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FINAL DRAFT RESOURCE CONSERVATION AND RECOVERY FACILITY INVESTIGATION
CNC CHARLESTON SC
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KEMRON ENVIRONMENTAL SERVICES

FINAL DRAFT

RCRA FACILITY INVESTIGATION (RFI)
CHARLESTON NAVAL BASE
CHARLESTON, SOUTH CAROLINA
CONTRACT NO. N62467-87-D-0650
AMENDMENT NO. 9

Report to:

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

MARCH 1991

WAPORA

Environmental Engineers/Scientists

VAPORA
Environmental Engineers/Scientists
A KEMRON Company

Project 520

4 March 1991

Mr. Reese Batten, P.E.
Southern Division, Code 114
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
Charleston, SC 29411-0068

Dear Reese:

Enclosed is the Draft Final RCRA Facility Investigation report for the Charleston Naval Base. This is issued under Amendment No. 9 Statement of Work dated 10 September 1990 of the Indefinite Delivery Contract, Contract No. N62467-87-0650. I have also forwarded a copy to Jeff Pallas at the Region IV EPA office in Atlanta.

Sincerely,

Steve A Holt

Steve Holt
Project Manager

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Project 520

30 September 1991

Response to USEPA and SC DHEC Comments

on

RCRA Facility Investigation Workplan (dated March 1991)
Charleston Naval Base
Charleston, South Carolina

Prepared for:
Naval Facilities Engineering Command
Southern Division
Charleston, South Carolina

Prepared by:

WAPORA, Inc.

RESPONSES TO EPA
COMMENTS ON
RFI WORK PLAN (Dated March 1991)
FOR

U.S. Charleston Naval Shipyard
EPA ID. NO. SCO 170 022 560

General Comments

I. The work plan contains two major deficiencies which prevent a comprehensive review of the proposed RFI activities at this time. These two major deficiencies are:

A. An inadequate description of the current conditions

The work plan refers to previous contaminant release studies without providing a summary of the previous findings or providing the reports and work plans. Any prior contaminant release studies intended for use in characterizing SWMU releases in accordance with the requirements of the EPA RCRA Permit must be summarized in the RFI Work Plan and copies of reports and work plans provided. The summary of the current conditions must include a discussion of the methods used in the completed investigations, the investigation's data gaps and the proposed method of filling those data gaps during the RFI. Maps must be used in describing the contaminant releases to show where data has been collected and the current interpretation of that data. Section 2 of the RFI Work Plan should provide a summary of the current conditions, including an identification of the existing data and data gaps. Section 3 should discuss how the specific data gaps identified in Section 2 will be filled under the proposed investigation. Without presentation of the current conditions as described above, the EPA cannot consider any of the previous investigatory findings in meeting the requirements of the EPA RCRA Permit.

Response: All prior contaminant release studies will be summarized in Section 2.6 of the RFI Work Plan. Copies of the previous studies and reports are not included as part of this RFI, but are available through the Navy on request.

B. Limiting scope of the RFI based on assumptions of need for corrective measures

Although releases have been documented for many SWMUs, only a limited groundwater investigation is proposed because of the reported lack of human consumption of on-site groundwater and the slow groundwater time-of-travel. Whereas these factors will be important in determining the need and/or extent of corrective measures, the RFI must characterize the releases of all hazardous constituents in all affected environmental media, as specified under Condition II.C.4 of the permit. Once characterization is complete, the Corrective Measures Study will evaluate the need for corrective action to ensure adequate protection of both human health and the environment.

Response: The RFI has addressed known and potential releases of hazardous constituents and implemented ground water monitoring at those SWMUs to characterize the groundwater and determine if contamination is present.

II. Due to the large number of SWMUs and AOCs requiring investigation, a Corrective Action Management Plan should be developed and approved by EPA and the State to meet the following objectives:

- Prioritize investigatory schedules with an emphasis on accelerating investigations for those units with the most significant releases.

- Group SWMUs and AOCs together based on commingled contaminant plumes or as appropriate to combine investigatory strategies to meet the data needs for multiple units.

- Identify interim actions appropriate for minimizing continued contaminant migration.

Response: A Corrective Action Management Plan will be submitted under separate cover.

Specific Comments

1. Section 1.1

The RFI Work Plan is required to address those SWMUs included in Paragraph I or Appendix A to the EPA RCRA Permit and those SWMUs and SWMU releases identified subsequent to issuance of the permit. Inclusion of all SWMUs is not necessary.

Response: The additional SWMUs in Paragraph II were included in the original contract to perform the RFI Work Plan for the Navy. Since they are already incorporated in the original document, they will remain.

2. Section 1.2

a. Elevated background concentrations of hazardous constituents may be present due to the wide-spread application of dredge spoils containing hazardous constituents. This work plan must provide a method of evaluating background contamination which may be present due to contaminated dredge spoils. Provide copies of the studies performed to characterize background contamination and summarize the findings in this section.

Response: Detailed studies of background concentrations are presented in EnSafe's reports (Ref. 4 to 8). Summaries of the data are presented in some of the section 2.6 descriptions and the Appendices.

b. Paragraph two, on page 1-2, is irrelevant for the purposes of scoping the RFI. These factors will be relevant in determining the need for corrective measures after the extent of any hazardous constituent releases are adequately characterized.

Response: The portions of this section that do not apply have been deleted.

c. Paragraph three, on page 1-2, refers to the preamble discussion to the proposed Subpart S Rule (FR Vol. 55, 7/27/90) to apparently support limiting the scope of this RFI Work Plan. This discussion has been taken out of context. This paragraph of the preamble pertains to a decision for selecting a remedy for corrective measures, not to assessing the releases from SWMUs.

Response: Paragraph three, on page 1-2 has been deleted. However, the action levels have been considered in determining what may be acceptable concentrations for no further action.

d. Do any of the "surface water bodies which nearly surround the NSY" meet the definition of wetlands?

Response: Some of the surface water bodies in the area meet the definition of wetlands.

e. The thickness of the clay layer below the surficial aquifer and the slow groundwater time-of-travel are not supported with data.

Response: The above items are supported by the Geraghty and Miller report (Ref 12). Section 2.3.3 and Appendix A present a more detailed description of supporting data.

f. The last sentence in paragraph four, on page 1-2, must be deleted. As discussed above, the RFI is a quantitative assessment of the releases from SWMUs. The scope of the RFI cannot be limited based on a preconceived conception of the viability or need for corrective measures.

Response: The portions of this section that do not apply have been deleted.

g. Again, the last four sentences of page 1-3 limit the scope of the RFI without adequate supporting data to compare the releases from the SWMUs to the background concentrations. Additionally, a deed restriction type of corrective action is considered for those SWMUs which are <u>believed</u> to not contribute significant contamination above the already existing background contamination. These sentences must be deleted for the purposes of defining the scope of the RFI.

Response: The portions of this section that do not apply have been deleted.

3. Figure 2-1

Identify the Naval Base North as the Charleston Naval Weapons Station, a separate RCRA facility.

Response: This change to Figure 2-1 has been made.

4. Section 2.3.3

Provide the extrapolated data and the sieve analysis data on the low permeability surficial soils.

Response: The requested data has been provided in Section 2.3.3 and Appendix A. A more detailed discussion is presented in Geraghty and Miller's report (Ref. 12).

5. Section 2.3.6

Identify the nearby shallow aquifer water well users west of the facility boundary and locate the wells on a map of appropriate scale.

Response: A survey of all public and private water well users in and around the NSY is planned and is described in the Corrective Action Management Plan.

6. Section 2.3.6

The work plan states that the "surface contaminants...represent a potential threat to aquatic habitats....although they do not threaten human health." A human exposure scenario of human consumption of contaminated biota should be considered.

Response: Human exposure to contaminants by way of human consumption of contaminated biota has been considered and is included in Section 3.2.1. A work plan will be developed for ecological assessment if bioassays are required.

7. Section 2.3.6

The work plan states that "various contaminants, particularly metals, are likely to be attenuated by absorption onto clay minerals while organic compounds will be absorbed by the native organic matter in the solids." Attenuation will be dependant on the degree of clays and organics present; the work plan

states that the surficial aquifer consists of silts and sands as well as clays and organic matter. Minimal attenuation within the surficial aquifer will be assumed unless the RFI collects and evaluates specific data identifying the degree of attenuation for specific constituents and releases.

Response: No additional data collection regarding attenuation is planned. Minimal attenuation is assumed.

8. Section 2.6

SWMUs 1, 6 and 21 are closing or have closed under 40 CFR 265 closure plans. The status of these closures and the resulting data and investigatory findings must be summarized under the description of current conditions.

The second sentence on page 2-13 is incomplete. What is an anomalous conclusion? Other editorial errors were noted in the work plan. Greater care should be used in proofreading the document.

Response: SWMUs #1 and #6 are being evaluated for clean closure under a risk assessment performed by Gradient Corporation (Ref. 16). SWMU #21 is no longer under clean closure status and further delineation work will be necessary (Section 2.6.21 and 3.10).

9. Section 2.6.1

The justification for no further action for releases from SWMU 1 is inadequate. The description of current conditions must include a summary of data collected during closure which show that the clean closure objectives have been achieved.

Response: Clean closure for SWMU #1 will depend on the approval of a risk assessment performed by Gradient Corporation (Ref. 16), currently in review by the USEPA and SCDHEC. Additional delineation activities (which will encompass SWMU #1) are planned for SWMU #2.

10. Section 2.6.2

Provide a description of the current conditions (i.e., data summaries, work plans and reports). Data summaries shall include a narrative discussion summarizing the previous investigations, tables of contaminants detected and their ranges of concentrations, and illustrations showing where the data was collected, the extent of the plume as defined in the previous investigation and the SWMU boundaries. The investigation of this site should consider releases to the railroad right-of-way and the storm sewers.

Response: A description of the current conditions has been provided using a summary of previous investigations, including tables and figures, in Section 2.6.2.

An investigation to further delineate storm sewers, creek sediments, the railroad right-of-way, and groundwater are planned in Section 3.2 of the RFI Work Plan.

11. Section 2.6.3

The justification for no further action is inadequate. Provide a description of the current conditions (see Comment 10). The data summary should clearly support the statement that "residual pesticide concentrations in the soil are below levels capable of impacting human health or the environment..."

Response: A description of current conditions has been provided using a summary of previous investigations, including tables and figures, in Section 2.6.3.

12. Section 2.6.5

Provide a description of the current conditions (see Comment 10).

Response: A description of current conditions has been provided using a summary of previous investigations, including tables and figures, in Section 2.6.5.

13. Section 2.6.6

Provide a description of the current conditions (i.e., data summaries, closure plans and reports). Provide a description of how closure for this unit differs from the closure of SWMU 1, which requires no further action under the RFI.

Response: A description of current conditions has been provided using a summary of previous investigations, including tables and figures, in Section 2.6.6. A risk assessment by Gradient Corporation (Ref. 16) is under evaluation by USEPA and SCDHEC to clean close this unit.

14. Section 2.6.7

Provide a description of the current conditions (see Comment 10). Describe, and show on a map, the drainage patterns from the unit and include past and proposed sample points.

Response: A description of current conditions has been provided using a summary of previous investigations, including figures, in Section 2.6.7. The prior data does not provide information as to the drainage patterns for SWMU #7.

15. Section 2.6.8

Provide a description of the current conditions (see Comment 10). The work plan must address constituents that may be associated with the wastes oils that are more soluble (e.g., chlorinated organics, benzene, toluene, xylene, etc.).

Response: A description of current conditions has been provided using a summary of previous investigations, including figures, in Section 2.6.8. Geraghty and Miller tested for constituents in two water samples that may be associated with the waste oils and found only methylene chloride (possibly a laboratory artifact). Section 3.6 plans additional sampling and analysis to fully characterize the oil.

16. Section 2.6.9

Provide a description of the current conditions (see Comment 10). The justification for no further action based on an assumed low groundwater migration potential and the high cost of remediation is not acceptable. As previously discussed above, sands within the surficial aquifer may provide preferential zones of contaminant transport with minimal attenuation. Also, the cost of corrective action is not applicable to the RFI stage and may be considered under the Corrective Measures Study stage. Include an investigatory strategy for this unit in Section 3 of the work plan.

Response: A description of current conditions has been provided using a summary of previous investigations, including figures and tables, in Section 2.6.9. A planned investigation for SWMU #9, the Closed Landfill, is discussed in Section 3.7.

17. Section 2.6.11

Provide a description of the current conditions (see Comment 10). A justification for no further action cannot be accepted without an adequate description of the current conditions. Were the soils analyzed for organics (other than petroleum associated compounds) and metals? Correct the editorial error in the 40 CFR citation to 261.22(a)(1).

Response: A description of current conditions for SWMU #11 has been provided using a summary of previous investigations, including figures, in Section 2.6.11. Editorial corrections have been made.

18. Section 2.6.12

Provide a description of the current conditions (see Comment 10). A justification for no further action cannot be accepted without an adequate description of the current conditions. Was the release to Shipyard creek adequately characterized and remediated? If so, the characterization of the surface water/sediment releases must be provided along with the reports and work plans on the remediation.

Response: A description of current conditions for SWMU #12, the Old Fire Fighting Area has been provided using a summary of previous investigations, including figures, in Section 2.6.12. An investigation performed at the site in 1982 using soil borings found no trace of petroleum contamination (as documented in the Geraghty & Miller report, Ref. 12). A search has been conducted for additional data on, or personnel familiar with, the 1991 spill but no data regarding characterization or remediation of the spill was found.

19. Section 2.6.14

Provide a description of the current conditions (see Comment 10). The description of current conditions should include all available reports on interim measures conducted (e.g., drum removal).

Response: A description of current conditions has been provided using a summary of previous investigations, including figures, in Section 2.6.14. No interim measures have been performed for SWMU #14, the Chemical Disposal Area.

20. Section 2.6.17

Provide a description of the current conditions (see Comment 10).

Response: A description of current conditions for SWMU #17, the Oil Spill Area, has been provided using a summary of previous investigations in Section 2.6.17.

21. Section 2.6.18

Provide a description of the current conditions (see Comment 10).

Response: A description of current conditions for SWMU #18, the PCB Spill Area has been provided using a summary of previous investigations in Section 2.6.18.

22. Section 2.6.20

No further action is justified for this unit in that it managed non-hazardous constituents bearing solid waste. However, investigation of SWMU 9 is required as discussed above.

Response: Section 2.6.9 discusses current conditions of the closed landfill (SWMU #9) and Section 3.7 discusses further investigation and monitoring planned for SWMU #9.

23. Section 2.6.21

The justification for no further action for releases from SWMU 21 is inadequate. The description of current conditions must include a summary of data collected during closure which show that the clean closure objectives have been achieved.

Response: A description of current conditions at SWMU #21, the Old Paint Storage Area, has been provided using a summary of previous investigations (Section 2.6.21). SCDHEC has not accepted clean closure and will require additional delineation of this unit. Section 3.10 presents the soil and groundwater investigation plan for this unit.

24. Section 2.6.34

The last paragraph of this section correctly addresses the leaking diesel fuel tank as a release from a unit which is not managing solid waste. However, if the facility does not correct the problem, an investigation of the unit and corrective action may be required for a routine and systematic release of hazardous constituents from a product storage tank. Under the description of current conditions, describe what has been done to mitigate releases from the product storage tank and an estimate of the quantity of fuel released.

Response: The tank has been removed and the contaminated soil and asphalt have been excavated and disposed of properly.

25. Chapter 3 - General

a. Temporary land use restrictions may be appropriate for interim measures; however, these restrictions shall not be used as a justification for limiting the scope of the RFI.

Response: Temporary land use restrictions have remained in the document to limit or restrict Naval work and construction activities in certain SWMUs. They will not be used as justification to limit the scope of work.

b. The RFI schedule must be based on calendar days from the date of approval of the work plan. The schedule must account for weekends, holidays and internal contract negotiations and a reasonable number of days of down-time due to weather and other unforeseen events. Time estimates may be appropriate for intermediate tasks; however, set time-frames must be established for major milestones (e.g., submission of the draft RFI Report to EPA). Failure to comply with the specified time-frame from the date of EPA approval of the work plan to completion of a major milestone may subject the facility to enforcement action.

Response: A Corrective Action Management Plan (CAMP) will be submitted under separate cover to address the schedule.

c. Provide maps for all unit specific investigations on a scale of appropriate size which shows the following:

- SWMU boundaries;
- Historical data collection points;
- Interpretations of historical data (e.g., plume maps);
- Proposed locations for sampling under the RFI;
- Direction of groundwater flow in the shallow aquifer; and
- Direction of run-off and surface water flow.

Response: For investigations of individual SWMUs, maps have been provided when available from prior investigations in Section 2. In Section 3, which discusses proposed investigations and activities, maps show proposed locations for sampling under the RFI. Data on groundwater and surface water flow directions from previous reports and studies is not available for every SWMU.

d. Table 3-1 is blank.

Response: Table 3-2 is blank and has been removed.

e. As required under Condition II.C.4., all environmental media must be evaluated for impact from SWMU releases. For those media not included in the work plan, a justification must be provided which shows that a release is not probable for each medium.

Response: Section 2.6 of the RFI Work Plan discusses the potential for releases to each medium which the RFA found to be potentially contaminated.

26. Section 3.1

As currently proposed, the work plan has no further action schedules for this unit. Investigations currently proposed are for SWMU 2 releases only. Unless unit specific investigations are required for characterizing releases from SWMU 1, delete this unit from Chapter 3. Note however that unit specific release investigations may be required dependant on the justification for no further action.

Response: SWMU #1 is under evaluation for clean closure. The risk assessment by Gradient Corporation (Ref. 16) is being reviewed by USEPA and DHEC. However, the area surrounding SWMU #1 is incorporated into the additional work at SWMU #2.

27. Section 3.2.1

In accordance with Condition II.D of the EPA RCRA Permit, the interim measures for this unit may be done concurrently with the RFI or precede the investigation. Due to the potential exposure of lead dust

to on-site workers, EPA recommends that these interim measures be conducted ahead of the schedule in the RFI. A separate schedule should be provided along with a more detailed description of the interim measures. The detailed description must include, at a minimum:

- Method of wash water containment;
- Design of containment structure;
- Method of transferring collected wash water to containers; and
- Map showing the areas to undergo interim measures.

The following issues must be addressed in the interim measures plan:

- Analyze asphalt for lead removal;
- Describe method of sampling concrete and asphalt;
- How will the random sample locations be selected; and
- Describe the laboratory analytical procedures.

Response: Interim measures will not be performed until additional sampling activities are completed. These areas include storm water sewers, Cooper River sediments, the railroad right-of-way, and groundwater. Additional soil samples will also be collected to complete delineation of the boundaries of the SWMU and verify existing areas of known contamination.

28. Section 3.2.2

Provide a summary of the rationale for selecting the sample locations and depths. This summary should address the data gaps remaining from the previous investigations and how those gaps will be filled with this investigation. Biased sampling (e.g., sample at stained locations) should be employed, to the extent feasible. Depth discrete sampling is required to evaluate the extent of vertical contaminant migration in the soil profile.

Samples must be analyzed for total lead to characterize the extent of the lead releases from the unit. TCLP should only be run on samples which display elevated total lead concentrations. 40 CFR Part 261, Appendix II, Section 1.2, states that TCLP is not appropriate when the total analysis yields low enough concentrations such that the TCLP regulatory concentrations could not possibly be exceeded. According to EPA's Environmental Services Division, the total analyte concentration cut-off for defining when the sample could not possibly fail the TCLP is "20 times" the TCLP regulatory concentration (i.e., 5 ppm for lead). Therefore, the TCLP should only be run on samples which yield a total lead concentration that approaches 100 ppm or greater.

The objective of the RFI for this unit is not to assess where soils fail the TCLP but rather to characterize the extent of the lead releases from the unit for the purpose of determining whether there is a threat to human health and the environment.

For those samples which contain elevated lead levels (i.e., approaching 100 ppm or greater), the samples must be analyzed for the TCLP to determine if the soil is a hazardous waste, which would therefore require meeting all RCRA regulatory requirements pertaining to management of a hazardous waste. The extent of remediation required shall be based on the extent of total lead concentrations in the soil, not based on where the soils fail EP Toxicity, as described in the final sentence of this section.

Response: Section 3.2.1, Initial Remedial Action has been removed from the RFI Work Plan until the area can be re-investigated. Section 3.2.2 is now 3.2.1. The sample locations and depths at SWMU #2 have been chosen to fill data gaps generated in the previous studies and current conditions. However, limited data is available on delineation of contamination beyond the immediate boundaries of the unit. A phased approach is required to determine horizontal and vertical limits of the contamination. Treatability testing of soils has been planned as a treatment option. The analysis for samples have been made consistent for similar SWMUs. Samples for this SWMU will be analyzed for total metals.

29. Section 3.2.3

Significant releases to the soil have been demonstrated to have occurred. Therefore, the potential for continued contaminant migration from the soil to the groundwater must be evaluated. The shallow aquifer characteristics and limited shallow groundwater use will be considered during the corrective measures study; however, these consideration shall not be the basis for not evaluating potential releases to the groundwater.

Response: This section is now Section 3.2.2. The effects of known or potential releases on groundwater will be investigated. Soil borings and monitoring wells will be installed under an initial investigation to determine if groundwater contamination exists. A second phase will be performed, if necessary, to completely delineate the contamination.

30. Section 3.3.1

See Comment 28. Describe the rationale for sampling at various depths for this unit and not for SWMU 2.

Response: Previous studies show where data gaps exist and where sampling is required. For this unit (SWMU #5), a previous investigation found contaminated soils at approximately seven feet below ground. For SWMU #2, previous studies did not find contamination below surficial soils.

31. Section 3.3.2

See Comment 29.

Response: The affects of known releases on groundwater will be investigated. Soil borings and monitor wells will be installed under an initial investigation to determine if groundwater contamination exists. A second phase will be performed, if necessary, to completely delineate the contamination.

32. Section 3.4.1

Provide a summary of the rationale for selecting the sample locations and depths. This summary should address the data gaps remaining from the previous investigations and how those gaps will be filled with this investigation. Depth discrete sampling is required to evaluate the extent of vertical contaminant migration in the soil profile. Describe why the investigation for this unit includes evaluating total lead levels, whereas only TCLP lead is proposed for SWMU 2 & 5 (see Comment 29). As described in Comment 29, TCLP lead analyses should be run on samples with elevated total lead concentrations. Describe the basis for the total lead action level of 210 ppm and how the number was derived. The proposed excavation of soils from this unit constitutes an interim measure. See Comment 27 for the general requirements for conducting interim measures. The Interim Measures Work Plan must describe the method of treating or disposing of excavated soils.

Response: Soil samples will not be collected as proposed under the Draft Final RFI Work Plan. SWMU #6 is currently being evaluated for clean closure under a risk assessment performed by Gradient Corporation (Ref. 16).

33. Section 3.4.2

See Comment 29.

Response: This section is now Section 3.4.1. The affects of known or potential releases on groundwater will be investigated. Monitoring wells will be installed under an initial investigation to determine if groundwater contamination exists. A second phase will be performed, if necessary, to completely delineate the contamination.

34. Figure 3-4

Provide a complete legend for the figure which identifies the symbols.

Response: The legend has been added.

35. Section 3.5.1

Provide a summary of the rationale for selecting the sample locations and depths. This summary should address the data gaps remaining from the previous investigations and how those gaps will be filled with

this investigation. Biased sampling (e.g., sample at stained locations) should be employed, to the extent feasible. Grab samples (biased and/or random) must also be collected to identify the potential for hot-spot zones. Depth discrete sampling is required to evaluate the extent of vertical contaminant migration in the soil profile. Provide the basis for layout of the sampling grid.

As described in Section 2.6.7, BHC was detected in previous studies and should therefore be included as a parameter for analysis.

The proposed excavation of soils from this unit constitutes an interim measure. See Comment 27 for the general requirements for conducting interim measures. The Interim Measures Work Plan must describe the method of treating or disposing the excavated soils.

Response: The sample locations and depths have been chosen based on current past studies and current conditions. Section 3.5.1 illustrates the sampling grid based on the EPA's Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup.

35. Section 3.5.2

See comment 29.

Response: The affects of known or potential releases on groundwater will be investigated. Monitoring wells at SWMU #6 will encompass the area surrounding SWMU #7. The monitoring wells will be installed under an initial investigation to determine if groundwater contamination exists. A second phase will be performed, if necessary, to completely delineate the contamination.

36. Figure 3-5

Why is the long axis of the concrete pad and bldg. 3902 in a different orientation on this figure as compared to Figure 3-4?

Response: This discrepancy has been rectified.

37. Section 3.6.1

The justification for no further investigation of the soil medium is inadequate. A justification for no further action cannot be accepted without an adequate description of the current conditions. Justifications for no further action, in accordance with Condition II.C.4., must show that a release is not probable from the unit into a given environmental medium to exclude the investigation of a given environmental medium from the RFI Work Plan. If not adequately conducted in previous studies, soil contamination at the source locations and along the pathway of surface water run-off from the pits must be evaluated. Again, the soil characteristics, the reportedly low impact potential of soil releases and consideration of property deed restrictions shall not be considered in determining the scope of the RFI.

Response: A description of current conditions has been provided using a summary of previous investigations in Section 2.6.8. The affects of known or potential releases on groundwater will be investigated (Section 3.6.1). Soil samples and samples of the oil will be collected to characterize the oil and initially delineate contamination at the site under a Phase I investigation. The findings from the initial investigation will be used to select additional sample locations, if required, to fully delineate contamination at the site.

The source of waste appears to have not been adequately characterized. Metals and volatile organic constituents are often associated with oily wastes. Unless a more detailed description of the wastes disposed in the pits are provided, total hazardous constituent analyses may be required (e.g., 40 CFR Part 264, Appendix IX) for both soil and ground water analyses. As discussed in Section 2.6.17, PCBs may also be associated with oily wastes and must therefore be included in the analyses for both soil and groundwater.

The statement that remediation of low level oily residues will produce no benefit is vague and inappropriate for consideration under the RFI. Such considerations must be evaluated during a Corrective Measures Study and shall consider impact to the environment, as well as human health, and be based on an adequate characterization of the release to all affected media.

Response: The prior study tested for volatile organics and PCBs in water samples. The investigation for SWMU #8 has been modified to analyze oil samples for RCRA metals, volatile organic and semi-volatile organic compounds, and PCBs.

38. Section 3.6.2

Groundwater sampling of the shallow aquifer must be included to assess the extent of the dissolved contaminant plume in the shallow groundwater aquifer. Describe what will be done with the open hole soil borings after evaluation of the presence of a floating phase on the water table. Provide the rationale for selection of the open hole soil boring locations shown in Figure 3-6. See the discussion under Comment 37 pertaining to the requirements for investigating all impacted environmental media.

Response: A phased approach is planned for SWMU #8. Under the planned initial investigation, samples will be collected to bracket the contamination from sample stations located at varying distances from the pits. The findings from the initial investigation will used to select additional sampling locations, if required, to fully delineate contamination at the site. Soil borings will be performed by a driller certified in the state of South Carolina. Soil boring will be abandoned by pressure grouting the holes as required by South Carolina. Groundwater monitoring is planned for this SWMU.

39. Section 3.7.1

The geophysical surveys should not be limited to a depth of ten feet. EPA has found contaminated debris at some sites in coastal areas at depths well below the current water table. Provide a figure showing the extent of contamination based on previous studies and the area to undergo geophysical surveys.

Response: Section 3.7 is now the Closed Landfill, SWMU #9. The geophysical study for the Chemical Disposal Area is described in Section 3.8. Previous investigative work have been included in Section 2.6.14, however, the prior work was limited in scope and did not delineate contamination at this SWMU. A map of the area is not available. Planned activities for this SWMU are presented in Section 3.7.1.

40. Section 3.7.2

What are the depth intervals for obtaining the three discrete samples per boring? Parameters for analysis must be identified in the work plan. If the characterization of the waste source is unknown, total hazardous constituent analyses (e.g., Appendix IX) should be performed. Describe the method of "field determining" which samples shall be sent for laboratory analysis. Whatever the criteria are for field screening samples, the work plan must identify a minimum number to be analyzed by the laboratory.

Response: This section has been modified and is presented in Section 3.8.2. Soil samples will be collected based on the findings of the geophysical surveys. Soil samples will be collected from each soil boring to delineate the horizontal and vertical extent of contamination.

41. Section 3.7.3

The justification for no further action for the groundwater is inadequate. In fact, according to this section, "a handful of constituents have been detected", thereby requiring an investigation under the requirements of Condition II.C.4. of the permit. If the characterization of the waste source is unknown, total hazardous constituent analyses (e.g., Appendix IX) should be performed.

Response: A groundwater monitoring program will be implemented for SWMU #14 (Section 3.8.3). Hydrogeological data and groundwater sampling from the existing monitoring wells will be collected to assess the need for additional monitoring wells.

42. Section 3.8.1

All hazardous constituents in No. 2 diesel fuel must be included in the parameters for analyses.

Response: This is now Section 3.9.1. The soil samples at SWMU #17 will be analyzed for PCBs, TPH and Base-neutral compounds.

43. Section 3.8.2

See above comments regarding limiting the scope of the RFI based on assumptions for migration and impact. Monitoring of release from this unit should include a background well upgradient to the unit. Periodic monitoring should be conducted on a more frequent basis than annually to detect potential seasonal fluctuations. Long term periodic monitoring, if required for remedial action, could then be reduced after a sufficient data base is developed under the RFI. See comment 42 regarding parameters for analysis.

Response: This is now Section 3.9.2. A background monitoring well has been added. Samples will be analyzed for PCBs, TPH, and Base-neutral compounds. Periodic sampling is planned for the NSY under the CAMP.

44. Figure 3-7

As described in the general comments above, show data from previous studies, identify the spill location and show the other information discussed in the general comments.

Response: The figure is now Figure 3-8. The prior studies are presented in Section 2.6.17. However data gaps still exist. Additional soil and groundwater sampling is planned in Section 3.9 for SWMU #17.

45. Figure 3-8

As described in the general comments above, show data from previous studies, show the location of the floor drainage conveyance system and show the other information discussed in the general comments.

Response: The figure is now Figure 3-10. Additional data collected in 1991 is presented in Section 2.6.25. The floor drainage system will be investigated following demolition of the overlying structure.

46. Section 3.10.1

Wipe samples must be conducted on the floor. The concrete samples will not evaluate the level of contamination on the surface of the floors. Why are the parameters for analysis different for the wipe samples and the core samples? List all individual "RCRA metals."

Response: Wipe samples were not proposed due to the visual heavy accumulations of material from the plating operation on the floor. Wipe samples have ben removed from the investigation. Davis and Floyd (Ref. 15) performed an investigation of the building's interior (Section 2.6.25).

47. Section 3.10.3

What are the parameters for analysis? Identify the sample intervals for the samples to be taken along the exterior of building 44.

Response: Section 3.11.2 describes soil sample analysis for RCRA metals and cyanide. Samples will be collected at one foot intervals from the surface (below the asphalt pavement) to the soil/groundwater interface.

48. Section 3.10.4

Again, why do the parameters for analysis differ for the various media to be sampled? Identify the proposed screened intervals. Figure 3-7 is for SWMU 17. Provide an appropriate figure which meets the requirements of the general comments above.

Response: Section 3.11.3 describes the groundwater sample analyses for RCRA metals and cyanide.

49. Section 3.11.1

Grab samples (biased and/or random) must be analyzed regardless of the results of the composite samples so that potential hot spots can be identified. Identify the individual parameters for analysis. Identify the parameters for analysis of those grab samples to be analyzed contingent upon the outcome of the composite samples.

