluids recovery from three wells. DNAPL recovery and volatile depletion from the unsaturated zone has been active on a seasonal basis from six wells in the DNAPL source zone. Combined, the remedial systems have recovered an estimated 125,687 pounds of TCE from startup through the first quarter of 2008.

With the transfer of the regulatory oversight of Evanite's remediation from its historic EPA/Resource Conservation and Recovery Act (RCRA) permit to the DEQ Cleanup Program, an updated feasibility study (FS) was required. DEQ had noted that the remediation scheme had matured to the level that efforts were primarily providing hydraulic containment only. DEQ concluded that further investigation, including pilot testing, was required in an effort to select, design, and implement a more aggressive remedy.

1.2 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

This document includes descriptions of procedures for sampling quality assurance/quality control (QA/QC), data validation, and data entry QA/QC for laboratory data. The QAPP provides a consistent set of QA/QC procedures that will be used throughout the project.

The quality assurance project objectives are addressed in terms of the data quality objectives (DQOs). DQOs are selected to ensure that the data collected during the project are of adequate quality to assure that project objectives are met. Additional considerations for DQOs are proven performance of analytical methods and procedures and indirect requirements, such as regulatory agency mandates. Specific objectives for this project are:

- Data collected are high quality, representative, and verifiable.
- Data are usable by the client and DEQ to support objectives stated in the Performance Monitoring Program and SAP.

2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The field activities associated with this investigation will be performed by PNG Environmental, Inc. (PNG). CH2M Hill Applied Sciences Laboratory (CH2M), located in Corvallis, Oregon, will perform laboratory analysis of the groundwater and soil gas samples.

PNG's Project Manager will be responsible for verifying that the procedures and guidelines described in the QAPP are observed. PNG and CH2M Hill personnel responsibilities for quality assurance activities are summarized below.

Project Manager – Responsibilities

- Oversee project performance to ensure compliance.
- Implement necessary action and adjustments to accomplish program objectives.
- Monitor field investigations.
- Coordinate field and laboratory sample tracking.
- Review all data and prepare reports and other project-related documents.
- Act as liaison between Evanite and DEQ.

Project QA Coordinators – Responsibilities

- Conduct field operations.
- Provide technical QA assistance.
- Arrange for other external procurement packages for QA needs.
- Coordinate corrective actions.
- Review analytical data and data validation reports.

Analytical QA Officer – Responsibilities

- Insure that laboratory instruments are calibrated and maintained as specified.
- Insure internal quality control measures and analytical methods are performed.
- Insure corrective action is taken and project QA coordinator is notified when problems occur.
- Insure that laboratory evaluation is complete and reported in the required deliverables.

3 DATA QUALITY OBJECTIVES

The overall DQOs are to collect acceptable data of known and usable quality. These objectives will be achieved and documented using the procedures and criteria set forth in the QAPP. For each measurement made to obtain quantitative data, a set of quality objectives will be used to aid in collecting usable data. This section identifies the known and potential contaminants of potential concern (COPCs) as identified by the DEQ, followed by the measurements that will be used to assess DQOs.

3.1 CHEMICALS OF POTENTIAL CONCERN

Tables C-1 and C-2 list the constituents and analytical methods for groundwater and soil gas to be analyzed for this project. Known and potential COPCs in groundwater will be analyzed by the following test method:

- Volatile Organic Compounds (VOCs) by EPA Method 8260B

Tables C-1 and C-2 compare method reporting limits (MRLs) for analytes by the selected analytical methods to DEQ risk-based concentrations (RBCs) and EPA risk-based screening levels. Although these criteria or standards may not necessarily be applicable to the Evanite site, they are used to compare achievable MRLs to generally conservative criteria.

3.2 DATA QUALITY OBJECTIVE MEASUREMENTS

The following sections discuss what measurements will be used to assess DQOs, specifically precision, accuracy, representativeness, completeness, and comparability.

Precision, accuracy, and completeness criteria used for field measurements are not generally well defined in guidelines and literature. These parameters have been defined using the best available guidelines to establish field measurement QA objectives and will be followed as closely as possible.

3.2.1 Precision

Data precision will be determined by examining replicate samples for degree of variance and determining if sampling error has occurred. Precision is generally assessed by duplicate measurements of a subset of samples (laboratory or field duplicate samples). The chemical analysis methods define the proportion of the samples being analyzed for which precision must be assessed. This proportion is defined in the laboratory's quality assurance manuals. The precision of physical measurements, such as water level measurements and of field measurements (such as pH and specific conductance) will be based on the general body of data for the instruments and methods, but will not be calculated specifically.

Precision will be expressed as a relative percent difference (RPD). When detected concentrations in either a sample or a duplicate are less than five times the MRL or method detection limit (MDL), DQOs for precision suggest that sample and duplicate results should be within plus or minus the MRL of each other. When detected concentrations in the sample and duplicate are both greater than five times the MRL, DQOs for precision suggest that the RPDs between the results should be less than or equal to 20 percent.

The RPD is calculated as follows:

$$RPD = 100 \times \frac{|c_1 - c_2|}{(c_1 + c_2)/2}$$

where:

RPD = relative percent difference

c_1 = concentration of an analyte in a sample

c_2 = concentration of an analyte in a duplicate sample

3.2.2 Accuracy

Accuracy measures the level of bias exhibited by an analytical method or measurement. To measure accuracy, a substance with a known value is analyzed or measured, and the result is compared with the known value. Only laboratory accuracy will be assessed. The accuracy of field measurements is inherent in the instrument and procedure used.

The accuracy of laboratory analysis is assessed by measuring standard reference materials (instrument calibration) and spiked samples (surrogate recoveries, matrix spikes, and laboratory control samples). Standard reference materials are used to calibrate laboratory instruments. The analytical method specifies the frequency and accuracy required for a spiked sample analysis.

Spike recovery is determined by splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions. Spike recovery is expressed as percent recovery:

$$\text{Percent Recovery} = \frac{(MC - KC) \times 100}{KC}$$

where:

KC = known concentration of an analyte

MC = measured concentration of an analyte

3.2.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population, the natural variation at a sampling point, or an environmental condition. There is no standard method or formula to evaluate representativeness. SAPs are designed to allow collection of representative samples. Representativeness is achieved by selecting sampling locations that are appropriate for the objective of the specific sampling task and by collecting an adequate number of samples. The representativeness of the data will be evaluated and used to identify data gaps that can be addressed during or following completion of the specific investigation.

3.2.4 Completeness

Completeness is generally expressed as a percentage of measurements that are valid and usable relative to the total number of related measurements. Completeness criteria between 80 to 85 percent are identified in the guidance (EPA 1987); these will be used

to determine the adequacy of the results. The percent completeness is defined by the following equation.

$$\text{Percent completeness} = \frac{N \times 100}{N_t}$$

where:

N = Number of samples that meet data quality goals

N_t = Total number of samples analyzed

3.2.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. The use of standard techniques for both sample collection and laboratory analysis should make the data collected comparable to both internal and other data generated.

4 SAMPLING PROCEDURES

Sampling procedures for groundwater are presented in the SAP for the Performance Monitoring Program. These procedures are designed such that samples are collected in a manner which will ensure that the project objectives are met.

QA samples will be collected in the field, as specified in the SAP. Samples include field equipment rinseate blanks, trip blanks, and field duplicates. QA samples will be blind-labeled and preserved as if they were typical samples. QA samples will be clearly identified on the field sampling data sheets (see SAP). Analytical results from the blanks and duplicates will facilitate data QC checks. Field and trip blank results may indicate possible contamination introduced by field or laboratory procedures and field duplicates indicate overall precision in both field and laboratory procedures. Results will be evaluated by applying the parameters discussed in previous section, and the evaluation will be discussed in the data validation report.

- **Trip Blanks** - Trip blanks are water samples prepared by the laboratory by filling a water sample container with laboratory-grade, distilled, deionized water in the laboratory. Trip blanks will be prepared at the same time and location as the sample containers for a particular sampling event. Trip blanks will accompany the sample containers to and from the event but at no time will they be opened or exposed to the atmosphere. One trip blank for VOCs will be included with each cooler sent to the analytical laboratory.
- **Equipment Rinseate Blanks** - Equipment rinseate blanks are another type of field blank for water samples. They will be obtained after nondedicated sampling equipment is decontaminated, and will involve passing laboratory grade water through the sampling equipment and transferring the water into an appropriate sample container.

Rinseate blanks will not be collected if single-use or dedicated equipment (e.g., bailers or tubing) is used for sampling. Rinseate blanks will be analyzed for VOCs to determine whether decontamination of sampling equipment is adequate (primarily split-spoon samplers). One equipment rinseate blank will be collected for every day of sampling, and analyzed for hydrocarbon VOCs.
- **Field Duplicates** - Duplicate soil and water samples will be collected to assess the precision of sampling and analytical procedures. Duplicate soil samples will be collected and tested for VOCs at an interval of one duplicate per 20 samples collected. During each groundwater-sampling event, at least one blind VOC duplicate sample will be collected from a source area monitoring well at the same time as the regular sample. Duplicate water samples will be obtained by alternately filling like sample bottles for the two sample sets (original and duplicate).
- **Laboratory Quality Control Samples** - Matrix spike/spike duplicates (MS/MSD) consist of identifying selected samples for laboratory quality control measures. MS/MSD samples will be identified at a rate of one per 20 samples or sample group per matrix, or as indicated by the analytical method.

4.1 SAMPLE PRESERVATION

Sample containers and methods of preservation for each analysis are listed in Table C-3. Sample containers will be supplied by the laboratory for each sampling event, and will include the appropriate preservatives.

4.2 SAMPLE PACKAGING AND SHIPPING

To insure that the laboratory has ample time to complete all analyses within holding time requirements and to reduce the potential for field degradation of samples, the samples will be shipped from the field to the CH2M Hill laboratory (or a comparable laboratory) at a minimum of every two days. Holding times for specific analytical methods are included in Table C-3. Samples will be stored in iced shipping containers or a refrigerator designated for samples, then transported in iced shipping containers with a custody seal affixed to CH2M Hill.

5 SAMPLE CUSTODY PROCEDURES

Samples will be handled, preserved, and stored using procedures that help ensure quality objectives are met.

5.1 FIELD SAMPLE CUSTODY

Sample custody will be tracked from point of origin through final analysis and disposal using a chain-of-custody (COC) form (see SAP), which will be filled out with the appropriate sample/analytical information as soon as possible after samples are collected. For purposes of this work, custody will be defined as follows:

- In view of a PNG field representative.
- Inside a cooler which is in view of a PNG field representative.
- Inside any locked space such as an office, vehicle, or storage unit under the control of the PNG field representative.

Sample possession will be recorded on a COC form. The following items will be recorded on the COC form:

- Project name.
- Project number.
- PNG project manager.
- Sampler's name.
- Sample number, date and time collected, media, and number of bottles submitted.
- Requested analyses for each sample.
- Turnaround requirements.
- Signature, printed name, organization name, date, and time of transfer of all persons having custody of samples.
- Additional instructions or considerations that would affect analysis.

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations. The COC will be included in the shipping containers with the samples and the containers will be sealed with a laboratory custody seal. The laboratory will implement its in-house custody procedures which begin when sample custody is transferred to laboratory personnel.

If samples are shipped via air or ground transportation by a third party, the procedures in SOP 10 (see SAP) will be followed. In general, samples will be packed in shipping containers, and a custody seal will be placed on the container to reduce the potential for tampering. Proper shipping insurance will be requested and the top two copies of the COC form will accompany the samples. The person shipping the samples will retain a third copy of the COC and shipping forms to allow sample tracking. The COC form will accompany the samples from point of origin in the field to the laboratory.

At CH2M Hill, a designated sample custodian will accept custody of the received samples, and will verify that the chain-of-custody form matches the samples received. The shipping container or set of containers is given a laboratory identification number,

and each sample is assigned a unique sequential identification number that includes the original container identification number.

5.2 SAMPLE LABELING

Sample container labels will clearly indicate:

- Sample location.
- Sample number.
- Date and time of sample collection.
- Sampler's initials.
- Any pertinent comments such as specifics of filtration or preservation.

Labels will be filled out at the time of sampling. Sample labeling information will also be recorded on appropriate field data sheets such as groundwater sampling forms, borehole logs, and daily field reports as indicated in the SAP.

6 EQUIPMENT CALIBRATION AND MAINTENANCE PROCEDURES

All instruments and equipment used during field sampling and analysis will be operated, calibrated, and maintained according to manufacture's guidelines and recommendations. Operation, calibration, and maintenance will be preformed by personnel properly trained in these procedures.

6.1 FIELD INSTRUMENTATION

Field instruments will be used during the investigation and may include the following:

- Flow-through cell.
- Photo-ionization detector (PID).
- Combustible gas indicator (CGI).
- Dissolved Oxygen (DO) meter.

If used, the following field equipment will require calibration before use and periodically during sampling activities:

- Flow-through cell.
- CGI.
- PID.

Field instrument calibration and preventive maintenance will follow the manufacturer's guidelines and any deviation from the established guidelines will be documented. Generally, field instruments will be calibrated daily before work begins. Field personnel may decide to calibrate more than once a day if inconsistent or unusual readings occur or if conditions warrant more-frequent calibration. Calibration activities will be recorded in field logbooks.

In case of equipment malfunction, PNG personnel will have pH, conductivity, temperature, and oxidation-reduction potential meters as back up measuring devices.

