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REMEDIAL ACTION PLAN

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96/1009

FINAL

HYDRO-SEARCH, INC.
A Tetra Tech Company

~~H+S~~ ~~AS~~ Ellison

Presentation

p 14 Revised pp.

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24

p 25

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Fig 41

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T 5-2

p 47

method
6020 is proposed
not approved

use 6010

As, Ba, Cd Cr Pb.

Kevin: Added revisions
as of 11-10-94 are in pencil
on pgs: 14, 18, 24, 25, 28
33, 34, 47

Fig 9-1
Table 9-2

HSI HYDRO-SEARCH, INC.
A Tetra Tech Company

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ENVIRONMENTAL CONSERVATION
REGION 9

SOIL STABILIZATION/
SOLIDIFICATION

FINAL - INTERIM REMEDIAL MEASURES
REMEDIAL ACTION PLAN
PRESTOLITE PLANT
ARCADE, NEW YORK

11-17-94

November 17, 1994

Prepared for:

Motorola, Inc.
Prestolite Plant Site
Arcade, New York

Prepared by:

Hydro-Search, Inc.
350 Indiana Street, Suite 300
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STATE OF NEW YORK
BRENDAN F. SHINE
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LICENSED PROFESSIONAL ENGINEER

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Hydro-Search, Inc. Project No. 204262049

350 Indiana Street, Suite 300, Golden, Colorado 80401 Telephone (303) 279-7982 (800) 544-5528 Facsimile (303) 279-7988

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1.0 INTRODUCTION

1.1 General

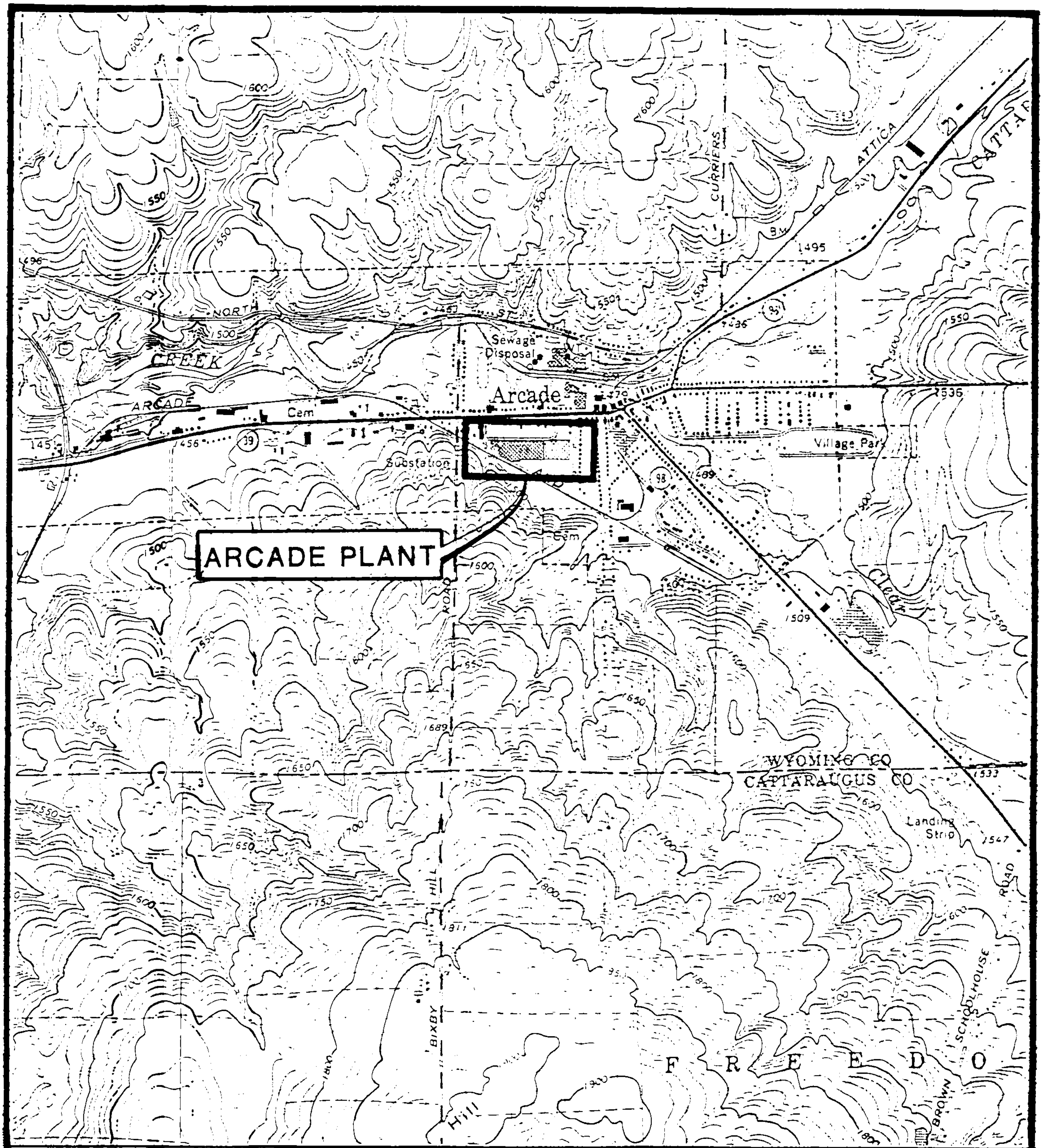
Hydro-Search, Inc. (HSI) was contracted by Motorola, Inc. (Motorola) to develop and oversee the implementation of an interim remedial measure (IRM), including the preparation of a Remedial Action Plan (RAP) for metal-impacted soil. A RAP has been developed for the impacted soil that consists of on-site stabilization and replacement of the stabilized soil back into the excavation and/or off-site shipment to an approved disposal facility. The objective of this RAP is to provide a detailed overview of the proposed stabilization methodology, including proposed methods for sampling to demonstrate that all impacted soil of concern has been removed and treated, and that the stabilized soil is non-hazardous. On-site stabilization work is presently being performed in compliance with a New York State Department of Environmental Conservation (NYSDEC) approved Waste Analysis Plan and Regulatory Compliance Submittal.

1.2 Site Location

The site is located on 400 Main Street in the town of Arcade, New York (see Figure 1-1). The property is currently owned by Prestolite Electronics, Inc. (Prestolite) and includes an active automotive parts manufacturing facility. The area of focus with respect to the IRM is located on the back portion of the property in front of and around the waste water treatment building and around the former chemical storage building. A detailed site map is provided on Figure 1-2 and a map showing the area of impact soil is provided on Figure 1-3.

1.3 Site History

The facility was originally owned and operated by the Sylvania Corporation. In the early 1950's, Motorola purchased the manufacturing facility from Sylvania and operated it until 1988 at which time Prestolite purchased the facility. Prestolite is at the present time actively manufacturing various automotive parts at the facility.



SOURCE: Quadrangle Arcade, N. Y.

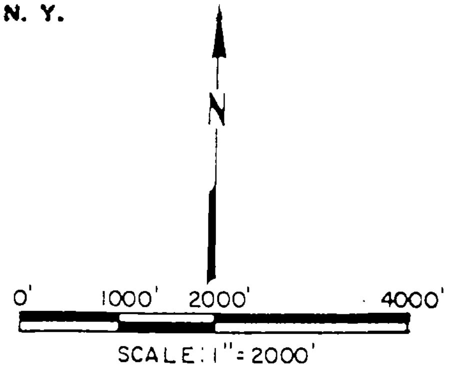
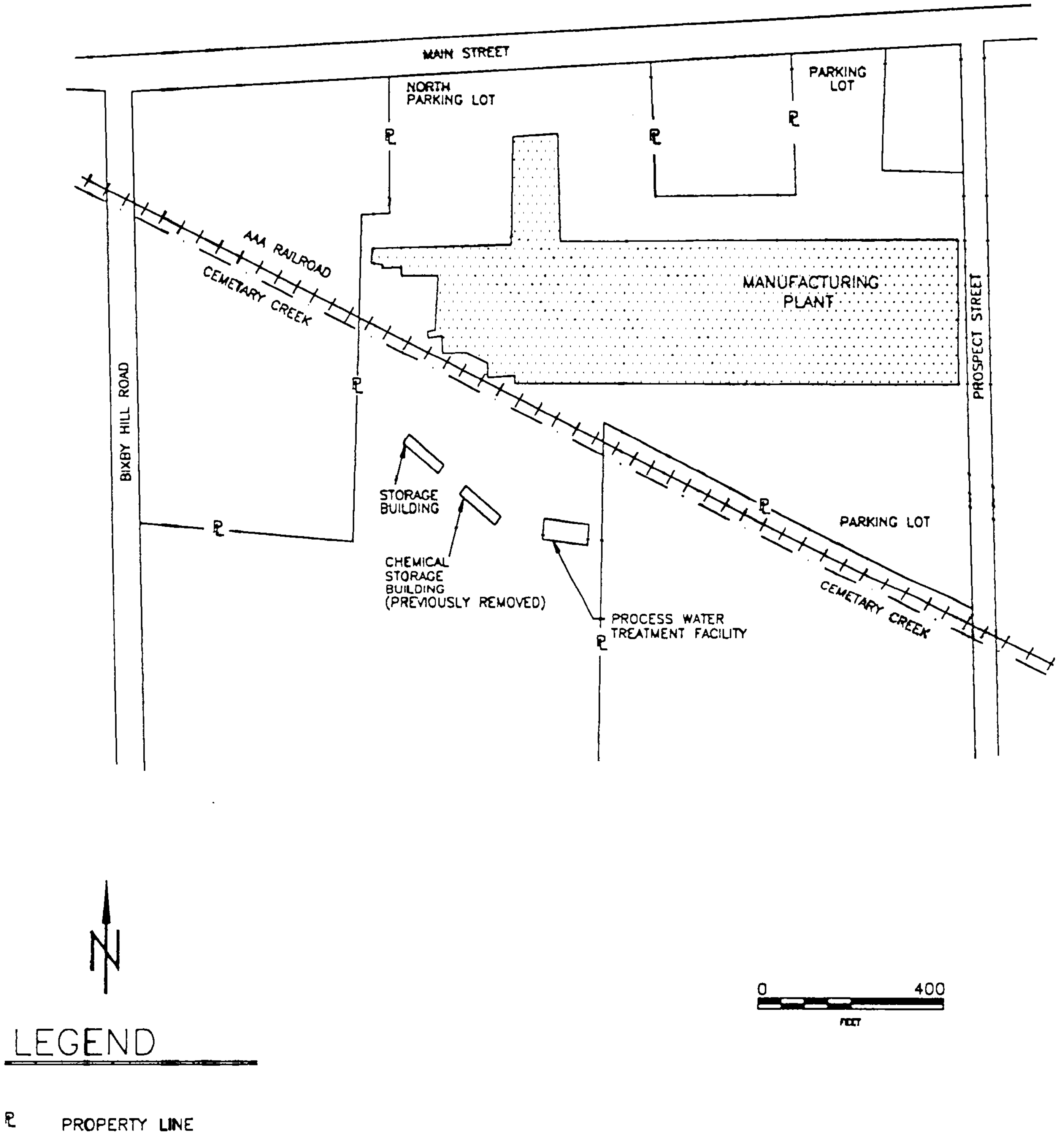


FIGURE 1-1

SITE LOCATION MAP

PROJECT 204262005	REVISIONS
DATE 11/12/91	

Hydro-Search, Inc.
CONSULTING HYDROLOGISTS-GEOLOGISTS
RENO DENVER MILWAUKEE IRVINE



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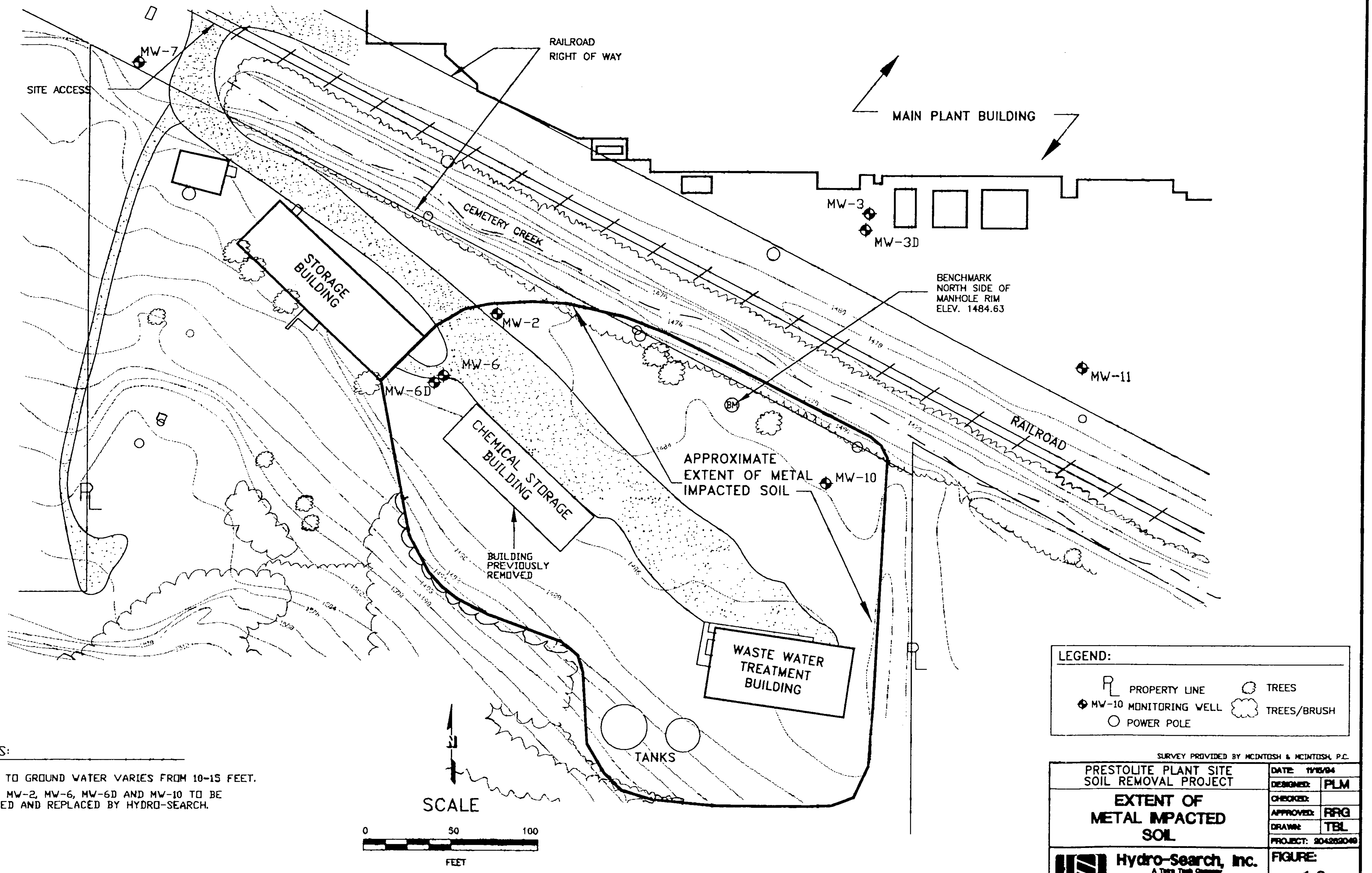
MOTOROLA

DETAILED SITE MAP

Dsgn. by: TBL | Chk. by: PLM | Apprv. by: RRG
PROJECT: 204262049 | DATE: 6/94 | DRAWING: | FIGURE: 1-2

(sanpgrid.dwg)



NOTES:

DEPTH TO GROUND WATER VARIES FROM 10-15 FEET.

WELLS MW-2, MW-6, MW-6D AND MW-10 TO BE REMOVED AND REPLACED BY HYDRO-SEARCH.

SURVEY PROVIDED BY MCINTOSH & MCINTOSH, P.C.

PRESTOLITE PLANT SITE
SOIL REMOVAL PROJECT

EXTENT OF METAL IMPACTED SOIL

DATE:	11/15/94
DESIGNED:	PLM
CHECKED:	
APPROVED:	RRG
DRAWN:	TBL
PROJECT:	204262049
FIGURE:	1-3

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A Tetra Tech Company
Reno•Denver•Milwaukee•Huntington Beach
Sacramento•Houston•Phoenix

(sitemap.dwg)

In June/July of 1991, Prestolite performed a Phase I Site Investigation which included monitoring well installation, ground water sampling, test pit excavation/sampling and soil gas screening for total organic vapors. Results of the sampling effort showed local areas of impacted soils and ground water. The main contaminants were volatile organic compounds (VOCs) and metals.

Based on the results of the Phase I investigation, a voluntary detailed Phase II site investigation was initiated. A Phase II Site Investigation Plan was developed and implemented in accordance with NYSDEC guidelines. Field activities were implemented January through February of 1992 and included the following:

- Soil Gas Survey;
- Monitoring Well Installation/Ground Water Sampling;
- In-Situ Permeability Testing;
- Surface/Subsurface Soil Sampling;
- Surface Water/Sediment Sampling; and
- Subsurface Structure Liquid/Sludge Sampling.

A Phase II Site Investigation Report was generated yielding the following conclusions:

- The ground water system beneath the site is comprised of two water bearing zones. The upper aquifer is unconfined with its lower boundary marked by a thick, low permeability silt. The lower aquifer is semi-confined by this silt; the lower boundary of the lower aquifer is marked by a very low permeability, red clay unit. A strong upward vertical gradient exists at the site.

- Ground water in the upper aquifer has been locally impacted by VOCs and inorganics associated with manufacturing activities. The primary VOC contaminants are dissolved phase TCE and 1,1,1-TCA. TCE concentrations ranged from non-detected to 120 μg/l. TCA concentrations ranged from non-detected to 17 μg/l. Inorganic contaminants include total cadmium, chromium, lead and silver with maximum concentrations of 33.8 μg/l, 453 μg/l and 68.7 μg/l, respectively. Dissolved phase for these metals are generally non-detected, this therefore indicates that the metals are not mobile in the ground water system.

- Total manganese concentrations in ground water below the site and upgradient of the site exceed established standards of 300 μg/l.

- The lower aquifer has not been impacted by site activities. The semi-confining silts of Unit 3 and the presence of an upward hydraulic gradient generally preclude the downward migration of contaminants.

- The low concentrations of VOCs in ground water indicate that the contamination is strictly dissolved phase (i.e., no free-phase product within the ground water system).

- Soils below the plant foundation in the vicinity of degreaser areas 1 and 2 are impacted by chlorinated hydrocarbons (TCE and methylene chloride) associated with manufacturing activities. Soil gas concentrations for TCE ranged from non-detected to 16 mg/l. Soil gas concentrations for methylene chloride ranged from 1.1 to 95 mg/l.

- Soils immediately behind the chemical storage building have been impacted with VOCs (chlorinated hydrocarbons and aromatics) associated with manufacturing activities. The highest soil gas concentrations were noted for methylene chloride ranging from non-detected to 2.8 mg/l. Toluene was found in soil gas ranging in concentration from non-detected to 0.23 mg/l. TCE was detected in concentrations ranging from non-detected to 0.088 mg/l.

- Surface soils in the vicinity of the chemical storage building and runoff receiving area (off-site area immediately east of the waste eater treatment building) are impacted by various inorganics including cadmium, chromium, copper and lead. Cadmium ranged from non-detected to 8,420 mg/kg; chromium ranged from 16 to 44.3 mg/kg; copper ranged from 12.6 to 224 mg/kg; and lead ranged from 9.5 to 241 mg/kg. These metals are associated with manufacturing activities.

- Sediments in Cemetery Creek show the presence of inorganics including cadmium, chromium and nickel. Cadmium ranged from non-detected to 71 mg/kg; chromium ranged from 9.1 to 20.2 mg/kg; and nickel ranged from 16.8 to 37.9 mg/kg. These metals are associated with manufacturing activities.

- Sediment in the drainage ditch on the south side of the active manufacturing building shows the presence of inorganics above background concentrations including cadmium (11.6 mg/kg), chromium (44.3 mg/kg), copper (204 mg/kg) and lead (189 mg/kg). These metals are associated with manufacturing activities.

With respect to source areas for the above noted impacts, the following source areas have been identified:

Ground Water Impact Sources

- Degreasers areas 1 and 2 and the impacted unsaturated zone soils beneath the foundation under the degreasers;
- Subsurface weir structure and associated piping beneath the front parking lot; and
- Unsaturated zone soils beneath and behind the chemical storage building.

Soil Impact Sources

- Surface Soils
    - Waste handling/storage areas
    - Runoff from waste storage areas
- Subsurface Soils
    - Degreaser areas 1 and 2

Sediment Impact Sources

- Drainage from the runoff receiving area and runoff from former waste storage areas; and
- Runoff from the parking lot and grassy areas into the drainage ditch and possibly discharge of non-contact cooling water from the active manufacturing building.