Response: This section is now Section 3.12.1. Grab samples will be analyzed as needed based on the constituents (analytes) identified in the composites samples.

50. Figure 3-9

Identify the boundaries for SWMUs 29 & 34 and show the information required under the general comments above.

Response: Figure 3-9 is now Figure 3-11. The boundary of the SWMU is illustrated by a heavier black line. The subtitle "SWMU Boundary" was mistakenly omitted from the final report.

51. Chapter 4

The Region IV Standard Operating Procedures and Quality Assurance Manual (SOP) shall be used for sampling and analysis protocol. This document must be referenced. Provide resumes for all key individuals conducting the RFI.

Response: The EPA document is referenced (Ref. 18) and resumes are included in Appendix N.

52. Section 4.3.2.1

All equipment calibrations should be recorded.

Response: Equipment calibrations are included as an item to be recorded during field operations.

53. Section 4.3.2.2

Identify where the decontamination areas will be located.

Response: Because of the number of different sites at NSY, and their distribution throughout, the locations for decontamination areas will be decided in the field by the site supervisor on a site-by-site basis.

54. Section 4.3.2.3

Trip blanks should be prepared for both water and soil matrices when both are being sampled. The water trip blank should contain organic-free water and the soil blank contain organic-free sand.

Response: Trip blanks will be prepared for both water and soil matrices.

55. Section 4.4.1

Additional samples should be collected when changes in soil lithology are observed or evidence of contamination is present (i.e., biased samples). The sampling intervals are not the same for each SWMU. Differences in choosing sample intervals should be discussed in this section.

Response: Additional samples will be collected as necessary. Sample interval differences are discussed in Section 4.4.1.

56. Section 4.4.2

Provide a generalized schematic of the monitoring well construction. This schematic should be used for the RFI Report and the appropriate depth intervals filled in for each well. Due to the reported fined grained nature of the shallow aquifer lithology, sizing of the screens and the sand pack grain size should be carried out by performing sieve analyses on the soil to determine the appropriate sizes. State that the hydration time for the bentonite seal will meet the manufacture's specifications. The EPA Technical Enforcement Guidance Document (TEGD) requires the sand pack to extend two feet above the top of the screened interval. An elevated concrete pad must be installed around the perimeter of the casing. If the wells are located in the area of vehicular traffic, protective bumpers should be installed.

Response: A schematic of monitoring well construction has been included as Figure 4-1A taking into account requirements of the EPA Technical Enforcement Guidance Document.

57. Section 4.4.4

In the second sentence of the second paragraph on page 4-7, replace the work "evaluate" with the word "estimate."

Response: Editorial corrections have been made.

58. Table 4-1

Revise this table to meet the requirements of the specific comments above. The only parameter listed for groundwater is total lead; however, Chapter 3 includes other parameters for groundwater analysis. Clarify this discrepancy. The source of the methods should be shown using footnotes. The SW-846 methods are incomplete without the appropriate extraction/preparation procedures.

Response: Extraction/preparation procedures and the other groundwater parameters have been added to the table.

59. Section 5.3.2

As per Section 5 of the RFI guidance, the RFI Work Plan must provide a detailed description of how the collected data will be manipulated, interpreted and shown on tables and figures. The maps to be used to report the data should be used to show the proposed sample collection locations.

Response: A more detailed description of data management is presented in Section 5.3.2.

60. Chapter 6

The RFI shall identify the locations in which there are groundwater pumping wells in the shallow aquifer, both on and off-site. The RFI shall identify the human consumption of biota in the area and the potentially affected ecological communities.

Response: See responses to EPA Comments 5 and 6.

61. Section 7.1

The Health & Safety Plan should contain a map and directions to the nearest hospital.

Response: A map to the nearest hospital in included as Figure 7-1 along with directions written in Section 7.9.2.

62. Section 7.2.4

Drilling into a known waste disposal area, particularly an area that has caused prior injuries, entails a considerable risk that should be addressed in detail in the plan.

Response: This has been addressed in Section 7.2.6 and 7.2.7.

63. Section 7.4

The plan should differentiate between the respiratory protection in level C (air-purifying respirator [APR]) versus level B (self-contained breathing apparatus [SCBA]). Unless the type of constituents are known, organic vapor concentrations above 5 ppm require the use of a SCBA. For concentrations in the working zones above 5 ppm with known organic vapors, an APR with an appropriate protection factor and proper cartridge may be used.

Response: Level B (SCBA) respiratory protection will be considered when the type of constituents are unknown and organic vapor concentrations in the ambient breathing work space exceed 5 ppm.

64. Section 7.4.2

EPA recommends the use of a full-face respirator.

Response: Only full-face respirators will be used for level C.

65. Section 7.6

The decontamination procedure listed in this section is not consistent with that listed in section 4.3.2.2.

Response: The discrepancy in decontamination procedures has been rectified.

State Comments
on the
RFI Work Plan - March 1991
for

Charleston Naval Shipyard
EPA I.D. No. SCO 170 022 560

1. Section 3.1

The DRMO Storage Shed, SWMU #1, was an interim status unit and must be closed under the 265 closure standards. The Shipyard is currently conducting a risk based assessment to determine the appropriate clean-up levels for soil. Section 3.1 states that lead is the only contaminant; however, the Progress Report on Interim Status Facility Closures dated May 1989 showed chromium, cadmium, nickel, lead, silver, and cyanide as contaminants. The removal of contaminated soil for this unit should continue to be handled under the interim status closure plan; however, any groundwater investigations should be handled under the RFI process.

Response: The RFI Work Plan will characterize the groundwater at the DRMO Storage Yard under SWMU #2. SWMU #2 will encompass the area around SWMU #1.

2. Section 3.4

The Public Works Storage Yard, SWMU #6, was an interim status unit and must be closed under 265 closure standards. The Shipyard is currently conducting a risk based assessment to determine the appropriate clean-up levels for soil. Section 3.4 indicates lead is the only contaminant; however, the Progress Report on Interim Status Facility Closures showed chromium, cadmium, nickel, lead, silver, barium, and mercury as contaminants. The removal of contaminated soil should continue to be handled under the interim status closure plan; however, any groundwater investigations should be under the RFI process.

Response: Groundwater monitoring is planned for SWMU #6.

REVIEW OF THE RCRA FACILITY INVESTIGATION (RFI) WORK PLAN
Charleston Naval Shipyard (CNAV)
Charleston, South Carolina
SCO 170 022 560
Reviewed by Joe B. Bowers
May 10, 1991

Introduction

The Charleston Naval Shipyard (CNAV) was issued Hazardous Waste Permit SCO 170 022 560 in February 1990. The permit was issued for storage of hazardous waste for periods greater than 90 days and became effective on June 6, 1990. Permit Condition IV.C requires CNAV to develop and submit an RFI Work Plan within 120 days of the effective date of the permit in order to investigate potential releases from several Solid Waste Management Units (SWMUs) identified in the RCRA Facility Assessment (RFA). The draft RFI Work Plan was submitted to EPA Region IV and SC DHEC in March 1991. Following receipt of the EPA's comments, SC DHEC reviewed the Work Plan. Please note that the original RFA Report, dated August 1987, identified SWMUs 1 through 24. An Addendum to the RFA report, dated November 1990, identified additional SWMUs number 25 through 35. The Department did not have access to a copy of the RFA Addendum report during the this RFI Work Plan review. Therefore, review comments generated with respect to SWMUs 25 through 35 relied on information included in the RFI Work Plan itself.

Below please find comments generated from this review.

Response: To assist in reviewing the RFI Work Plan, all previous investigations have been summarized in Section 2.6 of the work plan. Copies of the original reports are available through the Naval Facilities Engineering Command, Southern Division.

General Comments

1. As a matter of policy, the Department approve the installation of monitoring wells prior to their installation. CNAV must furnish the Department with all appropriate construction information in a separate request prior to initiation of drilling of any monitoring well boreholes. Information required prior to approval of the monitoring wells includes, but may not be limited to, drilling method, borehole diameter, expected depth(s), and construction information such as casing material, screen slot size and discussion for determining the proper size, screen length, grout material and mixture ratios, surface pad size, protective seal casing size, development methods and parameters that will be measured to determine when development is complete, etc. It is recognized that some of this information is included in Chapter 4 of the Work Plan, however, as indicated above, additional information is required before the Department will issue approval to install these wells. In addition, a driller certified to operate in the state of South Carolina must install the monitoring wells. Finally, Department form #1903 must be completed and submitted within 30 days of installation describing the "as built" well construction details.

Response: All available information available to KEMRON/WAPORA has been submitted under Appendix A of the RFI Work Plan. Many of the monitoring wells were installed in 1982 by Geraghty and Miller (Ref. 12).

2. Throughout the RFI Work Plan, CNAV argues that since there are no groundwater users downgradient of the site, no further action is justifiable for several SWMUs with potential releases to the environment. This is unacceptable. The purpose of the RFI is to assess the extent and severity of any contamination emanating from identified SWMUs on the CNAV site and to generate sufficient information to support a Corrective Measures Study (CMS). The CNAV cannot utilize this rational to limit the scope of work proposed in the RFI. (See EPA comment 2 for additional discussion on this subject.) The RFI Work Plan must be revised accordingly.

Response: The RFI Work Plan has been revised accordingly.

3. The RFI Work Plan should be revised to include all available groundwater elevation data obtained for existing monitoring wells located around the various SWMUs so that an evaluation can be made regarding proper placement of these wells. In addition, all available well construction information should be provided. If existing monitoring wells do not meet current RCRA monitoring well construction standards, abandonment and reinstallation of replacement wells may be necessary.

Response: All available information on monitor well construction and groundwater data has been supplied. Due to the age of the monitoring wells, the previous installation requirements may not meet the current SCDHEC guidelines.

4. Groundwater samples collected for metals analyses must not be filtered. Metals analyses must reflect total metal concentrations rather than filtered fractions.

Response: All future metals analyses on groundwater samples will not be filtered.

5. Several SWMUs were identified which resulted from unauthorized storage of hazardous wastes. The RFI Work Plan states that "zone inspections" and "enforcement of SOP" will prevent this from recurring. The RFI Work Plan should be revised to clearly define the meanings of "zone inspections" and "enforcement of SOP".

Response: A detailed description of zone inspections are presented in Section 2.4.

Specific Comments

6. SWMU #1 (DRMO Staging Area) was used to temporarily store materials and property no longer used by various branches of the Armed Forces in the region of CNAV. The RFI Work Plan notes

incorrectly that this SWMU has been clean closed under the authority of Interim Status while further noting that the source of lead contamination found in this area came from SWMU #2 (Lead Contamination Area). However, adequate information and discussion was not furnished in the RFI Work Plan to support this conclusion. Therefore, and in agreement with EPA's comments, the RFI Work Plan should be revised to describe in detail past investigations at SWMU #1, especially those activities associated with clean closure. If adequate information does not exist to justify no further action at this SWMU, additional investigation must be proposed in the revised Work Plan. See general comment 2 above and EPA comments 9 and 26.

Response: The Work Plan has been revised. SWMU #1 is being evaluated for clean closure under a risk assessment. However SWMU #1 also has been incorporated into the discussion of SWMU #2 (Lead Contamination Area) in Section 3.1. If remedial activities are required at SWMU #1, they will be included with SWMU #2.

7. The description of SWMU #4 (Pesticide Storage Building) states that the sink and floor drains within the building are either connected to the sanitary sewer or the "blind sumps". It is unclear what the phrase "blind sumps" means. The RFI Work Plan should be revised to describe this phrase in order to alleviate uncertainty regarding its meaning.

Response: A "blind sump" is a sump with no outlet. The Work Plan has been revised.

8. SWMU #5 (Battery Electrolyte Treatment Area) includes a tank which was used to neutralize battery acids. Soil samples collected from around the tank indicated high levels of lead contamination. The RFI Work Plan proposes additional soil sampling but does not propose investigation of possible groundwater contamination. Due to the reportedly high concentrations of lead in the soils, the possibility of groundwater contamination must be evaluated through the installation of monitoring wells.

Response: The Work Plan has been revised to include the installation of monitor wells for investigating possible groundwater contamination.

9. SWMU #8 (Oil Sludge Pit) consists of three separate pits in which oil sludges were disposed during the period of 1944 to 1971. Past investigations indicate that free-phase oil exists on the water table in the vicinity of this SWMU. The RFI Work Plan proposes to install ten (10) borings that will extend three to five feet below the water table to assess the presence of free-phase oil. This method of assessment is acceptable as an initial screening technique for the presence of free-phase oil. However, as noted in EPA's comments 37 and 38, investigations must be proposed in the revised RFI Work Plan to determine the horizontal and vertical extends of both soil and groundwater contamination. Furthermore, per State regulation R.61-71, any boring which is deeper than its largest surface dimension is, by definition, a well and therefore approval to install these "Non-Standard" wells must be obtained from the Department prior to drilling the proposed boreholes (see comment 1 above). In addition, the proposed boreholes must be properly

abandoned by pressure grouting after use. The RFI Work Plan should be revised to describe the abandonment procedures that will be used.

Response: The investigation has been revised to include an initial investigation (Phase I) and a second Phase II investigation to complete the site characterization and delineation based on the initial findings. All monitoring wells will be installed by a driller certified in the State of South Carolina. Abandonment procedures for boreholes are described in Section 4.4.1 of the final RFI Work Plan.

10. SWMU #12 (Old Fire Fighting Training Area) consisted of a pit approximately 30 to 50 feet in diameter used between 1966 and 1971. Oil, gasoline, and alcohol were poured into the pit and ignited during training exercises. The RFI Work Plan reports that no petroleum contamination was found during investigations conducted in 1982. However, adequate discussion of the specific details of these earlier investigations, along with all supporting data, were not provided in the Work Plan. This data should be provided in the revised RFI Work Plan.

Response: The available information from previous studies has been summarized and discussed in Section 2.6.12.

11. The RFI Work Plan describes SWMU #13 (Current Fire Fighting Training Area) as a fire training area in which No. 2 diesel fuel and gasoline are burned directly on the ground in a bermed area. The Work Plan does not propose to conduct any soil or groundwater sampling of this SWMU. Hazardous constituents contained in these fuels, particularly volatile, semi-volatile and metal constituents may not completely volatilize during fire training exercises. Therefore, the Work Plan should be revised to include assessment of possible soil contamination. If soil contamination is confirmed, assessment of groundwater contamination may be required.

Response: The area is concrete and not bare ground. Runoff is collected and treated in an oil water separator.

12. SWMU #17 (Oil Spill Area) is located beneath building FBM61 where a spill of No. 2 diesel fuel occurred in June 1987 due to a ruptured pipe. The RFI Work Plan proposes installation of three monitoring wells in the vicinity of building FBM61 to assess possible impacts to groundwater from this SWMU. However, justification was not provided for the proposed locations of the monitoring wells. The RFI Work Plan should be revised to include this justification along with any supporting information that may be necessary. Additional monitoring wells may be required to fully assess the vertical and horizontal extends of contamination emanating from this SWMU.

Response: Monitoring wells will be installed under an initial investigation to determine if groundwater contamination exists. A second phase will be performed, if necessary, to completely delineate the contamination.

13. SWMU #18 (PCB Spill Area) occurred due to spillage of PCBs during the loading of a transformer onto a truck. The RFI Work Plan states that contaminated soils have been excavated and removed and that additional sampling revealed that no more excavation was required. The RFI Work Plan should be revised to describe more fully the activities undertaken during remediation of this site. Of particular importance is the threshold level which was used to determine when soils would be excavated and disposed. This information should be provided in the revised RFI Work Plan.

Response: A description of current conditions for SWMU #18, the PCB Spill Area has been provided using a summary of previous investigations in Section 2.6.18.

14. The RCRA Facility Assessment (RFA) describes SWMU #19 (Solid Waste Transfer Station) as an unpaved, open area in the middle of SWMU #10. This SWMU serves as a staging area for temporary storage of solid waste prior to shipment offsite for disposal. It is noted that the RFI Work Plan states that the solid waste is stored in containers prior to shipment offsite. However, due to former storage of solid waste on the ground, soil samples should be collected from this area and analyzed for appropriate constituents.

Response: SWMU #19 received only non-hazardous waste and was recommended for no further action in the RFA.

15. SWMU #20 (Waste Disposal Area) is an open area in which solid wastes such as cardboard boxes, etc. are disposed and is located adjacent to SWMU #19. Per the RFI Work Plan, this SWMU is located on top of SWMU #9 (the Sanitary Landfill) and should be investigated along with this unit. However, according to Figure 2-6, which illustrates the locations of all SWMUs on CNAV, SWMU #20 does not appear to be within the areas of SWMU #9. The RFI Work Plan should be revised to include figures which will accurately illustrate the locations and boundaries of not only SWMU #20, but for all SWMUs for which investigations will be conducted.

Response: Additional figures have been added for all SWMUs requiring investigations.

16. SWMU #24 (Waste Oil Reclamation Facility) is utilized to reclaim waste oil from various base operations and from ships. Mixtures of oil and water are gravity separated in two storage/separation tanks. The RFI Work Plan states that all underground lines and piping associated with this SWMU are periodically pressure tested to insure integrity and therefore a release to the environment is not expected. The RFI Work Plan should be revised to include data from integrity tests of these lines and piping and a discussion of the frequency of these tests.

Response: Integrity test data from 1988 through 1990, received from DFSP personnel, have been added as an addendum to the RFI Work Plan as Appendix O. The integrity tests are performed on an annual basis.

17. The RFI Work Plan proposes to investigate SWMU #25 (Old Plating Operation, Building 44) along with SWMU #22 (Old Plating Show Waste Treatment System). It is proposed to install three monitoring wells around the area of these SWMUs to investigate possible adverse impacts to groundwater. However, no justification for the proposed well locations was provided. The RFI Work Plan should be revised to provide this justification.

Response: Soil borings and monitor wells will be installed under an initial investigation to determine if groundwater contamination exists. The findings from the initial phase of investigation will be used to complete the delineation under the second phase. Due to the lack of information in this area, monitoring well locations will be dependant on drill rig access and preliminary data from soil borings.

18. Chapter 4 of the RFI Work Plan in part describes groundwater sampling procedures to be followed during sampling of monitoring wells. However, this chapter does not contain the detail required to insure collection of samples which are representative of the quality of groundwater passing the well. This section of the RFI Work Plan should be greatly expanded to discuss in detail the topics already included in this chapter such as method of determining groundwater elevation, well purging methods and procedures, sample collection, preservation, handling and chain of custody control. Analytical procedures (i.e. EPA method 8240 for volatile analyses, etc.) should be specified for all analyses to be conducted. It should be noted that numerous review comments could have been generated regarding this chapter, however, due to time constraints, a detailed review was not possible. The RFI Work Plan should be revised to include as much detail and information as possible to allow a thorough review of this portion of the Work Plan.

Response: Additional detail has been added to Section 4.

FINAL DRAFT

RCRA FACILITY INVESTIGATION (RFI)
CHARLESTON NAVAL BASE
CHARLESTON, SOUTH CAROLINA
CONTRACT NO. N62467-87-D-0650
AMENDMENT NO. 9

Report to:

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

MARCH 1991

Environmental Engineers/Scientists

Project 520 1 March 1991

RCRA Facility Investigation (RFI)
Charleston Naval Base
Charleston, South Carolina

Prepared for:
Naval Facilities Engineering Command
Southern Division
Charleston, South Carolina

Prepared by:

WAPORA, Inc.

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CHAPTER 1. INTRODUCTION

1.1 OBJECTIVES. This RCRA Facility Investigation Workplan (RFI Workplan) for the Charleston Naval Shipyard (NSY), Charleston, South Carolina, was prepared by WAPORA, Inc. at the direction of Naval Facilities Engineering Command, Southern Division under Contract No. N62467-89-D-0650 dated 16 March 1989. The purpose of the project is to develop a plan for characterizing prior or continuing releases of hazardous waste or constituents from solid waste management units (SWMUs) identified during the RCRA Facility Assessment (RFA; Ebasco 1987). The objectives of the RFI are to conduct those investigations necessary to: (1) characterize the facility setting, (2) define the source, degree, and extent of releases of hazardous constituents, and (3) identify actual or potential receptors. The investigation must be of sufficient scope and contain adequate detail to support design of any necessary corrective action. This document was developed following the guidelines in RFI Guidance (EPA 530/SW-89-031) published May 1989. It is based on information contained in the RFA prepared by Ebasco Services, Inc. (Ebasco) and RFA Addendem prepared by Southern Division, Naval Facilities Engineering Command (SOUTHDIV) for the U.S. Environmental Protection Agency (EPA), the Part B permit application submitted by the Naval Shipyard (NSY), and on the prior work of Geraghty and Miller, Inc., (G&M) Environmental Science and Engineering, Inc. (ES&E) and Environmental and Safety Designs, Inc. (EnSafe).

1.2 RCRA FACILITY INVESTIGATION WORKPLAN. In November 1984, Congress enacted the Hazardous and Solid Waste Amendments (HSWA) amending the Solid Waste Disposal Act (SWDA). SWDA is more commonly known as the Resource Conservation and Recovery Act (RCRA) and will be referred to as RCRA herein. Among the provisions of HSWA are Section 206 which added to RCRA a new subsection 3004(u) (requiring corrective action for releases of hazardous waste or constituents from SWMUs at hazardous waste treatment, storage and disposal (TSD) facilities seeking final RCRA permits) and Section 207 which added a new subsection 3004(v) (compelling corrective action for releases which have migrated beyond the facility property boundary). For any SWMU suspected to be the source of a contaminant release to the environment, information must be available to sufficiently characterize the nature, extent, and rate of migration of releases of hazardous wastes or constituents to soils, groundwater, subsurface gas, air, and surface water. This information is used to determine whether interim corrective measures (ICM) or a corrective measures study (CMS) will be necessary. It is also used in formulating and implementing appropriate corrective measures. Such corrective measures may range from stopping the release through application of source control techniques to full-scale clean-up of the affected area. "No action" may also be an appropriate measure. If sufficient information to determine what is most appropriate is lacking prior to the RFI, it must be generated during the RFI. The RFI Workplan identifies needed information and describes procedures for gathering and organizing it during the RFI.

Previous studies in the area (ES&E 1983; G&M 1982; Ebasco 1987; EnSafe 1987, 1988a, 1988b, 1989) have indicated that the NSY could be characterized as having widespread, low-level contaminant concentrations in both the surficial soils and shallow groundwater. This is due in part to past waste handling practices by various NSY operational units (commands). But it may be due more significantly to the method of construction of the NSY site itself, primarily fill operations using dredge spoil consisting of contaminated sediments taken from nearby waterways.

Metropolitan Charleston along the Cooper River, in the Harbor area, and along the Ashley River has been heavily industrialized for the past 100 years. Waste disposal practices for much of this period included discharging raw wastes into the nearest surface water body. Much of the NSY site area was originally marshy. Most of the site was built up by placing fill across the site from dredged spoils. Most spoil materials have come from the Cooper River, Harbor Area, and Ashley River although the exact location of spoil origin is unknown. Several studies have been performed to determine the background levels of potential contaminants (EnSafe 1987, 1988a, 1988b, 1989). The distribution of background concentrations (especially lead) is erratic. This suggests a heterogeneous mix of spoils having several origins with at least some of the spoil material having been previously contaminated by industrial sources. Sediment contamination is heterogeneous but ubiquitous in the Charleston Area (ES&E 1983, G&M 1982).

As will be described in detail in other sections of this RFI Workplan, the shallow groundwater system has no current use, is of limited potential use and cannot practicably be made potable with existing or foreseeable technologies. Totally apart from contamination which may have resulted from waste handling practices, the surficial aquifer contains high levels of chloride ion and other dissolved solids which have leached into it from spoil, contamination typical of aquifers underlying made land. Soils are relatively fine grained with low permeability resulting in low capacity wells. Remediation of this type of system requires massive excavation of source materials (waste residues and spoil) or the installation of numerous closely spaced small capacity extraction wells. Neither option appears viable. Moreover, only contamination from waste residues is addressed under RCRA, contaminated spoil is not addressed. Hence, even the most comprehensive remediation under RCRA would not produce additional uses for the surficial aquifer.

Recent proposed rules in the Federal Regulations (July 27, 1990, P. 30829) codify EPA's position on groundwater remediation in areas which have been historically used for only industrial purposes and are unlikely to be used for drinking water. "A determination...that remediation to a media cleanup standard is not necessary might be made in situations where a SWMU located in a heavily industrialized area has released to ground water in an aquifer that is surrounded by groundwater that has been heavily contaminated from non-SWMU sources."

Low level contamination in the surficial aquifer poses no threat to human health or the environment. Groundwater flow within the uppermost aquifer is towards those surface water bodies which nearly surround NSY. Along those areas not bounded by surface water, groundwater flow is from off-site towards NSY. Beneath the surficial aquifer is a thick clay layer with low permeability. Because this stratum downdips toward the ocean and the aquifer beneath it is recharged in upland areas, it creates sufficiently artesian conditions so that, what little flow passes through it, is upwards into the surficial aquifer. Hence, the wide-spread but low level contamination at the site cannot impact additional groundwaters. Moreover, the rate of flow of NSY groundwaters into adjacent surface waters is so low relative to surface water flow that measurable impacts are precluded. Therefore, it would be reasonable to limit the RFI to areas with high or potentially high levels of contamination.

As detailed in the RFA (Ebasco 1987), several areas at NSY do not fit this general background of low-level, wide-spread contamination. Some are SWMUs where contaminant levels are such that a potential for deleterious impacts can be presumed and others are SWMUs where the

potential for impacts has not yet been ruled out. Remediation at these SWMUs is or may be practicable and would or might produce identifiable reductions in risk, primarily to potential receptors in adjacent surface waters. Consequently, this RFI Workplan is designed to concentrate investigation on these areas of primary concern, areas of significant or potentially significant contamination. Because contamination at a measurable level will necessarily remain, regardless of the extent of remedial efforts, a deed restriction on surficial groundwater use may be appropriate. Indeed, such a restriction might be appropriate even if SWMUs had never existed at NSY. Given these conditions, it is recommended that the RFI focus on SWMUs that appear to or might pose a threat to human health or the environment greater than that of the NSY site absent the effects of SWMUs.

CHAPTER 2. BACKGROUND INFORMATION

2.1 LOCATION AND ORGANIZATION. Charleston Naval Base is located on various contiguous and discontiguous properties in Charleston and Berkeley counties on South Carolina's central coast (Figure 2-1). The base is divided into two major areas, Naval Base North and Naval Base South. Only Naval Base South is covered by the RCRA regulatory activities which are the subject of this RFI Workplan. For purposes of RCRA, that part of Naval Base South situated on the right bank of the Cooper River constitutes a "facility." This part of Naval Base South is referred to as the Naval Shipyard (NSY). While the Naval Shipyard proper is only one of several Naval commands owning property at the base, it controls all of the RCRA regulated activity and has been designated by the Base Commander as having responsibility for implementation of RCRA at the "facility" as a whole.

Naval Base South is located on both banks of the Cooper River, approximately five miles north of downtown Charleston. The installation consists of two major areas: an undeveloped area on the east or left bank of the Cooper River consisting of Daniel Island in Berkeley County which is currently used only for the disposal of dredge spoil, and a developed area on the west or right bank of the Cooper River (Figure 2-2). The developed portion of Naval Base South lies on a peninsula, bound on the west by the Ashley River and the east by the Cooper River. This portion of the base (the "facility") is situated on the east side of the Ashley-Cooper or Charleston peninsula and is bounded on the west, for the most part, by Shipyard Creek. This is the area which will be hereafter referred to as the Naval Shipyard even though parts of it, for non-RCRA purposes, are controlled by other Naval commands.

Naval Base South covers approximately 3,300 acres and is divided between or into several distinct activities or "commands." Of these, Naval Shipyard proper is the largest "landholder" having jurisdiction over the spoil area and the majority of the central third of the developed area on the west bank of the river, approximately 1,958 acres. The southern one-third of the developed area of Naval Base South is controlled primarily by the Naval Station. The Naval Supply Center and Naval Station are the major landholders on the northern one-third of the developed area. Other commands control lesser areas of what we shall refer to generically as the Naval Shipyard (NSY).

2.2 LAND USE. Areas surrounding NSY, like NSY itself, are "mature urban" having been long developed with commercial, industrial, and residential land uses. Commercial areas are located primarily west of NSY; industrial areas lie to the north of NSY and along the west bank of Shipyard Creek.

The west or right bank of Shipyard Creek is concentrated with heavy industry, and has been for many years. Railways have served the area since at least the early 1900s. This, when combined with nearby waterways, has made the area ideal for heavy industry. While ownership has changed from time to time, the land adjacent to NSY remains dedicated to chemical, fertilizer, oil refining, metallurgical, and lumber operations.

The east or left bank of the Ashley River is also dotted with industry. In contrast, the east bank of the Cooper River is undeveloped and contains extensive wetlands, particularly along Clouter Creek and Thomas Island. Active dredge spoil disposal areas are located on Naval property, not

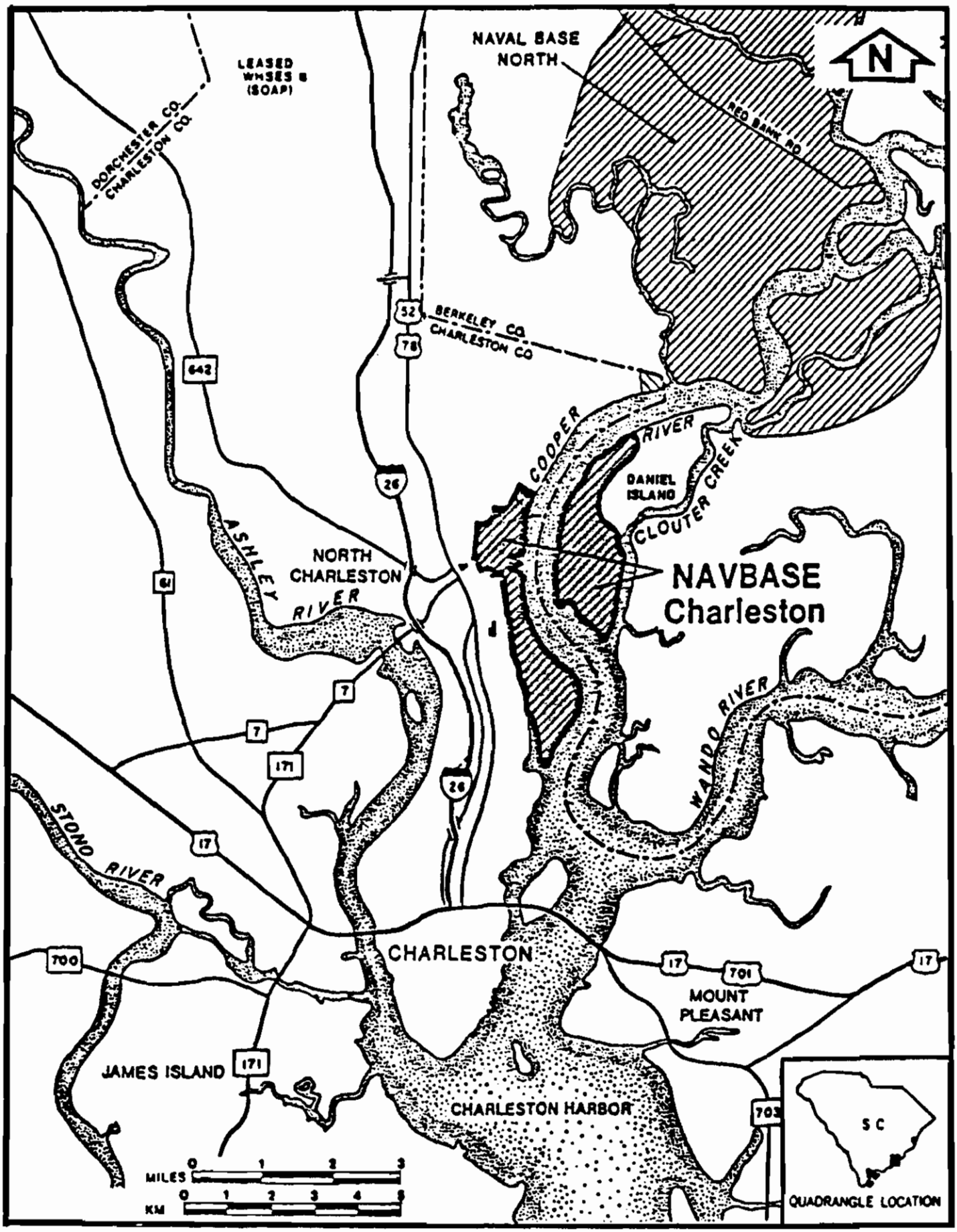

Figure 2-1. Site location map.

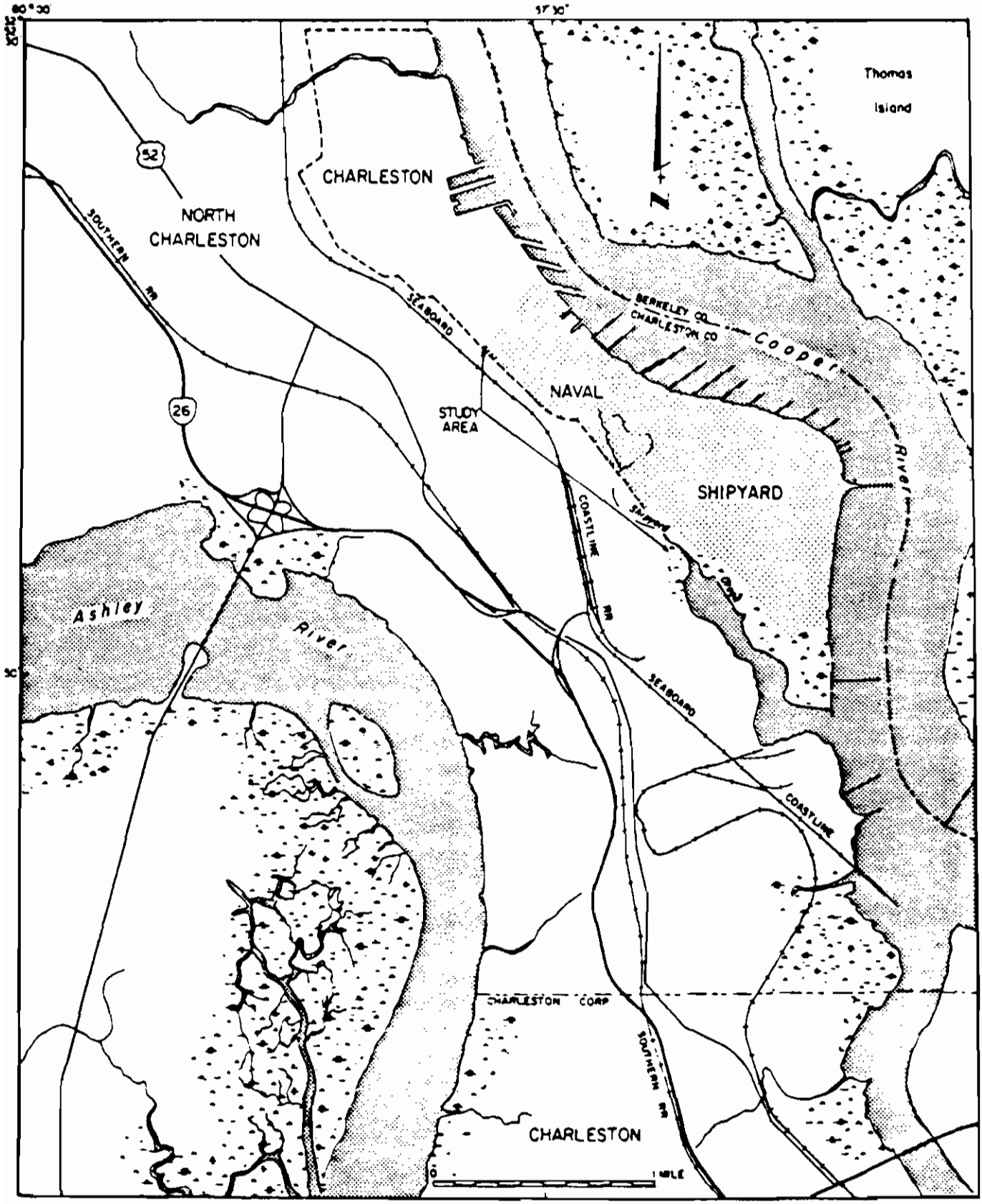

Figure 2-2. Naval shipyard and surrounding areas.

part of NSY, between the Cooper River and Clouter Creek. Active dredge spoil disposal areas are also located on the southern portion of Daniel Island and on Drum Island.

2.3 HYDROGEOGRAPHIC FEATURES.

2.3.1 Topography. NSY is in the lower South Carolina Coastal Plain Physiographic Province, on the Cooper River side of the Charleston Peninsula. The Charleston Peninsula is formed by the confluence of the Cooper and Ashley Rivers. Topography (Figure 2-3) in the area is typical of South Carolina's lower coastal plain, having low relief plains broken only by the meandering courses of sluggish streams and rivers which flow toward the coast past occasional marine terrace escarpments. Topography at NSY is essentially flat. Elevations range from just over 20 feet above mean sea level (MSL) in the northwest part of the base, to sea level at the Cooper River. Most of the original topography at NSY has been modified by man's activities. The southern end was originally tidal marsh drained by Shipyard Creek and its tributaries, and originally, the other portions of the facility were only slightly higher in elevation. The land surface at NSY has been filled with both solid wastes and dredged spoil (primarily the latter) in increments over the last 70 years. Nonetheless, most of NSY remains within the 100-year flood zone, that is, less than ten feet MSL.

2.3.2 Geology. Geology of the Charleston area is typical of the southern Atlantic Coastal Plain. Cretaceous and younger sediments thicken seaward and are underlain by older igneous and metamorphic basement rock (Figure 2-4). Surface exposures at NSY, in the limited areas which remain undisturbed, consist of recent and/or Pleistocene sands, silts, and clays of high organic content. NSY is underlain by a plastic calcareous clay known as the Cooper Marl. The Cooper Marl is, in turn, underlain by the Santee limestone and sequentially older rocks. A generalized north-south cross section passing through the approximate center of the base is shown in Figure 2-5.

2.3.3 Surface Soil. Surface soils at NSY have been extensively disturbed. Aboriginal soils were the fine-grained silts, silty sands, and clay, typical of terrigenous tidal marsh environments. The southern portion of the base has been filled using dredged spoil. The spoils are an unsorted mixture of sands, silts, and clays. Most of the remainder of the base has been either filled or reworked. Available data on permeability of surface soils and hydraulic conductivity of subsoils at NSY is limited to extrapolations based on known origin and/or sieve analyses. The permeability of surface soils is reported to be quite low (ES&E 1983).

2.3.4 Surface Hydrology. Parts of the southern portion of NSY are drained by Shipyard Creek while some northern areas are drained by Noisette Creek. Both creeks are tributary to the Cooper River. Surface drainage over the remainder of NSY flows directly into the Cooper River. The Cooper discharges into Charleston Harbor.

Shipyard Creek is a small tidal tributary, about two miles in length, which flows to the southeast along the southwestern boundary of NSY to its confluence with the Cooper River, opposite the southern tip of Daniel Island (river mile 9). Docking facilities are located along the western shore of the lower mile of the channel, while the entire length of the eastern shore is bounded by tidal marshland.

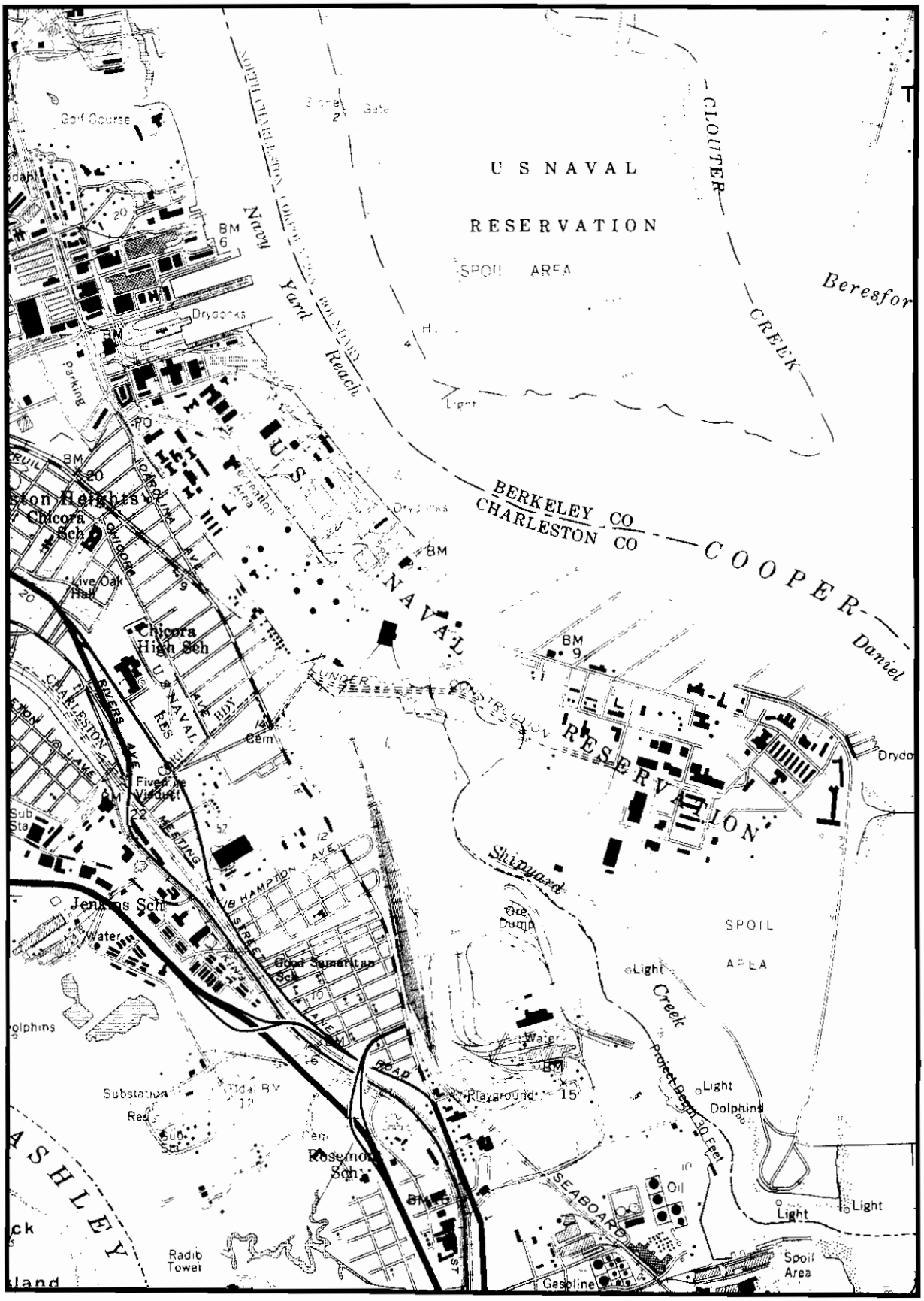

Figure 2-3. Vicinity map. Scale 1:24000
7.5 Minute USGS Charleston, SC Quadrangle.

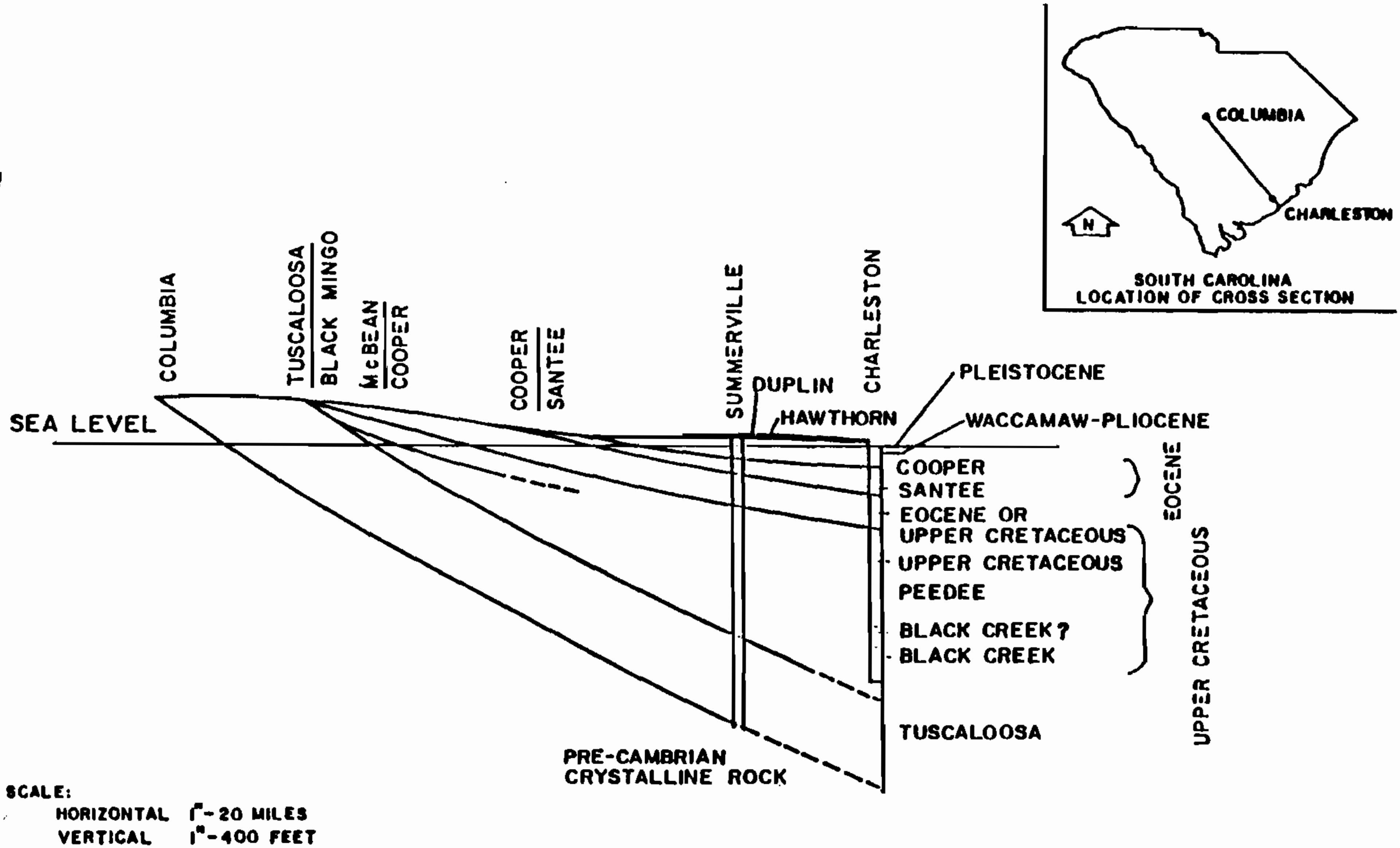

Figure 2-4. Geologic cross-section from Columbia to Charleston, South Carolina, including the NSY.

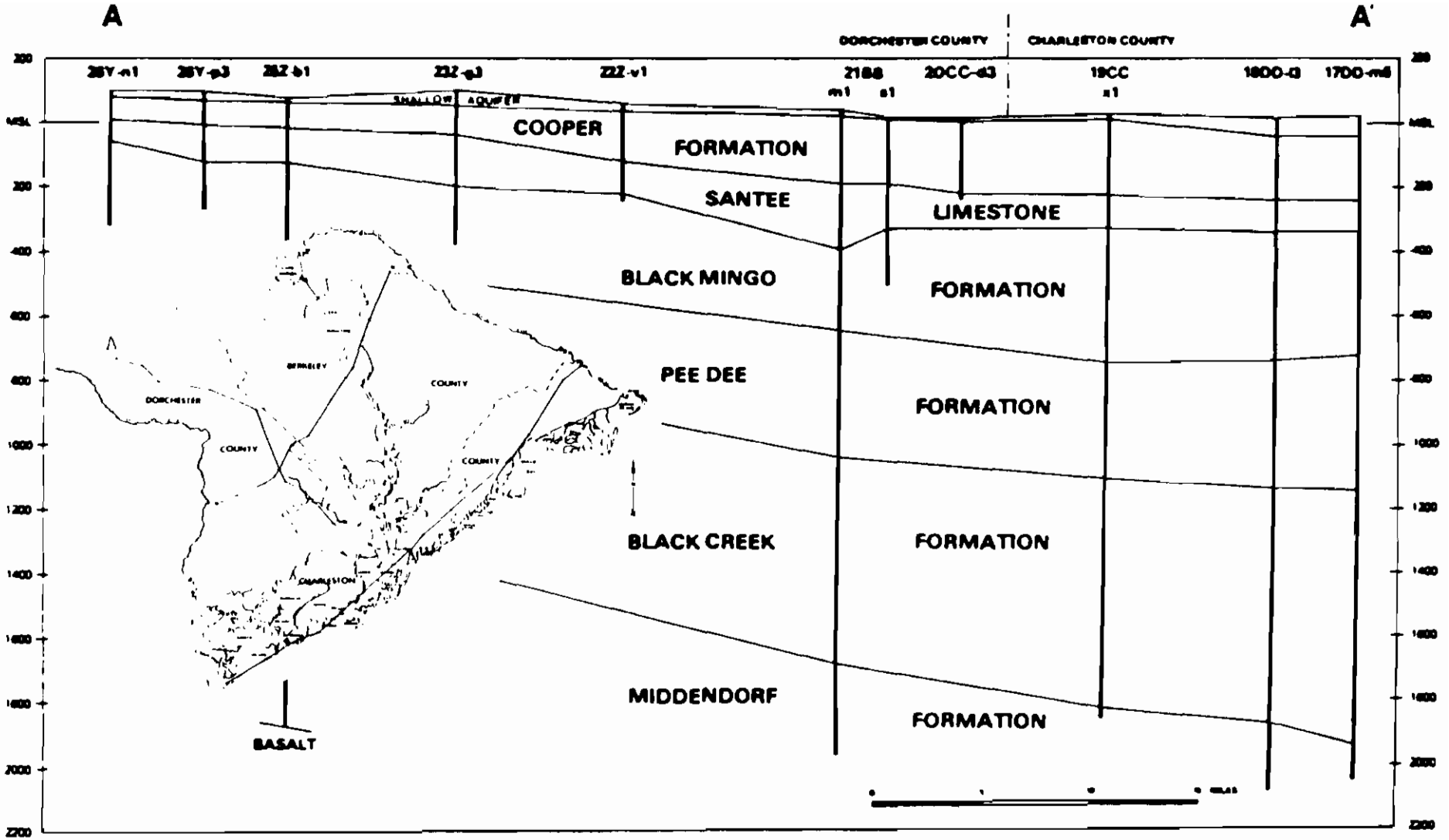

Figure 2-5. Geologic cross-section of Charleston County, South

Noisette Creek, which transects the northern portion of NSY, is a tidal tributary approximately 2.5 miles long. The creek flows nearly due east from its headwaters in the City of North Charleston and empties into the Cooper River at river mile 13.

2.3.5 Hydrogeology. Two distinct aquifers exist beneath the NSY site, a deep confined aquifer located within the Santee Limestone, and a shallow water table aquifer located within the near surface sediments. Both the shallow aquifer and the Santee Limestone function as potable aquifers in other locations. The shallow aquifer is not significantly developed in the NSY area and is not developed at all at NSY. In addition, the quality of the water from the Santee Limestone (in the vicinity of NSY) is not suitable for potable supply; total dissolved solids (TDS) range from 1,000 to 1,500 parts per million (ppm).

The Cooper Marl, in the Charleston area, is essentially impermeable and acts as a confining layer for the Santee Limestone. The top of the Santee Limestone, which occurs at about -250 feet MSL in the NSY area, has a groundwater potentiometric elevation of approximately 15 feet MSL. The hydraulic gradient is generally towards the southeast. Some wells in the vicinity of NSY are pumping from the Santee for industrial purposes. In July 1981, the water level of a deep water well in the Santee Limestone beneath NSY measured 15 feet MSL, indicating that the gradient across the confining Cooper Marl, is artesian. Specifically, water from the confined aquifer of the Santee Limestone formation has an upward potential through the Cooper Marl.

Groundwater in the shallow aquifer beneath NSY flows north-northeast into the Cooper river and south-southeast into Shipyard Creek due to the gently sloping topography away from the center of NSY. Groundwaters in the immediate vicinity of Noisette Creek flow into it. The water table is within three to seven feet of the ground surface. The shallow groundwater table continually but slowly discharges to the Cooper River and Shipyard Creek, and to a lesser extent, into Noisette Creek.

2.3.6 Migration Potential. Shallow groundwater beneath NSY eventually discharges to the Cooper River either directly or indirectly via its tributaries. Contaminants, if present in the shallow groundwater system, will eventually discharge into the Cooper River if not immobilized by subsurface soils or degraded or transformed by soil reactions. Flow rate in the shallow system, however, is expected to be rather slow due to the fine-grained nature of the sediments and the low groundwater gradient. Various contaminants, particularly metals, are likely to be attenuated by absorption onto clay minerals while organic compounds will be absorbed by the native organic matter in the soils. No use is made of the shallow groundwater downgradient of NSY since the Cooper River and Shipyard Creek are the base boundaries as well as the downgradient boundaries of the shallow groundwater system. Residential wells using the shallow aquifer upgradient of NSY are unlikely but have not been ruled out. Such wells, if present, would not be threatened by contaminant migration from NSY, since they are upgradient from the base and reversal of the natural gradient by pumpage from shallow residential wells would be extremely unlikely due to the very small capacity of this type of well and aquifer parameters which effectively limit the capture zone of such wells. The shallow groundwater system is not used at NSY.

In summary, potential contaminants from installation operations entering the shallow groundwater system do not threaten the health of onbase personnel, since the shallow system is not developed for use at NSY. Likewise, possible offsite contaminant migration via the shallow groundwater system does not threaten human health, since shallow groundwater flow is intercepted by surface waters at the installation boundaries and since the shallow system is not significantly developed in the vicinity of NSY. Contaminants entering the shallow groundwater system at NSY do, however, represent a potential threat to the environment, since contaminants have the potential to migrate via the shallow system to adjacent surface waters. Although aquatic habitats in the Cooper River, Noisette Creek, and Shipyard Creek may be threatened, human health is not directly threatened by contaminant migration, since these surface bodies do not function as potable supplies. Due to low rates of flow in the surficial aquifer and the much higher rates of flow in adjacent surface waters, only concentrated, high level contamination poses this threat to aquatic habitats.

The deeper aquifer (Santee Limestone) is not threatened by potential contamination from NSY. The Cooper Marl is a well-documented confining unit of the Santee Limestone and is essentially impermeable. In addition, metals would likely be absorbed by clays present in the Cooper Marl while organic compounds (such as PCBs) would likely be tightly bound and therefore immobilized by native organic carbon materials abundant in the Cooper Marl. The Cooper Marl is approximately 250 feet thick in the NSY area. In any case, water in the Santee Limestone aquifer is not of potable quality in the vicinity of NSY; the aquifer is significantly developed only for non-potable uses.

Migration pathways must also be considered for surface contaminants at NSY since they could migrate beyond installation boundaries via stormwater drainage. Stormwater is conveyed by natural and manmade drainage channels to the Cooper River or its tidal tributaries. The northern end of the base drains to Noisette Creek or the Cooper River. The heavily industrialized central portion of NSY drains to the Cooper River. Developed portions of NSY drain stormwater to the Cooper River via storm sewers. Undeveloped areas of NSY are drained by surface flow to either the Cooper River or Shipyard Creek, depending on the drainage patterns of the area. Thus, surface contaminants at NSY have the potential to migrate off the installation and into the Cooper River either directly or through its tributaries. Surface contaminants, therefore, represent a potential threat to aquatic habitats in the Cooper River, Noisette Creek, and Shipyard Creek although they do not directly threaten human health.

2.4 INDUSTRIAL OPERATIONS AND WASTE GENERATION. NSY is an extensive industrial complex containing virtually all shipyard and dockside operations necessary to provide logistical and labor task force support in conversion, overhaul, repair, alteration, dry docking and outfitting of ships, submarines, and service crafts. Currently NSY operates 18 major industrial shops. Operations performed by these shops and industrial wastes generated from these operations are described in detail in both The Industrial Process and The Waste Treatment Investigation (Moore, Gardner & Assoc. 1982) and the Initial Assessment Study Report (ES&E 1983). The RFA report (Ebasco 1987) has adequately summarized the industrial processes, waste generation, and treatment at the facility and should be referred to if further information is needed.

Although the types of wastes generated by industrial operations essentially have remained the same over the years, waste generation rates may have fluctuated as a result of varying production requirements. No historical information is available regarding past generation rates and only the current quantities are identified for most industrial operations in the RFA report.

2.5 NATURE AND EXTENT OF CONTAMINATION. There are 24 SWMUs identified in the RFA (Ebasco 1987) and 11 additional SWMUs added by SOUTHDIV's RFA Addendum (SOUTHDIV 1990). A list of the 35 SWMUs is presented in Table 2-1, the location of each is illustrated in Figure 2-6. Site and waste characteristics of each were described and explained accurately and in detail in the RFA reports (Ebasco 1987 and SOUTHDIV 1990). The extent and magnitude of contamination from each SWMU were concisely summarized. Additional data, not available in time for the RFA, data developed during attempted interim status closure of SWMU's #1, #5, #6, #21 and #22, is discussed in EnSafe 1987, 1988a, 1988b, and 1989. Some of the data is incorporated into the RFI workplan as well.

2.6 SWMU DESCRIPTIONS AND INTERIM CORRECTIVE MEASURES. On 4 May 1990 EPA and DHEC issued NSY its RCRA permit which allowed storage of hazardous waste in containers in Building 246 and the DRMO-Building 1606. Consequently, as of 4 June 1990, interim status for all previous interim status facilities (SWMU #1, #5, #6, #21 and #22) was terminated. The following sections describe each SWMU identified in the RFAs. Completed and on-going interim corrective measures are also described for each unit. Closure work by EnSafe on SWMUs #1, #5, #6, #21, and #22 is summarized.

Early in this project, SWMUs #1, #5, #6, #21 and #22 were considered to be regulated units under interim status. (SWMUs #5 and #22 were later determined to be elementary neutralization or wastewater treatment units under 40 CFR §270.1(c)(2)(v), 270.2 and 260.10, and hence, not subject to Part 270 permitting requirements.) NSY did not seek to have these units covered by its Part B permit, but rather, attempted clean closure under interim status. Closure plans were developed by EnSafe and approved by DHEC.

Implementation of the closure plans ran into several difficulties covered in the progress reports (EnSafe 88b, 89), accomplished substantial clean up of the most significant contamination, achieved clean closure of SWMU #21 and substantially delineated contamination at the remaining SWMUs.

Much of the difficulty in achieving clean closure developed from the way "clean" was defined. For the purposes of these closures, DHEC and NSY agreed to define "clean" as within some number of standard deviations of the mean background concentration. (The number of standard deviations was set as equal to the Student's *t* value associated with a 95% confidence interval and with the degrees of freedom dependent on the number of background samples collected.)

A number of difficulties occurred in using this definition. The most significant difficulty, in the context of this RFI Workplan, concerned determining mean background concentrations. All five SWMUs are located on made land composed of heterogeneous fill. Background samples could not be collected because there was no way to find identical strata sufficiently removed from the sites to preclude contamination. Samples analyzed as background came from soils which were chemically distinct from the SWMU soils.

Table 2-1. Solid Waste Management Units (SWMU).

SWMU #1.	DRMO Building 1617
SWMU #2	Lead Contaminated Area
SWMU #3.	Pesticide Mixing Area
SWMU #4	Pesticide Storage Building
SWMU #5.	Battery Electrolyte Treatment Area
SWMU #6.	Public Works Storage Yard (Old Corral)
SWMU #7.	PCB Transformer Storage Area
SWMU #8.	Oil Sludge Pit Area
SWMU #9.	Closed Landfill
SWMU #10.	Hazardous Waste Storage Facility
SWMU #11.	Caustic Pond
SWMU #12.	Old Fire Fighting Training Area
SWMU #13.	Current Fire Fighting Training Area
SWMU #14.	Chemical Disposal Area
SWMU #15.	Incinerator
SWMU #16.	Paint Storage Bunker
SWMU #17.	Oil Spill Area
SWMU #18.	PCB Spill Area
SWMU #19.	Solid Waste Transfer Station
SWMU #20.	Waste Disposal Area
SWMU #21.	Old Paint Storage Area
SWMU #22.	Old Plating Shop Waste Treatment System
SWMU #23.	New Plating Shop WWTS
SWMU #24.	Waste Oil Reclamation Facility
SWMU #25.	Building 44, Old Plating Operation
SWMU #26.	Waste Storage Area, Building 64-40, Pier C
SWMU #27.	Waste Storage Area, East End, Pier C
SWMU #28.	Waste Paint Storage Area, West End, Pier C
SWMU #29	Building X-10
SWMU #30.	Satellite Accumulation Area, Building 13
SWMU #31.	Waste Paint Storage Area, Dry Dock No. 5
SWMU #32.	Waste Paint Storage Area, Building 195
SWMU #33.	Waste Paint Storage Area, West End, Dry Dock No. 2
SWMU #34.	MWR, SW of Building X-10
SWMU #35.	Building X-12

SWMU #1

SWMU #2

COOPER RIVER

SWMU #23

SWMU #21

SWMU #26

SWMU #28

SWMU #27

SWMU #32

SWMU #31

SWMU #22

SWMU #25

SWMU #5

SWMU #33

SWMU #30

SWMU #3

SWMU #24

SWMU #4

LOCATION MAP

AREA OF PROPERTY (IN ACRES)	TOTAL
NAVAL SHIPYARD	1210.80
NAVAL BASE	1396.43
SPOIL AREA (EAST OF RIVER)	1307.00
TOTAL	2914.23

MEAN DESIGNATION	ELEV
A	17.08
B	11.56
C	11.84
D	11.64
E	11.64
F	11.68
G	11.71
H	11.72
J	11.00
K	11.10
L	11.50
M	11.12
N	11.08
O	11.11
P	11.12
Q	12.00
R	12.00
S	12.00
T	12.00
U	FLOATING
V	FLOATING
W	FLOATING
X	11.00
Y	20.00
375	13.00
376	12.00

ABBREVIATIONS

NH	NAVAL HOSPITAL
UG	UNDERGROUND
PA	PARKING AREA
PW	PUBLIC WORKS
NS	NAVAL STATION
TV	TRANSFORMER OR TRANSFORMER VAULT

LEGEND

- BUILDINGS
- PAVING
- RAILROAD TRACKS
- CRANE TRACKS
- FENCE
- STRUCTURES UNDER CONSTRUCTION
- STRUCTURES PLANNED
- INDUSTRIAL SECURITY FENCE GATE
- NAVAL BASE BOUNDARY FENCE GATE

WATER DATA

DATUM PLANE IS MEAN LOW WATER	0.0
MEAN HIGH WATER	+5.6
EXTREME LOW WATER (29 NOV 1953)	-3.7
EXTREME HIGH WATER (11 AUG 1940)	+10.4
HURRICANE HUGO (21 SEPT 1989)	+10.4

DRY DOCK DATA

NO. 1 – MAXIMUM SHIP LENGTH 807', BEAM 98'-10", DRAFT 30'-2 1/2" AT MEAN HIGH WATER, ELEV. COPING +11.6, ELEV. SILL -28.83

NO. 2 – MAXIMUM SHIP LENGTH 578'-6", BEAM 97', DRAFT 33'-3 1/2" AT MEAN HIGH WATER, ELEV. COPING +11.6, ELEV. SILL -31.9

NO. 3 & 4 – GATE OPENINGS, TWO AT 42' CLEAR WIDTH FOR EACH DOCK. INSIDE DIMENSIONS, 98'-0" BY 365'-10" ELEV. SILL -5.0 BELOW MEAN LOW WATER, ELEV. FLOOR -9.0'

NO. 5 – MAXIMUM SHIP LENGTH 741'-5", BEAM 110'-7", DRAFT 37'-9 1/2" AT MEAN HIGH WATER, ELEV. COPING +11.6 ELEV. SILL -31.4

GRAPHIC SCALE

DRAWN	SIMMS
CHECKED	WINSTEAD
AS MAR	SVENDSEN
APPROVED	
DIRECTOR ENGR DIVISION	DATE
APPROVED	
PUBLIC WORKS OFFICER	DATE
SATISFACTORY TO	
	DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

CHARLESTON NAVAL SHIPYARD CHARLESTON, S C

MAP OF CHARLESTON NAVAL SHIPYARD NAVAL STATION AND CONTIGUOUS ACTIVITIES EXISTING AND PLANNED AS OF 1 JANUARY 1990

SCALE 1" = 800'

SHEET 1 OF 2

FAC DRAWING NO H606-272

COOPER RIVER

SWMU #17

SWMU #13

SWMU #6

SWMU #7

SWMU #8

SWMU #29

SWMU #34

SWMU #15

SWMU #16

SWMU #14

SWMU #12

SWMU #10

SWMU #20

SWMU #19

SWMU #11

SWMU #18

SWMU #9

SPOIL AREA

MARINA

SHIPYARD

RIVER

LOCATION MAP

ABBREVIATIONS

PA PARKING AREA

TV TRANSFORMER OR TRANSFORMER VAULT

DRAWN SIMMS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
CHECKED WINSTEAD	CHARLESTON NAVAL SHIPYARD CHARLESTON, S.C.
DR. MGR SVENDSEN	MAP OF CHARLESTON NAVAL SHIPYARD NAVAL STATION AND CONTIGUOUS ACTIVITIES EXISTING AND PLANNED AS OF 1 JANUARY 1990
APPROVED	
DIRECTOR ENGR DIVISION DATE	
APPROVED 3/23/90	
PUBLIC WORKS OFFICER DATE	
LAST STATION NO.	P.W. DRAWING NO. H606-273
DATE	SCALE 1" = 200' SHEET 1 OF 2

"Background" pH and concentrations of barium, cadmium, chromium, nickel and silver were near the low end of the range typically found in uncontaminated soils. This lead to the anomalous conclusion that SWMU soils were contaminated quite typical concentrations. Consequently, where soils were involved, clean closure could not be achieved.

Each of the five interim status units is a SWMU in the context of this RFI Workplan and has been evaluated by standards consistent with those used on other SWMUs by NSY. By these standards, much, but not all, of the reported contamination at the interim status units can be seen for what it is: the normal elemental composition of uncontaminated soil. Actual contamination exists:

- At the DRMO (SWMU #1) lead concentrations exceed normal levels in the surficial strata, apparently due to migration from the adjacent lead bin #3 (SWMU #2).
- At the battery electrolyte treatment area (SWMU #5) substantial lead contamination affects nearby soils to depths which have not yet been determined.
- At the public works storage yard (SWMU #6) there are three isolated hotspots near the surface of the ground with slightly elevated lead levels.
- The waste paint storage pad (SWMU #21) was clean closed. An isolated spill that occurred in the same area sometime later and was cleaned up is discussed in Section 3.4.
- Soils surrounding the old plating treatment system (SWMU #22) have an elevated pH and, in some places, elevated cadmium and chromium.

2.6.1 DRMO Staging Area. This area (SWMU #1) has been used since 1974 by the Defense Reutilization and Marketing Office (DRMO) to store property. The property is that which is no longer needed for the purpose for which it was purchased and has been turned in to DRMO by various branches of the Armed Forces within the region of the Naval Base. The stored property handled by DRMO includes some products which cannot be reutilized by other commands and that have consequently become classified as wastes. Those which become hazardous wastes were stored until recently in a covered storage shed formerly known as building #1617. The storage shed was a wood framed and roofed structure. Part of the floor consisted of an asphalt pad; however, the remainder of the floor was unpaved. Hazardous wastes were stored in containers and segregated according to waste type.

No spills at the site have been documented. However, the area has become contaminated with lead dust which spread from nearby salvage bin #3 (SWMU #2). Although lead levels detected in soil samples exhibited a wide range of concentrations, significant concentrations are limited to the near surface (Ensafe 1987, 1988a, 1988b; ES&E 1986). The spread of lead dust resulted primarily from vehicular traffic during routine operations at the site. Wind-blown dust may also have contributed to the contamination.

The site was under interim status until DHEC issued the Final RCRA Permit to the NSY. Interim status for the DRMO and other SWMU's was therefore terminated on 4 June 1990.

In September of 1989, the inventory of containers was removed from this site and building #1617 demolished. Empty drums which have been triple rinsed are now stored in this area. ~~Final closure activities will consist of an additional limited sample investigation and excavating any lead contaminated soils.~~

The site has been extensively studied in connection with its closure. Findings indicated the only significant contamination of this SWMU #1 is the lead which migrated from SWMU #2. ~~It would be appropriate to address SWMU #1 as part of SWMU #2 under this RFI Workplan. Therefore,~~ all additional investigations and remediation work will be ~~handled under SWMU #2 of this RFI~~ Workplan.

2.6.2 Lead Contamination Area. The lead contamination area (SWMU #2) consists of a salvage bin (#3) and paved ground surface adjacent to it. The area was used to store recovered lead from lead-acid submarine batteries from the mid-1960's until 1984. Electrodes and associated internal metallic components were removed from the battery jars in the battery electrolyte treatment area. Recovered materials were then placed on a railcar and transferred to the DRMO area for storage and eventual sale to a salvage contractor. Lead dust from the recovered materials was released to the salvage bin by handling and rainfall.

Routine activities (vehicular traffic) in the DRMO yard area, wind and stormwater flow, spread the lead contamination, which eventually encompassed an area of approximately six acres. Extensive studies of soil and groundwater in the area have delineated the extent of lead contamination at the site (ES&E 1986 and 1988). The majority of lead contamination in the area is confined to the pavement surface and surficial soils (surface to 0.5 feet). Lead concentrations fall off rapidly with distance from the salvage bin; also, the lead does not appear to be migrating vertically. The concentrations vary from less than 10 mg/kg to greater than 100,000 mg/kg. Because an exposure hazard to human health via inhalation of lead-laden dust is ostensibly present, an air monitoring program was implemented in 1985 by ~~ES&E~~ (ES&E 1986). Results of the investigation revealed that no exposure problems existed for this area. ~~Proposed interim corrective measures to abate this exposure hazard are identified in Section 3.2 of this RFI Workplan. In addition, Section 3.1 includes a description of additional sampling to determine the extent of contamination in the local surficial soils at SWMU #1.~~

2.6.3 Pesticide Mixing Area. The pesticide mixing area (SWMU #3) is approximately 50 feet by 25 feet in size. Part of the area (approximately 20 square yards) is devoid of vegetation. However, the bare area is subject to substantial vehicular traffic. The area is contaminated with low concentrations of various pesticides handled at the site in the past and with pesticide degradation products. Prior to 1971, pesticides were mixed in a small shed south of the denuded area. However, equipment used for spraying and mixing of pesticides was rinsed on the grounds outside. Rinseate was allowed to drain into the soils. Soil samples collected in the area found primarily DDT, DDT degradation products, and arsenic (As). Peak contaminant concentrations are about one part per million. Groundwater sample analyses found no pesticide concentrations above detectable limits (ES&E 1983, G&M 1982 and Ebasco 1987). Residual pesticide concentrations in the soil are below levels capable of impacting human health or the environment either through the groundwater route or dermal exposure. Therefore, no additional investigations are recommended under this RFI Workplan.

2.6.4 Pesticide Storage Building. The pesticide storage building (SWMU #4) has been used to store various insecticides and rodenticides since 1980. It is a steel building with a concrete floor. The building is equipped with a formulation and mixing room. Sink and floor drains within the building are connected to the sanitary sewer system or to blind sumps. An equipment rinse area/wash rack is located adjacent to the storage administration facility. No significant levels of contamination were found or have been reported for this site. Therefore, no additional investigations are recommended under this RFI Workplan.

2.6.5 Battery Electrolyte Treatment Area. The battery electrolyte treatment unit (SWMU #5) was part of the battery salvaging, restoring, and recharging operation. It was the unit used for neutralization of submarine battery acid. Current used battery management practices at NSY are limited to shipment of intact batteries offsite for salvage.

The battery electrolyte treatment tank is not required to undergo closure pursuant to 40 CFR Part 265, Subpart G since it was not a regulated unit; it discharged to a Publicly Owned Treatment Works (POTW). However, the battery electrolyte treatment area (soils surrounding the tank) will be included in the RFI, since interim status was terminated. Final closure activities for this area will include remediation of contaminated soils.

EnSafe performed a sample investigation and tank decontamination in October of 1987. Twelve sample stations were hand augered around the perimeter, to a depth corresponding to that of the floor of the unit. Three vertically-successive, 6-inch soil samples were collected, analyzed, and found to contain high levels of lead contamination.

During the sample investigation, the interior of the tank was decontaminated. Observations as to the integrity of the tank with respect to groundwater infiltration was made over a period of several days. No leakage into the tank had occurred.

The prior investigations in this area focussed primarily on the soil adjacent to the treatment tank. To remediate this SWMU and avoid possible recontamination, additional delineation of the surrounding area will be required. In addition, the area identified during the DHEC and EPA site inspection, where a leaking drum labelled sulfuric acid was observed, will be part of the study area. For the purposes of this Workplan, SWMU #5 is being redefined to include the entire fenced compound within which DRMO activities occurred.

2.6.6 Public Works Storage Yard. The Public Works storage yard (SWMU #6) is a fenced open area where routinely-generated, containerized wastes were stored prior to shipment offsite. Among the wastes stored at the site were hazardous wastes generated from vehicle maintenance, building maintenance and pest control operations. Wastes generated by vehicle maintenance consisted of cleaning solvents and waste oil. Spent solvents were disposed of by a contractor. Waste oils were recycled through NSY's waste oil reclamation facility. Building maintenance generated paint waste which was disposed of by a contractor along with waste from the paint shop. The storage yard ceased operation as a hazardous waste storage area when construction of the new temporary hazardous waste storage and transfer facility was completed.

A partial closure of this unit was completed in 1986 when renovation and expansion to the cold storage warehouse (building #193) was extended into the eastern boundary of the public works storage yard.

Final closure activities to the remaining portion of this unit consisted of removing the final inventory of drums and material, and excavation of any residual contaminated soils. EnSafe implemented a sample investigation in 1987. Samples were collected on a 50-foot grid system and areas of obvious staining were independently sampled. A supplemental sampling phase was added to further define the vertical extent of contamination in subsurface soils down to a depth of three feet.

The evaluation of soil sample analysis followed the procedures developed in cooperation with DHEC during the "partial closure" of the southeastern portion of the storage yard. Three background samples were collected and analyzed. Threshold values were developed for clean up standards from the data, by utilizing statistical procedures, the "Student t-test."

Evaluation of the sample data found only trace metals contamination, but it is uncertain whether these are background concentrations.

This unit was undergoing closure under interim status until the RCRA permit was issued on 4 June 1990. To close this unit under RFI guidelines, the existing data and threshold levels will be compared with action levels established by the EPA. Section 3.4 of this RFI Workplan examines the data and provides recommendations for this unit.

2.6.7 PCB Transformer Storage Area. The PCB Transformer Storage Area (SWMU #7) consists of Building 3902 located within the old corral area, the adjacent concrete slab located outside the building, and surrounding areas that were used for storage of transformers and associated electrical equipment. Transformers no longer in service were brought to the concrete pad on the south side of the building prior to transportation off base between 1970 and 1976. Transformers were either sold intact or drained near the concrete pad prior to sale. The area around this concrete pad shows evidence of previous oil spills. The total amount of PCBs released to the soil and the concentration in particular areas have not been adequately characterized. Transformers have been stored in a new hazardous waste storage and transfer facility since 1986.

The site was sampled in 1981 and 1982 to determine the presence of contaminants in soil and groundwater. The study found PCB's, arsenic, DDT and its derivatives, and benzene hexachloride (BHC), in both the soil and groundwater in trace concentrations. Except for the PCB's, no contaminants were found at levels posing a threat to human health or the environment.

Delineation of the PCB contamination requires a more detailed sampling of the area prior to selection of an appropriate remedial action. The necessary additional delineation at this unit is described in Section 3.5 of this RFI Workplan.

2.6.8 Oil Sludge Pit. Oil sludges produced by industrial activities at NSY from 1944 to 1971 were disposed of in three unlined pits near the Warehouse Administrative Building. These pits are visible in aerial photographs taken in 1944 and 1951 and are collectively known as

SWMU #8. Heavy rains occasionally caused the pits to overflow, creating oil spills in low areas adjacent to the pits. Two of the pits had been covered with fill by 1956, potentially trapping oil within the subsoils. Free oil is known to have been pumped from the remaining pit in 1974. Clean fill was then brought in and compacted within the pit. Portions of the area have now been converted into a parking lot. A ditch dug at this site in 1982, intercepted free oil floating on the water table. The ditch was dammed immediately afterwards and later filled to prevent migration of oil into Shipyard Creek.

A boring program, instituted by Geraghty and Miller in 1982 to delineate the areal extent of oil in the ground, found substantial quantities of free phase oil floating on the water table. A long, narrow body of oil, approximately 50 feet wide and 600 feet long, was found in the southwestern portion of the oil-sludge area, oriented in a NE-SW direction. The shape of this plume reflects the shape of the underlying abandoned pit. Measurements taken in the borings indicated that the oil ranged in thickness from approximately two to four inches. The low hydraulic gradient, the low permeability of the soils, and the high viscosity of the oil within the soils limit the transport potential of the oil. This suggests that the potential for a lateral migration of the plume into the Cooper River or Shipyard Creek via the shallow groundwater system is minimal. However, any oil seeping into the Cooper River could create environmental degradation (visible sheen), although no impacts to human health are anticipated.

Distinct from the free floating oil on the water table is the possibility of oil-contaminated subsoils. Surely, such contamination existed at one time since the pits were unlined and are known to have overtopped during rain events. Nonetheless and despite an extensive boring program, significant soils contamination, apart from the free floating plume, was not found. This is probably due to a stripping of removable oils from oil-soaked soils (and their consequent addition to the free-floating plume) during periodic high water table conditions, and to the subsequent microbial degradation of non-removable residues. Whatever the cause, the extensive sampling by Geraghty and Miller in 1982, demonstrated that the only significant contamination at that time consisted of free oils floating on the water table.

Since unlikely but potential migration of this plume to nearby surface waters could create a sheen in violation of applicable water quality criteria, the plume, if it has not already dissipated, should be found and remediated. A boring and sampling plan to accomplish this is described in Section 3.6. Additionally, the absence of significant soils contamination will be confirmed. If free oils remain, their timely remediation will be proposed.

2.6.9 Closed Landfill. From the 1930's until 1973, many solid wastes generated at NSY were disposed of onsite in a landfill in the southwestern portion of the peninsula (SWMU #9). Originally, the area was marshland. Items reportedly disposed of in the landfill include: asbestos, acids, PCBs, waste oils, waste solvents, waste paints, paint sludges, mercury, metal sludge, acid neutralization sludge, various inorganic and organic chemicals, sanitary wastes, office wastes and rubbish. Far and away, the largest volume of wastes was office wastes and rubbish. Liquid wastes were placed in drums before disposal, and combustible wastes were burned daily. Residue from the burning was pushed into the marsh as fill along with concrete rubble, metal scrap, and other non-combustible materials. Waste materials were covered with soils when they were available. Soils from onsite building excavations, soil dredged from the

river, and bottom ash from the power plant were used as cover materials. Much of the site is currently paved and used as a parking lot.

Chemical analyses of groundwater samples collected from 13 perimeter monitoring wells found dissolved metals and organic compounds in trace concentrations (ES&E 1983). The shallow groundwater bearing unit is characterized by a low hydraulic gradient, low hydraulic conductivity, high clay content, and high natural organic content. The transport potential for both the metals and orgnic compounds is therefore limited. Most metals will bind to clays in the soil while most organic compounds will bind to humic compounds naturally abundant in area soils. In addition, most of the area is capped with asphalt pavement which reduces the recharge rate via infiltration. The absence of substantial groundwater contamination is no doubt due to these factors and to the age of the unit; mobile constituents no doubt migrated to nearby surface waters long ago. Due to the extremely high cost of remediation at this unit and the lack of substantial contamination, no further action is planned to be taken at this unit.

2.6.10 Hazardous Waste Storage Facility. The new hazardous waste container storage and transfer facility (SWMU #10) was completed in October 1986. The facility was constructed to serve the entire base and is managed by the shipyard. Current status of the unit is that of a permitted storage facility with permission to store wastes for a maximum of 90 days. The building contains seven storage bays; each bay has separate spill containment berms to allow flexibility in segregating incompatible wastes.

The hazardous waste storage facility is designed to store hazardous materials/wastes until time of proper disposal. A 6-inch high concrete ramp is located at the entrance to each storage bay for spill containment. Storage bays are separated by interior partition walls. A catch basin for spill and storm drainage is located in the exterior load/unload area. Wastes stored in the facility are grouped into 8 categories: (1) flammable liquids, (2) acids, (3) alkalis, (4) chlorinated hydrocarbons, (5) oxidizers, (6) reducers, (7) general wastes, and (8) PCBs. These general classifications are reflected on signs used to identify the contents of each storage bay. The unit is constructed of concrete with sloped floors bounded by curbs in order to isolate leaks or spills within each storage bay.

There is no evidence of a release from this unit. No action is planned to be taken at this unit.

2.6.11 Caustic Pond. The caustic pond (SWMU #11), located near the junction of Bainbridge Avenue and Viaduct Road was used for the disposal of calcium hydroxide $Ca(OH)_2$ from the early 1940's through the early 1970's. The site and adjoining areas are currently covered with vegetation. No signs of impairment can be observed in the area.

Calcium hydroxide was generated as a byproduct during the reaction of water with calcium carbide to produce acetylene gas. Water saturated with $Ca(OH)_2$ was discharged to and allowed to settle in the pond during operations. Supernatant was discharged to Shipyard Creek. The quantity and areal extent of the original $Ca(OH)_2$ deposits are not precisely known. Soil borings conducted during the initial assessment studies found sludge depths of up to one foot (ES&E 1983). Water infiltrating into the surficial groundwater through $Ca(OH)_2$ should have a high pH. Samples collected from the monitoring wells around the site, however, show that groundwater is neutral in pH (G&M 1982). Calcium hydroxide does not occur naturally and cannot persist

for extended periods when released to the environment. It reacts with carbon dioxide which diffuses from the air or is carried by infiltrating rainwater to form calcium carbonate (limestone). The groundwater data indicates that this process has gone to completion and that no calcium hydroxide remains.

Calcium hydroxide contains no hazardous constituents but is hazardous by definition (40 CFR 26.22(a)(1).) only when it is in solution and causes the pH to be greater than 12.5 standard units. This rarely occurs outside of laboratory conditions but is possible with saturated solutions of relatively pure $Ca(OH)_2$ at temperatures below 23.6° C. In any case, groundwaters beneath SWMU #11 are not even slightly elevated in pH. Consequently, no further investigation is planned at this site.

2.6.12 Old Fire Fighting Training Area. The old fire fighting training area (SWMU #12) consisted of a pit located at the southern end of NSY. The pit reportedly measured between 30 and 50 feet in diameter. It was used between 1966 and 1971 for training purposes. Oil, gasoline, and alcohol were poured into the pit, ignited, and subsequently extinguished during fire fighting training exercises.

The pit area is no longer discernible from the surrounding surface topography. The location of the pit is now known only from old aerial photographs. The pit area is currently separated from Shipyard Creek by a dense zone of shrubs, hardwoods, and a roadbed.

The pit was cited by the U.S. Coast Guard in 1971 for an oil spill. The spill occurred following a heavy rainfall which caused the oil in the pit to overflow into Shipyard Creek. The pit was closed, filled with bottom ash, and leveled in 1972. Soil borings at the site found no trace of petroleum contamination in 1982 (G&M 1982). No corrective measure or investigatory action is planned for this site.

2.6.13 Current Fire Fighting Training Area. Fire fighting training for both surface and submarine fleet personnel is currently conducted at the Fleet and Mine Warfare Training Center on Dyess Avenue. The training center (SWMU #13), in use since 1973, uses approximately 20,000 gallons of No. 2 diesel fuel and 2,000 gallons of gasoline per year in training operations. Training exercises include extinguishing ignited diesel fuel and gasoline. Fuel, floating on water in tanks, or sprayed onto mock buildings, is ignited in an enclosed, paved area or burned directly on the ground in a bermed area.

Wastewater from the area is routed through a gravity oil-water separator, prior to discharge into a sanitary sewer system leading to the North Charleston Consolidated Public Service Department (NCCPSD) sewage treatment plant. Recovered fuels are recycled. Effluent from the operation is well below discharge limits imposed by NCCPSD.

There is no evidence of releases from this unit. No corrective measures or investigatory activity is planned for this SWMU.

2.6.14 Chemical Disposal Area. The chemical disposal area (SWMU #14) is located at the southern end of the active portion of NSY in the vicinity of the skeet and pistol ranges. The precise locations of chemical burials are unknown. Unknown amounts of various chemicals,

including Decontaminating Agent Non-Corrosive (DANC) and DS-2 have reportedly been disposed of at the site. DANC consists of separately packaged components of tetrachloroethane and dichlorodimethyl-hydrantoin. DS-2 is a mixture of 70% diethylene triamine, 28% methyl cellosolve, and 3% sodium hydroxide. Other chemicals may have been buried either at the skeet range or behind the dike at the pistol range or both. Ten 5-gallon canisters of DS-2 were reported buried at the skeet range in 1977.

The groundwater samples collected from the site were found to contain trace amounts of bis(2-ethylhexyl) phthalate, chlorobenzene, chloroform, and methylene chloride. The data suggests that cleaning wastes may also have been disposed of in this unit and that the DANC and DS-2 either have degraded or have not yet been found (G&M 1982).

Construction crews unearthed drums of chemicals at the skeet range in 1972 and 1974. Some workers suffered minor chemical burns in the excavation episodes. Contaminant migration rates in the area are slow due to low hydraulic conductivity of the soils, and the low hydraulic gradient. Construction activities are proposed for the site. This area represents a potential safety hazard, because the type, quantity, and exact location of the chemical disposal areas are unknown. Also, the potential for impacts via groundwater pathways has not been adequately characterized. Section 3.7 of this RFI Workplan includes a description for further investigation planned for this site.

2.6.15 Incinerator. The incinerator (SWMU #15) is located adjacent to the pistol range and consists of a primary burning chamber and a 30 foot high stack. The unit is used only for burning of classified documents. Incineration activities occur approximately twice per week.

Residues from incineration operations are placed in waste disposal containers and disposed of along with other NSY solid waste. The unit is situated on a concrete pad. Since the incinerator burns only paper, no hazardous residues are generated. No releases have occurred at this unit. No additional investigations are planned for this RFI Workplan.

2.6.16 Paint Storage Bunker. The paint storage bunker (SWMU #16) was used briefly (and without proper authorization) for paint container and miscellaneous material storage piles. It was located at an ammunition magazine adjacent to the Cooper River. The storage piles contained paint, paint thinner, oil containment booms, wooden crates, and buoys (Ebasco 1987). The site was clean closed on the day it was brought to management attention, during a DHEC site inspection. No additional investigation is planned.

2.6.17 Oil Spill Area. The oil spill area (SWMU #17) is located beneath Building FBM61. The spill occurred in June 1987 when an underground pipe supplying No. 2 diesel fuel to the boiler in Building FBM61 ruptured, spilling a small amount of its contents into the basement of the building and several thousand gallons into soils beneath the building. Some of the oil entered drainage sumps beneath the building, entered the storm drainage system and discharged into the Cooper River. The resulting slick was promptly contained. Remediation efforts subsequently removed all floating oils from the water table.

Building FBM61 was built in 1961 as a Submarine Training Center. Electrical transformers were installed to serve the center at that time. Several samples collected from the spill area were

found to contain PCBs. The quantity of PCBs beneath the building and how it got there remain uncertain. PCBs from the transformers were probably released many years ago before the area was paved. The entire area is capped either by the building or an adjacent paved parking lot. Consequently, there is no current potential for exposure. Section 3.17 of this RFI Workplan describes additional soil and groundwater sampling planned for this unit.

2.6.18 PCB Spill Area. The PCB spill (SWMU #18) occurred at Building 1278 on 12 June 1987 while a PCB containing transformer destined for disposal was being loaded onto a truck. The loading accident resulted in discharge of insulating fluid from the unit onto unprotected ground. The spill was contained and the site was trenched. Twenty-two drums of soil were excavated and hauled offsite for disposal. Visibly contaminated soils were removed directly after the spill. Subsequent sampling of the area, however, showed additional excavation of soil was necessary. An additional 85,000 pounds of soil were removed from the spill site in June 1987. Soils were resampled following this excavation and again revealed unacceptable levels of contamination. Following additional excavation, analytical results indicated no more excavation was required. The site has been completely remediated (AmerEco 1987) under the Toxic Substances Control Act. No further investigation of the site is planned under this RFI Workplan.

2.6.19 Solid Waste Transfer Station. The Solid Waste Transfer Station (SWMU #19) consists of a staging area for temporary storage of solid waste, prior to transport and disposal off-site. The solid waste is compacted after collection and temporarily stored at the site in containers. No hazardous wastes have been stored at the site and the unit is only used for temporary storage of solid waste. No releases of hazardous constituents have occurred at this SWMU. No additional investigations are planned for this RFI Workplan.

2.6.20 Waste Disposal Area. The Waste Disposal Area (SWMU #20) occupies an open area adjacent to the solid waste transfer station and has been in operation since 1985. Solid wastes consisting of cardboard boxes, wood, concrete blocks, tree stumps, sandblasting residues, and a small number of vehicle batteries were disposed of in this area. The few batteries disposed of at the site are the sole concern. This SWMU overlies the old sanitary landfill (SWMU #9). The RFA recommends that this unit be considered part of the sanitary landfill and be addressed accordingly. Groundwater monitoring in the surrounding area has found widespread but low level contamination which cannot be remediated without much greater expense than potential benefits might justify. No evidence of a release of hazardous constituents to air, water or soil was observed (Ebasco 1987). No impacts to human health or the environment area anticipated. No additional investigation or remediation is planned for this unit.

2.6.21 Old Paint Storage Area. The old paint storage area (SWMU #21) is located inside the Controlled Industrial Area (CIA) near the waterfront adjacent to the Cooper River. The unit was used for temporary storage of containerized paint wastes from ships returning to NSY and from ship repair and overhaul operations at the base. The waste containers were temporarily stored on a 20 x 180 feet concrete pad to await offsite transport. Sandblasting operations also occurred in this area.

Paint wastes stored at this unit contained cadmium, chromium, lead, cyanide, toluene and tetrachloroethylene. Sandblasting residues containing organo-tin paints were also generated at this unit. These residues were allowed to accumulate on the ground surface. Clean closure of

this site under interim status has been completed. A release from a 55-gallon container was observed during a site inspection by DHEC and EPA in August of 1990. Leaking material (Oakite-PK144) from a hole in the bottom of the container was identified as kerosene. The spilled material was cleaned up immediately. Because this is a one-time release, of limited quantity, and immediately cleaned up, no further action is planned for this unit.

2.6.22 Old Plating Shop Waste Treatment System. The old plating shop waste treatment system is located within the CIA. The unit (SWMU #22) was constructed in 1972 to process wastewater from the metal plating shop and continued in operation until the new non-cyanide plating process and treatment system were built. The treatment facility included two inground concrete tanks, one for chromic acid reduction and one for cyanide oxidation. Additional treatment was conducted in a "clarifier" where soda ash was manually added and mixed with the wastewater to adjust the pH to approximately 8.5 and precipitate any chromium or other metals. After settling for 48 hours, the clarified wastewater effluent was discharged to the sanitary sewer. Sludge in the bottom of the clarifier was removed and disposed of at the base sanitary landfill until 1973. After 1973, sludge was transported off base for disposal.

The unit has not been operated since 1982 when the new plating shop WWTS (SWMU #23) started up. The waste treatment system has been decontaminated, but questions remain regarding subsurface contamination. An additional sample investigation to delineate the extent of contamination around the WWTS was proposed by EnSafe in their February 1989 report. However, a site investigation for the Old Plating Operation inside building 44 (SWMU #25) has been added to the RFI Workplan. So as not to duplicate efforts for these two complimentary units, both SWMU #22 and #25 will be addressed together under SWMU #25 for future investigative and remediation work.

2.6.23 New Plating Shop WWTS. The new plating shop WWTS unit (SWMU #23) is located inside the CIA. The system is currently used to treat wastewaters containing lead, chromium, cadmium, and acids or alkalis from metal plating operations. Treated effluent is discharged to a holding tank and tested prior to final discharge into the sanitary sewer system. Underflow from the clarifier is directed to a centrifuge for sludge thickening and then to a plate and frame filter press for dewatering. The sludge is hauled off base for disposal.

No evidence of a release from this operation has been found and no additional investigations are planned under this RFI Workplan.

2.6.24 Waste Oil Reclamation Facility. The waste oil reclamation facility (SWMU #24) is located in the central portion of the shipyard and has been in operation since 1980. This unit consists of two storage/separation tanks. Waste oils unloaded from ships or from base operations are pumped into this facility via underground pipelines. Gravity oil-water separation occurs inside the tanks which are operated in alternation. The water phase is drawn off and discharged to the sanitary sewer system. The oil is reused at the base. No evidence of a release from the site has been found. All underground lines are cathodically protected and all tanks and lines are periodically pressure tested. No additional investigations are planned under this RFI Workplan.

2.6.25 Building 44, Old Plating Operation. The old plating operation (SWMU #25) occupies the northern portion of Building 44. Phased out of operation in 1983, the unit was replaced by

a new (non-cyanide process) plating operation (SWMU #23). The interior of this unit still contains all operation equipment from the plating process (tanks, vats, ventilation hoods, mechanical and ancillary equipment). Before the plating operation was deactivated, all vats and tanks were emptied and the waste removed. Areas of concern for this SWMU are deteriorated concrete flooring, product accumulation around tanks, the floor drainage system, interior surface contamination, subsurface soils and groundwater.

No prior investigation has been performed for this unit. Contamination of subsoils and groundwater beneath the area of operation has not yet been documented, but visual observations of the floor and drainage system indicate a high potential for subsurface contamination.

Subsurface contamination around the waste treatment tank, SWMU #22, revealed high levels of chromium and cadmium. However, although the treatment tank is the most obvious source, contributing factors may include spillage and leaks from Building 44, underground ancillary piping or leakage and migration from the floor drain system.

An investigation and building decontamination is proposed for this SWMU. A phased approach delineating the potential contamination on the building's wall surface, concrete floor, subsurface soils and groundwater will be required to determine the effort required for remediation. This SWMU is fully addressed in Section 3.10 of this RFI Workplan.

2.6.26 Waste Storage Area, Building 64-40, Pier C. This area (SWMU #26) is approximately 100 square feet of asphalt pavement located on the east side of Building 74 in a heavily industrialized area near Pier C. Six 55-gallon drums of waste (seam filler, lead waste, adhesive waste, alcohol rags, and trichloroethane rags) were temporarily stored here (without proper authorization). The area was clean closed on the day it was brought to management's attention, during the DHEC and EPA site inspection.

No releases occurred at this unit. No additional investigation is planned.

2.6.27 Waste Storage Area, East End, Pier C. This paint storage area (SWMU #27) is a satellite accumulation area located at the east end of Pier C. The unit comprises approximately 200 square feet of the concrete pier. A flammable storage shed and lockers store virgin paints, enamel thinners and fire retardants used for ship repair. Waste containers from the operation are accumulated beneath a canvas tent. The floor is canvas covered plywood surrounded by a berm. Bermed areas at this unit include 55 and 30-gallon drum containers and a storm drain.

During the DHEC and EPA site inspection, containers of hazardous wastes were either not labeled or had no accumulation dates. Also, there were no inspection records for the unit. As a result of the large number of shops and numerous employees in the shipyard, implementation of established hazardous waste procedures for handling waste material have been difficult to implement fully at some of the shops. Additional training and inspections are required for the areas in violation. The NSY Environmental Division has established a zone inspection system to regularly perform site inspections. Incident reports are written up and notification of deficiencies is submitted to the shop heads for corrective action.

There is no evidence of a release in this area. Although there are paint stains on the surface, none is in proximity to the storm drain. Additional measures to be taken to mitigate a release include expanding bermed areas, sealing off the storm drain, and adding drip pans. No additional investigations are planned under this RFI Workplan.

2.6.28 Waste Paint Storage Area, West End, Pier C. This unit (SWMU #28) was used as a one time waste accumulation area unbeknownst to the NSY Environmental Division. The unit is approximately 100 square feet in area and is surrounded by asphalt. Adjacent to the area is an empty flammable liquids storage shed. A storm sewer drain is located 30 feet downgradient of this unit. Paint spills from this accumulation area were confined to the small 100 square foot area.

The inspection by DHEC and EPA observed drums and bags of paint waste, waste thinners, and waste naptha/alcohol. Standard protocol for labelling, maintenance, and control measures were not being followed in handling the hazardous waste.

The unit was clean closed the day of the inspection. No evidence of a release was observed. No additional investigations are planned for this unit.

2.6.29 Building X-10. This unit (SWMU #29) is located south of Building X-10, near Building 1431. Used as a waste accumulation area, this unit received waste from submarine maintenance and repair. This area is primarily a large asphalt covered area with some soil and grassy areas to the southwest and northeast. During our site visit, the area was clean and no evidence of surface staining was observed.

The inspection performed by DHEC and EPA revealed eleven 55-gallon containers (waste paint, waste monoethanolamine, and waste solvents), twenty-six 5-gallon containers of waste monoethanolamine and numerous 5-gallon and smaller containers of paint waste. Also stored in this unit were 20 pallets of waste stock (expired material) labelled corrosive along with other pallets of waste chemicals. Many of the containers failed to have the proper hazardous waste label, date of accumulation, or inspection records. Storage of incompatible waste and evidence of spills were also observed during the inspection.

Historical information gathered from the past utilization of this area and the visual observations noted during the DHEC and EPA site inspection, warrants a preliminary sample investigation for this unit under this RFI Workplan.

2.6.30 Satellite Accumulation Area, Building 13. The Satellite Accumulation Area (SWMU #30) is used to receive waste generated from the laboratory in Building 13. Located between Buildings 13 and 187, outside the southeast wall of Building 13, the unit and surrounding area is asphalt with a storm sewer drain 20 feet downgradient.

This accumulation area contains a steel box for storage and containment of pails (5 gallons and smaller), trash bags, and a portable 300-gallon steel waste oil tank. Two 55-gallon drums of oil sludge labelled hazardous waste were also present only at the time of the DHEC and EPA site inspection. Spillage was observed around the drums, the result of someone recently adding waste to the containers. Comments from the DHEC and EPA site inspection included containers

either did not have accumulation dates, proper labelling, inspection records, or spill control equipment to minimize release of hazardous waste to the environment.

Since this area will continue to be used as a satellite accumulation area, additional construction, operation, and maintenance measures are planned for this unit. Spill control measures and equipment such as concrete bermed area with roof, drip pans, signs, inspection records, and waste pickup schedule are planned. Beyond implementation of operational and maintenance procedures, no further action is planned for this unit under the RFI Workplan.

2.6.31 Waste Paint Storage Area, Drydock No. 5. This unit (SWMU #31) is a satellite accumulation area located in Dry Dock No. 5. The area, 200 square feet in size, performs the same functions as SWMU #26. Located on the concrete floor of the drydock near the center of the north wall, the unit is used intermittently to service submarines in drydock. A tent is erected over canvas covered plywood with sand bag berms. Paints are thinned and placed in one gallon buckets with plastic liners for transport to the submarine. A trench drain directly behind the unit is part of the intake system to drain the drydock once the ship has entered.

Comments made during the inspection by DHEC and EPA noted two 55-gallon drums of waste paint, solvent rags, and thinners stored onsite without proper labelling, date of accumulation, inspection records, or spill control equipment. Numerous spills were also noted in the unit. Additionally, a storage shed was noted as having a bad solvent odor.

No releases have been reported from this unit. In that wastes were stored in covered drums on concrete, the probability of a release to soil, groundwater, or air is limited.

Hazardous constituents have the potential to migrate to surface waters during filling of the drydock with water to remove the ships. According to the written SOP, these wastes are to be removed from the drydock prior to filling with water. The written SOP requires that the drydock will be maintained in such a manner as to limit the potential for release to surface waters. The potential for migration of the paints and thinners is limited since the paints harden and the thinners volatilize before the drydock is filled anyway.

This unit requires additional operational and maintenance measures to be implemented for prevention of spills and handling emergencies. Although this site is defined as a SWMU, no further action is planned for this unit in this RFI Workplan.

2.6.32 Waste Paint Storage Area, Building 195. This waste paint storage area (SWMU #32) was used as a one time waste accumulation area (without proper authorization) located along Pier F between Buildings 195 and 1802. The unit encompassed approximately 400 square feet of area 40 feet from the edge of the water. The surface is concrete with asphalt to the south.

At the time of the DHEC and EPA inspection, this area contained five 55-gallon drums of paint waste, lead and thinner waste, numerous 5-gallon containers of paint waste, and trash bags with paint and solvent rags. A shipping container, adjacent to the site, was also being used to store containers of paint. None of the containers had the proper labelling or markings; date of accumulation; lids securely closed; or maintained and operated properly to minimize fire, explosion, or a sudden release of hazardous waste to the environment. In addition, a corroded

area in the shipping container allowed liquids to leak from the shipping container into a storm drain.

An inspection of this unit by SOUTHDIV revealed the waste and shipping container had been removed from the area. A subsequent investigation performed by WAPORA confirmed SOUTHDIV's inspection that this area was no longer used for storage.

This unit was a one-time accumulation area. The containers stored here were removed from the area immediately after the investigation. Leakage from the container was a one-time event. Any sample investigation of this area would not provide significant information due to the conditions of the site and nature of the release. No further action is planned for this unit under this RFI Workplan.

As mentioned earlier, implementation of the established SOP for handling hazardous waste at the Naval Shipyard is still not being properly implemented by some of the shops. Increased zone inspections and enforcement of SOP for handling hazardous waste is priority for the NSY Environmental Division.

2.6.33 Waste Paint Storage Area, West End, Drydock No. 2. The waste paint storage area (SWMU #33) was used as a one time waste accumulation area located at the western end of Drydock No. 2. This unit covers approximately 200 square feet of concrete pavement and is situated 40 feet from the edge of the drydock. This heavily industrialized area is primarily asphalt with railroad tracks, overhead cranes, heavy equipment, and elevated offices surrounding the drydock and SWMU area.

The inspection performed by DHEC and EPA revealed two 55-gallon drums of waste paint and waste thinner, numerous 5-gallon containers of paint waste, and trash bags containing solvent rags and paint waste. Spillage was observed in the area. Operation and maintenance procedures to minimize a release were not followed, labelling, accumulation dates, and securing containers were not performed properly as well.

During the time subsequent investigations were performed by SOUTHDIV and WAPORA, the waste material had been removed from the site. In fact, much of the asphalt and concrete had been excavated to overhaul the railroad tracks servicing the drydock.

As stated earlier, increased zone inspections and enforcement of SOP will be essential for maintaining the proper handling of hazardous materials in the NSY. Because this is a one-time waste accumulation point, no further action is planned in the RFI Workplan for SWMU #32.

2.6.34 MWR, Southwest of Building X-10. The Morale, Welfare, and Recreation (MWR) (SWMU #34) was utilized as a one time waste accumulation area. This fenced compound, southwest of Building X-10, is 70 feet by 50 feet in size and is primarily soil and grass.

During the DHEC and EPA site inspection, four 55-gallon containers of paint were stored in this area. Several of the drums were reported as leaking, spillage apparent on the ground around them. A diesel tank in this area was also observed to be leaking. The containers lacked the

proper labelling, date of accumulation, inspection logs, and operations and maintenance procedures to guard against fire, explosion, or releases to the environment.

Although no surface staining or evidence of a release were observed in this area during the latter investigation, because the site is located on bare ground, a limited soil sampling investigation will be performed in concert with SWMU #29. SWMU #34 will be incorporated in to SWMU #29 to cover the area behind building X-10, since these are are adjacent to one another. Run-off from the asphalt storage area behind building X-10 influences both areas.

No further action will be implemented for the leak identified for the diesel fuel tank during this RFI Workplan. Since this area is considered passive leakage, it does not fit the definition of a solid waste management unit.

2.6.35 Building X-12. The area on the east side of Building X-12 (SWMU #35) was used as a one time waste accumulation area. The unit measures approximately 100 square feet in size and is covered in gravel.

At the time of the DHEC and EPA site inspection, five 55-gallon containers and numerous smaller containers of waste paint were stored at this unit. None of the containers were properly labelled, had a date of accumulation, or inspection records. Numerous containers did not have secured lids and spill control equipment was not available.

All improperly stored containers were removed immediately after the site inspection. Each container was handled following the established SOP for hazardous waste transportation, storage, and disposal at the Naval Shipyard facility. No new containers had been added to the area or any evidence of spills observed during the subsequent inspections of this unit.

This unit was used as a one-time waste accumulation area and does not exhibit the characteristics of having had routine or systematic releases of hazardous waste to the environment. Therefore, SWMU #35 will not be included as a SWMU in Section 3.0 of this RFI Workplan.

CHAPTER 3. INVESTIGATIVE AND REMEDIAL ACTIVITIES

This portion of the RFI Workplan describes planned field investigations, and at one unit (SWMU #2), additional interim corrective measures (Table 3-1). The purpose of this work is to collect sufficient data to further characterize the physical setting, nature of contaminants, and horizontal and vertical extent of contamination for SWMUs which have been inadequately characterized. As described in Section 2.6, twelve SWMU's will be further investigated. The investigations will include soil sampling, monitoring well installation and groundwater sampling, geophysical surveying, and remedial actions, varying from site to site.

A schedule of planned activities is shown diagrammatically in Figure 3-1 which depicts the general time frames for the RFI. This schedule allows five working days for project set-up and for obtaining internal Navy permits for access to the SWMUs. Two, 3-man field crews will perform the field tests over a period estimated at 35 working days. Laboratory analyses and data reduction will be performed as samples and results become available. Seventy-five working days are estimated to be required to complete the final laboratory testing. WAPORA will assign appropriate senior personnel for the draft report preparation. The time to complete a draft report is estimated at 60 working days. An additional 30 working days are estimated to incorporate regulatory review comments into the final report.

The schedule is in working days for investigatory and remediation personnel only and does not include any time for access delays, regulatory review, or meetings. No field activity can be performed without direct authorization from NSY.

3.1 SWMU #1, DRMO BUILDING 1617. The DRMO was extensively studied in connection with its closure. Results of the investigation revealed that lead is the only contaminant and lead contamination is limited to near surface soils. The contamination was transported, through mechanical means (vehicular traffic), during operations and to a lesser extent, by wind blown transportation migrating from salvage bin #3 (SWMU #2). Due to the threat of exposure through inhalation, an interim corrective measure will be performed. To prevent duplication of effort, SWMU #1 will be combined with SWMU #2. Section 3.2 describes the proposed remediation activities for both SWMUs.

3.2 SWMU #2, LEAD CONTAMINATION AREA. As previously described, this area includes a salvage bin (Bin No. 3), surficial dust on adjacent paved areas and contaminated soils adjacent to the paved area and surface contamination in the soils at the SWMU #1 where Building 1617 was formerly located. Prior site investigations have well-mapped the variation in total lead. Lead appears to be located as a thin layer of dust covering most of the paved areas, and within the near surface soils around the paved area.

3.2.1 Initial Remedial Action. Lead dust appears to represent a threat of exposure by inhalation therefore, an interim corrective measure will be performed prior to any additional investigative work at both SWMUs #1 and #2. The dust will be removed and treated as follows. Material, stored in the area by DRMO will be relocated to accommodate operations. The concrete bin and paved area will then be pressure washed with all rinseate diverted into a catch basin. Rinseate will be containerized and transported to the new metal plating WWTP where it will be treated and disposed of in accordance with the WWTP protocol for lead contaminated

Table 3-1. Summary of field sampling program.

Location	Field Sampling Type	Sample Type	Number of Sample Points	Number of Samples	Lab Analyses
SWMU #1 & #2	Hand Auger	soil	14	14	Total Pb
SWMU #5	Hand Auger	soil	14	42	TCLP Pb
SWMU #6	Hand Auger	soil	3	3(composite)	TCLP Pb
SWMU #7**	Hand Auger	soil	72	8(composite)	PCB
SWMU #8	Oil/Water Probe	GW	10	10	Free-phase Oil
SWMU #14	Hand Auger	soil	25	25	Volatiles Semi-Volatiles
SWMU #17	Split Spoon	soil	3	3	PCB
	Teflon Bailer	GW	3	3	PCB
SWMU #22 & #25	Wipe	surface	18	18	Cr, Cd, Cn
	Core	concrete	7	14	RCRA Metals
	Hand Auger	soil	17	68	RCRA Metals
	Teflon Bailer	GW	4	4	RCRA Metals
SWMU #29 & #35	Hand Auger	soil	10	50	Volatiles, Semi Volatiles, RCRA Metals, and PCBs

**More detailed sampling to be performed in areas where PCB levels >5mg/kg
GW - Groundwater

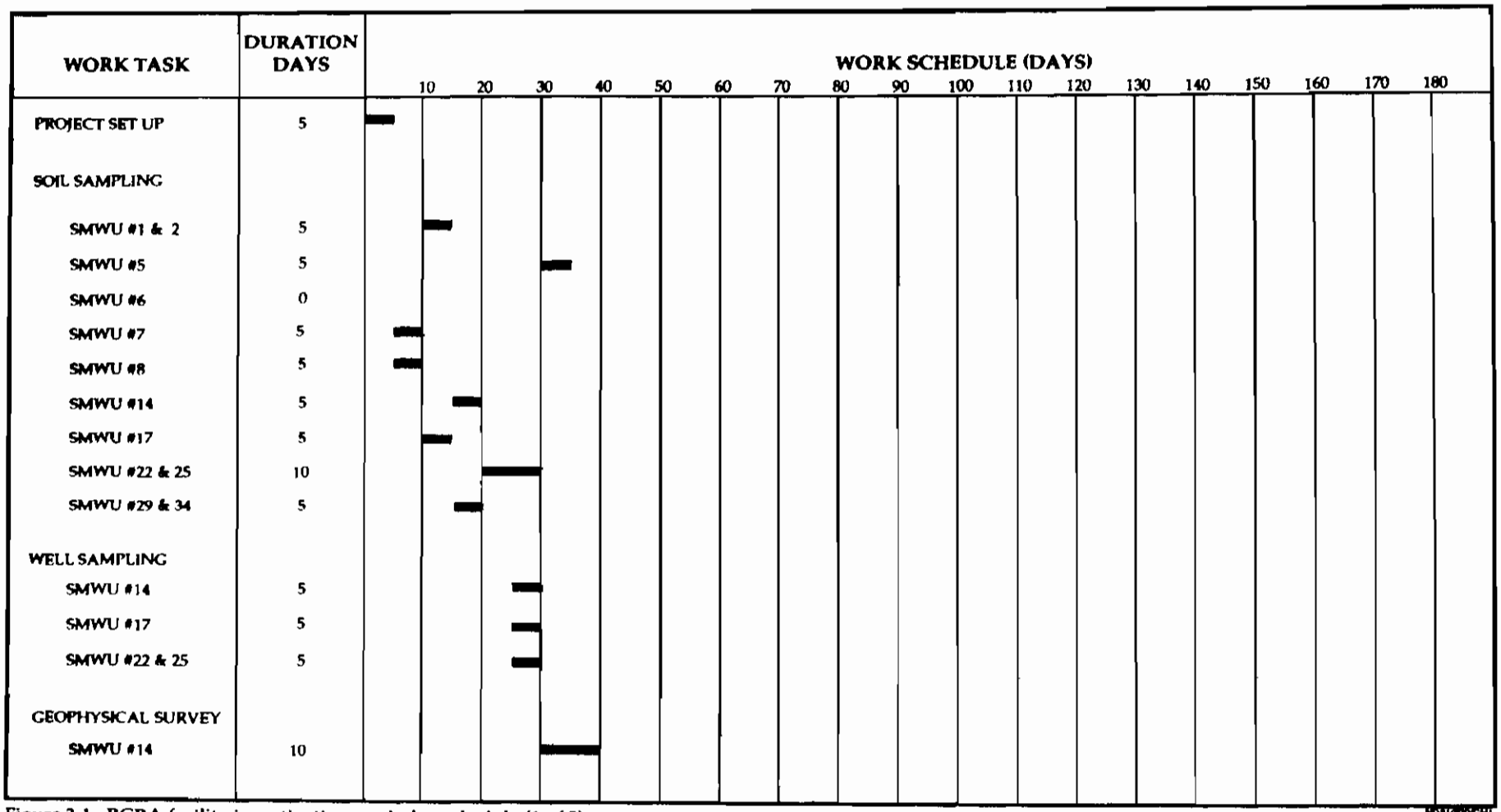

Figure 3-1. RCRA facility investigation workplan schedule (1 of 2).

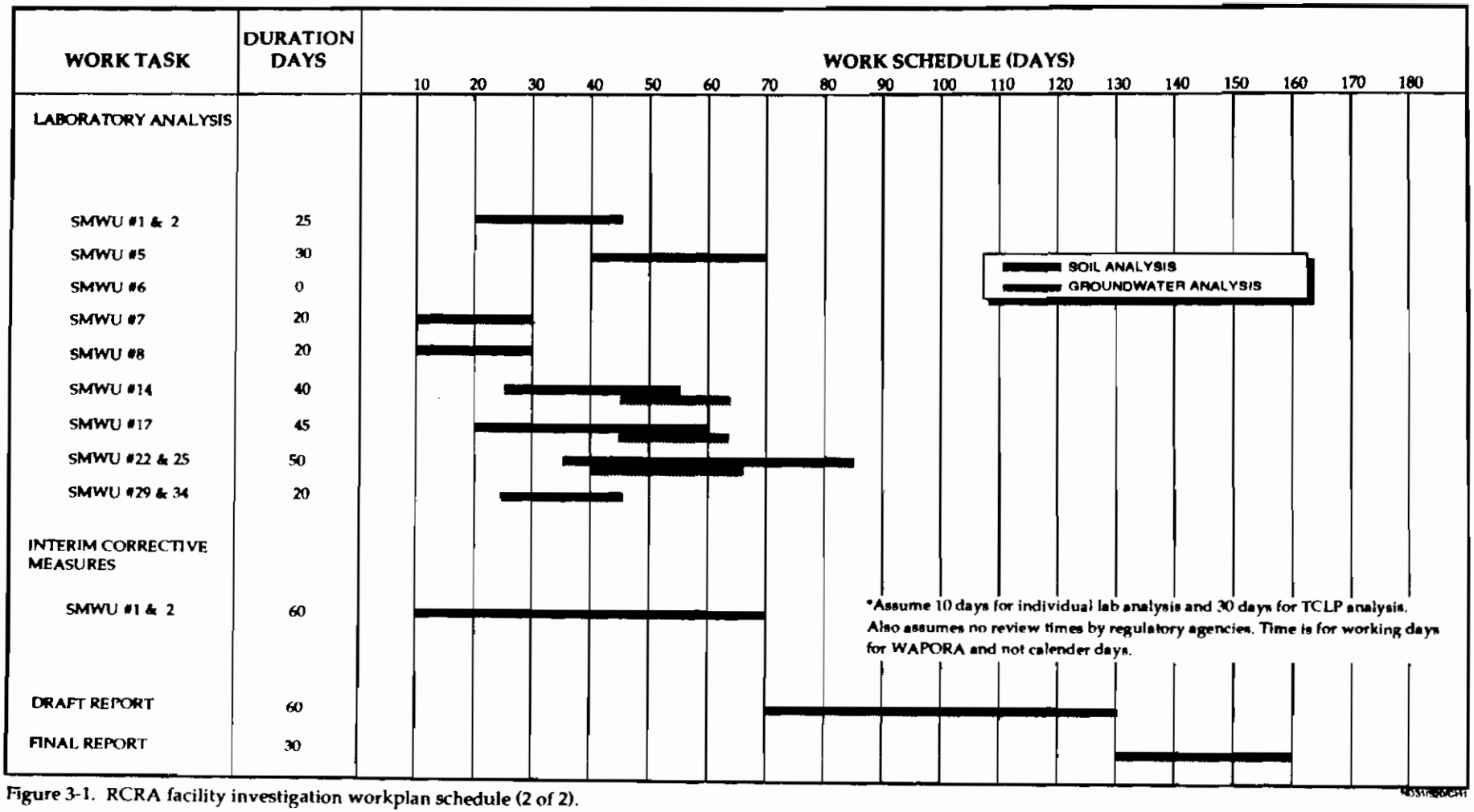

Figure 3-1. RCRA facility investigation workplan schedule (2 of 2).

wipe samples

wastewater. The effectiveness of this remedial action will be assessed by sampling the exposed (washed) concrete and testing for total lead. A total of five random samples will be taken. The flushing process will be repeated until the lead concentrations fall below background levels.

3.2.2 Soil Sampling. Prior investigation included the collection of 71 discrete soil samples at various depths. Of these, only two were tested for leachable (E.P. Toxicity) lead. Consequently, the limits of hazardous material remain undetermined. Any soils which are hazardous for the characteristic of E.P. Toxicity will be excavated and disposed of at a RCRA permitted landfill. In order to determine if any soils in the area are hazardous, 14 samples will be collected from the near surface soils at the locations shown in Figure 3-2. Each soil sample will be collected by the hand auger method using the sampling protocols listed in Section 4.4.4 of this RFI Workplan. Each soil sample is to be analyzed for extractable lead using the TCLP except that the zero-head-space extractor will not be used since lead is not volatile. If any sample produces an extractate with greater than 5 mg/l lead, plans for additional delineation and excavation will be formulated and proposed to DHEC and EPA. Soils surrounding the paved area contain much lower lead levels and are not expected to be E.P. toxic. Given the lack of an exposure pathway (see below), it is planned to leave in place soils which are not E.P. toxic.

3.2.3 Groundwater Sampling. Once surface dusts are removed the potential for lead to migrate from the site will be limited. The hydraulic gradient is flat, the hydraulic conductivity of the water bearing unit is low, and lead is known to bind tightly to both clay and organic soil constituents, i.e., the distribution coefficient should be relatively high. In addition, there are no groundwater users either at NSY or downgradient of the site. If required a deed restriction on groundwater use will be recorded. Because of this, groundwater remediation could produce no practical benefit and, hence, no groundwater monitoring is planned.

3.2.4 Temporary Land Use Restrictions. The site's activities should be limited to those which do not disturb the soil surface or groundwater. Utility construction should be minimized and conducted with the proper preventive measures to prevent physical contact with the contaminants. Restrictive access to the area should be enforced until remedial activities have been completed (Table 3-2).

3.3 SWMU #5, BATTERY ELECTROLYTE TREATMENT AREA. The battery electrolyte treatment area is primarily the acid waste treatment tank and surrounding soils. EnSafe's sample investigation of this area (EnSafe 1988) identified lead contaminated soils around the treatment tank at a depth equal to the bottom of the tank (7.4 feet below ground surface). However, the investigation encompassed only a five foot perimeter around the treatment tank and did not delineated areas beyond that. Under this RFI Workplan, an expanded investigation of the area around the acid waste treatment tank and the area identified during the DHEC and EPA site inspection will be performed. The expanded sample investigation will delineate the contamination so that a remedial design and cost estimate can be developed to close this unit.

3.3.1 Soil Sampling. Prior investigation included 36 subsurface samples collected five feet from the perimeter of the treatment tank. The expanded sample investigation planned for this unit involves collecting samples from 14 locations around the treatment tank and storage area. Figure 3-3 is a plan view illustrating the areas under investigation and sample location points.

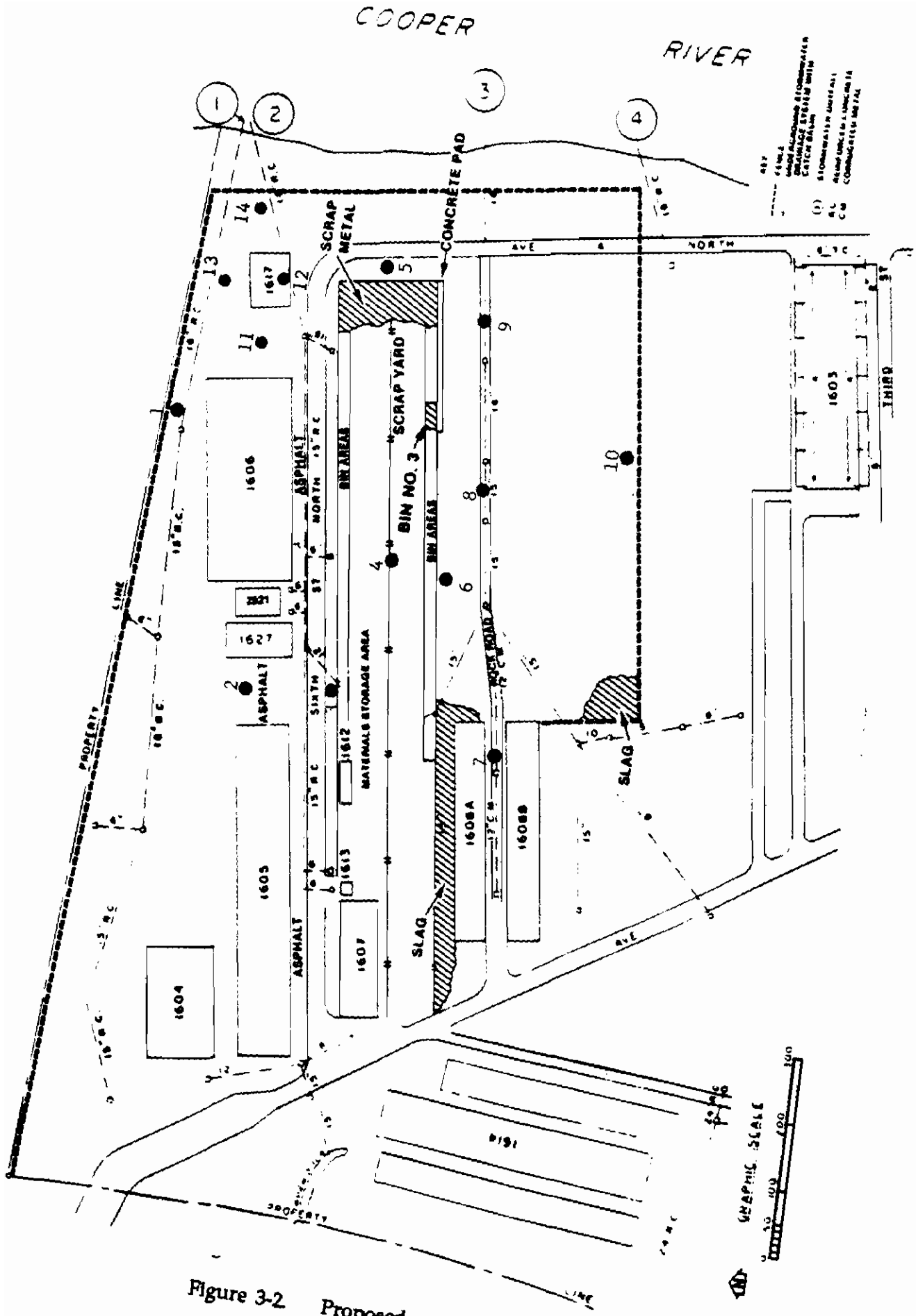

Figure 3-2 Proposed sampling locations at SWMU #2

TABLE 3-2

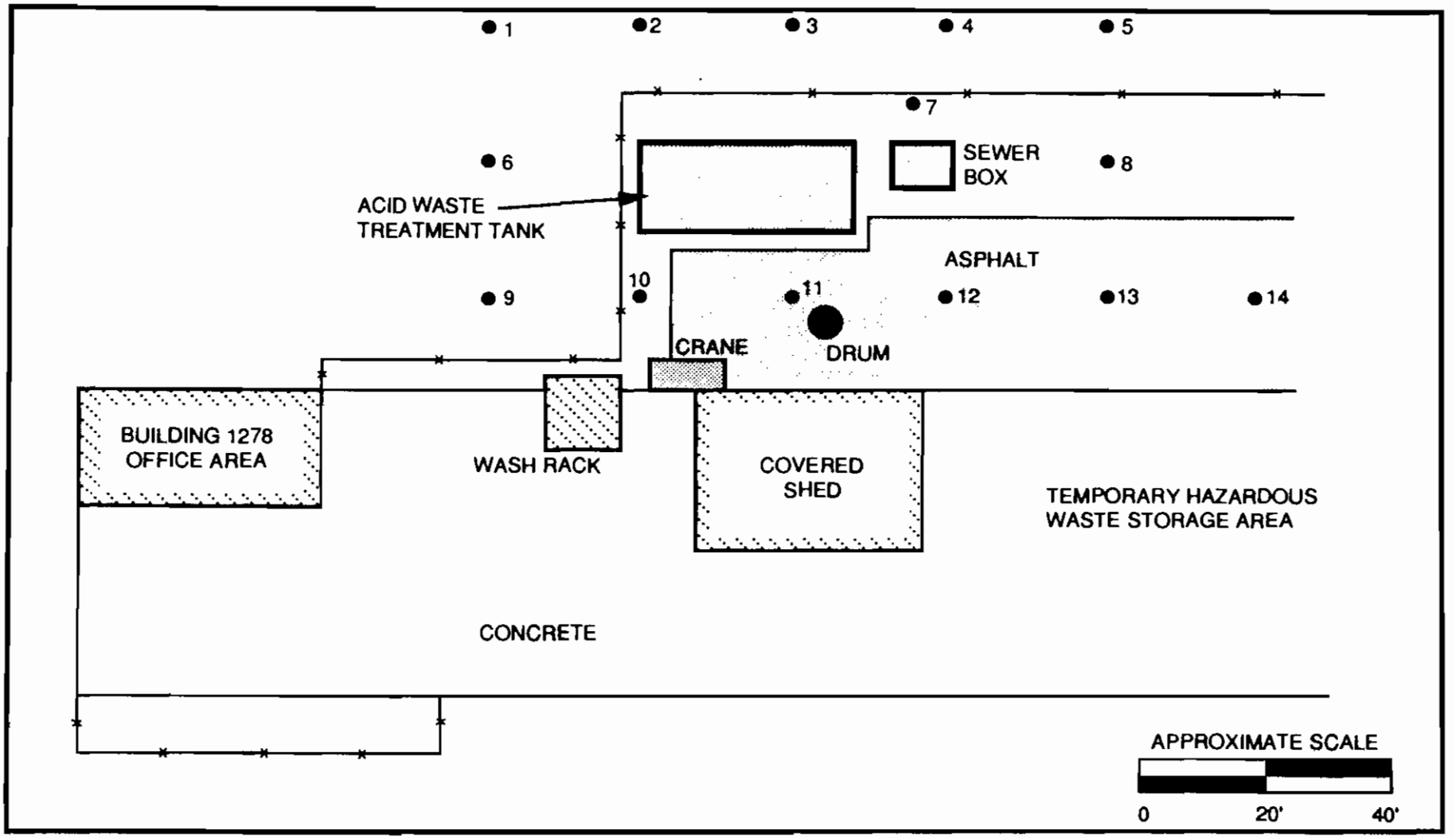

Figure 3-3. Proposed sample locations at SWMU #5.

ND29/520/F3.3

The drum in the figure illustrates the leaking drum during the DHEC and EPA site inspection. Each sample location will be hand augered and subsurface soil samples will be collected at three foot intervals from the surface to groundwater (e.g. 0 to 1 foot, 3 to 4 feet, and 6 to 7 feet). The samples will be analyzed for TCLP lead and pH.

Soils hazardous under TCLP lead will be remediated by either excavation and offsite landfilling or insitu fixation and solidification. Areas with a low pH (less than 4) will be neutralized by adding calcium carbonate or kiln dust to the soils. The minimum number of samples to be tested for TCLP lead analysis is 42.

3.3.2 Groundwater Sampling. Implementation of groundwater monitoring is not planned for this unit. Given the hydrogeological conditions already presented for the NSY, absence of any usage and sporatic lead levels discovered throughout the site, groundwater monitoring would not be of significant value. Furthermore, soils which are positive for TCLP lead will be remediated.

3.3.3 Temporary Land Use Restrictions. The site activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with proper preventive measures to prevent physical contact with the contaminants.

3.4 SWMU #6, PUBLIC WORKS STORAGE YARD. The public works storage yard has been extensively investigated since March of 1988. Samples collected for this unit were collected on 50 foot centers to a depth of three feet. Results of the sample investigation indicated elevated levels of lead contamination in three areas of the site.

3.4.1 Soil Sampling. Additional work planned for this unit involves collection of three composite soil samples from the stained areas where lead exceeds 210 mg/kg (Figure 3-4). The samples will be analyzed for total lead. If the extract from the test procedures exceeds the 210 mg/kg lead limit, the area(s) will be excavated. Excavation of the stained areas will extend five feet beyond the boundary and three feet below ground surface. Verification samples will be collected and analyzed again for total lead. If any sample is above the maximum level of 210 mg/kg lead, plans for additional delineation and excavation will be formulated and proposed to DHEC and EPA.

3.4.2 Groundwater Sampling. Groundwater sampling is not planned for this unit. Concentrations for metals are low, and where they do exceed action levels, the contamination is at the surface and is scheduled for further investigation and remediation.

3.4.3 Temporary Land Use Restrictions. The site activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with proper preventive measures to prevent physical contact with the contaminants.

3.5 SWMU #7, PCB TRANSFORMER STORAGE AREA. This unit includes Building 3902 and the attached concrete pad. The site was used to store out-of-service electrical materials such as rectifiers, transformers, and capacitors. In addition to storage, a number of transformers were drained near the concrete pad on the south side of building 3902 sometime before 1976. The total amount of PCB's released to the soil is uncertain due to the limited scope of prior studies.

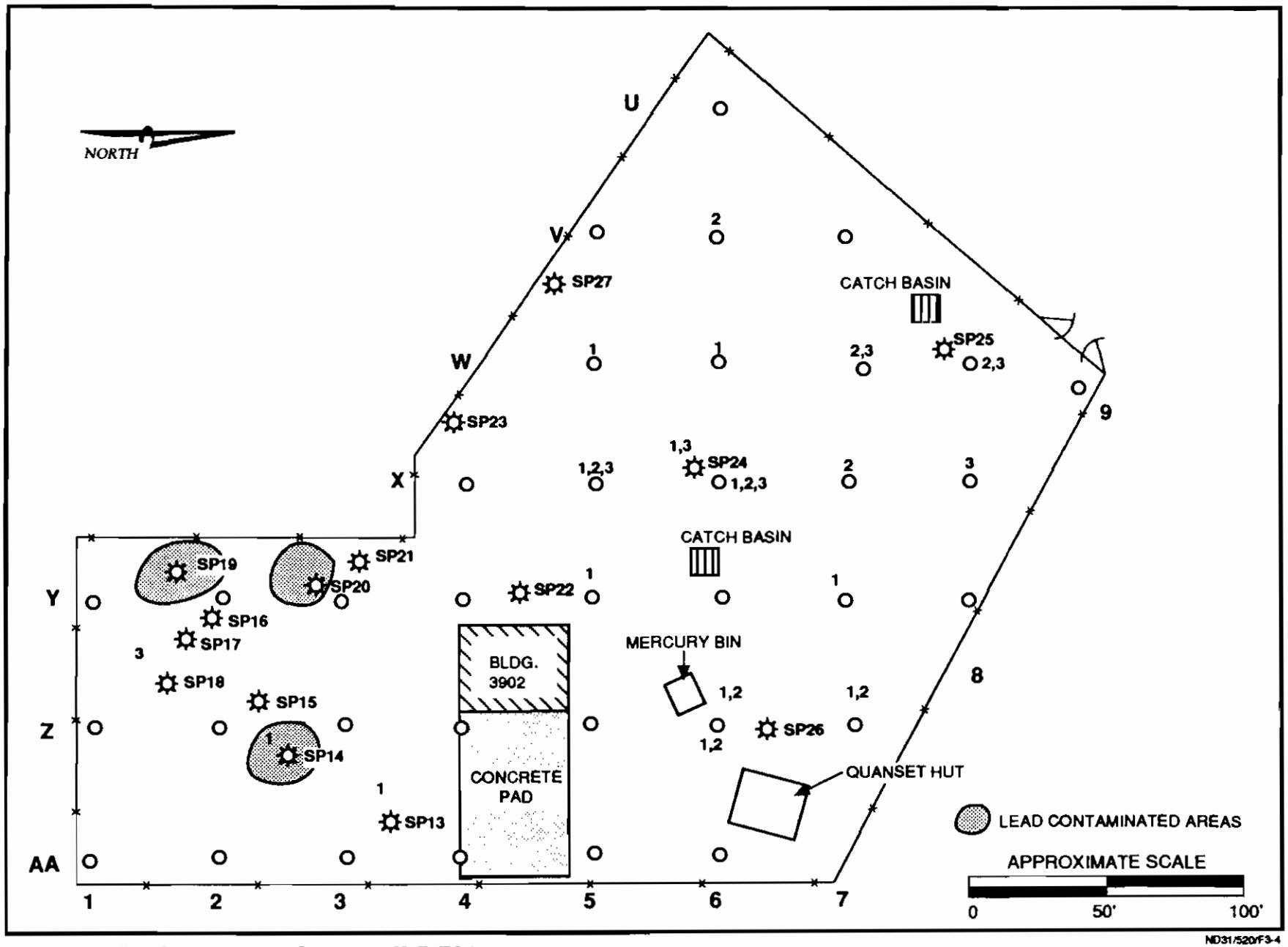

Figure 3-4. Lead contaminated areas at SWMU #6.

Several studies of groundwater and soil contamination at the site have been conducted since 1981. These studies found contaminants in both groundwater and soils. Detected constituents included PCBs, metals, and several chlorinated hydrocarbons, but except for the PCBs, only trace detections were found. Significant PCB concentrations were detected to the east and south of building 3902. These significant detections were in composite soil samples collected along lines running parallel to the sides of building 3902 and the attached concrete slab; therefore, the precise location of contaminated soils and concentrations in particular areas is unknown. Additional soil sampling will be conducted to delineate the extent and magnitude of PCB concentrations in the potentially contaminated area.

3.5.1 Soil Sampling. In order to delineate the magnitude and extent of PCB contamination, the potentially contaminated area will be divided into eight subareas as depicted in Figure 3-5. A composite sample consisting of nine subsamples will be collected from surface soils (0-6 inches) in each of the eight sub areas as depicted. Each composite will be assayed for PCBs. If any composite contains greater than 5 mg/kg PCBs, the subarea represented by that sample will be sampled in detail; also, soil stains and vegetative patterns will be accurately mapped. Composites containing less than 5 mg/kg PCBs constitute reasonable evidence that no soils in the subarea represented by that sample contain PCBs in excess of TSCA's action level of 50 parts per million.

Detailed examination of subareas found to be hot (> 5ppm) will begin with a mapping of soils and vegetation in the subarea and continue with sampling for PCBs on a finer grid. Soils will be mapped by color and vegetative cover will be mapped by species composition and density. Sampling will include surface samples and samples at a depth of 12-15 inches collected by compositing, in each case, four subsamples on a 5' X 5' grid within each of the nine 10' X 10' cells included in the subarea. If necessary, additional sampling will be conducted until contaminated areas are fully delineated both vertically and horizontally.

Following delineation, a report will be issued describing methods and results, and proposing methods, scheduling and areas of excavation. The report will also propose methods of post-excavation verification sampling. Excavated soils will be disposed of by a method to be proposed and consistent with applicable regulations.

3.5.2 Groundwater Sampling. Only trace amounts of PCBs or other constituents have been detected in groundwater at and near the site. No groundwater sampling is planned for this RFI Workplan due to the low groundwater gradient, low hydraulic conductivity of the water bearing unit, and immobilization of PCBs by the natural organic content of the soils. In addition, there are no groundwater users either onsite or downgradient of the site. In addition, if required, a deed restriction on groundwater use will be recorded.

3.5.3 Temporary Land Use Restrictions. The site activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with proper preventive measures to prevent physical contact with the contaminants. Restrictive access to the area should be enforced until remedial activities have been completed (Table 3-3).

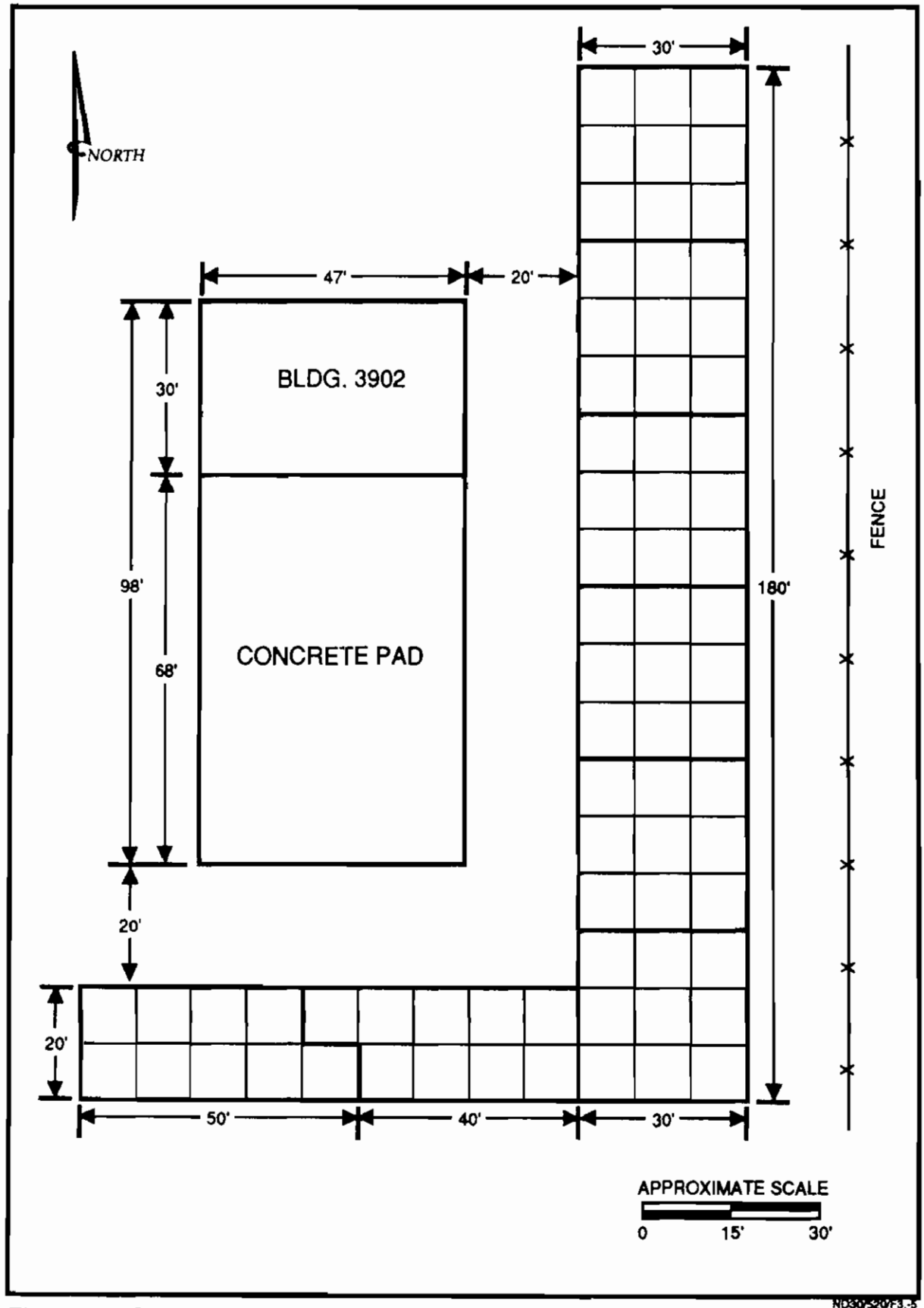

Figure 3-5. Proposed sample grids at SWMU #7.

Table 3-3. Land use restrictions.

SWMU#	Restricted Access	Protective Clothing Required	Limited Construction Activity
1	Yes	Yes	Yes
2	Yes	Yes	Yes
5	No	No	Yes
6	Yes	Yes	Yes
7	Yes	Yes	Yes
8	No	No	Yes
14	Yes	Yes	Yes
17	No	No	Yes
22	No	No	Yes
25	Yes	Yes	Yes
29	No	No	Yes
34	No	No	Yes

3.6 SWMU #8, OIL SLUDGE PIT AREA. Oil sludges produced from various industrial processes in NSY were disposed of in three unlined pits during the period of 1944-1977. Two of the pits were filled before 1955. The remaining pit was filled in 1974.

Ninety-three test borings were drilled in this area in 1982. Many found free-floating oil, particularly in the southwestern portion of the area overlying one of the three pits. The thickness of free-floating oil detected ranged from two to four inches over this unit at the time and attenuated rapidly with distance from the unit.

3.6.1 Soil Sampling. Soil sampling, per se, is not planned for the RFI. Apart from the free-floating oil plume overlying one of the old oil pits, very little oily contamination was found in the 1982 study. Oily residues were found in some borings associated with the other two units but these were limited in extent and had ceased by then to release oil as a separate phase to the groundwater surface. It appears likely that dissolved decomposition products continue to be released from these two older units to the groundwater. However, due to the minimal gradient and low hydraulic conductivity, flow into nearby surface waters could not produce impacts to either human health or the environment. Since the surficial aquifer is not used at NSY and does not exist downgradient, there can be no impacts directly from groundwaters. If necessary, a deed restriction on groundwater use will be recorded. Given time, residuals trapped in soils will biodegrade. Since remediation of low level oily residues in soils at the site would produce no benefit, delineation of such soils is not planned.

3.6.2 Groundwater Sampling. Groundwater sampling planned for the RFI is not sampling of waters but of the water table surface. Ten borings will be made to a depth of 3 to 5 feet below the water table at the locations shown on Figure 3-6. Three of the locations are within the 1982 plume boundaries. One is upgradient of the 1982 plume and six are downgradient. Cuttings from each boring will be examined by the geologist in charge to determine if it is probable that the boring will stay open once the augers are removed. If there is a significant risk of the boring collapsing, well-screen will be inserted before the augers are removed.

Each boring will be examined for the presence of oil as a separate phase floating on the water table. If free-oil is found where it was found in 1982 and no other place, this finding will be reported and a remedial design will be proposed. Current plans are to limit remediation to removal of free-oil. If free-oil is not found where it was in 1982 or if it is found elsewhere, additional borings will be made as necessary to delineate any currently existing plumes or demonstrate that none now exists in the area.

3.6.3 Temporary Land Use Restrictions. The site's activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with proper preventive measures to prevent release of groundwater contamination.

3.7 SWMU #14, CHEMICAL DISPOSAL AREA. The chemical disposal area is located at the southern end of NSY in the vicinity of the skeet and pistol ranges. Within this general area, the precise locations of disposals are unknown. Waste materials are thought to have been buried in drums, but may include bagged or bulk wastes.

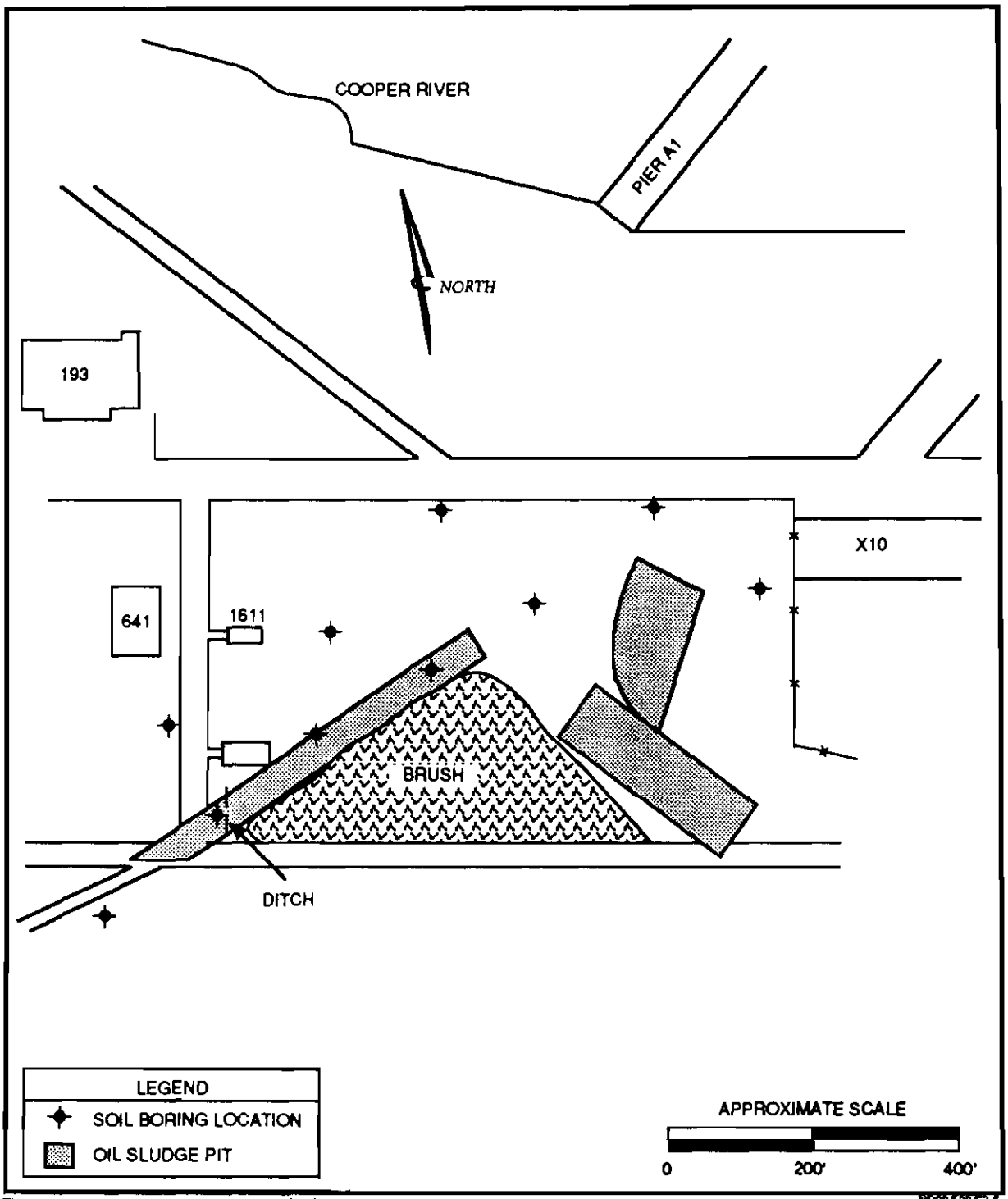

Figure 3-6. Proposed sample locations at SWMU #8.

3.7.1 Geophysical Surveys. Geophysical techniques will be used at SWMU #14 before initiation of the boring and sampling program. The purpose of the geophysical surveys is to find buried metal, areas where dissolved ions have altered the electrical conductivity of groundwaters, and patterns of differential disturbance of area soils. Results of the geophysical surveys will be used to plan the boring and sampling program, obviate the need for boring on a closely spaced grid and taking a correspondingly large number of samples for laboratory characterization.

First, a resistivity survey will be conducted on a grid spacing to be field determined but sufficiently close-spaced to characterize the uppermost ten feet of soils. Deeper burials can be ruled out by the shallowness of the water table. Following the resistivity survey, a magnetic survey will be conducted. A variable grid spacing will be used for the magnetic survey with tighter spacing in areas where conductive irregularities or anomalies have been found by the resistivity survey. In addition, tighter spacing will also be used to characterize magnetic anomalies. Although wider spacing may be used in some areas, the distance between transects will be kept low enough to detect a buried 55 gallon drum or several 5 gallon pails.

3.7.2 Soil Sampling. The purpose of this portion of the investigation is to characterize and delineate soil contamination. The scope of this work element is dependent on findings of the geophysical surveys. For the purposes of scheduling, 25 soil borings are estimated with the collection of three discrete samples from each boring. Sampling is anticipated to be performed using the hand auger method. Laboratory testing of soil samples will be field determined and will include, at a minimum, EPA methods 8240 and 8250 (volatiles, base/neutrals and acid extractables), possibly with a library search, and probably including additional assays for metals, pesticides and PCBs and/or cyanide. When assay results are compiled, they will be reported along with the geophysical results and proposed remedial activities.

3.7.3 Groundwater Sampling. The potential for constituents to migrate from this site is limited. The hydraulic gradient is essentially flat, the hydraulic conductivity of the water bearing unit is low, and constituent concentrations would likely be attenuated by the high clay and organic content of the soil. Groundwater at the site has already been studied and only a handful of constituents have been detected. Concentrations of these constituents, though in some cases high enough to render the water nonpotable, are low enough to pose no other threat to human health or the environment. In addition, there are no groundwater users either at the site or downgradient and a deed restriction on groundwater use may be recorded. Therefore, no additional groundwater monitoring is planned under the RFI at this time.

3.7.4 Temporary Land Use Restrictions. The site's activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with the proper protection to prevent physical contact with the contaminants. Limited access to the area should be enforced until remedial activities have been completed (Table 3-3).

3.8 SWMU #17, OIL SPILL AREA. This spill occurred in June 1987 when an underground pipe ruptured supplying No. 2 diesel fuel to the boiler in Building No. FBM61. Some samples collected during remediation of the spill were contaminated with PCB's. The location of samples with PCBs and their concentrations indicate that the source of the PCBs is beneath Building FBM61. There is insufficient information to estimate the distribution of concentrations in the contaminated zone or the total mass of contaminants.

3.8.1 Soil Sampling. Due to the location of the contamination (primarily beneath Building FBM61), a comprehensive soil sampling program is not possible. However, soil samples will be collected at the locations of the proposed monitor wells using the soil sampling protocols described in Section 4.4.1. Nine discrete soil samples will be collected and assayed for PCBs.

3.8.2 Groundwater Sampling. The migration potential of PCBs at SWMU #17 is limited. The hydraulic gradient is relatively flat, the hydraulic conductivity of the water bearing unit is low, the contaminated area has an impermeable cover consisting of the building and surrounding paved areas, and PCB's bind tightly to soils, especially those with a high native organic content. Under these circumstances, it is reasonable to assume that any contamination beneath the building will remain there virtually indefinitely. It is therefore proposed that characterization and remediation of PCBs beneath building FBM61 be deferred during the useful life of the overlying structure or until technologies are developed for dealing with such contamination without compromising the integrity of the building. In order to guard against unexpected contaminant movement and detect it should it occur, monitoring wells will be installed around the building. since the potential for advective transport is essentially zero and three wells would be sufficient to detect transport by diffusion, three wells are planned for installation. The wells will be installed and sampled using the protocols described in Section 4.4.2. Samples will be analyzed for PCB's. Wells will be located as shown in Figure 3-7. No further remedial action at this unit is planned until the building is demolished or until PCB's are detected in the groundwater. Monitoring is recommended to be performed annually until final closure.

3.8.3 Temporary Land Use Restrictions. The site's activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with the proper protection to prevent physical contact with the contaminants.

3.9 SWMU #22, THE OLD PLATING SHOP WASTE TREATMENT SYSTEM. As described in Section 2.22, this unit will be further investigated during the sample investigation and remedial activities planned for SWMU #25, the old plating operation.

3.10 SWMU #25, OLD PLATING OPERATION, BUILDING 44. The old plating operation will require a phased approach to delineate contamination, and decontaminate and restore the building for reoccupancy. This unit requires an investigation of the interior surface area, concrete floors, subsurface soils inside and outside the building, and groundwater monitoring. Analytical data gathered on SWMU #22 will be incorporated into the workplan. No prior investigations have been performed for SWMU #25. Metals contamination is suspected on the building interior surfaces, and floor and in subsurface soils. The sampling investigation for this unit will require wipe, concrete core, subsurface and groundwater samples to delineate the site. Figure 3-8 presents proposed sample locations.

The concrete floor inside the building has deteriorated and the condition of the floor drain piping is questionable. The potential for contaminant migration to groundwater is high, especially with the extreme pH conditions. All plating operation equipment is scheduled to be removed by a contractor, before the investigation begins.

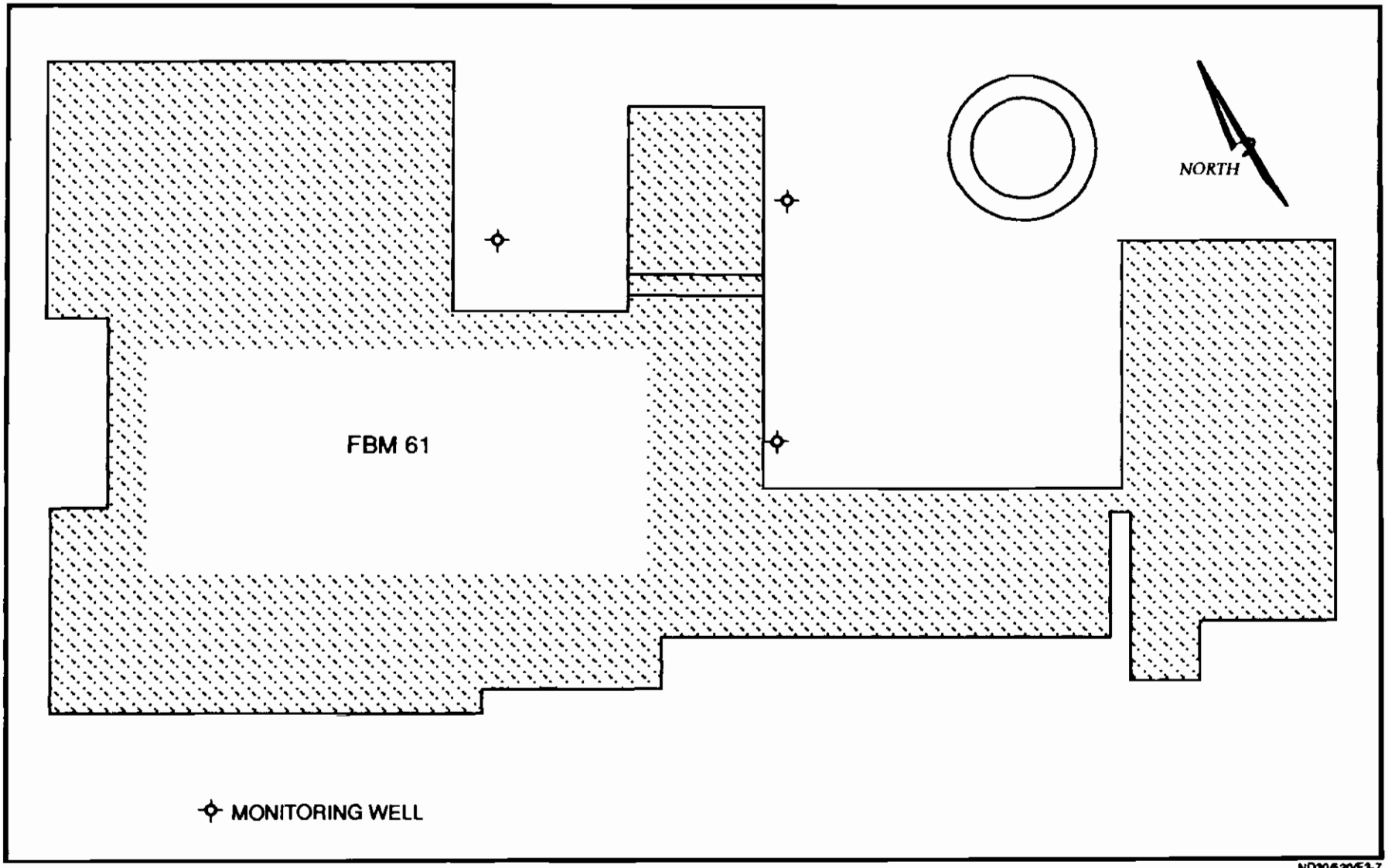

Figure 3-7. Proposed monitor well locations at SWMU #17.

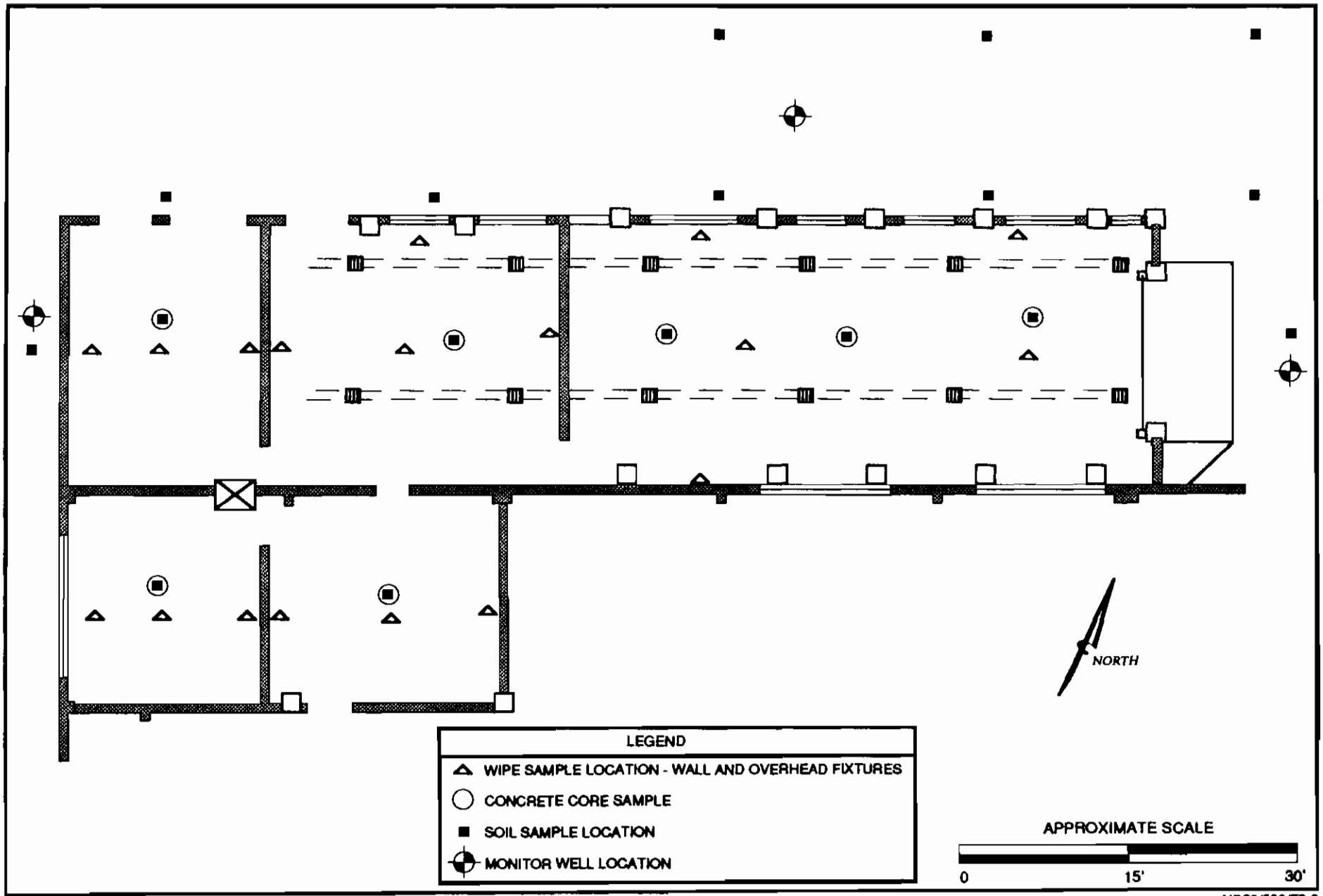

Figure 3-8. Proposed sample and monitor well locations at SWMU#25.

3.10.1 Wipe Sampling To determine if the interior building surfaces are contaminated with residual metals, wipe samples will be collected from the walls and overhead fixtures. A total of 19 wipe samples will be collected and analyzed for chromium, cadmium and cyanide. Results of the wipe samples will be used to calculate the effort required to decontaminate the building by pressure washing methods, and help establish acceptable clean up standards.

3.10.2 Core Samples. Concrete core samples will be collected inside Building 44 to delineate the potential for vertical migration of metals contamination into the concrete. Seven four-inch diameter core samples are proposed to be cored through the concrete. The cores will be divided into two-inch sections and pulverized for analysis. The maximum number of samples to be analyzed is 14. Samples will be analyzed for the eight RCRA metals and cyanide.

3.10.3 Soil Samples. A hand auger will be used to collect subsurface soil samples, beneath the concrete, from the seven four-inch diameter holes. A three-inch diameter hand auger will be utilized to collect soil samples at one foot intervals to a depth of four feet unless ground water is encountered first. Laboratory analysis will be performed first on the near surface samples and continue with deeper samples unless non-detectable levels are obtained.

The subsurface soils around the exterior areas of building 44 will also be sampled. Ten additional sample locations will be selected around the northern and eastern perimeter of building 44. Subsurface soil samples will be collected beneath the asphalt to ground water. The total estimated number of interior and exterior subsurface soil samples to be collected is 68.

3.10.4 Groundwater Sampling. Installation of wells and monitoring of groundwater at SWMU #25 and the associated waste treatment system, SWMU #22, are recommended under this RFI Workplan. The potential for constituents to migrate from the site is somewhat higher than at previously identified units. Even though the hydraulic gradient is nearly flat and hydraulic conductivity is low, metals in reduced pH (<5) conditions are more mobile than under higher pH conditions. The age of the plating operation and conduits for transport via the floor drain piping suggest a potential for significant contamination which warrants groundwater testing. Three groundwater wells will be installed and sampled using the protocols described in Section 4.4.2. Samples will be analyzed for the eight RCRA metals and cyanide. Proposed well locations are identified in Figure 3-7.

3.10.5 Temporary Land Use Restrictions. Access has been restricted in the plating operation area since the operation was shut down. The area between building 44 and the waste treatment system tank is an industrialized area of the CIA. Temporary land use restrictions should be implemented to restrict any utility construction between the units and minimized construction near these two areas.

3.11 SWMU #29, BUILDING X-10. As described earlier, the area south of Building X-10 was used as a waste accumulation area for submarine maintenance and repair. Although the site is almost entirely covered with asphalt, signs exist that spillage may have impacted soil and grassy areas surrounding the site. A sample investigation is proposed for this unit. SWMU #34 will be incorporated into this investigation as well.

3.11.1 Soil Sampling. Ten locations have been selected to collect subsurface soil samples as shown in Figure 3-9. Hand augered samples will be collected at one foot intervals at each location to a depth of five feet. The ten samples collected from the surface to one foot soil horizon will be split for grab and composite sample analysis. Ten subsamples will be divided and combined into three distinct composites based on location. The remaining (grab) subsurface samples will be temporarily archived at 4°C. The three composite groups will then be assayed for volatile organics, semi-volatile organics, total metals and PCBs.

If contamination is present, then an analyte or analytes will be selected and the grab samples will be assayed. Analysis will begin with near surface samples and progress downwards. Analysis for each sample location will be discontinued if results are non-detectable. The total number of composite samples is three. The maximum number of grab samples analyzed for a particular contaminant is 50.

3.11.2 Groundwater Sampling. No groundwater sampling is proposed for this site. Because historical data is not available, until preliminary sample data is completed, installation of monitor wells is not warranted.

3.11.3 Temporary Land Use Restrictions. The site's activities should be limited to those which do not disturb the soil or groundwater. Utility construction should be minimized and conducted with proper preventive measures to prevent release of groundwater contamination.

3.12 SWMU #34, MWR, SOUTHWEST OF BUILDING X-10. As described earlier, this former waste accumulation area will be included in the sample investigation performed for SWMU #29, the area behind building X-10.

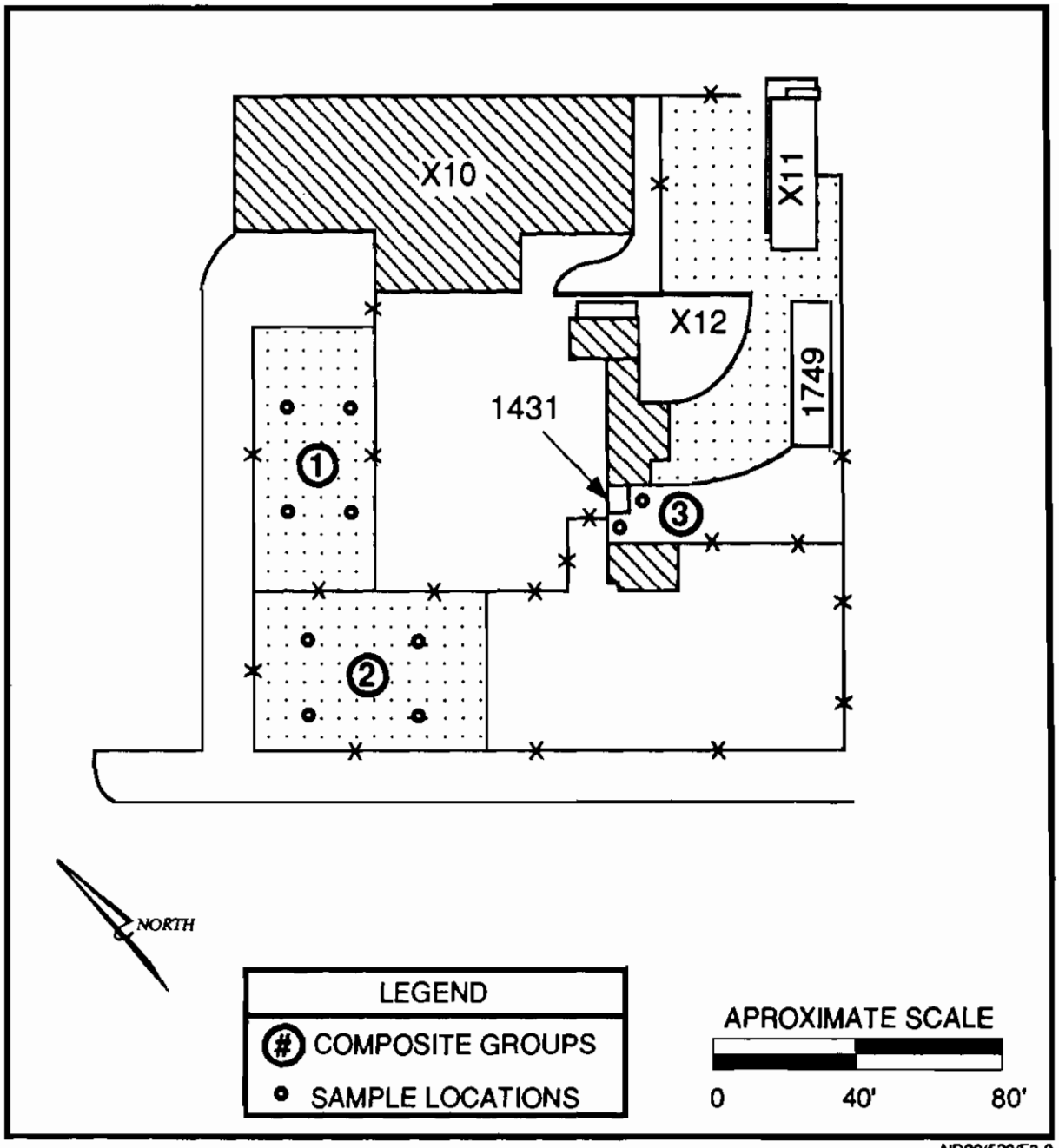

Figure 3-9. Proposed sample locations at SWMU #29.

CHAPTER 4. QUALITY ASSURANCE/QUALITY CONTROL PLAN

The following sections describe methods to be utilized to assure collection of usable data for the RFI. Elements of this program include project organization, sampling protocols, laboratory protocols, and quality control checks.

4.1 PROJECT DESCRIPTION. The RFA and its Addendum for the NSY identified 35 SWMUs. Twelve of these units require further investigation. These units are:

- the DRMO building 1617 (SWMU #1);
- the lead contamination area (SWMU #2);
- the battery electrolyte treatment area (SWMU #5);
- the public works storage yard (SWMU #6);
- the transformer storage area (SWMU #7);
- the oil sludge pit area (SWMU #8);
- the chemical disposal area (SWMU #14);
- the oil spill area (SWMU #17);
- the old plating shop waste treatment area (SWMU #22);
- building 44 old plating operation (SWMU #25);
- building X-10 (SWMU #29)
- SW of building X-10 (SWMU #34).

Section 2.6 describes the types of hazardous materials likely to be encountered at each unit.

To characterize the nature and extent of contamination, soil and groundwater samples will be collected. Sampling protocols and number of samples to be collected are described in this QA/QC plan. The rationale for particular kinds of sampling are discussed in Sections 2.0 and 3.0 of this RFI Workplan.

4.2 PROJECT ORGANIZATION AND RESPONSIBILITIES. This section describes project organization, lines of authority and responsibility of various personnel for particular tasks and quality assurance on the project. Figure 4-1 is a project organizational chart.

4.2.1 Project Manager. The project manager will be responsible for overall supervision and all administrative duties related to the project. Besides directing overall RFI activities, he will be responsible for ensuring full compliance with this QA/QC plan, the health and safety plan, and state and Federal regulations. He will have final authority over and responsibility for all activities conducted in connection with various phases of the RFI and will provide lines of communication between WAPORA, the NSY project manager, DHEC and EPA.

4.2.2 Project Hydrogeologist. The project hydrogeologist will be responsible for the activities of site personnel during well installation and sampling operations. He will report directly to the project manager and be responsible for assuring compliance with this QA/QC plan during the above operations. The project hydrogeologist will control submittal of collected samples to the laboratory for analyses.

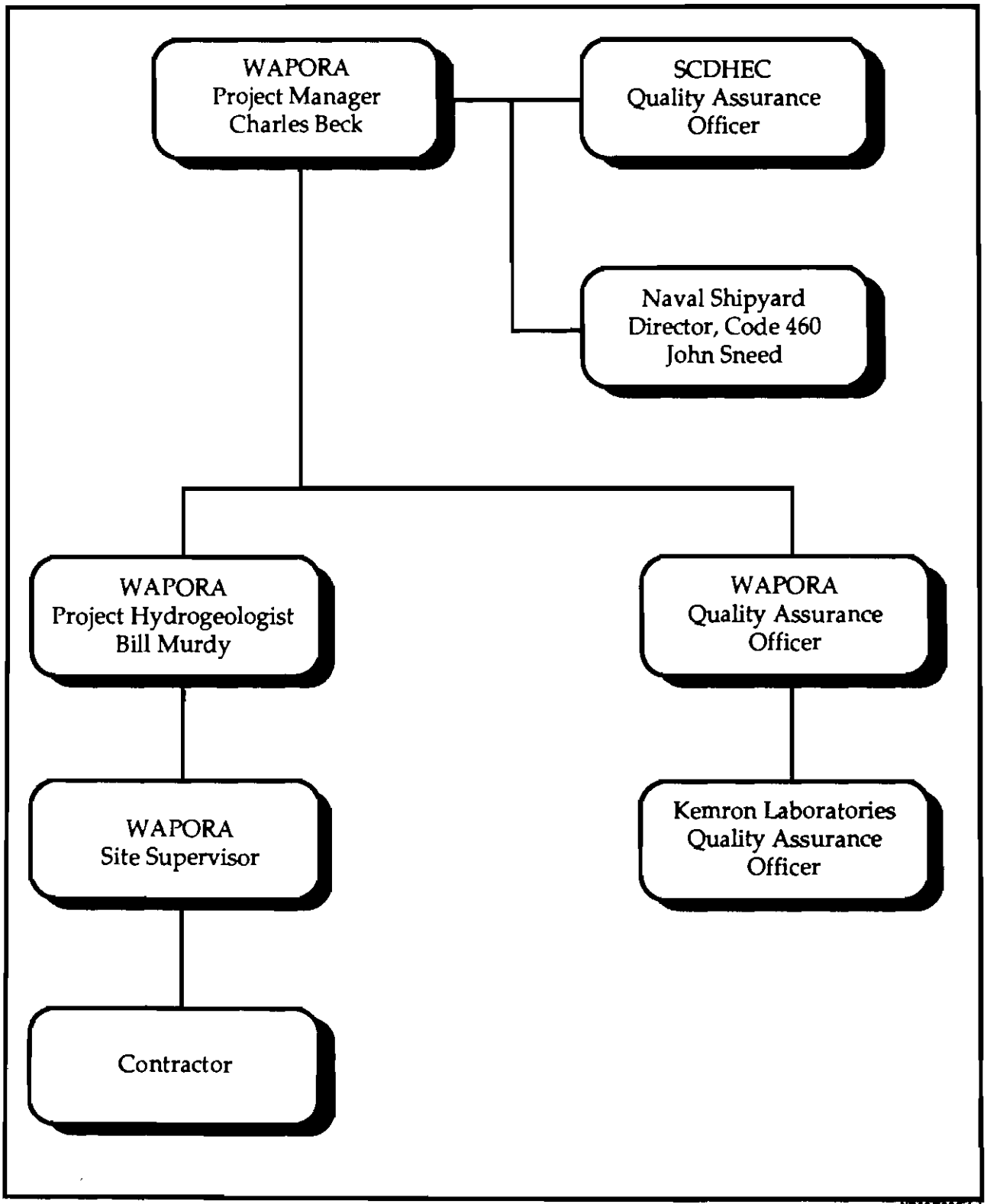

Figure 4-1. Project organization chart.

4.2.3 Project Quality Assurance Officer. The project quality assurance officer will be responsible for updating and reviewing compliance with program and site-specific QA/QC plans to assure that objectives of the plan are consistently met. He will review data recorded in the field log books and laboratory analytical data to validate conformity with standards set forth in the QA/QC plan. If changed conditions warrant, he will update this QA/QC plan to comply with DHEC and EPA guidelines.

4.2.4 Site Supervisors. Site supervisors will direct field teams under the overall direction of the project hydrogeologist. As site manager, each supervisor will be responsible for assuring that all QA/QC procedures are strictly followed by field technicians and all subcontractors under his direction. He will report any deviations from QA/QC procedures to the project hydrogeologist or quality assurance officer.

4.3 QA/QC OBJECTIVES AND PROCEDURES.

4.3.1 QA/QC Objectives. Data generated during the RFI will provide the basis for decisions on corrective measures or remedial responses at each site. Therefore, data collected during the investigation needs to be of sufficient quality to support subsequent decisions. In order to provide data that present a valid characterization of the situation for each SWMU, WAPORA and KEMRON (the laboratory selected to perform analyses under this project) have developed QA/QC procedures for the RFI at NSY. Implementation and enforcement of these procedures will assure the validity of data generated during the investigation. To specify the quality and quantity of data required to achieve the established goal, the data quality objectives (DQOs) have been established and used to design sampling and analysis plans, and to determine the appropriate level of QA/QC. The elements covered in the DQOs are laboratory selection, identification of the number of samples and their matrices, sampling schedules, constituents of interest, required analytical methodologies, detection limits, holding times, deliverables, levels of QA/QC, and turnaround of analytical results.

4.3.2 QA/QC Procedures. This section describes field Quality Assurance and Quality Control procedures. All personnel involved in this project will be required to read, understand, and comply with the procedures, methods, and protocols described in this section. The project manager, QA/QC officer and site supervisor will insure that field operations are conducted in accordance with these procedures in order to assure the validity of all data generated during field activities.

4.3.2.1 Documentation of Field Data. The site supervisor will see to it that the following information will be recorded in a site-specific field notebook:

- WAPORA site personnel and identity of any subcontractors
- Sample identification number
- Sample location and depth
- Date, time and method of sample retrieval
- Sample type (grab or composite)
- Sample description and classification (for soils)
- Sample preservative
- Sampler

- Weather conditions
- QA/QC sample designations (trip, field, or equipment blanks and duplicates)
- pH, conductivity, and temperature readings of water samples
- Organic vapor concentration readings from boreholes, wells or headspace analysis
- Static well water levels
- Monitoring well depths
- Volume of well water purged prior to sampling

4.3.2.2 Decontamination Procedures. This section describes procedures for decontamination of field equipment. Drilling augers are cleaned using a steam or hot water pressure washing system. Sampling tools such as split-spoons, stainless steel trowels, bailers, and groundwater pumps should be decontaminated using the following procedures:

Field Cleaning Procedures for Teflon and Stainless Steel Equipment Used to Collect Samples for Organic Compounds and Trace Metals Analyses

1. Clean with tap water and laboratory grade detergent (Alconox or equivalent) using brush if necessary to remove particulate matter and surface films.

2. Rinse thoroughly with tap water.

3. Rinse with 1 to 1 reagent grade nitric acid, HNO_3, but only if trace metals are to be sampled. The acid rinse should not be used on stainless steel sampling equipment (bailers, augers, trowels, etc.).

4. Rinse thoroughly with deionized water.

5. Rinse twice with pesticide grade or nanograde methanol or isopropanol.

6. Rinse thoroughly with analyte-free (usually organic-free or metal-free) water and allow to air dry as long as possible.

7. If analyte-free water is not available, allow equipment to air dry as long as possible.

8. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is to be stored or transported.

4.3.2.3 Preparation of Quality Control Samples. An integral component of a field QA/QC program is the use of trip blanks, field blanks, equipment blanks, and sample duplicates. A trip blank consists of a VOA vial filled with analyte-free water prepared in the laboratory. The trip blank is placed undisturbed in a cooler with samples retrieved during the day. The bottle is listed as a trip blank on the chain-of-custody form. At least one trip blank should accompany every shipment of water or soil samples from the field to the laboratory. The purpose of a trip blank is to detect potential contamination of samples from volatile organic compounds at any point during sample bottle shipment or storage activities.

A field blank is prepared in the field using analyte-free water. One field blank should be prepared for each parameter being sampled and placed into appropriate coolers prior to retrieval of monitoring well samples. The field blank frequency should be one per every 20 samples or one per sampling day. The purpose of a field blank is to determine if cross-contamination of samples is occurring during retrieval and storage in the field. It also serves as an additional check on laboratory QA/QC.

An equipment blank should be prepared periodically if non-dedicated sampling equipment is utilized. An equipment blank consists of rinse water collected after the final stage of equipment decontamination. The purpose of an equipment blank is to determine the adequacy of field decontamination procedures.

Duplicates should be prepared for both soil and groundwater samples at a ratio of about 1 for every 20 samples. The samples may be labeled as a duplicate or may be packaged as a blind duplicate with the identity of the sample not revealed on the chain-of-custody form. The purpose of duplicate samples is to check the accuracy and precision of laboratory analytical data.

4.3.3 Laboratory QA/QC Procedures. KEMRON's Quality Assurance Officer will direct analytical procedures so that they strictly follow the KEMRON QA/QC program to assure the accuracy and precision of analytical results. The QA/QC analytical procedures include:

- Appropriate sample storage;
- Appropriate sample preparation methods;
- Appropriate analytical methods;
- Appropriate calibration and analytical procedures;
- Data handling, review, and reporting; and
- Internal QA/QC control.

All these procedures are detailed explicitly in KEMRON's QA/QC manual and only briefly referred to here. KEMRON Laboratories is a certified Contract Laboratories Program (CLP) analytical laboratory. Its QA/QC manual, too lengthy to review here, complies with the CLP Statement of Work and is on file in USEPA's Contract Laboratories Program Office.

4.4 SAMPLING PROTOCOLS. During the RFI, soil and groundwater samples will be collected for chemical analysis. This will be accomplished by a variety of methods including soil test borings, hand auger borings, and monitor wells. An estimated 116 soil and water samples will be collected not including QA/QC laboratory samples. This number may have to be substantially enlarged depending on findings at particulate SWMUs.

4.4.1 Soil Test Borings. Soil test borings will be placed in areas of suspected or potential contamination at SWMUs #8, #14, and #25 as described in Section 3.0 of this RFI Workplan and may become necessary at any of the other SWMUs. Each boring will be advanced by hollow

stem auger techniques using either 3 ½-inch or 6 ¼-inch inside diameter augers. Soil samples will be collected ahead of the augers by use of a previously cleaned split barrel sampler. The first sample will be collected from 0.0 to 0.5 feet below the ground surface. Additional samples will be collected at five foot intervals from 3.5 to 5.0 feet, 8.5 to 10.0 feet, etc. or as necessary by professional judgement. The sampler will be driven by a 140-pound hammer falling 30 inches following ASTM D-1586. Each sample will be visually examined and logged by a site geologist. Representative samples will be placed into appropriate containers.

During the drilling operations, an OVA or HNu will be used to monitor organic vapors in the breathing zone and near the auger cuttings. ("OVA" and "HNu" are trade names for vapor analyzers using flame ionization and photo-ionization detectors, respectively). Individual soil samples will be monitored using the head space technique to locate possible contamination areas.

The soil test boring operations will be performed in level "C" health and safety protection. After completion of each boring, drilling equipment will be decontaminated.

4.4.2 Monitoring Well Construction. Six monitoring wells will be constructed at the locations identified in Section 3.5 of this RFI Workplan. Each monitoring well will be drilled using 6 ¼-inch hollow stem augers using the techniques described above for soil borings. The total depth of each well will vary depending on site conditions. Each will penetrate the water table at least ten feet. Each well will include a 10 foot long, 2-inch I.D. schedule 40, PVC screen with 0.010 inch slot. Both screen and casing will be inserted through the auger. Sand pack will consist of 10-30 silica sand washed into the annular space by tremie pipe and extended 0.5 feet above the screened interval. Once the sand is placed, a minimum of a 2-foot bentonite pellet seal will be placed above the sand pack. The placing of both the sand pack and bentonite seal will occur in increments of two feet or less, with the augers withdrawn in similar increments. After placing the bentonite seal, the augers will be withdrawn and the remaining annular space will be grouted by tremie pipe using a 5%, $\pm$ 1%, bentonite and neat cement mixture.

Each monitoring well will be completed with a 6-inch locking protective steel surface casing with locking cover. The casing will be marked with the international symbol for monitoring wells.

4.4.3 Groundwater Sampling. Groundwater samples will be collected from the monitoring wells approximately one week after well construction. Each well will be fully developed by surge and bailing. During the development process, pH and conductivity will be measured. Each well will be considered developed when pH and conductivity have stabilized and the water is free of silt.

Prior to sampling, each well will be purged of 3 to 5 well volumes. Both pH and conductivity will be measured to verify the adequacy of the purging. Individual samples will be collected using dedicated teflon bailers. Each sample will be placed into the proper prelabeled container. Pertinent data will be recorded in the field log and chain-of-custody protocols will be maintained.

4.4.4 Hand Auger Borings. Standard hand auger borings will be drilled to shallow depths at selected locations at SWMUs #2, #5, #6, #7, and #14, #25, and #29 by use of a previously cleaned 3-inch stainless steel hand auger. Borings will be advanced through 6-inch intervals. Soils will

be described and representative samples retained. Borings will be terminated at or slightly below the water table.

One or more laboratory samples will be collected from each boring as required with each sample placed in an appropriate container and labeled accordingly. The extent of contamination also will be evaluated in the field by visual and OVA/HNu examination. A two person sampling crew will be utilized during the collection of the soil samples. All samples will be properly packed with chain-of-custody documentation and shipped to KEMRON Laboratories for analysis.

4.5 SAMPLE CUSTODY. Strict chain-of-custody procedures will be followed by all personnel. Possession and handling of samples will be recorded from the time of collection through analysis and final disposition. An example of WAPORA's chain-of-custody form is shown in Figure 4-2.

Cleaned sample containers will be securely packed, sealed, and delivered to WAPORA by KEMRON. The package will be opened by authorized personnel only at which time a preprinted label will be affixed to each container. Chain-of-custody forms will be filled out immediately after sample collection. Information such as sample ID number, types of sample (composite/grab), date and time of sampling, sample location, sampler, constituents to be analyzed, and special analytical requirements. The chain-of-custody form will be signed by the site supervisor upon completion of the sample collection. A copy of the form will accompany the sample. Samples, packed with ice when necessary, will be shipped to the laboratory via overnight delivery.

4.6 CALIBRATION PROCEDURES.

4.6.1 Field Equipment. Equipment anticipated to be used includes an organic vapor analyzer (OVA), HNu, portable pH meter, and portable conductivity meter.

The OVA will be checked before each field use. The battery charge and possibility of leaks will be checked. The instrument will be calibrated with a gas of known concentration prior to startup and recalibrated monthly.

The HNu will have the battery, lamp, and fan checked before each field use. Isobutylene will be used as the calibration gas before each day's field use. The probe will be cleaned or replaced as needed.

Portable pH meters will be checked daily before use for mechanical and electrical functions. The meter will be calibrated with two buffer solutions (pH 4 and 7) before sampling. The buffer solution will be changed daily.

Portable conductivity meters will be checked daily. Batteries will be checked and internal calibration procedures followed using the manufacturer's guidelines.

4.6.2 Laboratory Equipment. The laboratory calibration procedures for analytical instruments will be in accordance with KEMRON Laboratories' QA/QC Plan.

VAPORA Environmental Engineers/Scientists

CHAIN-OF-CUSTODY RECORD

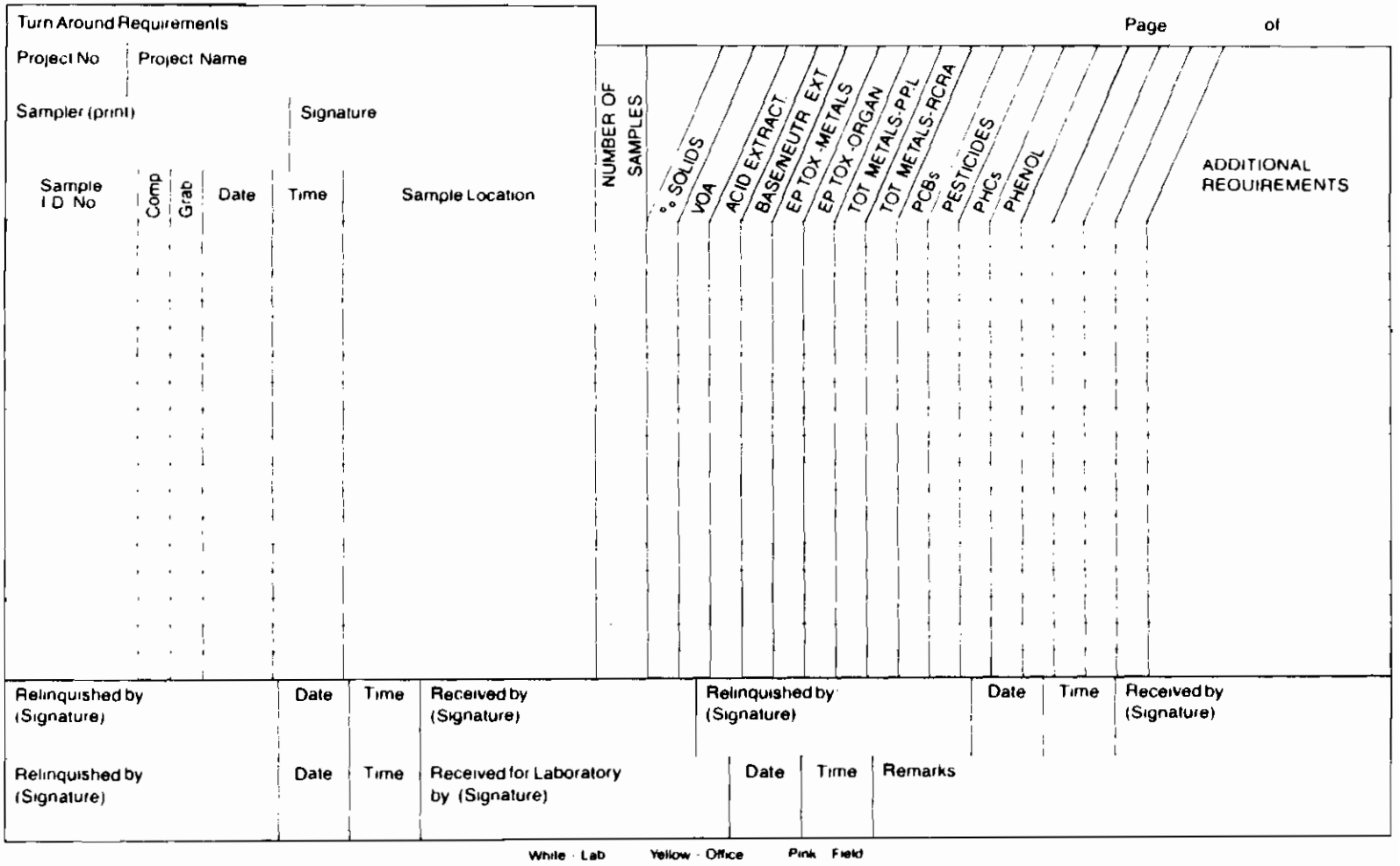

Figure 4-2. Chain-of-custody form.

4.7 ANALYTICAL PROCEDURES. The analytical procedures for various constituents of interest are described in detail in KEMRON's QA/QC Plan. Specific EPA analytical procedures to be used during this project are shown in Table 4-1.

4.8 DATA REDUCTION, VALIDATION, AND REPORTING. Data transfer, reduction, validation, and reporting are primarily functions of the analytical laboratory. The project manager generally provides an interpretation of the data based upon site conditions and characteristics. These interpretations may include utilizing acceptable statistical techniques. The project manager will assist the laboratory in data validation by checking and interpreting the results of field blank and duplicate analyses.

Laboratory procedures for data reduction, validation, and reporting are described in KEMRON's QA/QC Plan. These procedures follow those given in each of EPA's approved methods (40 CFR Part 136).

Sample locations will be reported graphically and assay results will be tabulated for each site. Because of the nature of the samples to be taken, no statistical or trend analyses are to be performed for this project.

4.9 INTERNAL QUALITY CONTROL CHECK. The intralaboratory control program is a continuing, systematic, in-house regimen intended to ensure the production of analytical data of continuing high validity. Its functions are:

- To provide a measure of the precision of analytical methods;
- To maintain a continuing assessment of the accuracy and precision of analysts within the laboratory group;
- To identify weak methodology and provide a continuing source of research into problems aimed at overcoming deficiencies;
- To provide a permanent record of instrument performance as a basis for validating data and projecting repair or replacement needs;
- To detect training needs within the analytical group; and
- To upgrade the overall quality of laboratory performance.

The intralaboratory control checks for analytical work are described in KEMRON Laboratories' QA/QC Plan.

4.10 PERFORMANCE AND SYSTEM AUDITS. A system audit is a qualitative evaluation of all components of the measurement systems to determine their proper selection and use. After systems (procedures) are operational and generating data, performance audits are conducted periodically to determine the accuracy of the total measurement system. The performance and system audits of analytical works are stated in KEMRON Laboratories' QA/QC Plan.

Table 4-1. EPA analytical methods for constituents of interest.

Soils	
Parameter	Method
PCB's and Organochlorine Pesticides	8080
Volatile Organics (GC/MS)	8240
Semi-volatile Organics (GC/MS)	8250, 8270
Organophosphorus Pesticides (GC)	8140
Total Metals (Atomic Absorption)	7040-7950
Extractable Lead	7420, 7421
Groundwater	
Parameter	
Total Lead	239.2

4.11 PREVENTIVE MAINTENANCE. The purpose of preventive maintenance for analytical instrumentation, field devices, and instrumentation is to assure normal operation of the equipment. The OVA and HNu used during drilling operations and site investigation will be recharged overnight to prevent downtime. Conductivity and pH will be rinsed with distilled water between measurement and stored in distilled water overnight. Analytical instruments will be maintained according to manufacturer's specifications. The process is referred to in KEMRON Laboratories' QA/QC Plan.

4.12 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS. Analytical performance measurements are described in KEMRON Laboratories' QA/QC Plan.

4.13 CORRECTIVE ACTION. The purpose of WAPORA's internal corrective action protocol is to investigate and resolve any quality control problems related to field sampling procedures, sample custody, and sample analysis such as identification of contaminated field or laboratory trip blanks. In the event of a QA problem, the WAPORA quality assurance officer will review the sampling procedures utilized in the field to determine whether the sample integrity was compromised. The investigation will include interviews with the site supervisor and other site personnel, review of field notes, and examination of chain-of-custody documents. WAPORA's project quality assurance officer will also coordinate with KEMRON Laboratories' quality assurance officer concerning any incident of questionable analytical results or internal QC data. He will work with the laboratory staff to resolve any problems and implement appropriate corrective action. WAPORA will subscribe to any corrective action deemed necessary by DHEC, EPA, or NSY QA offices.

The internal laboratory corrective action procedures for analytical work are described in KEMRON Laboratories' QA/QC Plan.

4.14 QUALITY ASSURANCE REPORTS TO MANAGEMENT. The WAPORA project quality assurance officer will report to the WAPORA project manager concerning the performance of measurement systems and data quality. The final contamination assessment report will include a separate QA section summarizing all data quality information, significant quality assurance problems, if any, recommended solutions, and the outcome of any corrective actions. A copy this report will be forwarded to the DHEC, EPA, and NSY QA offices.

WAPORA also will compile laboratory quality assurance reports and include them in its report. The nature and content of laboratory QA reports are described in KEMRON Laboratories' QA/QC Plan.

CHAPTER 5. DATA MANAGEMENT PROCEDURES

The objective of this portion of the RFI Workplan is to describe methods WAPORA will utilize throughout the RFI project to manage collected data.

5.1 GENERAL DOCUMENTATION PROCEDURES. Each field team will have at least one person, generally the site supervisor, who is thoroughly familiar with the appropriate documentation procedures. This person will personally perform or will directly oversee the completion of the documents which accompany the task. Documentation tasks will be performed on a sample-by-sample or item-by-item basis throughout the day. However, items such as shipping containers and sample tags will be prepared in advance.

5.2 FIELD DOCUMENTATION. Sample possession will be traceable from the time the sample is collected to its delivery to the laboratory. In order to identify samples and manage the information, samples will be numbered sequentially by SWMU site and type (i.e., soil, groundwater, etc.).

The following sections describe records and forms to be used to provide documentation and quality control.

5.2.1 Field Log Books. Permanently bound field notebooks will be used to record data and activities performed at each SWMU site. Entries will be described in as much detail as practical. Each notebook will be identified by the project specific document number. The notebook cover will include: project name and number, book number, start and end dates, and the name of the field team whose activities are recorded in the book.

At the beginning of each entry, the date, start time, weather, field personnel present, and activity will be recorded. Additional entries may include geologic logs, drilling records, sample records, and such other data as may be appropriate. Each entry will be initialled by the person making the entry.

5.2.2 Sample Tags. Sample tags will be filled out and attached to each collected sample prior to the time of collection. Label information will be recorded in the Field Log Book as a cross-reference at the time of collection.

5.2.3 Chain-Of-Custody Records. The chain-of-custody record will contain a summary of the contents of the shipment, dates, times, sample numbers, tag numbers, number and volume of containers, and signatures for the transferral of samples.

5.2.4 Subsurface Boring Logs. The subsurface boring logs will be prepared as each boring is advanced. Items to be recorded include materials encountered, depth to water, obvious contamination areas, and any other necessary or appropriate information. A general log also will be recorded in the Field Log Book as a cross-reference.

5.2.5 Monitoring Well Schematic. The monitoring well schematic will provide a summary of pertinent monitoring well information including location, date drilled, drilling method, well depth, screen location, and construction data. A general log also will be recorded in the Field Log Book as a cross-reference.

5.3 OTHER RELATED DATA. Other related data will include illustrations, graphs, meeting summaries, audit reports, and laboratory results. This information will be compiled and reviewed for report presentation.

5.3.1 General Data.

Meeting Summaries, Telephone Conversations, and Notes

These will be recorded in the field notebooks along with the dates, time, and names of persons involved. These meetings and conversations will be available for photo copies if requested by the NSY project manager. Meetings and conversations with a substantial impact on the project will be described in a memorandum to the NSY project manager.

Illustrations, Computation, and Engineering Data

Original illustrations and graphics will be initialed and dated by the person originating the document. A second person will check these documents for completeness and needed corrections. All maps, calculations, and data will be reported or prepared to normally accepted standards and confidence levels.

5.3.2 Reports.

Progress Report

These will be written periodically by the project manager and include: number of samples collected, sites investigated, monitoring wells installed, deviations from approved field or laboratory procedures, if any, and other appropriate information. These reports will be directed to the NSY's project manager.

RFI Report

This report will be written following sampling and completion of laboratory testing. The report will consolidate and summarize the collected data and document the SWMU site evaluations. An initial draft report will be submitted for comment by the NSY, USEPA, and SCDHEC. Where appropriate, the comments will be incorporated into the final document.

Interim reports may be necessary or appropriate to describe significant divergence of site conditions from those anticipated, to secure concurrence on the need for emergency or interim corrective measures, or to gain regulatory input on unanticipated issues.

CHAPTER 6. IDENTIFICATION OF POTENTIAL RECEPTORS

Potential receptors of constituents released at NSY include users of the surficial aquifer, biota in adjacent surface waters and wetlands (primarily at locations where the surficial aquifer discharges to surface water) and NSY personnel. Potential exposure of NSY personnel is limited to DRMO personnel potentially exposed to airborne lead dust and personnel involved in excavation or similar construction-related activities who could be exposed dermally at any of several sites. Institutional controls are in place to prevent this. Additional, conceptually possible exposure routes and/or receptors might be addressed. For example: ingestion exposure of NSY personnel from soils or of off-site personnel through consumption of contaminated biota or of potential future users of the surficial aquifer. However, the risk of harm to such additional receptors or through such additional routes, can be calculated, using conservative assumptions and is well below the level of risk which prudent people guard against.

As discussed in Section 1.2 and elsewhere, the surficial aquifer at NSY is not used for any purpose, realistically cannot be made useable, and does not exist downgradient from NSY. Moreover, NSY can prevent future use of the surficial aquifer through the simple expedient of making a notation to that effect on its master engineering site plan. If required, a deed restriction on groundwater use could be recorded. In any case, while direct groundwater use is a potential exposure route, as an actual route it is remote under any sort of reasonable worst case.

There is no question, however, that groundwater from the surficial aquifer continuously discharges to wetlands and surface water bodies within and at the boundary of NSY. Significant impacts to potentially affected ecological communities can and should be eliminated. However, as discussed in Chapter 2, most conditions at NSY have no potential to significantly impact such communities due to the almost flat hydraulic gradient, low hydraulic conductivity and soil properties which prevent or attenuate movement of constituents. Where the potential for significant impacts could not be ruled out, additional investigation is planned and remedial measures may be necessary.

Similarly, there is a potential for exposure of NSY personnel via dermal or inhalation pathways. At SWMU #2, there is an apparent potential for chronic inhalation exposure of DRMO personnel to lead dusts. Although the risk is low due to the low volume of activity in the area and its intermittent character and medical surveillance has failed to detect lead accumulations in site workers, surface lead concentrations exceed generally applied standards, and in some locations, quite substantially. Consequently, this area is scheduled for interim corrective measures to eliminate the potential for inhalation exposure.

Lead contaminated areas are present at SWMU #6 as well, except the potential risk for dermal or inhalation exposure is extremely low. The lead contaminated areas are small localized hot spots and activity around this area is limited. This unit is addressed in the RFI process and is scheduled for remediation activities.

The highest potential risk for exposure via dermal or inhalation pathway is SWMU #25. The building contains the potential for heavy metal residues on the building's interior surfaces, the result of the old plating operation. To limit exposure in this area, the NSY has secured the

building allowing access only through proper authorization. The sample investigation addressed in the RFI Workplan will provide data necessary to design a building decontamination and remediation.

The potential for dermal exposure during earth moving activities is more remote but also more difficult to quantify. At SWMUs #5, #7, #14, and #29, peak constituent concentrations and their locations have not been identified, and at the latter, the identity of constituents has been insufficiently studied. These deficiencies will be addressed through the RFI process and necessary remediation will be proposed.

CHAPTER 7. HEALTH AND SAFETY PLAN

7.1 INTRODUCTION. This Health and Safety Plan (HASP) addresses health and safety concerns associated with site investigations at NSY. It covers all site investigators, other workers, Naval personnel, and the general public as required by the interim final rule covering work at RCRA sites (29 CFR 1910.120). The HASP describes standard operating field procedures. In addition, it includes available information on the site and on known or suspected contaminants. It sets required levels of protection, decontamination procedures, the locations of various zones of contamination, and provides other pertinent information giving greater particularity to standard procedures.

The purpose of this program is to assure adequate protection against known and potential hazards which may be encountered during RFI and ICM activities conducted at individual SWMU sites. Involved individuals must be familiar with standard operating procedures as well as any more specific instructions relevant to particular SWMUs as described in the HASP. These requirements for protecting the health and safety of involved individuals are applicable throughout the investigation and associated remedial activities.

The planned levels of protection are based on limited knowledge of the extent and magnitude of contamination in certain areas of the site, and are intended to be protective in the event that worst case conditions are encountered. The level of protection will be modified accordingly as more information becomes available and as conditions warrant. The project manager will have final authority to approve field activities and to establish personal protection levels for all field work as necessary. However, the project manager may delegate certain aspects of this authority to the ranking individual at particular sites as may be appropriate.

Achievement of HASP objectives requires that all involved personnel be adequately trained and familiarize themselves with the provisions described below regarding medical surveillance, safety practices, use of personal protective equipment, and procedures for field inspections and sampling operations, sample handling and shipping, etc. The program also provides procedures for contingencies which may be encountered during various phases of the site investigation. Lines of command are set out to deal with situations which may arise.

The HASP has been compiled to comply with existing requirements of the Occupational Safety and Health Administration (OSHA), the EPA, and state and local agencies for all activities to be conducted. Updated rules and regulations covering this portion of the RCRA facility investigation will be followed and incorporated as they become applicable.

The 12 sites where work will be conducted are described in sections 2.6.1, 2.6.2, 2.6.5, 2.6.6, 2.6.7, 2.6.8, 2.6.14, 2.6.17, 2.6.22, 2.6.25, 2.6.29, and 2.6.34. Additional information and a description of work to be performed is contained in sections 3.1 through 3.12. Project organization and lines of command are described in section 4.2.

7.2 POTENTIAL RISKS. A variety of potential risks will accompany implementation of the RFI. These include the general physical hazards associated with working out-of-doors and around heavy equipment. In addition, there are chemical exposure hazards which will vary from site to site. Anticipated hazards at particular sites are described below. Finally, there is

always the possibility of encountering unanticipated chemical or physical hazards when exploring the subsurface environment.

7.2.1 SWMU #1, DRMO Building 1617 and SWMU #2, Lead Contamination Area. Anticipated hazards in the lead contamination area include the chemical hazards of working around lead dust and lead contaminated water and the physical hazards associated with the interim corrective measures to be conducted. Until the corrective measures are completed, all surfaces in the area should be considered as lead contaminated. Soils adjacent to paved areas should be considered as lead contaminated until delineation is completed, and following delineation if test results so indicate.

During washing of the paved surfaces there will be the potential for creation of lead contaminated aerosols. Prevention of this is discussed in section 7.4.1. In addition, there will be physical hazards; the high pressure spray itself, slippery surfaces, and potential electrical hazards near power lines. Collecting and drumming the rinseate for transport to the treatment plant will involve the chemical exposure and physical hazards of pumping rinseate into drums and the physical hazards of handling drums.

7.2.2 SWMU #5, Battery Electrolyte Treatment Area. Chemical and physical hazards exist around the battery electrolyte treatment area. Lead and low pH levels in the soils around the waste acid treatment tank are anticipated hazards for this unit. An expanded soil sampling program increases the potential for chemical exposure when collecting samples in areas where contamination is undefined. Additional safety precautions are required around structures where above ground and underground utilities (gas, electric, or water) may service the area. Overhead power lines can also be dangerous not only to drill rigs, but field crews using long extensions on hand augers.

7.2.3 SWMU #6, Public Works Storage Yard. Anticipated hazards in the public works storage yard are the chemical hazards when working around lead contaminated soils and physical hazards associated with the remediation activities of contaminated soils.

7.2.4 SWMU #7, PCB Transformer Storage Area. All soils within the zone depicted in Figure 3-4 (within the sampling grid) should be considered to be PCB contaminated until delineation is completed, and following delineation where test results indicate.

7.2.5 SWMU #8, Oil Sludge Pit Area. Anticipated hazards in the oil sludge pit area are the physical hazards of working around a soil boring rig and the potential for chemical exposure to petroleum constituents and degradation products.

7.2.6 SWMU #14, Chemical Disposal Area. Anticipated hazards during the geophysical survey include the possible presence of snakes and the possibility of surface instability caused by corrosion of buried containers. If surface instability is encountered, there would be a potential for tripping or falling and a possibility for chemical exposure.

During the soil boring program, to be conducted in areas where the geophysical survey suggests chemicals may be buried, anticipated potential hazards include the chemical exposure hazards possible when boring into buried waste and the physical hazards of working around a drill rig.

Although current knowledge regarding this site suggests that there is no potential for encountering toxic or explosive gasses, workers during this phase of the investigation should assume such possibility exists until all borings have been completed.

7.2.7 SWMU #17, Oil Spill Area. During well installation and soil sampling, all groundwater and subsoils should be assumed to be contaminated with PCBs and petroleum constituents until laboratory assay results show otherwise. Other hazards anticipated during this work are the physical hazards associated with well drilling and installation.

7.2.8 SWMU #22, Old Plating Waste Treatment System and SWMU #25, Old Plating Operation. Anticipated hazards of working around contaminants from the plating operations in air, soils, and water media. Physical hazards associated with the sampling investigation involve collection of wipe samples from walls and overhead structures, coring concrete, and working around drill rigs during the installation of monitor wells. Underground and above ground utilities associated with the operation will also require detailed health and safety plans to ensure electrical and mechanical systems are tagged and locked out.

7.2.9 SWMU #29, Building X-10 and SWMU #34, SW of Building X-10. Anticipated potential hazards when hand augering into sediments where chemical contamination if present, is unknown. The physical hazards, depending on the climate, may include heat stress to workers when hand augering for long periods of time in protective clothing.

7.3 WORK ZONES. Work zones will be established by the project manager at each site to limit the spread of contamination and provide for the protection of site workers. An exclusion zone will be established (by flagging or roping off depending on the degree of potential hazard) enclosing all potentially contaminated areas. In the oil sludge pit area, the chemical disposal area, and the oil spill area, a separate exclusion zone will be established around each boring or well installation location. A decontamination zone will be established adjacent to each exclusion zone. The site supervisor will be responsible for ensuring that all support zone activities and equipment are kept out of the decontamination and exclusion zones. All movement between zones will be controlled by the site supervisor.

Special procedures will be necessary during the interim corrective measures work in the lead contamination area. Initially, the entire area will be considered an exclusion zone. The southern part of the paved area, where contamination is lowest, will then be washed in order to establish the decontamination zone and a support zone. Once other areas are cleaned, they can be removed from the exclusion zone so that DRMO personnel can reenter and resume operations. Cleaned areas will not be removed from the exclusion zone until it is clear that they will not be recontaminated by activities in adjacent areas.

7.4 PERSONAL PROTECTIVE EQUIPMENT AND SAFETY MEASURES. The following sections specify personal protective equipment to be used at each of the work sites and general safety measures for those sites. This section describes general measures applicable to all sites. The site supervisor may specify additional measures during the morning safety meeting and must specify additional measures at any time when in his judgement additional measures are warranted. Whenever existing measures may be inadequate to properly protect worker safety, the site supervisor will stop work and evacuate personnel until adequate measures can be

implemented. Additionally, work shall be stopped and personnel evacuated whenever explosive vapors are present in the vicinity of the work being performed above 20% of the LEL and whenever volatile organics are present in the breathing zone above 50 ppm as methane. Whenever explosive vapors are present above 10% of the LEL, non-sparking tools will be used. Whenever organic vapors in the breathing zone exceed 5 ppm as methane, all exposed personnel shall be in level C or level B respiratory protection. OVA monitoring will be conducted continuously during all boring and well installation procedures. Whenever organic vapors exceed 5 ppm as methane in the work zone, continuous explosimeter monitoring will also be conducted.

The site supervisor is responsible for monitoring his workers' exposure as described in section 7.8.

The site supervisor, with the concurrence of the project manager, may downgrade the level of personal protective equipment when it is reasonably certain that the work can be safely performed at a lower level of protection.

7.4.1 DRMO, Building 1617, and Lead Contamination Area. During washdown of the paved areas, workers handling the washers will wear Saranex suits with hoods and splash-guard face plates, neoprene boots and disposable latex gloves. If wind exists capable of moving dust or spray around, dusty areas will be wetted sufficiently to eliminate the dust and pressure settings and nozzles on the washers will be adjusted to minimize misting. If dust and mist cannot be eliminated, full face respirators with dust cartridges will be worn.

The site supervisor will direct the work so that activities in one area do not recontaminate an already cleaned area or compromise the safety of workers in another area. Ambient temperature will be recorded in the log book every two hours, and workers will be monitored and given breaks according to ACGIH guidelines. An adequate supply of ice water and Gatorade will be maintained in the support zone. Paper cups will be maintained in the support zone to supply partially decontaminated workers with liquids. Liquids will be supplied by the decon man. No other hand-to-mouth activities (eating, drinking, smoking) will be permitted in the decontaminated zone. Any worker showing signs of heat stress will be immediately relieved.

All rinseate drums will be externally decontaminated prior to transfer to the treatment plant. Workers handling drums will wear steel-toed boots.

During the soil boring program, workers will wear Tyveks, steel-toed boots, hard hats, and disposable latex gloves.

7.4.2 Battery Electrolyte treatment Area. During sampling of this area, the sampling crew will don tyveks, disposable latex gloves, steel-toed boots, and hard hats. Workers will wear at least two pair of latex gloves and monitor pH levels in samples during collection. If pH decreases to <3, workers will add an outer acid resistant glove. The out latex gloves will be changed between each sample. If acid resistant gloves are worn, then they will be decontaminated between each sample as well to prevent cross-contamination. Sample collection will always begin in the area of the lowest contamination and proceed to the areas of high concentration.

Workers exiting the work zone will enter the decontamination area. All workers will pass through the boot wash, glove wash, then remove tyvek and latex gloves.

Sample containers and field equipment will be left in the decon area. Any equipment or samples exiting the work zone will be wiped down to remove any fugitive dust or residues. Equipment used in collecting samples will be decontaminated following the procedures as specified in 4.3.2.2.

7.4.3 Public Works Storage Yard. No further investigative work is planned for the public works storage yard. Health and safety procedures will be developed in the site specific health and safety plan during remediation for this site.

7.4.4 PCB Transformer Storage Area. During sampling of this area, the sampling technicians will wear Tyveks, disposable latex gloves, and disposable booties over their boots. Workers will be informed that latex offers only short-term protection against PCBs. The site supervisor will ensure that gloves are changed following each potentially contaminating exposure. If difficulties are encountered and exposure to the gloves becomes unavoidable, workers will don viton outer gloves.

Booties will be disposed of in the decon zone and boots will be washed with soap and water.

Workers will be informed that PCBs can be smelled at much lower concentrations than they can be detected with field equipment. If any worker smells aromas which he cannot identify (or which he recognizes as askerel), work will be allowed to proceed only after donning of half-face or better respirators with organic cartridges.

7.4.5 Oil Sludge Pit Area. During the installation of borings in this area, workers will wear Tyveks, steel-toed boots, hard hats, and disposable gloves. Borings will be monitored for organic vapors. If organic vapors are encountered above 5 ppm, workers will don organic cartridge respirators and the explosimeter will be used for supplemental monitoring.

7.4.6 Chemical Disposal Area. During the geophysical survey, workers will wear Tyveks and neoprene boots.

If the magnetometer survey finds areas suggestive of buried drums, the area will be explored using a backhoe prior to beginning the boring program. During any such work, the site supervisor will ensure that all workers stay at a safe distance and upwind and that the operator has a 5-minute bottle within reach should emergency evacuation become prudent.

During the boring program, workers will wear Tyveks, hard hats, steel-toed boots, and disposable gloves. Organics monitoring will be conducted by and only by someone wearing a face shield and having a 5-minute bottle close at hand. The person will wear a Responder chemical-resistant suite. The monitoring technician will periodically measure the pH of the cuttings. The driller will at all times be equipped with a hooded tyvek, face-shield and 5-minute bottle. Non-essential personnel will be kept well back of any drilling operations and up wind.

7.4.7 Oil Spill Area. During well installation in this area, workers will wear Tyveks, disposable latex gloves, disposable booties over steel-toed boots, and hard hats. Prior to initiating this work, they will be informed that PCBs are known to occur nearby in the subsurface and it should be assumed that all subsurface soils and waters are PCB-contaminated. They will also be informed that latex gloves offer only short-term protection from exposure. Change-out will be required following each potentially contaminating contact with gloves. If repeated contact becomes unavoidable, the site supervisor will require viton outer gloves.

Booties will be disposed of in the decon zone and boots washed with soap and water.

7.4.8 Building 44, Old Plating Operation and Waste Treatment System. During sampling of the interior of building 44, the sampling technicians will wear tyveks, disposable latex gloves, hard hats, and disposable booties over their boots. Dust suppression will be of primary concern during wipe sampling and concrete coring. If dust accumulations are present on walls or overhead fixtures, work will proceed only after donning a half-face or better respirator.

Dust suppression during concrete coring will be prevented by the water used to lubricate the coring bit. If however, movement in the area results in airborne dust, then respirators will be used.

During the soil boring and collection of subsurface samples in areas where corrosive liquids may have been present, the procedures set forth in Section 7.4.2 will be adhered to.

7.4.9 Building X-10 and SW of Building X-10.

During sampling of this area, the sampling technicians will wear Tyveks, disposable latex gloves, and disposable booties over their boots. The outer latex glove will be changed after each sample is collected.

If organic vapors are encountered above 5 ppm, workers will don organic vapor cartridge respirators and the explosimeter will be used for supplemental monitoring.

Ambient temperature will be recorded in the log book every two hours, and workers will be monitored and given breaks according to ACGIH guidelines. Areas will be designated for field sampling, decontamination of equipment and personnel, and breaks.

7.5 PERSONNEL DECONTAMINATION. Personnel decontamination procedures will vary from site to site and within a site depending on what exposures are encountered. The site supervisor will establish a decontamination train in the decontamination zone appropriate to potential needs. Appropriate stations from the following list should be selected. The full list will not be necessary except at the chemical disposal area.

1. Equipment drop.
2. Outer glove, suit and boot wash.
3. Outer glove, suit and boot rinse.
4. Outer glove and bootie removal.
5. Outer suit removal.

6. Inner glove wash.
7. Inner glove rinse.
8. Respirator removal.
9. Inner glove removal.
10. Inner suit removal.

7.6 EQUIPMENT DECONTAMINATION. Drill rigs and augers will be steam cleaned between borings. Sampling trowels and hand augers will be cleaned with Alconox and water between samples. The site supervisor will designate appropriate decontamination procedures for all other equipment and containers and ensure that they are performed prior to anything leaving the decontamination zone.

7.7 TRAINING. The project manager shall ensure that all workers at the site have training meeting the standards of 29 CFR 1910.120(e) including both classroom and field training, and for site supervisors, supervisory training. In addition, he will ensure that each worker is experienced in operating the types of equipment to be used and in performing the procedures to be employed at each site. This applies to subcontractor employees as well.

Each morning before work begins, the project manager or his delegate will hold a meeting to discuss procedures to be used on that day with particular emphasis on potential hazards that may be encountered and how to deal with them. In addition, before changes in the nature of the work to be performed, site supervisors will review safety procedures with potentially impacted workers.

7.8 SURVEILLANCE. The project manager shall ensure that all workers at the site have been examined by an occupational medicine physician within the past 12 months, and is otherwise under medical surveillance in compliance with 29 CFR 1910.120(f). The Project Manager will review the medical surveillance program of any subcontractor used to ensure compliance with applicable standards.

The site supervisor will establish a buddy system for work at a site prior to the work beginning. Among other aspects of the buddy system will be a requirement that each worker report to the site supervisor any breach of safety measures, physical or procedural, any resultant exposure to potentially hazardous materials, and any signs of heat stress pertaining to himself or his buddy. The site supervisor will observe the progress of the work with particular attention to compliance with safety procedures and signs of heat stress. During breaks in the work, either as a whole or by individuals, the site supervisor will interrogate workers regarding safety compliance and heat stress and make an appropriate examination of the same.

7.9 EMERGENCY RESPONSE. In the event of an emergency on site during the RFI field activities, the project manager will serve as emergency coordinator. The project manager will have the authority to commit team resources as they may be required to prevent, reduce, or eliminate the emergency. The following procedures are guidelines for response to emergencies.

7.9.1 Fire/Explosion. Although the project manager is expected to enforce provisions for ignition control, the possibility of fires at the NSY exists. In the event of a fire, no matter how small or contained, the local fire department must be notified immediately. A-B-C type fire

extinguishers are to be available in the Support Zone. The project manager is responsible for establishing evacuation routes, which will vary depending on the area being investigated. He will also establish an emergency communication signal to alert all field personnel to evacuate. The project manager will also alert the local fire fighters to the human health and pollution potential at the site.

7.9.2 Personal Injury/Chemical Exposure. During the performance of work tasks within high hazard areas, a minimum of three personnel shall be used. In the event of a personal injury or exposure to one member of the team, the other members will provide assistance in exiting the site.

If a personal injury occurs, the project manager shall arrange for immediate first aid and transport to the nearest emergency care facility. The injured person must be accompanied to the emergency care facility by a team member who can provide information to medical personnel related to possible chemical exposure and a means of contacting the physician holding medical surveillance records on the injured person.

7.9.3 Spills, Leaks, and Discharges. In the event of a spill, leak, or discharge of contaminants which may pose a threat to human health or environment, the project manager must make an immediate assessment of the threat. This assessment may include:

- A threat to field teams requiring an increase in level of PPE;
- A threat to residents or other members of the community near the site requiring notification to local authorities;
- A threat to uncontaminated areas; and
- An increase or change in the potential environmental hazards already present.

Actions which may be appropriate depending on the assessment may include:

- Stop all on-site activities;
- Contact local authorities;
- Implement spill control measures;
- Revise work plans; and
- Abandon work until incident has abated.

Table 7-1 lists the appropriate local, state, and federal agencies as well as project personnel who may be needed.

Table 7-1. Emergency contacts.

Local Sources of Assistance:

NAVBASE, Charleston, South Carolina

Fire	(74) 3-5333
Police	(74) 3-5555*
Ambulance	(74) 3-5444

*Note: When on base, only the digit 3 is dialed followed by the four digits listed.

Charleston County, South Carolina

Fire	911
Police	911
Ambulance	911

National or Regional Sources of Assistance:

WAPORA	1/404/636-0928
EPA	1/404/347-3931
Chemtrec (24-Hours)	1/800/424-9300
Bureau of Explosives (24 Hours) (Association of American Railroads)	1/202/293-4048
Communicative Disease Center (Biological Agents)	1/404/633-5313
National Response Center, NRC (Oil/Hazardous Substances)	1/800/424-3802
DOT, Office of Hazardous Operations DOT, (Regulatory Matters)	1/202/426-0656 1/202/426-9280
U.S. Coast Guard (Major Incidents)	1/800/424-8802

Table 7-1. Emergency contacts (concluded).

National Agricultural Chemical Assoc.	1/513/961-4300
Duke University Occupational Health Services (24 hours)	1/919/684-8111

Special First Aid or Evacuation Procedures: All casualties should be routed through the base infirmary. Base medical personnel will determine if evacuation to a special care facility is necessary.

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