Work Plan Addendum No. 02 for Subsurface Investigation at Building 41 for Remedial Investigation of IR Program Site 16

Naval Construction Battalion Center North Kingstown, Rhode Island

Contract No. N62472-92-D-1296
Task Order No. 0097

Prepared for

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2-14-02
Date

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2/14/02
Date

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QUALITY REVIEW STATEMENT

Contract No. N62472-92-D-1296 EA Project No.: 29600.97.3101
Contract Task Order No. 0097
Activity: Naval Construction Battalion Center (NCBC) Davisville, North Kingstown, Rhode Island

Description of Report/Deliverable:

Final Work Plan Addendum No. 02 (Revision 1) For Subsurface Investigation at Building 41 For Remedial Investigation of IR Program Site 16
Naval Construction Battalion Center, North Kingstown, Rhode Island

EA CTO Manager: James A. Shultz, C.P.G.

In compliance with EA's Quality Procedures for review of deliverables outlined in the Quality Management Plan, this final deliverable has been reviewed for quality by the undersigned Senior Technical Reviewer(s). The information presented in this report/deliverable has been prepared in accordance with the approved Implementation Plan for the Contract Task Order (CTO) and reflects a proper presentation of the data and/or the conclusions drawn and/or the analyses or design completed during the conduct of the work. This statement is based upon the standards identified in the CTO and/or the standard of care existing at the time of preparation.

Senior Technical Reviewer

[signature] 2/14/02

Richard W. Waterman (Date)
Senior Engineer

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1. INTRODUCTION

This Work Plan Addendum No. 2 has been prepared by EA Engineering, Science, and Technology to conduct subsurface investigation at Building 41 (Figures 1 and 2). This is the initial stage of the Phase II Remedial Investigation (RI) at Installation Restoration (IR) Program Site 16 (Site 16), Naval Construction Battalion Center (NCBC), North Kingstown, Rhode Island. The work would include soil borings through the floor of Building 41 to assess the potential for historical Navy activities that may have been a source area for trichloroethene (TCE) detected in deep ground water during the Phase I RI of Site 16. This work is being performed for the U.S. Navy, Engineering Field Activity Northeast (EFANE), Naval Facilities Engineering Command (NAVFAC), under the Base Realignment and Closure Act (BRAC) Contract No. N62472-92-D-1296, Task Order No. 0097.

This Work Plan Addendum presents the investigative plan and field procedures for the subsurface investigation at Building 41. The fieldwork presented in this Addendum will be performed in accordance with the Safety, Health, and Emergency Response Plan (SHERP) (Appendix B of the March 2000 Final Work Plan).

2. SITE DESCRIPTION AND HISTORY

The area around Building 41 is paved with ground surface elevation ranging from 29.0 to 31.7 ft above mean sea level (MSL) (Figure 2). Building 41 was a preservation and packing shop, and a construction equipment and automotive parts storage building. Preservation and degreasing operations occurred at Building 41. Based on past activities, it is likely that petroleum products and solvents were used and stored onsite. Building 41 is divided into three sections, as shown on Figure 3. Figure 3 illustrates the current understanding of the historical use of the building during 1951 to 1953, based on the information obtained during the Phase I RI. The following summarizes the activities that reportedly occurred in the three sections of the building:

- The northeastern third (bay) of the building was reportedly used for packing and storage of parts for shipment. The area was observed on 15 February 2001 to be a large room with a high ceiling and generally empty, except for piles of salted sand stored by Rhode Island Economic Development Corporation (RIEDC) in part of the southwestern portion.

- The middle third of the building was used for preservation of Quonset Huts by dipping in a large, partially in-ground tank(s) of Cosmolene (a grease used to prevent rusting of metallic surfaces). The Cosmolene dipping appears to have included a group of four tanks (Tanks 41-1 through 41-4). Based upon a related Tank Closure Assessment Report by HRP Associates, Inc. (June 1995), the tanks were excavated in January 1995, cleaned, and disposed as part of the Navy's underground storage tank (UST) program. A petroleum-based material was shoveled from the tanks before steam cleaning them. The metal tanks were reported to be in good condition (no rust or breaks) and there was no apparent leakage. It was reported that there was no petroleum odor or discernable staining in the excavation and TPH was not detected (less than 21 mg/Kg) in the final soil samples collected from the base of the excavation (about 6 ft bgs). Tank 41-1 was a 6,500-gal rectangular, open-top steel tank within which there were three 900-gal square, open-top steel tanks (41-2, 41-3, and 41-4). Based on the presence of an old steam pipe that entered near the base of the west end of Tank 41-1, this tank appeared to have been used to heat the other three tanks. The excavation was backfilled to grade using the excavated soil and a common borrow fill consisting of a sand and gravel mix, and completed with an asphalt surface at floor grade that is still visible. The area was observed in February 2001 to be a large room with a high ceiling and generally empty, except for the southwestern portion as stated below:

- The stripping of rust from metal parts in an aboveground tank of phospholene (manganesed phosphoric acid). This tank was reportedly above floor grade, and was apparently Tank 41-5 that was removed from the building in December 1994. Based upon a related Tank Closure Assessment Report by HRP Associates, Inc. (March 1995), Tank 41-5 was a rectangular, open-top steel tank located along the east wall of the former restrooms area. An area of etching of the concrete floor surface, observed on 15 February 2001, may be evidence of their former location.

- The southwest portion was insulated and has a lowered ceiling apparently to retain heat for the workers in that area. This area was reportedly used for the packing of preserved small metal parts for vehicles.

- The southwestern third of the building was used for degreasing activity that included a vapor degreasing unit and a solvent recovery still. The area was also used for packing and shipping of parts. The vapor degreasing tank (apparently Tank 41-6) and associated equipment were located in a pit (concrete vault) in the floor. Based upon a related Tank Closure Assessment Report by HRP Associates, Inc. (April 1995), Tank 41-6 was a 500-gal rectangular steel tank and equipment that was removed in December 1994 as part of the Navy's UST program. The tank "was dry and required no cleaning prior to removal." The concrete vault in the floor of the building "was 5 ft wide, 6 ft long, and 7 ft deep". Because the tank was removed from a concrete vault, there was no excavation. Following removal from the vault, it was reported "that the tank appeared to be in generally good condition with some staining along the upper edge, around plumbing fixtures, and under small holes in the tank walls. The tank piping was constructed of steel and appeared to be in moderate condition. Pipe joints were secure with no visible signs of leakage. The floor and sidewalls of the vault were stained, especially in the east corner." The pit was filled with common fill consisting of a sand and gravel mix, and then, completed with an asphalt surface at floor grade that is still visible. The area was observed on 15 February 2001 to be a large room with a high ceiling and generally empty, except for the northeastern portion where the old solvent recovery still equipment is still present. There was reportedly also a locked cage area where tools were stored in this portion of the building.

The various volatile organic compounds (VOC) and TCE (main VOC detected in deep ground water – 45 to 60 ft below ground surface [bgs]) concentrations detected in ground-water samples collected March 2001 are shown on Figures 4-30 and 4-32, respectively, of the Phase I RI Report for Site 16. The geology and detected vertical extent of TCE and total chlorinated volatile organic compounds (CVOC) along the south side of Building 41 were included in Figure 4-25 of the Phase I RI Report for Site 16 (wells MW16-10D/R and MW16-15D/R are located at either end of the building [Figure 3]). The depth to ground water, as measured on 2 May 2001, in six monitoring wells located around the building (Figure 3) ranged from approximately 12.0 to 13.5 ft bgs. The interpreted direction of ground-water flow is approximately east-southeast. Competent bedrock was encountered in the same six monitoring wells at depths ranging from approximately 60 to 65 ft bgs.

3. OBJECTIVES AND SCOPE

The objectives of the subsurface investigation at Building 41 are to:

- Identify the area(s) where the VOC release occurred beneath the floor of Building 41.
- Aid in assessment of the need for and location of additional soil borings and monitoring wells in the vicinity of Building 41.

To accomplish these objectives, three soil borings (SB16-30 through SB16-32) will be drilled through the building floor and underlying overburden, plus 5-ft of coring to confirm bedrock, as discussed during the BRAC Closure Team (BCT) meetings of 8 November 2001 and 10 January 2002. The planned locations of these soil borings are shown on Figure 3.