In addition, during the Phase II investigation it was determined that local residents are using a municipal water supply. The municipal wells are screened in the lower aquifer which was determined not to be impacted by past site activities. There are no municipal wells downgradient of the site. In addition, no private wells were identified by the Town of Arcade downgradient of the site. The nearest municipal well is approximately 0.25 miles northeast (upgradient) of the site. It is located behind the Town of Arcade municipal building. Ground water samples collected from this well during Phase II site investigation activities showed the well to be unimpacted. The well is currently on a semi-annual monitoring program at the request of the New York State Department of Health.

Subsequent follow-up sampling over the open area in front of the waste water treatment building confirmed a large area of cadmium impacted soils.

Since the Phase II site investigation, the following voluntary cleanup activities were performed in 1992 and 1993:

- Cleanout and decontamination of the subsurface weir structures (1992);
- Excavation and off-site stabilization/disposal of metals impacted soil from the runoff receiving area 1992);
- Removal and disposal of buried metal debris near the waste water treatment building 1992); and
- Installation of a soil vapor extraction system beneath the floor of the active manufacturing facility in the vicinity of degreaser areas 1 and 2 (1993).

The main remaining source area identified during Phase II site investigation activities are the metals impacted soils in front of the waste water treatment building and around the former chemical storage building. To better delineate the area of impact, some additional sampling and metals analysis was performed by Hydro-Search, Inc. (HSI) in May and July of 1992. The results of the additional sampling are provided in Appendix A. A representative soil sample from in front of the waste water treatment building was also collected during the drum removal by Sevenson Environmental (cleanup contractor) in July of 1992. The soil was analyzed for TCLP organics, TCLP metals, total and free cyanide, pH, ignitability and total sulfide. These analyses are also included in Appendix A. The data show the soils to be non-hazardous for all constituents except for cadmium which had leachable concentrations at 1.99 mg/l which are slightly above the TCLP regulatory standard of 1 mg/l.

1.4 Purpose and Objective of IRM Removal Action

The metals impacted soils in front of the waste water treatment building and around the former chemical storage building have been identified as a potential source of elevated metals to

Cemetery Creek due to direct runoff. The soils may also present a direct contact hazard. Some soil samples were tested for TCLP metals and failed for cadmium, suggesting a leachable potential. To date, ground water data in the vicinity of the waste water treatment plant has shown elevated total metals concentrations however dissolved phase data indicates that the metals are not mobile in the ground water system. The purpose/objective of the IRM is, therefore, to:

- Eliminate contaminated runoff potential to Cemetery Creek relative to site soils;
- Mitigate potential direct contact hazards associates with site soils; and
- Minimize leachability potential of metals in the site soils.

The proposed IRM which is detailed in this RAP intends to fulfill the project objectives by excavating the impacted soils, stabilizing the soils on-site using a Portland cement stabilizing agent, and either placing the soils back into the excavation or transported off-site for disposal at an approved facility. Proposed cleanup levels to address the metals of concern are provided in Section 3.2. Upon backfilling, the site will either be capped with clean fill from an approved off-site source and seeded or asphalted. The stabilization process will minimize the leachability potential of the metals relative to ground water and the subsequent capping will eliminate the runoff impacts to Cemetery Creek as well as the potential direct contact hazard. Placing the processed soil back into the excavation will not pose environmental concerns since the metals will be immobilized and will not impact the upper aquifer. In addition, the upper aquifer is not used for potable water. With respect to the lower aquifer, there is also a substantial silty clay layer separating the upper aquifer from the lower aquifer which is used for potable water, and there is an upward gradient between the water bearing units which would act to prohibit or impede potential downward migration of any contaminants. A ground water monitoring program will also be established (see Section 9) to monitor site conditions after completion of the IRM.

2.0 OVERVIEW OF THE REMEDIAL ACTION PLAN

2.1 RAP Components

This section also identifies the components of the RAP which are summarized below:

1. The RAP specifies the parameters for which each hazardous or non-hazardous waste will be analyzed and the rationale for the selection of these parameters.
2. The RAP specifies the test methods that will be used to test for the parameters.
3. The RAP specifies the sampling method to be used to obtain a representative sample of the waste to be analyzed.
4. The RAP specifies the frequency with which the initial analysis of the waste will be reviewed or repeated to ensure that the analysis is accurate and up to date.
5. If the waste is to be disposed off-site at a treatment, storage or disposal facility, the RAP specifies what analyses will be provided to the off-site facility by the generator.

2.2 Remedial Action Plan Format

The requirements specified in Section 2.1 are addressed in the remainder of this document. Section 3.0 provides the identification of the material to be stabilized on site. Section 4.0 provides a detailed description of the proposed stabilization procedure which includes the waste handling plan. Section 5.0 presents the waste sampling and analysis plan. An erosion and sediment control plan is presented in Section 6.0.

3.0 IDENTIFICATION OF MATERIAL TO BE STABILIZED ON-SITE

3.1 Nature of Material

Soil at the Prestolite site has been impacted primarily by cadmium, with some elevated chromium and lead. Soil samples have been collected and analyzed for total cadmium, chromium and lead and by the Toxicity Characteristic Leaching Procedure (TCLP) cadmium and lead. Tables 3-1 and 3-2 provide a summary of the results for total and TCLP analyses, respectively. As noted in Table 3-1, total chromium concentrations were approximately equivalent to the TCLP concentration for chromium (5 mg/l), therefore, TCLP chromium was not analyzed. Based on these analyses the impacted soils would be considered a characteristic waste due to the cadmium (D006).

3.2 Volume and Extent of Contamination

Cadmium is the most prevalent metal of concern in the soil and has, therefore, been selected as the indicator chemical for estimation of impacted soil volumes. The action levels for soil removal under the approved Waste Analysis Plan and Regulatory Compliance Submittal were:

now is → 10 mg/kg -(see pg 14)

Total Cadmium	~~40~~ mg/kg*
Total Chromium	18 mg/kg**
Total Lead	30 mg/kg***

* Based on 10^{-6} cancer rate health risk criteria provided in proposed 40 CFR Subpart S.

** Based on site background samples collected during site investigation activities.

*** Based on NYSDEC Technical and Administrative Guidance Memorandum HWR-92-4046 dated November 16, 1992.

Action
Levels

TABLE 3-1

SUMMARY OF TOTAL CADMIUM, CHROMIUM AND LEAD CONCENTRATIONS (mg/kg)

Sample No.	Total Cadmium	Total Chromium	Total Lead
SS-13-03	255.60	11.99	41.63
SS-13-01	44.40	10.37	31.57
SS-19-01	33.00	6.94	23.57
SS-19-03	8.693	5.99	25.20
SS-04-03	4.548	NA	NA
SS-22-01	540.70	NA	NA
SS-10-03	0.410	NA	NA
SS-22-03	389.50	NA	NA
SS-5-05	15.04	NA	NA

NA Not Analyzed

TABLE 3-2

SUMMARY OF TCLP CONCENTRATIONS FOR CADMIUM AND LEAD (mg/L)

Sample No.	TCLP Cadmium	TCLP Lead
SS-13-03	6.20	0.25
SS-22-03	9.60	0.10
SS-22-01	14.60	0.10

Based on a review of the initial draft of this IRM plan by NYSDEC CERCLA personnel, the cleanup goal for total cadmium has been adjusted downward to 10 mg/kg for the excavation. The cleanup goals for chromium and lead (18 mg/kg and 30 mg/kg, respectively) have not been changed. Meeting the cleanup goals for the excavation will be evaluated/documented using the Students t-Test with a 95% confidence level (i.e., we will be 95% confident that the average concentration of total cadmium, chromium and lead within the excavation will be below the established cleanup goals for each metal). All ongoing and remaining work will target the above noted cleanup levels.

The areal extent of soil to be processed is shown on Figure 1-3. The total volume of impacted soil has been estimated to be 20,000 cubic yards based on the depth to ground water and known areal distribution of impacted soils.

Pb goals
30 ppm

4.0 REMOVAL ACTION PLAN

4.1 Overview

The proposed removal action plan consists of soil excavation, on-site stabilization, temporary stockpiling of stabilized soil, backfill of stabilized soil into the excavation and/or transport for disposal at an approved facility and site restoration. Confirmation sampling will be performed to determine the limits of excavation and also to assess the effectiveness of the stabilization process.

Remediation Services, Inc. (RSI) has been contracted to implement the interim remedial measure, with oversight provided by HSI. RSI has used stabilization extensively on similar projects and has a thorough working knowledge of the process.

4.2 Stabilization

Stabilization is a chemical and physical process whereby the leachable components of the material are made less mobile or physically bound within a matrix that significantly reduces or eliminates mobility. Portland cement will be used as the stabilizing agent for the impacted soils. The resulting product will be a dense, low permeability, acid resistant solid that has the physical characteristics of a soil/gravel mixture.

Portland cement is a mixture containing several metal oxides, but is comprised primarily of calcium silica oxides. During the chemical and physical reaction, complex compounds are formed which bind heavy metals within the matrix. Portland cement is a common stabilization agent that is readily available, cost-competitive and has been successfully demonstrated for similar soil types with the same contaminants. RSI has determined through prior experience that soil can be rendered non-hazardous with the addition of Portland cement at 10 to 30 percent by weight. Bench scale tests have been performed by RSI on representative soil samples collected from the Arcade site and the results show that the stabilized soil is rendered non-hazardous as measured by the TCLP using between a 10 and 20 percent cement mixture. The results of the bench scale tests showed the stabilization process using Portland cement to be effective for on-site soils. The bench scale test data are provided in Appendix B.

4.3 Material Handling Plan

40 CFR 262.34 and 6NYCRR 373-1.1 (d) (I) (iii) permits facilities to treat characteristic hazardous waste in containers on-site as long as the material remains on-site less than 90 days and the container standards specified in 40 CFR 265 and 6NYCRR 373-1.1 (b) (iii) (c) are met. The contaminated soil will be excavated, mixed with Portland cement in containers, temporarily stored in a staging area and analyzed to ensure the stabilization has been successful. The nonhazardous stabilized soil will be placed back into the excavation and/or taken off-site to an approved disposal facility. The sampling analysis plan for stabilized soil is provided in Section 5.

The first step will be the establishment of two processing areas with four 10 cubic yard roll-off bins per processing area. Each processing area will be approximately 50 feet by 40 feet and will be graded to provide a smooth level, slightly depressed surface. The processing areas will also be lined with a 30-mil low density polyethylene liner (LDPE). An earthen berm will be constructed around the treatment area to control run-on and run-off. The liner will extend to the toe of the berm and be anchored into place. Crushed stone or gravel will be placed on top of the liner to protect it from damage.

It is anticipated that one processing area will be located over metal impacted soil during the first stages of excavation and backfilling. The second processing area will be located over a clean backfilled area to allow access to the remaining portion of the site (i.e., where the first processing area was located). For the processing area located over the clean backfilled area, two baseline and two post-remediation composite soil samples will be collected and analyzed for pH, total cadmium, total chromium an total lead. The results will be compared to confirm that no impacts resulted from the stabilization process.

Temporary staging areas will be constructed outside the processing areas for staging the non-hazardous stabilized soils. The areas will be lined with a 6-mil LDPE liner and a 6 to 12 inch layer of clean or processed non-hazardous soil will be spread on top of the liner to allow stockpiling of processed material without tearing apart the plastic. Upon completion of the project the liner will be pulled up and verification samples will be collected from below the liner to ensure leaving unimpacted conditions.

Roll-off containers will be used as the portable containers for mixing the contaminated material with Portland cement. It is anticipated that four containers will be utilized on a rotating basis during the stabilization activities, however, at no time will more than 8,800 gallons (or approximately 40 cubic yards) of untreated soil be containerized.

The containers will be placed on six-inch blocks to allow continuous visual inspection of each container's integrity. Prior to the stabilization of the first batch of soil, each container will be leak tested by filling to within one foot of the top with potable water and waiting for one hour while inspecting for leaks. Once the first container has been tested, the water will be transferred to the adjacent container for leak testing. Once testing has been completed, the water will be discharged to an adjacent storm sewer or area outside the process and staging areas.

Excavated soils will be placed into the mixing containers with a front end loader equipped with bucket scales. The will allow a known volume of soil to be placed into each mixing container. Based on bench scale test results, the correct amount of Portland cement will be added to the soil from an on-site storage silo (15 to 20 percent). Water will be added to the waste/cement mixture. HSI will monitor dust generation and any dust control will be achieved through the use of water sprays.

Liner

Once the soil, cement and water have been thoroughly mixed, the mixture will be allowed to cure until the mixture passes the EPA SW-846 Method 9095 Paint Filter Liquids Test. To pass the paint filter test, the material must yield no free liquid. The curing time required to pass this test will vary from several minutes to one hour, depending upon the ambient temperature and the amount of water added to the mixture. Once a batch passes the paint filter liquids test, a composite verification sample will be collected as described in Section 5.0.

The stabilized soil will be transferred to the staging areas and held in the staging areas until the results of the verification have been obtained. Stabilized soils that pass the TCLP analysis and/or land disposal restriction requirements (i.e., meet regulatory levels) will be backfilled and compacted into the excavation and/or transported off-site to an approved disposal facility. To date, approximately 24,000 tons of soil have been processed and stockpiled or taken for appropriate off-site disposal under the approved Waste Analysis Plan and Regulatory Compliance Submittal. The TCLP data from the processing is provided in Appendix C. The data shows that cadmium and lead are stabilized sufficiently to meet ground water standards and chromium leachable levels are within background concentrations. Compaction will be achieved with a minimum of two passes with a vibrator/compactor. In the unlikely event that a stabilized soil batch fails to pass the TCLP and/or land disposal restriction requirements, the materials will re reprocessed in the same manner as untreated soil to mitigate potential materials storage violations.

Stabilized soil stockpiles and the mixing containers will be covered at all times when not in use. The staging area (i.e., stockpiles) will be covered with polyethylene sheeting. The mixing containers will be covered with waterproof tarps.

The processing and staging areas will be inspected on a daily basis and after each precipitation event to ensure the integrity of the liner and cover systems.

Once stabilization at the site is complete, the mixing containers will be cleaned by scraping and/or sandblasting as required to remove all adhering materials. The mixing containers will then be removed from the processing area to allow removal and off-site disposal of the liner. Two samples will then be collected from the soils beneath the liner as previously discussed. Although unlikely, should the analysis indicate the liner has failed and the underlying soil becomes contaminated, RSI will excavate and properly dispose of the contaminated soil off-site.

The site will be regraded to provide adequate surface water runoff and prevent ponding. Final surface elevations will be higher than original elevations due to the stabilization expansion factor of 10 to 30 percent. If too much excess material is generated due to the stabilization process, a portion of the material may be manifested and transported off-site for appropriate disposal.

4.4 Health and Safety Plan

A Health and Safety Plan (HSP) has been be developed for all field activities included in this cleanup effort. The HSP complies with requirements outlined by the Occupational Health and Safety Administration (OSHA) 29 CFR, Part 1910.120 - Hazardous Waste Operations and Emergency Response Standard. Specifically, the HSP includes:

- General Information
    - Address
    - Tasks/Activities
    - Personnel/Responsibilities
- Site/Hazard Characteristics
    - Facility Description
    - Site Access
    - Unusual Features
    - Nature of Contamination
    - Hazard form/Characteristics
    - Major Health Hazards
- Task Health and Safety Analysis
    - Hazard/Risk Evaluation
    - Personal Protection
    - Area/Personnel Monitoring
- General Site Requirements
    - Work Zones
    - Fit Test Requirements
    - Medical Monitoring Requirements
    - Training Requirements

- Contamination Control
    - Local Resources
    - Site Resources
    - Personnel Roles
    - Emergency Contacts
    - Emergency Routes
        - Hospital
        - Evacuation

    - Site Communications
    - Reporting Procedures
    - Response Procedures

- Minimum Attachments
    - Attachment A Site Maps
    - Attachment B Route to Hospital
    - Attachment C Chemical Hazard Information
    - Attachment D Site Safety Plan Acknowledgment Form

The HSP had been reviewed and approved by a Certified Industrial Hygienist. All project field personnel will be required to provide documentation of 40-hour health and safety training and 8-hour refresher training. A copy of the HSP is provided under separate cover.

5.0 WASTE SAMPLING AND ANALYSIS

5.1 Overview

Sampling and analyses will be performed for two purposes. The first purpose is to assure that all soil above action levels is excavated (Excavation Confirmation Sampling). The second purpose is to confirm that the processed soil meets established TCLP criteria (Process Confirmation Sampling). Each sampling methodology to be used is described in this section. In addition, the analytical laboratory methods and quality assurance (QA) plan are also discussed in this section.

5.2 Excavation Confirmation Sampling

Excavation confirmation samples will be collected from the base and sidewalls of the excavation using a decontaminated trowel, provided that the excavation is safe to enter and would not violate any OSHA regulations. Should the excavation be unsafe to enter, samples will be collected using a decontaminated backhoe bucket. Soil from the bucket will be taken using a trowel.

The USEPA Field Manual for Grid Sampling of Spill Sites to Verify Cleanup (EPA-56015-86-017) will be used to determine the number of samples to be collected. This method provides for the collection and compositing of samples. Pertinent portions of this document regarding procedures for establishment of the grid and choosing the appropriate number of samples is provided in Appendix D. Composite samples will be prepared in a decontaminated mixing bowl before transferring the sample aliquot into laboratory approved containers (either glass or plastic).

All sampling equipment will be decontaminated using a clean water rinse followed by an Alconox solution wash and a distilled water rinse. Decontamination water will be drummed for later sampling and disposal or for use in the stabilization process.

5.3 Process Confirmation Sampling

Bench scale stabilization tests have been performed on a number of soil samples collected from the site. The results of the bench scale tests show the soils to be amenable for metals stabilization (i.e., all samples passed TCLP criteria immediately upon processing). Field process verification sampling will be performed by collecting five point composite samples (four corners and center) from stockpiled processed soils. At each sample point in the stockpile, sample volume will be obtained from the top, center and bottom of the stockpile to assure sample representativeness. Verification samples will be analyzed with the following frequency:

- One individual five-point composite sample from each bin for the first 20 batches (20 cubic yards per batch).
- One composite sample per five batches (i.e., per 100 cubic yards) for the remainder of the project.

If analytical results for the 100 cubic yard stockpile composite sample are within 80 percent of the TCLP criteria for cadmium, chromium or lead, the stockpile of processed material will be resampled and analyzed with one five-point composite per bin (i.e., per 20 cubic yards) to determine if any individual batch may actually be above standards, therefore skewing the results upward.

All sampling equipment will be decontaminated using a clean water rinse followed by an Alconox solution wash and a distilled water rinse. Decontamination water will be drummed for later sampling and disposal.

5.4 Laboratory Analysis

Excavation Confirmation Samples will be analyzed for cadmium, chromium and lead at a State certified, off-site laboratory using EPA Method 6020. Process Confirmation Samples will be analyzed for TCLP using Method SW-846-1311 for extraction. The extract will then be analyzed for cadmium, chromium and lead using EPA Method 6020. The detection limits will

Confirmation Sample

be set at or below ground water standards for those metals to allow verifying not only that the material is non-hazardous but also whether the extract meets ground water standards since the processed soil may be placed back into the excavation.

In addition, process verification samples from soils in the vicinity of the former chemical storage building will be analyzed for VOCs using Method 8240 since there was some potential for solvent spillage in this area in the past. If any VOCs are detected above land disposal restrictions, the soils will be shipped off-site to a licensed and approved disposal facility.

5.5 Quality Assurance Plan

The overall objective of the QA Plan is to develop and implement procedures for field sampling, chain of custody, laboratory analysis and reporting that will provide defensible and reproducible results.

Field colocate samples and field blanks will be collected and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from the field sampling. Field colocate will be collected immediately adjacent to a verification sample. Colocate samples will be analyzed to check for sampling and analytical reproducibility. Field blank samples will consist of clean silica sand and will be analyzed to check for procedural contamination and/or ambient conditions at the site which may affect sampling results. The general level of QA effort for this project will be at least one field duplicate and one field blank for every 10 composited samples. This level of QA effort applies independently to excavation confirmation sampling and process confirmation sampling.

DL's

The level of laboratory QA effort will be consistent with that currently used by the EPA Contract Laboratory Program as specified in:

- U.S. EPA, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods". Office of Solid Waste and Emergency Response. November 1986, SW-846, Third Ed.

The accuracy, precision and sensitivity criteria for analytical data will be as specified for the individual analytical methods specified above. Third party data review will be performed by a NYSDEC approved validator. The data review will consist of a cursory check of all the data and a 10 percent calculation check.

6.0 EROSION AND SEDIMENT CONTROL PLAN

Soil removal will be accomplished using a variety of earth moving equipment which may include, but not be limited to, bulldozers, excavators, loaders and graders. It is anticipated that excavation will be required to a maximum depth of 12 feet and will include some excavation work near the bank of Cemetery Creek. Soil excavation will not encroach upon the "ordinary high water mark" as defined by the U.S. Army Corps of Engineers, therefore, a permit under Section 404(b)(1) of the Clean Water Act will not be required.

