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26 July 2005

Ms. Claudia Sait
Maine Department of Environmental Protection
State House, Station 17
Augusta, Maine 04333-0017

And

Ms. Christine Williams
U.S. Environmental Protection Agency, Region I
1 Congress Street, Suite 1100 (HBT)
Boston, Massachusetts 02214-2023

SUBJECT: Final Letter Work Plan for Pore Water Sampling at Mere Brook, Naval Air Station Brunswick, Brunswick, Maine
ECC Project No. 5700.017.002.100

Dear Ms. Sait and Ms. Williams:

On behalf of the Department of the Navy, Engineering Field Activity Northeast (EFANE), ECC is pleased to present this final Letter Work Plan for pore water sampling within Mere Brook in the vicinity of Eastern Plume monitoring well MW-313 at the Naval Air Station, Brunswick (NASB), Maine. The location of NASB and the Eastern Plume and Mere Brook are shown on Figures 1 and 2, respectively. The services detailed herein will be performed as requested by EFANE under Contract No. N62472-02-D-0810, Contract Task Order No. 017. It is anticipated that proposed activities will commence during the first week of August 2005, subsequent to final review and concurrence by Maine Department of Environmental Protection (MEDEP), U.S. Environmental Protection Agency (US EPA), and on-site NASB-specific personnel. Comments issued by MEDEP on 19 July 2005 have been incorporated in this final Letter Work Plan, per Attachment A.

ECC has been tasked with development of this work plan, staking proposed sampling locations, survey proposed sample point locations with Global Postioning System (GPS), assisting MEDEP and US EPA sampling personnel with NASB Weapons access and escort within the restricted area of the weapons compound, completion of laboratory analysis of selected split-samples for verification purposes, and generatering a Summary Report. The MEDEP will provide all sampling equipment, materials and labor for the Pore Water Sampling Program. The US EPA is providing the mobile laboratory to perform on-site analysis of samples for volatile organic compounds (VOCs). The Navy will provide pre-cleaned sample containers for all sample locations for the mobile lab and the Navy's split samples.

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BACKGROUND

MEDEP requested that pore water sampling be conducted along a limited segment of Mere Brook to assess whether VOCs from the Eastern Plume in the vicinity of monitoring well MW-313 may be upwelling in this area. Previous surface water samples have suggested VOCs may be entering Mere Brook, although this hypothesis has not been confirmed by sampling results. The completion of additional investigative activities will provide data to assess potential dissolved-phase impacts immediately downgradient of the Eastern Plume in the area of monitoring well MW-313. The proposed activities detailed herein were developed subsequent to discussions with MEDEP and US EPA personnel at site-specific technical meetings held in late 2004 and early 2005.

MEDEP is developing a sampling program (and associated standard operating procedures) to collect pore water samples along the southeastern boundary of the Eastern Plume near monitoring well MW-313 within the stream sediments along Mere Brook. MEDEP is planning to use the US EPA mobile field gas chromatograph (GC) laboratory to analyze each sample for VOCs. A selected percentage of these samples (undetermined at this time) will also be analyzed for 1,4-dioxane. During field sampling, ECC will be present onsite as a Navy representative to oversee the field activities and, based on the results of the mobile field laboratory analysis, to collect split samples for laboratory analysis. The split samples will be sent to a Navy- and MEDEP-certified laboratory for analyses of VOCs by US EPA Method 8260B and for 1,4-dioxane (as applicable) by US EPA Method EIASOP VOADIOX1.

The above-referenced field activities, equipment calibration, and sampling protocols, will be performed in accordance with the draft Base-Wide Quality Assurance Project Plan (QAPP) specific to Sites 1 & 3 and Eastern Plume Long-Term Monitoring Plan (EA 2004[1]), the site-specific Safety and Health Emergency Response Plan (SHERP) (EA 1997[2]), and the procedures detailed herein, with the following exceptions (as applicable); US EPA Field Screening Procedures for Volatile Organics and MEDEP's Pore Water Sampling Standard Operating Procedure (SOP), both of which are included as attachments to this work plan (Attachments B and C, respectively).

Pore Water Sample Locations

Prior to initiation of pore water sampling activities, ECC will use sub-meter GPS to locate the proposed sample intervals along the stream bank of Mere Brook (Figure 3). This will facilitate revisiting these locations in the future, adding the sample locations to the GIS, and incorporating the sample locations with data into the NAS Brunswick analytical database. Small wooden stakes with flagging will be used to mark the positioning of the sample locations. MEDEP will also perform GPS monitoring activities at each sampling location subsequent to sample collection to assess deviations from proposed locations and/or to document locations that may have been modified due to changes in site conditions. Sample

1. EA Engineering, Science, and Technology (EA). 2001. Long-Term Monitoring Plan for Sites 1, 3, and the Eastern Plume. Naval Air Station Brunswick, Brunswick, Maine. August.
2. EA. 1997. Base-Wide Safety, Health, and Emergency Response Plan, Naval Air Station, Brunswick, Maine. June.

collection of the pore water will be conducted by MEDEP personnel via a small boat (if and where necessary) or by using hip waders and walking along the stream bank.

Based on previous technical discussions with EFANE, MEDEP and US EPA and subsequent comment the proposed technical approach, a segment of Mere Brook with an approximate reach of 1,000 ft was selected for investigation. Samples will be collected every 20 ft along this reach in accordance with the following protocols: (1) collect samples from the section of Mere Brook defined by the confluence of Mere Brook and the Merriconeag Stream and downgradient monitoring well MW-313, for a total of 39 sampling locations over an approximate 780 ft length of Mere Brook, and (2) collect samples from an additional 11 sampling locations situated immediately downgradient of monitoring well MW-313 along another 220 ft length of Mere Brook. A total of 50 samples are expected to be collected over a 2-day period, at an assumed frequency of 25 samples per day. Proposed sampling locations are shown on Figure 3. If field observations (i.e., visual confirmation of seeps) and/or analytical data indicate potential impacts, select sample locations may be modified and re-located to allow for the collection of data along stream transects. If applicable, stream transects will consist of samples collected from each bank of the stream and the stream-center.

Pore Water Sampling Protocols

Pore water samples will be collected from the top 6 to 18 inches of sediment along the submerged stream bank of Mere Brook. The pore water sample device consists of a steel drive point with a 1.5 inch diameter slotted screen affixed to the end of the apparatus. Pore water samples will be collected via a peristaltic pump attached to the end length of the silicon tubing affixed to the pore water sampling apparatus. Sampling will commence along the upgradient/northern-most proposed sampling locations and continue downgradient towards monitoring well MW-313 along Mere Brook. Per site reconnaissance recently performed by MEDEP, most proposed locations (Figure 3) are readily accessible from the stream banks and edges. Accordingly, minimal stream bed disturbance will only be required at locations to facilitate actual sample collection, and unlike sampling activities associated with surface water media, should not adversely impact downgradient results.

Field parameters, including temperature and conductivity only will be measured and recorded in the field by MEDEP personnel during purging and prior to sample collection for laboratory analysis. Stabilization of field parameters (and the use of a flow-through cell) will not be required; rather, field parameters will be measured from purged and containerized pore water (collected in a rigid, open container) following confirmation that pore water is visually-free of sediment and immediately prior to sample collection. Field measurements and observations will be recorded on the Field Sampling form included as Attachment D to this Letter Work Plan.

When appropriate, samples will be collected for on-site mobile laboratory analyses (US EPA) and for split samples for submittal to an offsite laboratory. Of the collected split samples, ECC will then select up to 15 of these samples (inclusive of QA/QC sample requirements) for submittal to a Navy- and MEDEP-certified laboratory for confirmatory laboratory analysis. MEDEP is anticipating the use of the US EPA mobile field laboratory to analyze each sample for VOCs. As previously detailed, the proposed plan calls for collection of samples

from up to 50 locations along the Mere Brook. Based on the results obtained from the US EPA mobile field laboratory, a select number of these samples (up to 15 total, including appropriate QA/QC) will be submitted by ECC for laboratory analyses of VOC by US EPA Method 8260B, and a select subset will also be submitted for 1,4-dioxane analysis by US EPA Method EIASOP VOADIOX1. Furthermore, pore water samples will be collected in accordance with the following protocols:

- MEDEP personnel will perform the pore water sampling procedure to collect samples from the 50 proposed locations within Mere Brook. Water samples will be collected in pre-cleaned sample containers provided by ECC. Sufficient sample volume will be collected to permit analysis via the US EPA on-site mobile laboratory and also for potential submission to a Navy- and MEDEP-certified laboratory.