- SB16-30 - Assess the subsurface beneath the backfilled former vapor degreaser 'pit'.
- SB16-31 - Assess the subsurface beneath the backfilled former Cosmolene tank excavation.
- SB16-32 - Assess the subsurface approximately midway between the backfilled former Cosmolene tank 'pit' and wells MW16-14D and MW16-15D where CVOC has been detected in samples from the deep overburden ground-water zone.
- If elevated soil sample headspace measurements are encountered during drilling of a soil boring, the boring will be completed as a monitoring well screened in the deep (D) overburden ground-water zone just above competent bedrock. Such monitoring wells will be constructed in accordance with Sections 4.4 and 4.5 of the March 2000 Final Work Plan, except for the surface completion that will be flush with the floor of the building. Pending results of the three borings, additional soil borings may be proposed.

4. FIELD PROCEDURES

Procedures for drilling; soil sampling; investigative-derived waste (IDW) management; and decontamination of reused field equipment will be the same as is presented in the Final Work Plan Remedial Investigation of IR Program Site 16, NCBC, North Kingstown, Rhode Island, dated March 2000. For convenience, the pertinent portions are restated in this section.

The drilling activity will be performed using the following guidelines:

- Obtain NCBC Davisville and RIEDC approval for drilling locations.
- Obtain all clearances for drilling locations prior to initiating the fieldwork, as follows: NCBC Davisville CSO (617) 753-4656, RIEDC (401) 295-0044, and Dig Safe (800) 225-4977.

NCBC Davisville CSO, RIEDC, and Dig Safe clearance will be obtained prior to conducting any drilling activities. Location and marking of all underground utilities in the vicinity of each site will be done prior to any drilling. This clearance will be coordinated by the EA Project Manager.

4.1 DRILLING AND SUBSURFACE SOIL SAMPLING

Because all locations will be in paved areas within the building, it is assumed that up to 12 in. of concrete flooring will need to be penetrated first, and a concrete subflooring at approximately 7 ft bgs at location SB16-A. During the drilling work in the building, the numerous wide bay doors (Figure 3) will be opened to provide an exchange of fresh air. Drilling will be performed using standard methods: drive and wash with 4-6 in. diameter steel casing which has been steam cleaned (in accordance with the Decontamination Procedure in Section 4.4), prior to use at each boring. Specifically, drive and wash 4-in. diameter temporary steel casing to the top of competent bedrock, tri-cone drill 3-ft into rock to confirm rock, then obtain a 5-ft length of NX-core of the rock. The overburden will be sampled using a 2-3 in. inside diameter (ID) split-barrel sampler that is 18 in. or 24 in. in length. Such samples will be collected continuously from ground surface to the top of bedrock or refusal.

4.1.1 Soil Boring and Sampling

Drill cuttings will be containerized and handled in accordance with the IDW procedures. The area above the borehole will be monitored with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) probe or flame ionization detector (FID). The PID/FID will be calibrated each work day before work begins, and then checked after lunch, at the end of the day, and as required in the field. The procedures for the calibration of the PID are included in Attachment F of the SHERP (see Appendix B of the March 2000 Final Work Plan). The FID calibration procedures are attached.

Drilling and sampling equipment including drill pipe, sampling tools, and drill casing will be freed of potentially contaminating materials by steam cleaning prior to use at each boring as stated in Section 4.4. The drill rig will be steam cleaned prior to use at NCBC Davisville Site 16 and as required by the EA Geologist or Geotechnical Engineer. The rig will be free of leaks which could potentially contaminate the borings. No petroleum-based grease will be used on drill pipe joints.

Samples will be obtained in soil by driving a 2-3 in. ID split-barrel sampler that is 18 in. or 24 in. in length. The sampler will be driven into undisturbed soil by a 140-lb drop hammer free-falling 30 in. The number of "blows" (hammer drops) required to effect each successive 6 in. of penetration are recorded on the log. The sampler is advanced until one of the following occurs.

- A total of 50 blows have been applied during any one of the first, second, or third 6-in. increment;
- There is no observed advance of the sampler during the application of 10 successive blows of the hammer; or
- A 24-in. sampler is advanced a total of 24 in. or, an 18 in. long sampler is advanced a total of 18 in. without the limiting blow counts, as described above, occurring.

A portion of the soil from each sampled interval will be placed in a new clean glass jar for screening of the total organic vapors in the headspace using a FID. The measured FID values will be recorded on the log of each boring for each related sample interval.

4.1.2 Collection of Soil for Chemical Analyses

Soil sample aliquots will be collected from the split-barrel sampler from the three intervals with the highest soil sample headspace field-measure values or stained intervals and placed in appropriate containers on ice for submittal to the laboratory for chemical analyses of the Target Compound List Volatile Organic Compounds (TCL VOC) by EPA Method 8260. If there are not three soil sample intervals with headspace values or staining, then the three intervals for soil sample laboratory analysis will be: (1) the apparent water table interval; (2) the interval just above competent bedrock; (3) and the sample depth interval located midway between these first two selected sample intervals. Soil material will not be composited between sample intervals. Soil sample aliquots planned for VOC analysis will be collected from the split-barrel sampler and quickly placed in the sample containers with methanol preservative provided by the contracted laboratory and placed on ice. In addition, for locations SB16-30 and SB16-31, a soil aliquot will be collected from the 2-ft interval just below the base of the former pit or tank excavation and the interval just above the apparent water table to be submitted for analysis of oil and grease by Method 9071B. Each cooler submitted to the laboratory containing VOC samples will contain a trip blank will be submitted for analysis of TCL VOC by EPA Method 8260. One duplicate sample and one matrix spike/matrix spike duplicate (MS/MSD) sample will be collected and submitted to the laboratory for analysis of TCL VOC by EPA Method 8260.

Additionally, one rinsate blank will be collected from a decontaminated split-barrel sampler and submitted to the laboratory for analysis of TCL VOC by EPA Method 8260. Handling, labeling, and shipping of samples is presented in Section 4.3. Data validation requirements and procedures are provided in Chapters 17 and 18 of Appendix A of the March 2000 Final Work Plan. Oil and grease analysis by Method 9071B has been added to revised Tables 7-2, 8-1, 9-2, and 12-2 that were originally in the QAPP of the March 2000 Final Work Plan.

4.1.3 Water Source

Water for drilling, steam cleaning, and other necessary field activities will be arranged by the drilling contractor from the potable water system/hydrant at NCBC Davisville as coordinated with the RIEDC. The drilling contractor will be responsible for obtaining and transporting all water to the drilling areas for required uses. EA will sample the water at each source and analyze it for the TCL VOC by EPA Method 8260 and oil and grease by Method 9071B. This information and documentation of the source of the water (i.e., fire hydrant location, etc.) will be is used to evaluate the potential effect the water source may have on the analytical results for samples collected from the borings.

4.1.4 Borehole Logging

The drilling activities will be observed by an EA Geologist or Geotechnical Engineer. The Geologist or Geotechnical Engineer will log the subsurface conditions encountered in the boring and record the information on a soil boring log and rock core log as follows.

4.1.4.1 Soil Borehole Logging Requirements

Soil samples will be visually classified in the field using a modified Unified Soil Classification System (USCS). Soil borehole logging requirements are:

1. Logs will be prepared in the field, as borings are drilled, by an EA Geologist or Geotechnical Engineer. Each log will include the name of the preparer and the date of the logging activity, and Quality Control (QC) checked in the office by a Senior Geologist.

2. Borehole depth information will be direct measurements from land surface accurate to 0.1 ft.

3. Logs will be prepared on a Soil Boring Log Form.

4. Relevant information in the log heading will be completed. Location sketches referenced by measured distances or prominent surface features (where present), will be shown on, or attached to the log.

5. Log scale will be as shown on the attached form.

6. Material type encountered will be described on the log form. Unconsolidated materials will be described as follows:

   - Descriptive modified USCS classification modified from American Society of Testing and Materials (ASTM) D 2488-84
   - Consistency of cohesive materials or apparent density of non-cohesive materials
   - Moisture content assessment, (e.g., dry, moist, wet)
   - Color
   - Other descriptive features (e.g., bedding characteristics, organic materials, macrostructure of fine-grained soils; root holes; and fractures)
   - Fill material will be described including organic and inorganic material and content (e.g., wood, plastic, glass, paper, metal).

   The number of hammer blows required to advance a split-barrel sampler shall be recorded for each 0.5-ft advance for each sampling attempt. The number of blows and the number of inches penetrated for an incompleted 0.5-ft interval shall be recorded (e.g., 75/3 in.). “WOR” or “WHO” will indicate that the sampler was advanced by the weight of the drill rods (WOR) or the weight of the drill rods and hammer without driving (WHO). For the Standard Penetration Test (and only for the Standard Penetration Test), when less than 18 in. (but greater than 12 in.) are penetrated by a total (maximum allowable) of 100 blows, the number of blows for the 6-18 in. of penetration (N) shall also be recorded (e.g., N = 63).