Earth berms or silt fences will be constructed around each zone of excavation, staging area and the treatment area. The earthen berms will serve two purposes. One purpose will be to function as a diversion dike to prevent storm water from entering the work areas and the other purpose will be to prevent impacted storm water and soil from leaving the site and entering the creek. Storm water collected within the work area will be incorporated into the stabilization process, provided that the volume of water is not excessive. In the event that the volume is excessive, the water will be pumped out, stored in on-site holding tanks and transported to an approved, off-site treatment facility.

All diverted runoff will flow through silt fencing or straw dikes to reduce sediment loading to the creek. The silt fences will not exceed 36 inches in height and will be constructed using a filter fabric. The fabric will be supported with fence posts spaced no more than 10 feet apart and driven into the ground at least 12 inches. A trench approximately four inches wide by four inches deep will be excavated parallel with and on the upslope side of the silt fence. The fabric will be keyed into the trench and the trench will be backfilled and compacted. The silt fence will remain in place until all soil stabilization is complete and the excavations have been backfilled.

The berms and silt fence will be inspected on a daily basis to assure their integrity. Any damage to the berms or silt fence will be repaired immediately. Maintenance of the silt fence will involve the removal of any silt accumulations after precipitation events if the accumulation may cause ponding upslope of the fence.

Upon completion of the work, the berms will be removed and the soil will be backfilled into the excavations or used for final grading. The silt fence will be removed and all materials will be properly disposed at an off-site landfill. Any residual silt will be stabilized and placed into the excavation.

7.0 OPERATION AND MAINTENANCE PLAN

The operation and maintenance (O&M) plan for the site will consist of quarterly inspections of the ground surface and repair of damaged areas. Specifically, the restored ground surface will be inspected for stressed vegetation, barren soil, subsidence, rodent infestation, cracked asphalt and erosion. Repairs will include measures necessary to restore ground surface conditions to post remediation condition. In the case of erosion, surface water control measures will be implemented as necessary to correct the problem and minimize the potential for future erosion.

Quarterly inspections will be performed as necessary following activities that may disturb the ground surface. These activities include, but are not limited to, snow plowing and new construction. Depending on the results of the first year of inspections, the frequency of inspections may be extended to semi-annual.

All materials used for repairs will be certified as clean materials. All materials removed from ground surface (i.e., deteriorated asphalt and vegetation debris) will be disposed off-site as a solid waste.

An inspection log will be maintained at the site which will include the following information:

- Date of Inspection;
- Name of Inspector;
- Weather Conditions at Time of Inspection;
- Identified Problem Areas;
- Potential Problem Areas;
- Recommendations for Corrective Measures;
- Signature of Inspector; and
- Signature of Plant Representative.

Any maintenance activities performed will also be recorded and a follow-up inspection will be required for any maintenance performed. The re-inspection will also be recorded in the inspection log.

8.0 CLOSURE PLAN

8.1 Overview

This section presents the closure plan for remedial activities at the site. The closure plan includes site reclamation activities that are designed to restore ground surface topography conditions to pre-remediation condition (see Figure 1-3). Once the closure plan is implemented, the site will be made available for normal business operations. Continued ground water monitoring will be performed as discussed in Section 9.0 to monitor the long-term effectiveness of the stabilization process.

8.2 Final Grade

Final grade for the site may locally be higher than pre-remediation grade, however, it will be graded to enhance surface runoff away from buildings, other structures and stabilized soil areas. The ground surface slope will be maintained at a minimum of two inches vertical relief per ten feet of horizontal distance.

As part of the remedial activities, a drainage swale was established on the south side of the site to divert surface water runoff from the hillside. The drainage swale diverts surface water flow to the west where it ultimately drains into Cemetery Creek through an existing drainage. This drainage swale will remain in place and will be maintained as necessary.

8.3 Backfill

Stabilized soil will be backfilled to within 18 inches of the final grade for areas to be revegetated and to within 6 inches of final grade for areas to be asphalted. For the areas to be revegetated, approximately 12 inches of clean fill will be imported, placed and compacted over the stabilized soil. Approximately 6 inches of clean, imported topsoil will then be placed over the fill

Fx 303 279 2988   4/3/95

Chris Williams   HS
Grant Sherwood   RSI

Regrading
Clean fill → 12"
Topsoil   6"
Seed

VOC area - 2 layers of 10 mil + gravel

10 - 12 days   8hr/d

Can send plan this wk

material. A sample of backfill to be used will be collected and analyzed for metals and VOCs prior to hauling the material to the site.

For the areas to be re-asphalted, 3/4-inch crushed aggregate will be placed over the stabilized soil to a depth of 4 inches to provide a sufficient subbase for the asphalt. A 2-inch thick asphalt layer will then be placed over the crushed aggregate subbase.

8.4 Revegetation

A 10-10-10 fertilizer mix will be added to the topsoil to enhance vegetation growth. The area will then be hydroseeded with a seed mix consisting of tall fescue and annual rye or other suitable blend that is native to the area. The seed mix will be drought tolerant and will not require irrigation once established under normal circumstances.

It is anticipated that hydroseeding will be performed in Spring 1995 and that supplemental irrigation to establish the vegetation will be provided on an as-needed basis using potable water.

8.5 Inspections

A regular inspection program will be developed to assure the integrity of the final cover. During the first full growing season, the hydro-seeding will be warranted by the hydroseeding contractor. Settlement and grading problems will be handled by the remediation contractor for the first year. The remediation contractor will warranty the asphalt for a period of 6 months.

9.0 ENVIRONMENTAL MONITORING

A formal ground water monitoring program will be developed upon NYSDEC review and classification of the site. In the interim, an environmental monitoring of the effectiveness of the proposed remediation will consist of ground water monitoring. The monitoring program and associated sampling and analysis requirements are discussed below.

9.1 Ground Water Monitoring Program

The purpose of the ground water monitoring program will be to monitor for any degradation in ground water quality potentially associated with the placement of processed soil back into the excavation. The wells proposed for use in the monitoring program are summarized on Table 9-1 along with the rationale used for choosing the well. Existing and proposed well locations are provided on Figure 9-1. All samples collected will be analyzed for VOCs and total and dissolved cadmium, chromium and lead. Specific analytical protocols are provided in Section 9.2.

The proposed monitoring well network will provide information on the effectiveness of the remediation within the main source area and at the downgradient edge of the treatment system. Initial monitoring/sampling will be performed on a quarterly basis. Depending on the analytical results of the first year of monitoring, the monitoring frequency will be changed to semi-annual.

All ground water monitoring data will be provided to the NYSDEC in quarterly reports. Monitoring well installation/construction procedures and ground water sampling procedures are provided in Section 9.2.

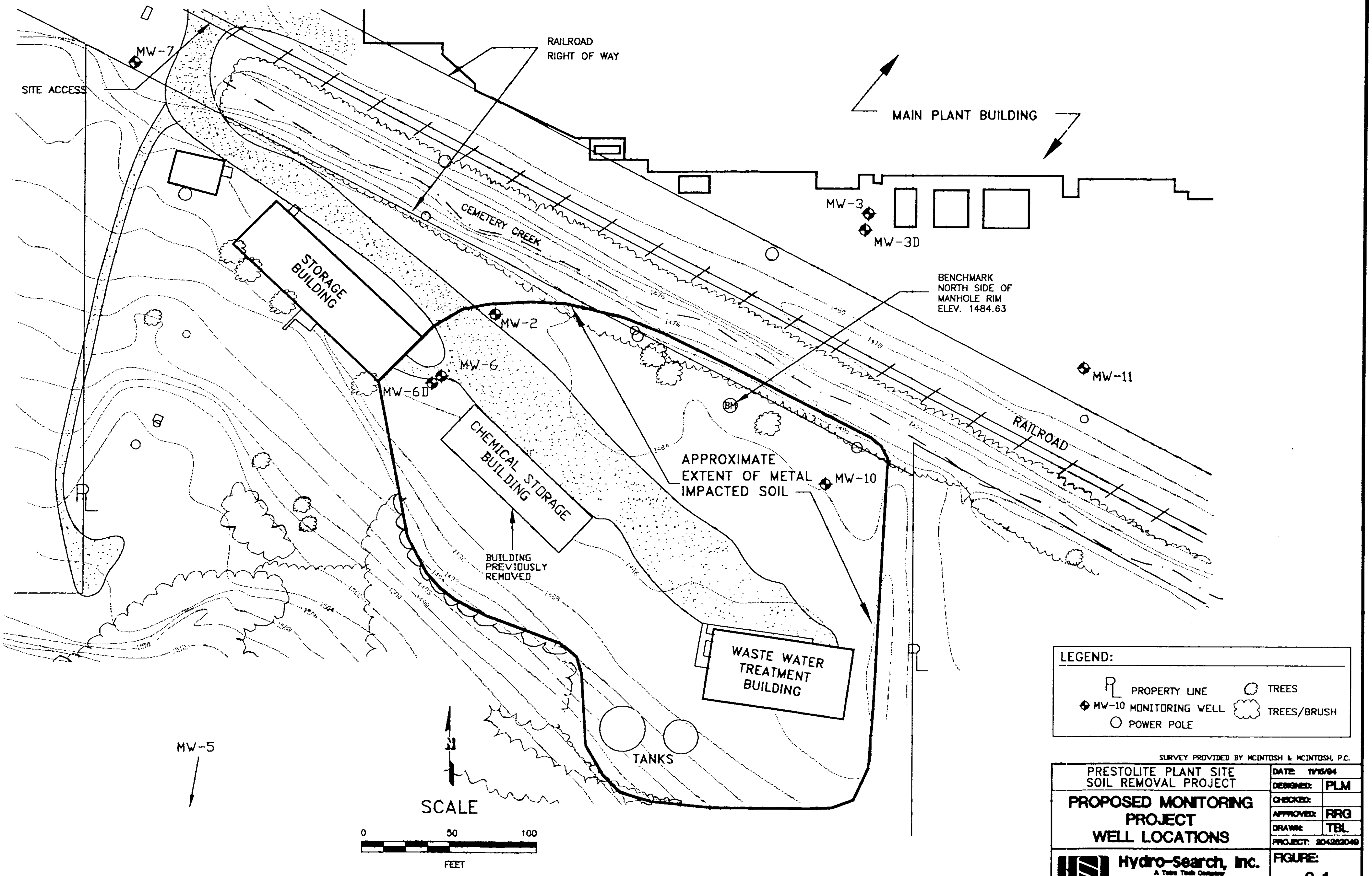
9.1.1 Monitoring Well Installation

Monitoring wells MW-2, MW-6 and MW-6D were abandoned prior to initiation of excavation activities. The wells were abandoned by removing the protective casing, pulling the inner PVC

TABLE 9-1

PROPOSED GROUND WATER MONITORING NETWORK

Well No.	Status	Rationale
MW-2	Currently abandoned. Needs to be redrilled.	Downgradient of former chemical storage building.
MW-3	Existing.	Downgradient of remediated soil area.
MW-5	Existing	Upgradient well.
MW-6	Currently abandoned. Needs to be redrilled.	Water table well within remediated former burn area.
MW-6D	Currently abandoned. Needs to be redrilled.	Deep well clustered next to MW-6 to monitor deeper water bearing zone.
MW-7	Existing.	Downgradient of remediated soil area.
MW-11	Existing	Downgradient of remediated soil area.



SURVEY PROVIDED BY MCINTOSH & MCINTOSH, P.C.

PRESTOLITE PLANT SITE SOIL REMOVAL PROJECT	DATE: 11/15/94
	DESIGNED: PLM
PROPOSED MONITORING PROJECT WELL LOCATIONS	CHECKED:
	APPROVED: RRG
	DRAWN: TBL
	PROJECT: 204262049
Hydro-Search, Inc. A Tetra Tech Company Reno•Denver•Milwaukee•Huntington Beach Sacramento•Houston•Phoenix	FIGURE: 9-1

casing out of the ground and pressure grouting the remaining hole using a tremie pipe. The grout consisted of a cement-bentonite mixture. These wells will be redrilled upon completion of interim remedial measures.

Prior to well installation at each location, the drill rig, all drilling equipment and well installation materials will be steam cleaned. Well screen and riser pipe will be isolated from contact with surface soils by sealing them in plastic immediately after decontamination. A hydrogeologist or engineer will supervise all drilling and well installation activities.

Drilling

Boreholes will be advanced using 4.25-inch inside diameter (I.D.) hollow stem augers. Lithologic sampling will not be performed during drilling activities since logs already exist for these locations. Field logs will be generated based on drill cuttings and drill rig response to aid in well design.

A photoionization detector (PID) will be used to field screen drill cuttings. Drill cuttings that show detections above 1 ppm using the PID will be containerized in 55-gallon drums for later analysis and proper disposal. Any drums generated will be sealed and labeled to identify contents, date and location from which the material was derived. Drill cuttings that show no detections using the PID or analytical results that are shown to be non-hazardous will be spread on the ground around the drill site.

Well Construction

Monitoring wells will be constructed of 2-inch I.D., Schedule 40 threaded PVC riser with 5 to 10 feet of 0.010-inch machine slotted PVC screen. The screened interval will be determined by the hydrogeologist or engineer based on subsurface materials encountered and conditions encountered during the installation of the previous well. The annular space around the screen will be backfilled with clean, well-sorted silica sand to a depth of one to two feet above the top of the screen. All wells will be constructed with a three foot bentonite-pellet seal placed immediately above the sand pack. The pellets will be hydrated and allowed to swell. The remainder of the annular space will be backfilled with cement/bentonite grout. Both wells will be completed with locking protective casings with approximately three feet of stickup and a concrete runoff diversion apron. As-built well construction data will be documented on well construction summary forms.

Well Development

Well development will not be started until cement in the annulus of each well has been allowed to set for 24 hours. The wells will be developed using the surge and bail method. A minimum of five casing volumes of water will be removed and field measurements of pH, specific conductance, temperature and turbidity will be monitored to document stable conditions. The goal for turbidity will be less than 50 NTU. Specific well development data will be documented on the as-built well construction summary forms.

9.2 Sampling and Analysis Plan

This section provides details regarding sampling procedures to be used in the field as part of the ground water monitoring program. A summary of the sampling program is provided on Table 9-2. In addition, this section will provide the sample numbering system to be used, sample handling procedures, and sample documentation/tracking.

9.2.1 Sample Collection Procedures

9.2.1.1 Ground Water Sampling

Ground water samples will be collected from all monitoring wells specified for use Section 9.1. The following procedures will be used for on-site monitoring well sampling:

- Depth to water and total depth of each well will be determined using an electric water level indicator. The volume of water in the well casing will then be calculated.
- A minimum of three well volumes of water will be purged from the well with a PVC or Teflon bailer prior to sampling.

TABLE 9-2

SUMMARY OF GROUND WATER MONITORING PROGRAM MATRIX

Media	Monitoring Samples	Field QC Samples		Lab QC Samples			Total
		Duplicate	Field Blank	MS	MSD	MSB	
Ground Water	7	1	1	1	1	1	12

MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSB	Matrix Spike Blank

- Purging will continue until three successive pH, specific conductance and temperature measurements show stable conditions to ensure that the sample is representative of formation water. If the well bails dry before removing three complete well volumes, the well will be allowed to recharge for 15 minutes, or until adequate sample volume returns to the well, and sample collection will be initiated. Turbidity measurements will also be taken at the time of sampling.
- The sample will be collected using a PVC or Teflon bailer. Sample water will be poured directly into laboratory prepared containers.
- The bailers will be decontaminated between each use by scrubbing with an Alconox solution, followed by thoroughly rinsing the bailer with distilled water.

9.2.2 Field QC Samples

Two types of QC samples will be collected and analyzed for liquids sampled during this project:

- Field blanks; and
- Duplicates

The purpose behind each QC sample is explained in Section 9.3. The sample collection procedures for each QC sample type are detailed below.

9.2.2.1 Field Blanks

For this monitoring program, one field blank will be collected during each round of sampling. The field blank will be analyzed for cadmium, chromium and lead. It will be prepared by pouring Ultra-Pure water (HPLC-grade water) from a decontaminated bailer directly into laboratory prepared containers.

9.2.2.2 Duplicates, Matrix Spikes/Matrix Spike Duplicates/Matrix Spike Blanks

One duplicate will be collected for each sampling event. Additionally, one matrix spike, one matrix spike duplicate and one matrix spike blank will be collected. Sampling procedures for each of the samples will be identical to those used to collect the monitoring samples.

9.2.3 Sample Numbering System

All samples for chemical analysis, including QC samples, will be given a unique sample number. A listing of sample numbers will be maintained on the chain-of-custody and in the field logbook.

Each sample will be identified by a sample number. This project sample number will highlight the sample matrix and location, and will be used for presentation of the data in the quarterly reports.

The project sample numbers will be composed of three components, which are described below:

- Project Identifier. A two-character designation will be used to identify the site where the sample is collected. For this project, it will be AR (Arcade);
- Sample Type and Location. A two to three character type code followed by a two-digit location code will indicate sample type and location; and
- Sequence. A three-digit number will be used to indicate the monitoring event.

Some examples of the project sample numbering system are as follows:

- AR-GW05-193: Arcade ground water, location 5, first sampling in 1993.
- AR-GW05-493: Arcade ground water, location 5, fourth sampling in 1993.

QC samples will be assigned a specific sample number and submitted to the laboratory blind.

9.2.4 Sample Handling

9.2.4.1 Sample Containers and Sample Preservation

Samples will be handled and shipped as low-concentration environmental samples. The containers used to collect samples for chemical analysis will be provided by the contracted laboratory. These containers will be specific to the analysis and volume requirements of a particular sample matrix. Table 9-3 summarizes the sample containers to be utilized, preservation techniques and holding time requirements.

9.2.4.2 Sample Packaging and Shipment

Sample packaging and shipping procedures are based on U.S. EPA specifications, as well as Department of Transportation (DOT) regulations. The procedures vary according to sample concentration and matrix, and are designed to provide optimum protection of samples and the public.

All samples will be shipped within 48 hours of collection. Following collection, the exterior of sample bottles will be cleaned by wiping the outer surface with a moist cloth.

In preparation for shipment, the following procedures will be followed:

<u>Low-Concentration Environmental Samples</u>

1. Prepare cooler(s) for shipment.
    - Tape drain plug of cooler shut;
    - Affix "This Side Up" arrow labels on all four sides, and "Fragile" labels on at least two sides of each cooler; and
    - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. Mark volume levels on bottles with a grease pencil.
4. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
5. Arrange containers in front of assigned coolers.

TABLE 9-3

SAMPLING CONTAINERS, PRESERVATIVES AND HOLDING TIMES

Matrix	Parameters	Container (Number, Size, Type)	Preservation	Holding Time
Ground Water	TCL VOCs	2 - 40 ml glass, TLC	Cool to 4° C 2 drops of 1:1 HCl	14 days
	Total and dissolved cadmium, chromium, lead	1 - liter plastic	HNO_3 to $pH < 2$	6 months

TCL -	Target Compound List
VOC -	Volatile Organic Compound
TLC -	Teflon Lined Cap

6. Seal sample containers within plastic zip-lock bags to prevent vermiculite from contacting samples.

7. Place approximately 2 inches of vermiculite at the bottom of the cooler to act as a cushion for the sample containers.

8. Arrange containers in the cooler so that they do not touch.

9. Fill remaining spaces with vermiculite (VOA vials should be placed in cooler suspended in vermiculite).

10. Ensure all containers are firmly packed in vermiculite.

11. If ice is required to preserve the samples, cubes should be repackaged in double zip-lock bags, and placed on top of the vermiculite.

12. Sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or other carrier, as appropriate.

13. Separate copies of COC forms. Seal proper copies within a large zip-lock bag and tape to inside lid of cooler. Retain copies of all forms in-house.

14. Close lid and latch.

15. Secure each cooler using evidence seals.

16. Tape cooler shut on both ends, making several complete revolutions with strapping tape.

17. Relinquish to Federal Express or other courier service. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT DAY" delivery.)

18. Telephone laboratory contact and provide him/her with the following shipment information:

    - Your name;
    - Project name;
    - Number of samples sent according to matrix and concentration; and
    - Airbill number.

9.2.5 Sample Documentation

9.2.5.1 Field Records

Field observations and other information pertinent to the collection of samples will be recorded in the field. All entries will be made in a field notebook or on field sampling sheets. The data to be recorded for each sample will include date, time, sample number, sample description, and the person collecting the sample. Photographs will be taken and logged to document sampling activities.

9.2.6 Analytical Program

All samples collected as part of IRM environmental monitoring programs will be analyzed for Target Compound List (TCL) VOCs and total and dissolved cadmium, chromium and lead in accordance with the methods specified in the NYSDEC Analytical Services Protocol (ASP) dated December, 1991.

9.3 Data Quality Assurance Plan

This data quality assurance plan focuses on the QA/QC to be performed as part of the proposed environmental monitoring program.

9.3.1 Quality Assurance Objectives for Measurement Data

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis and reporting that will provide defensible and reproducible results. This section defines the goals for the level of QA effort; accuracy, precision and sensitivity of analyses and completeness, representativeness, and comparability of measurement data. QA objectives for field measurements are also discussed as well chain-of-custody, calibration, laboratory analysis, reporting internal quality control and corrective actions.