6.1.1 Field Calibration

Calibration procedures, calibration frequency, and standards for measurement will be conducted according to manufacture's guidelines. To assure that field instruments are properly calibrated and remain operable, the following procedures will be used, at a minimum:

- Operation, maintenance, and calibration will be performed in accordance with the instrument manufacturer's specifications.
- All standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the equipment operation manual. Standards will be used before any expiration dates that may be printed on the bottle.
- Acceptable criteria for calibration will be based on the limits set in the operations manual.
- All users of the equipment will be trained in the proper calibration and operation of the instrument.

- Operation and maintenance manuals for each field instrument will be brought to the site.
- Field instruments will be inspected before they are taken to the site.
- If used, field instruments will be calibrated at the start and end of each work period. Meters will be recalibrated, as necessary, during the work period.
- pH meters will be calibrated at the start of each workday. Meters will be recalibrated, as necessary, during the workday.
- Calibration procedures (including time, standards used, and calibration results) will be recorded in a field logbook. Although not reviewed during routine QA/QC checks, the data will be available if problems are encountered.

6.1.2 Preventive Maintenance

Preventative maintenance of field instruments and equipment will follow the operations manuals. A schedule of preventive maintenance activities will be followed to minimize downtime and ensure the accuracy of measurement systems. Maintenance will be documented in the field logbook.

6.2 LABORATORY INSTRUMENTATION

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the EPA, following procedures presented in SW-846.

7 ANALYTICAL PROCEDURES

The analytical methods and references for analyses which may be used during project implementation are summarized in Tables C-1, C-2, and C-3 and discussed in Section 3.

In accordance with the QA/QC requirements set forth in this QAPP, CH2M Hill will perform the analyses of groundwater using EPA methods, with modifications noted in Section 3. Samples will be analyzed by CH2M Hill, which is qualified to perform the analyses using standard, documented laboratory procedures. CH2M Hill has QA/QC plans and standard operation procedures that provide data quality procedures according to the protocols for the analytical method and cleanup steps. The data quality procedures are at a level sufficient to meet the sampling program's DQOs. CH2M Hill will perform, document, and report laboratory procedures, as described in their quality assurance manuals.

8 DATA REDUCTION, VALIDATION, AND REPORTING

The laboratory performing sample analyses will be required to submit analytical data supported by sufficient QA information to permit independent and conclusive determination of data quality. Data quality will be evaluated by PNG using the data validation procedures described in this section. The results of the PNG evaluation will be used to determine if the project DQOs have been met.

8.1 LABORATORY EVALUATION

Initial data reduction, evaluation, and reporting at CH2M HILL will be carried out as described in EPA SW-846 manuals for organic and inorganic analyses, as appropriate. Additional data qualifiers may be defined and reported to further explain the laboratory's quality control concerns about a particular sample result. All additional data qualifiers will be defined in the laboratory's case narrative report associated with each laboratory report.

8.2 DATA EVALUATION

8.2.1 Validation

After PNG receives the analytical data, the data will be validated under the supervision of the project QA coordinator. PNG will examine the data for precision, completeness, accuracy, and adherence to standard operating procedures. PNG will validate laboratory analytical data as described in the following sections. QC checks will be performed on laboratory information using the sample log-in reports faxed to PNG after samples are entered into the laboratory information management system. The reports will be assessed early in the process, which will allow QC checks to begin before sample holding times have expired or before errors are incorporated in the laboratory reports.

VALIDATION PROCEDURES

Laboratory analytical data will be reported in a CH2M Hill standard format to facilitate data validation. The items reported by the laboratory include those listed below:

- Dates samples were collected, received by the laboratory, and analyzed.
- On each laboratory sample data sheet: method of detection (e.g., GC, HPLC, AA, ICP).
- On each laboratory sample data sheet: a tabulation of MDLs or MRLs, or a master sheet of MDLs or MRLs with detection limit multiplication factors (due to dilutions or dry weights) specified.
- Constituent concentrations reported in micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$) or parts per billion by volume (ppbV) for air, micrograms per liter ($\mu\text{g}/\text{L}$) or milligrams per liter (mg/L) for water, and milligrams per kilogram (mg/Kg) for soil (dry-weight basis).
- Volumes analyzed and dilution factors, if any.
- Ancillary information, including percent moisture in soil sample.
- Method blank data associated with each sample.

- Results for matrix spike analyses, concentrations added, and percent recovery.
- Results of laboratory duplicate or laboratory control sample analyses for each constituent, as applicable to the method.
- A statement in the cover letter describing how standard calibration curves were generated and applied to the samples for quantitation (and access to laboratory records of standard calibration curves and all other pertinent data for possible inspection), if this varies from the method specified in SW-846.
- A statement in the cover letter describing any significant problems in any aspect of sample analysis, deviation from prescribed QA/QC criteria, or other relevant information. A statement in the cover letter describing any changes or deviations from the required methods, the reason for the change(s), and a description of the deviations that were used for sample analysis.
- A copy of the chain-of-custody form for each batch of samples reported.

PNG will review data and assign data qualifiers to sample results, following portions of the EPA procedures. Data qualifiers are used to classify sample data as to its conformance to QC requirements. The most common qualifiers are listed below:

- A – Acceptable.
- J – Estimate, qualitatively correct but quantitatively suspect.
- R – Reject, data not suitable for any purpose.
- U – Not detected at a specified detection limit.

Poor surrogate, blank contamination, or calibration problems, among other things, can cause the sample data to be qualified. Whenever sample data is qualified, the reasons for the qualification will be stated in the data validation report.

For inorganic and organic analyses, the following information will be reviewed during data validation:

- Sampling locations and blind sample numbers.
- Sampling dates.
- Requested analysis.
- Laboratory service request number(s).
- COC documentation.
- Sample preservation.
- Holding times.
- Method blanks.
- Surrogate recoveries (organic analyses only).
- Matrix spike results (inorganics analyses only).
- Matrix spikes/matrix spike duplicate (MS/MSD) analyses (organic analyses only).
- Laboratory duplicates (inorganic analyses only).
- Field duplicates (if submitted).
- Laboratory control samples (organic analyses only).

- MRLs above requested levels.
- Any additional comments or difficulties reported by the laboratory.
- Overall assessment.

The results of the data validation review will be summarized for each batch of samples. Data qualifiers will be assigned to sample results as per EPA guidelines. The data validation reports will summarize the precision and accuracy for the samples. The quality of the analytical data, as defined by precision and accuracy, will be assessed and compared to DQOs for the project.

The laboratory will routinely archive raw laboratory data, including initial and continuing calibration data, chromatograms, quantitation reports, blank sheets, and sampling logs, and will provide these data in addition to the deliverables listed above, if requested.

8.2.2 Reduction

Following data validation and assignment of data qualifiers, if any, the analytical data will be tabulated. The tabulation of analytical and field data, with the appropriate data qualifiers, will be stored on computer disk. Data will be further reduced and managed using the following computer software applications:

- Excel™ (spreadsheet).
- Word™ (word processing).
- Surfer™ (geostatistical contouring).
- Statistical applications using appropriate methods.

Data will be reduced to summarize particular data sets. In addition, statistical techniques may be applied to test results. These techniques will help assess the representativeness, comparability, precision, and completeness of the data sets. Reduced data sets will be used in reporting the overall accuracy of the assessment.

8.2.3 Reporting

After completing data collection, validation, and reduction, the data will be used in reports. Copies of the reports will be kept in the main project file, submitted to the client for review, and then submitted to DEQ. The original copy of any document that PNG produces will remain in the main project file.

9 INTERNAL QUALITY CONTROL AND QUALITY ASSURANCE

9.1 BASIC QUALITY CONTROL

Quality control data will involve the collection of field sample duplicates and blanks, laboratory analysis of the samples, and evaluation of the data.

Daily internal QC checks will be performed for field activities. Checks will consist of reviewing field notes and field activity memoranda to determine whether the specified measurements, calibrations, and procedures are being followed. The need for and content of corrective action will be assessed on an ongoing basis, in consultation with the project manager.

Field sample blanks and duplicates will be collected and submitted to the laboratory for analysis to determine if any sampling contamination is caused by field sampling equipment and to check data precision.

The laboratory will document the completion and evaluation of internal QC checks and any corrective actions or reanalysis completed.

Data reduction QC checks will be performed on all entered, calculated, and graphic data produced by PNG. Data entry will be compared with data generated during field activities and recorded in notebooks or on field data forms. Analytical data entry will be reviewed against laboratory reports and data validation reports.

9.2 PERFORMANCE AND SYSTEM AUDITS

PNG's project manager will monitor the performance of the field and laboratory quality assurance program. Proper communication between field staff, project management, and the laboratory will be maintained so that consistent and appropriate methods and techniques are used throughout the project.

9.2.1 Field Performance

Field performance will be monitored through daily review of documentation, sample handling records (i.e., COC forms), field measurements, and periodic field inspections. All field and sampling will be checked for compliance with relevant work plans.

9.2.2 Laboratory Performance and System Audits

The laboratory will audit in-house performance and systems under their in-house QA/QC guidelines. Such audits will be made available for review on request. While samples for this investigation are analyzed, the project QA coordinator will be in contact with the analytical laboratory to assess progress toward obtaining the DQOs and to make corrective measures as problems arise.

9.3 PREVENTATIVE MAINTENANCE

Field equipment will be checked daily to detect any malfunctions. Steps will be taken to repair or replace any piece of equipment that appears unreliable. Repairs will be made according to the manufacturers' guidelines, or by qualified repair technicians.

Equipment will also be periodically serviced, according to the manufacturers' recommendations.

Preventive maintenance of analytical equipment is discussed in Section 6 and described in CH2M Hill's quality assurance manual.

9.4 DATA ASSESSMENT PROCEDURES

Procedures to assess data precision, accuracy, and completeness will be completed routinely, through data validation reports. Precision and accuracy will be based on laboratory documentation. Completeness will be based on the usability of the data collected, relative to the data needs of an investigative task or the amount of data scheduled for collection. Completeness will be quantified when appropriate, but will be qualitatively evaluated with respect to the representativeness of the data when detection or lack thereof, is the objective.

The Quality Assurance Program for CH2M Hill outlines the precision and accuracy limits for each laboratory analytical method and parameter. The laboratory is responsible for assuring that these precision limits are consistently met or exceeded.

9.5 CORRECTIVE ACTION

The need for corrective action will be evaluated on an ongoing basis, depending on the results of internal and laboratory QC checks. In the event that quality assurance is not met, corrective actions will be taken.

During field operation and sampling procedures, field personnel will be responsible for reporting any changes to specified sampling procedures. A description of any such change will be entered in appropriate field sheets.

If quality control audits result in detection of unacceptable conditions or data, the project manager in conjunction with the project quality assurance coordinator, will be responsible for implementing corrective action. Specific corrective actions are outlined in each SW-846 method, or in CH2M Hill's quality assurance manuals, and include, but are not limited to:

- Identifying the source of the unacceptable condition.
- Reanalyzing samples if holding time criteria permit.
- Re-sampling and re-analyzing.
- Evaluating and amending sampling and analytical procedures.
- Accepting data and flagging to indicate the level of uncertainty.

DEQ will be notified of each significant field, laboratory, or project corrective action, if taken.

9.6 QUALITY ASSURANCE REPORTS

No separate QA report for this project is anticipated. The RI/RA/FS report will contain a separate QA section that will summarize the overall quality of the chemical results in terms of the specific data quality goals identified in this QAPP, and will identify chemical results qualified by PNG.

Reports will be maintained in the project files and will include results of performance and system audits; periodic assessment of measurement data accuracy, precision, and

completeness; significant QA/QC problems and recommended solutions; and resolutions of previously identified problems.

10 REFERENCES

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PERFORMANCE MONITORING PLAN

H&V Fiber Corporation
Corvallis, Oregon

DEQ ECSI File No. 0040

Prepared for:

H&V FIBER CORPORATION
1115 SE Crystal Lake Drive
Corvallis, Oregon 97333

Prepared by:

PNG ENVIRONMENTAL, INC.

1122-01
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APPENDICES

Appendix A – Field Forms
Appendix B – PNG Standard Operating Procedures (SOPs)

1 INTRODUCTION

This report presents the proposed performance monitoring plan for remediation of trichloroethene (TCE) in soil and groundwater at the H&V Fiber Corporation (H&V) facility in Corvallis, Oregon (Figure 1). The plume resulted from manufacturing operations by former Evans Product Submicro operations that used TCE to strip oil from a PVC battery separator product. PNG Environmental Inc. (PNG), on behalf of H&V, and as defined by the Oregon Department of Environmental Quality (DEQ) in the *Fourth Addendum to Consent Order DEQ No. WMCSR-WR-00-19*, has prepared this Performance Monitoring Plan (PMP) to define the current monitoring schedule and field protocols of three related remedial operations:

- Monitoring of remedial system off-gas to provide data to quantify the mass of TCE removed from the subsurface, evaluate the efficiency of the treatment system, and quantify the masses of TCE destroyed and TCE discharged by the Catalytic Oxidizer (CatOx)/scrubber treatment system.
- Monitoring of the progress of soil vapor extraction (SVE) and groundwater extraction systems that are operational in a focused mode of aggressive mass reduction in the dense non-aqueous phase liquid (DNAPL) Source Zone.
- Monitoring of groundwater conditions in the TCE plume to evaluate the following:
 - Hydraulic containment.
 - Progress with plume cleanup through comparison of soil vapor, groundwater, and surface water concentrations to applicable cleanup standards.
 - Potential rebound of TCE concentrations in areas of the plume that have been reduced to below applicable cleanup standards.