7. For each soil sampling attempt the type and diameter of sampler shall be indicated at the appropriate depth.

8. Depth of casing during sampling.

9. Borehole refusal—The maximum depth to which 4 in. diameter casing can be advanced.

10. Borehole and sample diameters and depths at which drilling or sampling methods or equipment change.

11. Total depth of penetration and sampling. The bottom of the hole will be clearly identified on the log with the notation "Bottom of Boring."

12. Document the use of drilling fluids, including source water and additives by brand and product name.

13. Document discernable drilling fluid losses to the geological formation or discernable gains including depths at which they occur, and estimated volume lost or gained.

14. Depth and type of temporary casing used, if any.

15. Visual/olfactory observations of contamination in samples, cuttings, or drilling fluids, (e.g., staining, odors).

16. PID measurements of the headspace vapors for each soil sample interval.

4.1.4.2 Bedrock Borehole Logging Requirements

Bedrock borehole logging requirements are:

1. Logs will be prepared on a Log of Core Boring.

2. The core bit size shall be indicated on the first sheet of each Core Log Form.

3. Information will be recorded on the log in reference to the depth scale of the log.

4. The Geologist or Geotechnical Engineer will record drilling activities in chronological sequence and with respect to the depth scale in the "Core Log." Equipment changes will be documented with notation of time (24-hour clock), date of occurrence and depth of the boring at the time of occurrence.

5. Start and stop time (24-hour clock) for each core run will be recorded. Interruptions in coring shall be documented by time of occurrence and description of the problem and its resolution. Coring rates and depths of significant changes in coring rate shall be recorded.

6. The intervals of nonrecovered core will be estimated and an evaluation of the reason for loss recorded.

7. Casing depth, changes in core bit size, and changes in color of circulating water/drilling fluid will be recorded. Quantitative estimates of discernable fluid losses and gains to the geological formation and the estimated interval over which they occur will be indicated.

8. A description of special problems and their resolutions will be recorded on the boring log, (e.g., hole caving, recurring problems at a particular depth, plugging of the core barrel, unrecovered tools).

9. A summary description of the completion of the monitoring well will be summarized on the boring log.

10. Core runs will be numbered consecutively down the hole as performed and indicated on the log with horizontal lines at the appropriate depth and the core run number recorded in the lower left quadrant of the Core Log Form for the indicated core run.

11. Total core recovery will be measured to within 0.1 ft and recorded on the log.

12. Total core recovery as a percent of the length of the core run will be determined for each core run and recorded on the log.

13. The Rock Quality Designation (RQD), as a percent of the length of the core run, will be calculated for each core run and recorded on the log. The RQD method of determining rock quality is as follows:

    - The sum of the total length of core pieces recovered in each run that are at least 4 in. in length and which are hard and sound, divided by the total length of the run, represented as a percentage. If the core is broken by handling or by the drilling process, the fresh broken pieces will be fitted together and counted as one piece.

14. The angle of bedding and schistosity will be recorded as the dip angle as measured from the perpendicular to the core axis.

15. The angle of fracture, joint, fault, or seam surfaces shall be measured from the perpendicular to the core axis and graphically illustrated.

16. The dominant type of coatings or fillings present in fractures or seams will be recorded. Slickensides shall be identified as apparent dip-slip or strike-slip.

17. Standard rock symbols will be used in the graphic log to show major variations in lithology. Minor changes will be documented in the written lithologic log.

18. Rock cores will be visually described for the following parameters:

    - Lithology
    - Grain Size and texture
    - Color

- Bedding/Foliation/Banding
- Weathering
- Solution or void conditions.

4.1.4.3 Handling and Storage of Rock Core

Rock cores will be placed in wooden core boxes with the top and bottom of each run clearly labeled. Core will be placed with the top at upper left and bottom at lower right of the core box. For the standard hinged core box, the hinged side is designated the upper side of the box. Any breaks that are made to fit the core into the boxes will be marked.

Wooden spacers showing the footage at the beginning of each run will be placed in the boxes. In addition, core boxes will be clearly marked on the inside and outside of top cover and each outside end to identify the job, the boring number, the numerical sequence of the box (e.g., 2 of 7), and the footage interval within the box.

When it is necessary to split cores for detailed examination, the cores will be handled carefully and put back into the box in the same position they were prior to splitting.

4.1.5 Borehole Backfilling

Bentonite chips will be placed in the borehole as the backfilling material from the bottom of the boring up to the base of the floor grade as the temporary casing is removed. As the bentonite is placed, the depth to the top of the bentonite backfill will be measured/monitored with a weighted tape. Then a concrete or asphalt patch will be placed through the building floor interval.

4.2 SAMPLE DESIGNATION AND LABELING

Once the soil sample has been collected, label the appropriate sample bottle with the appropriate sample tag and provide the following data for the chain-of-custody (COC): sample identification number, project number and name, date, time, sampler's signature, number of containers per analyte, analysis requested, and preservative(s) added.

EA will employ the following sample designation system:

I. Soil Samples

Example: SB16-31-00-02 = the soil samples collected from soil boring location SB16-31 from a depth of 0 to 2 ft below grade.

II. Quality Assurance/Quality Control Samples

Example 1: SB16-DUP01
>SB16 – Soil sample from Site 16
> DUP 1 – First duplicate. The actual well number and depth interval from which the duplicate sample is collected will be recorded in the field notebook and Field Sampling form.

Example 2: SB16-TB01 = The first trip blank for VOC analysis for this soil sampling work at Site 16.

Example 3: SB16-RB01 = The first rinsate blank sample for this soil sampling work at Site 16.

Example 4: SB16-MS/MSD01 = The first MS/MSD for this soil sampling work at Site 16.

4.3 HANDLING, CUSTODY, AND SHIPPING

Seal the sample containers with custody tape (for VOC vials, seal the vials in a quart plastic bag). Complete COC document (provided by the contracted laboratory) entries and record the sampling event in the bound field notebook.

The properly labeled and sealed containers will be placed in a plastic ziplock-type bag and sealed. The sample will be packed with wet ice which has been double bagged with heavy duty polyethylene bags or similar, prior to placement into the cooler. Samples will be packed so as to maintain a temperature of 4° C.

The COC form will be sealed in a ziplock-type bag and taped to the inside of the cooler lid. Laboratory will be notified by phone of the sample shipment at least 24 hours before arrival and 48 hours before arrival if the arrival is to occur on a Saturday. Laboratory will be notified one week prior to the beginning of sampling. The containers for each matrix are listed in Tables 3-1 and 3-2 of the Quality Assurance Project Plan (QAPP) (Appendix A of the March 2000 Final Work Plan). Samples will be picked up by the contracted laboratory for chemical analyses in accordance with the QAPP.

A completed COC Form will accompany the samples shipped to the laboratory and will contain the following information:

- Project name and EA project number
- Name of person collecting samples
- Date and time samples were collected
- Type of sampling conducted (e.g., composite, grab)
- Sample Matrix (e.g., soil, ground water)

- Parameters and method for analysis
- Location of sampling station
- Field filtration and/or preservation methods
- Number and type of containers used
- Signature of EA field personnel relinquishing sample
- Date and time of custody transfer to overnight courier
- Sample shipper (e.g., United Parcel Service, Federal Express).

The COC forms will provided by the contracted laboratory with the sample containers/coolers and will be completed by the sampling team and included with the samples.

4.4 DECONTAMINATION PROCEDURES

The primary objective of the decontamination process is to prevent the accidental introduction of potential contaminants to non-contaminated areas and/or samples. This section describes the methods associated with decontamination of field equipment.. The SHERP (Appendix B of the March 2000 Final Work Plan) addresses personnel decontamination.
Decontamination will be performed in the vicinity of each boring/well and the area will contain a wash solution collection system. The collected material will be contained in Department of Transportation (DOT) approved, 17H, 55-gal drums that are suitable for storage of liquid hazardous materials. Drums will be labeled (indicated in the IDW section below) and temporarily located in the vicinity of the EA Field Office Trailer pending selection of the disposal method and contractor. Wash tubs used in the field to clean split-barrel soil samplers will be emptied into a DOT approved, 17H, 55-gal drum and labeled.