- ECC will determine which split samples will be submitted for laboratory analysis based primarily on the results obtained from the US EPA mobile laboratory. In the event there are no positive detections of VOCs from the US EPA mobile laboratory, ECC will select samples based on proximity to a known VOC detection in monitoring well samples collected at locations sbetween monitoring well MW-313 and Mere Brook.

DECONTAMINATION AND INVESTIGATION-DERIVED WASTE MANAGEMENT

To minimize the potential for cross-contamination between sampling locations, all sampling equipment that contacts site soil and potentially contaminated pore water will require decontamination procedures. All re-usable sampling equipment, such as the stainless steel rods, will be decontaminated in accordance with the following protocols before and after each use:

- Wash with potable water and laboratory-grade detergent (e.g., Alconox® detergent)
- Rinse with potable water
- Rinse with deionized water
- Air dry

IDW generated in support of development and sampling activities (i.e., purged pore water and decontamination fluids, etc.) may be containerized following a review of investigation-related findings and subsequent consideration by MEDEP, US EPA, the Navy, ECC, and other project stakeholders. If applicable, IDW will be containerized in U.S. Department of Transportation-approved 55-gal drums, which would be staged at Building 50 pending characterization and subsequent final disposition.

If applicable, it is assumed that purged groundwater associated with development and sampling activities would be treated onsite at Building 50, and would not require characterization or offsite disposal. Any solids (i.e., entrained sediments) would be removed to the extent practicable. However, pending characterization and if necessary, IDW would be disposed of in accordance with State of Maine and appropriate and applicable US EPA requirements by a State- and US EPA-licensed waste broker/hauler. As previously stated, a final determination as to the management and disposal of IDW will be dependent upon a

review of investigation-related findings and subsequent consideration by MEDEP, US EPA, the Navy, ECC, and other project stakeholders.

Spent personal protective equipment (PPE) will be disposed of as general refuse at Building 50.

SUMMARY REPORT

ECC will prepare a report summarizing field tasks completed and results of all laboratory analyses performed. MEDEP will provide ECC with field sampling forms or copies of the logbooks, and a narrative pertaining to sample collection procedures, field parameter water quality measurements, and any deviations from the work plan for field sampling methods. The US EPA will provide a summary of laboratory analyses performed with the USEPA mobile GC laboratory and the mobile lab data. ECC will incorporate all information into a summary report, including figures, tables and copies of all field forms and laboratory documentation (fixed and mobile).

It has been ECC's pleasure to provide you with this Letter Work Plan detailing pore water sampling activities within Mere Brook in the vicinity of well MW-313, at the Naval Air Station Brunswick, Maine. Should you have any questions or wish to discuss the proposed activities further, please do not hesitate to contact the undersigned at 508-229-2270.

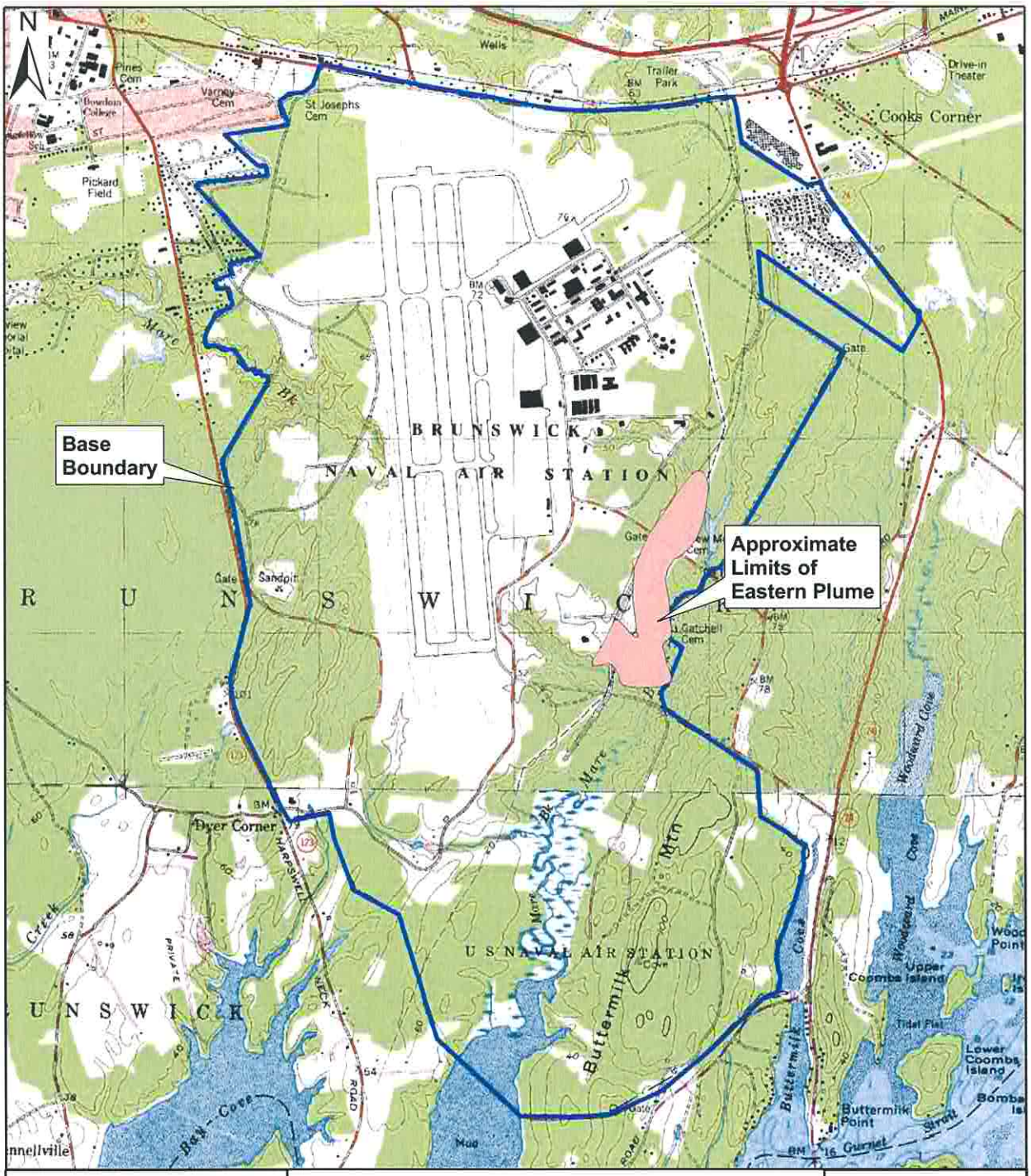
Regards,
ECC

Darren Gainer

Darren Gainer, C.P.G
Project Manager

DMG/rsw
Attachments

cc: L. Monaco (EFANE)
F. Cellucci (EFANE)
A. Easterday (ECC)
R. Wasserman (ECC)
P. Nimmer (EA)
C. Evans (MEDEP)
L. Joy (NASB)
C. Lepage (BACSE Consultant)



ECC

50 D'Angelo Drive
Marlborough, MA

FIGURE 1
SITE LOCATION MAP

NAVAL AIR STATION
BRUNSWICK, MAINE

2,000 1,000 0 2,000 Feet

DATE LAST MODIFIED: 07/08/05

LAST MODIFIED BY: JK

SCALE AS SHOWN

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ECC H:\NAVY\TO 07 Brunswick, ME\Mere Brook\Figures\Mere_Brook_Fig1_SiteLocus.mxd