The consent order addendum provides a general framework for the monitoring program and requires this site-specific plan be developed and approved for implementation. Whereas DEQ recognizes the remedial systems will be supplemented in the future during post-ROD remedial design, and will be optimized on an ongoing basis, this site-specific plan will be revisited periodically and modified based on hydrologic conditions and contaminant concentrations in the future. Plan modifications shall become effective upon written approval of the DEQ project manager and any modifications shall not require amendment of the Consent Order.

2 REMEDIAL SYSTEMS

The H&V site remediation system is illustrated in Figures 1 through 4 and includes components for SVE groundwater pump and treat through an air stripper, and offgas treatment of the combined airflow from these two systems in a CatOx treatment system. N/A The unsaturated zone SVE and groundwater extraction are centered around a dense non-aqueous phase liquid (DNAPL) source zone at the Submicro Building. Contaminated air from the two treatment technologies is piped to the CatOx unit located adjacent to the H&V facility scrubbers located in Glass Plant Building #2 (see Figure 2).

2.1 ANALYTICAL SUITE

Evanite has been undergoing investigation and active remedial operations of SVE, including groundwater pump and treat, since the mid 1980's. In the early years, full Resource Conservation and Recovery Act (RCRA) Appendix IX analytical suites were routinely analyzed on groundwater and EPA Method 8260 chemicals on soil, air, and water. Historic data trends indicate contaminants are limited to TCE and related products (tetrachloroethene [PCE], Cis-1,2-dichloroethene [Cis-1,2-DCE], Trans-1,2-Dichloroethene (Trans-1,2-DCE), Vinyl chloride, and 1,1-dichloroethene [1,1-DCE]) as DEQ allowed this limited suite to be analyzed for the past decade. Analyses for this plan will be limited to this suite of chemicals using EPA Method 8260B and TO-15 for the respective media.

All sampling efforts at this time are being conducted to monitor ongoing remedial operations using a timeframe that extends over two decades post startup. As such, field quality assurance samples are not necessary. These are engineering-level data and are all samples that are repeatedly collected on a routine schedule. For example, monitoring well MW-2 has been sampled on 77 occasions since 1986. If any outlier results are reported, PNG will recommend resampling and coordinate with DEQ, as needed.

Laboratory quality assurance will remain at industry standard levels. PNG will perform a limited data validation on all data to ensure usability in our analyses of system performance.

The analytical suite and field quality assurance samples for any new investigation efforts or pilot tests will be presented in work plans for those specific events.

2.2 CATOX SYSTEM This section is N/A

CatOx operations are monitored daily to ensure the system is providing optimal volatile organic compound (VOC) destruction and to quantify influent and effluent loading. H&V staff maintains a system log at the CatOx unit to document the timing and duration of any system outages. If the CatOx system is not operational, the groundwater extraction wells and SVE system are automatically shut down.

A six-inch diameter steel pipe is used to transport the contaminated airstream from the Submicro Building across a distance of 600 feet of piping to the CatOx unit in the Glass Plant #2. The pipeline has sampling ports and flow meters at each end and also contains two water knockout features to allow removal and treatment of any condensate.

CatOx system performance monitoring data, which are collected from accessible points on and around the CatOx system, include air flow rates and VOC concentrations. The three CatOx system monitoring points consist of the following:

- CatOx Pre-bleed Monitoring Point.

- CatOx Post-bleed Monitoring Point.
- CatOx Effluent Monitoring Point.

Both field measured, and laboratory analyzed VOC data are collected from each monitoring points as outlined in Table 1. As the remedial systems are upgraded and mass removal rates stabilize, the frequency of sampling will be reduced as approved by DEQ. Field forms for recording CatOx operations and sample collection are included in Attachment 1. The CatOx effluent sample is collected in a summa canister that connects directly to a port on the offgas line.

2.3 REMEDIAL SYSTEMS

The remedial system consists of groundwater extraction wells at two targeted depths of the aquifer and three SVE systems. Wells are shown on Figures 2 through 4.

The deep extraction wells are screened at the base of the aquifer between roughly 35 and 45 feet below ground surface (bgs) and are underlain by over 200 feet of plastic clay that serves as a regional aquitard. The yields at this level range from 15 to 30 gallons per minute from individual wells as fine-grained materials have generally been washed from the sandy gravel soil horizon. Deep wells located in the Submicro DNAPL source zone generally have a second, intermediate well located adjacent. These intermediate wells are constructed to allow both groundwater extraction from the unsaturated zone and groundwater pumping as they straddle the water table. With a typical seasonal fluctuation of groundwater levels of up to eight feet, these wells are generally unsaturated in the summer months and nearly fully saturated in the winter. The current scheme of aggressive TCE mass removal using SVE involves pumping the nested deep wells at maximum yield to draw down the water table and create an unsaturated zone in the overlapping cones of depression. SVE is applied within this cone of depression.

The SVE systems include the intermediate wells as described above along with a series of six wells screened in the overlying silts and a subslab system in the structural fill beneath Submicro. Multiple subslab monitoring points in Submicro and three vadose zone wells in the source area are present and allow characterization of vacuum zone of influence. Non-active intermediate wells can also be used to measure vacuum.

Currently, the system includes eleven intermediate wells, six upper zone wells, and four subslab wells in the Submicro building.

Note that the goal of maximizing TCE removal requires that the SVE well scheme be modified throughout the seasons. For this reason, the monitoring program is left flexible such that active wells are sampled at the required schedule.

additional wells
and pore
water locations
have been
added since
2013

The sampling schedule for the remedial systems is presented in Table 2 with distinct schedules for water and vapors. As with the CatOx monitoring presented above, it is anticipated that the frequency of sampling will be reduced as the mass removal rates stabilize.

Field forms for recording remedial operations and sample collection are included in Attachment 1. Water samples are collected directly from the pumping well sampling ports into vials. Air samples are collected in tedlar bags and/or summa cans.

2.4 PLUME MONITORING

The TCE plume is currently characterized with 38 wells, four surface water sampling locations (i.e., two in Millrace and one each in Marys and Willamette rivers) and seven designated pore water sampling locations. Active pumping wells are routinely sampled

on a quarterly basis to provide data necessary to optimize the mass removal. A few wells located at targeted locations to represent distinct areas of the plume (see Figure 2) are sampled on a semiannual basis to evaluate the potential for rebound. All wells that are saturated during the period are sampled annually in September to support an overall analysis of plume cleanup, hydraulic containment, and to update the site conceptual model.

The sampling schedule is presented in Table 3 with water level measurements, NAPL measurements, and water quality sampling included on a quarterly, semiannual, and annual basis depending on the well and rationale for sample collection. For example, pore water samples are collected in September when the Marys and Willamette Rivers are at sufficiently low yields to allow access to the beach face along the steep bank. Intermediate wells are sampled in March when the water table is sufficiently high to saturate the bottom portions of the well screens.

Field forms for recording sampling events are included in Attachment 1. Standard operating procedures for sampling, including wells, depth to water, and pore water are included in Attachment 2.

3 REPORTING

Reporting will be conducted on monthly, quarterly, and annual schedules to report the data from the three performance tasks.

3.1 MONTHLY

The monthly report will include a simple tabulation of total groundwater pumped and mass removed from the combined SVE and groundwater air stripper systems. Any laboratory data received during the period will be updated in tracking tables and briefly discussed in text. Influent and effluent data for the CatOx unit along with operating conditions will be reported. The total mass of TCE removed will be estimated and presented in graphic form.

We don't do monthly or quarterly reports. But these are combined in the bi-monthly memos.

It is anticipated this routine monthly report will be emailed to DEQ.

3.2 QUARTERLY

The quarterly report will include a compilation of all data collected and received during the reporting period and will include summary tables, laboratory data reports, data validation discussion, and a general discussion of operating conditions. Any optimization efforts or maintenance for the remedial systems will be included.

3.3 ANNUAL

The annual report will be similar to the previous year's reports (PNG 2012) and will include sections for the following key tasks:

- Update of site conceptual model.
- Current monitoring schedule and recommendations for any modifications.
- Groundwater, surface water, and pore water results.
- Vapor and air results.
- Well logs for any new wells.
- Groundwater remedial performance.
- SVE remedial performance.
- Enhanced reductive dechlorination performance.
- Capture zone analyses.
- Treatment system performance.
- Recommendations for system optimization.

The annual report will be prepared after receipt of the September annual data collection effort.

Reporting for any future investigation or pilot testing efforts will be conducted independent of the routine schedule presented in this document.

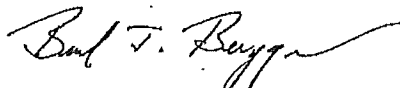
4 LIMITATIONS

PNG has prepared this report for use by the H&V Fiber Corporation. This report may be made available to future property owners and to regulatory agencies. This report is not intended for use by others and the information contained herein is not applicable to other sites.

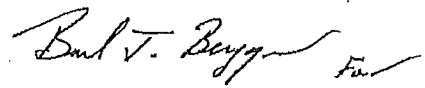
Our interpretation of subsurface conditions is based on field observations and chemical analytical data. Areas with contamination may exist in portions of the site that were not explored or analyzed.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices and laws, rules, and regulations at the time that the report was prepared. No other conditions, express or implied, should be understood.

PNG ENVIRONMENTAL, INC.



Brad Berggren, P.E., R.G.
Senior Environmental Engineer



Paul McBeth, R.G.
President



TABLES

Table 1
CatOx Offgas Monitoring Schedule
February 2013
H&V Fiber Corporation
Corvallis, Oregon

Well Identification	Air VOCs for Evanite Chemicals (EPA TO-15)
Submicro Legs	See Table 2
Post-SVE	See Table 2
SVE + Stripper	See Table 2
CatOx Prebleed	See Table 2
CatOx Postbleed	Bi
CatOx Effluent	Bi

Notes:

Bi = Twice monthly measurement if component is active

Table 2
Remedial System Monitoring Schedule
February 2013
H&V Fiber Corporation
Corvallis, Oregon

Well Identification	Date Installed	Water Pumping Rates and Totalizer	Water VOCs for Evanite Chemicals (EPA 8260)	Air VOCs (PID and Flow)	Air VOCs for Evanite Chemicals (EPA TO-15)
IMW-3	06/05/2009	Bi	See Table 3	Bi	Q
IMW-16	06/04/2009	Bi	See Table 3	Bi	Q
IMW-17	06/08/2009	Bi	See Table 3	Bi	Q
IMW-24	06/02/2009	Bi	See Table 3	Bi	Q
IMW-25	06/03/2009	Bi	See Table 3	Bi	Q
IMW-26	06/09/2009	Bi	See Table 3	Bi	Q
IMW-27	02/06/2013	Bi	See Table 3	Bi	Q
IMW-28	02/12/2013	Bi	See Table 3	Bi	Q
IMW-29	02/11/2013	Bi	See Table 3	Bi	Q
IMW-30	02/12/2013	Bi	See Table 3	Bi	Q
IMW-31	02/13/2013	Bi	See Table 3	Bi	Q
Stripper influent		Bi	M		
Stripper effluent		Bi	M		
Submicro Legs				W	M
Post-SVE				W	M
SVE + Stripper				W	M
CatOx Prebleed				W	M
CatOx Postbleed				W	M

Notes:

W = Weekly measurement if component is active

Bi = Twice monthly measurement if component is active

M = Monthly sample if component is active

Q = Quarterly (March, June, September, & December) if component is active

Table 3
Plume Monitoring Schedule
February 2013
H&V Fiber Corporation
Corvallis, Oregon

Well Identification	Date Installed	Water VOCs for Evanite Chemicals (EPA 8260)	Depth to Water and NAPL
MW-1	02/21/1986	As	S
DMW-2	02/14/1986	S	M
DMW-3	02/12/1985	Q	M
IMW-3	06/05/2009	Am	M
MW-5	02/19/1985	As	S
MW-6	04/22/1986	As	S
MW-7	01/30/1987	S	S
MW-8	02/02/1987	S	S
MW-9	01/27/1987	As	S
MW-10	02/03/1987	As	S
DMW-11	06/06/1988	S	S
DMW-12	06/03/1988	S	S
MW-13	05/25/1988	As	S
MW-14	05/26/1988	As	S
MW-15	06/17/1988	As	S
DMW-16	12/05/1988	Q	M
IMW-16	06/04/2009	Am	M
DMW-17	12/09/1988	Q	M
IMW-17	06/08/2009	Am	M
MW-18	12/21/1988	As	S
MW-19	07/10/1990	As	S
MW-20	10/29/2008	S	S
MW-21	10/29/2008	As	S
MW-22	10/28/2008	As	S
DMW-23	06/08/2009	Q	M
DMW-24	06/02/2009	Q	M
IMW-24	06/02/2009	Am	M
DMW-25	06/03/2009	Q	M
IMW-25	06/03/2009	Am	M
IMW-26	06/09/2009	Am	M
DMW-27	02/05/2013	Q	M
IMW-27	02/06/2013	Am	M
DMW-28	02/07/2013	Q	M
IMW-28	02/12/2013	Am	M
DMW-29	02/11/2013	Q	M
IMW-29	02/11/2013	Am	M
IMW-30	02/12/2013	Am	M
IMW-31	02/13/2013	Am	M
Millrace 1		S	S
Millrace 2		S	S
Porewater (7)		As	S