9.3.1.1 Level of QA Effort

For ground water samples, field duplicates and field blanks will be taken and submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Field blank samples are analyzed to check for procedural contamination and/or ambient conditions at the site which may be affecting sample results. The general level of the QA effort for this project will be at least one field duplicate and one field blank for every round of monitoring.

Water samples will be analyzed for TCL VOCs and total and dissolved cadmium, chromium and lead. The level of laboratory QA effort for TCL analyses of water and sediment samples will be consistent with the NYSDEC ASP, December 1991.

9.3.1.2 Accuracy, Precision, and Sensitivity of Analyses

Accuracy, precision and sensitivity (detection limit) criteria for analytical services for organics will be consistent with the corresponding with the NYSDEC ASP dated December, 1991. In addition, the analytical laboratory used will have a current New York State Department of Health Environmental Laboratory Approval Program (DOH ELAP) certification in all categories of CLP and Solid and Hazardous Waste.

9.3.1.3 Completeness, Representativeness, and Comparability

The analytical laboratory will provide analytical results with the completeness required in the NYSDEC ASP dated December, 1991. The sampling network was designed to provide data representative of site conditions for the intended objectives of the project as defined in Section 9.1 of this Work Plan.

9.3.1.4 Field Measurements

Measurement data will be generated during field activities that are incidental to collecting samples for analytical testing or unrelated to sampling. These activities include, but are not limited to determining pH, specific conductance and temperature of water samples.

The general QA objective for field measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of data through standardized procedures.

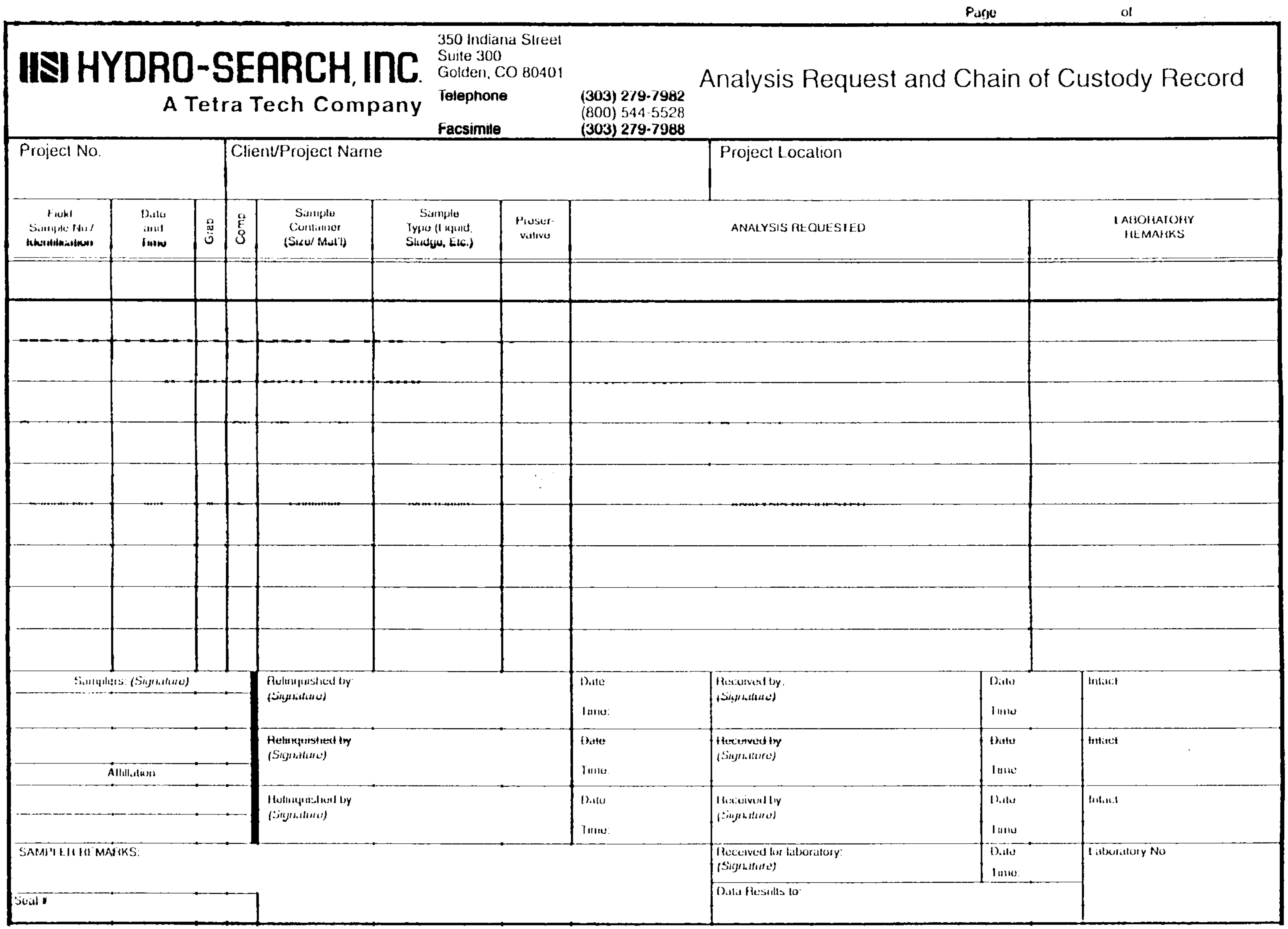
9.3.2 Implementation

9.3.2.1 Chain-of-Custody Procedures

Chain-of-custody procedures document the history of sample containers and samples from the time of preparation of sample containers through sample collection, shipment, and analysis. A sample is considered in custody if:

- The sample is in the sampler's physical possession;
- The sample is secured by the sampler to prevent tampering; or
- The sample is secured by the sampler in an area that is restricted to authorized personnel.

To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody record will be completed for each sample at each sampling location. Each time the samples are transferred, signatures of the person relinquishing and receiving the samples, as well as the date and time, will be documented. An example chain-of-custody record is provided in Figure 9-2.



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HSI HYDRO-SEARCH, INC.
A Tetra Tech Company

350 Indiana Street
Suite 300
Golden, CO 80401
Telephone (303) 279-7982
(800) 544-5528
Facsimile (303) 279-7988

Analysis Request and Chain of Custody Record

Project No.	Client/Project Name	Project Location

Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/ Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS

Samplers: *(Signature)*	Relinquished by: *(Signature)*	Date Time:	Received by: *(Signature)*	Date Time	Intact
Affiliation	Relinquished by *(Signature)*	Date Time:	Received by *(Signature)*	Date Time	Intact
	Relinquished by *(Signature)*	Date Time:	Received by *(Signature)*	Date Time	Intact
SAMPLER REMARKS:			Received for laboratory: *(Signature)*	Date Time:	Laboratory No
Seal #			Data Results to:		

PROJECT	REVISIONS
DATE	

Hydro-Search, Inc.
CONSULTING HYDROLOGISTS-GEOLOGISTS
Milwaukee • Denver • Reno

FIGURE 9-2

EXAMPLE CHAIN OF CUSTODY

9.3.2.2 Decontamination Program

All sampling equipment will be decontaminated prior to each use by the following protocol:

- Scrub equipment thoroughly in a low-sudsing detergent solution (e.g., Alconox);
- Rinse with distilled water; and
- Wrap equipment in plastic or aluminum foil for handling and/or storage until next use.

All drilling and borehole sampling equipment will be steam cleaned before beginning work, between borings and prior to leaving the site.

9.3.2.3 Calibration Procedures and Frequency

The calibration procedures and frequency of calibration for analysis of specified TCL parameters to be followed are specified in the NYSDEC ASP dated December, 1991.

Calibration of the field pH meter will be checked prior to the collection of each water sample. The field pH meter will be calibrated using two reference solutions as appropriate to the pH of the sample. The calibration of the specific-conductance/temperature meter will be checked using a reference solution of 0.01 N KCl (specific conductance, 1413 μmhos/cm at 25°C.) on a daily basis. Calibration readings must be within 5 percent to be acceptable.

9.3.2.4 Quality Control Samples

Field duplicates and field blanks will be submitted for analysis to provide the means to assess the quality of the data from the field sampling program. Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Field blanks are analyzed to check for any procedural contamination that could adversely affect the integrity of the sample. The level of QC effort for this project is summarized in Section 9.3.1.1.

One set of trip blank samples will also accompany each sample shipment. Trip blanks will only be analyzed if it is suspected that custody was breached, or if one of the investigative sample containers was broken during shipment.

9.3.2.5 Analytical Procedures

All samples collected for chemical analysis will be tested for TCL organics and inorganics using analytical methods specified in the NYSDEC ASP dated December, 1991.

9.3.2.6 Data Reduction, Validation and Reporting

Analytical data from the laboratory will be evaluated by the Organics Laboratory Supervisor for conformance to NYSDEC ASP requirements for accuracy, precision and completeness. Qualifications for approval, if appropriate, will be addressed in case narratives. In addition to the summarized forms for precision and accuracy of the analyses, the laboratory will provide the analytical results for blanks and duplicates and the recovery data for matrix and surrogate spikes. Complete data reporting packages in accordance with the ASP will be required from the laboratory.

9.3.2.7 Internal Quality Control Procedures

Internal quality control procedures for analysis of specified TCL parameters by the analytical laboratory will be in accordance with the NYSDEC ASP dated December 1991. These specifications include the types of audits required (surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for surrogate spikes, and the quality control acceptance criteria for these audits.

Quality control procedures for field measurements are limited to checking the reproducibility of the measurement in the field by obtaining multiple readings and by routine calibration of the

10-17-94

MOTOROLA INC.

August 9, 1994

TO: Pat Vadney

FROM: Meg MacFarlane

RE: Update on Arcade facility activities

Per your phone call to Bill Bruyere of Motorola, I wanted to update you on our (Prestolite and Motorola) voluntary environmental activities in Arcade.

As was previously communicated, Motorola and Prestolite are working together to address specific locations that may have a potential environmental impact. To date, the following activities have been accomplished.

1. The old subsurface waste water treatment structure, located under the parking lot, has been properly cleaned and closed.
2. Metals impacted soils have been removed from the run-off receiving area.
3. Exploratory test pits have been completed and all metal debris removed from the area immediately to the north of the waste water treatment building.
4. A soil vapor extraction system has been installed beneath the plant flooring.

Automotive and Industrial Electronics Group
4000 Commercial Ave Northbrook, IL 60062 / 312-480-8000 Telex 671-5420 MOTAPDUW/ TWX 910-693-2986 FAX (312) 480-5485

Arcade Facility Update

June 14, 1994

Following is an update on the voluntary environmental activities being conducted jointly by Motorola and Prestolite at Prestolite's Arcade facility.

As was previously communicated, Motorola and Prestolite are working together to address specific locations that may have a potential environmental impact. To date, the following activities have been accomplished.

1. The old subsurface waste water treatment structure, located under the parking lot, has been properly cleaned and closed.
2. Metals impacted soils have been removed from the run-off receiving area.
3. Exploratory test pits have been completed and all metal debris removed from the area immediately to the north of the waste water treatment building.
4. A soil vapor extraction system has been installed beneath the plant flooring.

We now are beginning one of the final field activities for the remaining source area identified. The area to be addressed is located on the north side of the water treatment facility. We will be stabilizing the metals impacted soils on-site using a cement-based process. The process involves the excavation of the impacted soils; screening the soil to remove large rock and debris; blending the soil with cement and water; curing of the stabilized material; and placement of the material back into the excavation. The process results in a concrete like mass that chemically and physically binds up the metals of concern.

The work is expected to take 16 to 20 weeks to complete. The work will be performed consistent with guidelines outlined by the NYSDEC and will not pose any threat to the employees and local residents. A copy of the work plan is available for your review in the environmental department.

If you have any questions, please contact your group leader.

We now are beginning one of the final field activities for the remaining source area identified. The area to be addressed is located on the north side of the water treatment facility. We will be stabilizing the metals impacted soils on-site using a cement-based process. The process involves the excavation of the impacted soils; screening the soil to remove large rock and debris; blending the soil with cement and water; curing of the stabilized material; and placement of the material back into the excavation. The process results in a concrete like mass that chemically and physically binds up the metals of concern.

The work is expected to take 16 to 20 weeks to complete. The work will be performed consistent with guidelines outlined by the NYSDEC and will not pose any threat to the employees and local residents. A copy of the work plan is available for your review in the environmental department.

Pat, I am including a copy of the notice given to employees on June 14th. If you have any further questions, please call me at 708/480-6696. Thanks.

instruments, where appropriate. Quality control of field sampling will involve collecting field duplicates and blanks in accordance with the applicable procedures described in Section 5.3.

9.3.2.8 Data Assessment Procedures

Analytical data from the laboratory will be assessed for accuracy, precision, and conformance with QC criteria by the Laboratory Section Supervisors with overview by the Quality Assurance Manager in accordance with the NYSDEC ASP dated December, 1991.

Data from the field measurements will be assessed by thorough review of documentation of analytical procedures that were adhered to, and results of systems audits. All data will be reviewed for completeness by the oversight project manager as appropriate to his operational responsibilities.

9.3.2.9 Corrective Action Procedures

If a quality control audit results in detection of unacceptable conditions or data, the oversight project manager will be responsible for developing and initiating corrective actions. The laboratory will be notified if the nonconformance is of program significance. Corrective action may include:

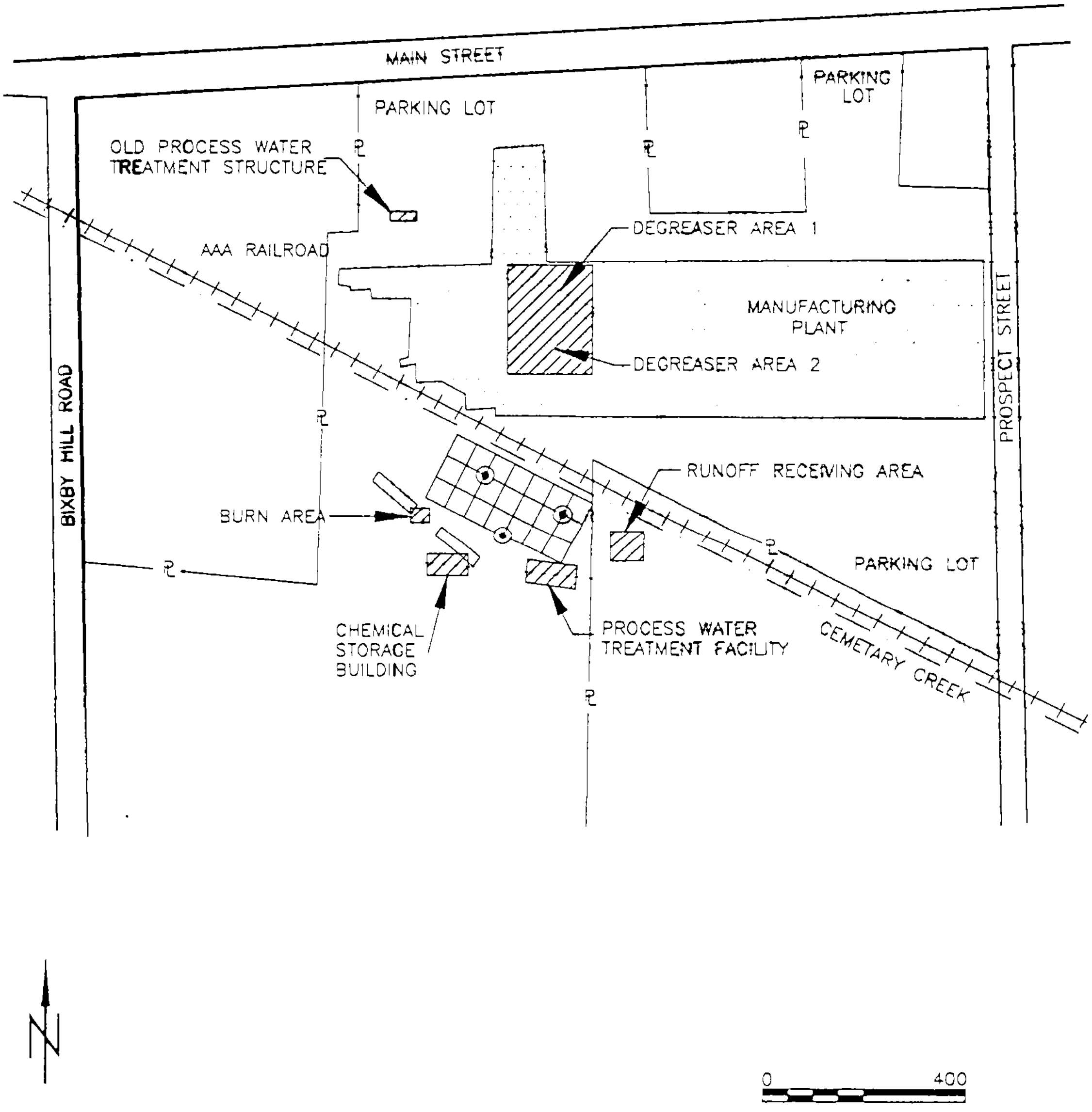
- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting the data and acknowledging its level of uncertainty.

9.3.2.10 Quality Assurance Reports

No separate QA report is planned for the environmental monitoring program. The quarterly reports will contain a separate QA/QC section summarizing the quality of the data collected and/or used as appropriate to the project.

APPENDIX A

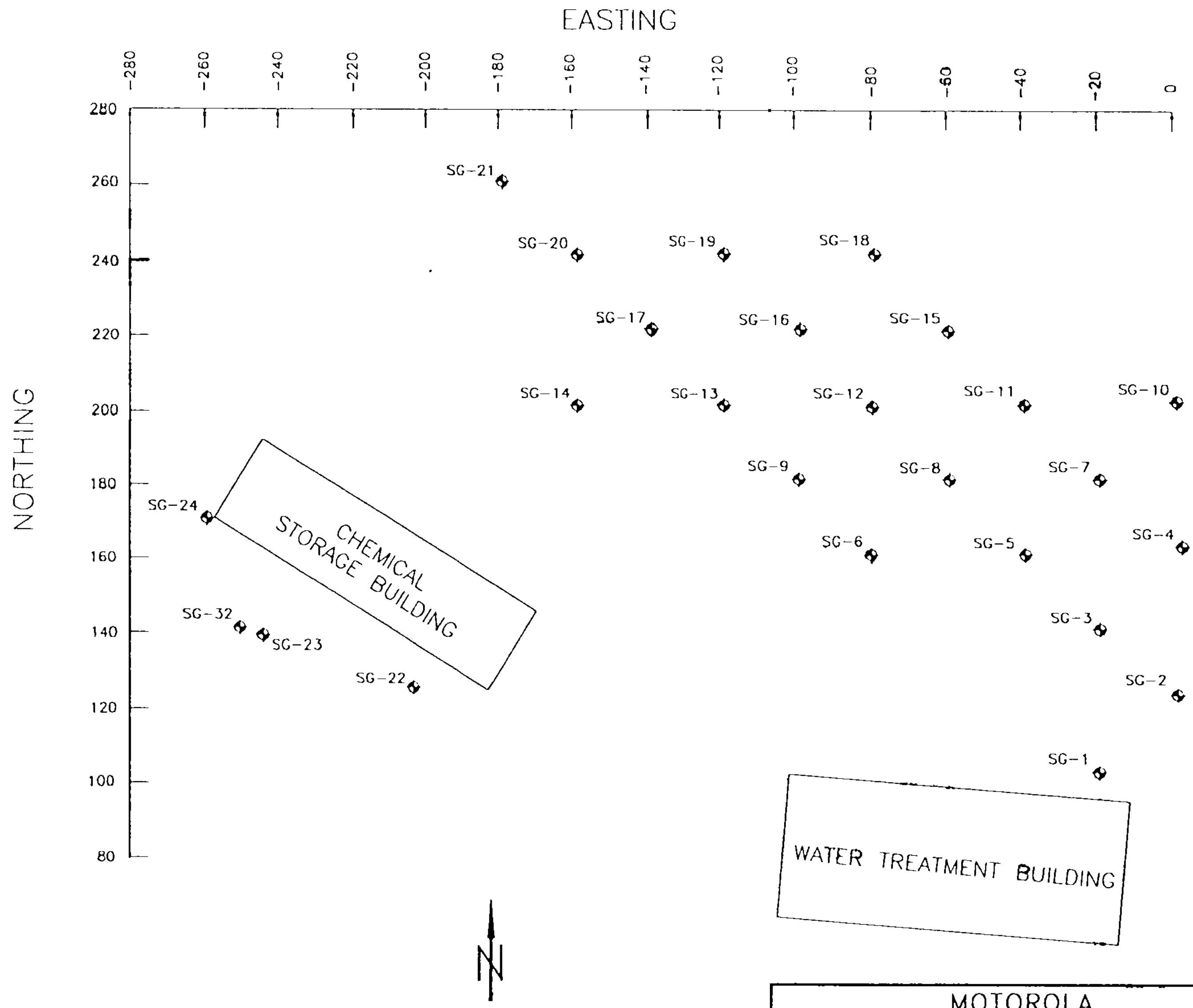
ADDITIONAL SAMPLING RESULTS



LEGEND

ᘓ	PROPERTY LINE
⊙	SAMPLING POINT WITH VEHICAL SAMPLING
⊞	SOIL SAMPLING GRID

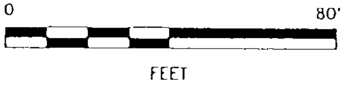
MOTOROLA	DATE:	11/30/92
SAMPLING GRID	DESIGNED:	
	CHECKED:	
	APPROVED:	RG
	DRAWN:	TBL
	PROJ.:	204262005
HSI SIMON HYDRO-SEARCH	Figure 1	