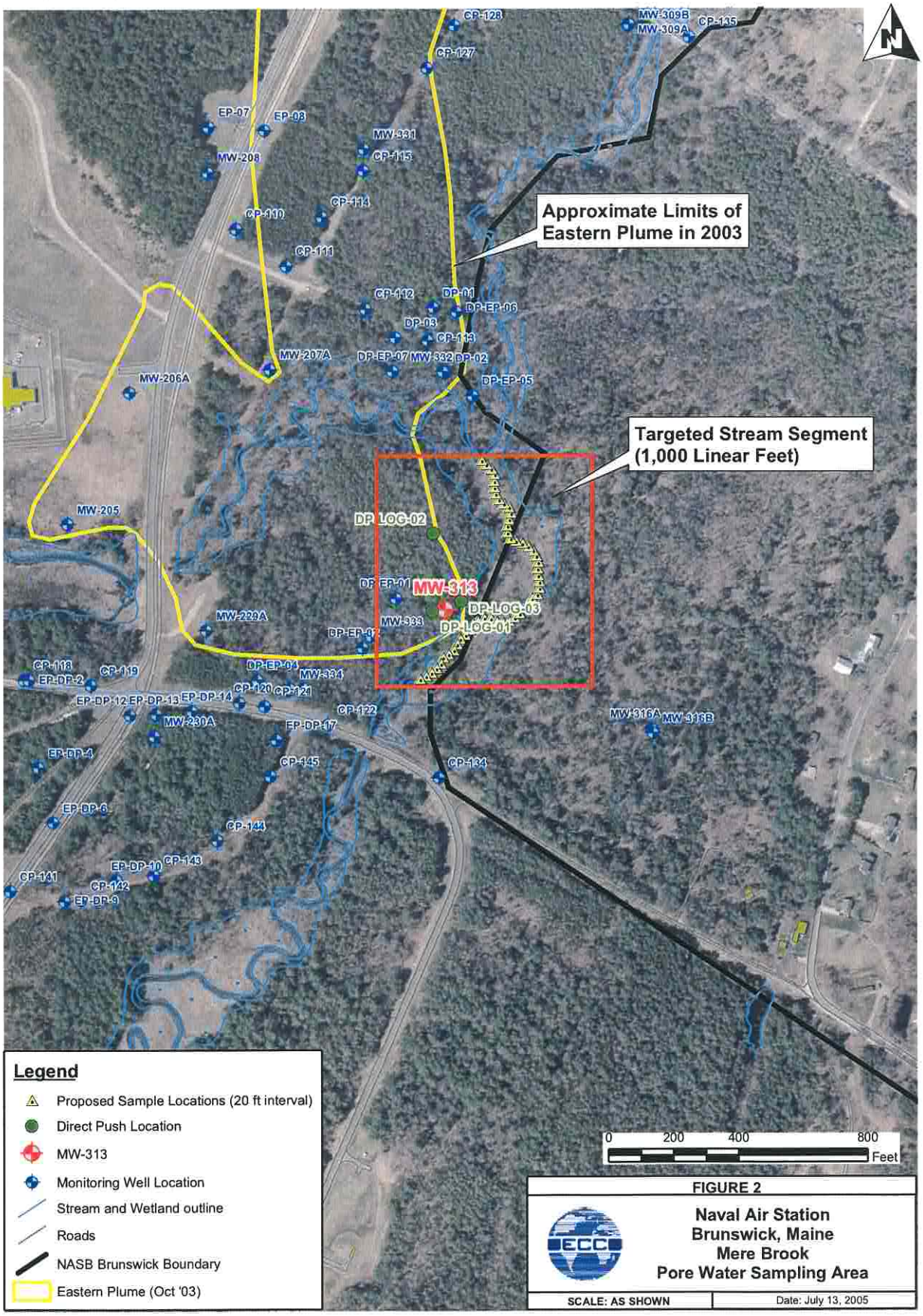

FIGURE 2

Naval Air Station
Brunswick, Maine
Mere Brook
Pore Water Sampling Area

SCALE: AS SHOWN

Date: July 13, 2005

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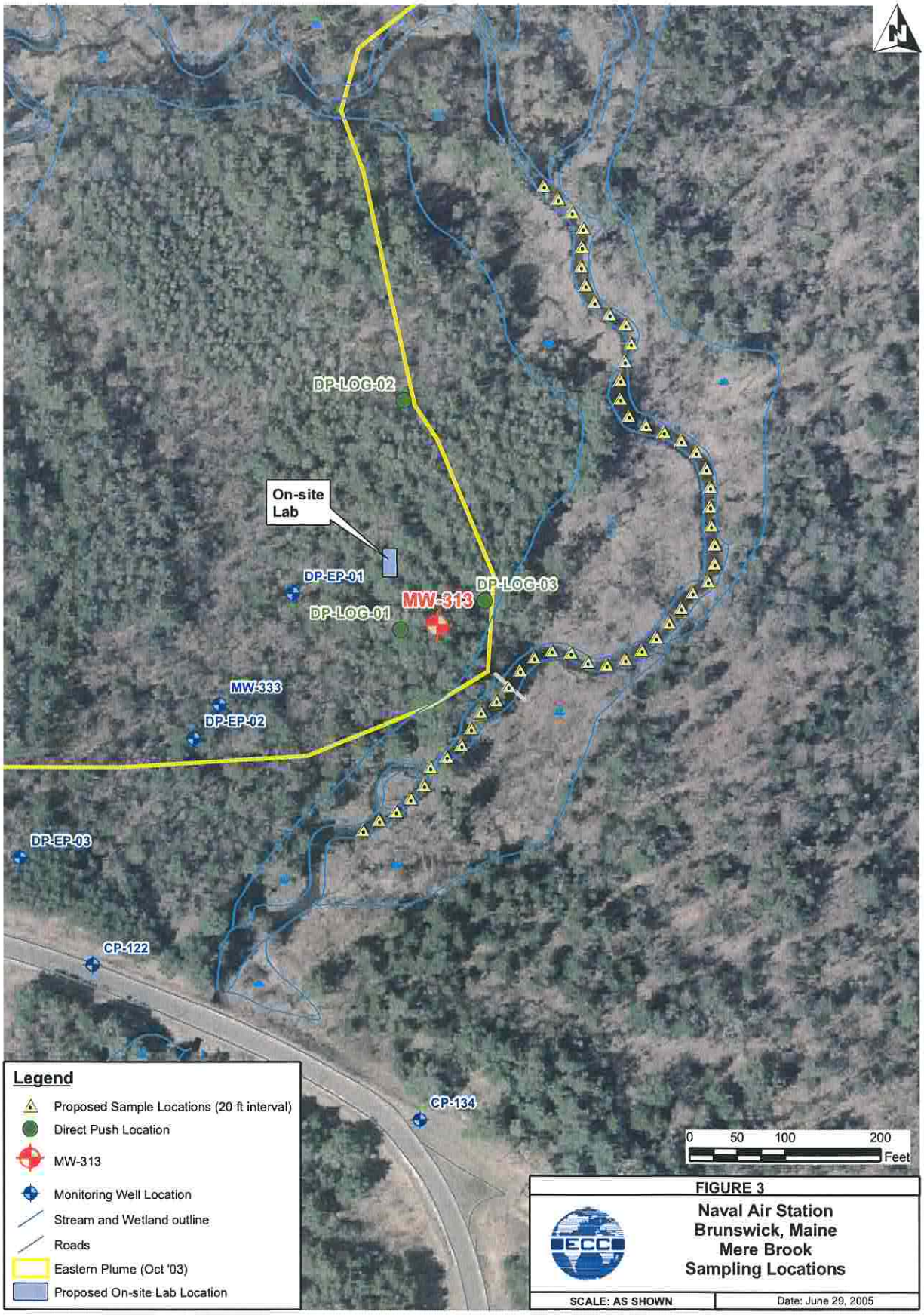

FIGURE 3

Naval Air Station
Brunswick, Maine
Mere Brook
Sampling Locations

ECC

SCALE: AS SHOWN	Date: June 29, 2005

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Attachment A

MEDEP Comments and Navy Response to Comments
Draft Letter Work Plan for Pore Water Sampling
at Mere Brook, Naval Air Station Brunswick,
Brunswick, Maine
Dated 11 July 2005

ATTACHMENT A

RESPONSE TO COMMENTS FROM THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION LETTER WORK PLAN FOR PORE WATER SAMPLING AT MERE BROOK, NAVAL AIR STATION BRUNSWICK, BRUNSWICK, MAINE

Commentor: Claudia Sait	
Comment Issue Date: 19 July 2005	**Navy Response Date: 28 July 2005**

The Maine Department of Environmental Protection (MEDEP) has reviewed the draft "Letter Workplan for Pore Water Sampling, Mere Brook", dated 11 July 2005, prepared by ECC. Based on that review MEDEP has the following comments and issues.