Equipment (drilling tools/pipe, bits, temporary steel casing) that will be used during drilling activities will be steam cleaned prior to use and before starting each boring. Equipment will be kept off the ground on clean sawhorses, racks, or pallets. If blowing dust is a problem, equipment shall be covered with plastic sheeting during storage. Upon completion of the work, the portions of the drilling rig which came in contact with subsurface soil/drilling fluids will be steam cleaned.

Reusable soil sampling equipment will be cleaned prior to use in the field. Wherever possible, sampling equipment will be dedicated to a single location to minimize potential for cross-contamination. All other non-dedicated sampling equipment will be decontaminated as described below.

Stainless Steel or Teflon

This includes all split-barrel soil samplers, spoons, spatulas, trowels and bowls, and other stainless-steel or Teflon equipment that may reused for field activities:

1. Wash thoroughly (at each boring/well location) using a brush and Liquinox, or similar non-phosphate detergent, plus clean water from the designated source.

2. Rinse equipment thoroughly with distilled water.

3. Rinse with isopropyl alcohol by spray bottle and allow to air dry.

4. Flush with distilled water to remove isopropyl alcohol.

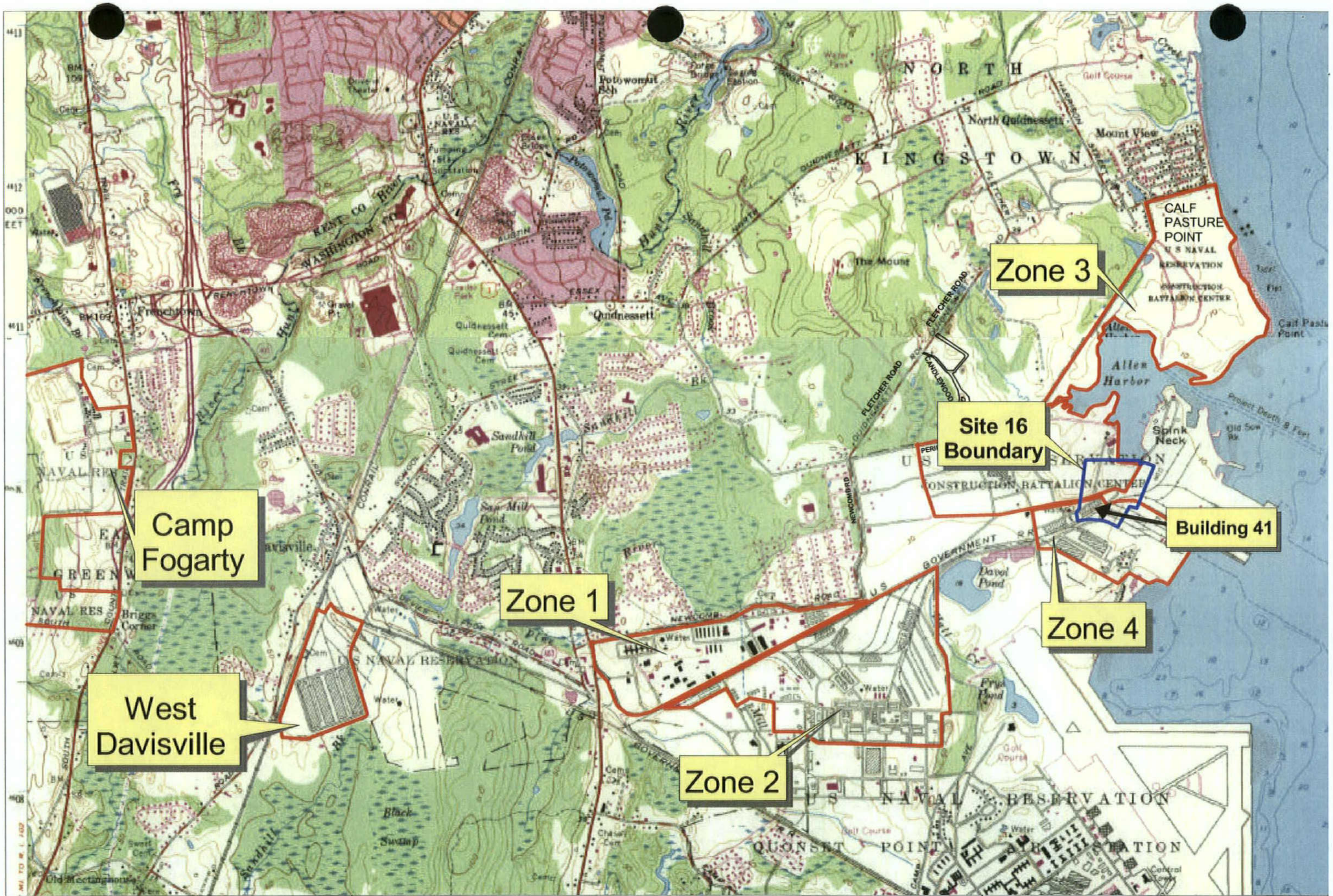
5. Air dry and store on plastic poly sheeting, or if not being used shortly, in plastic garbage bags to prevent contamination during storage and/or transport to the field.

4.5 INVESTIGATIVE DERIVED WASTE MANAGEMENT

Drill cuttings will be containerized in DOT-approved, 17E, 55-gal drums and temporarily located in the vicinity of the EA Field Office Trailer pending selection of the disposal method and contractor. Drums will be marked as IDW and be labeled with the contents (soil), the soil boring designation number, and the date of collection.

Liquid generated as a result of decontamination activities will be collected and containerized initially in DOT-approved, 17H, 55-gal drums at the time of generation. The drums will be marked as IDW and labeled with the description of drum contents, related boring/well numbers, and the date the drum was filled. The drums will be temporarily located in the vicinity of the EA Field Office Trailer pending selection of the disposal method and contractor.

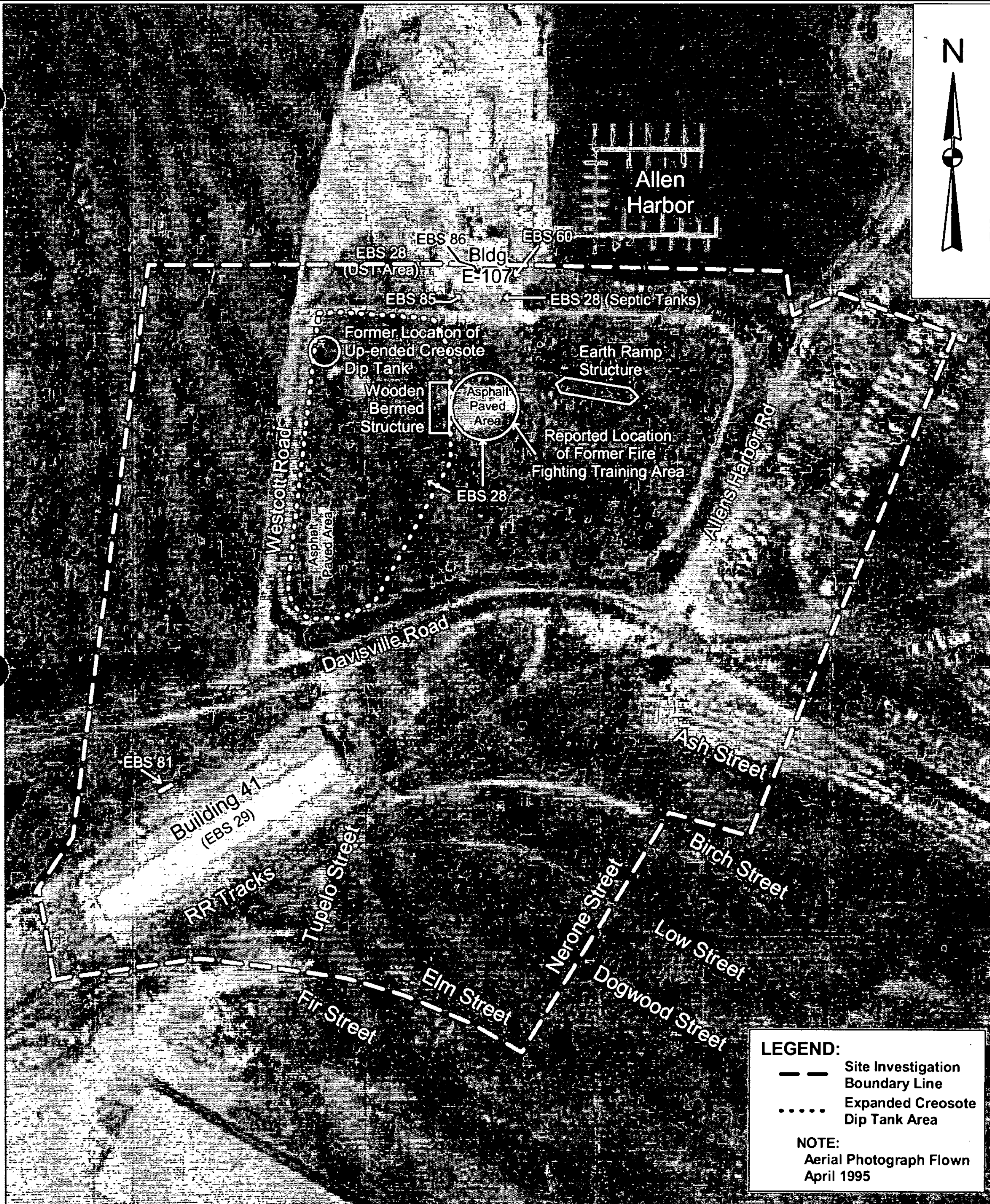
Other wastes generated during decontamination activities, including discarded personal protective equipment, aluminum foil, and other debris, will be collected and containerized in DOT-approved, 17E, 55-gal drums marked as IDW and labeled with the description of drum contents, related boring/well numbers, and the date the drum was filled. The drums will be temporarily located in the vicinity of the EA Field Office Trailer pending selection of the disposal method and contractor.



EFANE
REMEDIAL INVESTIGATION
WORK PLAN ADDENDUM NO. 2
IR PROGRAM SITE 16
NCBC DAVISVILLE, NORTH KINGSTOWN, RHODE ISLAND

BUILDING 41 LOCUS MAP

FIGURE 1



EA ENGINEERING, SCIENCE, AND TECHNOLOGY

100 0 100 Feet

EFANE
Remedial Investigation
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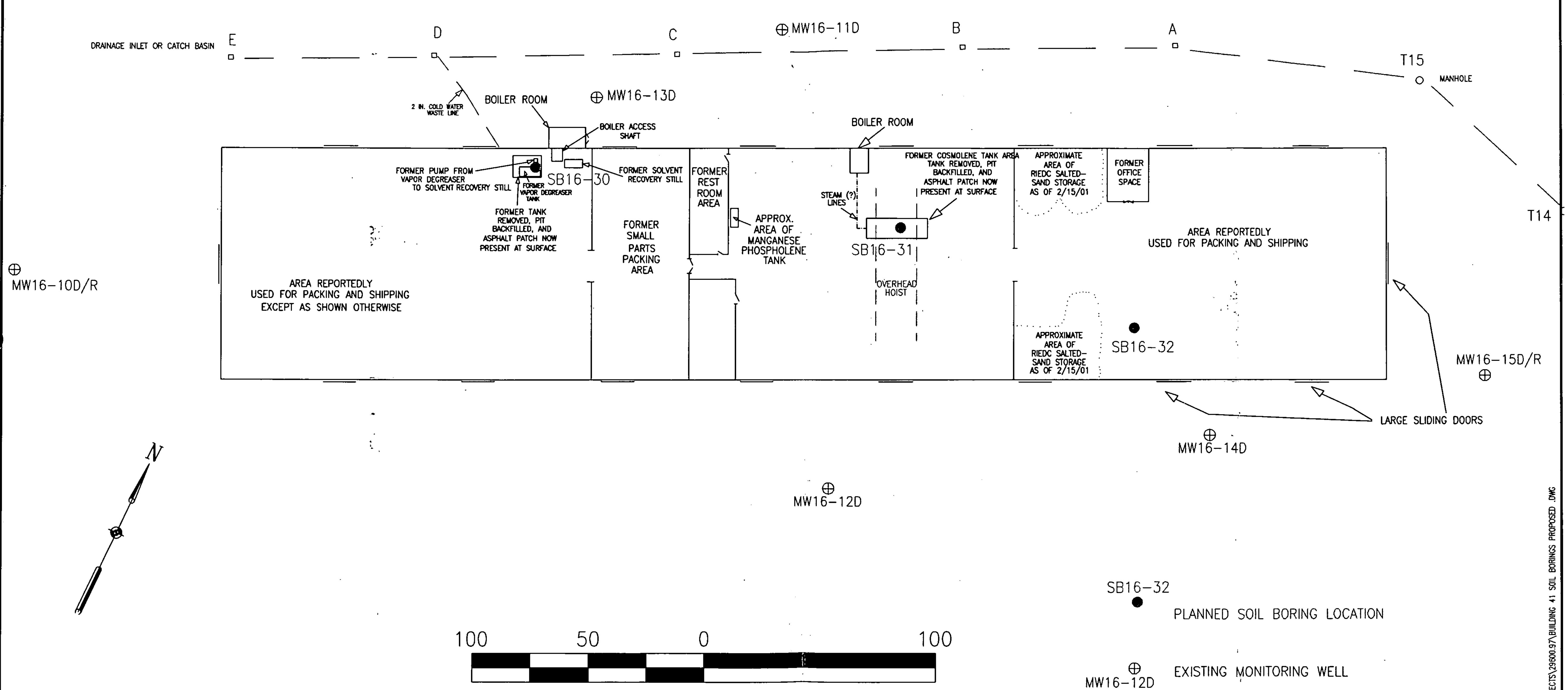
IR Program Site 16
NCBC Davisville
North Kingstown, Rhode Island

SITE MAP

FIGURE 2



COMPILED FROM THE FOLLOWING HISTORICAL DRAWINGS:
BUILDING 41, FLOOR PLAN AND ELEVATION, ARCHITECHTURAL, 1/9/53, LAST UPDATED 7/26/54
MANIFOLD LINE AND SOLVENT STILL F/ BLDG. #41, 8 SEPT. 1952, LAST UPDATED 4/30/53
MANGANESE PHOSPHOLENE TANK IN 41, 8 AUGUST 1952
BLDG 41 LAYOUT AND DETAIL OF TANK RAILING, 9/9/53
MASTER SHORE STATION DEVELOPMENT PLAN UTILITIES STORM DRAINAGE SYSTEM, SHEET 13 OF 27, REVISED 6/ 58

EA® EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	FILE NAME
JS	RC	2/8/02	29600.97	BLDG 41 SOIL BORINGS PROPOSED
CHECKED BY	PROJECT MGR.	SCALE	DRAWING NO.	FIGURE
JS	JS	AS SHOWN	–	3

EFANE
IR PROGRAM SITE 16
REMEDIAL INVESTIGATION WORK PLAN ADDENDUM NO. 2
FORMER NCBC DAVISVILLE FACILITY
NORTH KINGSTOWN, RHODE ISLAND

BUILDING 41
PLANNED LOCATIONS FOR SOIL BORINGS
FIGURE 3

TABLE 7-2 QUALITY CONTROL CRITERIA FOR PRECISION AND ACCURACY FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATES, SURROGATES, AND LABORATORY CONTROL SAMPLES FOR SITE 16, NCBC DAVISVILLE

QC Parameter	Spiking Compounds	Accuracy (%R)		Precision(b)	
		Water	Sediment/Soil	Water	Sediment/Soil
SW5030B/8260B Volatile Organic Compounds by GC/MS (Water)					
Surrogate Spike	Toluene-d8	82-120	68-147	≤40	≤40
	Dibromofluoromethane	75-129	66-149	≤40	≤40
	Benzene	60-140	60-140	≤40	≤40
	Toluene	60-140	60-140	≤40	≤40
	Chlorobenzene	60-140	60-140	≤40	≤40
LCS/MS/MSD	1,1-Dichloroethene	60-140	60-140	≤40	≤40
	Trichloroethene	60-140	60-140	≤40	≤40
	Chlorobenzene	60-140	60-140	≤40	≤40
	1,2-Dichloroethane-d4	36-117	66-149	≤40	≤40
	4-Bromofluorobenzene (BFB)	47-114	64-152	≤40	≤40
SW5035/8260B Volatile Organic Compounds by GC/MS (Sediment, Soil)					
Surrogate Spike	Toluene-d8	82-120	68-147	≤40	≤40
	Dibromofluoromethane	75-129	66-149	≤40	≤40
	Benzene	60-140	60-140	≤40	≤40
	Toluene	60-140	60-140	≤40	≤40
	Chlorobenzene	60-140	60-140	≤40	≤40
LCS/MS/MSD	1,1-Dichloroethene	60-140	60-140	≤40	≤40
	Trichloroethene	60-140	60-140	≤40	≤40
	Chlorobenzene	60-140	60-140	≤40	≤40
	Nitrobenzene d5	36-117	14-107	≤40	≤40
	2-Fluorobiphenyl	47-114	32-109	≤40	≤40
Oil and Grease, Method 9071B (Soil)					
Surrogate Spike	Not Applicable				
LCS/MS/MSD	EPA Method 1664 Standard	60-140	60-140	≤40	≤40

Table 8-1 Summary of Sampling and Analytical Program, Site 16, NCBC Davisville, RI

Sample Media	US EPA Method (SW8460)	# Field Samples	Number of QC Samples				Total Number of Samples
			Duplicate	Rinsate	MS/ MSD	Trip Blank	
Subsurface Soil	TCL VOC (5035/8260)	9	1	1	1/1	3	16
	Oil and Grease (9071B)	4	1	1	1/1		8

TABLE 9-2 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SOLID SAMPLES [a]

Parameter	Weight Required (g)	Container	Preservative	Holding Time
Oil and Grease (Method 9071B)	50	8 oz. Glass	Cool 4 C	14 days
Volatile Organics (Method 5035/8260B)	200	Glass, Teflon-lined septum	Methanol, 4 °C	14 days

(a) From time of sample collection (40 CFR Part 136.3, 40 CFR Part 261).