LEGEND

◈	SURVEY GRID SAMPLE LOCATION
SG-22	SAMPLE NAME AND NUMBER

SCALE



MOTOROLA
ARCADE

SOIL SAMPLE LOCATIONS

SIMON
HYDRO-SEARCH

DATE:	11/25/92
DESIGNED:	
CHECKED:	
APPROVED:	
DRAWN:	TBL
PROJ.:	204262005

Figure 2

TABLE 1

ARCADE PRESTOLITE PLANT SITE SAMPLE LOCATIONS

Surface Soil Samples

Sample	Location Description			Date
ID	Northing	Easting	Description	Collected
SS11			Former burning area	May 1992
SS12			Former burning area	May 1992
SS13			Former burning area	May 1992
SS14			Former burning area	May 1992
SS15			Former burning area	May 1992
SG-1	100	-20	Survey Grid	July 21, 1992
SG-2	120	0	Survey Grid	July 21, 1992
SG-3	140	-20	Survey Grid	July 21, 1992
SG-4	160	0	Survey Grid	July 21, 1992
SG-5	160	-40	Survey Grid	July 21, 1992
SG-6	160	-80	Survey Grid	July 21, 1992
SG-7	180	0	Survey Grid	July 21, 1992
SG-8	180	-60	Survey Grid	July 21, 1992
SG-9	180	-100	Survey Grid	July 21, 1992
SG-10	200	0	Survey Grid	July 21, 1992
SG-11	200	-40	Survey Grid	July 21, 1992
SG-12	200	-80	Survey Grid	July 21, 1992
SG-13	200	-120	Survey Grid	July 21, 1992
SG-14	200	-160	Survey Grid	July 21, 1992
SG-15	220	-60	Survey Grid	July 21, 1992
SG-16	220	-100	Survey Grid	July 21, 1992
SG-17	220	-140	Survey Grid	July 21, 1992
SG-18	240	-80	Survey Grid	July 21, 1992
SG-19	240	-120	Survey Grid	July 21, 1992
SG-20	240	-160	Survey Grid	July 21, 1992
SG-21	260	-180	Survey Grid	July 21, 1992
SG-22	124	-205	Survey Grid	July 22, 1992
SG-23	138	-245	Survey Grid	July 22, 1992
SG-24	170	-260	Survey Grid	July 22, 1992
SG-25	170	-40	2-foot depth	July 22, 1992
SG-26	170	-40	4-foot depth; same location as SG-25	July 22, 1992
SG-27	260	-180	4-foot depth; same location as SG-21	July 22, 1992
SG-28	260	-180	2-foot depth; same location as SG-21	July 22, 1992
SG-30	200	-120	2-foot depth; same location as SG-13	July 22, 1992
SG-31	200	-120	4-foot depth; same location as SG-13	July 23, 1992
SG-32	140	-250	2-foot depth; same location as SG-23	July 23, 1992
SG-33	140	-250	4-foot depth; same location as SG-32	July 23, 1992

Subsurface Soil Samples

Sample	Location Description			Date
ID	Northing	Easting	Description	Collected
SB09-1			Former burning area, near MW-06D, 2-foot depth.	May 1992

TABLE 2
INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)

	SUBSURFACE SOILS						SURFACE SOILS						
	RUNOFF RECIEVING AREA			FORMER BURNING AREA			CHEMICAL STORAGE BUILDING						
PARAMETER	SS03	SB08-1	SB08-2	SS02	SB09-1	SB02	SG-26	SG-27	SG-28	SG-30	SG-31	SG-32	SG-33
Al Aluminum	12900	18500	15800	12900	9670	14700	—	—	—	—	—	—	—
Sb Antimony	ND	ND	ND	ND	ND	ND	—	—	—	—	—	—	—
As Arsenic	14.4	15.9	11.8	10.7	11.2	8.7	—	—	—	—	—	—	—
Ba Barium	118	180	171	79.3	39.1B	54.8	—	—	—	—	—	—	—
Be Beryllium	1.1B	1.2B	1.5	0.74B	ND	0.86B	—	—	—	—	—	—	—
Cd Cadmium	8420	602	225	475	2.7	ND	15.8	0.66	0.43	590	35	98.5	588
Ca Calcium	3230	2190	1690	12800	1670	1770	—	—	—	—	—	—	—
Cr Chromium	44.3	22.2	19.1	23.7	12.9	17	116	10.5	13.2	18.8	15.4	17.2	16.4
Co Cobalt	12.8	14.9	16.2	11.1B	7.0B	10.6	—	—	—	—	—	—	—
Cu Copper	224	32.7	17.4	75.4	25.8	21.3	—	—	—	—	—	—	—
Fe Iron	24100	34800	34800	25700	21600	26400	—	—	—	—	—	—	—
Pb Lead	241	21.9	24.4	22.9	14.5	16.7	267	37.7	12.9	890	75.2	26.7	77.2
Mg Magnesium	2900	4280	3770	4880	3100	3820	—	—	—	—	—	—	—
Mn Manganese	1160	1190	1800	740	1190	746	—	—	—	—	—	—	—
Hg Mercury	ND	ND	ND	ND	ND	ND	—	—	—	—	—	—	—
Ni Nickel	46.8	31.1	28.2	25.9	20.1	23.5	—	—	—	—	—	—	—
K Potassium	1440	1590	1330	1450	986B	1630	—	—	—	—	—	—	—
Se Selenium	ND	ND	ND	ND	ND	ND	—	—	—	—	—	—	—
Ag Silver	0.75B	0.87B	1.0B	ND	ND	0.56B	—	—	—	—	—	—	—
Na Sodium	75.98	44.7B	45.1B	78.3B	46.5B	79.4B	—	—	—	—	—	—	—
Th Thallium	ND	ND	ND	ND	ND	ND	—	—	—	—	—	—	—
Va Vanadium	16	23.2	22.1	16.5	11.9	18.1	—	—	—	—	—	—	—
Zn Zinc	377	123	99.6	310	82.7	85.9	—	—	—	—	—	—	—

— = Parameter not analyzed.

B = The analyte was found in the blank as well as in the sample indicating possible/probable contamination and warning the data user to take appropriate action.

ND = The analyte was analyzed for but not detected.

NOTE: SS01, SS02, SS03, SB01 and SB02 were collected as part of the Phase II Site Investigation and are shown for comparison only.

SG-25 and SG-26 were sampled at 2 and 4 feet, respectively.

SG-27 and SG-28 were sampled at location SG-21 at 4 and 2 feet, respectively.

SG-30 and SG-31 were sampled at location SG-13 at 2 and 4 feet, respectively.

SG-32 and SG-33 were sampled at location SG-23 at 2 and 4 feet, respectively.

TABLE 2
INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)
(cont)

PARAMETER	SURFACE SOILS (cont)															BACKGROUND SAMPLES	
	SURVEY GRID AREA (cont)										FORMER BURNING AREA						
	SG-16	SG-17	SG-18	SG-19	SG-20	SG-21	SG-22	SG-23	SG-24	SG-25	SS11	SS12	SS13	SS14	SS15	SS01	SB01
Al Aluminum	—	—	—	—	—	—	—	—	—	—	11000	8290	8130	10600	12000	15600	12800
Sb Antimony	—	—	—	—	—	—	—	—	—	—	ND	ND	ND	ND	ND	ND	ND
As Arsenic	—	—	—	—	—	—	—	—	—	—	8.7	9.4	123	11.0	10.2	6.6	12.9
Ba Barium	—	—	—	—	—	—	—	—	—	—	90.7	57.3	59.4	61.6	114	73	70.9
Be Beryllium	—	—	—	—	—	—	—	—	—	—	ND	ND	ND	ND	ND	0.76B	0.68B
Cd Cadmium	260	70.7	215	406	118	105	1260	893	326	1.4	25.4	193	33.7	803	1230	ND	ND
Ca Calcium	—	—	—	—	—	—	—	—	—	—	15800	10100	11100	2710	3370	1430	2400
Cr Chromium	13.9	2.8	14.6	10.7	13.8	11.3	17.2	19.1	15.6	15.8	19.5	16.9	17.2	26.6	16.1	18	16
Co Cobalt	—	—	—	—	—	—	—	—	—	—	9.2B	7.6B	7.6B	10.0B	11.4B	7.0B	13
Cu Copper	—	—	—	—	—	—	—	—	—	—	207	91.8	53.8	70.1	130	12.6	26.2
Fe Iron	—	—	—	—	—	—	—	—	—	—	25900	19100	19700	23200	27300	22700	28300
Pb Lead	74.9	8.6	41.9	35.7	44.6	26.9	45	50.9	36.7	33	54.4	32.2	36.7	107	51.5	18.1	16.2
Mg Magnesium	—	—	—	—	—	—	—	—	—	—	4790	5170	5120	3290	3530	2440	9000
Mn Manganese	—	—	—	—	—	—	—	—	—	—	722	604	660	495	947	406	408
Hg Mercury	—	—	—	—	—	—	—	—	—	—	0.14	0.19	ND	0.14	ND	ND	ND
Ni Nickel	—	—	—	—	—	—	—	—	—	—	27.8	20.9	21.8	23.8	22.8	11.3	26.3
K Potassium	—	—	—	—	—	—	—	—	—	—	989B	734B	715B	853B	1070B	1790	2130
Se Selenium	—	—	—	—	—	—	—	—	—	—	ND	0.27B	ND	0.50B	ND	ND	ND
Ag Silver	—	—	—	—	—	—	—	—	—	—	ND	ND	ND	ND	ND	ND	0.71B
Na Sodium	—	—	—	—	—	—	—	—	—	—	55.6B	39.2B	46.3B	37.8B	46.6B	64.1B	114B
Th Thallium	—	—	—	—	—	—	—	—	—	—	ND	ND	ND	ND	ND	ND	ND
Va Vanadium	—	—	—	—	—	—	—	—	—	—	18.3	13.5	13.0B	15.6	20.0	28.3	17.4
Zn Zinc	—	—	—	—	—	—	—	—	—	—	236	208	214	436	636	79.7	73.9

— = Parameter not analyzed.

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SG-25 and SG-26 were sampled at 2 and 4 feet, respectively.
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SG-32 and SG-33 were sampled at location SG-23 at 2 and 4 feet, respectively.

TABLE 2
INORGANIC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (mg/kg)
(cont)

PARAMETER	SURFACE SOILS (cont)														
	SURVEY GRID AREA														
	SG-1	SG-2	SG-3	SG-4	SG-5	SG-6	SG-7	SG-8	SG-9	SG-10	SG-11	SG-12	SG-13	SG-14	SG-15
Al Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sb Antimony	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
As Arsenic	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ba Barium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Be Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cd Cadmium	35.8	401	113	764	519	510	6.4	292	34.5	701	512	182	229	3.9	146
Ca Calcium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cr Chromium	5.8	33.5	12.4	14.1	13.3	17.4	8.2	12.5	6.3	13.4	14.4	12	7.7	6.1	17
Co Cobalt	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cu Copper	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fe Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pb Lead	12.6	99.3	37.1	44.2	121	90.8	11.6	25.2	12.4	33.6	51.5	33.3	22.5	9.5	34.3
Mg Magnesium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mn Manganese	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hg Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ni Nickel	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
K Potassium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Se Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ag Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Na Sodium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Th Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Va Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zn Zinc	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

— = Parameter not analyzed.

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SG-32 and SG-33 were sampled at location SG-23 at 2 and 4 feet, respectively.

General Testing Corporation

A Full Service Environmental Laboratory

LABORATORY REPORT

Job No: R92/03138 Date: AUG. 26 1992

Client:
Mr. Kenneth Paisley
Sevenson Environmental
2749 Lockport Rd.
Niagara Falls, NY 14302

Sample(s) Reference

Arcade, NY

Soil Sample Collected by Sevenson During Drum Removal From in Front (North) of the Waste Water Treatment Building

Received : 07/23/92 P.O. #: IE 7045

[illegible]CLP VOLATILES BY EPA METHOD 8240*** ANALYTICAL RESULTS - ug/l

Sample:	-001						
Location:	Treatment Plant Exc.						
Date Collected:	07/22/92						
Time Collected:	12:05						
	BIASED	UNBIASED	% RECOVERY				
Date Analyzed:	07/31/92						
Dilution:	10						
Benzene	50 U	50 U	104				
Carbon Tetrachloride	50 U	50 U	100				
Chlorobenzene	50 U	50 U	96				
Chloroform	50 U	50 U	104				
1,2-Dichloroethane	50 U	50 U	100				
1,1-Dichloroethene	50 U	50 U	100				
Methyl Ethyl Ketone	100 U	100 U	88				
Tetrachloroethene	50 U	50 U	96				
Trichloroethene	50 U	50 U	100				
Vinyl Chloride	50 U	50 U	100				
SURROGATE STANDARD RECOVERIES							
1,2-Dichloroethane-d4	105						
(Acceptance Limits: 76-114%)							
Toluene d8	98						
[illegible]cceptance Limits: 88-110%)							
Bromofluorobenzene	101						
(Acceptance Limits: 86-115%)							

Unless otherwise noted, analytical methodology has been obtained from references as cited in 40 CFR, parts #136 & #261.

NY ID# in Rochester: 10145
N[illegible] ID# in Rochester: 73331
N[illegible] ID# in Hackensack: 02317
NY ID# in Hackensack: 10801

*TCLP Toxicity Characteristic Leaching Procedure.
Federal Register, Part 261, Vol. 55, No. 126,
June 29, 1990.

[illegible]ata reported is biased on the above regulation.

Michael K. Perry
Laboratory Director

General Testing Corporation

A Full Service Environmental Laboratory

LABORATORY REPORT

Job No: R92/03138 Date: AUG. 19 1992

Client:
Mr. Kenneth Paisley
Sevenson Environmental
2749 Lockport Rd.
Niagara Falls, NY 14302

Sample(s) Reference

Arcade, NY

Received : 07/23/92

P.O. #: IE 7045

ANALYTICAL RESULTS - mg/l

Sample:	-001		
Location:	Treatment Plant Exc.		
Date Collected:	07/22/92		
Time Collected:	12:05		
	BIASED	UNBIASED	% RECOVERY
TCLP Extraction Metals ***			
Arsenic	0.500 U	0.500 U	104
Barium	1.58	1.56	99
Cadmium	1.99	1.99	111
Chromium	0.100 U	0.100 U	99
Copper	--	0.557	--
Lead	0.238	0.218	92
Mercury	0.0020 U	0.0020 U	89
Nickel	--	0.096	--
Selenium	0.500 U	0.500 U	102
Silver	0.100 U	0.100 U	90
Zinc	--	5.3	--

Unless otherwise noted, analytical methodology has been obtained from references as cited in 40 CFR, parts #136 & #261.

NY ID# in Rochester: 10145
NJ ID# in Rochester: 73331
NJ ID# in Hackensack: 02317
NY ID# in Hackensack: 10801

***TCLP Toxicity Characteristic Leaching Procedure.
Federal Register, Part 261, Vol. 55, No. 126,
June 29, 1990.

Data reported is biased on the above regulation.

Laboratory Director

General
Testing
Corporation

A Full Service Environmental Laboratory

LABORATORY REPORT

Job No: R92/03138 Date: AUG. 19 1992

Client:
Mr. Kenneth Paisley
Sevenson Environmental
2749 Lockport Rd.
Niagara Falls, NY 14302

Sample(s) Reference:

Arcade, NY

Received : 07/23/92

P.O. #: IE 7045

ANALYTICAL UNITS - ug/g Wet Wt.

Sample:	-001							
Location:	Treatment Plant Exc.							
Date Collected:	07/22/92							
Time Collected:	12:05							
Cyanide, Total	12.0 J							
Cyanide, Free	0.010 UJ							

Unless otherwise noted, analytical methodology has been obtained from references as cited in 40 CFR, parts #136 & #261.

NY ID# in Rochester: 10145
NJ ID# in Rochester: 73331
NJ ID# in Hackensack: 02317
NY ID# in Hackensack: 10801

Michael K. Perry

Laboratory Director

General Testing Corporation

A Full Service Environmental Laboratory

LABORATORY REPORT

Job No: R92/03138　　Date: AUG. 25 1992

Client:
Mr. Kenneth Paisley
Sevenson Environmental
2749 Lockport Rd.
Niagara Falls, NY 14302

Sample(s) Reference

Arcade, NY

Received　: 07/23/92

P.O. #: IE 7045

ANALYTICAL RESULTS - ug/g Wet Wt.

Sample:	-001							
Location:	Treatment Plant Exc.							
Date Collected:	07/22/92							
ime Collected:	12:05							
pH	8.22							
Ignitability °C	>100							
Reactivity								
Total Available Cyanide	0.333 U							
Total Available Sulfide	8.0							

Unless otherwise noted, analytical methodology has been obtained from references as cited in 40 CFR, parts #136 & #261.

Y ID# in Rochester: 10145
J ID# in Rochester: 73331
NJ ID# in Hackensack: 02317
Y ID# in Hackensack: 10801

Michael K. Perry

Laboratory Director

General Testing Corporation

A Full Service Environmental Laboratory

LABORATORY REPORT

Job No: R92/03138 Date: AUG. 13 1992

Client: Sample(s) Reference

Sevenson Environmental Arcade, NY

Date Received: 07/23/92 Date Sample Taken: 07/22/92

LABORATORY CHRONICLE
DATE ANALYZED

Sample:	-001						
Location:	Treatment Plant Exc.						
pH	07/22/92						
Ignitability °C	08/03/92						
Cyanide, Total	08/14/92						
Cyanide, Free	08/14/92						
Reactivity							
Total Available Cyanide	07/29/92						
Total Available Sulfide	07/29/92						
TCLP Metals							
Arsenic	07/30/92						
Barium	07/30/92						
Cadmium	07/30/92						
Chromium	07/30/92						
Copper	08/14/92						
Lead	07/30/92						
Mercury	07/29/92						
Nickel	08/14/92						
Selenium	07/30/92						
Silver	07/30/92						
Zinc	08/14/92						

APPENDIX B

BENCH SCALE TEST DATA

94017

RSI *Remediation Services, Inc.*

P.O. Box 587
Independence, KS 67301
(316) 331-1200

April 27, 1994

Mr. Rich Gnat
Simon Hydro-Search
350 Indiana Street, Suite 300
Golden, Colorado 80401

Re: Prestolite Plant Site
Arcade, NY
RSI Project No. 94017

Dear Rich:

Please find enclosed results of bench tests performed on the soil samples we received on April 12, 1994. Type 1 Portland cement was mixed with the waste at the rate of 10%, 15%, and 20%. Another portion of the sample was mixed with 15% Type 1 Portland cement and sodium silicate at the rate of 5% silicate to the total weight of Portland cement. As you will note, all of the samples exhibited a concentration lower than the regulatory limits for lead and cadmium when subjected to the Toxicity Characteristic Leaching Procedure. Percentage of weight gain/loss for each of the mixtures is as follows:

Portland Cement/Silicate:

10%	1,100 Grams	Waste & Cement
	1,067 Grams	Final Weight
	3%	Weight Loss
15%	1,150 Grams	Waste & Cement
	1,134 Grams	Final Weight
	1.4%	Weight Loss
15% / 5%	1,157.5 Grams	Waste, Cement & Silicate
	1,129.0 Grams	Final Weight
	2.46%	Weight Loss
20%	1,200 Grams	Waste & Cement
	1,154 Grams	Final Weight
	3.83%	Weight Loss

The sample which we received contained a considerable amount of free liquids. These liquids were separated to simulate the waste characteristics as they would exist during the waste treatment process. However, the moisture content may have still have been greater than will exist in the actual field conditions and therefore, impact the actual weight gain/loss that will be experienced in the field.

Although all of these samples exhibited less than the regulatory levels for cadmium and lead when subjected to the Toxicity Characteristic Leaching Procedure, additional samples will be collected for bench testing during the initial excavation phase to verify these results.

We look forward to working with you on this project. Should you have any questions or need additional information, please feel free to call.

Sincerely,

REMEDIATION SERVICES, INC.

Grant V. Sherwood
President

Encl.