Thanks to the Navy for producing the workplan as part of the team effort on the pore water sampling.

General Comments:

1. It appears from Figure 2 that much of the targeted stream reach is located off base property on private property. MEDEP has determined that the off base property belongs to Charles and Judith Ferguson and has received verbal permission to conduct pore water sampling on their portion of Mere Brook. (MEDEP will follow up the phone conversation with a letter to the Fergusons).

   Navy Response: Comment noted.

2. MEDEP recommends recording the sampling locations with a GPS after the sampling has been performed in case the sampling locations have to be moved.

   Navy Response: In response to this comment and MEDEP Comment No. 5, the text of the final Letter Work Plan has been modified to incorporate a provision for post-sampling GPS activities to assess deviations from proposed locations and/or to document locations that may have been modified due to changes in site conditions.

3. MEDEP plans on starting at the northern most sampling location and working southward. Unlike surface water sampling, pore water sampling is not affected by the streambed disturbance by the samplers. Based on our reconnaissance it appears we will be able to walk along the edge of the stream with minimal need to be in the stream except for sampling.

   If we have any hits from the first days collection we may decide to perform a transect in the vicinity of the hit. Therefore to ensure that there is enough sampling points MEDEP recommends having enough bottles to collect two additional samples if necessary.

   Navy Response: The text of the final Letter Work Plan has been modified to incorporate text addressing both the proposed north-to-south sampling methodology and provisions for collecting pore water samples along transects if site conditions dictate. Modifications are included in the sections entitled *"Pore Water Sampling Protocols"* and "*Pore Water Sample Locations*", respectively.

Specific Comments:

4. Page 2, Background para 1:

   a.) MEDEP requested that pore water sampling be conducted along a limited segment of Mere brook to assess whether VOCs from the Eastern Plume in the vicinity of monitoring well MW-313 may be upwelling in this area."

MEDEP thinks there is more value in moving at least fourteen of the samples to the north to be in the area of where the plume may be shifting and into the area east-northeast of DP LOG-02 which had a concentration of 26 ppb of DCE. Therefore MEDEP suggests the following language: MEDEP requested that pore water sampling be conducted along a limited segment of Mere brook to assess whether VOCs from the Eastern Plume in the vicinity of monitoring well MW-313 *and DP-LOG-02 that* may be upwelling in this area."

Navy Response: The Navy agrees with this rationale, and the final Letter Work Plan and associated figures have been modified accordingly.

b.) "The above-referenced field activities, equipment calibration, and sampling protocols, will be performed in accordance with the draft base-Wide Quality Assurance Project Plan (QAPP) specific to Sites 1 & 3 and Eastern Plume Long-Term Monitoring Plan (EA 2004)...

Normally MEDEP would not be able to accept a draft QAPP however since the previous Long Term Monitoring Plan and QAPP (Feb. 2000) for Sites 1, 3, & the Eastern Plume did not contain protocols for 1, 4, dioxane MEDEP will accept the draft QAPP for this specific project.

Navy Response: Comment noted.

5. Page 2, Pore Water Sample Locations, para 1:

"Prior to initiation of pore water sampling, ECC will use sub-meter GPS to locate the proposed sample intervals along the stream bank of Mere Brook (Figure 3).

See General Comment 2 above. MEDEP has GPS units and will bring one for the sampling event so that the locations can be GPS'd as we go along. MEDEP does agree that approximate sampling location should be staked out prior to the sampling event.

Navy Response: Please refer Comment No. 2 and associated response.

6. Pages 2 & 3, Pore Water Sample Locations, para 2:

Samples will be collected every 20 ft along the tow 500 sections to the north and south of monitoring well MW-313.

Based on the extent of the southeastern boundary of the Eastern Plume, data from DP-LOG-02, and the recent shift in the plume MEDEP would prefer move 14 of the southern most proposed sampling points upstream using the same 20 foot spacing. This should extend approximately to the confluence of the Mere Brook and Merriconeag Stream. If necessary the other four samples could be used to run transects or be used in seeps or runs found along the stream. In any event, four proposed sampling locations on the east side of what appears to be an island in the stream may need to be moved to the west side. We will need to make this determination in the field.

Navy Response: The Navy agrees with this approach, and the text of the final Letter Work Plan has been modified, where applicable and appropriate.

7. Page 3, Pore Water Sample Locations, para 1:

a.) "Pore water samples will be collected from the top six inches of sediment ...

The pore water will be collected from the top 6 to 18 inches of sediment. Please revise. (This portion of the discussion should under a different heading, for example, sample collection.)

Navy Response: The text of the final Letter Work Plan has been modified accordingly. Additionally, a distinct section entitled *"Pore Water Sampling Protocols"* has been added to the final Letter Work Plan.

b.) "The pore water sample device consists of a steel drive point with a six inch long screen at the end. A metal stopper plate attached to the drive point will prevent the probe from being installed further than the target depth of six inches. Pore water samples will be collected using a peristaltic pump and a length of Teflon lined tubing inserted to the depth of the screen.

To be consistent with equipment to be used MEDEP suggests the following language: "The pore water sample device consists of a steel drive point with *1.5 inch slotted screen at the end.* ~~six inch long screen at the end. A metal stopper plate attached to the drive point will prevent the probe from being installed further than the target depth of six inches.~~ Pore water samples will be collected using a peristaltic pump attached to the end silicon tubing connected to the pore water sampler. ~~and a length of Teflon lined tubing inserted to the depth of the screen.~~

The web site for the sampler to be used can be found at MHEproducts.com if more information on the pore water sampler is needed for the workplan.

Navy Response: The text of the final Letter Work Plan (Section entitled *"Pore Water Sampling Protocols"* has been modified accordingly.

8. Page 3, Pore Water Sample Locations, para 2-4:

"Field parameters (DO, ORP, ph, temperature, turbidity and conductivity) will be measured and recorded.

To streamline the sampling effort, the field parameters to be collected will be temperature and conductivity, but not pH, ORP, DO or turbidity. Temperature and conductivity will be taken from the pore water sample prior to taking the sample to be analyzed for VOC. The readings will be taken from an open container while pore water is pumped and overflowing (and collected), The flow through cell will not be used due to the amount of water and time needed to fill the cell and take the readings. Stabilization of these parameters is not necessary for pore water sampling, the pore water sampler will be purged until the water is visually free of sediment. Please revise these paragraphs.

Navy Response: The text of the final Letter Work Plan (Section entitled *"Pore Water Sampling Protocols"* has been modified accordingly

9. Page 4, Decontamination and Investigation-Derived waste, bullet 4:

a.) Please delete the bullet 4-rinse with methanol.

Navy Response: The text of the final Letter Work Plan has been modified accordingly.

b.) The stakeholders will need to discuss the logistics of removing the IDW and the best way to do this on our Thursday conference call.

Navy Response: The text of the final Letter Work Plan has been modified to include a provision to this effect.