TABLE 12-2 REPORTING LIMITS FOR SOIL SAMPLES

Parameter	Units	Project Reporting Limit
Oil and Grease Method 9071B	mg/kg	33
Volatile Organics GC/MS (SW846 Method 5030A/8260B)		
Acetone	µg/kg	25
Benzene	µg/kg	5
Bromodichloromethane	µg/kg	5
Bromoform	µg/kg	5
Bromomethane	µg/kg	5
2-Butanone	µg/kg	25
Carbon disulfide	µg/kg	5
Carbon tetrachloride	µg/kg	5
Chlorobenzene	µg/kg	5
Chloroethane	µg/kg	5
Chloroform	µg/kg	5
Chloromethane	µg/kg	5
Dibromochloromethane	µg/kg	5
1,1-Dichloroethane	µg/kg	5
1,2-Dichloroethane	µg/kg	5
1,1-Dichloroethene	µg/kg	5
1,2-Dichloroethene (total)	µg/kg	5
1,2-Dichloropropane	µg/kg	5
cis-1,3-Dichloropropene	µg/kg	5
trans-1,3-Dichloropropene	µg/kg	5
Ethylbenzene	µg/kg	5
2-Hexanone	µg/kg	25
4-Methyl-2-pentanone (MIBK)	µg/kg	25
Methylene chloride	µg/kg	5
Styrene	µg/kg	5
1,1,2,2-Tetrachloroethane	µg/kg	5
Tetrachloroethene	µg/kg	5
Toluene	µg/kg	5
1,1,1-Trichloroethane	µg/kg	5
1,1,2-Trichloroethane	µg/kg	5
Trichloroethene	µg/kg	5
Vinyl chloride	µg/kg	5
Xylenes (total)	µg/kg	25

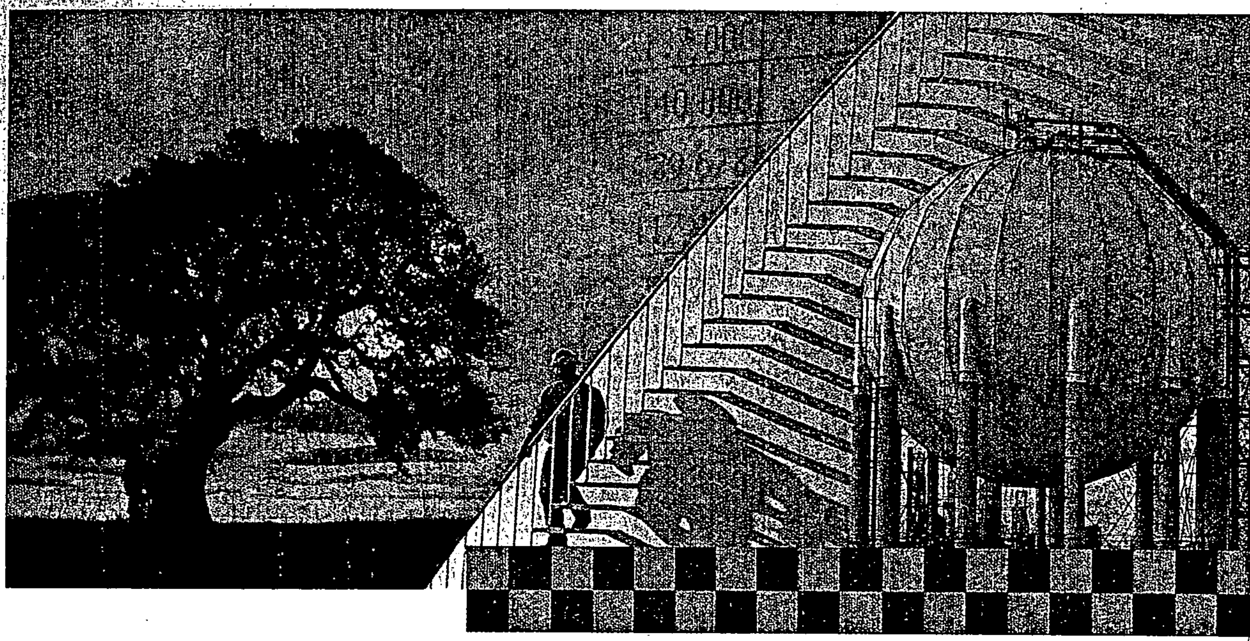
NOTE: GC/MS = Gas chromatograph/mass spectrometry.
Dashes (---) indicate no Ground-Water Protection Criteria available.

ATTACHMENT

Flame Ionization Detector Calibration Procedure

VOC DETECTION

Photovac MicroFID
Portable Flame Ionization Detector



Instrument Manual

PerkinElmer™
instruments.

Calibration

General Information

MicroFID must be calibrated in order to display concentration in ppm units equivalent to the calibration gas. First a supply of zero air, which contains no ionizable gases or vapors, is used to set MicroFID's zero point. Then, calibration gas, containing a known concentration of an ionizable gas or vapor, is used to set the sensitivity.

Occasionally clean ambient air will be suitable as zero air. Due to MicroFID's sensitivity, outdoor air is usually unsuitable for calibration. A charcoal filter (Part No. MX396021, MX396022) may be connected to the instrument to produce clean air from otherwise unsuitable ambient air. For best results, use a commercial source of zero grade air and a second sampling bag. Zero air should have not more than 0.1 ppm total hydrocarbons (THC).

Methane in air is recommended as span gas. The concentration of the calibration gas will depend on your application. When ordering calibration gas, specify methane in hydrocarbon free air. Balance air should have not more than 0.1 ppm total hydrocarbons (THC).

Method 21 protocol requires that commercial cylinders of calibration gas be analyzed and certified to be within +/- 2% accuracy and that a shelf life must be specified on the cylinder. At the end of the shelf life, the cylinder must be replaced or re-analyzed.

Preparing the Calibration Gas Bag and the Zero Air Bag

Use the calibration kit (Part No. MX396011) as follows:

> *Observe proper handling techniques for all gases! See* Warnings and Safety Practices *on page 22.*
>
> WARNING

1. Connect the regulator to the calibration gas cylinder.

   If you are using a portable tank of calibration gas, connect the regulator supplied with the calibration kit.

   If you are using a large cylinder of calibration gas, you must obtain a high purity regulator as specified in *Support Equipment and Consumables* on page 28. Methane in air is usually supplied with a standard CGA 590 cylinder valve outlet. Obtain a regulator with the matching fitting. Connect the regulator to the tank of calibration gas.

NOTE: *Do not force the connection.*

Do not use Teflon tape with CGA fittings. In general, these fittings are designed for metal to metal sealing.

Do not use adapters to connect one CGA fitting to another type of CGA fitting. If the regulator does not match the outlet on your calibration tank, contact your specialty gas supplier.

2 Tighten the regulator onto the tank with a wrench. Do not over-tighten.

3. Attach the knurled nut on the gas bag adapter to the regulator. Finger-tighten the fitting.

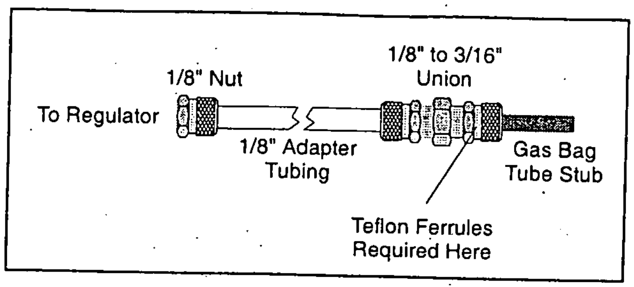


Figure 10 Gas Bag Adapter

4. Loosen the knurled nut on the reducing union of the gas bag adapter.

NOTE: *Do not remove the nut from the union, as the Teflon ferrules contained inside the nut may be lost. See* Figure 10.

5. Insert the tube stub from the gas bag into the knurled nut. Tighten the knurled nut and ensure the tube stub is secure. If the gas bag is not secure, ensure you have inserted the tube stub far enough into the knurled nut. Do not over tighten the fitting.

Over-tightening the Teflon ferrules will result in damage to the ferrules.

CAUTION

6. The union should be connected to the gas bag adapter. If it is not, then tighten the nut on the adapter tube to the union.

7. Open the gas bag valve. Turn the knurled plastic knob counter clockwise to loosen it, then use the knurled collar on the valve tube to gently push the valve tube toward the bag.

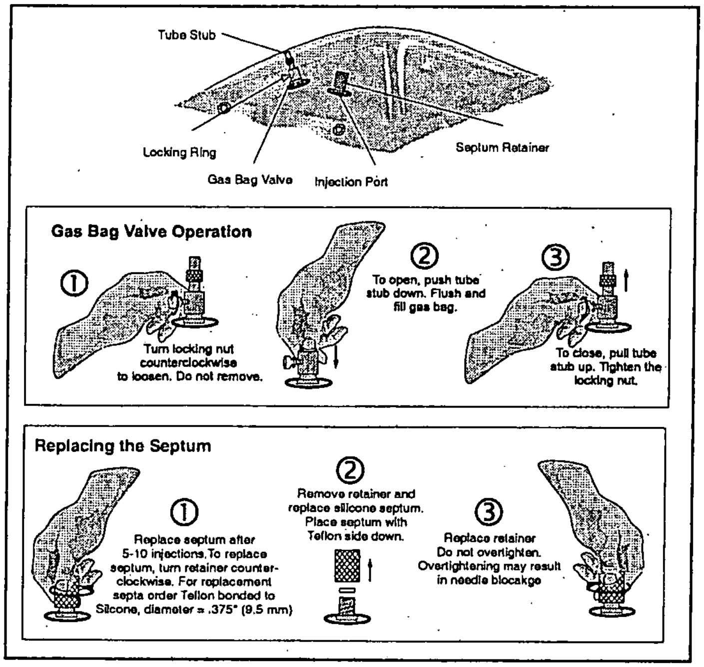


Figure 11 Using the Gas Bag

8. Turn the regulator knob counter clockwise about half a turn to start the flow of gas. Fill the gas bag about half full and then close the regulator.

9. Disconnect the gas bag from the gas bag adapter and empty the bag. Flush the bag a few times with the calibration gas and then fill it.

10. Close the gas bag valve. Gently pull the valve tube away from the bag, and then turn the knurled plastic knob clockwise to tighten it against the valve tube.

11. Remove the knurled nut on the adapter tube from the regulator.

12. Repeat this procedure, if necessary, to prepare a bag of zero air.

NOTE: *Do not use the same gas bag or gas bag adapter for the bag of zero air. You will contaminate the bag of zero air.*

Calibrating MicroFID

To calibrate MicroFID:

1. Press CAL and select the desired Cal Memory. MicroFID has 10 Cal Memories and can be calibrated with 10 different span gases or response factors if desired. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm level

2. Enter the desired response factor and press ENTER. Refer to *Response Factors* on page 148 for a list of Response Factors. If the compound is not in this list or you measuring gas mixtures then enter a value of 1.00. The concentration detected by MicroFID will be multiplied by the response factor before it is displayed and logged.

3. Select Low Range or High Range and press ENTER. Use Low Range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling concentrations between 10 and 50,000 ppm (methane equivalents)

4. Connect the supply of zero air. If you are using room air press ENTER.

5. If you are using a charcoal filter, connect the filter as outlined in *Charcoal Filters* on page 95. Press ENTER and MicroFID will set its zero point.

NOTE: *The charcoal filter does not filter methane or ethane. If these compounds are present, use a gas bag with a supply of commercial zero air.*

6. If you are using a gas bag with zero air, connect the gas bag adapter to the inlet. Open the bag and press ENTER. MicroFID sets its zero point.

7. MicroFID then asks for the span gas concentration. Enter the known span gas concentration and then connect the gas bag adapter to the inlet. Open the bag.

8. Press ENTER and MicroFID sets its sensitivity.

NOTE: *Readings may fluctuate slightly as the gas bag empties. Do not allow the MicroFID to evacuate the bag completely.*

9. When MicroFID's display reverts to normal, it is calibrated and ready for use. Remove the span gas bag from the inlet.

10. Press the ALARM key and enter the alarm level for the selected Cal Memory.

Programming the Cal Memories

MicroFID has 10 Cal Memories and can be calibrated with 10 different span gases or response factors if desired.

To program the Cal Memories:

1. Prepare the bags of calibration gas as outlined in *Preparing the Calibration Gas Bag and the Zero Air Bag* on page 66. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas.

   You can use the same gas bag to zero all the Cal Memories; however, you must refill the bag for each Cal Memory.

2. Press CAL and select the desired Cal Memory (1 to 10) with the ARROW keys.

3. Enter the desired response factor and press ENTER. See *Response Factors* on page 148.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.*

4. Select the Low Range or High Range and press ENTER. The range will depend on the concentration of the calibration gas. Use Low range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling

concentrations between 10 and 50,000 ppm (methane equivalents).

5. You will now be prompted to connect a supply of zero air. You can use ambient air, a charcoal filter (Part No. MX396021, MX396022) to clean ambient air or, for best results, use a clean sampling bag filled with zero grade air.

6. After MicroFID has set its zero point, you then enter the concentration of the calibration gas and then connect the calibration gas. MicroFID sets its sensitivity for the specified Cal Memory. The span gas concentration, response factor and alarm level entered here are specific to the selected Cal Memory only.

When the calibration is completed it is automatically stored in the selected Cal Memory.

7. Press the ALARM key and enter the alarm level for the selected Cal Memory.

8. Repeat this procedure for each Cal Memory you need.

When calibrating MicroFID, ensure the instrument is level. If MicroFID is tilted side to side, gravity will affect the flame height and cause erroneous readings

Whenever the instrument is calibrated, MicroFID updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

High Sensitivity Operation

MicroFID can be used as a high sensitivity leak detector. In high sensitivity operation, MicroFID does not read in ppm units equivalent to the calibration gas, but displays a reading proportional to the total concentration of ionizable gases and vapors detected.

During calibration, no span gas is required. MicroFID zeros its reading with zero air and then sets itself to maximum sensitivity.

To use the High Sensitivity option:

1. Press SETUP. Select the 0-20 ppm display range with the ARROW keys and press ENTER.

2. Press CAL. Under Cal Memory, use the ARROW keys to select High Sensitivity and press ENTER.

3. Press EXIT. Select the bar graph with the DISPLAY key.

4. Press CAL and calibrate MicroFID with zero air. You should use a supply of commercial zero grade air and a gas sampling bag when zeroing MicroFID for high sensitivity operation.

As MicroFID samples air closer to the leak, the length of the shaded area on the display increases.

MicroFID's 3 second response time and detection limit of 0.5 ppm methane permit fast detection of small leaks.

Method 21 Operation

Method 21 is a US EPA protocol for the determination of volatile organic compound (VOC) leaks in process equipment. MicroFID has a Method 21 mode that facilitates Method 21 measurements. The STAR 21 Software (Part No. MX396027) provides more comprehensive data management consistent with the Method 21 protocol. Contact PerkinElmer for more information.

You must be familiar with the Method 21 protocol to use MicroFID for Method 21 monitoring. You must use the specifications outlined in the Method 21 documentation for programming MicroFID's Cal Memories and monitoring the sites.

As part of Method 21 operation, you must setup MicroFID to monitor various locations. Since each location may contain different compounds and concentration ranges you will store a Cal Memory and the associated response factor and alarm level as part of each event. In this way you can sample numerous locations without having to re-calibrate MicroFID at each location.

You can enter the monitoring schedule in one of two methods. Regardless of the method you use to enter the monitoring schedule; you must calibrate the required Cal Memories before you enter the monitoring schedule.

Calibration

You must determine the number of calibration standards that will be required to perform Method 21 monitoring for your site. Refer to the Method 21 documentation for details.

To program your cal memories:

1. Prepare the bags of calibration gas as outlined in *Preparing the Calibration Gas Bag and the Zero Air Bag* on page 66. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas.

   You can use the same gas bag to zero all the Cal Memories; however, you must refill the bag for each Cal Memory.

2. Press CAL and select the desired Cal Memory (1 to 10) with the ARROW keys.

3. Enter the desired response factor and press ENTER. See *Response Factors* on page 148.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.*

4. Select the Low Range or High Range and press ENTER. The range will depend on the concentration of the calibration gas. Use Low Range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling

concentrations between 10 and 50,000 ppm (methane equivalents).

5. Follow the displayed calibration instructions. When the calibration is completed it is automatically stored in the selected Cal Memory. The span gas concentration and response factor entered here are specific to the selected Cal Memory only.

6. Press the ALARM key and enter the alarm level for the selected Cal Memory.

Whenever the instrument is calibrated, MicroFID updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

Programming the Monitoring Schedule in the Field

The easiest way of entering the Method 21 information is to go to each site and enter the required information. In this way, the schedule will be entered into the instrument in the exact manner in which it will be used.

To program the monitoring schedule:

1. Press the SETUP key. Press ENTER until "Interval" is displayed. Use the ARROW keys to select Method 21 as the Interval. Press ENTER.

2. You will be prompted to clear the datalogger. If you want to save the contents of the datalogger, press EXIT. You must print or save the data to disk. See *PRINT Key* on page 55, *GRAPH Key Mode* on page 58 or *Computer* on page 88 for details of printing or saving your data. Press ENTER to clear the datalogger.

3. Go to the first site to be monitored. You can enter the sites in any order; however, using the schedule after it has been

stored is easier if the sites are stored in the order in which they will be monitored.

4. Press the EVENT key. Use the ARROW keys to select "Insert". Press ENTER. Use the keypad to enter an event name up to 16 characters long. To obtain alphabetic characters you must use the STAR 21 software (Part No. MX396027).

   If your site is bar coded, use the ARROW keys to select "Scan". Press ENTER to activate the bar code reader. The bar code reader will remain activated until you scan a code. If no bar code is scanned within 15 seconds the bar code reader will be deactivated. See *Bar Code Reader* on page 103 for details of connecting the bar code reader to MicroFID.

   It is possible to enter an event name that already exists in the datalogger. When you select "Insert" or "Scan" you can enter the name of an event that already exists in the datalogger. MicroFID will not overwrite the existing event. It will insert an event with the same name. In this way you can create multiple copies of the same schedule in the datalogger. You can see the duplicate events when you print the contents of the datalogger.

5. Press the CAL key and select the calibration memory to be used for this site. Press ENTER and then press EXIT.

6. Press SETUP and enter a 2-digit repair code for this location. See *SETUP Key* on page 50 for a description of Repair code. This step is optional.

7. When you return to the default display, the instrument status will be "Locate". You should be at the site. If not, locate the site. If the event name is greater than 3 characters the bottom line of the display will scroll from right to left.

8. Once you have located the designated site, press ENTER. The instrument status will change to "BkGnd". A background measurement must be made as specified in the Method 21 protocol. When you have an accurate background, press ENTER. MicroFID will record the

maximum background concentration when you press the ENTER key.

9. The instrument status will now be "Sample". Take a sample measurement, as specified in the Method 21 protocol. When you have an accurate sample, press ENTER. MicroFID will record the maximum sample concentration when you press the ENTER key.

10. The instrument status will again be Locate. At this time, since there are no other locations stored in the datalogger the same event will be displayed.

11. Press EXIT at anytime to return to the beginning of the current event and repeat the readings.

12. To store the next location, go the next site and press the EVENT key. Select "Insert" or "Scan" to enter an event name.

13. Press the CAL key and select the calibration memory to be used for this site.

14. Press SETUP and enter a repair code for this location.

15. When you return to the default display, the instrument status will be "Locate". Record a background and sample reading for this site. You will now have two events recorded in the datalogger.

16. Repeat this procedure for all sites that must be monitored. You can record data for up to 250 sites.

17. Once all event entries have been recorded in the datalogger, you may want to download them to a computer to perform your own calculations.

Response Factors for Gases and Vapors

In situations where only a single pure compound is present in air, MicroFID should be calibrated with a standard of that specific compound as span gas. MicroFID's 10 Cal Memories can be used to store calibration information for 10 different span gases.

MicroFID's reading will always be influenced by any other ionizable compounds present in the air sample. Even if MicroFID has been calibrated with a specific compound, its response is not specific and the presence of another ionizable impurity may render the numerical result invalid.

It is often impractical to carry a range of different standards into the field. Approximate results can be obtained by calibrating MicroFID with the recommended span gas and entering the appropriate response factor. The response factor is based on the ratio of the response of the specific compound to the response of the span gas. The response factor multiplies MicroFID's reading then displays and records it (if the datalogger is on).

Response Factors on page 148 provides a list of response factors from which approximations can be made for guidance purposes. Data extrapolated from the use of response factors must be regarded as interim and approximate only. The response factors in the list should be used only for concentrations up to 500 ppm of the specific compound, as response factors change with concentration.

To use the response factors:

1. Press the CAL key and enter the response factor for the specific compound.

2. Calibrate MicroFID with zero air and 500 ppm methane as described in *Calibration* on page 65.

3. Expose MicroFID to the sample. The displayed reading is the approximate concentration of the specific compound.

The response factors on page 148 serve as a guide to concentrations measured by MicroFID.

Results are expected to be accurate to within +/-10 ppm or +/-25% of result, whichever is greater. Accuracy of response factors to other gases and vapors may differ from that stated.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.*

Preparing for Field Operation

Field Check List

The following items should be carried into the field to reduce or eliminate instrument down time. If you will be in the field for a single 8-10 hour day, you should include the following accessories:

•	Spare battery pack (Part No. MX396005 or MX396006)
•	Long sample probe (Part No. MX396018)
•	Calibration kit(s) (Part No. MX396011)
•	Tank(s) of calibration gas (Part No. MX396028)
•	Spare gas bag for zero air (Part No. MX396017)
•	Gas bag adapter for zero air (Part No. MX396010)
•	Supply of commercial zero air
•	Charcoal filters (Part No. MX396021, MX396022)
•	Shoulder strap (Part No. MX395002)
•	Spare inlet filters (Part No. MX396020 or MX396015)
•	Bar code reader and interface module (Part No. MX396054)
•	Spare 9 volt battery for bar code reader
•	Carrying case (Part No. MX396007)
•	Headset (Part No. MX396053)
•	MicroFID Instrument Manual (Part No. MX396003)

Table 3 Check List for Field Operation

If you will be in the field for more than one day you should include the following additional items:

•	Battery chargers (Part No. MX396013 or MX396014). Take one charger for each battery pack.
•	Hydrogen and refill adapter (Part No. MX396004)
•	Printer cable (Part No. MX396051)
•	Computer and associated cables

Table 4 Additional Field Items

Operational Check List

Before beginning field work, set up and calibrate MicroFID for your particular application. Ensure the instrument is in working order before heading into the field.

To prepare MicroFID for field work:

1. Ideally, you should not transport MicroFID with the hydrogen cylinder filled. If it is possible to fill the internal hydrogen cylinder when you arrive at your destination then do so. If not, then you must fill the cylinder before you leave and observe all precautions for handling compressed, flammable gases. See *Warnings and Safety Practices* on page 22.

   If you are travelling by passenger aircraft, you must make arrangements to fill the hydrogen cylinder when you arrive at your destination. You cannot transport MicroFID by passenger aircraft unless the internal hydrogen cylinder is empty. See *Emptying the Hydrogen Cylinder* on page 110 more information.

2. Press the BATT key and ensure the battery pack is fully charged. The voltage should be 9 volts.

3. Press the SETUP key and ensure the correct date and time are entered.

4. Program and calibrate all the Cal Memories you will be using. See *Calibration* on page 65. After calibration is complete, sample the bag of calibration gas and the bag of zero air to ensure MicroFID has been calibrated correctly.

5. Press the MAX key and clear the Max register if necessary.

6. If you are using an averaging interval, you may also want to delete all events from the datalogger to avoid confusion between different days' data and to avoid running out of space in the datalogger. See *EVENT Key* on page 51.

7. If you are performing Method 21 monitoring ensure you have programmed and calibrated all the Cal Memories. You must also program your monitoring schedule. See *Method 21 Operation* on page 72 for more information.