RECEIVED APR 26 1994

RECRA ENVIRONMENTAL, INC.
Chemical and Environmental Analysis Services

April 22, 1994

Remediation Services, Inc.
P.O. Box 587
Independence, KS 67301
Attn: Grant Sherwood

Re: Analytical Results

Dear Mr. Sherwood;

Please find enclosed results concerning the analyses of the samples recently submitted by your firm. The Pertinent Information regarding these analyses is listed below:

Quote #: OH94-032
Matrix: Soil/Extract
Sample Received: 4/19/94
Sample Date: 4/18/94

If you have any questions concerning these data, please contact me at (216) 328-9510 and refer to the I.D. number listed below. It has been our pleasure to provide Remediation Services, Inc. with Environmental Testing Services. We look forward to serving you in the future.

Sincerely,

RECRA ENVIRONMENTAL, INC.

Robert M. Kissel

Robert M. Kissel
Manager
Ohio Environmental Testing
Operations

RMK/rb
Enclosure

I.D. Number: C94-0159

ANALYTICAL RESULTS

Prepared For

Remediation Services, Inc.
P.O. Box 587
Independence, KS 67301

Prepared By

Recra Environmental, Inc.
8001 Sweet Valley Dr.
Valley View, OH 44125

METHODOLOGIES

The specific methodologies employed in obtaining the enclosed analytical results are indicated on the specific data table. The method numbers presented refer to the following references.

- U.S. Environmental Protection Agency "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846), Third Edition, August, 1993.

COMMENTS

Comments pertain to data on one or all pages of this report.

The enclosed data are reported utilizing data qualifiers (Q) as defined on the Organic and/or Inorganic Data Comment Pages.

METALS TESTING

The Toxicity Characteristic Leaching Procedure was performed on 4/19/94. The TCLP matrix spike quality control analyses was performed on sample 94016/20%.

INORGANIC DATA COMMENT PAGE

Laboratory Name: RECRA ENVIRONMENTAL, INC.

USEPA Defined Inorganic Data Qualifiers:

B - Indicates a value greater than or equal to the instrument detection limit but less than the contract required detection limit.

U - Indicates element was analyzed for but not detected. Report with the detection limit value (e.g., 100).

E - Indicates a value estimated or not reported due to the presence of interference.

S - Indicates value determined by Method of Standard Addition.

N - Indicates spike sample recovery is not within control limits.

* - Indicates duplicate analysis is not within control limits.

+ - Indicates the correlation coefficient for method of standard addition is less than 0.995.

M - Indicates duplicate injection results exceeded control limits.

W - Post digestion spike for Furnace AA analysis is out of control limits (85%-115%), while sample absorbance is less than 50% of spike absorbance.

G - The TCLP Matrix Spike recovery was greater than the upper limit of the analytical method.

L - The TCLP Matrix Spike recovery was lower than the lower limit of the analytical method.

e: 04/22/94
e: 15:07:23

REMEDIATION SERVICES, INC.
MOTOROLA
ANALYTICAL RESULTS

Rept: AN0353
Page: 1

Client Sample ID:			94016/10%	94016/15%	94016/15/5%	94016/20%	
Job Number & Lab Sample ID:			C94-0159 C4015902	C94-0159 C4015901	C94-0159 C4015904	C94-0159 C4015903	
Sample Date:			04/18/94	04/18/94	04/18/94	04/18/94	
Analyte	UNITS OF MEASURE	PQL	Result	Result	Result	Result	
METALS							
dmium - Total	MG/L	0.0050	0.025	0.021	0.028	0.028	
ead - Total	MG/L	0.10	0.36	0.32	0.33	0.35	

Recra Environmental, Inc.

Indicates Result is Outside QC Limits
Not Applicable

e: 04/22/94
e: 15:07:23

REMEDIATION SERVICES, INC.
MOTOROLA
QC ANALYTICAL RESULTS

Rept: AN0353
Page: 2

Client Sample ID:			94016/20%				
Job Number & Lab Sample ID:			C94-0159 C4015903MS				
Sample Date:			04/18/94				
Analyte	UNITS OF MEASURE	PQL	Result				
' METALS							
dmium - Total	MG/L	0.0050	0.13				
ead - Total	MG/L	0.10	1.4				

Recra Environmental, Inc.

Indicates Result is Outside QC Limits
ot A[illegible]able

Rept: AN0364

e : 04/22/94 15:08
No: C94-0159

REMEDIATION SERVICES, INC.
MOTOROLA
QUALITY CONTROL SPIKE ANALYSIS

nt Sample ID: 94016/20% 94016/20%
ab Sample ID: C4015903 C4015903MS

nalyte	Units of Measure	Concentration		Spike Amount	% Recovery MS	QC LIMITS
		Sample	Matrix Spike			
P METALS ANALYSIS						
CLP TOTAL CADMIUM	MG/L	0.028	0.13	0.10	102	75-125
CLP TOTAL LEAD	MG/L	0.35	1.4	1.0	105	75-125

Indicates Result is outside QC Limits
[illegible] Not [illegible]late[illegible]D = [illegible]alcu[illegible]

Recra Environmental, Inc.

:MEDIATION SERVICES, INC.
O. BOX 587
DEPENDENCE, KS 67301

PHONE: (316) 331-1200
FAX: (316) 331-6216

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Page 1 of 1

ject Manager: oras Sherwood
dress:
Phone:
Fax:
Site Location: Arcade N.Y.
ject Number: ~~94016~~ 94017
Project Name: Motorola
Sampler Name:

est that the proper field sampling ceedures were used during the collection nese samples.

						ANALYSIS REQUEST						
FIELD SAMPLE I.D.	LAB #	MATRIX Water Sludge Soil Other	METHOD PRESERVED HCl HNO3 ICE NONE	SAMPLING DATE	SAMPLING TIME	TCLP Metals (8)	TCLP Lead (Pb)	Total Lead (Pb)	Corrosivity (pH)	Flash Point	Reactivity	TCLP Cd
4016 / 15%		soil	None	4/18	1pm		X					X
1016 / 10%				"	1:05		X					X
4016 / 20%				"	1:07		X					X
4016 / 15/5%				"	1:09		X					X

SPECIAL HANDLING

4 HOURS	RUSH	48 HOURS	5-DAY	NORMAL	FAX
( )	( )	( )	(X)	( )	(X)

Laboratory Sample Sent To
Name: RECRA
Phone: 216-328-9510

REMARKS:
Report Seperately
Bench Tests from Sample Received from QSRI.

USTODY RECORD:

	DATE	TIME	
elinquished by Sampler:	4/18	4:30	Received By: Federal Express
elinquished by:			Received By:
elinquished by:	4-19-94	08 15	Received By Laboratory:

Waybill #

APPENDIX C

TCLP DATA

TABLE C-1

SUMMARY OF PROCESS SAMPLES COLLECTED TO DATE

MOTOROLA ARCADE SITE REMEDIATION ANALYTICAL SUMMARIES

SAMPLE ID	DATE SUBMITTED	Cd	Cr	Pb	PASS/FAIL	STATUS	COMMENTS
B-1	08/10/94	>0.005	0.18	>0.03	Pass		
B-2	08/10/94	0.016	0.24	>0.03	Pass	Disp. at BFI	
B-3	08/10/94	>0.005	0.21	>0.03	Pass	Disp. at BFI	
B-4	08/10/94	>0.005	0.21	>0.03	Pass	Disp. at BFI	
B-5	08/10/94	>0.005	0.24	>0.03	Pass	Disp. at BFI	
B-6	08/10/94	0.014	0.13	>0.03	Pass	Disp. at BFI	
B-7	08/10/94	>0.005	0.27	>0.03	Pass	Disp. at BFI	
B-8	08/10/94	>0.005	0.21	>0.03	Pass	Disp. at BFI	
B-9	08/11/94	>0.005	0.04	>0.03	Pass	Disp. at BFI	
B-10	08/11/94	>0.005	0.05	>0.03	Pass	Disp. at BFI	
C-10	08/11/94	0.005	0.09	>0.03	Pass		Collocate
D-10	08/11/94	>0.005	0.01	>0.03	Pass		Field Blank
B-11	08/11/94	>0.005	0.09	>0.03	Pass	Disp. at BFI	
B-12	08/11/94	>0.005	0.17	>0.03	Pass	Disp. at BFI	
B-13	08/11/94	>0.005	0.19	>0.03	Pass	Disp. at BFI	
B-14	08/11/94	>0.005	0.19	>0.03	Pass	Disp. at BFI	
B-15	08/11/94	>0.005	0.20	>0.03	Pass	Disp. at BFI	
B-16	08/11/94	>0.005	0.18	>0.03	Pass	Disp. at BFI	
B-17	08/11/94	>0.005	0.18	>0.03	Pass	Disp. at BFI	
B-18	08/11/94	>0.005	0.17	>0.03	Pass	Disp. at BFI	
B-19	08/11/94	>0.005	0.21	>0.03	Pass	Disp. at BFI	
B-20	08/11/94	>0.005	0.22	>0.03	Pass	Disp. at BFI	
C-20	08/11/94	>0.005	0.22	>0.03	Pass		Collocate
D-20	08/11/94	>0.005	0.01	>0.03	Pass		Field Blank
B-21-25	08/12/94	>0.005	0.12	>0.005	Pass	Disp. at BFI	Composite of batches 21 through 25
B-26-30	08/12/94	>0.005	0.16	0.15	Pass	Disp. at BFI	
B-31-35	08/12/94	>0.005	0.15	>0.03	Pass	Disp. at BFI	
B-36-40	08/15/94	>0.005	0.09	>0.03	Pass	Disp. at BFI	
B-41-45	08/15/94	>0.005	0.13	>0.03	Pass	Disp. at BFI	
B-46-50	08/15/94	>0.005	0.12	>0.03	Pass	Disp. at BFI	
B-51-55	08/16/94	0.030	0.10	0.33	Pass	Disp. at BFI	
B-56-60	08/16/94	0.040	0.15	0.29	Pass	Disp. at BFI	
T-15-1	08/17/94	0.040	0.13	0.26	Pass	Disp. at BFI	15 percent test sample

TABLE C-1
SUMMARY OF PROCESS SAMPLES COLLECTED TO DATE
MOTOROLA ARCADE SITE REMEDIATION ANALYTICAL SUMMARIES

SAMPLE ID	DATE SUBMITTED	Cd	Cr	Pb	PASS/FAIL	STATUS	COMMENTS
B-61-65	08/17/94	0.020	0.06	0.28	Pass	Disp. at BFI	
C-61-65	08/17/94	0.030	0.07	0.33	Pass		Collocate
D-61-65	08/17/94	0.030	0.04	0.35	Pass		Field Blank
B-66-70	08/17/94	0.050	0.13	0.28	Pass	Disp. at BFI	
B-71-75	08/18/94	0.030	0.08	0.36	Pass	Disp. at BFI	
B-76-80	08/18/94	0.030	0.11	0.33	Pass	Disp. at BFI	
B-81-85	08/18/94	0.040	0.14	0.35	Pass	Disp. at BFI	
B-86-90	08/18/94	0.030	0.15	0.28	Pass	Disp. at BFI	
B-91-95	08/18/94	0.030	0.13	0.34	Pass	Disp. at BFI	
B-96-100	08/19/94	<0.01	0.05	<0.01	Pass	Disp. at BFI	
B-101-105	08/19/94	<0.01	0.05	<0.01	Pass	Disp. at BFI	Batch with 15% Portland Cement
B-106-110	08/19/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-111-115	08/19/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
C-111-115	08/19/94	<0.01	<0.05	<0.01	Pass		Collocate
D-111-115	08/19/94	<0.01	<0.05	<0.01	Pass		Field Blank
B-116-120	08/24/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-121-125	08/24/94	<0.01	0.08	<0.01	Pass	Disp. at BFI	
B-126-130	08/24/94	<0.01	0.10	<0.01	Pass	Disp. at BFI	
B-131-135	08/25/94	<0.01	0.09	<0.01	Pass	Disp. at BFI	
B-136-140	08/25/94	<0.01	0.06	<0.01	Pass	Disp. at BFI	
B-141-145	08/25/94	<0.01	0.05	<0.01	Pass	Disp. at BFI	
B-146-150	08/25/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-151-155	08/26/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-156-160	08/26/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-161-165	08/26/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
C-161-165	08/26/94	<0.01	<0.05	<0.01	Pass		Collocate
D-161-165	08/26/94	<0.01	<0.05	<0.01	Pass		Field Blank
B-166-170	08/26/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-171-175	08/27/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-176-180	08/27/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-181-185	08/29/94	<0.01	<0.05	<0.01	Pass	Disp. at BFI	
B-186-190	08/29/94	<0.01	0.06	<0.01	Pass	Disp. at BFI	
B-191-195	08/30/94	<0.01	0.06	<0.01	Pass	Disp. at BFI	

TABLE C-1
SUMMARY OF PROCESS SAMPLES COLLECTED TO DATE
MOTOROLA ARCADE SITE REMEDIATION ANALYTICAL SUMMARIES

SAMPLE ID	DATE SUBMITTED	Cd	Cr	Pb	PASS/FAIL	STATUS	COMMENTS
B-196-200	08/30/94	<0.01	0.25	<0.01	Pass	Disp. at BFI	20% cement, batches from E of WTB (Area 8)
B-201-205	08/30/94	<0.01	0.23	<0.01	Pass	Disp. at BFI	20% cement, batches from E of WTB (Area 8)
B-206-210	08/31/94	<0.01	0.09	<0.01	Pass	Disp. at BFI	15% cement
B-211-215	08/31/94	<0.01	0.11	<0.01	Pass	Disp. at BFI	15% cement
C-211-215	08/31/94	0.05	<0.05	<0.01	Pass		Collocate
D-211-215	08/31/94	<0.01	<0.05	<0.01	Pass		Field Blank
B-216-220	09/01/94	<0.01	0.51	<0.01	Pass	Disp. at BFI	
B-221-225	09/01/94	<0.01	0.34	<0.01	Pass	Disp. at BFI	
B-226-230	09/01/94	<0.01	0.40	<0.01	Pass	Disp. at BFI	
B-231-235	09/01/94	<0.01	0.41	<0.01	Pass	Disp. at BFI	
B-236-240	09/07/94	<0.01	0.22	<0.01	Pass	Stockpiled	
B-241-245	09/07/94	0.01	<0.05	<0.01	Pass	Stockpiled	
B-246-250	09/07/94	<0.01	0.31	<0.01	Pass	Stockpiled	
B-251-255	09/07/94	<0.01	0.41	<0.01	Pass	Stockpiled	
B-256-260	09/07/94	<0.01	0.57	<0.01	Pass	Stockpiled	
B-261-265	09/08/94	<0.01	0.55	<0.01	Pass	Stockpiled	
C-261-265	09/08/94	<0.01	0.51	<0.01	Pass		Collocate
D-261-265	09/08/94	<0.01	<0.05	<0.01	Pass		Field Blank
B-266-270	09/08/94	<0.01	<0.05	<0.01	Pass	Stockpiled	
B-271-275	09/08/94	<0.01	0.42	<0.01	Pass	Stockpiled	
B-276-280	09/09/94	<0.01	0.34	<0.01	Pass	Stockpiled	
B-281-285	09/09/94	<0.01	0.12	<0.01	Pass	Stockpiled	
B-286-290	09/09/94	<0.01	0.07	<0.01	Pass	Stockpiled	
B-291-295	09/09/94	<0.01	0.08	<0.01	Pass	Stockpiled	
B-296-300	09/10/94	<0.01	0.06	<0.01	Pass	Stockpiled	
B-301-305	09/10/94	<0.01	0.07	<0.01	Pass	Stockpiled	
B-306-310	09/10/94	<0.01	0.31	<0.01	Pass	Stockpiled	
B-311-315	09/10/94	<0.01	0.99	<0.01	Pass	Stockpiled	Reprocessed to reduce Cr
C-311-315	09/10/94	<0.01	1.02	<0.01	Pass		Collocate
D-311-315	09/10/94	<0.01	<0.05	<0.01	Pass		Field Blank
B-311-315-R	09/12/94	<0.01	0.47	<0.01	Pass	Stockpiled	Reprocessed Batches 311 through 315
B-316-320	09/12/94	<0.01	1.31	<0.01	Pass	Stockpiled	Reprocessed to reduce Cr
B-321-325	09/12/94	<0.01	0.50	<0.01	Pass	Stockpiled	

TABLE C-1
SUMMARY OF PROCESS SAMPLES COLLECTED TO DATE
MOTOROLA ARCADE SITE REMEDIATION ANALYTICAL SUMMARIES

SAMPLE ID	DATE SUBMITTED	Cd	Cr	Pb	PASS/FAIL	STATUS	COMMENTS
B-326-330	09/13/94	<0.01	0.36	<0.01	Pass	Stockpiled	
B-331-335	09/13/94	<0.01	0.39	<0.01	Pass	Stockpiled	
B-336-340	09/13/94	<0.01	0.43	<0.01	Pass	Stockpiled	
B-341-345	09/13/94	<0.01	0.19	<0.01	Pass	Stockpiled	
B-316-320-R	09/14/94	<0.01	0.63	<0.01	Pass	Stockpiled	Reprocessed Batches 316 through 320
B-346-350	09/14/94	<0.01	0.12	<0.01	Pass	Stockpiled	
B-351-355	09/14/94	<0.01	0.26	<0.01	Pass	Stockpiled	
C-351-355	09/14/94	<0.01	0.29	<0.01	Pass		Collocate
D-351-355	09/14/94	<0.01	0.09	<0.01	Pass		Field Blank

APPENDIX D

USEPA FIELD MANUAL FOR GRID SAMPLING OF SPILL SITES TO VERIFY CLEANUP (EPA-56015-86-017)

IV. GUIDELINES ON SAMPLING AND ANALYSIS

Reliable analytical measurements of environmental samples are an essential ingredient of sound decisions for safeguarding public health and improving the quality of the environment. Effective enforcement monitoring should follow the general operational model for conducting analytical measurements of environmental samples, including: planning, quality assurance/quality control, verification and validation, precision and accuracy, sampling, measurements, documentation, and reporting. Although many options are available when analyzing environmental samples, differing degrees of reliability, dictated by the objectives, time, and resources available, influence the protocol chosen for enforcement monitoring. The following section outlines the factors critically influencing the outcome and reliability of enforcement monitoring of PCB spill cleanup.

A. Sampling Design

This section presents a sampling scheme, for use by EPA enforcement staff, for detecting residual PCB contamination above a limit designated by EPA-OPTS after the site has been cleaned up. Two types of error traceable to sampling and analysis are possible. The first is false positive, i.e., concluding that PCBs are present at levels above the allowable limit when, in fact, they are not. The false positive rate for the present situation should be low, because an enforcement finding of noncompliance must be legally defensible; that is, a violator must not be able to claim that the sampling results could easily have been obtained by chance alone. Moreover, all sampling designs used must be documented or referenced.

The second type of error possible is a false negative, i.e., failure to detect the presence of PCB levels above the allowable limit. The false negative rate will depend on the size of the contaminated area and on the level of contamination. For large areas contaminated at levels well above the allowable limit, the false negative rate must, of course, be low to ensure that the site is brought into compliance. The false negative rate can increase as the area or level of contamination decrease.

1. Proposed Sampling Design

In practice, the contaminated area from a spill will be irregular in shape. In order to standardize sample design and layout in the field, and to protect against underestimation of the spill area by the cleanup crew, sampling within a circular area surrounding the contaminated area is proposed. Guidance on choosing the center and radius of the circle, as well as the number of sample points to be used is provided in Section 2 below.

The detection problem was modeled as follows: try to detect a circular area of uniform residual contamination whose center is randomly placed within the sampling circle. Figure 1 illustrates the model. The figure depicts a sampling circle of 10 ft centered on a utility pole (site of the spill). After cleanup, a residually contaminated circle remains. However, in choosing locations at which to sample, the sampler has no knowledge of either the location of the circle or the level of contamination. This

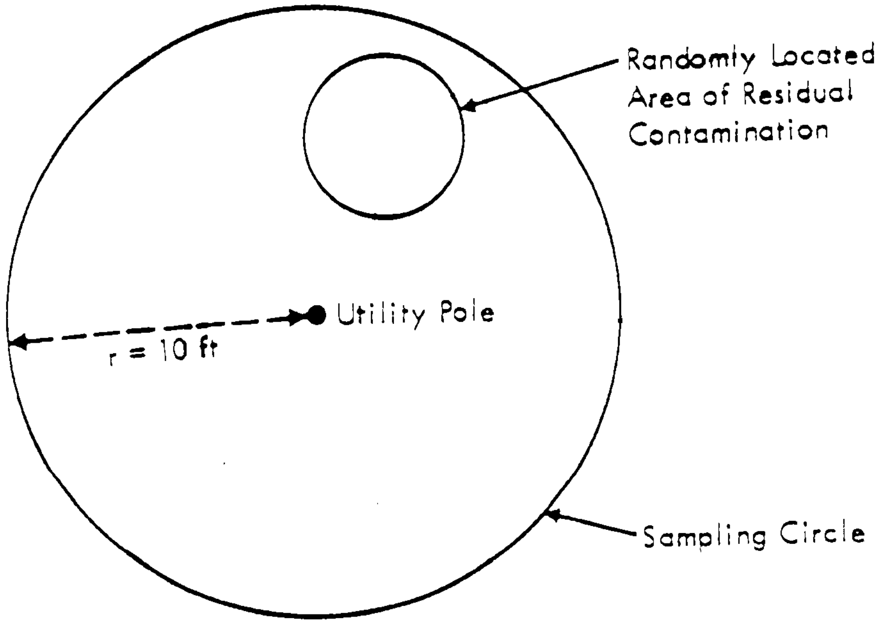


Figure 1. Randomly located area of residual contamination within the sampling circle.

lack of knowledge was modeled by treating the sampling locations as fixed and the center of the contaminated circle as a randomly located point in the circle of radius 10 ft. The implicit assumption that residual contamination is equally likely to be present anywhere within the sampling area is reasonable, at least as a first approximation (Lingle 1985). This is because more effort is likely to have been expended in cleaning up the areas which were obviously highly contaminated.