10. Figures 2 and 3 will need to be revised to move proposed sampling locations upstream in the area with more potential for impact from the Eastern Plume.

Navy Response: Figures 2 and 3 have been modified accordingly.

Attachment B

US EPA Standard Operating Procedure
Headspace Screening for Volatile Organic Compounds in Aqueous and Soil Samples

STANDARD OPERATING PROCEDURE FOR HEAD SPACE SCREENING FOR VOLATILE ORGANIC COMPOUNDS IN AQUEOUS AND SOIL SAMPLES

The Office of Environmental Measurement and Evaluation
EPA Region New England
11 Technology Dr
North Chelmsford, MA 01863

Prepared by:_____ Date:_____
Scott Clifford, Chemist
Investigations and Analysis Unit, OEME

Approved by:_____ Date:_____
Agnes Van Langenhove, Laboratory QA Officer
Investigations and Analysis Unit, OEME

Approved by:_____ Date:_____
Robert Maxfield, Chief
Investigations and Analysis Unit, OEME Unit Manager

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1.0 Scope and Application:

1.1 The procedure contained herein is applicable to all EPA Region I chemists performing screening for volatile organic compounds for soil and water samples.

1.2 This method is applicable for the screening of various volatile organic compounds in water and soil samples. Typical achievable reporting levels using a photoionization detector (PID) and an electron capture detector (ECD) are given below. These reporting levels are based on instrument response, and can vary depending upon instrument conditions. For soils, the reported values are on a wet weight basis.

Table I - Target Compound List
And Approximate Reporting Levels

Analyte	Aqueous RL, ug/l	Soil RL, ug/Kg
Benzene	0.5	15
Chlorobenzene	2	60
1,1-Dichloroethylene	0.5	15
cis-1,2-Dichloroethylene	0.5	15
trans-1,2-Dichloroethylene	0.5	15
Ethylbenzene	1	30
Tetrachloroethylene	0.2	6
Trichloroethylene	0.5	15
1,1,1-Trichloroethane	0.2	6
Toluene	1	30
m/p-Xylene	1	30
o-Xylene	2	60

1.3 This method may be used when the quality assurance objectives are either QA1 or QA2 as defined in Interim Final Guidance for the Quality Assurance/Quality Control Guidance for Removal Activities, April 1990. Briefly, QA1 is a screening objective to afford a quick preliminary assessment of site contamination. QA2 is a verification objective used to verify analytical (field or lab) results. A minimum of 10% of samples screened must be analyzed by a full protocol method for qualitative and quantitative confirmation.

2.0 **Summary of Method:**

2.1 An aqueous sample is collected in a 40 ml VOA vial, 10 mL is poured off, and allowed to equilibrate to ambient temperature. A sample of the head space gas is withdrawn with a steel barrel syringe and analyzed on a gas chromatograph (GC) equipped with a photoionization detector (PID) and electron capture detector (ECD).

2.2 A 10 g soil sample is collected with a plastic syringe with the tip cut off or a Terra Core sampler and injected into a pre- weighted VOA vial containing 10 mL of methanol. The vial is then weighed to calculate the soil wet weight and shaken or vortexed for 30 - 60 sec. One ml (approximately 0.79 g) of the methanol extract is diluted into a VOA vial containing 30 mL of VOA free water (31 dilution). This sample dilution can vary depending on the levels found at the site.

2.3 An aliquot of the headspace is injected into a calibrated gas chromatograph. The compounds are separated on a mega-bore capillary or packed column. Retention times are used for compound identification and peak heights are used to quantitate the identified compounds.

2.4 This method can be used to provide analytical data in a timely manner for guidance of ongoing work in the field.

2.5 Based on the project's data quality objectives (DQOs), the operator can modify some conditions. For example, the injection volumes can be changed depending on the levels found at the site.

3.0 **Definitions:**

3.1 FIELD DUPLICATES (FD1 and FD2): Two separate samples collected at the same time and place under identical circumstances and treated exactly the same throughout field and laboratory procedures. Analyses of FD1 and FD2 give a measure of the precision associated with sample collection, preservation, and storage, as well as with laboratory procedures.

3.2 Headspace: Air above water in sample vial.

3.3 Laboratory Duplicate (LD1 and LD2): Two injections from the same sample. The analyses of LD1 and LD2 give a measure of the precision associated with the laboratory procedure.

3.4 LABORATORY REAGENT BLANK (LRB): An aliquot of VOA free reagent water or other blank matrix (ie. methanol diluted into reagent water for soils) that is treated exactly as a sample including exposure to all glassware, equipment, solvents, and reagents that are used with other samples. The LRB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

3.4.1 REAGENT WATER BLANK: An aliquot of VOA free reagent water.

3.5 STOCK STANDARD SOLUTION: A concentrated solution containing one or more method analytes (in methanol) prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source.

3.6 WORKING STANDARD SOLUTION: A solution of several analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare aqueous calibration solutions and other needed analyte solutions.

3.7 SECONDARY STANDARD: A standard from another vender or a different lot number that is used to check the primary standard used for quantitation.

4.0 **Health and Safety Warnings:**

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest

possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses. For example, concentrated sulfuric acid presents some hazards and is moderately toxic and extremely irritating to skin and mucous membranes. Use these reagents in a fume hood whenever possible and if eye or skin contact occurs flush with large volumes of water.

4.2 Always wear safety glasses or a shield for eye protection, protective clothing, and observe proper mixing when working with these reagents.

4.3 Some method analytes have been tentatively classified as known or suspected human or mammalian carcinogens. Pure standard materials and stock standard solutions of these compounds should be handled with suitable protection to skin, eyes, etc.

5.0 **Cautions:**

5.1 The methanol stock and secondary standards are replaced every 3 months.

5.2 The working and secondary aqueous standards are good for 7 days provided these standards are stored on ice with no headspace.

6.0 **Interferences:**

6.1 Method interferences may be caused by contaminants in solvents, reagents, glassware and other sample processing hardware that lead to discrete artifacts and/ord elevated baselines in the chromatograms. All of these materials must routinely be demonstrated to be free from interferences under the conditions of the analysis by running laboratory method blanks.

6.2 Matrix interferences may be caused by contaminants that

coelude with the target compounds. The extent of matrix interferences will vary considerably from source to source. A different column or detector may eliminate this interference.

6.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. To reduce carry-over, a VOA free water blank should be analyzed following an unusually concentrated sample to assure that the syringe is clean.

7.0 **Personnel Qualifications:**

7.1 The analyst should have at least a four year degree in a physical science.

7.2 The analyst should be trained at least one week and have a working knowledge of this method and quality control before initiating the procedure.

7.3 All personnel shall be responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function.

8.0 **Equipment and Supplies:**

8.1 Photovac 10A10 portable gas chromatography equipped with a PID and a 4 ft, 1/8 in, SE30 pack column.

8.2 Shimadzu 14A portable gas chromatography equipped with a PID, ECD, and a 30 m, 0.53 mm DBPS-624 megabore capillary column.

8.3 Syringes, Hamilton, steel barrel, 250 µL to 1 mL

8.4 Vial: 40 mL VOA vials with a Teflon lined septum cap.

8.5 Methanol - demonstrated to be free of analytes.

8.6 Reagent water - VOA free water demonstrated to be free of analytes.

8.7 Standard and Secondary Stock Solutions - Solutions are either prepared from pure standard materials or purchased by the

Region I Chemistry Laboratory and are used to prepare aqueous working and secondary standards.

8.7.1 Standard Preparation and Use:

Standards should be prepared in water at a 10 ppb (µg/l) concentration, and labeled. Standards should be made up fresh weekly from the methanol stock solution (Supelco or equivalent vender), and stored with no head space on ice until ready for use. Standard preparation should be recorded in the field standard logbook. After preparation, the standard is placed into a 40 ml VOA vial, filling the vial to the top leaving no head space. The standard is then put into a cooler on an ice bath for storage until it is ready to use. When the standard is ready to use in connection with aqueous or soil analysis, 10 mls of liquid from the 10 ppb Standard VOA vial are withdrawn to give a head space above the liquid standard. The standard is then equilibrated to ambient temperature and stored septa side down, at all times.