Notes:

Q = Quarterly (March, June, September, & December)

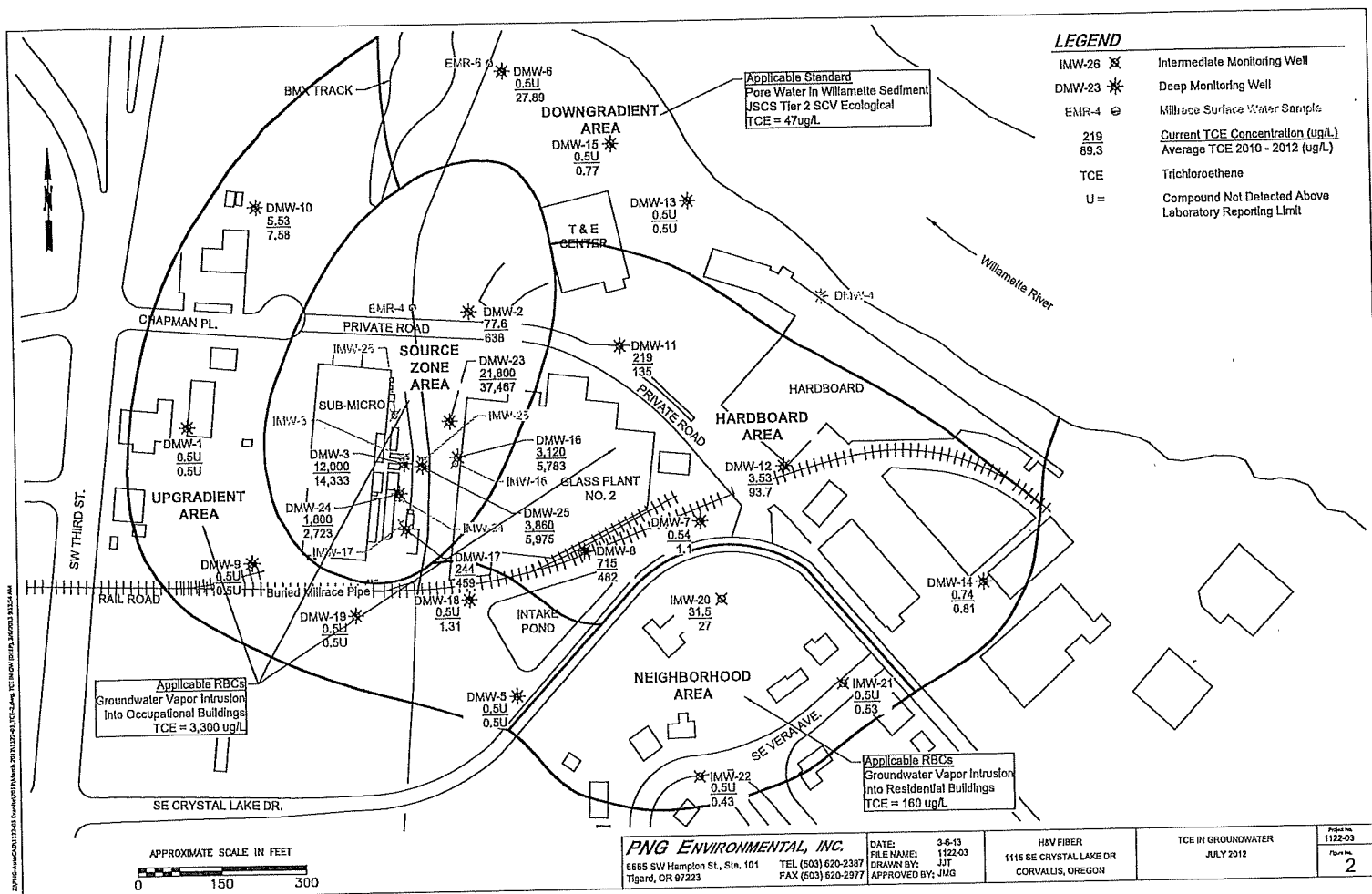
S = Semiannual (March & September)

Am = Annual (March)

As = Annual (September)

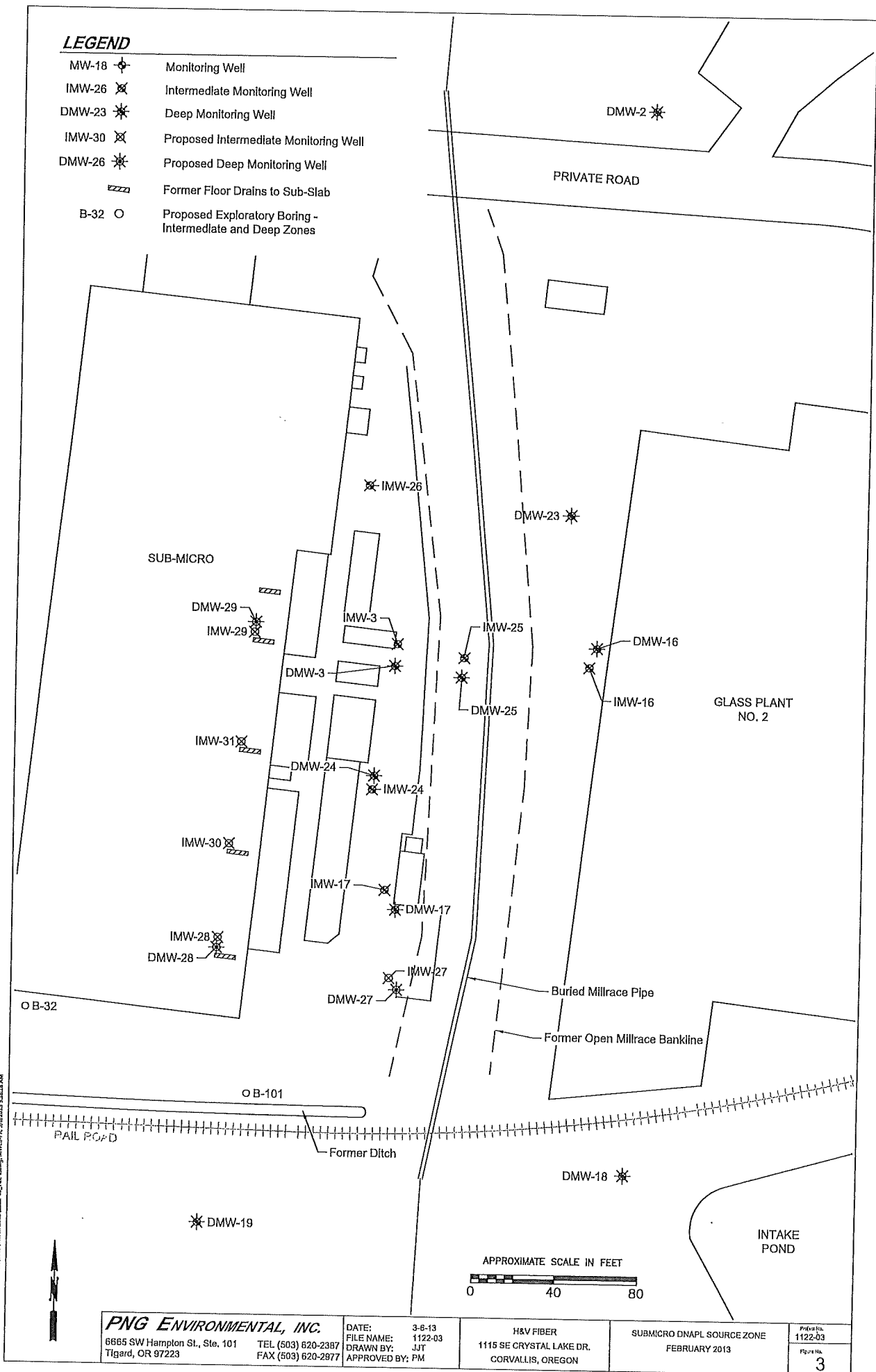
M = Monthly measurement

FIGURES



LEGEND

- MW-18  Monitoring Well
- IMW-26  Intermediate Monitoring Well
- DMW-23  Deep Monitoring Well
- IMW-30  Proposed Intermediate Monitoring Well
- DMW-26  Proposed Deep Monitoring Well
-  Former Floor Drains to Sub-Slab
- B-32  Proposed Exploratory Boring - Intermediate and Deep Zones



PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101
Tigard, OR 97223

TEL (503) 620-2387
FAX (503) 620-2977

DATE: 3-6-13
FILE NAME: 1122-03
DRAWN BY: JJT
APPROVED BY: PM

H&V FIBER
1115 SE CRYSTAL LAKE DR.
CORVALLIS, OREGON

SUBMICRO DNAPL SOURCE ZONE
FEBRUARY 2013

Project No.
1122-03

Figure No.
3

LEGEND

74 PNG-AU/CAD1112-03 Evnig 2013 March 2013 112-03 SVE-3.dwg Vapor and Air 3/6/2013 1:59:27 PM

APPENDIX A
FIELD FORMS

H&V Fiber Remediation Wells
Corvallis, Oregon

Form A

Well Identification	Sump Length	Screen Length	Depth to Bottom	Depth to Bottom Screen	Depth to Top Screen
MW-1	0.00	10.00	38.88	38.88	28.88
DMW-3	0.00	10.00	42.10	42.10	32.10
IMW-3	1.50	8.84	29.12	27.62	18.78
DMW-16	0.60	6.00	43.08	42.48	36.48
IMW-16	1.00	8.84	30.98	29.98	21.14
DMW-17	0.50	10.00	46.40	45.90	35.90
IMW-17	1.00	8.84	31.92	30.92	22.08
DMW-23	3.84	8.50	46.80	42.96	34.46
DMW-24	3.92	8.84	49.09	45.17	36.33
IMW-24	1.50	8.84	33.41	31.91	23.07
DMW-25	3.50	8.84	46.94	43.44	34.60
IMW-25	1.50	8.84	31.40	29.90	21.06
IMW-26	1.50	8.84	31.18	29.68	20.84
DMW-27	5.17	9.33	46.55	41.38	32.05
IMW-27	1.20	9.33	35.59	34.39	25.06
DMW-28	5.13	9.50	48.07	42.94	33.44
IMW-28	1.13	9.50	28.82	27.69	18.19
DMW-29	5.13	9.50	42.85	37.72	28.22
IMW-29	1.13	9.50	28.72	27.59	18.09
IMW-30	1.20	9.33	28.96	27.76	18.43
IMW-31	1.50	9.33	29.01	27.51	18.18

H&V Fiber Catalytic Oxidizer Performance - Weekly
Corvallis, Oregon

Form B

PNG Environmental, Inc 6695 SW Hampton St., Ste. 101 Tigard, Oregon 97223 PH (503) 620-2387 FAX (503) 620-2977 Prepared By: _____ Date: _____		Catalytic Oxidizer Performance					Catox Parameters			
		Project: H&V Fiber 1122-03					Inlet Temperature _____ Time _____			
		Location: Corvallis, OR					Arrival: _____			
		Water Traps Emptied: Y / N					Departure: _____			
							PID Calibration _____ PID Brand _____ Calibration Gas/Conc _____ PID Owner _____			
Location	FPM to CFM Conversion	Reading Date/Time	Velocity (FPM)	Flow (CFM)	Other	PID (PPM)	Air Sample Collected			
							Date/Time	Container	Location Name	Sample Name
Subslab 4	0.023303							Tedlar	SS4-9/28-1415	
Subslab 5	0.023303							Tedlar	SS5-9/28-1415	
Submicro Legs	Direct Read							Tedlar	SLegs-9/28-1415	
SVE Post-Blower	Direct Read				Amps: _____			Tedlar	PSVE-9/28-1415	
SVE + Stripper to Glass Plant	0.20428				Temp: _____			Tedlar	S+S-9/28-1415	
Catox PreBleed	Pitot Gauge				Temp: _____			Tedlar	PreBld-9/28-1415	
Catox PostBleed	Pitot Gauge							Tedlar	PostBld-9/28-1415	
Catox Effluent	N/A							Summa	CatEff-9/28-1415	
Notes:										