Two general types of design are possible for this detection problem: grid designs and random designs. Random designs have two disadvantages compared to grid designs for this application. First, random designs are more difficult to implement in the field, since the sampling crew must be trained to generate random locations onsite, and since the resulting pattern is irregular. Second, grid designs are more efficient for this type of problem than random designs. A grid design is certain to detect a sufficiently large contaminated area while some random designs are not. For example, the suggested design with a sample size of 19 has a 100% chance to detect a contaminated area of radius 2.8 ft within a sampling circle of radius 10 ft. By contrast, a design based on a simple random sample of 19 points has only a 79% chance of detecting such an area.

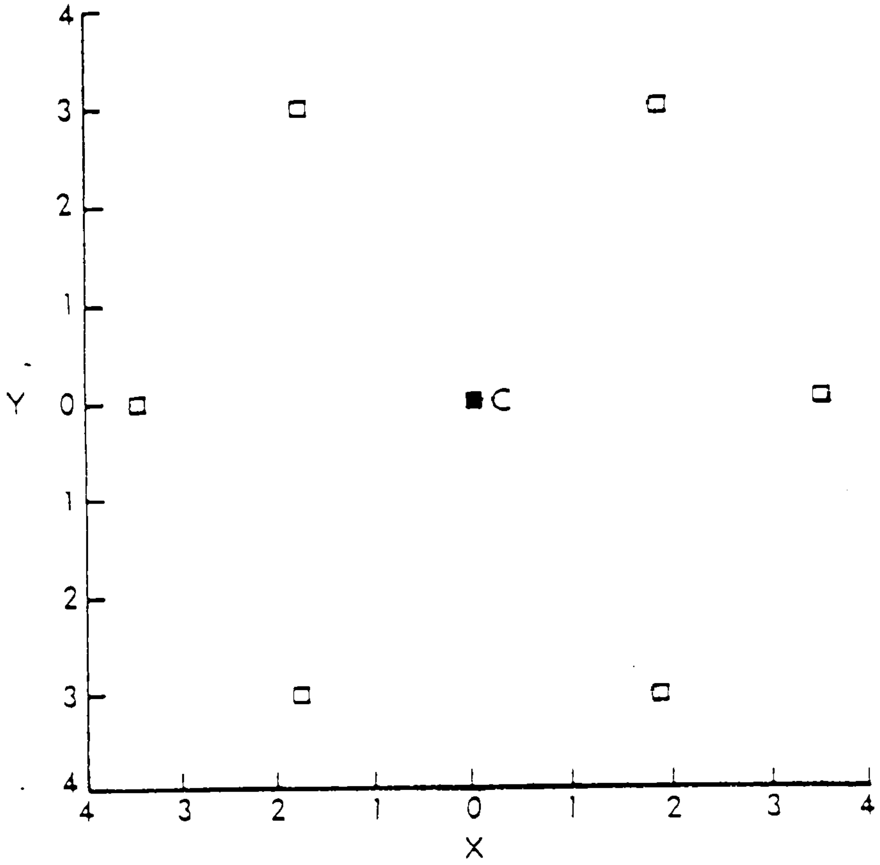
Therefore, a grid design is proposed. A hexagonal grid based on equilateral triangles has two advantages for this problem. First, such a grid minimizes the circular area certain to be detected (among all grids with the same number of points covering the same area). Second, some previous experience (Mason 1982; Matern 1960) suggests that the hexagonal grid performs well for certain soil sampling problems. The hexagonal grid may, at first sight, appear to be complicated to lay out in the field. Guidance is provided in Section 2 below and shows that the hexagonal grid is quite practical in the field and is not significantly more difficult to deploy than other types of grid.

The smallest hexagonal grid has 7 points, the next 19 points, the third 37 points as shown in Figures 2 through 4. In general, the grid has $3n^2 + 3n + 1$ points. To completely specify a hexagonal grid, the distance between adjacent points, s, must be determined. The distance s was chosen to minimize, as far as possible, the size of the residual contaminated circle which is certain to be sampled. Values of s so chosen, together with number of sampling points and radius of smallest circle certain to be sampled are shown in Table 2. For example, the grid spacing for a circle of radius 20 ft for the 7-point design is $s = (0.87)(20) = 17.4$ ft. For a given size circle, the more points on the grid, the smaller the residual contamination area which can be detected with a given probability.

GRID SPACING

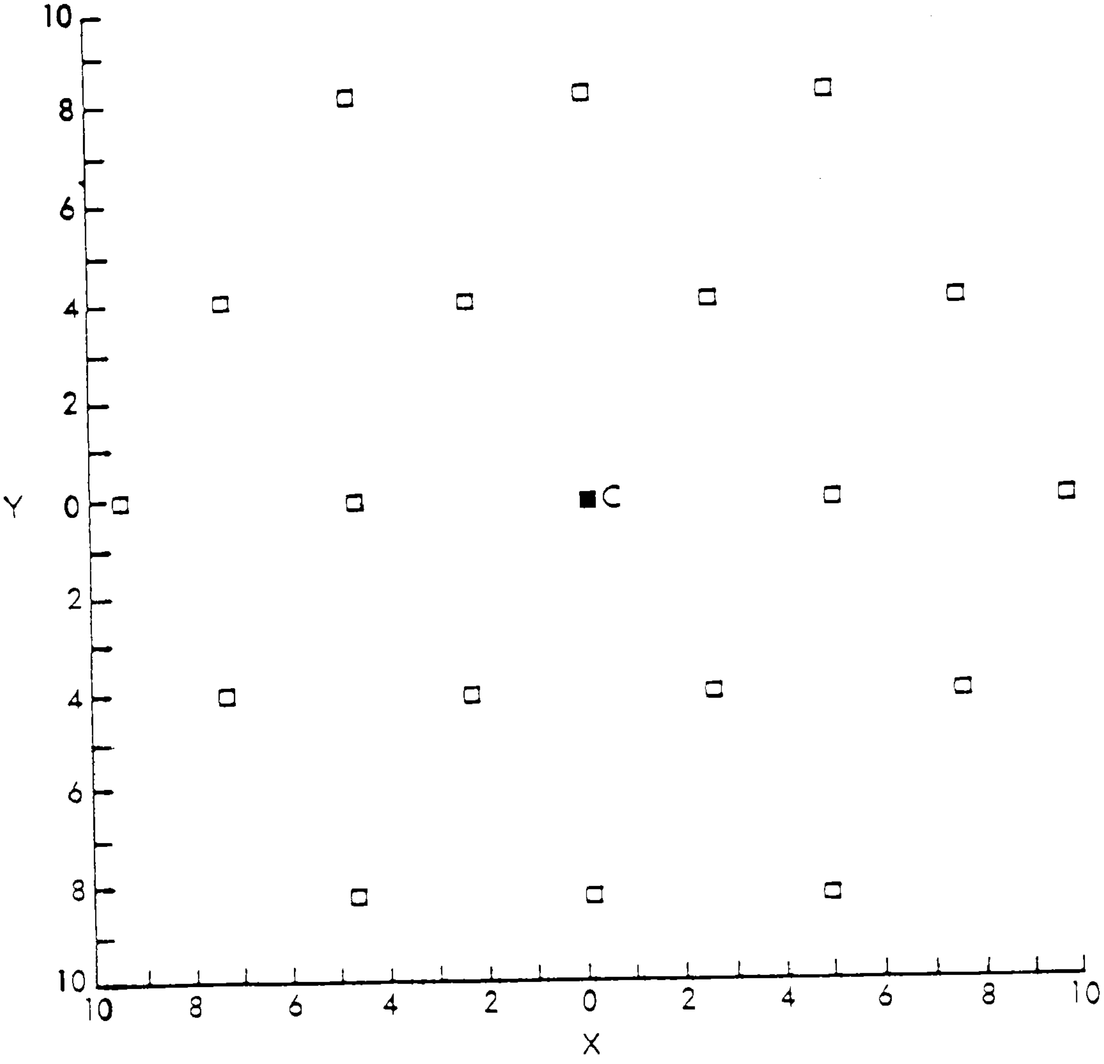
Table 2. Parameters of Hexagonal Sampling Designs for a Sampling Circle of Radius r Feet

No. of points	Distance between adjacent points, s (ft)	Radius of smallest circle certain to be sampled
7	0.87r	0.5r
19	0.48r	0.28r
37	0.3r	0.19r



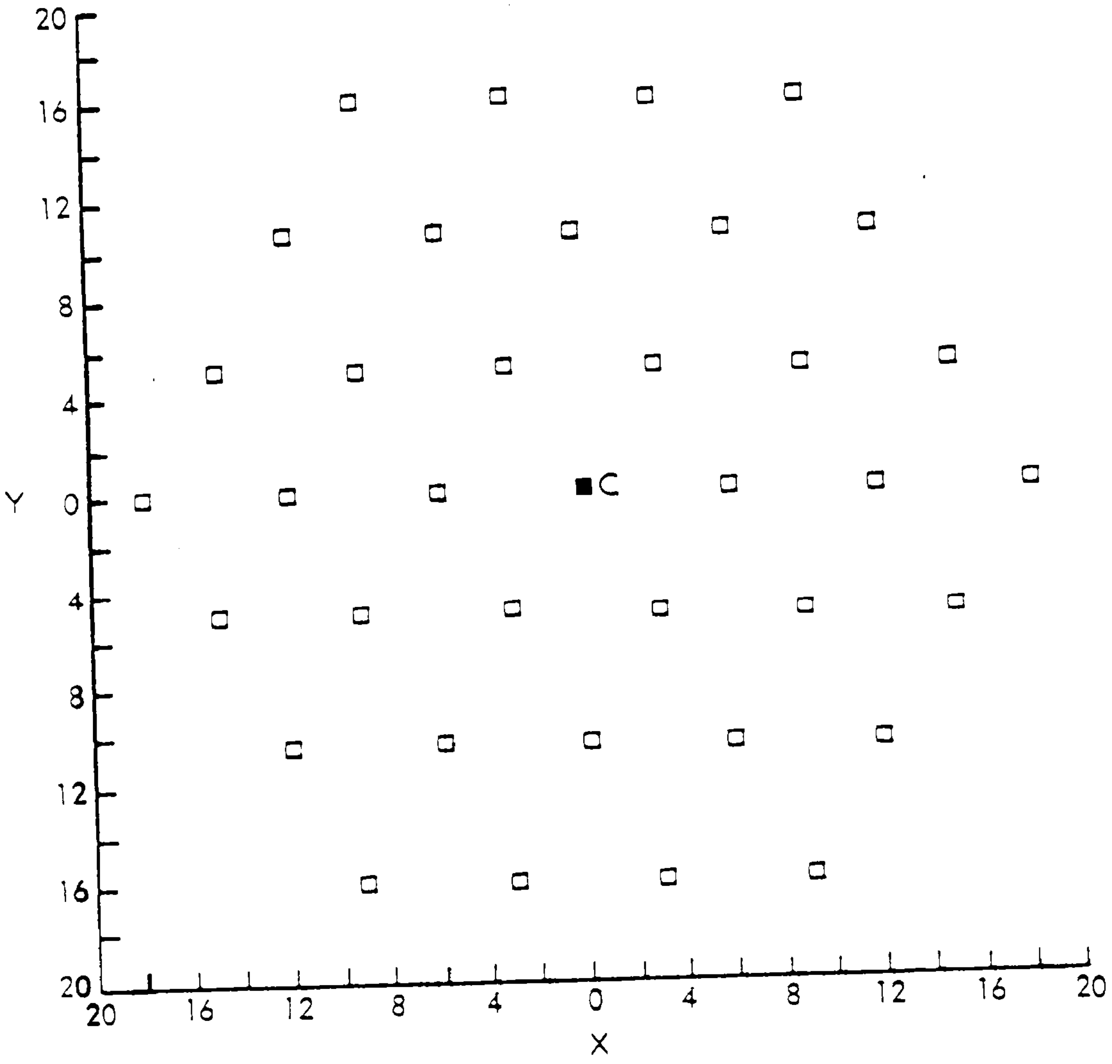
The outer boundary of the contaminated area is assumed to be 4 feet from the center (C) of the spill site.

Figure 2. Location of sampling points in a 7-point grid.



The outer boundary of the contaminated area is assumed to be 10 feet from the center (C) of the spill site.

Figure 3. Location of sampling points in a 19-point grid.



The outer boundary of the contaminated area is assumed to be 20 feet from the center (C) of the spill site.

Figure 4. Location of sampling points in a 37-point grid.

The first three hexagonal designs are shown in Figures 2 to 4, for a sampling circle radius of r = 10 ft. The choice of sample size depends on the cost of analyzing each sample and the reliability of detection desired for various residually contaminated areas. Subsection 2 below provides some suggested sample sizes for different spill areas, based on the distribution of spill areas provided by the Utility Solid Waste Activities Group (USWAG 1984; Lingle 1985).

2. Sample Size and Design Layout in the Field

a. Sample Size

The distribution of cleanup areas for PCB capacitor spill sites, based on data collected by USWAG (1984; Lingle 1985) is shown in Table 3. The smallest spill recorded in the USWAG database is 5 ft^2, the largest 1,700 ft^2. The median cleanup area is 100 ft, the mean 249 ft^2; the wide discrepancy between the mean and the median reflects the presence of a small percentage of relatively large spills in the database.

Recommended sample sizes are given in Table 4. Several considerations were involved in arriving at these recommendations. First, the maximum number of samples recommended for the largest spills is 37, in recognition of practical constraints on the number of samples that can be taken. Even so, it is important to note that not all samples collected will need to be analyzed. The calculations in Section 5 below show that, even for the 37 sample case, no more than 8 analyses will usually be required to reach a decision. Since the cost of chemical analyses is a substantial component of sampling and analysis costs, even the 37-sample case should not, therefore, be prohibitively expensive. Second, the typical spill will require 19 samples. Small spills, with sampling radius no greater than 4 ft, will have 7 samples, while the largest spills, with sampling radius 11.3 ft and up, will require 37 samples. It should be noted that only capacitor spills are represented in Table 3. Transformer spills, however, would be expected to be generally smaller than capacitor spills because energetic releases are less likely from transformers. Thus, one would expect the smaller sample sizes to be relatively more likely for transformer spills than capacitor spills.

Table 3. Distribution of PCB Capacitor Spill Cleanup Areas Based on 80 Cases

Cleanup area (ft^2)	Percent of cases
≦ 50	32.5
51-100	18.8
101-200	15.0
201-300	12.5
301-400	3.8
401-700	7.5
701-1,300	8.8
≧ 1,300	1.3

Source: Lingle 1985.

Table 4. Recommended Sample Sizes

Sampling area (ft^2)	Radius of sampling circle (ft)	Percent of PCB capacitor spills	Sample size
≦ 50	≦ 4	32.5	7
51-400	4-11.3	50.0	19
> 400	> 11.3	17.5	37

The final consideration in recommending sample sizes was to achieve roughly comparable detection capability for different size spills. The radius of the smallest contaminated circle certain to be sampled at least once by the sampling scheme is used for comparative purposes (see Table 2). Table 5 presents some calculations of this quantity. The absolute detection capability of the sampling scheme is seen to be relatively constant for different spill sizes. This means that a given area of residual contamination is about as likely to be detected in any sized spill.

Table 5. Detection Capability of the Recommended Sampling Schemes

Sampling area (ft^2)	Radius (ft)	Sample size	Radius of smallest circle to be sampled (ft)
50	4.0	7	2.0
150	6.9	19	1.9
400	11.3	19	3.2
875	16.7	37	3.2

b. Design Layout in the Field

Figure 5 presents a typical illustration of design layout in the field. The first step is to determine the boundaries of the original cleanup area (from records of the cleanup). Next, find the center and radius of the sampling circle which is to be drawn surrounding the cleanup area. The following approach is recommended:

(a) Draw the longest dimension, L_1, of the spill area.

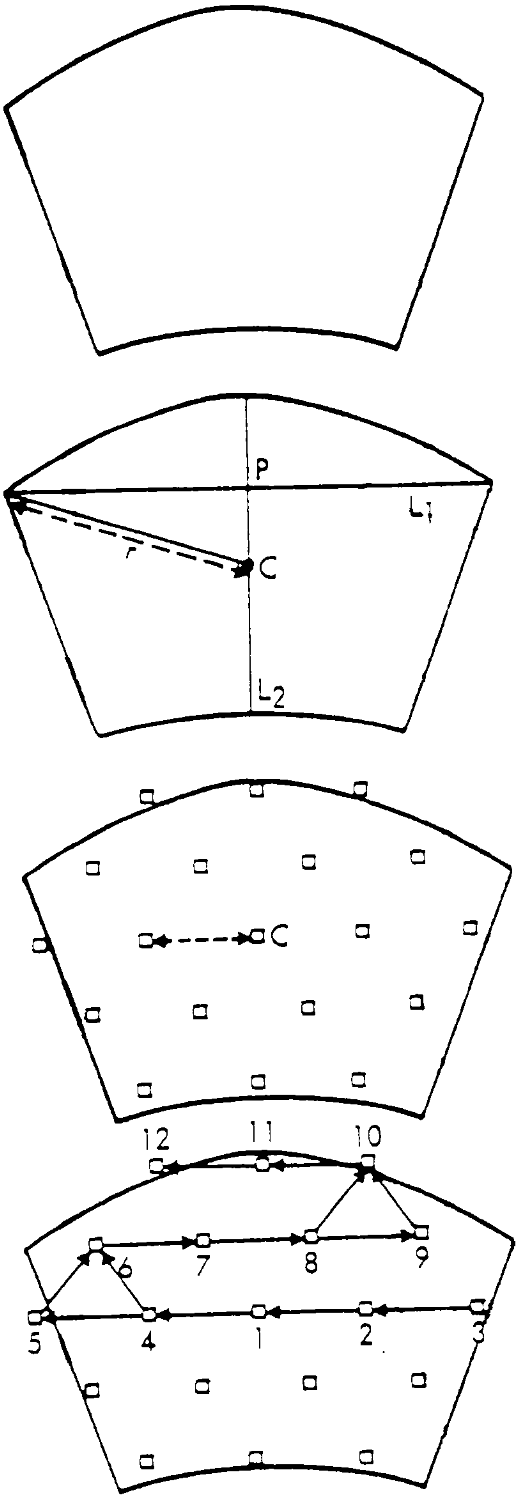
(b) Determine the midpoint, P, of L_1.

(c) Draw a second dimension, L_2, through P perpendicular to L_1.

(d) The midpoint, C, of L_2 is the required center.

(e) The distance from C to the extremes of L_1 is the required radius, r.

Figure 5 shows an example of the procedure; Figure 6 demonstrates how the center is determined for several spill shapes. Even if the center determined is slightly off, the sampling design will not be adversely affected.



(a) Original cleanup area

(b) Locating the center of the sampling circle

(c) Centering the hexagonal grid

(d) Staking out the grid points

Figure 5

Once the sampling radius, r, has been found, the sample size can be selected based on Table 4.

Example: Suppose r = 5 ft. From Table 4, a sample size of 19 should be used.

Having selected the sample size, the grid spacing can be calculated from Table 2.

Example (continued): For a 19-point design with radius r = 5, the grid spacing is s = 0.48r = (0.48)(5) = 2.4 ft.

The procedure for laying out a 19 point design is as follows. The first sampling location is the center C of the sampling circle, as shown in Figure 5. Next, draw a diameter through C and stake out locations 2 through 5 on it as shown; adjacent locations are a distance s apart. The orientation of the diameter (for example east-west) used is not important; it may be chosen at random or for the convenience of the samplers. The next 4 locations, Nos. 6-9, are laid out parallel to the first row, again a distance s apart. The only difficulty is in locating the starting point, No. 6, for this row. To accomplish this the sampler needs two pieces of rope (or surveyor's chain, or equivalent measuring device) of length s. Attach one piece of rope to the stake at each location 4 and 5. Draw the ropes taut horizontally until they touch at location 6. Once the second row is laid out, the third and final row of 3 locations in the top half of the design is found similarly, starting with number 10. In the same way, the bottom half of the design is staked out. The 7-point or 37-point designs are laid out in an analogous fashion.