8.8 Secondary source standard is prepared as outlined in step 8.7.1 using another supplier or lot number.

9.0 **Instrument Preparation:**

The Photovac 10A10 GC and the Shimadzu GC 14A in the laboratory using A.C. power should always have carrier gas flowing through their columns. The Photovac uses zero air and the Shimadzu uses zero nitrogen as carrier gas. When moving the GCs to a site, carrier gas should always be flowing through the GC columns.

9.1 The following steps are taken before analysis of samples on the Photovac:

- Check detector. Insure that the detector source is on by observing the "source off" lamp (red) on the face of the instrument. When the source is on, the "source off" lamp should not be illuminated. Another method of checking the detector is to remove the detector housing with an allen wrench. With the detector on, you will observe a purple glow inside the Teflon detector chamber.

- Check carrier gas flow. The gas flow is checked

using a bubble flow meter hooked up to the detector out vent port. Flow can be adjusted to the desired rate by using the vernier knobs on the left side of the instrument face or by adjusting the delivery pressure on the carrier gas cylinder regulator. A desirable flow is from 400 - 600 cc/min, depending upon application.

- Check injection port septum. It is a good idea to put in a new septum before analyzing a large number of samples.

- Check to be sure that signal cable is connected from Photovac output to strip chart recorder input.

- Set strip chart recorder input to 100 MV full scale and chart speed to 60 cm/hr. for Photovac 10A10. (Recorder input for Photovac 10S50 should be set to 1 V full scale)

- Adjust needle on Photovac output meter using the offset dial so that when attenuation is switched, the needle does not deflect. Setting the output somewhere between 4-10 mv DC will usually achieve this.

- Set recorder zero to 5% of chart full scale and establish an acceptable base line.

9.2 The following steps are taken before analysis of samples on the Shimadzu GC 14A. Using isothermal conditions.

- Check injection port septum. It is a good idea to put in a new septum before analyzing a large number of samples. The system must be cool before changing the septum.

- Check PID detector Temperature. It should be set to 150^{0}C. from the external PID power source. It can take upto 3 hrs. to warm up the detector from cold. Insure that the detector lamp is on by quickly observing the lamp (purple) on the left side of the instrument.

- Turn on the instrument and the instrument heaters on the face of the instrument. On the control

keyboard, hit the START button and set the default temperature conditions.

Injector 125°C
ECD detector 190°C
Oven 60°C

After a 30 -60 minute warm-up, monitor actual temperatures using the control keyboard.

- Check zero nitrogen carrier gas flow. The gas flow is checked using a flow meter hooked up to the detector out vent port. Flow can be adjusted to the desired rate by using the vernier knobs on the gas control unit on top of the instrument. A desirable flow is from 30 - 60 cc/min, depending upon application.

- Check to be sure that signal cables are connected from PID and ECD outputs to strip chart recorder inputs.

- Set strip chart recorder input to 5 MV full scale for the PID and 50 MV full scale for the ECD, and chart speeds to 60 cm/hr.

- Set recorder zero to 5% of chart full scale and establish acceptable base lines.

10.0 **Aqueous Sample Collection and Preparation:**

10.1 Sample Collection - Fill the 40 ml sample bottle completely.

10.2 Approximately 10 mL is poured off and allowed to equilibrate to ambient temperature with the vial's septa facing down.

11.0 **Soil Sample Collection and Preparation:**

11.1 A representative soil sample, collected with a 10 mL syringe with the tip cut off or a Terra Core, of approximately 10 grams is placed in a pre weighed 40 ml VOA vial containing 10 ml of methanol.

11.2 Weigh the vial to get the wet soil weight.

11.3 Shake or vortex for 30 - 60 sec. Let solution settle so that the methanol sits above the soil.

11.4 Weigh 0.79 g (1 mL) of the methanol extract into a VOA vial with 30 mL of VOA free water (1:31 times dilution). Allow the sample to equilibrate with the septa facing down, 10 -60 minutes.

12.0 **Sample Analysis:**

Insert the syringe needle into the sample's headspace and flush the syringe barrel three times using the plunger. After flushing, pull the plunger up to the 200 µl point on the barrel. Put the syringe needle into the GC injection port, and push the needle through the septum until the barrel comes up against the injection port and immediately push the plunger with a quick action. Turn on the strip chart recorder and note on the chart:

1. start of run
2. sample number
3. sample volume
4. attenuation or gain
5. any other relevant comments

The order in which analyses of a group of samples is performed is as follows:

1. Standard - Inject a 200 µl sample of your 10 ppb standard head space into the GC. Keep standard peaks at approximately 50% scale or more, if possible, by adjusting the attenuation or gain.

2. Repeat 10 ppb standard to check for reproducibility. Standard chromatograms should have compound peak heights within **± 15%** of each other and identical retention times.

3. Inject the secondary standard for confirmation. The acceptance criteria is **± 20%** of the accepted true value.

4. Blank - Inject a 200 µl sample of clean air into

the GC with the attenuation set at or lower than what your samples will be run on. Blank clean air is taken from the head space above reagent water blank in a 40 mL. VOA vial.

5. Samples - Inject 200 µl sample volumes into the GC at the same attenuation or lower, than the standard was run. If contaminant levels put the chromatograms off-scale, adjust the attenuation or gain to decrease instrument response. If chromatographic peaks are still off-scale dilute the samples and rerun.

6. A Laboratory Reagent Blank (LRB) for soils should be analyzed daily as a sample. This consists of taking 1 ml(0.79 g) of methanol from a pre-weighed VOA vial into 30 mls of clean dilution water.

7. Repeat the 10 ppb standard every 10 samples and at the end of the sample batch to check for reproducibility. Standard chromatograms should have compound peak heights within **± 20%** of each other and identical retention times.

13.0 **Qualitation and Quantitation:**

Identifications of compounds present in a sample are made by matching retention times of peaks in the sample chromatogram to the retention times of standard peaks. After a compound is identified, quantitation is done by peak height comparison.

Water example: If the 10 ppb aqueous standard head space had a benzene peak height of 32 units from a 200 µl injection with instrument attenuation at 2, an identified benzene peak 12 units high from an 200 µl sample injection with instrument attenuation at 2 would represent a sample concentration of 3.8 ppb benzene.

$$X = \frac{\text{Std conc. * Sample's peak height}}{\text{Std peak height}}$$

$$X = \frac{\text{10 ppb * 12 units}}{\text{32 units}}$$

X = 3.8 ppb Benzene

Soil example: If the water concentration is 3.8 ppb benzene and the wet weight is 10.5 g, the soil concentration will be obtained by adjusting for the dilutions, the methanol extract vol.

$$X = \frac{\text{Water Conc.} * \text{Methanol Volume} * \text{Methanol dilution}}{\text{Soil Wet Weight}}$$

$$X = \frac{3.8 \text{ ppb} * 10 \text{ mL} * 31}{10.5 \text{ g}}$$

X = 110 ug/Kg, ppb (wet weight basis)

14.0 **Data and Records Management:**

14.1 All work performed for the analyses of samples should be entered into the field screening logbook. The analyses data should be presented to the project manager on site. This is followed up by an Internal Correspondence Report, that is reviewed by the Advanced Analytical Chemistry Expert from the Chemistry Section of the EIA Laboratory. Chromatograms generated should be saved and filed in the project folder. The samples analyzed should also be logged into the laboratory tracking system.

14.2 Chromatograms:

14.2.1 Site name, analyst name, and date at the start of the chromatogram strip chart.

14.2.2 Every chromatogram/every sample/standard

Sample number or standard
Sample volume injected
Instrument gain or attenuation setting

15.0 **Quality Control:**

15.1 A reagent water blank and a one point standard is used for instrument's calibration. Initially run 10 µg/L standard to determine retention times and response factors of instrument. Repeat a second 10 µg/L standard to check the reproducibility. **Acceptance criteria: within ± 15% difference from the first**

standard.