H&V Fiber Catalytic Oxidizer Performance - Bi-Monthly
Corvallis, Oregon

Form C

PNG Environmental, Inc 6665 SW Hampton St., Ste. 101 Tigard, Oregon 97223 PH (503) 620-2387 FAX (503) 620-2977		Catalytic Oxidizer Performance				Catox Parameters			
Project: H&V Fiber 1122-03 Location: Corvallis, OR Date: _____ Prepared By: _____ Water Traps Emptied: Y / N		Arrival: _____ Departure: _____		Inlet Temperature _____ Time _____ Outlet Temperature _____ Time _____ PID Calibration _____ PID Brand _____ Calibration Gas/Conc _____ PID Owner _____		Air Sample Collected			
Location	FPM to CFM Conversion	Velocity (FPM)	Reading Date/Time	Flow (CFM)	Other	PID	Container	Location Name	Sample Name
IMW-26	0.023303						Tedlar	126-9/28-1415	
IMW-16	0.020506						Tedlar	116-9/28-1415	
IMW-25	0.023303						Tedlar	125-9/28-1415	
IMW-3	0.023303						Tedlar	13-9/28-1415	
IMW-24	0.023303						Tedlar	124-9/28-1415	
IMW-17	0.023303						Tedlar	117-9/28-1415	
IMW-28	0.023303						Tedlar	128-9/28-1415	
IMW-29	0.023303						Tedlar	129-9/28-1415	
IMW-30	0.023303						Tedlar	130-9/28-1415	
IMW-31	0.023303						Tedlar	131-9/28-1415	
Subslab 4	0.023303						Tedlar	SS4-9/28-1415	
Subslab 5	0.023303						Tedlar	SS5-9/28-1415	
Submicro Legs	Direct Read						Tedlar	SLegs-9/28-1415	
SVE Post-Blower	Direct Read				Amps:		Tedlar	PSVE-9/28-1415	
SVE + Stripper to Glass Plant	0.20428				Temp:		Tedlar	S+S-9/28-1415	
Catox PreBleed	Pilot Gauge				Temp:		Tedlar	PreBld-9/28-1415	
Catox PostBleed	Pilot Gauge						Tedlar	PostBld-9/28-1415	
Catox Effluent	N/A						Summa	CatEff-9/28-1415	
Scrubber Blowdown	N/A						VOA Vial	SBlow-9/28-1415	

H&V Fiber Active Pumping Wells Corvallis, Oregon

Form D

[illegible]

H&V Fiber Water Level Monitoring
Corvallis, Oregon

Form E

PNG Environmental, Inc 6665 SW Hampton St., Ste. 101 Tigard, Oregon 97223 PH (503) 620-2387 FAX (503) 620-2977		H&V Water Level Monitoring			Date					
					Field Technician			Notes		
					Weather					
Well	Time	Total Well Depth from TOC (ft)	Depth to Top of Screen	Depth to Bottom of Screen	Wellhead Elevation	Depth to Water	Water Elevation			
DMW-2		39.01	29.01	39.01	224.16					
DMW-3		42.10	32.10	42.10	225.39					
IMW-3		29.12	18.78	27.62	226.44					
DMW-16		43.08	36.48	42.48	223.53					
IMW-16		30.98	21.14	29.98	225.26					
DMW-17		46.40	35.90	45.90	226.23					
IMW-17		31.92	22.08	30.92	226.17					
DMW-23		46.80	34.46	42.96	223.57					
DMW-24		49.09	36.33	45.17	226.52					
IMW-24		33.41	23.07	31.91	227					
DMW-25		46.94	34.60	43.44	224.15					
IMW-25		31.40	21.06	29.90	224.41					
IMW-26		31.18	20.84	29.68	226.67					
DMW-27		46.55	32.05	41.38	223.83					
IMW-27		35.59	25.06	34.39	223.78					
DMW-28		48.07	33.44	42.94	223.74					
IMW-28		28.82	18.19	27.69	223.48					
DMW-29		42.85	28.22	37.72	223.75					
IMW-29		28.72	18.09	27.59	223.51					
IMW-30		28.96	18.43	27.76	223.67					
IMW-31		29.01	18.18	27.51	223.73					

H&V Fiber Water Level Monitoring - Monthly
Corvallis, Oregon

Form E

A large grid of graph paper, consisting of 20 columns and 40 rows of small squares. The grid is used for recording data for H&V Fiber Water Level Monitoring.

H&V Fiber Water Level Monitoring - Semi-Annually
Corvallis, Oregon

Form F

PNG Environmental, Inc 6665 SW Hampton St., Ste. 101 Tigard, Oregon 97223 PH (503) 620-2387 FAX (503) 620-2977		H&V Water Level Monitoring			
		Field Technician			Date
		Weather			
Well	Time	Depth to LNAPL	Depth to Water	Depth to DNAPL	Total Well Depth from TOC (ft)
DMW-1					38.88
DMW-2					39.01
DMW-3					42.10
IMW-3					29.12
DMW-4					40.46
DMW-5					44.60
DMW-6					35.98
DMW-7					36.57
DMW-8					40.40
DMW-9					42.74
DMW-10					39.21
DMW-11					42.40
DMW-12					41.17
DMW-13					38.80
DMW-14					49.38
DMW-15					27.86
DMW-16					43.08
IMW-16					30.98
DMW-17					46.40
IMW-17					31.92
DMW-18					40.29
DMW-19					45.34
IMW-20					42.09
IMW-21					43.18
IMW-22					43.13
DMW-23					46.80
DMW-24					49.09
IMW-24					33.41
DMW-25					46.94
IMW-25					31.40
IMW-26					31.18
IMW-27					35.59
DMW-27					46.55
IMW-28					28.82
DMW-28					48.07
IMW-29					28.72
DMW-29					42.85
IMW-30					28.96
IMW-31					29.01

H&V Fiber Water Level Monitoring - Semi-Annually
Corvallis, Oregon

Form F

A large grid of graph paper for data recording. The grid consists of 20 columns and 40 rows of small squares. There are four horizontal lines that divide the grid into five equal vertical sections, each 4 columns wide. These lines are located at rows 10, 20, 30, and 40. The grid is intended for recording water level monitoring data.

GROUNDWATER SAMPLE COLLECTION FORM

Well ID no. _____ Sample no. _____ Date ____/____/____	Project name _____ Project no. _____ Collector _____
--	--

Well Information
 Monument condition ☐ Good ☐ Needs repair
 Well cap condition ☐ Good ☐ Locked ☐ Replaced ☐ Needs replacement
 Headspace reading ☐ Not measured _____ ppm ☐ Odor _____
 Elevation mark ☐ Yes ☐ Added ☐ Other _____
 Well diameter ☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other _____

Purge Data
 Total well depth _____ ft ☐ Clean bottom ☐ Muddy bottom ☐ Not measured
 Depth to product _____ ft Top of Screen _____ ft bgs Water above Screen Y/N
 Depth to water _____ ft Pump/Tubing Intake Depth _____ ft
 Casing volume _____ ft (H₂O) X _____ gpf = _____ X 3 = _____
 Casing volumes 3/4"=0.02 gpf 1"=0.04 gpf 2"=0.16 gpf 4"=0.65 gpf 6"= 1.47 gpf
 Bladder Pumps: 1/4" Tubing purge: 5.3mL/ft + 100mL; 3/8" Tubing purge: 9.5 mL/ft + 500mL

Purge Method
 Pump type ☐ Peristaltic ☐ Bladder ☐ Submersible ☐ Other _____
 Purge tubing ☐ New LDPE ☐ New HDPE ☐ New Teflon ☐ New Tygon ☐ Other _____
 Bailer type ☐ Disposable ☐ Teflon ☐ Stainless ☐ PVC ☐ Other _____
 Purge start time _____ Purge stop time _____ Purge rate _____
 Refill Timer Setting _____ Discharge Timer Setting _____ Pressure Setting _____ Flow Rate _____

Field Parameters
 Meter used ☐ HYDAC ☐ QED Flow Cell ☐ Hanna ☐ Other _____

<u>Gallons / mL</u>	<u>Temp(°F)</u>	<u>Conductivity</u>	<u>DO mg/L</u>	<u>pH</u>	<u>Turbidity</u>	<u>ORP</u>	<u>Comments</u>

Sampling Device
 Bailer ☐ Disposable ☐ Stainless ☐ Teflon ☐ Other _____
 Filter Type _____ Size _____ (micron) Bailer cord used ☐ Monofilament

Bottles Filled	Time _____	Preservative	Filtration
Number	Type		
_____	☐ VOA ☐ Amber ☐ Poly	☐ HCL ☐ Nitric ☐ Sulfuric ☐ None ☐ Other	☐ Yes ☐ No
_____	☐ VOA ☐ Amber ☐ Poly	☐ HCL ☐ Nitric ☐ Sulfuric ☐ None ☐ Other	☐ Yes ☐ No
_____	☐ VOA ☐ Amber ☐ Poly	☐ HCL ☐ Nitric ☐ Sulfuric ☐ None ☐ Other	☐ Yes ☐ No
_____	☐ VOA ☐ Amber ☐ Poly	☐ HCL ☐ Nitric ☐ Sulfuric ☐ None ☐ Other	☐ Yes ☐ No

 Comments: _____

 Sampler's Signature _____ Date ____/____/____

APPENDIX B
PNG STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE EQUIPMENT DECONTAMINATION FOR SOIL AND WATER SAMPLING SOP 4

This standard operating procedure (SOP) describes procedures for decontamination of sampling equipment, drilling equipment and other tools that could come in to contact with contaminated media. Procedures were adopted from guidance documents and reports prepared by USEPA and include:

- Technical Enforcement Guidance Document (USEPA, November 1992).
- Compendium of Superfund Field Operations Methods (EPA, December 1987).
- Protocol for Ground-Water Evaluations (USEPA, September 1986).
- Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs (Ohio EPA, June, 1993).
- Field Sampling Procedures Manual (New Jersey DEP, July 1986).
- ASTM 5088-90 Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites (1992).

Personnel performing the decontamination procedures will wear protective clothing as specified in the site-specific Health and Safety Plan.

Benefits of an appropriately developed, executed, and documented equipment decontamination program are three-fold:

- Minimize the spread of contaminants within a study area or from site to site,
- Reduce the potential for worker exposure, and
- Improve data quality and reliability by eliminating the opportunity for cross-contamination

DECONTAMINATION REAGENTS

- Detergents shall be nonphosphate
- Acid rinses (inorganic constituents) shall be reagent grade nitric or hydrochloric acid
- Solvent rinses (organic constituents) shall be pesticide grade methanol, hexane, isopropopropanol or acetone
- Deionized water rinse shall be organic free, reagent grade (generally provided by laboratory)
- Tap water rinse shall be either local tap water or distilled water available from retail stores. Note that this distilled water generally contains low levels of organic contaminants and can not be used for Deionized rinse or blanks.

INORGANIC CONTAMINATED SAMPLING EQUIPMENT

- Wash equipment with nonphosphate detergent, scrubbing off any residues
- Rinse generously with tap water
- Rinse equipment with Acid Rinse (0.1 N nitric or hydrochloric)
- Rinse with Reagent Water
- Allow to air dry

After decontaminating all sampling equipment, the gloves and other disposables will be placed in garbage bags. The wash and rinse will be containerized for proper disposal.

ORGANICALLY CONTAMINATED SAMPLING EQUIPMENT

- Wash equipment with nonphosphate detergent, scrubbing off any residues
- Rinse generously with tap water
- Rinse equipment with Solvent Rinse
- Rinse with Reagent Water
- Allow to air dry

After decontaminating all sampling equipment, the gloves and other disposables will be placed in garbage bags. The wash and rinse will be containerized for proper disposal.

DECONTAMINATION OF SAMPLING PUMPS

When pumps (e.g., submersible or bladder) are submerged below the water surface to collect water samples, they shall be thoroughly cleaned and flushed between uses. This cleaning process consists of an external detergent wash and high-pressure tap water rinse, or steam cleaning of pump casing, tubing, and cables, followed by a flush of potable water through the pump. This flushing can be accomplished by placing the pump in a newly purchased plastic garbage can filled with tap water and pumping multiple volumes through the pump. The procedure should be repeated first with detergent water and then with tap water. Blanks can be performed by pouring Reagent Water through the pump into the appropriate sample container.

STANDARD OPERATING PROCEDURE MEASUREMENT OF STATIC WATER LEVEL AND PRODUCT LEVELS SOP 10

This standard operating procedure (SOP) describes procedures for measuring water and light (floating) and dense (sinking) product levels in monitoring wells. Procedures outlined below are applicable to electronic interface probes, electronic water level meters, and product reactive paste.

FIELD PROCEDURES

- Open all well caps to be measured to allow equilibration of the water table to ambient barometric pressure. Always approach the well from the upwind direction and monitor the wellhead with health and safety equipment, as applicable for the site and outlined in the Site Health and Safety Plan.
- Check interface probe or electronic water level meter for proper operation following manufacturer's instructions. Clean probes and tapes at the end of each day of sampling. Note that the interface probes are susceptible to fouling and must be cleaned carefully. The interface probe is not to be used on wells that do not have high concentrations of contaminants based on field screening (PID readings or using a disposable bailer to check for presence of non-aqueous phase liquids [NAPLs]) or historical monitoring experience. Inexpensive, disposable bailers are always available for checking NAPLs in the case of unknown conditions.
- Clean probe and tape by washing with Alconox and water, rinsing with methanol or nitric (See SOP 4, Equipment Decontamination for Soil and Water Sampling) and rinsing with distilled, deionized water.
- If well depth is to be sounded to check accuracy of well completion documentation or to check for buildup of sediment in sump, the length of tape requiring additional cleaning is determined by the distance between top of casing and bottom of casing. If the fluid level probe is used for sounding the well, it must be fitted with a stainless steel weight and the distance from the bottom of weight to the tape markings calibrated into the measurements.
- Water level sounders will either have an audible alarm and/or a light, to indicate the water surface. Some brands of indicators are affected by NAPLs and provide false readings.
- Interface probes generally provide two tones or a constant tone and intermittent tone for indication of water and NAPL. If properly cleaned, the probes are effective for light non-aqueous phase liquids (LNAPLs). Be careful with dense non-aqueous phase liquids (DNAPLs), as many of the brands of probes are not accurate. A useful check is to slowly lower a disposable bailer into the well and let it sit for ten minutes before retrieval and direct measurement of the DNAPL layer.
- Product paste for petroleum LNAPLs is effective. Lower the coated tape quickly, and let sit for a period-of-time. A common problem with the paste is the smearing of petroleum on the lower end of the tape that fully penetrates the LNAPL layer. The tape section that is actually in the groundwater often turns color, providing an overestimate of the actual thickness. Repeated trials or use of a bailer to check the thickness is recommended.

FLOATING PRODUCT MEASUREMENTS

An interface probe which differentiates between floating product (e.g., aromatic hydrocarbons and water), is used to measure floating product thickness and depth to water. An alternate method involves using a stainless steel tape and hydrocarbon marking paste. The thickness of the floating product and depth to the groundwater table are measured relative to the monitoring well top of casing (TOC), which should be clearly marked with a notch. This notch is the reference for the vertical survey of the well. The probe is lowered into the well and direct readings for the air/oil and oil/water interface are taken from the tape, which has graduated marks at 0.01 -ft intervals. For the steel tape method, the tape is held at a specific interval such that the marking paste overlaps the hydrocarbon interval. After 5 minutes, the paste reacts and the two interfaces can be calculated from the graduated tape. The probe will be decontaminated in accordance with SOP 4 prior to use at each well. Where floating product is encountered, the true water table elevations will be calculated by adding the elevation of the measured water interface to a proportion of the hydrocarbon thickness that is based on the density of the hydrocarbon.

$$Z_{aw} = Z_{ow} + [P_{ro} (Z_{ao} - Z_{ow})]$$

[True Level = Measured Water + (Density x Product Thickness)]

Where:

Z_{aw} = True elevation of air/water interface

Z_{ow} = Measured elevation of oil/water interface

Z_{ao} = Measured elevation of air/oil interface

P_{ro} = Specific gravity of the hydrocarbon

MAINTENANCE

- Carry spare batteries for the interface probe at all times. Check the circuitry in the field laboratory weekly during a sample run, by assembling the apparatus and dipping the end of the tape into a beaker of water.
- Clean probes and tapes at the end of each day of sampling by washing with Alconox and water, rinsing with methanol, and rinsing with deionized water. In addition, clean tapes between wells at all times. Never use an interface probe on a "clean" well, as full decontamination is nearly impossible. When in doubt whether a well contains NAPL, use a disposable bailer to check for the presence of NAPL.

STANDARD OPERATING PROCEDURES

GROUNDWATER SAMPLING WITH SUBMERSIBLE PUMP

SOP 13

This standard operating procedure (SOP) describes the general method for collecting groundwater samples including well purging and sample collection.

WELL PURGING

- Measure water level and well depth (if appropriate) according to SOP 10. Calculate casing storage volume.
- Calculate placement of the pump such that it is at 50% of the well screen during sampling (center of saturated screen). For example if the static well head is above the screen at 40 ft bgs and the screened interval is from 50-60 ft bgs, the pump should be placed at 55 ft bgs. If the static well head is at 52 ft bgs, within the screened interval, the pump should be placed at $\frac{1}{2}$ of the static head in the well or at 56 ft bgs (assuming total well depth is 60 ft).
- Lower decontaminated clean submersible pump (disregard if well is equipped with a dedicated pump) to the center of the saturated screen. Connect surface tubing (discharge end) to flow meter and/or Flow Cell (see SOP 19).
- Turn on the pump. Monitor the cumulative volume pumped using an in-line meter or graduated container.
- After about 0.5 well volumes have been pumped, rinse a plastic beaker with flowing well water. Place the end of the pump discharge tube in the bottom of the beaker. Allow the water to fill and overflow the beaker.
- Measure field parameters (temperature, pH, DO, TDS, ORP and electrical conductivity) as described in SOP 11.
- When a minimum of three well volumes have been purged and water temperature, pH, and EC measurements have stabilized (i.e., $\pm 3\%$ of temperature reading, ± 0.1 pH units, $\pm 3\%$ EC, $\pm 10\%$ of DO reading of the previous reading, ± 10 mV of ORP reading) sample collection can begin. Record field parameter measurements on *Groundwater Sampling Form*.
- Collect samples for analysis as described in the following section.

GROUNDWATER SAMPLING

- Reduce the purge rate from the pump to a maximum of 0.1 gpm and allow steady flow.
- If filtration is required, attach tubing to the in-line filter for filling into bottles that cap tightly.
- If a sample for volatile organic compound analysis was collected, recheck that the sample container does not contain headspace. If any air bubbles are present, the volatile organic compound sample must be retaken using a fresh sample container. All samples collected will be filled to the capacity required for analysis. Sample containers must not be rinsed with sample water before final filling in case of possible presence of floating products in the well, which can adhere to the sample container wall and bias analyses.
- Label the sample bottles with all necessary information. Record the information in the field logbook and complete all chain-of-custody documents and seals. Clean

the exterior of the filled, sealed sample containers using a brush and soap and water mixture, and rinse with distilled water. Seal the sample container in a Ziploc bag and bubble pack to reduce the possibility of contaminating other samples if a sample bottle leaks or breaks.

- Place the properly labeled and sealed sample bottles on ice in a cooler for the duration of the sampling and transportation period. If collected, do not allow samples for volatile organic compound analysis to freeze. Note whether the sample type requires isolation from other sample types.
- Clean the outside of the submersible pump and tubing (or discard tubing) with clean tap water and Alconox or a high-pressure spray. Run water with Alconox through the pump followed by deionized water. Repeat. Collect decontamination water in appropriate containers.

STANDARD OPERATING PROCEDURE

LOW-FLOW PERISTALTIC PUMP GROUNDWATER SAMPLING

SOP 17

This standard operating procedure (SOP) is designed to assist the user in taking representative groundwater samples. Groundwater samples will be collected using low-flow (minimal drawdown) purging and sampling methods as discussed in U.S. EPA, Ground Water Issue, Publication Number EPA/540/S-95/504, April 1996 by Puls, R.W. and M.J. Barcelona - "Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures."

The field sampler's objective is to purge and sample the well so that the water that is discharged from the pump, and subsequently collected, is representative of the formation water from the aquifer's identified zone of interest.

This SOP is applied when the wells to be sampled are not equipped with dedicated down well equipment.

INITIAL PUMP FLOW TEST PROCEDURES

Measure and record the Static Water Level (SWL) on the field data sheet following procedures outlined in SOP 10.

If possible, the optimum flow rate for each well will be established during well development/redevelopment or in advance of the actual sampling event. The appropriate tubing type (Teflon, HDPE, PVC, polyethylene, etc.) should be preselected based on the analytes of interest.

The mid-point of the saturated screen length is used by convention as the location of the pump intake (i.e. if total well depth is 30 feet below ground surface (bgs) and well is screened from 20-30 feet with a SWL of less than 20 feet bgs, base of tubing should be lowered to 25 feet.). If the head within the well is within the screened interval tubing intake should be placed at $\frac{1}{2}$ of the static well head (i.e. for previous example SWL is at 22 feet bgs, tubing intake should be placed at 26 feet bgs: well depth [30 feet] minus SWL [22 feet] equals eight feet of head in well; $30 \text{ minus } [8 \times \frac{1}{2}] \text{ equals } 26 \text{ feet.}$)

Site specific work plans may change the pump intake depth in order to sample from the highest yielding zone within the screened interval. In wells with a fully saturated screen length over ten feet, testing should be performed if possible during development to determine the highest water yielding zone within the screened interval.

PURGE AND SAMPLING EVENTS

Prior to the initiation of purging a well, the Static Water Level will be measured and documented. The peristaltic pump will be started utilizing its documented control settings and its flow rate will be confirmed by volumetric discharge measurement with the In-Line Flow Cell connected. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. If necessary, any minor modifications to the control settings to achieve the well's optimum flow rate will be documented on the gauging sheet. When the optimum pump flow rate has been established, the SWL drawdown has stabilized within the required range, and at least one pump system volume (down well extraction tubing, pump head tubing, and discharge tubing volume) has been purged, begin taking field measurements for pH, temperature (T), conductivity (Ec), oxygen reduction potential (ORP), dissolved oxygen (DO), and turbidity (TU) using an in-line flow cell. All water chemistry field

measurements will be documented on the gauging sheet. Measurements should be taken every three to five minutes until stabilization has been achieved. Stabilization is achieved after all parameters have stabilized for three consecutive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or dissolved oxygen. Three consecutive measurements indicating stability should be within:

Temperature	± 3 percent of reading (minimum of ± 0.2 C)
pH	± 0.1 units, minimum
Conductance	± 3 percent of reading
Dissolved Oxygen	± 10 percent of reading
Redox (ORP)	± 10 mv
Turbidity	± 10 percent NTU (Turbidity is not a water chemistry indicator parameter but is useful as an indicator of pumping stress on the formation)

When water quality parameters have stabilized, and there has been no change in the stabilized SWL (i.e., no continuous drawdown), sampling collection may begin.

EQUIPMENT LIST

The following equipment is needed to conduct low flow purging and sampling:

- Portable peristaltic pump equipped with a flow controller
- Disposable down well sampling tubing of sufficient length to intake groundwater at the target sampling depth for each well
- In-Line Flow Cell and meter(s) with connection fittings and tubing to measure water quality
- Water Level Probe or installed dedicated water level measurement system
- Photoionization Detector (PID)
- Sample containers appropriate for the analytical requirements
- Field measurement documentation forms
- 300 to 4000 milliliter graduated cylinder or measuring cup
- Five gallon bucket(s) or other containment system for containerizing purge water
- Wristwatch with second hand or stopwatch
- Sufficient cleaning and decontamination supplies if portable Water Level Probe is utilized

PROCEDURE

- Calibrate all field instruments at the start of each day's deployment per the instrument manufacturer's instructions. Record calibration data on the *Field Instruments Calibration Documentation Form*.
- Drive to the first well scheduled to be sampled (typically the least contaminated). Make notes in the field log book describing the well condition and activity in the vicinity of the well. Decontaminate the portable water gauging probe by washing with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.
- Remove the wellhead cover and take a measurement of the well vapor space with a PID. Record the measurement on the gauging and sampling sheet.

- Measure the depth to water from the surveyed reference mark on the wellhead and record the measurement on the gauging and sampling sheet if not completed previously.
- Insert a sufficient length of disposable sampling tubing into the well casing to ensure that the tip of the tubing is located within the appropriate sampling depth within the well screen.
- Insert a new length of flexible silicone tubing into the peristaltic pump head fixture.
- Connect the down well sampling tubing to the silicone tubing in the peristaltic pump head fixture.
- Connect the pump discharge tubing to the In-Line flow cell's "IN" fitting.
- Connect the Flow Cell's "OUT" line and secure to drain the purge water into the purge water collection container.
- After a single pump-system's volume (down well sampling tubing, pump head silicone tubing, and discharge tubing volume) has been adequately purged, read, and record water quality field measurements every three to five minutes until all parameters have stabilized within their allowable ranges for at least three consecutive measurements. When stabilization has been achieved, sample collection may begin.
- Disconnect the flow cell, and its tubing, from the pump discharge line before collecting samples. Decrease the pump rate to 100 milliliters per minute or less by lowering the pump controller's setting prior to collecting samples for volatiles. Refer to the task instructions for the correct order and procedures for filling sample containers. Place the samples in a cooler with enough ice to keep them at 4 degrees Centigrade.
- Once samples for volatiles have been collected, re-establish pump flow rate to the original purge flow rate by inputting the documented controller settings for the well without the In-Line Flow Cell connected, and collect remaining samples.
- Measure and record total purge volume collected. Consolidate generated purge water.
- Disconnect and dispose of each length of down well sampling tubing, silicone pump head tubing, and pump discharge tubing.
- Secure the wellhead cover and secure it with its lock. Move equipment to the next well to be sampled.
- Clean and decontaminate the In-Line Flow Cell with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.

**STANDARD OPERATING PROCEDURES
PUSH-PROBE PORE WATER SAMPLING
(GROUNDWATER-SURFACE WATER TRANSITION ZONE)
SOP 31**

This standard operating procedure (SOP) describes methods for collecting pore-water and groundwater samples including well purging and sample collection using a PushPoint pore water sampler.

GENERAL

The PushPoint device is a simple, precisely machined tool consisting of a tubular body with a screened zone at one end and a sampling port at the other. The bore of the PushPoint body is fitted with a guard-rod that gives structural support to the PushPoint and prevents plugging and deformation of the screened zone during insertion into sediments. The PushPoint is made of 316 stainless steel assuring compatibility with most sampling environments. The screened-zone consists of a series of interlaced machined slots which form a short screened-zone with approximately 20% open area within the screen (Figure 1).

PUSHPOINT INSTALLATION

To install the PushPoint, hold the device in a manner that squeezes the two handles towards each other to maintain the guard-rod fully inserted in the PushPoint body during insertion (as shown in Figure 2). Continue to hold the device in this manner and push the PushPoint into the sediments or beach to the desired depth using a gentle twisting motion. When the desired depth is reached (or at refusal), remove the guard-rod from the PushPoint while holding the body in place to prevent disturbing the position of the screened zone. Once the guard-rod has been removed from the PushPoint, it should not be reinserted into the device until the bore of the PushPoint has been thoroughly cleansed of all sand, silt, etc.

PORE WATER SAMPLING

Prior to pore water sampling, a representative surface water sample should be collected and field-measured water quality parameters including specific conductance recorded for later comparison. More than one surface water sample may be required during the pore water event.

Attach a peristaltic pump and In-line flow cell (optional) to the "installed" PushPoint sample-port (see Figure 3) and withdraw water at a low-flow sampling rate (50-200 milliliters per minute [ml/min]). Once the first 20-50 ml of groundwater have been purged and discarded, measurement of groundwater stability parameters including specific conductance should begin (as described in SOP 17). Specific conductance should be compared to surface water as a qualitative tool to check for surface water infiltration since pore water/surface water conductivities typically differ (Zimmerman et al, 2005). Once groundwater stability parameters have stabilized, sample collection can begin. Sample volume and containers should be pre-determined in conjunction with the laboratory.

RELATIVE STATIC WATER LEVEL COMPARISON

The PushPoint can be used as a piezometer to determine the static head of groundwater/porewater for comparison with static surface water and potential evaluation of groundwater flow direction. To do this, a tube is connected to the sample port as shown in Figure 5. A continuous stream of water is established from the pump to the screened-zone by pumping out any air remaining in the PushPoint and attached tubing. As indicated in Figure 5, the tubing should be curved down into the surface water body for comparison before disconnecting the pump. Once the pump is disconnected from the tubing, the static water level in the tube will represent the static water level at the depth that the screened-zone occupies. If the static water level in the PushPoint is above the static surface water level, it is indicative of a positive relative head difference and a "gaining reach," such that groundwater/porewater is discharging to surface water. If the static water level is below surface water, it is indicative of a negative relative head difference and a "losing reach," such that surface water is infiltrating to the screened zone of the PushPoint. It is possible to encounter artesian conditions such that water can flow from the PushPoint and attached tubing out into surface water.

CLEANING AND DECONTAMINATION

The PushPoint is a reusable device. The tolerance between the guard-rod and the bore of the PushPoint is very minor. Increases in this tolerance through abrasion and damage may allow silty material into this annular space, eventually jamming the guard-rod into the bore - possibly permanently. Thus it is extremely important to thoroughly clean and decontaminate the bore before reinserting the guard rod. Excess wear and abrasion can also be introduced if the guard-rod is inserted frequently when the PushPoint body is bent. Bending can occur during PushPoint installation and all bends should be removed prior to reinsertion of guard-rod to avoid abrasive contact between the bore and the guard rod. Use caution when straightening the screened-zone, it is somewhat delicate without the guard-rod inside it, and can be broken through repeated bending. Similarly, the guard-rod should be bend-free and clean when inserted into the bore of the device. When a clean and straight PushPoint is assembled, the guard-rod should slide fairly easily through the PushPoint bore and its handle should seat against the sampling port.

Clean the exterior of the guard-rod and PushPoint body and screened-zone with a stiff brush and cleaning solution (phosphate-free Alconox solution). Cleaning and decontamination of the bore of the instrument is easily accomplished using the cleaning adapter provided. Remove the spray nozzle of a "garden sprayer" filled with cleaning solution. Connect the adapter as shown in Figure 4. Insert the sampling port of the PushPoint to the adapter and squirt ~ 100 ml of pressurized cleaning solution backwards through the sampler and out the screened- zone into a waste receptacle. Cleaning solution and/or rinse water can be pumped via the peristaltic pump with the flow direction reversed from the purge/sample direction. If you wish to reuse the PushPoint sampler at a particular sampling location and want to clean the bore quickly so that the guard-rod may be safely reinserted, you can use pump inlet tubing with surface water or de-ionized water to back flush the bore several times before reinserting the guard-rod. Gently push the guard rod into the bore of the PushPoint to its end to dislodge any bridged material. Re-rinse the bore with cleaning solution. Follow this with a distilled water and/or methanol rinse. Reinsert the guard-rod and the device is ready to be used again.

In some instances, it may be advantageous to force the cleaning solution through the screened-zone and out the sampling port. To do so, gently insert the screened-zone of the PushPoint into the cleaning adapter, making sure not to bend the screened-zone, until the entire screened-zone is within the adapter. The screened-zone is somewhat fragile. To avoid damage, do not bend the screen-zone during insertion into the adapter. Squirt cleaning solution through the sampler to a waste receptacle.

OPERATIONAL DETAILS, TROUBLESHOOTING AND OTHER NOTES:

- Multiple depths can be sampled in one hole if samples are collected, in order, from deepest to shallowest, however, it is recommended to fully remove and reinsert the PushPoint in a new adjacent location. To sample multiple depths insert the sampler using a twisting motion until you reach refusal. Remove the guard-rod. Do not push the sampler further into the sediments once the guard-rod has been removed as this may damage the screened-zone and plug the device with sediment. Once sampling has been completed at this deepest depth, the PushPoint can be partially pulled from the hole to a new sampling elevation. To prevent screened-zone damage, do not insert the PushPoint into the sediments without the guard-rod inserted into the PushPoint body. Alternately, multiple holes can be used to collect samples from multiple depths at a particular sampling location. If vertical sampling is performed in one hole, it is recommended that some type of device, such as a sampling platform, be used to prevent lateral movement and slippage of the PushPoint as sampling is conducted near the top of the hole (see Figure 3). This offsets the leverage of the instrument and reduces hole degeneration. A simple platform would be a plate of steel with a 3/16" diameter hole through its center and would serve the fundamental purpose of maintaining a rigid hole opening.
- If you wish to reuse the PushPoint sampler at a particular sampling location and want to clean the bore quickly so that the guard-rod may be safely reinserted, you can use a syringe filled with surface water or de-ionized water to back flush the bore several times before reinserting the guard-rod. Use at least 100 ml of water. If you have too much trouble reinserting the guard-rod (i.e. grit), it will be necessary to use the standard cleaning procedures.
- When straightening the screened zone it is sometimes helpful to flush out the bore of the device with a cleaning solution and then insert the guard-rod to the area of the bend in the screened-zone. Gently unbend the portion of the screened-zone nearest the rod and carefully advance the rod to the next bend. After the rod has been fully inserted into the screened-zone perform the final screened-zone, straightening until the guard-rod slides freely through it.
- If the screened-zone of the PushPoint becomes plugged while inserted in the sediments, it may be possible to hydraulically/pneumatically shock the screened-zone free of adhering material while it is inserted into the sediments. Attach a large-volume (50 ml) syringe to the sampling port. In a quick motion, pull the syringe plunger most of the way back (creating a vacuum) and then immediately release the plunger - the plunger will slam to a neutral position, sending a shock wave through the bore of the PushPoint and may alleviate the problem. It is possible to achieve this effect by reversing the flow direction on the peristaltic pump.

- It is possible to push the PushPoint through thin lenses of low-permeably material and collect samples from below them and gather valuable geochemical samples. At many of the sites where the PushPoint has been used, sampling from just below a layer of fine sand/silt/clay, one occasionally encounters seemingly large pockets of gas that seem to have coalesced and collected under this less permeable stratum. If this condition exists, the degassing effect can be minimized by decreasing the sampling rate to a rate more easily yielded by the sampled formation.
- The PushPoint is constructed of 316 stainless steel, as mentioned previously. There are two places where the stainless parts are silver soldered together, the handle of the guard-rod and the handle on the PushPoint sampler. If the investigator is collecting samples for metals analysis, the silver solder joint on the guard-rod may impart trace levels metallic residue to the sampling port mouth. Although the possibility is minor and has never been recorded in trial runs it does exist. The silver solder used by the manufacturer is Safety-Silv 45 which contains silver (45%), copper (30%), and zinc (25%). Material safety data sheets (MSDS) available upon request. In the unlikely event that these metals cause contamination of samples, the manufacturer (MHE) can produce specialty guard-rods that are not silver soldered.
- These devices can be dedicated as semi-permanent underwater monitoring devices. If a PushPoint is inserted to the desired depth through a plate (such as the sampling platform mentioned earlier) that can lock the sampler at the correct insertion depth, a vinyl cap can be placed over the mouth of the sampler, and the sampler can be dedicated to that location so that future samples can be withdrawn when desired.

REFERENCES

Zimmerman, Mark J., Massey, Andrew J., Campo, Kimberly W. 2005. *Pushpoint Sampling for Defining Spatial and Temporal Variations in Contaminant Concentrations in Sediment Pore Water near the Ground-Water/Surface-Water Interface*. Scientific Investigations Report 2005-5036. US Department of the Interior, US Geological Survey.

Figure 1
the PushPoint sampler

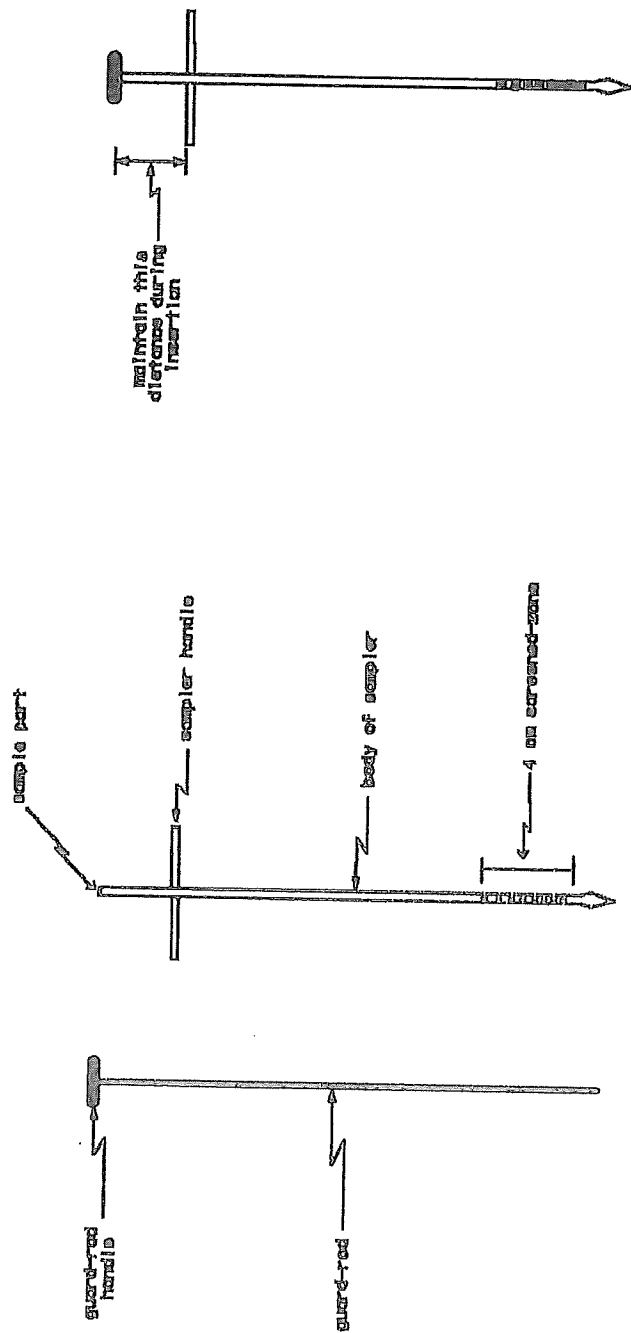


Fig. 1a
disassembled sampler

Fig. 1b
assembled sampler

Figure 2

grasp instrument firmly
and squeeze two handles
together to maintain
this distance while
inserting into sediments

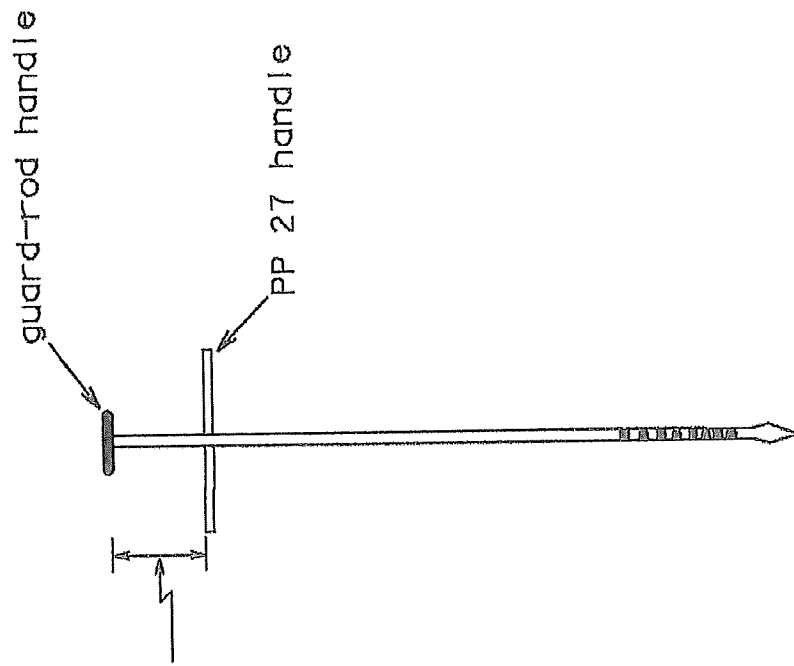


Figure 3

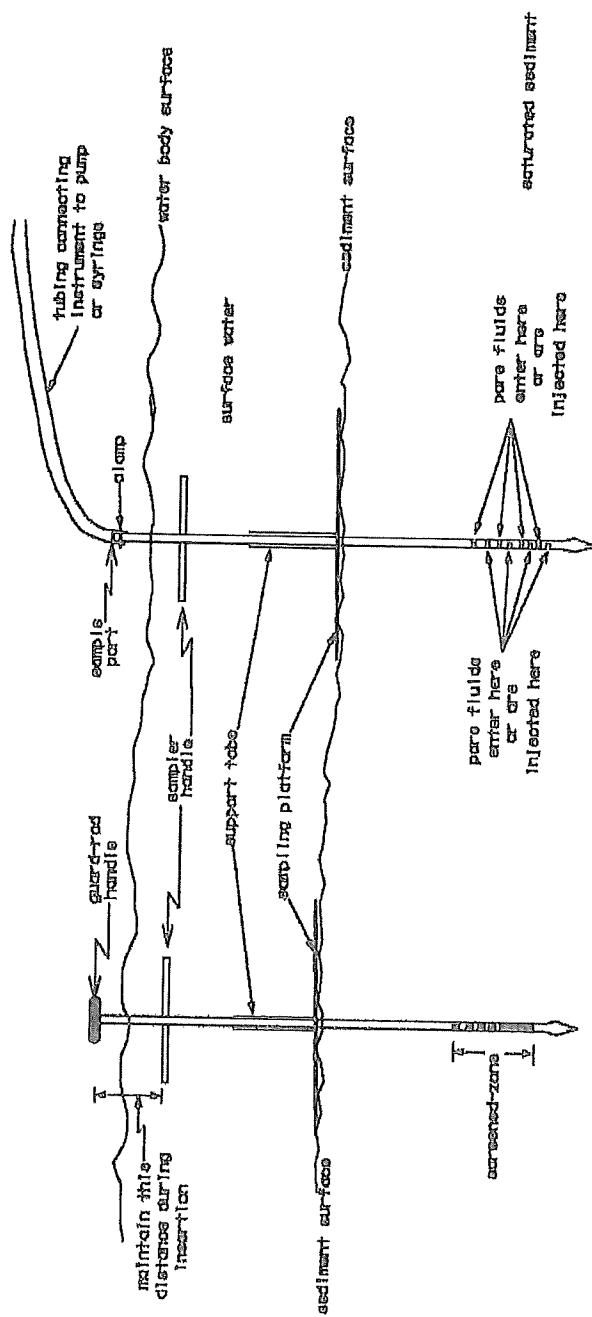
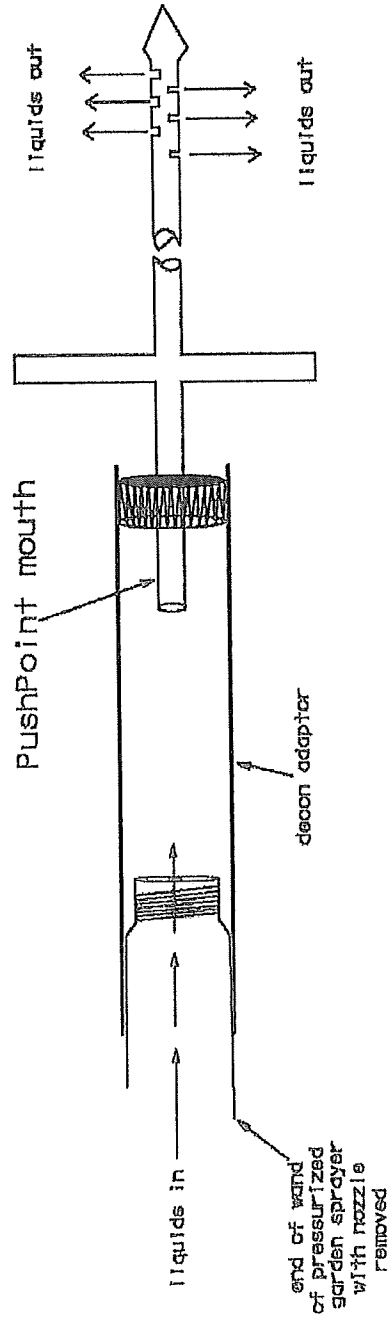


Fig. 3a
configuration when
installing in sediments

Fig. 3b
configuration while
sampling groundwater

Figure 4

attachment of decon adaptor



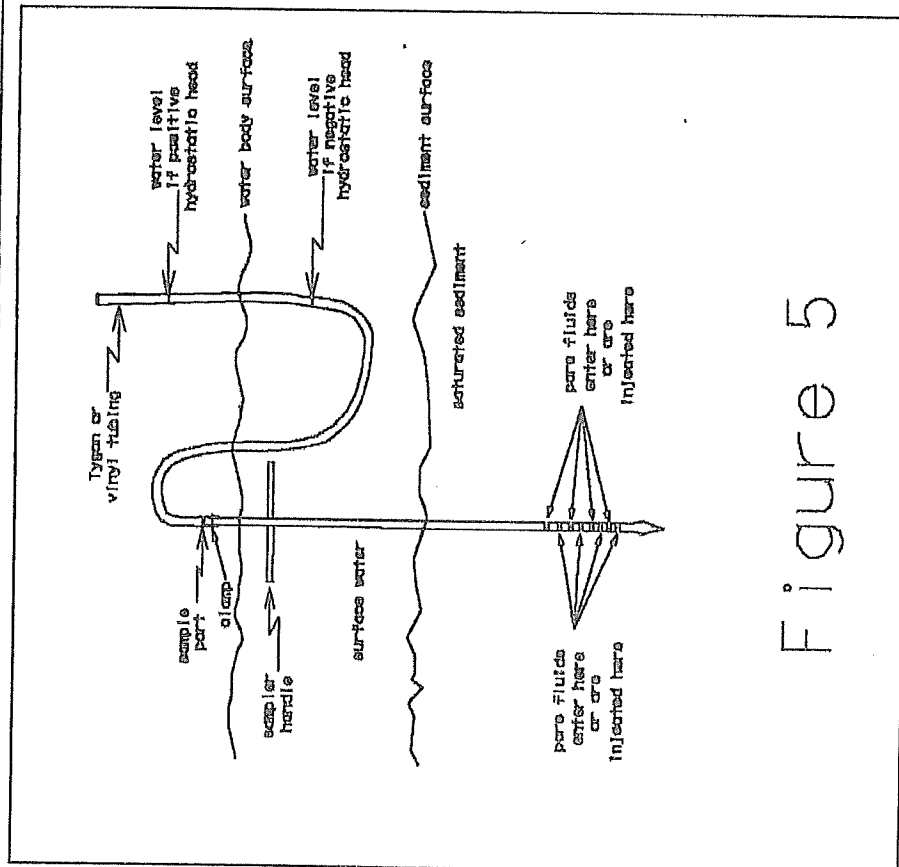


Figure 5

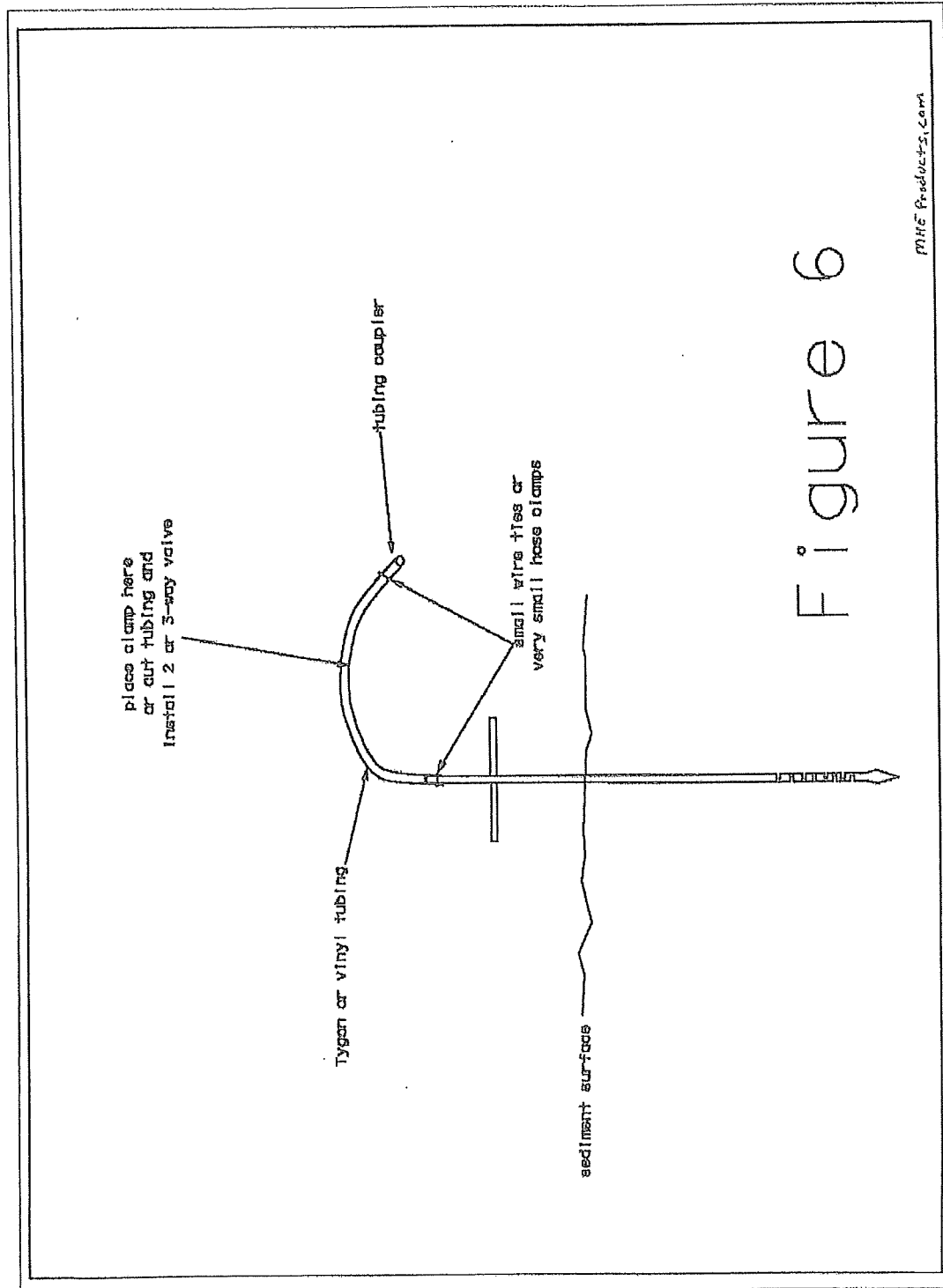
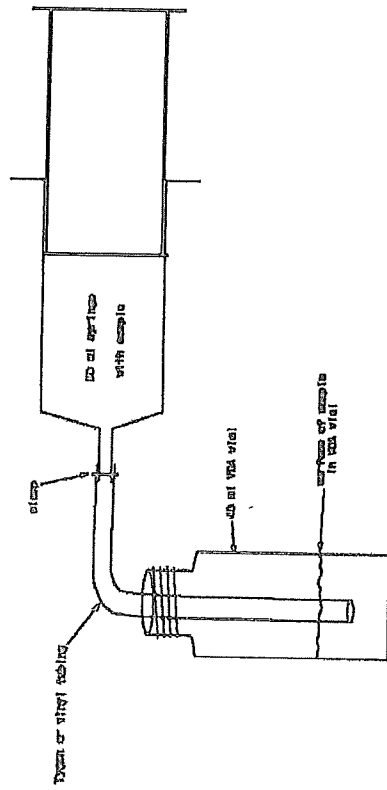
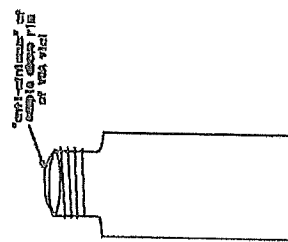


Figure 6



dispensing sample
into VOA vial



sample in VOA vial
sealing preservation
and capping

Figure 7
filling VOA vial "headspace free"

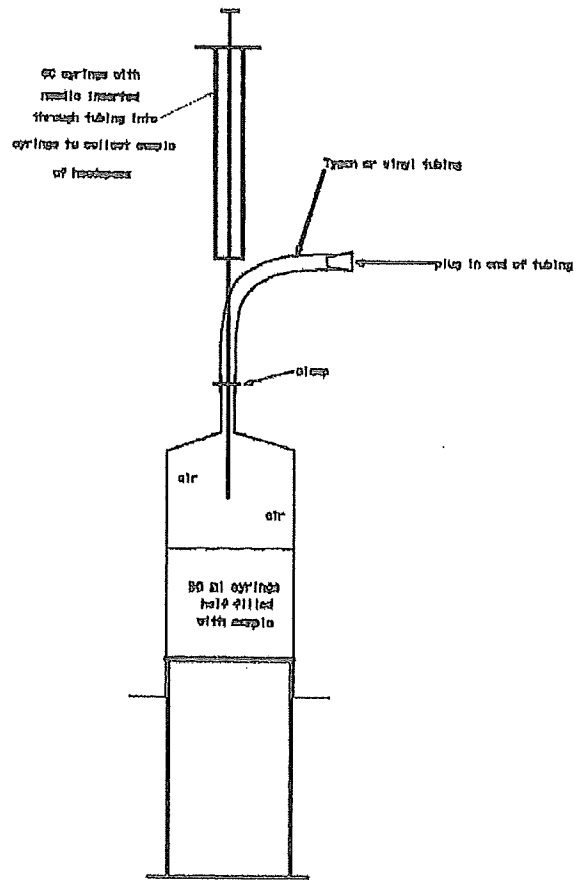


Figure 8