Once the sampling locations are staked out the actual samples can be collected. In the example in Figure 5, three of the sampling locations fall outside the original cleanup area. Samples should be taken at these points, to detect contamination beyond the original cleanup boundaries. This verifies that the original spill boundaries were accurately assessed.

In practice, various obstacles may be encountered in laying out the sampling grid. Many "obstacles" can be handled by taking a different type of sample, e.g., if a fire hydrant is located at a point in a sampling grid otherwise consisting of soil samples, then a wipe sample should be taken at the hydrant, rather than taking a sample of nearby soil. The obstacle most likely to be encountered is a vertical surface such as a wall. To determine the sampling location on such a surface, draw taut the ropes (chains) of length s attached to two nearby stakes and find the point on the vertical surface where their common ends touch. See Figure 7 for an illustration of the procedure. If more samples from the vertical surface are called for, the same principle may be applied, always using the last two points located to find the next one.

3. Judgemental Sampling

The inspector or sampling crew may use best judgement to collect samples wherever residual PCB contamination is suspected. These samples are

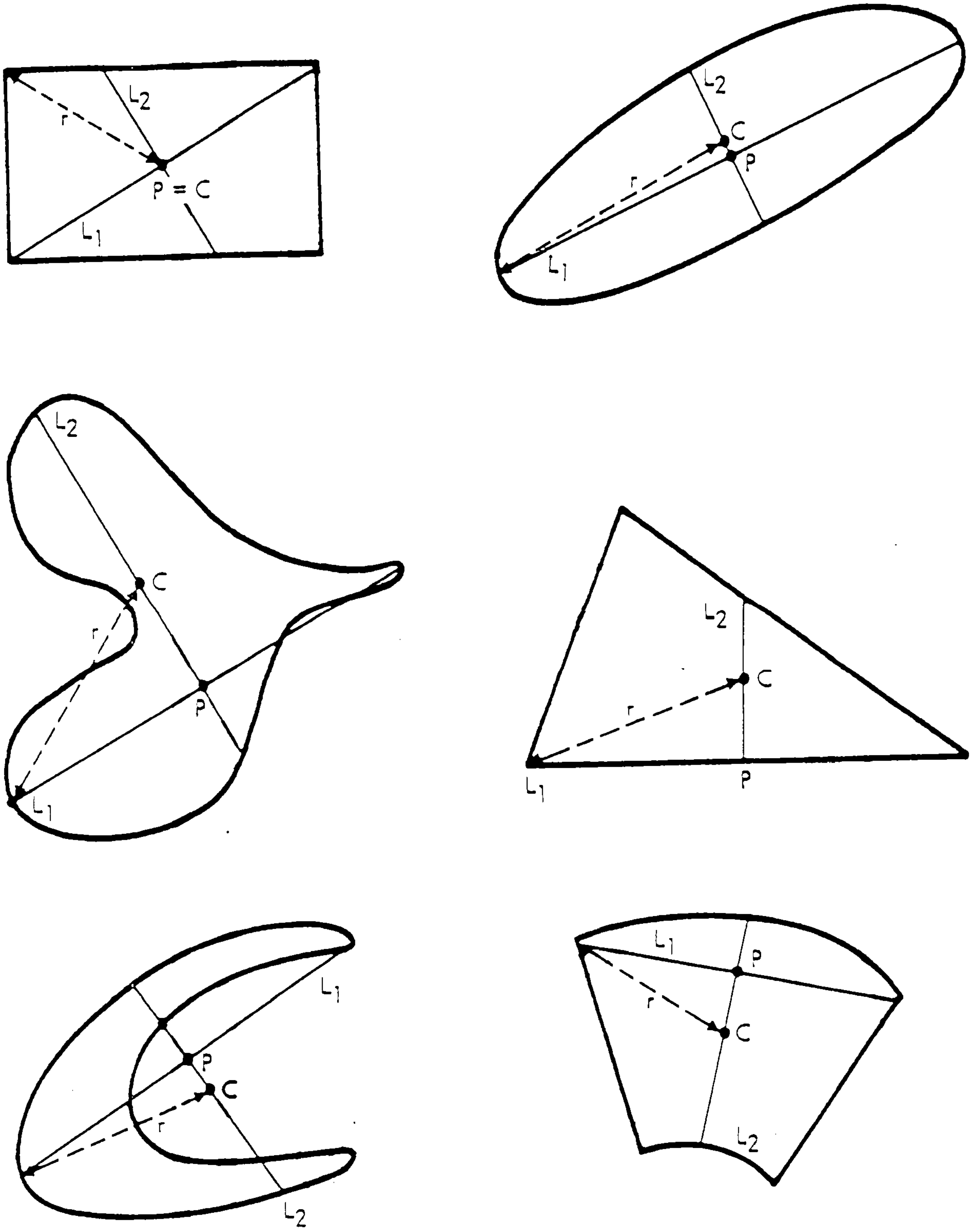


Figure 6. Locating the center and sampling circle radius of an irregularly shaped spill area.

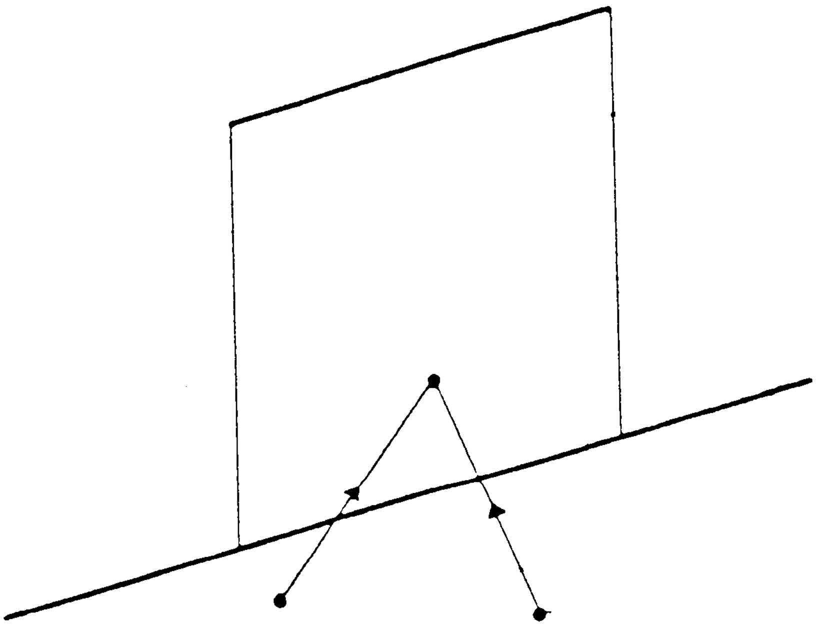


Figure 7. Location of a sampling point on a vertical surface.

in addition to those collected from the sampling grid. Examples of extra sampling points include suspicious stains outside the designated spill area, cracks or crevices, and any other area where the inspector suspects inadequate cleanup.

4. Compositing Strategy for Analysis of Samples

Once the samples have been collected at a site, the goal of the analysis effort is to determine whether *at least one* sample has a PCB concentration above the allowable limit. This sampling plan assumes the entire spill area will be recleaned if a single sample contaminated above the limit is found. Thus, it is not important to determine precisely which samples are contaminated or even exactly how many. This means that the cost of analysis can be substantially reduced by employing *compositing* strategies, in which groups of samples are thoroughly mixed and evaluated in a single analysis. If the PCB level in the composite is sufficiently *high*, one can conclude that a contaminated sample is present; if the level is *low* enough, all individual samples are clean. For intermediate levels, the samples from which the composite was constructed must be analyzed individually to make a determination. Thus, the number of analyses needed is greatly reduced in the presence of very high levels of contamination in a few samples or in the presence of very low levels in most samples.

For purposes of this discussion, assume that the maximum allowable PCB concentration in a single soil sample is 10 ppm. The calculations can easily be adapted for a different level or for different types of samples. Based on review of the available precision and accuracy data (Erickson 1985), method performance of 80% accuracy and 30% relative standard deviation should be attainable for soil concentrations above 1 ppm.

To protect against false positive findings due to analytical error, the measured PCB level in a single sample must exceed some cutoff greater than 10 ppm for a finding of contamination. Assume that a 0.5% false positive rate for a single sample is desired. As will be shown later, this single sample false positive rate controls the *overall* false positive rate of the sampling schemes to acceptable levels. Then, using standard statistical techniques, the cutoff level for a single sample is

$$(0.8)(10) + (2.576)(0.3)(0.8)(10) = 14.2 \text{ ppm},$$

where 0.8(80%) represents the accuracy of the analytical method, 10 ppm is the allowable limit for a single sample, 2.576 is a coefficient from the standard normal distribution, and 0.3(30%) is the relative standard deviation of the analytical method. Thus, if the *measured* level in a single sample is 14.2 ppm or greater, one can be 99.5% sure that the *true* level is 10 ppm or greater.

Now suppose that a composite of, say, 7 samples is analyzed. The true PCB level in the composite (assuming perfect mixing) is simply the average of the 7 levels of the individual samples. Let X ppm be the measured PCB level in the composite. If $X \leq (14.2/7) = 2.0$, then all 7 individual samples are rated clean. If $X > 14.2$, then at least one individual sample must be above the 10 ppm limit. If $2.0 < X \leq 14.2$, no conclusion is possible based on analysis of the composite and the 7 samples must be analyzed individually to reach a decision. These results may be generalized to a composite of any arbitrary number of samples, subject to the limitations noted below.

The applicability of compositing is potentially limited by the size of the individual specimens and by the performance of the analytical method at low PCB levels. First, the individual specimens must be large enough so that the composite can be formed while leaving enough material for individual analyses if needed. For verification of PCB spill cleanup, adequacy of specimen sizes should not be a problem. The second limiting factor is the analytical method. Down to about 1 ppm, the performance of the stipulated analytical methods should not degrade markedly. Therefore, since the assumed permissible level is 10 ppm, no more than about 10 specimens should be composited at a time.

In compositing specimens, the location of the sampling points to be grouped should be taken into account. If a substantial residual area of contamination is present, then contaminated samples will be found close together. Thus, contiguous specimens should be composited, if feasible, in order to maximize the potential reduction in the number of analyses produced by the compositing strategy. Rather than describe a (very complicated) algorithm for choosing specimens to composite, we have graphically indicated some possible compositing strategies in Figures 8 Through 11. Based on the error probability calculations presented in Section 4 below, we recommend the compositing strategies indicated in Table 6. The recommended strategy for the 7-point design requires no explanation. The strategies for the 19- and 37-point cases are shown in Figures 9 and 11, respectively. The strategies shown in Figures 8 and 10 are used in Section 5 for comparison purposes. For details on the reduction in number of analyses expected to result (as compared to individual analyses), see the next Section, 5.

5. Calculations of Average Number of Analyses, and Error Probabilities

Estimates of expected number of analyses and probabilities of false positives (incorrectly deciding the site is contaminated above the limit), and false negatives (failure to detect residual contamination) were obtained for various scenarios. The calculations were performed by Monte Carlo simulation using 5,000 trials for each combination of sample size, compositing strategy, level, and extent of residual contamination. The computations were based on the following assumptions:

a. Only soil samples are involved. In practice other types of samples will often be obtained and analyzed. Although the results of this section are not directly applicable to such cases, they do indicate in general terms the type of accuracy obtainable and the potential cost savings from compositing.

A 2 GROUP COMPOSITING PLAN FOR 7 SAMPLE POINTS

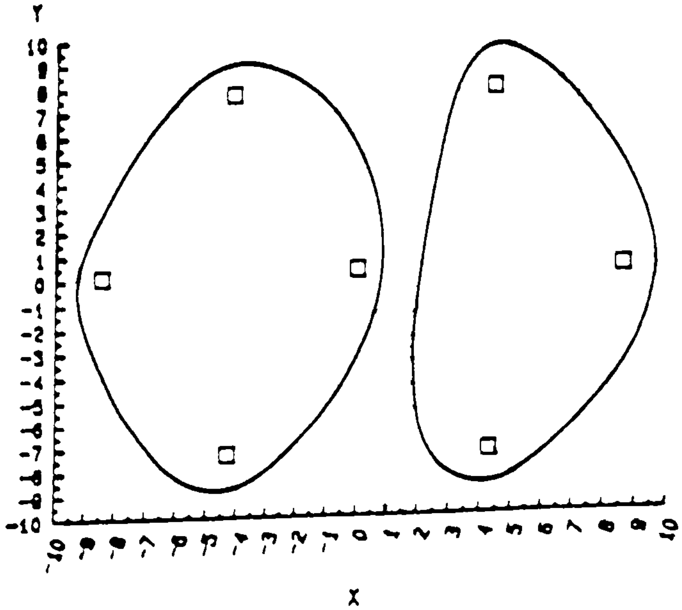


Figure 8

A 2 GROUP COMPOSITING PLAN FOR 19 SAMPLE POINTS

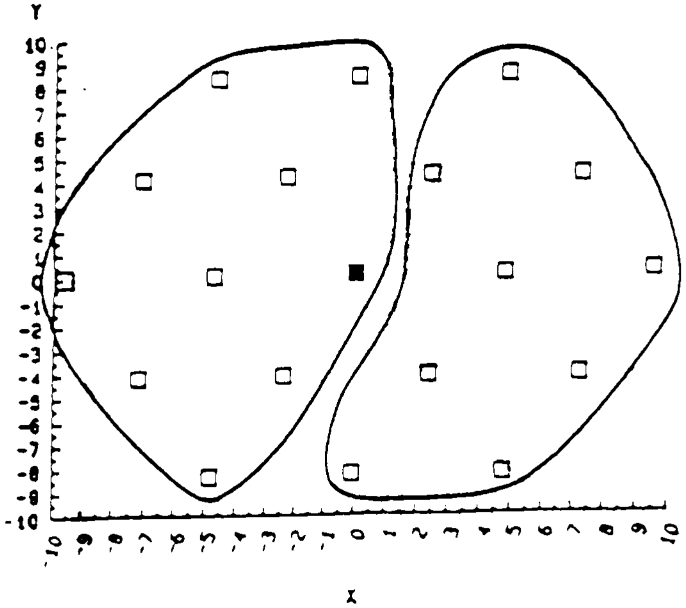


Figure 9

A 6 GROUP COMPOSITING PLAN FOR 19 SAMPLE POINTS

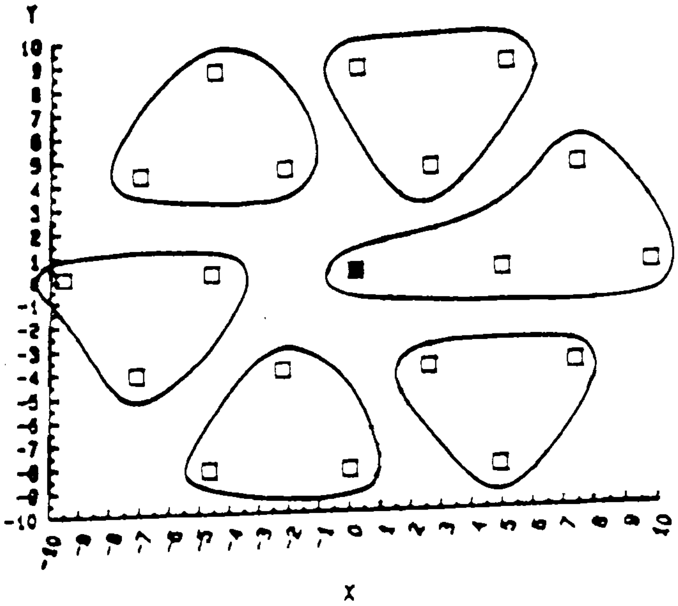
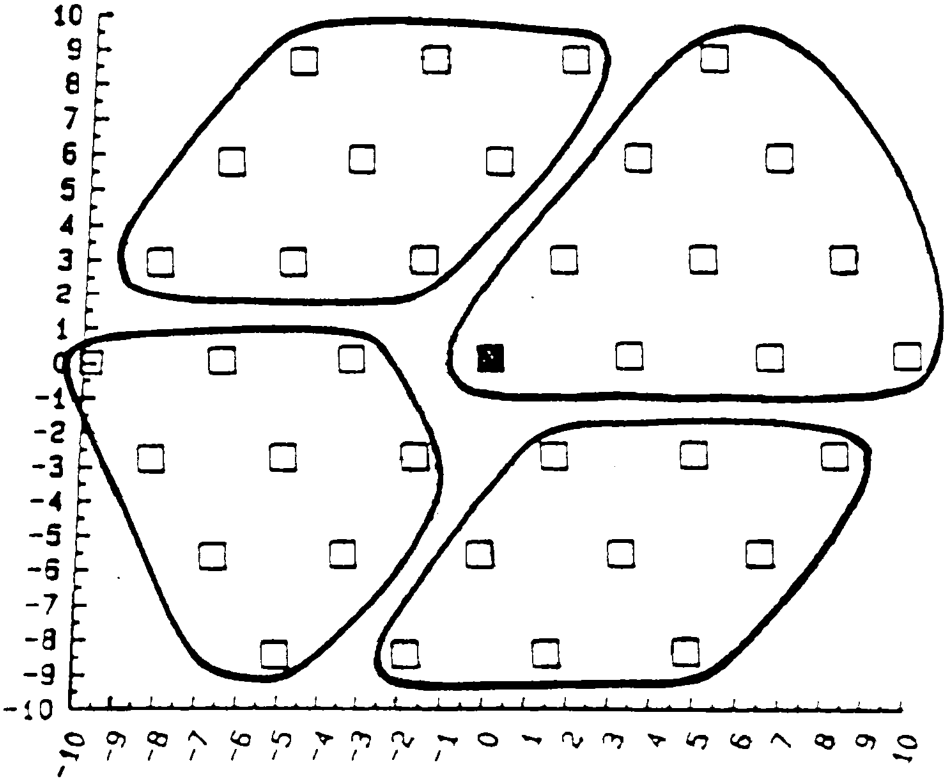


Figure 10. Location of sample points in a 19 sample point plan, with detail of a 2 group compositing design.



A 4 GROUP COMPOSITING PLAN FOR 37 SAMPLE POINTS

Figure 11. Location of sample points in 37 sample point plan, with detail of a 4 group compositing design.

Table 6. Recommended Compositing Strategies

No. of samples collected	Compositing strategy
7	One group of 7
19	One group of 10, one of 9
37	Three groups of 9, one of 10

b. If the true PCB level in a sample is C, then the measured value is a normally distributed random variable with mean 0.8C and standard deviation (0.3)(0.8C) = 0.24C. Thus, it is assumed that the analytical method is 80% accurate, with 30% relative standard deviation.

c. The maximum allowable level in a single sample is 10 ppm. However, the <u>measured</u> level for a single sample must exceed 14.2 ppm for a finding of noncompliance. As previously discussed, this corresponds to a single-sample false positive rate of 0.5%.

d. The residual contamination present is modeled as a randomly placed circle of variable radius and contamination level. The PCB level is assumed to be uniform within the randomly-placed circle and zero outside it.

e. Analysis of samples is terminated as soon as a positive result is obtained on a single analysis. If a composite does not give a definitive result (positive or negative), the individual specimens from which the composite was formed are analyzed in sequence before any other composite.

f. The compositing strategies used are shown in Figures 8 and 11.

The results of the computations are shown in Tables 7 through 20. Tables 7 through 12 show the performance of the compositing strategies recommended in Section 3. For each strategy, there is a pair of tables. The first table shows the probability of reporting a violation of a 10 ppm cleanup standard, for different levels of residual contamination and percent of cleanup area contaminated. When the contamination level is 10 ppm or less, the number in the table is the probability of a false positive, i.e., a false finding of noncompliance. These probabilities are all very low, as they should be. When the level is above 10 ppm, the number in the table is the probability that a violation will be detected by the sampling design. For levels close to 10 ppm, and for small percentages of cleanup area residually contaminated, the detection probability is low. When the level is high and the percent of area contaminated is large, however, detection probability approaches 100%. For small areas with high contamination, detection capability is modest. This is because there is only a small chance that the contaminated area will be sampled. Similarly, detection capability is also modest for large areas contaminated near the 10 ppm limit. The reason for this is that, even though a number of contaminated samples will be found in such cases, the analytical method is not likely to give positive identification of levels near the 10 ppm cutoff. This is the price paid for reducing the single-sample false positive rate to 0.5%.

The second table for each compositing strategy shows the expected (average) number of analyses needed to reach a decision. For a fixed percent of area contaminated, the smallest number of analyses is needed if the level of contamination is very high or very low. For intermediate levels, more analyses are needed. The largest number of analyses are required with a large area contaminated at close to 10 ppm. In such a situation, the levels of the composite(s) will mostly lie in the intermediate range for which no conclusion is possible based on analysis of the composite. Thus, individual analyses will almost always be required, so that the advantage of compositing is lost.

Tables 13 through 20 compare the recommended compositing strategies for the 7-point and 19-point designs to alternative compositing strategies for these designs, for 4 different contaminated percentages (1%, 9%, 25%, and 49%). The comparison is based on the expected number of analyses required. Overall detection capabilities are comparable for the different strategies. The tables show that the recommended strategies are best, except for larger areas contaminated close to the 10 ppm level.