15.2 Lab reagent blanks are analyzed daily for soils and periodically for aqueous samples to be sure of no reagent interferences and to be sure of no carry over from previous injections. Technical judgement is used to determine frequency. **Acceptance criteria: No target compound peaks greater than one-half the reporting level.**

15.3 A second source standard containing some compounds of interest is analyzed daily to verify calibration standard. **Acceptance criteria: ± 20% of true value.**

15.4 A continuing calibration standard is run at least every 10 samples and at the end of the sample batch to update the instrument's calibration due to changes from temperature fluctuations with respect to retention times and response factors. **Acceptance criteria: ± 20%D agreement with the previous calibration.**

15.5 Run field and laboratory duplicates when possible. **Acceptance criteria: RPD ± 20%.**

15.6 When possible (ie. soil gas, ambient air), GC/MS confirmation of 10% of the field samples analyzed should be performed. This is done, dependent upon the project data quality objective.

16. **References:**

16.1 Interim Final Guidance for the Quality Assurance/Quality Control Guidance for Removal Activities, April 1990.

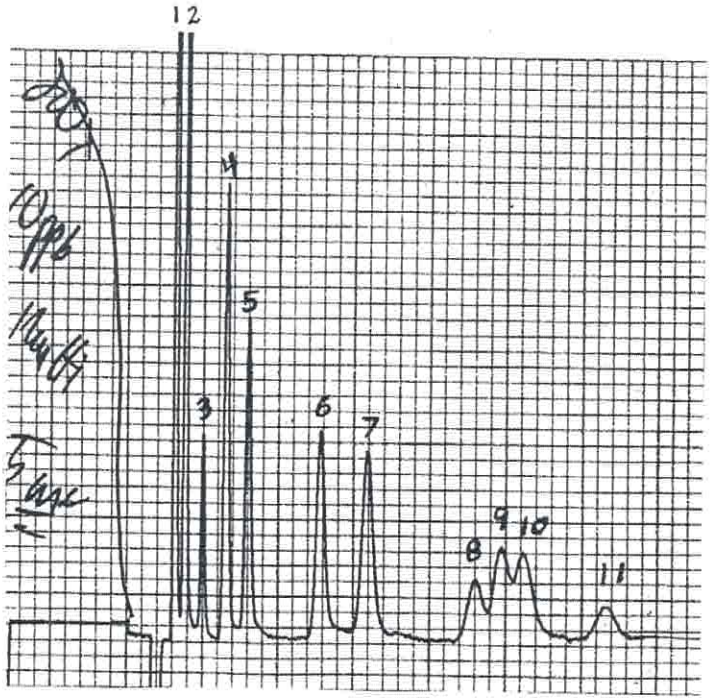
Quality Control Table			
QC Item	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration	Daily, before samples	< 15%D [1], done visually for some stds	Inject another std, check system
Cont. Cal. STD	Every 10 samples and at the end	< 20%RPD[1], done visually for some stds	Inject another std, repeat initial calibration, check system
Second Source Std	Daily, every batch	< 20%D [1], done visually for some stds	Inject another std, repeat initial calibration, check system
Reagent Water Blank	Daily, every batch	< 1/2 RL [1]	Repeat blank injection, prepare a new blank, check system, increase RLs depending on the DQOs
LRB	Daily, every batch	< 1/2 RL [1]	Repeat blank injection, prepare a new blank, check system, increase RLs depending on the DQOs
Field Duplicate	Option, depends on DQOs	< 20% RPD [1]	Repeat injection, run another duplicate
Laboratory Duplicate	Option, depends on DQOs	< 20% RPD [1]	Repeat injection, run another duplicate

[1]= Acceptance criteria defined based on technical judgment

Figure 1

Volatile Organic Screening Method
Target Compound Chromatogram (PID)

1. 1,1-Dichloroethylene
2. t-1,2-Dichloroethylene
3. c-1,2-Dichloroethylene
4. Benzene
5. Trichloroethylene
6. Toluene
7. Tetrachloroethylene
8. Chlorobenzene
9. Ethyl Benzene
10. m/p-Xylenes
11. o-Xylene

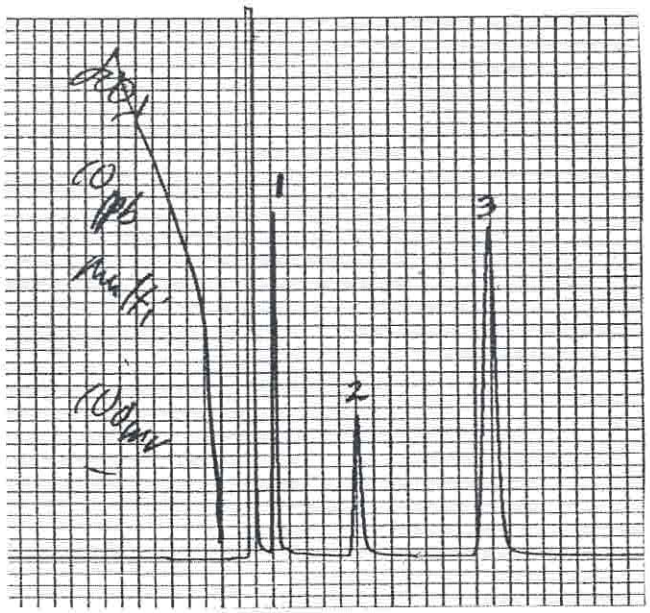


Instrument : Shimadzu gas chromatography 14A
Detector : Photoionization Detector (PID)
Column : DBPS 624, 30 m, 0.53 micron
Temperature : 60 C
Carrier Gas : Zero grade nitrogen
Flow Rate : 30 - 60 cc/min
Chart Speed : 1 cm/min

Figure 2

Volatile Organic Screening Method
Target Compound Chromatogram (ECD)

1. 1,1-Dichloroethylene
2. Trichloroethylene
3. Tetrachloroethylene



Instrument : Shimadzu gas chromatography 14A
Detector : Electron Capture Detector (ECD)
Column : DBPS 624, 30 m, 0.53 micron
Temperature : 60°C
Carrier Gas : Zero grade nitrogen
Flow Rate : 30 - 60 cc/min
Chart Speed : 1 cm/min

Attachment C

MEDEP Standard Operating Procedure
Protocols for Groundwater and Surface Water Interface Sampling Using Pore Water Samplers

PROTOCOL FOR GROUNDWATER/SURFACE WATER INTERFACE SAMPLING USING A PORE WATERSAMPLER

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: DR#023
Revision: 2
Date: July 12, 2004
Written by: Joe Siviski
Reviewed by: Brian Beneski

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation (MEDEP/DR) standard operating procedure (SOP) for collecting groundwater samples using a pore water sampler.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of these investigations, samples are sometimes taken from groundwater discharge points beneath surface water bodies. This Standard Operating Procedure (SOP) is designed to be a guideline for MEDEP/DR staff for collecting such groundwater samples for chemical analysis. This procedure is based on current methodology guidelines and field experience of MEDEP personnel.

It is often difficult to determine the extent and origin of contamination using solely surface water sampling techniques. In some cases, a surface water body may be clean but the groundwater beneath it may be contaminated. Thus, sampling the groundwater prior to its discharge to a surface water body may lead to a better understanding of the extent and origin of contamination. This can be accomplished by using a pore water sampler.

Underlying this procedure is the assumption that surface water bodies are common discharge points for groundwater. Thus, a sample of the water beneath a stream or riverbed would be characteristic of the groundwater in the area. This SOP identifies sampling protocols to be followed when collecting samples using a pore water sampler.

3.0 RESPONSIBILITIES

All MEDEP/DR staff must follow this procedure when using a pore water sampler to perform groundwater sampling activities. Typically, MEDEP/DR field staff (OHMS positions) conduct this type of sampling, although other staff may collect these types of samples in specific instances if accompanied by, or once appropriately trained

in, this methodology. The respective managers and supervisors for MEDEP/DR are responsible for ensuring that their staff receive adequate training, are familiar with, and adhere to these procedures.

4.0 EQUIPMENT

The following is a list of equipment currently owned and available to MEDEP/DR staff for collecting groundwater samples using the pore water sampler method.

--Peristaltic Pump

--Tubing - Two types of tubing are needed for this sampling technique. Polyethylene tubing with an inside diameter (ID) of one-quarter (1/4) inch is the standard size tubing used in conjunction with peristaltic pumps. This size tubing should also be used to fit around the top opening of the pore water sampler. Additionally, three-eighths (3/8) inch inside diameter (ID) polyethylene tubing will be necessary to connect the pore water sampler to the peristaltic pump. A knife or other tool to cut tubing to desired lengths is recommended.

--Power Supply - A power supply will be necessary to operate the peristaltic pump. A deep cycle battery is recommended for this procedure.

--Hip Waders - This sampling method will likely require the sampler to wade into stream or river in order to insert pore water sampler in a suitable location.

--Pore Water Samplers - A pore water sampler comes in two parts, a strengthening rod and the pore water sampler itself, both made of stainless steel. The pore water sampler is basically a hollow tube with small holes in its tip that allow groundwater to percolate through. The strengthening rod slides into the pore water sampler, and while in place, blocks all water from entering pore water sampler. Both pieces are placed in a PVC sheath for protection. Although the pore water sampler is fairly sturdy, exercise caution during use, as once either piece becomes bent, the equipment is useless. Bring at least as many pore water samplers as there are sampling locations, as onsite decontamination is difficult and should be avoided.

--Sample Collection Containers - These will be provided by the lab, and will vary depending on parameters to be sampled.

5.0 GUIDELINES/PROCEDURES FOR USE OF PORE WATER SAMPLER

5.1 Preparation

Prior to undertaking any groundwater sampling using the pore water sampler, a site and event specific Sampling and Analysis Plan (SAP) and/or a Quality Assurance Project Plan (QAPP) should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan and SOP DR#016 - Requirements for the Development of a Site Specific Quality Assurance Project Plan). A SAP for a groundwater sampling event should specify the means of accessing the sample points.

5.2 Sampling Procedure

Once an appropriate sampling location has been determined, obtain pore water sampler and carefully insert into river/streambed to desired depth. Do not remove strengthening rod until instrument has been securely placed in sediment. Pore water sampler should be inserted deep enough as to ensure the sample collected will contain only groundwater and no surface water. Typically, this depth is at least 8 inches. Once this has been accomplished, remove the strengthening rod from the pore water sampler and connect pore water sampler to peristaltic pump using appropriate tubing described in section 4.0 of this SOP. Turn pump on and purge water until it is free of particulate. If sample is not visually free of sediment, it should be documented in field notes (see SOP DR#013: Documentation of Field Notes and Development of a Sampling Event Trip Report).

If sampling for metals, it is recommended that turbidity be measured. If turbidity is above 30 NTUs, it is recommended that an additional sample be collected that has been filtered through a 0.2-0.45 μm inline particulate filter.

After water has been sufficiently purged, decrease pumping rate and begin collecting sample. Pumping rate should be low enough to ensure that surface water is not drawn down into the sample. Low flow purging and sampling protocol is

not required, but if desired, refer to SOP DR#003 - Groundwater Sampling Using Low Flow Purging and Sampling Protocol. Course sediment and sediments with a high percentage of organic matter are the most transmissive; with experience, samplers can actually "feel" the type of sediment as the pore water sampler is advanced. If the formation intercepted by the screen is not transmissive enough for collection of sample, gently advance and/or pull back the sampler in an attempt to find a more transmissive zone. If formation does not allow adequate transmission of water, it may require a change in sampling location. This change is made at the discretion of the sampler and should be documented in field notes (see SOP DR#013: Documentation of Field Notes and Development of a Sampling Event Trip Report).

Once a satisfactory flow rate has been achieved, collect pore water sample in appropriate containers provided by the laboratory as specified in the SOP for that particular analysis.

Once sample has been taken, turn off pump, disconnect all tubing and remove pore water sampler from river/streambed. Neither the tubing nor the pore water sampler should be reused at subsequent sampling locations without prior decontamination. Do not put strengthening rod back in pore water sampler once sample has been collected, as sediment in the sampler must be flushed out first. Rather, place both pieces separately into plastic sheath.

Repeat the above process at all sampling locations.

6.0 DECONTAMINATION PROCEDURE

Decontamination procedures generally follow SOP DR#017: Decontamination Procedures Protocol. However, specific decontamination procedures are as follows.

In the course of sampling, sediment will build up in sampler that must be carefully flushed out. For this reason, it is best if decontamination is conducted with a large amount of water available for continuous flushing. If possible, bring as many pore water samplers as there are sampling locations, as onsite decontamination can be difficult.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The sampling plan of QAPP (MEDEP DR#014) and DR#016) should outline the data quality needs for the event.

7.1 Deviations from SOPs

All deviations from the procedures outlined in this or in any other SOP followed for groundwater sampling using a pore water sampler must be documented in field notes.

8.0 DOCUMENTATION

Documentation is the most important aspect of any sampling event. Documentation should be completed with the idea that someone not present during the actual event may need to repeat the event exactly as it was conducted originally. During the sampling event or immediately upon the completion of the event, diagram a map of the area and locate sampling points (and corresponding sample container numbers) on the map. Also, record observational data concerning the groundwater, such as the approximate depth of the screen when the sample was collected, any detection of odor or contamination, color and turbidity. Make sure to record in your personal field book any and all information that is pertinent to the sample. Refer to the MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report. It is very important that all information regarding a sampling event (or any events/activities) be accurately recorded. Record all information obtained while sampling such as sample numbers, measurements taken, observations made and other comments. A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP DR#013.

When checking in samples at the laboratory for analysis, a Chain of Custody (COC) form must be completed. Refer to MEDEP/DR SOP DR#012 - Chain of Custody Documentation for requirements for COC protocol.

9.0 HEALTH AND SAFETY

As part of the overall work plan at a hazardous substance site, a site specific health and safety plan (HASP) must be developed and adhered to by all personnel working at the site. Refer to MEDEP/DR SOP DR3014 - Development of a Sampling and Analysis Plan.

All personnel must understand that if a sample cannot be obtained safely, the sample should not be taken at all. If a sample cannot be obtained due to safety considerations it should be documented in the sampler's field book.

All personnel should be aware of the potential dangers associated with this particular sampling method. These dangers include, but are not limited to, strong water currents, slippery substrate, roots or sharp objects beneath the water's surface that may cause a fall or other personal injury. If sampling in water that is greater than three feet deep, all DEP personnel are required to wear life jackets. All necessary precautionary measures should be heeded when performing this sampling technique.

Attachment D

MEDEP Field Sampling Form

Porewater Sampler Field Form

Sample ID: _____ Date _____ Time _____

Depth of Sample: _____

Depth of Water: _____

Distance from waterline: _____

Temperature: _____
Conductivity: _____
DO: _____
ORP: _____
pH: _____

turbid y/n? _____
Bottom Substrate: (mud/sand/clay/organic muck)

Notes:

Sampled By:

Porewater Sampler Field Form

Sample ID: _____ Date _____ Time _____

Depth of Sample: _____

Depth of Water: _____

Distance from waterline: _____

Temperature: _____
Conductivity: _____
DO: _____
ORP: _____
pH: _____

turbid y/n? _____
Bottom Substrate: (mud/sand/clay/organic muck)

Notes:

Sampled By:

Porewater Sampler Field Form

Sample ID: _____ Date _____ Time _____

Depth of Sample: _____

Depth of Water: _____

Distance from waterline: _____

Temperature: _____
Conductivity: _____
DO: _____
ORP: _____
pH: _____

turbid y/n? _____
Bottom Substrate: (mud/sand/clay/organic muck)

Notes:

Sampled By: