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HAZARDOUS WASTE
REMEDIATION

WORK PLAN
FOR THE
OPERABLE UNIT 3
REMEDIAL INVESTIGATION

Sunnyside Yard
Queens, New York

June 23, 1997

(Revised January 13, 1999)

Prepared for:

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Washington, D.C.

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1.0 INTRODUCTION

The Remedial Investigation (RI) Work Plan for Operable Unit 3 of the Sunnyside Yard (Yard) located in Queens, New York (Figure 1) was developed by Roux Associates, Inc. (Roux Associates) on behalf of the National Railroad Passenger Corporation (Amtrak) and the New Jersey Transit Corporation (NJTC). The Work Plan was prepared in accordance with the provisions of the Order on Consent (OOC), Index #W2-0081-87-06 between the New York State Department of Environmental Conservation (NYSDEC), Amtrak, and the NJTC.

In accordance with the OOC, several investigations have been performed at the Yard including Phase I, Phase II and Phase II Addendum RIs as well as a health-based Risk Assessment. As a result of these investigations, areas of the Yard were identified where levels of contamination require remedial efforts. Initially 17 Areas of Concern were identified based on the results of Yard inspections, discussions with Amtrak personnel, and previous investigations. These areas included:

Area		Description
Area 1:	Underground Storage Tank and Fueling Area	Nine abandoned underground storage tanks (USTs), former locomotive fueling station, Engine House, Metro Shop.
Area 2:	Material Control Area (Yard receiving area)	Central receiving, temporary storage and distribution point for materials and supplies received at the Yard.
Area 3:	Gas Tank Area	Three 750-gallon USTs and pump used for storing and dispensing gasoline.
Area 4:	Fuel Oil Tank Area	20,000-gallon UST used to store fuel oil for Boiler House.
Area 5:	Transformer Area	Two transformers containing polychlorinated biphenyls (PCBs) are located in this area.
Area 6:	Drum Storage Area (Oil House)	Drum and equipment storage area; formerly the Yard receiving area.
Area 7:	Storage Area	Reported to be a former empty drum storage area; currently no drums stored there.
Area 8:	Transformer Area	Former PCB transformer area. This area is comprised of three distinct areas referred to as Area 8A, 8B and 8C.
Area 9:	Compressor Area (Substation 1-A)	Contains a two-story brick structure which houses air compressors and transformers.
Area 10:	Transformer Area (Substation 44)	Contains PCB transformers.

Area		Description
Area 11:	Empty Drum Area	Former empty drum storage area.
Area 12:	Car Washer Area	Used to wash railroad cars.
Area 13:	Former Storage Area	Former storage area for materials including non-PCB transformers; currently contains a Consolidated Edison transformer substation.
Area 14:	Empty Drum Area	Former empty drum storage area.
Area 15:	Empty Drum Area	Former empty drum storage area.
Area 16:	Underground Storage Tank Area	Approximately twelve USTs are located in this area. These tanks were emptied in 1989.
Area 17:	68 Spur	Used to store maintenance equipment and to stage materials.

With the NYSDEC's concurrence, to accommodate the High Speed Trainset Facility (HSTF) construction schedule and still address remedial efforts sitewide in a timely and orderly manner, the Yard has been subdivided into six operable units. The operable units (OUs) are described as follows:

- Operable Unit 1 (OU-1) - designated as the soils above the water table within the footprint of the proposed HSTF Service and Inspection (S&I) Building;
- Operable Unit 2 (OU-2) - designated as the soil above the water table within the footprint of the HSTF S&I Building ancillary structures (i.e., the access road and utilities route, the parking area, the construction easement area which surrounds the building, and the construction laydown area);
- Operable Unit 3 (OU-3) - designated as the soil and separate-phase petroleum above the water table in Area 1 of the Yard;
- Operable Unit 4 (OU-4) - designated as the soil above the water table in the remainder of the Yard;
- Operable Unit 5 (OU-5) - designated as the sewer system beneath the Yard; and
- Operable Unit 6 (OU-6) - designated as the saturated soil and the ground water beneath the Yard.

Additionally, the NYSDEC has issued the following cleanup levels for the compounds of concern at the Yard (i.e., PCBs, carcinogenic polycyclic aromatic hydrocarbons [cPAHs], and lead):

- PCBs - 25 parts per million (ppm);
- cPAHs - 25 ppm; and
- lead - 1000 ppm.

With regard to the HSTF project, a portion of what was formerly considered Area 1 has been addressed in the RI's for OU-1 and OU-2 and a Record of Decision for each of these units has been issued by the NYSDEC; therefore, these areas will not be considered in this Work Plan. Additionally, no further work is projected in the portion of OU-3 previously addressed as the HSTF-Related Work Area; however, results of that investigation will be included in the OU-3 RI report.

This Work Plan is designed to develop additional site-specific data to supplement previous work and investigate previously uninvestigated areas in order to describe environmental conditions in the media of concern. Prior to the preparation of this OU-3 Work Plan, numerous telephone conversations, letters and meetings were attended with Amtrak, NJTC, NYSDEC, and Roux Associates to discuss the further characterization of OU-3. The outcome of the correspondence, meetings, and prior recommendations for additional work presented in previous Roux Associates' reports are incorporated into this Work Plan.

The scope of work described in this Work Plan was developed to achieve these objectives:

- investigate the soil adjacent to transformers 31, 35, 36, and 37 to characterize soil quality for PCBs;
- characterize soil quality to conclude vertical delineation of subsurface saturated soil for PCBs;
- further delineate location(s) known to exceed soil cleanup levels;
- provide additional soil characterization and soil quality data; and
- further characterize deep ground-water quality.

It should be noted that a ground-water sampling round was completed in June 1997 to develop a baseline as part of the OU-6 RI. All wells without separate-phase petroleum were sampled including those wells in OU-3.

As you are aware from our May 19, 1998 letter, a number of wells in OU-3 were damaged beyond repair and/or located within the HSTF construction envelope and were subsequently properly abandoned before additional damage was sustained. Following completion of the HSTF construction program, the monitoring well network at the Yard will be evaluated and replacement wells will be installed as necessary. Therefore, although ground water will be sampled as part of the OU-3 investigation, ground water will be addressed in the OU-6 investigation.

Data developed during the OU-3 RI will be used to support the evaluation of remedial action alternatives during the Feasibility Study (FS) and to assess the performance and effectiveness of the remedial efforts implemented by Amtrak and NJTC. The OU-3 RI Scope of Work is organized into the following tasks to permit efficient acquisition of data necessary to support the FS:

- Task I: Soil Boring and Sampling; and
- Task II: Ground-Water Sampling.

This Work Plan, which describes the methodology by which the RI will be implemented, was developed based upon a detailed review of existing Yard-specific data, published information, and a January 24, 1997 meeting of Amtrak, Roux Associates and the NYSDEC. The RI will be conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Superfund Amendments and Reauthorization Act (SARA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and applicable United States Environmental Protection Agency (USEPA) guidance documents.

Included in the Work Plan as appendices are the following project operation plans:

- Field Sampling Plan (FSP);
- Quality Assurance Project Plan (QAPP);

- Health and Safety Plan (HASP); and
- Citizen Participation Plan (CPP).

The FSP (Appendix A) describes the types of soil and ground-water samples to be collected and the procedures to be followed (e.g., drilling, decontamination, sample collection) during the soil characterization activities. Therefore, these procedures will not be presented separately in each task description, but will be referred to in Appendix A. The QAPP (Appendix B) presents the organization, objectives, functional activities and specific quality assurance/quality control activities associated with the investigation. The HASP (Appendix C) has been prepared in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Rule (29 CFR Part 1910.120), Department of Transportation Roadway Worker Protection (49 CFR Part 214), Roux Associates Standard Operating Procedures (SOPs) and Yard-specific safety rules. The CPP included as Appendix D, describes activities to inform and involve affected/interested citizens during investigation and cleanup of OU-3. The CPP for the Yard, was accepted by the NYSDEC on July 19, 1991.

Also included as Appendix E is the New York City Transit (NYCT) ground-water monitoring data package, which includes the data collected from the Amtrak Monitoring Wells MW-19 and MW-35 located in OU-3. These data are included in the NYSDEC's request and are generally in agreement with analytical results from split samples analyzed by Amtrak. As previously stated, ground water will be addressed in the OU-6 investigation and these data will be discussed at that time.

2.0 OPERABLE UNIT 3 BACKGROUND AND SETTING

A description of the physical setting and history of OU-3 is based upon Roux Associates' review of available conditions at the Site, including previous consultants' reports, and the many years of field investigation conducted by Roux Associates.

2.1 Site Location and History

OU-3, which consists of the soil and separate-phase petroleum accumulation above the water table in what was formerly referred to as Area 1 (Figure 1), is located at the northern border of the Yard. OU-3 includes the former Engine House, Metro Shop, and workers locker room buildings, the former diesel fuel storage and fueling areas, drum storage areas, and a portion of what is now a Long Island Rail Road (LIRR) freight yard. A small portion of what was formerly considered Area 1 has been addressed in the RI's for OU-1 and OU-2 and a Record of Decision for each of these units has been issued by the NYSDEC; therefore, these areas will not be considered in this Work Plan. Additionally, no further work is projected in the portion of OU-3 previously addressed as the HSTF-Related Work Area.

OU-3 and the surrounding Yard were originally owned and used by the Pennsylvania Tunnel and Terminal Company, a subsidiary of the Pennsylvania Railroad (later known as the Penn Central Transportation Company). On April 1, 1976, the Consolidated Rail Corporation (Conrail) acquired the Yard, and the same day, conveyed it to Amtrak. The Yard originally operated as a storage and maintenance facility for railroad rolling stock and currently functions primarily as a train maintenance and train makeup facility for electric locomotives and railroad cars for Amtrak and NJTC.

Land use immediately adjacent to the Yard is almost exclusively mixed commercial and light industrial with surrounding residential areas located primarily to the south and east.

2.2 Previous Investigations

The media investigated in OU-3 include soil, sewer water and sediment, separate-phase petroleum, and ground water (deep and shallow). The results of the investigations performed are discussed below. Sample locations are shown on Plate 1.

2.2.1 Soil

In 1986, during a hydrogeologic investigation conducted by Geraghty & Miller, 13 shallow (0 to 2 ft) soil samples were collected in OU-3 and analyzed for PCBs. PCBs were detected in 12 of the 13 samples ranging from a low of 0.19 ppm to a high of 24 ppm, all below the PCB soil cleanup level. During the Phase I RI, work within OU-3 included analyzing 17 shallow (0 to 2 ft.) and three deeper soil samples for PCBs and five shallow soil samples for lead. PCB analyses were used for screening purposes and to determine confirmatory sample locations for the Phase II RI. No lead samples exceeded the soil cleanup level.

Phase II and Phase II RI Addendum soil sampling within OU-3 consisted of Target Compound List/Target Analyte List (TCL/TAL) analyses and hydrocarbon scans of the following seven samples: S-122 (7.5-8.5 feet below land surface [bls]), S-129 (3 to 5 feet bls), S-134 (2 to 4 feet bls), S-135 (3 to 3.5 feet bls), S-139 (3 to 3.1 feet bls), MW-54 (3 to 5 feet bls) and MW-58 (2 to 3 feet bls). In addition, nine samples were analyzed for PCBs (i.e., seven confirmatory samples from Phase I screening locations and two non-Analytical Services Protocol [ASP] analyses performed for screening purposes only). With the exception of the confirmatory samples, the additional soil sampling was performed in four general areas including:

- northwest and west of the former Turntable;
- south of the former Metro Shop;
- adjacent to Geraghty & Miller-installed Monitoring Well MW-10; and
- adjacent to Geraghty & Miller-installed Monitoring Well MW-12.

The findings of these investigations are discussed below.

<u>Former Turntable Area</u>

One soil boring sample, S-129 (3 to 5 feet) and one monitoring well pilot borehole sample, MW-54 (3 to 5 feet), were analyzed for the TCL/TAL and a hydrocarbon scan. Although a sheen was noted at location S-129, no volatile organic compounds (VOCs) were detected in the sample. Ethylbenzene was detected in MW-54 at 640 micrograms per kilogram (µg/kg) (0.64 parts per million [ppm]). Fourteen semivolatile organic compounds (SVOCs) (predominantly PAHs) were detected in S-129 and five SVOCs (all PAHs) were detected in MW-54. No metals were detected significantly above background ranges. PCB Aroclor-1260 was detected at a concentration of 190 μg/kg (0.19 ppm) in S-129, while 140 μg/kg (0.14 ppm) Aroclor-1248 and 33 μg/kg (0.033 ppm) Aroclor-1260 were detected in MW-54 soil. No. 2 fuel oil was detected by the hydrocarbon scan in both S-129 (770 milligrams per kilogram [mg/kg] [equivalent to ppm]) and MW-54 (11,300 mg/kg [ppm]). No exceedances of the cleanup levels for the compounds of concern were detected.

Area South of the Former Metro Shop

Soil samples that showed evidence of petroleum contamination from hand borings PD-45 and PD-47 were collected for PCB screening analyses (non-ASP). The results indicated that low levels of PCBs (i.e., less than 1 ppm) were present in both samples. Soil from PD-45 (3 to 4 feet) contained Aroclor-1260 at an estimated concentration of 14 μg/kg (0.014 ppm). Soil from PD-47 (6.5 to 7 feet) contained the following: Aroclor-1242 (140 μg/kg [0.14 ppm]), Aroclor-1254 (390 μg/kg [0.39 ppm]), and Aroclor-1260 (270 μg/kg [0.27 ppm]).

Monitoring well pilot borehole MW-58 was drilled and one soil sample collected for TCL/TAL analyses and a hydrocarbon scan. No VOCs were detected in the MW-58 (2 to 3 feet bls) soil sample. Ten SVOCs were detected. Five of these SVOCs (naphthalene, 2-methylnaphthalene, fluorene, phenanthrene and pyrene) are known constituents of No. 2 fuel oil, which was detected at a concentration of 13,900 mg/kg (ppm). Copper, lead, and zinc exceeded background concentrations by more than one order of magnitude. Three PCBs were detected in the MW-58 soil sample: Aroclor-1248 (100 μg/kg [0.1 ppm]), Aroclor-1254 (340 μg/kg [0.34 ppm]) and Aroclor-1260 (290 μg/kg [0.29 ppm]). No exceedances of the cleanup levels for the compounds of concern were detected.

One soil sample from test pit S-122 (7.5 to 8.5 feet bls) was collected for TCL/TAL analyses and a hydrocarbon scan. No VOCs were detected. Eight SVOCs (predominantly PAHs) were detected, ranging in concentration from 15 μg/kg (0.015 ppm) to 48 μg/kg (0.048 ppm). No metals exceeded the background metals concentrations by an order of magnitude. Aroclor-1260 was detected at a concentration of 37 μg/kg (0.037 ppm). No petroleum hydrocarbons (PHCs) were detected in this soil sample. No exceedances of the cleanup levels for the compounds of concern were detected.

Area Adjacent to Geraghty & Miller-Installed Monitoring Well MW-10

Soil sample S-134 (2 to 4 feet bls) was analyzed for the TCL/TAL and PHCs (a hydrocarbon scan). No VOCs were detected in the S-134 soil sample. Eleven SVOCs (including PAHs) were detected in the sample. Two of the PAHs detected in this sample (phenanthrene and pyrene) are known constituents of No. 2 fuel oil, which was detected at a total concentration of 1,350 mg/kg (ppm). Copper, lead and zinc were detected significantly above background concentrations. Aroclor-1254 and Aroclor-1260 were present at 110 μg/kg (0.11 ppm) and 390 μg/kg (0.39 ppm), respectively. No exceedances of the cleanup levels for the compounds of concern were detected.

Area Adjacent to Geraghty & Miller-Installed Monitoring Well MW-12

Soil samples were collected from borings S-135 (3 to 3.5 feet) and S-139 (3 to 3.1 feet) for laboratory analyses for the TCL/TAL and PHCs (a hydrocarbon scan). Although a clear oily substance was observed at approximately 3 to 3.5 feet bls in Soil Boring S-135, only low levels of one VOC and two SVOCs were detected: 1 μg/kg (0.001 ppm) xylenes (total), 17 μg/kg (0.017 ppm) dibenzofuran and 31 μg/kg (0.031 ppm) fluorene. PHCs were not detected in the hydrocarbon scan. Metals were not detected at concentrations significantly above background. Aroclor-1254 was detected at 12 μg/kg (0.012 ppm). No exceedances of the cleanup levels for the compounds of concern were detected.

No VOCs were detected in soil sample S-139 (3 to 3.1 feet). Nine SVOCs (predominantly PAHs) were detected in S-139. No metals were detected significantly above background. PHCs were not detected in the hydrocarbon scan. Aroclor-1260 was detected at a concentration of 140 μg/kg (0.14 ppm). No exceedances of the cleanup levels for the compounds of concern were detected.

Confirmatory Sampling

Seven soil samples (CS-1, CS-3, CS-5, CS-10, CS-76, CMW-20 and CMW-22) were collected to confirm the concentrations of PCBs previously detected during the Phase I RI. PCBs were also detected in all seven confirmatory samples. Shallow soil samples CS-1 and CS-76 each contained Aroclor-1248 and Aroclor-1260. CS-1 (0 to 2 feet bls) soil concentrations were as follows: Aroclor-1248 at 700 µg/kg (0.7 ppm), and Aroclor-1260 at 8,600 µg/kg (8.6 ppm). The CS-76 (0 to 0.5 feet bls) soil sample contained Aroclor-1248 at 2,900 µg/kg (2.9 ppm), and Aroclor-1260 at 73,000 µg/kg (73 ppm). Only Aroclor-1260 was detected in CS-10 at 370 µg/kg (0.37 ppm). Two Aroclor species, Aroclor-1254 and Aroclor-1260, were detected in the CS-3, CS-5, CMW-20 and CMW-22 samples. Soil sample CS-3 was collected from 3 to 5 feet bls and contained 850 µg/kg (0.85 ppm) Aroclor-1254 and 1,400 µg/kg (1.4 ppm) Aroclor-1260. Aroclor-1254 was detected at 440 µg/kg (0.44 ppm) and Aroclor-1260 was detected at 1,700 µg/kg (1.7 ppm) in soil sample CS-5 (0 to 2 feet bls). Aroclor-1254 and Aroclor-1260 were detected in CMW-20 at 190 µg/kg (0.19 ppm) and 360 µg/kg (0.36 ppm), respectively. Sample CMW-22 showed concentrations similar to CS-5; 400 µg/kg (0.4 ppm) of Aroclor-1254 and 1,100 µg/kg (1.1 ppm) of Aroclor-1260. Only the sample from location CS-76 exceeded the PCB cleanup level.

HSTF-Related Work Area

As a result of numerous HSTF-related investigations, additional soil data has been collected in OU-3 and reported to the NYSDEC (Roux Associates, March 18, 1998 report titled "Results of Soil Samples in Selected Work Areas Located in Operable Unit 3" and July 13, 1998 letter report "Results of Additional Soil Samples Collected in the Subject Area of Operable Unit 3). As shown on Plate 1, total of 25 soil borings (24 new and one previously sampled location) were completed and sampled for one or more of the compounds of concern. A total of 31 samples were analyzed for PCBs. Concentrations of PCBs ranged from not detected to a high of 2.9 ppm, all well below the PCB cleanup level.

A total of 35 samples were analyzed for cPAHs. Concentrations of cPAHs ranged from not detected to a high of 108.2 ppm at location HST-22B. Only the 0 to 2 feet bls interval at two locations, HST-22B and HST-22A (35.5 ppm) exceeded the cPAH cleanup level. These exceedances were delineated and remediated (excavation and disposal off site) as part of the HSTF construction activities and reported to the NYSDEC (Roux Associates, August 13, 1998 letter report "Summary of Remedial Activities Completed in Operable Unit 3").

A total of 30 samples were analyzed for lead. The lead concentrations ranged from 2.6 ppm to a high of 1180 ppm at location HST-28. Only the 0 to 2 feet bls interval at two locations, HST-28 and MW-58 (1160 ppm) exceeded the lead cleanup level. The exceedances were subsequently delineated and remediated (excavated and disposed off site) in conjunction with the HSTF construction activities and reported to the NYSDEC (Roux Associates, August 13, 1998 letter report "Summary of Remedial Activities Completed in Operable Unit 3").

In summary, only two detections of VOCs occurred in OU-3 soil. SVOCs (predominantly PAHs) were detected in soil throughout the OU-3 area with the cPAH soil cleanup level exceeded in only two of the samples analyzed (subsequently delineated and remediated). Lead was detected above the soil cleanup level in only two samples analyzed (subsequently delineated and remediated) and PCBs were detected above the soil cleanup level in only one sample from the OU-3 area (further delineation of this location is proposed).

2.2.2 Separate-Phase Petroleum

As discussed in the Roux Associates (January 22, 1992) Phase I RI report, an accumulation of separate-phase petroleum is present on the ground water in OU-3. During the Phase II RI and Addendum, the areal extent of the accumulation was delineated and true petroleum thicknesses ranging from less than 0.01 feet (sheen) to a high of 1.22 feet were determined (Plate 1).

2.2.2.1 Off-Site Extent of Separate-Phase Petroleum Accumulation

The off-site extent of the separate-phase petroleum accumulation was determined by performing monitoring well installation, inspecting sumps within off-site buildings, completing hand borings, and sampling the sewer that parallels the northern property boundary. The results of these tasks are discussed below. The delineation work commenced on October 15, 1991 in the presence of the NYSDEC.

Monitoring Well MW-35, located north (hydraulically downgradient) of the sewer line, was installed first. No soil staining or petroleum odors were detected during drilling of this well and no separate-phase petroleum was detected during well development or subsequent water-level gauging. Soil staining, a strong petroleum odor, and separate-phase petroleum were encountered during drilling and development of Monitoring Well MW-36, located south (hydraulically upgradient) of the sewer line.

On October 16, 1991 an inspection of the off-site buildings was conducted by Roux Associates personnel and the NYSDEC. During the inspection, a basement dewatering sump was noted in the southeast corner of the basement of the building located at 34-18 Northern Boulevard, directly north of Monitoring Wells MW-35 and MW-36. The sump contained water with no sheen or petroleum odor. A second sump was noted in the same basement located northwest (downgradient) of the first sump, which contained a black, odorless oily substance similar to lubricating oil. The nature of the oil and location within the building suggests the petroleum in the sump is attributable to a source other than the accumulation at the Yard.

During a previous inspection in the basement of the building located at 34-18 Northern Boulevard with the NYSDEC, Roux Associates personnel were informed of an excavation where separate-phase petroleum was encountered at a depth of approximately 2 feet beneath the basement floor. The elevation of the basement floor was approximately 3.5 feet higher than the elevation of land surface at Monitoring Well MW-20 (the closest well to this building), which is located approximately 80 feet southeast (upgradient and on the opposite side of the sewer line) from the basement excavation. The top of the separate-phase petroleum accumulation in Monitoring Well MW-20 has been measured at approximately 3 feet bls, or about 6.5 feet below the building basement. Since this reported petroleum accumulation was at an elevation approximately 4.5 feet higher than the accumulation measured in Monitoring Well MW-20, a source area other than the Yard is indicated.

Water-level and separate-phase petroleum thickness measurements were collected on October 16 and 23, 1991 from the monitoring wells located in OU-3. Separate-phase petroleum is present south, but not north of the sewer. Also, shallow ground water flows in a northwest direction across OU-3, however, in the immediate vicinity of the sewer, shallow ground-water flow is parallel to the sewer line (westerly) and ground-water elevations were slightly lower on the north side of the sewer. Visual inspection of the sewer and a review of the ground-water elevation data indicated the sewer line intersects the water table in the study area. These data indicate that the sewer is acting as a barrier to shallow ground-water flow. Moreover, based on the fact that no separate-phase petroleum has been detected to the north of the sewer in Monitoring Wells MW-19 and MW-35, the sewer appears to be acting as a barrier to the northward migration of the separate-phase petroleum accumulation floating on the ground water, thereby preventing off-site migration.

To further delineate the extent of the separate-phase petroleum accumulation on the south (upgradient) side of the sewer, eight hand borings (designated HB-1 through HB-8) were completed to a depth below the water table. Each hand boring remained open for approximately one hour to allow separate-phase petroleum, if present, to enter the borehole. The following observations were made upon completion of the borings:

- a sheen was present in Hand Borings HB-1 and HB-2;
- separate-phase petroleum was present in Hand Borings HB-3, HB-4, HB-5 and HB-6; and
- no separate-phase petroleum or sheen was detected in Hand Borings HB-7 and HB-8.

These data indicate that the separate-phase petroleum accumulation does not appear to have migrated offsite beyond the sewer line.

While determining proper placement of Monitoring Well MW-35 on October 15, 1991, the manhole cover at MH-3 was removed to determine the exact location of the sewer line. At that time, during a steady, light rain, a sheen was observed on the sewer discharge water. On October 16, 1991 (no precipitation), a sheen was also observed. Therefore, the NYSDEC requested an interim sample be collected and analyzed for PHCs (a hydrocarbon scan) and PCBs to determine if the sewer line was acting as a conduit for off-site migration of PHCs or PCBs.

Roux Associates collected sewer-water samples from manhole locations MH-3 and MH-5 on October 23, 1991 to be analyzed for PHCs (a hydrocarbon scan) and PCBs. There were no PHCs or PCBs detected in the samples. However, it should be noted that no sheen was present during the scheduled sampling on October 23, 1991.

The results of the off-site delineation work indicated that the separate-phase petroleum accumulation has not migrated northward beyond the sewer line, was not present beneath the buildings located along Northern Boulevard, and was not migrating offsite in the sewer. The sewer line which parallels the northern boundary of the LIRR property is apparently acting as a physical barrier to the northward migration of ground water and the separate-phase petroleum accumulation.

2.2.2.2 On-Site Extent of Separate-Phase Petroleum Accumulation

Following completion of the Phase I RI, further delineation of the on-site extent of the separate-phase petroleum accumulation was accomplished by:

- completing four phases of hand borings;
- drilling 24 soil borings during the Phase II Addendum; and
- installing and gauging 13 monitoring wells during the Phase II Addendum.

The results of these tasks are discussed in a series of Roux Associates letters to the NYSDEC, and are summarized below.

Hand Borings

Prior to the placement of permanent monitoring wells onsite during the Phase II Addendum, the extent of the separate-phase petroleum accumulation was further defined during four phases of additional delineation. These investigations consisted of the completion of 52 hand borings to the water table. These hand borings were used as a screening tool to determine the presence or absence of separate-phase petroleum. The actual placements of the Addendum soil borings and permanent monitoring wells were based on the results of the hand borings that are described below.

Phase 1 of the additional delineation consisted of completing nine hand borings (GM-2, GM-2A, GM-2B, GM-2C, GM-3 and GM-9 through GM-12) next to Geraghty & Miller wells.

Screening Location	Monitoring Well Results	Hand Boring	Hand Excavation Results
MW-2	No petroleum or odors noted	GM-2	Measurable petroleum thickness noted
Downgradient of MW-2	Not applicable	GM-2A	Measurable petroleum thickness noted
Upgradient of MW-2	Not applicable	GM-2B, GM-2C	Sheen and photoionization detector (PID) readings above background
MW-3	Very slight sheen, very slight petroleum odor noted	GM-3	Obvious sheen, very strong petroleum odor noted
MW-9	No petroleum or odors noted	GM-9	No petroleum or odors noted
MW-10	No petroleum or odors noted	GM-10	Measurable petroleum thickness noted
MW-11	No petroleum or odors noted (however, at the time of inspection, water table was above screened interval)	GM-11	No petroleum or odors noted
MW-12	No petroleum or odors noted	GM-12	Obvious sheen noted

Based on the results of the screening (i.e., the lack of correlation between the observations made in the hand-dug boreholes adjacent to the wells and observations made within the actual wells) the NYSDEC determined that the wells should no longer be used as monitoring points since the data obtained from them was invalid. As a result, the NYSDEC required additional delineation of the separate-phase petroleum accumulation. These results were used to develop the scope of work for Phase 2 of the additional delineation.

Phase 2 of the delineation consisted of completing 19 hand borings (PD-1, PD-4 through PD-19, PD-22 and PD-23). No petroleum or sheen was present on the water table within borings PD-1, PD-13 through PD-15, PD-17 and PD-18, confirming the previous delineation results along the western and southwestern boundaries of the separate-phase petroleum accumulation. Petroleum was observed on the water table within borings PD-10, PD-16 and PD-23, confirming the presence of the previously identified accumulation. With the exception of PD-19 (which is located west of the accumulation), all remaining borings (PD-4 through PD-9, PD-11, PD-12 and PD-22) contained either petroleum or a sheen on the water table, extending the former eastern boundary of the separate-phase petroleum accumulation further east toward the former Turntable and further southeast. A sheen was also noted within PD-19, and appeared to be an isolated occurrence.

Based on these observations, a determination regarding the extent of petroleum accumulation was made. PD-19 and GM-12 (phase 1) were the only borings that contained petroleum hydraulically downgradient of the previously determined separate-phase petroleum accumulation. At the request of the NYSDEC, these isolated occurrences of petroleum required additional delineation.

Phase 3 of the additional delineation consisted of completing 15 hand borings (PD-24 through PD-30, PD-32 and PD-34 through PD-40). No petroleum or sheen was present on the water table at locations PD-25 and PD-26, located east of the Turntable. However, petroleum or a sheen was observed in boreholes PD-24 and PD-27 through PD-29, extending the separate-phase petroleum accumulation boundary further east and southeast. No petroleum or sheen was noted in PD-30 and, therefore, the southwest corner of the separate-phase petroleum accumulation was delineated. Borings PD-32 and PD-34 were installed to delineate the petroleum observed in GM-10 (adjacent to MW-10). No sheen or petroleum was observed on the water table within either boring, confirming the opinion that the petroleum noted at location GM-10 is an isolated occurrence. Borings PD-35 through PD-40 were installed to delineate the petroleum observed on the water table within GM-12 (adjacent to MW-12). Results show that petroleum or a sheen was present in each upgradient boring (PD-35, PD-36 and PD-38), and absent in the crossgradient (PD-37) and each downgradient boring (PD-39 and PD-40). Therefore, the petroleum observed on the water table at location GM-12 also appears to be an isolated occurrence.

These data indicate that the separate-phase petroleum accumulation was not completely delineated to the southeast, south of the former Metro Shop and east of the former Locker Room/Shop. In addition, a sheen was observed downgradient (northwest) of the former Turntable.

Phase 4 of the additional delineation was scoped based on the results of phase 3 (above). Phase 4 consisted of completing nine hand borings (PD-41 through PD-48 and PD-53). No petroleum or sheen was present on the water table at locations PD-44 and PD-46, located south of the former Metro Shop and east of the former Locker Room/Shop. However, petroleum was noted in PD-45 and a sheen was observed in borehole PD-47, prompting completion of an additional boring to the east (PD-53). No petroleum or sheen was observed in PD-53, therefore delineating the southeastern extent of separate-phase petroleum. No petroleum or sheen was observed in two of the borings located downgradient of the former Turntable (PD-42 and PD-43), and only a sheen was noted in PD-41. These data complete the delineation of the northeast edge of the separate-phase petroleum accumulation. No sheen or petroleum was observed on the water table of PD-48. These data complete delineation of the separate-phase petroleum detected near MW-12 (GM-12), confirming that this is an isolated occurrence of petroleum and not part of the larger accumulation.

The results of the additional delineation investigations, Phases 1 through 4, indicated that the previously delineated northern, western and southwestern boundaries of the separate-phase petroleum accumulation were accurate. However, the extent of the accumulation was not fully delineated to the east and southeast. The information obtained during Phases 1 through 4 was used to modify the locations of permanent monitoring wells proposed for the Phase II RI, and determine locations of additionally required wells resulting from the newly-delineated extent of separate-phase petroleum.

Soil Borings

Northwest and West of the Former Turntable - Eight soil borings (S-118 through S-121, S-129, and S-140 through S-142) and one monitoring well pilot borehole (MW-54) were drilled northwest and west of the former Turntable. These borings were drilled to confirm the extent of the separate-phase petroleum accumulation determined by the four phases of hand borings. No evidence of petroleum was detected in soil borings S-118, S-119 and S-140. Soil staining and petroleum odors were noted within soil at locations S-121 (PID reading was 39.4 ppm above background), S-141 and S-142. Separate-phase petroleum was detected at the water table in soil boring S-120 (PID reading was 84.4 ppm above background). At location S-129 (PID reading was 27.8 ppm above background) a sheen was present on the water table. The data collected indicate that separate-phase petroleum is present west of the former Turntable and between the retaining walls, but is absent at S-119 and north of location S-119. In addition, separate-phase petroleum was measured in Monitoring Well MW-60, located west of the former Turntable and between the retaining walls. Based on these results and observations of surface soil, the separate-phase petroleum detected west of the former Turntable is a part of the larger previously identified accumulation.

South of the Former Metro Shop - Monitoring well pilot borehole MW-58 was drilled south of the former Metro Shop and Locker Room/Shop buildings to confirm the edge of the separate-phase petroleum accumulation. Staining and a petroleum odor were noted in soils at the water table in monitoring well pilot borehole MW-58. South of MW-58 and south of the retaining wall, three test pits (S-122 through S-124) were dug to determine if the accumulation extends beyond the retaining wall. Test Pits S-122 through S-124 were dug to the water table, approximately 7.5 to 8 feet bls in that area. No staining, odors or evidence of separate-phase petroleum were encountered in the test pits. In addition, no PID readings above background were noted during this work. The Phase II data collected south of the former Metro Shop indicate that separate-phase petroleum is present south of both the former Metro Shop and former Locker Room/Shop, but does not extend south beyond the retaining wall. Based on these results, additional borings and wells were not required in this area.

Adjacent to Monitoring Well MW-10 - Soil Borings S-130 through S-134 and S-143 through S-145 were completed around MW-10 (south of the former Engine House), to determine the extent of the isolated separate-phase petroleum detections near MW-10. These soil borings were drilled to the water table. Although dark staining was noted in the shallow soil (0 to 2 feet) of borings S-130 through S-133, a petroleum odor was only detected at locations S-133 and S-134.

West of borings S-130 through S-134, a sheen was noted at S-143 and separate-phase petroleum was observed at S-144. However, there was no evidence of petroleum at location S-145, approximately 15 feet west of S-144. This indicates that the separate-phase petroleum detected in MW-10 is only present between S-133 (east) and a point between S-144 and S-145 (west), and between S-130 (north) and S-131 (south). The limited extent of this separate-phase petroleum indicates that it is an isolated occurrence, not related to the previously identified separate-phase petroleum accumulation located east of the former Engine House.

Adjacent to Monitoring Well MW-12 - Separate-phase petroleum was delineated around MW-12 by completing five hand-augered borings to the water table. Soil Borings S-135 through S-139 each showed hydrocarbon staining within the shallow soils only (less than 3 feet bls). No measurable separate-phase petroleum or sheens were noted on the water table within these borings. The limited extent of this separate-phase petroleum in the vicinity of MW-12 indicates that it is an isolated occurrence, not related to the previously identified separate-phase petroleum accumulation.

Monitoring Wells

In addition to the soil borings, 13 monitoring well locations (MW-49 through MW-60 and MW-63) were designed to confirm the extent of the separate-phase petroleum accumulation. During drilling activities, hydrocarbon odor and/or staining was observed within soil below the water table at locations MW-50 through MW-56, MW-58 and MW-60. No evidence of petroleum was noted in soil at locations MW-49, MW-57, MW-59 and MW-63.

2.2.2.3 Separate-Phase Petroleum Characteristics

Petroleum thickness gauging, bail-down testing, and separate-phase petroleum sampling and analyses were performed to determine characteristics of the separate-phase petroleum accumulation in OU-3. These characteristics include: the areal extent of the petroleum, true thicknesses, recharge rates, an estimated total volume, the type(s) of PHCs comprising the accumulation, occurrence of PCBs, and the physical characteristics of the petroleum (i.e., specific gravity and kinematic viscosity).

Petroleum Thickness Gauging Results

On February 1 and 2, 1994, June 14, 1994, May 2 and 3, 1996, and June 17 to 19, 1997, OU-3 monitoring wells were screened for the presence of separate-phase petroleum, including sheens. Measured (i.e., apparent) separate-phase petroleum thicknesses ranged from a sheen in wells near the periphery of the petroleum accumulation and Monitoring Well MW-13 (apparently an isolated occurrence), to 4.56 feet in Monitoring Well MW-50.

No petroleum or sheen was observed in Monitoring Wells MW-49, MW-57, MW-59 or MW-63 during any gauging round. Monitoring Wells MW-21, MW-52, MW-55, MW-56 and MW-58 each contained a sheen on the water table during one or more of the gauging rounds, presumably indicating the edge of the petroleum accumulation.

The results of the soil boring and monitoring well gauging were used to define the areal extent of the separate-phase petroleum accumulation (Plate 1). Compared to previous data, the northwestern and western limits of the accumulation have not changed significantly, but has been more accurately delineated. Based on the installation of Monitoring Well MW-49, the western edge of the accumulation does not extend as far west as previously estimated. However, the upgradient edge of the petroleum accumulation has now been delineated in an easterly direction to the former Turntable, and to the southeast beyond the former Locker Room/Shop to the retaining wall. As previously mentioned, Monitoring Wells MW-21, MW-52 and MW-55 appear to delineate the boundary of the separate-phase petroleum accumulation.

Bail-Down Testing Data Evaluation and Results

Separate-phase petroleum bail-down tests were conducted on seven monitoring wells within Area 1: MW-17, MW-22, MW-36, MW-50, MW-53, MW-54 and MW-60. The data collected during these tests were plotted as graphs of depth to water/depth to petroleum (in feet bls) versus elapsed time (in minutes) for each well tested. These graphs were used to determine the "true" petroleum thickness by:

- identifying the inflection point of the depth-to-water graph (i.e., the point where the graph changes from a positive to a negative slope);
- reading the elapsed time that corresponds to the inflection point (i.e., the inflection point time) off the graph; and

- determining the petroleum thickness that occurred at the inflection point time, which is the "true" petroleum thickness. This information can be read off a graph of measured petroleum thickness versus elapsed time (Testa and Paczkowski, 1989).

In general, the true petroleum thickness within each well had recharged in 10 minutes or less, and the pre-test measured thickness had recharged in about 30 minutes.

The results of the data evaluation indicate that the thickest portion of the petroleum accumulation occurs at Monitoring Well MW-50, which showed a measured petroleum thickness of 4.14 feet and a true petroleum thickness of 1.22 feet. A similar true petroleum thickness is indicated for Monitoring Well MW-17 (1.09 feet), which had a measured thickness of 3.62 feet. All other wells tested contained true petroleum thicknesses that were equal to or less than 0.5 feet. A true petroleum thickness of 0.5 feet was obtained for Monitoring Well MW-60, located downgradient of the former Turntable. For Monitoring Wells MW-22, MW-53 and MW-54, petroleum thicknesses were determined to be 0.20, 0.19 and 0.14 feet, respectively.

Monitoring Well MW-36 contained a measured petroleum thickness of 0.56 feet. The bail-down test on this well was performed in the same manner as the previous tests, with all petroleum being bailed from the well. The petroleum recovered to a thickness of 0.03 feet after 1.13 minutes. However, although recovery was monitored for greater than four hours, the inflection point of the depth-to-water readings was never attained. Therefore, the test performed on Monitoring Well MW-36 was inconclusive. The recovered petroleum thickness remained at 0.03 feet more than four hours after petroleum was bailed from the well. These data indicate that the true petroleum thickness at this location is equal to or greater than 0.03 feet.

A review of the thickness contours from the bail-down tests performed during March 1994 indicates that the majority of the separate-phase petroleum accumulation in Area 1 is less than one-foot thick. Thicknesses greater than one foot are limited to the Interim Remedial Measures petroleum recovery area. This area includes wells MW-50, MW-17 and RW-3, and is presumed to include well RW-1. Monitoring Well MW-16, which is currently being used as a recovery well in place of RW-2, is estimated to contain less than one foot of separate-phase petroleum as a result of petroleum recovery.

Observations made during installation of the Phase III IRM (October 1998) indicate the eastern and western limits of the petroleum accumulation in the IRM area remain as previously defined.

Using the methodology described by Testa and Paczkowski (1989), an estimate of the actual volume of petroleum was calculated. The planar areas of the petroleum accumulation between the zero and one-foot contours and within the one-foot contour were calculated with the use of a digitizer and AutoCAD™. The area within the one-foot contour was estimated to be 11,195 square feet, and has an average actual petroleum thickness of 1.155 feet. The area between the zero and one-foot contours was estimated to be 122,405 square feet, and has an average actual petroleum thickness of 0.212 feet. Since the majority of the Yard deposits consist of glacial till (both undisturbed and reworked), a soil porosity of 0.25 was assumed (Walton, 1991). The calculation is shown below.

$$(\text{Area}_{1\text{-ft}} * \text{Ave. } PT_{1\text{-ft}} * \eta) + (\text{Area}_{<1\text{-ft}} * \text{Ave. } PT_{<1\text{-ft}} * \eta) = \text{Actual Volume}$$

$$(11{,}195 \text{ ft}^2 * 1.155 \text{ ft} * 0.25) + (122{,}405 \text{ ft}^2 * 0.212 \text{ ft} * 0.25) = 9{,}720 \text{ ft}^3$$

$$9{,}720 \text{ ft}^3 * 7.48 \frac{\text{gallons}}{\text{ft}^3} = 72{,}705 \text{ gallons}$$

Therefore, the actual total volume of petroleum is estimated to be approximately 72,700 gallons. According to published data, between 15 and 50 percent of the total petroleum could be recoverable (Testa and Paczkowski, 1989). Assuming 35 percent recoverability based on the characteristics of the petroleum and soil, only 25,500 gallons of petroleum is estimated to be recoverable by conventional methods. Approximately 7,700 gallons of petroleum (including 2,175 gallons removed during test of the Phase III IRM conducted on December 7 and 8,1998) have been recovered by the combined IRM's through January 1, 1999, leaving an estimated 17,800 gallons of recoverable petroleum remaining.

Petroleum Analytical Results

A separate-phase petroleum sample was collected from Monitoring Well MW-36 and analyzed for PCBs. Aroclor-1260 was detected at a concentration of 14,000 µg/kg (14 ppm). On February 17, 1994, separate-phase petroleum samples were collected from four monitoring wells within Area 1: MW-50, MW-53, MW-54 and MW-60. A sufficient volume of petroleum existed within these wells to be analyzed for PCBs, PHCs (a hydrocarbon scan), specific gravity and kinematic viscosity.

PCBs were detected in all four samples. Two samples contained only Aroclor-1260: MW-50 (18,000 μg/kg [18 ppm]), located north of the former Engine House, and MW-60 (830 μg/kg [0.83 ppm]), located downgradient of the former Turntable. The remaining two samples each contained both Aroclor-1260 and Aroclor-1254. Samples MW-53 and MW-54 contained similar concentrations of Aroclor-1254: 5,300 μg/kg (5.3 ppm) and 5,200 μg/kg (5.2 ppm), respectively. Aroclor-1260 was detected in MW-53 at 3,100 μg/kg (3.1 ppm), and in MW-54 at 2,200 μg/kg (2.2 ppm).

The results of the hydrocarbon scans indicate that the petroleum within the four wells sampled most resembled No. 2 fuel oil. The petroleum sample was therefore quantified to a No. 2 fuel oil standard. Reported concentrations of No. 2 fuel oil range from 920,000 mg/kg (ppm) in sample MW-60 to 1,550,000 mg/kg (ppm) in sample MW-54. The results for the MW-50 and MW-54 samples represent more than 100 percent of No. 2 fuel oil. However, the analytical laboratory stated that the petroleum was extremely weathered and was therefore not a clear match to any of the laboratory standards, and the petroleum may be either kerosene, diesel or No. 2 fuel oil, or a mixture of these products since they have very similar characteristics. Discussions with Yard personnel indicate that No. 2 fuel oil has been used to fuel trains since the Yard converted from coal use (year unknown). Historical documentation shows that the USTs in OU-3 were installed during the 1930s and abandoned in place during 1984. This information suggests that the age of the separate-phase petroleum on the sampling date was within the range of 10 to 64 years. Based on its estimated age, the petroleum is expected to be degraded and therefore heavily oxidized. As the petroleum degrades, retention times (during gas chromatograph analyses) increase and the petroleum is less likely to appear on a chromatograph. This information may explain why the samples were not clear matches to any of the pure undegraded petroleum standards used by the laboratory.

Chemical properties of the separate-phase petroleum samples are summarized herein. The specific gravity of the four samples were similar, ranging from 0.8704 (MW-54) to 0.8799 (MW-50). These specific gravity values are similar to those documented for No. 2 fuel oil (American Petroleum Institute, 1989). The kinematic viscosity of the samples ranged from 5.35 (MW-53) to 7.70 (MW-50). These data will be used during the feasibility study for remedial alternative screening.

Based on the above data and an understanding of historical operations at the Yard, the source of the separate-phase petroleum is attributable to the former fuel storage areas and former fueling areas north of the former Metro Shop. Although the same PCB species were found in the petroleum within Monitoring Wells MW-50 and MW-60, the levels of Aroclor-1260 detected in these two samples vary by greater than one order of magnitude. These data indicate different sources for the PCBs detected at these two locations, and suggest that the separate-phase petroleum is not mixing and is therefore variable in nature. It is our understanding that PCBs were introduced into the separate-phase petroleum accumulation primarily by leaks from train-mounted transformers. The resulting distribution of PCBs in the petroleum is controlled by historical activities in the area, especially in the vicinity of the former Engine House (Plate 1). The PCB distribution remains non-homogenous because the degraded, viscous nature of the petroleum and the demonstrated lack of migration of the accumulation precludes mixing. Based on these data, no additional separate-phase petroleum sampling is warranted.

2.3 Physical Setting

Physical characteristics of the Yard, including surface features, surface water, geology, hydrogeology, and man-made structures, have been investigated throughout previous investigations. Summaries of these characteristics are discussed in the following sections.

2.3.1 Surface Features

The Yard encompasses approximately 105 acres and lies in a basin-like area with ground elevations that range from approximately 10 to 25 feet below the surrounding land surface. The topography is generally flat and slopes gently to the west. The Yard topography and drainage patterns are strongly influenced by the large number of railroad tracks and bulkheaded areas throughout the Yard. Overland surface runoff does not appear to be a source of contamination to adjacent properties.

The Yard is underlain by a combined sanitary/storm sewer drainage system, consisting of two drainage subsystems that connect catch basins located throughout the Yard. The primary subsystem serves approximately 90 percent of the Yard. Storm water from the primary subsystem leaves the Yard to the north, approximately 360 feet west of Honeywell Street. The secondary drainage subsystem is located in the southwest corner of the Yard and services approximately 10 percent of the Yard. Storm water from the secondary subsystem exits the Yard to the south, approximately 360 feet west of the intersection of Skillman and Thompson Avenues.

OU-3 discharges surface water and ground water into the primary sewer drainage system from the following identified sources:

- storm water and surface runoff into 13 catch basins located throughout OU-3;
- water from an oil/water separator located east of the former Engine House that is connected to the former fuel transfer area;
- storm water and/or ground water from service bays Pit 3 and Pit 4 located directly north of the former Engine House; and
- ground water from the service bay located in the former Metro Shop.

In OU-3, most of the sewer appears to be located below the water table and surface runoff with sheens was observed flowing into some of the catch basins during periods of precipitation.

As previously noted, the sewer system beneath the entire Yard has been designated as OU-5 and, therefore, will not be considered during the OU-3 investigation.

2.3.2 Geology

Published geologic data, historical maps, and geologic logs for borings drilled during the investigations were evaluated to define the current geologic conditions observed at the Yard.

2.3.2.1 Regional Geology

The Yard is located within the Atlantic Coastal Plain Physiographic Province. The regional subsurface geology consists of unconsolidated sand, silt, clay and gravel deposits that overlie crystalline bedrock. The strata in the area dip gently to the southeast, following the topography of the bedrock surface (Soren, 1978). Boreholes drilled within northwestern Queens County indicate that the unconsolidated deposits are predominantly Upper Pleistocene glacial deposits that range from approximately 30 to 150 feet in thickness. These borehole logs also indicate that Lower Pleistocene deposits, consisting of the Jameco gravel overlain by the Gardiner's clay unit, may be discontinuously present beneath the Yard. These Lower Pleistocene deposits unconformably overlie bedrock.

The Upper Pleistocene deposits are covered by a thin veneer of recent and Holocene deposits. Unconsolidated Upper Pleistocene glacial (ground moraine) deposits of unstratified, poorly sorted mixtures of sand and silt with some gravel and cobbles (Buxton, et al., 1981) overlie the Lower Pleistocene deposits (where present), which overlie crystalline bedrock. The saturated portion of the Upper Pleistocene deposits form the Upper Glacial aquifer of Long Island.

2.3.2.2 Yard Geology

The geologic logs of soil borings drilled on the Yard during the previous investigations indicate that the Yard is underlain by the following units (in order by increasing depth); fill, Upper Pleistocene glacial deposits (including both till and channel deposits), and bedrock. The fill is predominantly comprised of reworked glacial deposits (sand, silt, clay and gravel) and railroad ballast, with minor amounts of construction debris and other materials.

The Upper Pleistocene glacial deposits consist mainly of ground moraine deposits; unstratified, poorly sorted mixtures of sand, silt, clay and gravel (as previously described). In addition, a cobble layer was encountered in three deep soil borings drilled at the Yard. This unit may represent a relict stream channel that was formed by glacial meltwaters. One borehole was drilled to the bedrock surface beneath the Yard. In this soil boring (P-3D), located within OU-3, bedrock was encountered at a depth of 74 feet bls (i.e., 53 feet below mean sea level). In the southwestern portion of the Yard, a Holocene wetland deposit was encountered below the fill and above the Upper Glacial formation. This deposit consisted of organic silty clay and meadow mat. As discussed below, this deposit is associated with a buried stream channel.

During evaluation of the geologic and hydrogeologic data for the Yard, a historical topographic map for western Queens, dated 1890, was obtained for reference (Julius Bien & Co., 1890). Utilizing this map, a 1910 Yard map and recent area maps, a comparison was made between the historical and current topographic features of the Yard. This comparison indicated that:

- the majority of topographic changes that occurred at the Yard took place between 1890 and 1910;
- current land surface elevation throughout much of the Yard is actually lower than original elevation;
- two former surface-water bodies at the Yard have been filled; and
- the current elevation of the LIRR main line approximately correlates with 1890 topography.

The topography shown on the 1890 map for the land now occupied by the Yard is much different than present topographic conditions. The map indicates that approximately 750 feet east of Dutch Kills (which flowed through the western portion of the Yard) land surface begins a rapid increase from less than 10 to greater than 60 feet above mean sea level west of Honeywell Street. Although this topographic high is still present south of the Yard, the mound no longer exists across the Yard. West of Honeywell Street land surface gradually sloped to the north, from a high elevation of approximately 80 feet above mean sea level along Skillman Avenue (designated Skillman Avenue on the 1890 map) to a low of about 30 feet above mean sea level at the wetland along Northern Boulevard (designated Jackson Avenue on the 1890 map). A comparison of the 1890 topographic map, the 1910 Yard map, and recent site plans indicate that major topographic changes took place at the Yard between 1890 and 1910, bringing the Yard close to its present, generally flat, topographic condition. These changes are discussed below.

Although only a limited number of landmarks and surveyed points could be correlated between the 1890 and more recent maps, this comparison suggests that the central portion of the Yard has been scraped down rather than filled to reach its present elevation. One portion of the Yard that had an elevation of approximately 60 feet above mean sea level in 1890 (near the corner of Hill

Street and the new Skillman Avenue), now lies 45 feet lower at approximately 15 feet above mean sea level. Although it is apparent that surficial fill (ballast) is located throughout the Yard, this information suggests that the sand and gravel deposits underlying the ballast in this area are native glacial deposits, as opposed to fill or reworked deposits.

Two surface-water bodies are also indicated on the 1890 map; a wetland is shown along Northern Boulevard (Jackson Avenue) near the northeast corner of the Yard, and a stream, Dutch Kills, is indicated in the northwest corner of the Yard flowing southwest to Newtown Creek. Present conditions prove that these areas have been filled since 1890. Presumably, the glacial deposits that were excavated from the central portion of the Yard were used to fill these wetland and stream areas between 1890 and 1910. Geologic logs from borings in the northwest corner of the Yard (MW-30 and S-32) describe fine to medium sands overlying wetland-deposited meadow mat and clays. These logs support the theory that local glacial deposits were used to fill the former wetland. A 48-inch diameter sewer line charted on the 1910 Yard map indicates that the Dutch Kills drainage is culverted beneath the northwest corner of the Yard.

A comparison of the LIRR main line elevation with 1890 topographic contours indicates that this right-of-way is similar to original land surface elevation. These data suggest that the LIRR main line, which is elevated more than 20 feet above the adjacent Yard, was not built up during its construction. Instead, the right-of-way may reflect original (or close to original) land surface, with the surrounding Yard having been excavated or scraped down to its present, low-lying elevation.

During the Phase II RI, six deep boreholes were drilled at the Yard; MW-38D, MW-39D, MW-40D, MW-44D, MW-48D and MW-62D. These data supplemented the current understanding of geologic conditions beneath the Yard. Based on these geologic logs, an approximately 4-foot thick cobble zone is located in the subsurface at locations MW-40D, MW-44D and MW-48D. The cobble unit is encountered at an elevation of approximately 2.3 feet above mean sea level at MW-48D, and deepens to the west, where it is encountered at approximately 18 feet below mean sea level at MW-44D. This unit may be a relict stream channel deposit, and therefore may not be laterally continuous.

Based on information obtained from the NYSDEC, the bedrock surface appears to be highly irregular in this area. Boreholes drilled adjacent to the Yard indicate that the depth to bedrock ranges from approximately 30 to 150 feet bls (i.e., 10 to 130 feet below mean sea level). As part of additional work at the Yard one borehole (P-3D), located approximately 15 feet from Monitoring Well MW-40D, was drilled to the bedrock surface. Bedrock was encountered at a depth of 74 feet bls (53 feet below mean sea level).

2.3.3 Hydrogeology

Published hydrogeologic data and Yard-specific water-level elevation and aquifer test data were evaluated to define the hydrogeologic conditions observed at the Yard during previous investigations. A summary of the Yard hydrogeology is presented in the following sections. More detail on the hydrogeology will be presented in the OU-6 RI report.

2.3.3.1 Regional Hydrogeology

Ground water in the area occurs under water-table (unconfined) conditions in the Upper Glacial aquifer. Regional ground-water flow in the area is to the northwest, eventually discharging to the East River approximately one mile northwest of the Yard (McClymonds and Franke, 1972). Vertical flow within the aquifer changes from a downward flow in central Queens to an upward flow nearing the East River, where ground water discharges. The published horizontal hydraulic conductivity of the Upper Glacial aquifer in Queens County ranges from 214 feet per day (McClymonds and Franke, 1972) to 270 feet per day (Franke and Cohen, 1972).

Published water-level data for Long Island show that from the early 1930s to about 1960 the water table within Kings County and western Queens County was depressed to elevations below sea level due to over pumpage. The cone of depression caused significant salt-water intrusion into the Upper Glacial and confined aquifers beneath these areas, and as far inland as the center of the Kings County (Smolensky, 1983). Historical data for wells near the Yard indicate that salt-water intrusion also affected the aquifers beneath the Yard. In documentation obtained during the Freedom of Information Act (FOIA) search, two bedrock wells (Q-173 and Q-58) are noted as having brackish water conditions during 1925 and 1932, respectively. Both wells are located northeast of the Yard, with well Q-173 being the closest (within 500 feet of the Yard).

Due to the corrosive nature of the water, well Q-173 went out of use around 1921 and well Q-58 eventually went dry in 1936. However, published data indicate that by the late-1950s the cone of depression within Queens County had recovered (Smolensky, 1983). Current water-level elevations at the Yard range from 8 to 23 feet above mean sea level, precluding salt-water intrusion in this area. However, the effects of the historical salt-water intrusion can still be detected in ground-water quality, which exhibits elevated concentrations of sodium and chloride (Soren, 1971).

Regional ground-water quality of the Upper Glacial aquifer is characterized as having a wide range of iron and manganese concentrations (Buxton, et al., 1981). Concentrations of iron and manganese increase as conditions become anoxic (i.e., as the dissolved oxygen content decreases). Anoxic conditions are typically associated with swamp or wetland deposits, such as those identified in the western portion of the Yard.

2.3.3.2 Yard Hydrogeology

Ground water beneath the Yard occurs under water-table (unconfined) conditions. The water table lies between 1 and 15 feet bls and occurs in either fill deposits (e.g., western part of Yard) or the Upper Pleistocene glacial deposits (e.g., eastern part of Yard). The saturated Upper Pleistocene deposits comprise the Upper Glacial aquifer. Beneath the Yard, the saturated fill deposits and the shallow Upper Glacial aquifer were not always distinguishable, and are, therefore, collectively referred to as shallow deposits (which contain the water table). Deeper wells at the Yard (designated by a "D") are screened within the deeper Upper Glacial aquifer.

Ground water within the shallow deposits flows predominantly west beneath the Yard. However, between Queens Boulevard and Honeywell Street, ground water flows northerly and northwesterly toward the East River.

3.0 PRELIMINARY IDENTIFICATION OF REMEDIAL ACTION ALTERNATIVES

Roux Associates has identified potential remedial action alternatives for OU-3 based upon an evaluation of data developed during previous investigations, and the present implementation of Interim Remedial Measures (IRMs) for separate-phase petroleum (discussed below).

The purpose of identifying potential alternatives in the Work Plan is to verify that data needed to support a detailed evaluation of these alternatives in a feasibility study (including continued implementation of the IRM) are collected during the RI.

3.1 Soil

The evaluation of available Yard-specific data indicates the presence of PCBs, PAHs, metals and PHCs in soil beneath OU-3 (Section 2.2.1). Additional information concerning the nature and the extent of soil contamination in OU-3 will be generated as part of the RI.

Based upon our current understanding of OU-3 conditions (Section 2.0) and review of the analytical data, remedial alternatives which may be suitable for soil on OU-3 include:

- no action;
- in-situ treatment;
- excavation and off-site disposal;
- excavation/on-site treatment and on-site or off-site disposal; and
- containment.

These preliminarily identified alternatives represent a range of response actions which is consistent with USEPA guidance documents.

3.1.1 No Action

The no action alternative will be evaluated to provide a comparative baseline for the evaluation of other remedial alternatives. The no action alternative may include monitoring and institutional controls. The evaluation of this alternative will consider:

- the nature and extent of contamination;

- the migration potential for the contaminants; and
- the potential exposure scenarios.

3.1.2 In-Situ Treatment

In-situ treatment is preliminarily identified as a remedial action alternative for contaminated soils. Specifically, bioremediation, soil washing, solidification, stabilization and vitrification may be considered as potential remedial action alternatives.

3.1.3 Excavation and Off-Site Disposal

Excavation and off-site disposal is preliminarily identified as a remedial action alternative for PCBs, metals and PHC-impacted soils in OU-3. Evaluation of this alternative will consider permanence of remedy, the need for treatment in order to meet land disposal restrictions (LDRs), and the classification of soils as either hazardous or nonhazardous.

3.1.4 Excavation/On-Site Treatment and On-Site or Off-Site Disposal

Excavation and on-site treatment is preliminarily identified as a remedial action alternative for PCBs, metals and PHC-impacted soils in OU-3. Evaluation of this alternative will consider treatment techniques, such as those described above, which may be used to reduce the toxicity and mobility of the excavated waste materials. Depending upon the degree of treatment, the final disposition of the material may be onsite or offsite.

3.1.5 Containment

Containment alternatives that may be considered include:

1. caps, slurry walls or other impermeable barriers to isolate the contaminated soil from contact with rainwater, surface runoff and ground water; and
2. diversion of ground water (e.g., pumping) to prevent contact with contaminated soil.

3.2 Separate-Phase Petroleum

As discussed in Section 2.0, separate-phase petroleum has been identified in OU-3 and an IRM is presently in place as discussed in Section 3.3. In view of this information, tentatively identified separate-phase petroleum remedial action alternatives include:

- no action;
- natural attenuation; and
- enhanced separate-phase petroleum extraction/disposal.

3.2.1 No Action

The no action alternative means that the IRM will continue operating but no enhanced extraction will be performed. This may include institutional controls and monitoring.

3.2.2 Natural Attenuation

Natural attenuation relies on natural processes of biodegradation, dispersion, dilution, and adsorption to degrade and dissipate petroleum constituents to achieve remedial goals. Determining the occurrence of biodegradation, and the extent to which it occurs, is a critical step in the process. The other key components include plume status (e.g., steady state, shrinking or fluctuating), and potential-receptor analysis to determine the overall ability of the aquifer system to attenuate the plume.

3.2.3 Enhanced Separate-Phase Petroleum Extraction/Disposal

An enhanced recovery trench system (interceptor trench), complete with product recovery pump and water-table depression within interconnecting manholes, is considered a preliminary remedial action alternative to remediate the recoverable free product at the Site. Evaluation of this alternative will address preventing migration and aggressively recovering the separate-phase petroleum accumulation.

3.3 Interim Remedial Measures

The IRM was designed to recover the separate-phase petroleum accumulation previously determined to be present on the ground water in OU-3 of the Yard. The initial placement of the IRM was based upon Roux Associates' review of site-specific information that was developed during a previous investigation (Geraghty & Miller, 1986).

The implementation of the IRM system proceeded in phases. The first phase (Phase I IRM) was installed prior to initiating RI activities and was designed to mitigate the migration of separate-phase petroleum into the service pit of the former Metro Shop building, which was located at the southeastern edge of the petroleum accumulation. The Phase I IRM system consisted of three petroleum recovery trenches, each connected to a recovery sump equipped with an Oil Recovery Systems (ORS) large diameter Filter Scavenger™. One recovery trench was located along the southwestern corner of the former Metro Shop building and two recovery trenches were located along the northwestern corner of the building. The Phase I IRM commenced operation on January 31, 1990.

The second phase (Phase II IRM) was implemented during the initial phase of the RI at the Yard and became operational in July 1991. After startup of the Phase II IRM the Phase I IRM was decommissioned. The Phase II IRM consisted of three 4-inch diameter recovery wells, each containing an ORS small diameter Filter Scavenger™. The recovery wells were placed in the area northeast of the former Engine House, where the greatest separate-phase petroleum thickness existed. Discharge lines, contained within an underground conduit system, transferred recovered petroleum to a 2,000-gallon aboveground storage tank.

In August 1993, the Phase II IRM was modified to increase the rate of petroleum recovery. The ORS equipment originally installed in Recovery Well RW-2 was transferred to an adjacent monitoring well (MW-16) and one recovery trench from the Phase I IRM was integrated into the Phase II IRM system.

In February 1996, the partial collapse of the west end of the former Metro Shop building necessitated the relocation of the Phase II IRM recovery tank and associated equipment. Additionally, due to equipment damage, the recovery trench was decommissioned.

A Phase III IRM system was installed during October and November 1998, and is designed to accelerate the rate of petroleum recovery in OU-3. The Phase III IRM system is located in the area where, historically, product thickness has been the greatest. A test of the Phase III IRM system on December 7 and 8, 1998 removed a total of 2,175 gallons of petroleum. The system is scheduled to begin operating in late January 1999, following installation of a new 2,000-gallon aboveground storage tank. This IRM system expansion can be integrated into the final remedy for the OU-3 Site.

Roux Associates has performed continuing operation and maintenance (O&M) and conducted performance monitoring of the IRM systems since operations commenced and will perform similar functions for the Phase III IRM system.

4.0 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

ARARs will be identified during the assessment of environmental conditions to ensure that the appropriate data are obtained during the RI.

SARA defines an ARAR as:

- any standard, requirement, criterion, or limitation under any federal environmental law; or
- any promulgated standard, requirement, criterion, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criterion, or limitation.

The purpose of this definition is to make CERCLA responses consistent with both federal and state environmental requirements.

Within these jurisdictional boundaries, ARARs are further segregated into the following three categories:

- Ambient or Chemical-Specific Requirements
  Health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.
- Performance, Design, or Other Action-Specific Requirements
  Technology- or activity-based requirements or limitations taken with respect to hazardous wastes.
- Location-Specific Requirements
  Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations.

In New York State, remedy selection must also conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated. The site's program should be designed with consideration being given to guidance determined, after the exercise of engineering judgment, to be applicable on a case-specific basis.

The terms "standards and criteria" and "guidance" (SCGs) include both those of the State and those of the United States to the extent that they are more stringent than those of this State (6 NYCRR 375-1.10).

A preliminary list of potential ARARs/SCGs is given below.

Federal ARARs	**New York State SCGs**
Resource Conservation and Recovery Act	Hazardous Waste Regulations
Clean Air Act	Solid Waste Regulations
Toxic Substances Control Act	Technical and Administrative Guidance Memoranda
Occupational Safety and Health Administration	
Federal Floodplain Management Act	

It should be noted that the NYSDEC issued recommended soil cleanup levels for all of the operable units at Sunnyside Yard (February 25, 1997 correspondence). These chemical-specific cleanup levels are classified To Be Considered (TBCs).

5.0 SCOPE OF WORK

This RI is designed to develop information pertaining to both the nature and extent of contamination at OU-3. The overall scope of work will be divided into the following tasks:

- Task I: Soil Boring and Sampling; and
- Task II: Ground-Water Sampling

The specific elements of each task are described below.

5.1 Task I: Soil Boring and Sampling

Yard safety procedures regarding buried utilities require that the top three feet of each borehole be advanced by hand (e.g., post-hole digger, hand auger, and/or split spoon sampler). Soil samples collected from this interval (if any) will be visually inspected for any evidence of contamination (i.e., staining, presence of petroleum or odors) and also screened using a portable PID.

Seven proposed soil borings (TSB-1 through TSB-7, shown on Plate 1) are to be located adjacent to transformers 31 (south side of the former Engine House), and 35 through 37 (north side of the former Metro Shop) to verify that these transformers have not leaked. Although the existence of the transformers in these locations (or any locations) does not indicate that these transformers leaked, these locations were chosen to verify that these areas have been adequately characterized. These locations were proposed based on the February 21, 1996 meeting with the NYSDEC. Soil samples will be collected and analyzed for PCBs using ASP Method 95-3. Validation of the analytical results will be performed.

Additionally, three soil borings (TSB-8 through TSB-10, shown on Plate 1) will be installed within the thickest portion of the identified separate-phase petroleum accumulation using a GeoProbe Unit. These locations were chosen to characterize soil quality and to conclude vertical delineation of subsurface saturated soil beneath the separate-phase petroleum accumulation. Soil samples will be collected at continuous two-foot intervals above the water table and every five feet thereafter. All samples will be examined for lithology, evidence of contamination (i.e., presence of oil, odor, staining), degree of saturation, and screened for the presence of VOCs using a PID. To determine if soil quality beneath the separate-phase petroleum accumulation has been impacted by PCBs, two soil samples from each borehole will be collected for laboratory analysis. One sample will be collected from the saturated soil based on evidence of petroleum contamination, and one sample which appears unimpacted from below the contaminated sample. The samples will be analyzed for PCBs using ASP Method 95-3. Validation of the analytical results will be performed.

To delineate the exceedance of the PCB soil cleanup level detected at location CS-76, four soil borings (TSB-11 through TSB-14) are proposed at the locations shown in Plate 1. Soil samples will be collected and analyzed for PCBs using ASP Method 95-3. Validation of the analytical data will be performed.

In addition to the PCB analyses described above, soil samples from locations TSB-2, TSB-5, TSB-11 and the petroleum-impacted sample from location TSB-9 will be analyzed for the following:

- PAHs and lead by 95 ASP Methods;
- SVOCs and RCRA metals by Toxicity Characteristic Leaching Procedure (TCLP); and
- ignitability, and reactivity.

Also, geotechnical analyses may be performed at selected boring locations.

5.2 Task II: Ground-Water Sampling

As discussed in Section 1.0, ground water at the Yard will be addressed in OU-6. As previously mentioned, continuing HSTF construction activities preclude the installation of permanent monitoring wells in OU-3 at this time. However, to further characterize deep ground-water quality beneath the separate-phase petroleum accumulation, ground-water samples will be collected from each of the deep boreholes. Ground-water samples will be collected from the unimpacted soil sample zone and analyzed for TCL VOCs, TCL SVOCs, PCBs (total and dissolved), TAL metals (total and dissolved), chloride and total dissolved solids using ASP methods as appropriate. Data validation of the analytical results will be performed. Field parameters include pH, temperature, and specific conductance. Ground-water sampling procedures are provided in the FSP.

6.0 REPORT PREPARATION

Following the completion of the OU-3 RI, a report will be prepared to include all the data collected during this investigation together with findings, conclusions, and any recommendations that may be appropriate (i.e., if additional delineation is required in some areas). Report appendices will include soil boring logs, analytical data documentation, and other technical data as appropriate. These data will be used to support the preparation of the FS for OU-3.

7.0 SCHEDULE

Following NYSDEC approval of this Work Plan, the estimated schedule for completion of the work is as follows:

- completion of field work within three weeks following written NYSDEC approval of the Work Plan;
- receipt of analytical data package four weeks following completion of field work;
- data validation report within three weeks following receipt of analytical data package; and
- remedial investigation report submittal within eight weeks following receipt of data validation report.

8.0 REFERENCES

American Petroleum Institute, 1989. A Guide to the Assessment and Remediation of Underground Petroleum Releases, API Publication 1628, August 1989.

Buxton, et al., 1981. Reconnaissance of the Ground-Water Resources of Kings and Queens Counties, New York: U.S. Geological Survey Open-File Report, 81-1186.

Franke, O.L., and Philip Cohen, 1972. Regional Rates of Ground-Water Movement on Long Island, New York. U.S. Geological Survey Professional Paper 800-C, p. C-271 - C-277.

Geraghty & Miller, Inc., 1986. Results of Hydrogeologic Investigation at the AMTRAK, Sunnyside, Queens, New York Train Yard, June 1986.

Julius Bien & Co., 1890. Topographic map of western Queens, New York, 1890.

McClymonds, N.E. and O.L. Franke, 1972. Water-Transmitting Properties of Aquifers on Long Island, New York.

Smolensky, Douglas A., 1983. Potentiometric Surfaces on Long Island, New York--A Bibliography of Maps. U.S. Geological Survey Open-File Report 84-070.

Soren, Julian, 1978. Subsurface Geology and Paleogeography of Queens County, Long Island, New York. U.S. Geological Survey Water-Resources Investigations 77-34 Open-File Report. February 1978.

Testa, S.M. and Michael T. Paczkowski, 1989. Volume Determination and Recoverability of Free Hydrocarbon.

Walton, W., 1991. Principles of Groundwater Engineering.

SOURCE:

CENTRAL PARK AND BROOKLYN, NEW YORK QUADRANGLE 7.5 MINUTE SERIES (TOPOGRAPHIC)

Title:

YARD LOCATION MAP

SUNNYSIDE YARD
39-29 HONEYWELL STREET
QUEENS, NEW YORK

Prepared For:

AMTRAK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.R.	Date: 1/99	FIGURE
Prepared by: G.M.	Scale: 1"=2,000'	1
Project Mgr: H.G.	Office: NY	
File No: A4511602	Project: 05545Y	

FIELD SAMPLING PLAN

Operable Unit 3
Sunnyside Yard
Queens, New York

Appendix A

June 23, 1997

(Revised January 13, 1999)

Approvals:

Roux Associates, Inc.
Project Manager
1/14/99
Date

Roux Associates, Inc.
Quality Assurance
Coordinator
1-14-99
Date

Roux Associates, Inc.
Field Manager
1/14/99
Date

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ATTACHMENTS

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has developed a work plan (Work Plan) for a Remedial Investigation (RI) to determine the nature and extent of environmental impacts present at Operable Unit 3 (OU-3) of the Sunnyside Yard (Yard). The Work Plan and this Field Sampling Plan (FSP) have been developed by Roux Associates in accordance with direction provided in United States Environmental Protection Agency (USEPA) guidelines for conducting an RI (USEPA, 1988).

To prepare the Work Plan, Roux Associates reviewed available information including previous investigations conducted at the Site, historical aerial photographs, available correspondence, Site plans and drawings. In addition, Roux Associates has developed multiple phase work plans and addenda to address the nature and extent of environmental impacts at the Yard. A detailed description of the Site history and setting based upon available data are provided in Section 2.0 of the Work Plan.

As discussed in Section 5.0 of the Work Plan, soil and ground water will be investigated to define soil quality adjacent to existing transformers, characterize the vertical delineation of subsurface saturated soil beneath the separate-phase petroleum accumulation, and further characterize deep ground-water quality. Methods proposed to carry out the tasks identified in the Work Plan are described in detail in this FSP.

2.0 SAMPLING OBJECTIVES

This FSP describes in detail the sampling and data gathering methods to be used during implementation of the RI. Guidance for the FSP methodology was acquired from the USEPA Compendium of Superfund Field Operations Methods (USEPA, 1987). The FSP was developed based upon a detailed review of available information developed during previous investigations and is designed to obtain the data necessary to achieve the following objectives of the RI:

- investigate the soil adjacent to transformers 31,35, 36, and 37 to characterize soil quality for PCBs;
- characterize soil quality for PCBs to conclude vertical delineation of subsurface saturated soil;
- further delineate location(s) known to exceed soil cleanup levels;
- provide additional soil characterization and soil quality data; and
- further characterize deep ground-water quality.

2.1 Scope of Work

The scope of work discussed in the FSP includes the tasks described in the Work Plan. Specifically, these tasks are:

- Task I: Soil Boring and Sampling; and
- Task II: Ground-Water Sampling.

The above listed tasks are discussed in detail in Section 6.0 of this FSP.

2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G-4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;
- determine the most appropriate conditions from which to collect the data; and

- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objective of the sampling in OU-3 is to further assess soil quality conditions in areas not fully delineated to determine the nature, extent and gradients of the constituents of concern. A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for potential areas of concern. A judgmental sampling design consists of directed samples at specific sampling locations to confirm the existence of contamination at these chosen locations based on visual or historical information.

Total study error is the combination of sampling and measurement error. Total study error is directly related to decision error. These decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline condition) is that the parameter of interest exceeds the action level. This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using more precise laboratory methods. Analyses will be performed using New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol(ASP) and the USEPA Contract Laboratory Program (CLP) for the majority of parameters, and the Standard Methods for the Examination of Water and Wastewater for parameters not analyzed under the ASP/CLP.

3.0 SAMPLE TYPES, LOCATION AND FREQUENCY

Locations for the soil borings are shown on Plate 2 of the Work Plan.

3.1 Sample Matrix Types

The two sample media to be collected during implementation of the Work Plan are soil and ground water. Sample types and analytical parameters are summarized in Table A-1 by the assigned RI task. The projected number of field samples for each task is presented in Table A-2.

Ground-water and soil samples collected during the course of the field investigation in OU-3 will be analyzed in accordance with the specified ASP/CLP procedures for organic and inorganic parameters. The analytical suite for ground-water samples may include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and polychlorinated biphenyls (PCBs) listed on the Target Compound List (TCL), and inorganic constituents (metals) listed on the Target Analyte List (TAL), chloride, and total dissolved solids (TDS). For soils, the analytical suite may include PCBs, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), lead, Toxicity Characteristic Leaching Procedure (TCLP) SVOCs, TCLP RCRA metals, ignitability and reactivity. The analytical parameters for the projected field samples are presented in Table A-2 and further described in the Quality Assurance Project Plan (QAPP) (Appendix B).

Field instrumentation will be used to measure physical parameters (i.e., pH, specific conductance, and temperature) in ground water. Sections 4.0 and 7.0 of the QAPP discuss the field and laboratory analytical method choice rationale.

3.2 Sample Location and Frequency

Sample locations and the number of samples collected vary by task, and are summarized in Table A-2. The project quality control summary is included in Table A-3. Specifics regarding the collection of samples at each location and for each task are provided in Section 6.0. Quality control samples for the field and laboratory are summarized in Tables A-4 and A-5, respectively.

3.2.1 Task I: Soil Boring and Sampling

Soil borings will be sampled to delineate the nature and extent of contamination. Seven soil borings will be drilled to determine that the existing PCB transformers have not leaked, three soil borings will be installed to conclude vertical delineation of subsurface saturated soil beneath the separate-phase petroleum accumulation in OU-3, and four soil borings will be installed to delineate a known soil cleanup level exceedance. Soil samples will be analyzed for one or more of the following parameters: PCBs, cPAHs, lead, TCLP SVOCs, TCLP RCRA metals, ignitability, and reactivity.

3.2.2 Task II: Ground-Water Sampling

To further characterize deep ground-water quality, ground-water from the unimpacted zone beneath the separate-phase petroleum accumulation will be sampled and analyzed for TCL VOCs, TCL SVOCs, PCBs (total and dissolved), TAL metals (total and dissolved), TDS, and chloride.

4.0 SAMPLE DESIGNATION

Sample bottles (preserved, if necessary), labels, shipping containers, trip blanks, and field blank water will be provided by the laboratory. During collection and containment of soil samples, the sample container will be labeled with the following information:

- Site identifier;
- Roux Associates' project number;
- sample type (media) identification code;
- sample location identifier and field quality control (QC) identifier (if applicable);
- sample depth and analysis identifier;
- date and time of collection; and
- type of preservative added (if applicable).

During collection and containment of ground-water samples, the sample containers will be labeled with the following information:

- Site identifier;
- Roux Associates' project number;
- sample type (media) identification code;
- sample location identifier and field QC identifier (if applicable);
- date and time of collection;
- field handling (e.g., filtration); and
- type of preservative added (if applicable).

The sample identification code and number provided on each sample label will follow the sample number and coding system as described below.

1. Sample type (media) abbreviations will be as presented below.

    ground-water sample = GW
    soil sample = SS

    Sample location abbreviations will be as presented below.

    soil boring = TSB followed by the designated boring number.

2. Depth intervals will be designated in feet or tenths of a foot (e.g., 0.1, 1.0, etc.).
3. Analytical Method Designations will be as presented below.

    Volatile Organic Compound Analysis = VOC
    Semivolatile Organic Compound Analysis = SVOC
    Polychlorinated Biphenyls Analysis = PCB
    Metals Analysis = MET
    Carcinogenic Polycyclic Aromatic Hydrocarbon = cPAH

4. QC identifiers will be as follows:

    Field replicate = R
    Trip blank = TB
    Field blank = FB
    Matrix Spike and Matrix Spike Duplicate = MS/MSD
    Matrix Spike Blank = MSB

A record of sequentially numbered soil samples for each boring location with corresponding sample designations will be kept in the field book.

5.0 FIELD ACTIVITIES

The following sections describe the standard protocols to be used by field personnel during the course of the RI sampling activities. Roux Associates' Standard Operating Procedures (SOPs) included in Attachment A-1 will be referenced where applicable. Additional information regarding Quality Control/Quality Assurance (QA/QC) protocols and methods may be found in the QAPP (Appendix B).

5.1 Field Management

The overall management structure for field activities is presented in Figure A-2. A general discussion of the responsibilities of management and the field technical staff is provided below.

Project Manager

The Project Manager bears the primary responsibility for the successful completion of the work assignment within the budget and schedule. Provides overall management for the execution of the RI and directs the activities of the Site Manager and technical staff. Performs technical review of all field activities, data review and interpretation and the preparation of all investigation reports. Works closely with the analytical laboratory, data validation contractors, drillers, and surveyors during the execution of the field program. Activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Site Manager

The Site Manager bears the primary responsibility for the successful execution of the field program. Directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. Responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, works closely with the Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff

Field technical staff consists of hydrogeologists and technicians who will perform activities such as water-level measurements, soil and ground-water sampling, and preparation of any field documentation which may be necessary.

Laboratory Manager

The Laboratory Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analyses through oversight of the laboratory staff. The Laboratory Manager will ensure that quality assurance procedures are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Manager reports to the Project Manager.

Project Quality Assurance Coordinator (PQAC)

The PQAC is responsible for conducting reviews, inspections, and audits to assure that the data collection is conducted in accordance with the FSP. These responsibilities range from effective field equipment decontamination procedures, to proper sample collection, to review of all laboratory analytical data (including tentatively identified compounds, if analyzed) to ensure completeness and usefulness. The PQAC reports to the Project Manager.

5.2 Yard Control

Yard control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities in OU-3. In order to accomplish this objective, the following three considerations have been addressed:

- the establishment of discrete work zones in the investigative area;
- the decontamination of field equipment; and
- the security and access procedures for the Yard.

All personnel who come onto the OU-3 field work zones, including Yard employees, contractors, and observers, will be required to adhere strictly to the conditions imposed herein, and within the provision of the HASP (Appendix C).

5.2.1 Field Work Zones

Field work zones will be limited to areas where intrusive activities, including soil and groundwater sampling and drilling, are conducted. Access will be limited in accordance with the HASP (Appendix C). Control of work zone access will be the responsibility of the Site Manager.

5.2.2 Decontamination

The location of the decontamination area will be determined prior to the start of operations.

5.2.3 Site Security and Access

The Yard is currently active. Site security and access control protocols used by the Yard will be followed during implementation of the RI. At the completion of each working day, all loose equipment (e.g., sampling equipment, water-level measuring devices, coolers, etc.) will be secured. Heavy equipment, such as the drill rig, will remain onsite within the current work zone.

5.3 Field Equipment

All measurement systems utilized in the field will be operated in accordance with the manufacturer's instructions and the applicable SOPs in Attachment A-1. Methods of calibrating and maintaining the equipment are provided below.

5.3.1 Equipment Calibration

All measurement equipment will be calibrated according to the manufacturer's recommendations, where applicable. Frequency of instrument calibration will be dictated by the type of measurement device. Table A-6 lists the field measurement equipment to be used and the calibration frequency for the instrument. Records of all calibrations (both frequency and results) will be kept in the field or instrument logbook.

5.3.2 Equipment Maintenance

All field equipment will be stored in a clean, controlled environment (as necessary) to prevent damage due to heat, cold, moisture, etc. prior to use. Reusable equipment will be decontaminated as soon as reasonably possible after use and stored as described above. Decontamination procedures are provided in Section 5.7 and in the SOPs (Attachment A-1). Maintenance for measurement and health and safety equipment will be in accordance with the schedule found in Table A-6.

Equipment failing to meet manufacturer's minimum specifications will be removed from service immediately and kept out of service until the problem is identified and/or resolved. Records of all routine maintenance and repair will be kept in the instrument or field logbook.

5.4 Field Documentation

The following sections provide guidance to field personnel in the areas of documentation and record keeping. The goal of field documentation is to provide a clear and complete record which can be used for reference and information retrieval at a later date. All field documentation will be recorded in bound logbooks or pre-generated activities specific forms using indelible (water proof) ink. Details of record keeping requirements are described in Attachment A-1, and in the QAPP. Samples of field forms are provided in Attachment A-2.

5.4.1 Field Logbooks

Field logbooks will be used for all record keeping to provide a permanent, bound record of all field-related activities. Additional records may be kept on pre-generated forms for sample tracking and other purposes. The types of information and level of detail required for logbook recording are described in the Field Record Keeping and Quality Assurance/Quality Control SOP in Attachment A-1 and in the QAPP.

5.4.2 Field Documentation for Drilling

Daily field activities will be summarized in a field notebook to ensure that an accurate record of all field investigation tasks are maintained. Geologic logs will be recorded in the field notebook during the drilling of soil borings. For each soil boring completed during the RI, a geologic log will be prepared. Examples of geologic logs are provided in Attachment A-2.

5.4.3 Sampling Documentation

A complete record of how each sample was selected, aliquotted, packaged, and preserved for analysis will be maintained in field logbooks. Specific procedures regarding the level and type of sampling documentation can be found in the activity-specific Roux Associates' SOP in Attachment A-1. Sample designation and labeling are discussed in Section 4.0 of this FSP. Questions regarding sampling methods and QA will be addressed by the Project Manager, or the Roux Associates' PQAC.

5.5 Field Custody Procedures and Documentation

The following sections describe the procedures necessary to document sample custody. The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable). Specific procedures regarding sample tracking from the field to the laboratory are described in the SOP (Attachment A-1) and in the QAPP. Examples of a chain of custody form and a custody seal can be found in Attachment A-2.

5.5.1 Field Custody

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. The technical staff will review all field activities with the Site Manager to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

Samples must be accompanied by a properly completed chain of custody form (Attachment A-2). The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

If split samples are requested, a separate chain of custody form is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency will request the representative's signature on the chain of custody form, acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted in the "Received By" space.

If samples are to be collected and delivered directly to the Site Manager, the Site Manager will complete the chain of custody for laboratory shipment and have the field sampler sign in the "sampler" box. If samples are transferred from the field sampler to an intermediary person before being transferred to the Site Manager, a separate chain of custody form from that used to ship samples to the laboratory must be completed for the field transfers. Any questions regarding custody procedures or QA will be addressed by the Site Manager and/or the PQAC.

5.5.2 Laboratory Custody

The sample custodian at each laboratory will ensure that chain of custody records are completed upon receipt of the samples and will note questions or observations concerning sample integrity. The quality assurance officer will also ensure that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements. Section 6.0 of the QAPP describes the specific laboratory custody and sample handling procedures required for this project.

5.6 Sample Handling and Analysis

To assure quality data acquisition, and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples as well as sample packaging and shipping procedures. These items are also discussed in Section 6.0 of the QAPP.

5.6.1 Field Sample Handling and Shipment

All samples will be collected and handled according to the appropriate protocols for each matrix described in the SOPs (Attachment A-1). The types of containers, volumes needed and preservation techniques for the aforementioned testing parameters are presented in Table A-7.

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix, and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in the SOPs (Attachment A-1) and in Section 6.0 of the QAPP.

All samples will be shipped within 48 hours of collection and will be preserved appropriately from the time of sample collection. A description of the sample packing and shipping procedures is presented below.

1. Prepare cooler(s) for shipment.
    - Tape drain(s) of cooler shut; and
    - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. 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.

4. Arrange containers in front of assigned coolers.
5. Place approximately 2 inches of vermiculite or other packaging material at the bottom of the cooler to act as a cushion for the sample containers.
6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
7. Fill remaining spaces with vermiculite or other packaging material.
8. Ensure all containers are firmly packed in vermiculite or other packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in double zip-lock bags, and placed on top of the vermiculite or other packaging material.
10. 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.
11. Separate copies of chain of custody forms. Seal proper copies within a large zip-lock bag and tape to cooler. Retain copies of all forms.
12. Close lid and latch.
13. Secure each cooler using custody seals.
14. Tape cooler shut on both ends.
15. Relinquish to Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT DAY" delivery.
16. Telephone laboratory contact and provide him/her with the following shipment information:
    - Sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

5.6.2 Field Analysis

Field analysis for specific conductance, temperature, and pH in aqueous media will be conducted in accordance with the Roux Associates' SOPs included in Attachment A-1.

5.6.3 Laboratory Analysis

Analytical methods for the chemical analysis of constituents of concern have been chosen to provide the highest level of data quality for purposes of the evaluation of remedial alternatives. Laboratory analyses will be conducted using standard methodologies as summarized in Table A-3. Applicable QA/QC is described in Table A-4 and Table A-5 for field QC and laboratory QC, respectively. Rationale for the choice of specific analytical methods is provided in Section 2.0 of this document and in Section 7.5 of the QAPP.

5.7 Decontamination Procedures

The procedures for the decontamination of field equipment, personnel and sampling equipment are outlined in the following sections. Detailed procedures for the decontamination of field and sampling equipment are included in the SOPs provided in Attachment A-1.

In an attempt to avoid the spread of contamination, all equipment (i.e., drilling tools, sampling equipment, etc.) must be decontaminated at a reasonable frequency in the decontamination area. The location of the decontamination area will be determined prior to the start of operations.

5.7.1 Drilling Equipment

The rig and all associated equipment will be cleaned by the contractor before arriving at and exiting the Site. The augers, drilling casings, rods, samplers, tools, and any piece of equipment that may come in contact (directly or indirectly) with the soil, will be steam cleaned prior to set up for drilling to ensure proper decontamination. The same steam cleaning procedures will be followed for augers and sampling tools used for each borehole.

All steam cleaning (decontamination) activities will be monitored and documented by Roux Associates. Specific procedures for decontaminating drilling equipment are provided in the Roux Associates' SOP in Attachment A-1.

5.7.2 Personnel Protection

The field work will be performed in level D protection with continuous air monitoring provided to demonstrate the adequacy of this protection. Any decontamination of personnel required will be performed at a designated area of the Site and appropriate decontamination materials (e.g., eye wash) will be maintained for use in this area. The required photoionization detector (PID) readings for changing protection levels and other specifics regarding personnel protection and decontamination are discussed in the HASP (Appendix C).

5.7.3 Sampling Equipment

All soil and any non-disposable water sampling equipment will be decontaminated prior to sampling and between sampling locations according to the procedures outlined in the SOPs included in Attachment A-1. Soil sampling equipment will be decontaminated using either steam cleaning equipment or non-phosphate, laboratory-grade detergent solution, and distilled or potable water in a clean bucket. Non-disposable water sampling equipment will be decontaminated prior to sampling in a similar manner.

5.8 Waste Handling and Disposal

Any wastes generated during performance of field tasks will be containerized in labeled 55-gallon drums and stored within a designated area of the Site. Each drum will be labeled with the Site name, drum number, date, and nature of contents.

The handling of all wastes will conform to all health and safety requirements of the HASP. Composite samples will be collected to characterize the wastes prior to transport and disposal. Sample types, analytical parameters, and number of samples analyzed will be dependent upon state and federal transportation, landfill and/or site disposal requirements, and the requirements of the contracted waste hauler and waste-processing facility for wastes determined to be hazardous.

6.0 FIELD INVESTIGATION PROCEDURES

This section describes the methods to be utilized during implementation of each field task described in the Scope of Work section of the Work Plan. The tasks identified in the Work Plan are:

- Task I: Soil Boring and Sampling; and
- Task II: Ground-Water Sampling.

The balance of this section is organized by task and provides descriptions of the methods to be utilized in the performance of each task.

6.1 Task I: Soil Boring and Sampling

As part of the RI, 14 soil borings (TSB-1 through TSB-14)will be completed in OU-3 at the locations shown in Plate 2 of the Work Plan. Soil boring, drilling, and sampling procedures to be used are provided in Attachment A-1. A general discussion concerning the completion of soil borings in OU-3 is provided below.

Safety concerns related to the abundance of unmarked and unmapped underground utility lines and cable warrant that the interval 0 to 3 feet for all soil borings be advanced by hand. Soil samples in the 0 to 2 feet below land surface (bls) and 2 to 3 feet bls intervals will be collected by placing the excavated soil on plastic sheeting, homogenizing it, and collecting a representative sample from the interval. The sampling will be performed as follows.

- The samples will be visually inspected and a log describing the geologic conditions will be developed. The soil samples will be screened in the field for any evidence of contamination (i.e., staining, presence of petroleum or odors) and also by using a portable PID.
- Any non-representative material (i.e., cinders, pieces of railroad ties, asphalt), when observed, will not be placed in the sample container.
- Any soil samples selected for laboratory analyses will be placed on ice and protected from light immediately after collection and until delivery to the laboratory.

Soil samples will be collected from depths greater than three feet bls using a Geoprobe sampler.

All laboratory analyses will be performed by a NYSDEC-approved laboratory following the NYSDEC Analytical Services Protocols (ASP). Validation of the analytical results will be performed. A general discussion describing the collection of soil borings is provided below.

6.1.1 Former Engine House

Transformer 31 is located on the south side of the former Engine House. Sampling of the transformer fluid indicates that greater than 50 parts per million (ppm) PCBs was detected in this transformer. Although there is no evidence that transformer 31 has had any releases, at the NYSDEC's request, three soil borings (TSB-1 through TSB-3) are proposed adjacent to transformer 31 (Work Plan Plate 2). Soil samples will be collected from the 0 to 2 foot bls interval and will be analyzed for PCBs.

6.1.2 Former Metro Shop

As with the former Engine House, three transformers (35, 36, and 37) were identified as containing transformer fluids containing greater than 50 ppm PCBs. Although there is no evidence that any of these transformers have leaked, at the NYSDEC's request, four soil borings (TSB-4 through TSB-7) are proposed adjacent to transformers 35, 36, and 37 (Work Plan Plate 2). Soil samples will be collected from the 0 to 2 foot bls interval and analyzed for PCBs.

To characterize soil quality to conclude vertical delineation of subsurface saturated soil beneath the separate-phase petroleum accumulation, three soil borings (TSB-8 through TSB-10) will be completed to unimpacted saturated soil (Work Plan Plate 2). Soil samples will be collected during drilling at continuous two-foot intervals. Two soil samples from the saturated zone, one contaminated and one unimpacted, will be collected from each boring and analyzed for PCBs.

To delineate the exceedance of the PCB soil cleanup level detected at location CS-76, four soil borings (TSB-11 through TSB-14) are proposed (Work Plan Plate 2). Soil samples will be collected from the 0 to 2 ft bls interval and analyzed for PCBs.

Additionally, the soil samples from locations TSB-2, TSB-5, TSB-11 and the petroleum impacted sample from location TSB-9 will be analyzed for cPAHs, lead, TCLP SVOCs, TCLP RCRA metals, ignitability, and reactivity.

The soil samples will be collected according to the following procedures.

- Samples will be collected using a standard Geoprobe sampler. Loose material will be brushed off the external surface of the sampler prior to opening.
- The samples will be visually inspected and a log describing the geologic conditions will be developed. The soil samples will be screened in the field for any evidence of contamination (i.e., staining, presence of petroleum or odors) and also by using a portable PID.
- The sampler will be placed on clean plastic sheeting and opened. Total recovery will be measured and recorded. A representative composite of recovered material will be immediately placed in the proper container, sealed and labeled.
- Any non-representative material (i.e., cinders, pieces of railroad ties, asphalt), when observed, will not be placed in the sample container.
- Equipment used for filling sample containers will be cleaned prior to each subsequent use as outlined in Section 5.7.3.
- Any soil samples selected for laboratory analyses will be placed on ice and protected from light immediately after collection and until delivery to the laboratory.

Roux Associates will provide oversight of all drilling activities in accordance with Roux Associates' SOPs, which are presented in Attachment A-1.

6.2 Task II: Ground-Water Sampling

As stated in the Work Plan, ground-water quality will be investigated in OU-6. However, to further characterize deep ground-water quality, one ground-water sample will be collected from the unimpacted zone in each of the three deep borings TSB-8 through TSB-10. SOPs for sampling, decontamination of non-disposable measuring, sampling, and field analytical equipment, and implementing QA/QC procedures are provided in Attachment A-1. All disposable sampling equipment will be discarded in an appropriate manner.

Ground-water samples will be collected utilizing either a vacuum or low flow peristaltic pump and dedicated, disposable teflon tubing flowing directly into appropriate laboratory-supplied containers (Table A-7) and covered with Teflon™ septa and caps. The samples for VOCs will be filled to exclude headspace.

Ground-water samples will be sent to a laboratory for the following analyses: TCL VOCs, TCL SVOCs, PCBs (total and dissolved), TAL metals (total and dissolved), chloride, and TDS. In addition, field measurements of pH, specific conductance, and temperature will be taken. The samples collected for dissolved PCBs and dissolved TAL metals will be field filtered using a 0.45-micron membrane to remove particulates prior to submitting the sample to the laboratory. Roux Associates' SOPs for field filtering and for obtaining field measurements of pH, specific conductance and temperature of water samples are included in Attachment A-1.

7.0 REFERENCES

USEPA. December 1987. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response, EPA/540/P-87/001.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response, EPA/540/G-89/004.

USEPA. 1994. Guidance for the Data Quality Objectives Process. September 1994, EPA QA/G-4.

Table A-1. Sample Types/Analyses by Task

Task	Matrix	Field Analyses	Laboratory Analyses
I. Soil Boring and Sampling	Soil	Photoionization Detector Screening	PCBs, cPAHs, lead, TCLP SVOCs, TCLP RCRA metals, ignitability, reactivity
II: Ground-Water Sampling	Water	pH, specific conductance, temperature	TCL VOCs, TCL SVOCs, PCBs (total and dissolved), TAL Metals (total and dissolved), Chloride, TDS

PCBs = Polychlorinated Biphenyls
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TCLP = Toxicity Characteristic Leaching Procedure
TCL = Target Compound List
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound
TAL = Target Analyte List
TDS = Total Dissolved Solids

Table A-2. Projected Number of Field Samples

Task	Parameter	Field Samples	Field Duplicates[a]	Field Blanks[a]	Trip Blanks[b]	MS/MSD/MSB[c]	Total Laboratory Samples
I: Soil Boring and Sampling	PCBs	17	1	1	NA	3	22
(Soil)	cPAHs	4	1	1	NA	3	9
	Lead	4	1	NA	NA	2	7
	TCLP SVOCs	4	NA	NA	NA	NA	4
	TCLP RCRA Metals	4	NA	NA	NA	NA	4
	Ignitability	4	NA	NA	NA	NA	4
	Reactivity	4	NA	NA	NA	NA	4
II: Ground-Water Sampling[d]	VOCs	3	1	NA	1	2	7
	SVOCs	3	1	NA	NA	2	6
(Water)	PCBs (total)	3	1	NA	NA	2	6
	PCBs (dissolved)	3	1	NA	NA	2	6
	Metals (total)	3	1	NA	NA	2	6
	Metals (dissolved)	3	1	NA	NA	2	6
	Chloride	3	1	NA	NA	NA	4
	TDS	3	1	NA	NA	NA	4

a. Frequency estimates based on one blank per twenty samples, or one per day minimum.
b. The number of trip blanks is estimated based on one trip blank per cooler.
c. Matrix Spike/Matrix Spike Duplicate Matrix Spike Blank - one per twenty samples.
d. Field parameters include pH, Eh, specific conductance, and temperature.

PCBs = Polychlorinated Biphenyls
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds
TDS = Total Dissolved Solids
NA - Not Applicable

Table A-3. Project Quality Control Summary

Parameter	Media	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision[b]	Completeness	Analysis Method
TCL Volatile Organic Compounds	Water	10 µg/L	58-137%	24 RPD	95%	ASP 95-1[c]
TCL Semivolatile Organic Compounds	Water	10 to 50 µg/L	10 - 111%	50 RPD	95%	ASP 95-2[c]
Polychlorinated Biphenyls	Water	0.05 to 1.0 µg/L	24 - 151%	27 RPD	95%	ASP 95-3[c]
TAL Metals	Water	0.2 to 5,000 µg/L	75- 125%	20 RPD	95%	ILM04.0[d]
Chloride	Water	0.1 to 2 mg/L	75-125%	15 RPD	90%	325.3[e]
Total Dissolved Solids	Water	10 to 20,000 mg/L	NA	NA	90%	160.1[e]
pH	Water	0.1 unit	NA	NA	90%	150.1[e]
Specific Conductance	Water	NA	NA	NA	90%	120.1[e]
Temperature	Water	NA	NA	NA	90%	170.1
Carcinogenic Polycyclic Aromatic Hydrocarbons	Soil	330 to 1,600 µg/kg	20-150%	50 RPD	95%	ASP 95-2[c]
Polychlorinated Biphenyls	Soil	8.0 to 160 µg/kg	20-150%	50 RPD	95%	ASP-95-3[c]
Lead	Soil	0.2 to 1,000 mg/kg	75-125%	50 RPD	95%	ILM 04.0[d]
RCRA Characteristics						
Ignitability	Soil	NA	NA	NA	90%	1010/1011[f]
Reactivity	Soil	NA	NA	NA	90%	9010/9030[f]
Toxicity						
SVOCs	Soil	NA	NA	NA	90%	1311/8270[f]
RCRA Metals	Soil	NA	NA	NA	90%	1311/6010/7471[f]

mg/L - milligrams per liter
µg/L - micrograms per liter
µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
RPD - relative percent difference
NA - Not applicable
SOP - Standard Operating Procedure

a. Quantitation limits are based on Contract Laboratory Program (CLP) Statement of Work requirements (where applicable), or on method references. Limits for soil are based on nominal wet weight of the sample. Dry weight limits will be higher.
b. Actual limits for matrix spikes, system monitoring compounds, and laboratory control samples are provided in the CLP Statement of Work or cited method.
c. Analytical Services Protocols
d. CLP Statement of Work
e. Standard Methods for the Examination of Water and Wastewater

Table A-4. Field Quality Control Sample Frequency

Parameters	Media	Trip Blank[a]	Field Blank[b]	Field Duplicates[c]	MS/MSD/MSB[d]
Carcinogenic Polycyclic Aromatic Hydrocarbons	Soil	NA	1/20	1/20	1/20
Polychlorinated Biphenyls	Soil	NA	1/20	1/20	1/20
Lead	Soil	NA	1/20	1/20	1/20
RCRA Characteristics	Soil				
Ignitability	Soil	NA	NA	NA	NA
Reactivity	Soil	NA	NA	NA	NA
Toxicity					
SVOCs	Soil	NA	NA	NA	NA
RCRA Metals	Soil	NA	NA	NA	NA
TCL Volatile Organic Compounds	Water	1/20	1/20	1/20	1/20
TCL Semivolatile Organic Compounds	Water	NA	1/20	1/20	1/20
Polychlorinated Biphenyls	Water	NA	1/20	1/20	1/20
TAL Metals	Water	NA	1/20	1/20	1/20
Total Dissolved Solids	Water	NA	NA	1/20	NA
Chloride	Water	NA	NA	1/20	NA
pH/Temperature/Specific Conductance[e]	Water	NA	NA	1/20	NA

NA - Not applicable
MS/MSD/MSB - Matrix Spike/Matrix Spike Duplicate/Matrix Spike Blank

a. Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only), whichever is more frequent.
b. Where applicable, one per twenty of fewer field samples, or one per day, whichever is most frequent.
c. Where applicable, one per twenty or fewer field samples.
d. Where applicable, one per twenty field samples or twice per week during sampling, whichever is more frequent.
e. Field parameters.

Table A-5. Laboratory Quality Control Sample Frequency

Parameter	Media	Method Blank[a]	MS/MSD[a]	Laboratory Replicate[a]	Analysis Method
Polycyclic Aromatic Hydrocarbons	Soil	1/20	1/20	NA	ASP 95-2[b]
Polychlorinated Biphenyls	Soil	1/20	1/20	NA	ASP 95-3[b]
Lead	Soil	1/20	1/20	1/20	ILM04.0[c]
RCRA Characteristics	Soil				
Ignitability	Soil	NA	NA	1/20	1010/1011
Reactivity	Soil	NA	NA	1/20	9010/9030
Toxicity	Soil				
SVOCs	Soil	1/20	1/20	1/20	1311/8270
RCRA Metals	Soil	1/20	1/20	1/20	1311/6010/7471
TCL Volatile Organic Compounds	Water	1/20	1/20	1/20	ASP 95-1[b]
TCL Semivolatile Organic Compounds	Water	1/20	1/20	1/20	ASP 95-2[b]
Polychlorinated Biphenyls	Water	1/20	1/20	1/20	ASP 95-3[b]
TAL Metals	Water	1/20	1/20	1/20	ILM04.0[c]
Total Dissolved Solids	Water	1/20	1/20	1/20	160.1[d]
Chloride	Water	1/20	1/20	1/20	325.3[d]

NA - Not applicable

a. Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent
b. Analytical Services Protocol
c. Contract Laboratory Program Statement of Work
d. Standard Methods for the Examination of Water and Wastewater

Table A-6. Field Equipment Calibration Requirements and Maintenance Schedule

Equipment Type	Calibration Requirements	Maintenance Schedule
PID	Manufacturer's Directions	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
pH Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Specific Conductance Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Thermometer	Manufacturer's Directions	Regularly check for breakage.
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.
Magnetometer	Manufacturer's Directions	Replace batteries as necessary.
Surveying Instruments	Attachment A-1	Regularly clean instrument lenses.
Interface Probe/ Water-Level Indicator	Manufacturer's Directions	Replace batteries as necessary.

Table A-7. Preservation, Holding Times and Sample Containers

Parameter	Preservation	Holding Time[a]	Containers
Aqueous VOCs	HCl to pH<2 4°C store in dark	14 days	2 x 40 ml vials w/teflon septum
Aqueous SVOCs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous PCBs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous Metals (Mercury)	HNO_3 to pH<2	180 days (26 days)	1 liter plastic bottle (included above)
Total Dissolved Solids	4°C until analysis	7 days	300 ml plastic bottle
Chloride	NA	28 days	50 ml plastic bottle
Soil SVOCs (PAHs)	4°C until extraction and analysis	14 days until extraction 40 days until analysis	4 oz jar w/teflon lined lid
Soil Metals (Lead)	4°C until analysis	180 days	8 oz jar w/teflon lined lid (included above)
Soil PCBs	4°C until extraction and analysis	14 days until extraction 40 days until analysis	100 grams jar w/teflon lined lid
Soil RCRA Characteristics			
Ignitability	NA	NA	8 oz jar w/teflon lined lid
Reactivity	NA	NA	8 oz jar w/teflon lined lid
Toxicity			
SVOC	4°C until extraction and analysis	40 days[b]	4 oz jar w/teflon lined lid
RCRA Metals	4°C until extraction and analysis	180 days[c]	8 oz jar w/teflon lined lid

a. From collection until analysis unless otherwise specified.
b. 14 days from field to TCLP extraction, 7 days from TCLP extraction to preparative extraction, 40 days from preparative extraction to analysis
c. 180 days from field to TCLP extraction, 180 days from extraction to analysis

NA - Not applicable
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
ml - milliliter

FIELD ORGANIZATION CHART

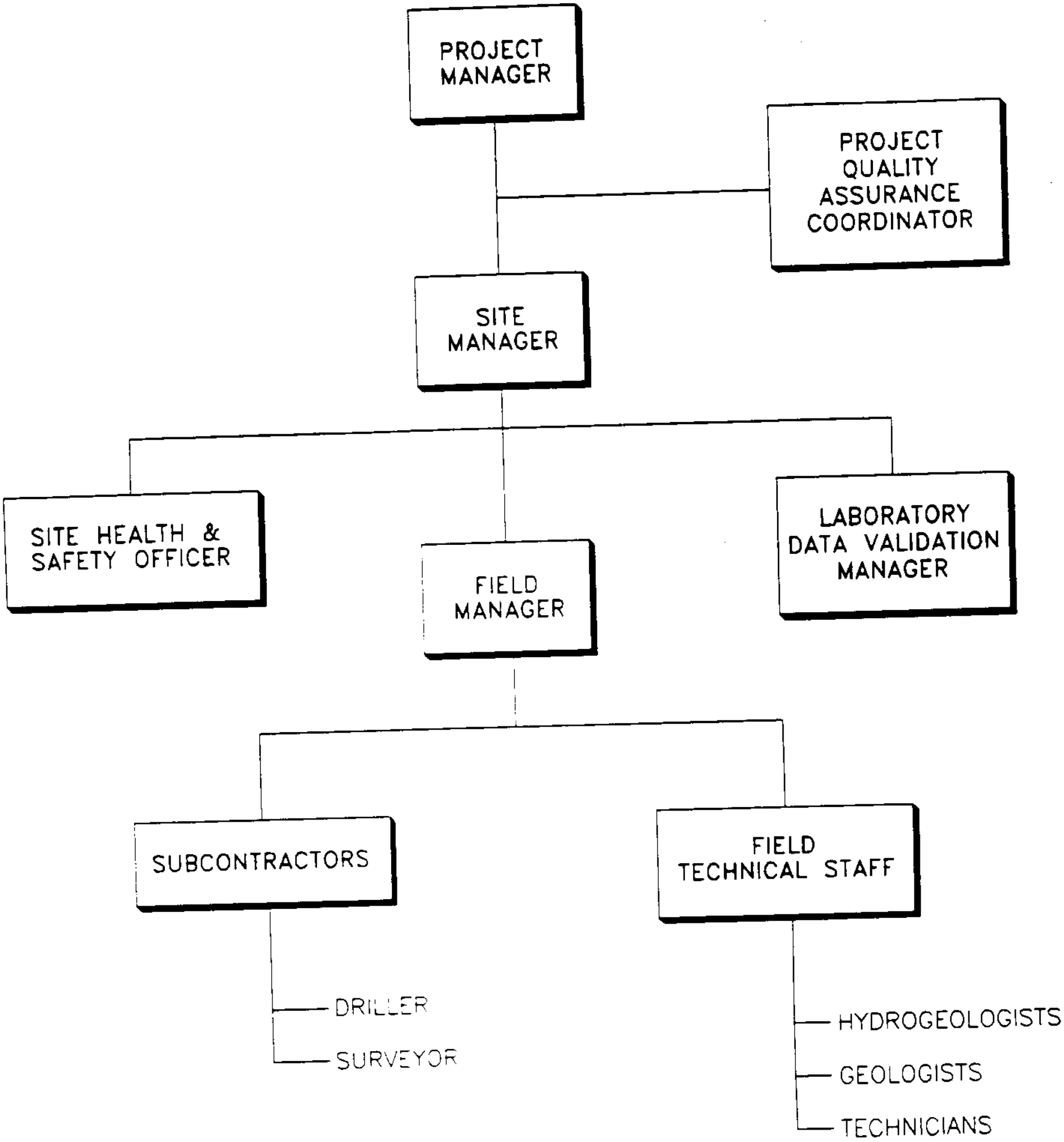

FIGURE A-1

ATTACHMENT A-1

Roux Associates'
Standard Operating Procedures

STANDARD OPERATING PROCEDURE
FOR MEASURING THE pH OF WATER SAMPLES

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cillo

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the pH of water in the field. The pH is measured in the field using a pH meter which should have the ability to compensate for temperature (automatically or manually). The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The manufacturer's instrument manual for each particular pH meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when pH readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of the pH meter is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific instructions. Usual procedures are given below.

2.2 Recalibration must occur if: 1) the pH of the samples being measured is outside the previous calibration range; 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.3 Two buffer calibrations bracketing the expected pH range of samples are to be performed prior to its use in a study. Three pH buffers (4.0, 7.0, and 10.0) are read after standardization at pH of 7.0 to evaluate the linearity and electrodes.

2.4 The measurements of sample and buffers are made while stirring. The samples and buffers are measured at the same temperature; therefore, the pH meter must be temperature compensated. If not, then record the temperature.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.

b. pH meter identification.

c. Calibration results using pH standards.

d. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 The pH electrodes must be kept in good working order as follows:

a. Proper levels of electrolyte solution are maintained. The electrolyte solution level should be at least 1 inch above the solution being measured.

b. The electrodes must be carefully rinsed with distilled or deionized water before each measurement.

3.3 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature and pH are measured immediately.

3.4 The temperature of the sample is measured and the pH meter is compensated for the water temperature. If compensation is not possible, then record the temperature.

3.5 The electrodes are immersed in a water sample and stirred continuously until the pH reading equilibrates. The pH will be measured and recorded in increments of 0.1 or 0.1 SU.

3.6 Pertinent data are documented in the field notebook or appropriate field form, and initialed and dated.

3.7 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

STANDARD OPERATING PROCEDURE FOR MEASURING THE CONDUCTIVITY OF WATER SAMPLES

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cillis

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the electrical conductance (conductivity) of water in the field. The conductivity is measured in the field using a conductivity meter which compensates for temperature (automatically or manually). Some conductivity meters measure directly in micromhos/centimeter (μmhos/cm) while others have to be converted to this unit. Conductivity will be recorded in μmhos/cm. The manufacturer's instrument manual of each particular conductivity meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the ground water or surface water. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when conductivity readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration is in accordance with the manufacturer's specific directions.

2.2 Calibration of the conductivity meter is to be performed at the beginning and end of each day's use.

2.3 Recalibration must occur if: 1) the specific conductivity of samples being measured is outside the calibration standard solution range; or 2) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.4 Choose a conductivity calibration solution that is near the conductivity of the water samples to be measured.

2.5 Select the appropriate conductivity calibration solution and adjust the span on the instrument to the conductivity calibration solution value.

2.6 Rinse the probe in distilled or deionized water and store the probe according to the manufacturer's specifications (e.g., distilled or deionized water, or a buffer solution).

2.7 The following information is documented in the calibration logbook:

a. Date.

b. Conductivity meter identification.

c. Initials of individual performing calibration.

d. Calibration results.

3.0 PROCEDURE

3.1 The conductivity electrodes must be kept in good working order as specified by the manufacturer.

3.2 The water sample is placed in a clean, appropriate container(s) and the temperature and conductivity are measured immediately.

3.3 The temperature of the sample is taken and the conductivity meter is compensated for the water temperature.

3.4 The probe is immersed in a water sample until the meter equilibrates.

3.5 In reading the conductivity meter scale, one or more of the following may have to be considered:

a. The reading may have to be multiplied appropriately (e.g., the reading is expressed in micromhos/centimeter).

b. If the conductivity meter is not capable of compensating for temperature differences, then note that the conductance measurements are not temperature compensated and document the temperatures.

c. If the conductivity meter can be compensated for temperature, then adjust the temperature control before reading the conductance measurement. (Some meters automatically compensate for temperature, and this should be documented.)

3.6 Conductivity measurements are recorded in the field notebook and on the appropriate field form, and initialed and dated. Units of μmhos/cm are used to represent conductivity.

3.7 The probe will be cleaned with distilled or deionized water after each use and will be stored according to the manufacturer's specifications (e.g., conductivity cells may have to be stored in distilled or deionized water, or a buffer solution).

STANDARD OPERATING PROCEDURE FOR FILTRATION OF GROUND-WATER AND SURFACE-WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael G.

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of ground-water samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Ground-water samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that filtration of ground water for metals analysis has been a standard practice with the United States Geological Survey (USGS) for many years. However, it should also be noted that certain regulatory agencies insist that ground-water samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, in order to quantify the concentrations of dissolved metals in ground water, filtration will be employed.

Within this framework, filtration refers to the filtering of water either directly or at the end of a filtration series through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltering of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter and using an exorbitant amount of time to filter the sample.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below is also used.

2.0 MATERIALS AND EQUIPMENT

To field filter ground-water samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

a. Non-phosphate, laboratory-grade detergent.

b. Distilled/Deionized water.

c. Potable water.

d. Field forms (e.g., daily log, sampling, etc.) and field notebook.

e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.

f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

g. Teflon™ tape.

h. Vacuum pump (e.g., hand-operated or electric).

i. Appropriate tubing and fittings.

j. Disposable gloves.

k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If reusable filtering equipment is being used, the following is the minimum decontamination procedure:

a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.

c. Remove vacuum tubing from flask.

d. Remove filter membrane from funnel.

e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.

f. Rinse with potable water.

g. Rinse with copious amounts of distilled or deionized water.

h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc.

4.0 PROCEDURE

4.1 Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.

4.2 Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.

4.3 Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).

4.4 Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).

4.5 Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.

4.6 Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.

4.7 Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).

4.8 Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

STANDARD OPERATING PROCEDURE FOR SAMPLING GROUND-WATER MONITORING WELLS FOR DISSOLVED CONSTITUENTS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A.

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).
dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lick bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

STANDARD OPERATING PROCEDURE
FOR MEASURING WATER LEVELS USING
AN ELECTRONIC SOUNDING DEVICE (M-SCOPE)

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCilli SDM

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using m-scopes. A m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be calibrated before use.

2.0 DECONTAMINATION

The m-scope must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated.

4.0 PROCEDURE

4.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.2 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.3 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.

4.4 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.5 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.

4.6 Measurements will be taken accurately and to the nearest 0.01 foot.

4.7 Always remeasure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.)

4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.9 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

STANDARD OPERATING PROCEDURE FOR MEASURING WATER-LEVELS AND SOUNDING A WELL WITH A STEEL TAPE

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeGillis (EDD)

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using steel measuring tapes. A steel tape is used to measure the depth to ground water below an established (surveyed) measuring point (MP) and/or to sound a well (i.e., to measure the depth of well). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow. A well is sounded to determine the total depth of the well (i.e., to provide information regarding potential siltation problems [filling-in with sediment]). This can be used to eliminate possible confusion concerning identification of the well in cases where there are several similar, adjacent, unlabeled wells. Depth to water and sounding data can also be used to calculate the volume of standing water in the well (which is a prerequisite for purging a well before well sampling, and will be addressed in respective SOPs).

A steel tape is the preferred water-level measuring device because it is the most accurate, especially when measurements are taken under static conditions. However, this technique may be inappropriate under nonstatic (changing) conditions such as aquifer tests when water levels may be changing rapidly or when water is cascading into a well. These conditions would require the use of an electronic sounding device (refer to SOP for Measuring Water Levels using an Electronic Sounding Device (M-Scope).

2.0 DECONTAMINATION

The steel tape must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 PROCEDURE

3.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

3.2 The tape will be equipped with a weight to ensure the tape is held vertically and is kept taut when lowered into the well. Measure and record the distance from the bottom of the tape to the bottom of the weight to ensure the proper depth is measured when sounding a well.

j. Appropriate discharge hose and valves.

k. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.

l. Appropriate compressed gas if using bladder-type or gas-displacement device.

m. Extension cord(s) or portable generator (and fuel) if using an electric submersible pump.

n. Non-absorbent cord (e.g., polypropylene, etc.), cotton (absorbent) cord.

o. Tripod(s).

p. Water Well Handbook.

q. Explosimeter.

r. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Additionally, disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner.

4.0 PROCEDURE

4.1 The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).

4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation [$V = (7.48\ \mathrm{gal/ft^3})(r^2h)$, where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)

4.3 If purging is performed by evacuating a specified number of casing volumes, then three to five volumes are purged (typical regulatory agency requirement).

4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. If the recovery rate is fairly rapid and time allows, then remove more than one casing volume; otherwise, the evacuation of one casing volume may suffice. (Refer to the site sampling and analysis plan [SAP] for details of purging a low-yield well.)

4.5 Evacuation will occur from the top of the water column in the well to ensure that "fresh" formation water enters the bottom of the well through the screen, moves up as standing water is removed from the top, and all standing water is removed (i.e., only representative formation water is in the well).

4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.

4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.

4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake is lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.

4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.

4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.

4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.

4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an explosimeter will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

CAPACITY OF HOLE

Diameter of Hole (Inches)	Gallons per Lin.Ft.	Lin.Ft. per Gallon	Sacks Cement* per Lin.Ft.	Lin.Ft. per Sack Cement*
2	0.1632	6.1275	0.0199	50.2513
1/2	.2550	3.9216	.0311	32.1543
3	.3672	2.7233	.0444	22.5225
1/2	.4998	2.0008	.0607	16.4745
4	.6528	1.5319	.0791	12.6422
1/4	.7369	1.3570	.0893	11.1982
1/2	.8262	1.2104	.1006	9.9404
3/4	.9206	1.0862	.1118	8.9445
5	1.0200	.9804	.1240	8.0645
1/4	1.1246	.8892	.1367	7.3153
1/2	1.2342	.8102	.1500	6.6667
3/4	1.3489	.7413	.1639	6.1013
6	1.4688	.6808	.1785	5.6022
1/4	1.5938	.6276	.1937	5.1626
1/2	1.7238	.5801	.2095	4.7733
3/4	1.8590	.5379	.2259	4.4267
7	1.9992	.5002	.2430	4.1152
1/4	2.1445	.4663	.2606	3.8373
1/2	2.2950	.4357	.2789	3.5855
3/4	2.4505	.4081	.2978	3.3580
8	2.6112	.3830	.3173	3.1516
1/4	2.7769	.3601	.3375	2.9630
1/2	2.9478	.3392	.3583	2.7910
3/4	3.1237	.3201	.3796	2.6344
9	3.3048	.3026	.4016	2.4900
1/4	3.4910	.2865	.4243	2.3568
1/2	3.6822	.2716	.4475	2.2346
3/4	3.8785	.2578	.4714	2.1213

* Cement calculations based on the volume of an average cement mixture being 1.1 cubic feet per sack of cement.

—Courtesy Halliburton Oil Well Cementing Co.

CAPACITY OF HOLE (CONT'D)

Diameter of Hole (Inches)	Gallons per Lin.Ft.	Lin.Ft. per Gallon	Sacks Cement* per Lin.Ft.	Lin.Ft. per Sack Cement*
10	4.0800	0.2451	0.4958	2.0169
1/4	4.2865	.2333	.5209	1.9198
1/2	4.4982	.2223	.5467	1.8292
3/4	4.7150	.2121	.5730	1.7452
11	4.9368	.2026	.5999	1.6669
1/4	5.1637	.1937	.6276	1.5934
1/2	5.3958	.1853	.6557	1.5251
3/4	5.6329	.1775	.6846	1.4607
12	5.8752	.1702	.7140	1.4006
1/2	6.3750	.1569	.7748	1.2907
13	6.8952	.1450	.8380	1.1933
1/2	7.4358	.1345	.9036	1.1067
14	7.9968	.1251	.9718	1.0290
1/2	8.5782	.1166	1.0425	.9592
15	9.1800	.1089	1.1156	.8964
1/2	9.8022	.1020	1.1913	.8394
16	10.4448	.0957	1.2694	.7878
17	11.7912	.0848	1.4329	.6978
18	13.2192	.0756	1.6065	.6225
19	14.7288	.0679	1.7900	.5587
20	16.3200	.0613	1.9833	.5042
22	19.7472	.0506	2.3998	.4167
24	23.5008	.0426	2.8560	.3501
26	27.5808	.0363	3.3519	.2983
28	31.9872	.0313	3.8873	.2572
30	36.7200	.0272	4.4625	.2241
36	52.8768	.0189	6.4260	.1556

* Cement calculations based on the volume of an average cement mixture being 1.1 cubic feet per sack of cement.

—Courtesy Halliburton Oil Well Cementing Co.

STANDARD OPERATING PROCEDURE
FOR DECONTAMINATION OF FIELD EQUIPMENT

Date: December 21, 1989 Revision Number: 0

Corporate QA/QC Manager: Michael A. Di Alto

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinsate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

STANDARD OPERATING PROCEDURE
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael C. De Cillis

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

STANDARD OPERATING PROCEDURE FOR SAMPLE HANDLING

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael G. De

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., Teflon™) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., Teflon™). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record

Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an indivudual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.
e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

STANDARD OPERATING PROCEDURE
FOR FIELD RECORD KEEPING AND
QUALITY ASSURANCE/QUALITY CONTROL

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cillo

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel onsite.

b. Name, date, and time of arrival onsite by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival onsite by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel onsite.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

2.4 If a temperature measuring meter is used to measure temperature, then the meter must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the meter does not read within this range and the meter cannot be calibrated, then it will not be used for temperature measurements and will be sent to the manufacturer for service and repair. If the meter does not read within this range and the meter can be calibrated, then the meter will be calibrated to the NBS-traceable thermometer.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.

b. Thermometer and/or Meter identification.

c. Calibration results relative to NBS-traceable thermometer.

d. Initials of individual performing calibration.

3.0 PROCEDURE

3.1 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature is measured immediately.

3.2 If a thermometer is used, then the thermometer is first rinsed with distilled or deionized water and is then immersed in water until the temperature equilibrates. The temperature is read in °C. The thermometer is rinsed again after measuring the temperature.

3.3 If a temperature measuring meter is used, then the probe is first carefully rinsed with distilled or deionized water. The probe is then immersed in water according to the manufacturer's specifications (e.g., specified submergence, stirred) until the temperature equilibrates. The temperature is read in °C. The probe is rinsed again after measuring the temperature.

3.4 Temperature data are recorded in the field notebook or appropriate field form, and initialed and dated.

STANDARD OPERATING PROCEDURE
FOR COLLECTION OF QUALITY CONTROL SAMPLES
FOR WATER-QUALITY DATA

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cellis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

STANDARD OPERATING PROCEDURE
FOR SURVEYING DISTANCES AND ELEVATIONS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cillo

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for surveying distances and elevations. This SOP applies to the following automatic level instruments: Wild-Heerbrugg models NA-1, NA-20, NA-24, and NA-28; and Lietz model C40.

2.0 CONSIDERATIONS

2.1 Personnel

Two people are required to conduct land surveying activities. The instrument person is responsible for collecting measurements with the automatic level. The leveling staff person is responsible for holding the leveling staff at given locations.

2.2 Equipment

The basic equipment required for surveying includes a tripod, an automatic level and a leveling staff (or rod). The leveling staffs and the tripods may vary slightly from office to office, but no discussion is warranted. The automatic levels are all quite similar in construction and operation. The primary differences are in the telescope, compensator setting, and leveling accuracy which are described in the technical data sections of the respective operator's manuals. Certain features such as the optical sight, pentaprism for viewing the circular bubble, and coarse/fine focusing vary between models, and in some cases these features are absent.

A composite description of automatic level features is provided in Exhibit A. The individual features are identified and briefly described. Those who are unfamiliar with the automatic level must seek instruction and practice with the instrument and the operator's manual prior to entering the field.

2.3 Equipment Assembly and Set Up

Tripod

The tripod is set up by fully extending each leg and locking the legs in place with the clamp screws. The legs are spread out until the tripod head is roughly at chin level and the leg tips form an equilateral triangle. While confirming that the tripod head is approximately level, push the legs into the ground by stepping on the tripod points. If the tripod is to be set up on smooth surfaces, then care must be taken to make sure the legs do not shift at all during measurements. In paved areas, putting the tripod points in cracks, grooves, or small holes helps to secure the legs. If the instrument is set up on asphalt in hot weather, then blocks or "shoes" must be placed under the tripod points to prevent it from sinking into the soft surface.

Automatic Level

Place the automatic level on the tripod head and anchor it using the centering screw. The base of the automatic level should be approximately centered within the tripod head. The instrument is leveled by adjustment of the three footscrews located between the instrument and the base plate. The adjustment is continued until the circular bubble is centered. Rotate the instrument 90° without disturbing the tripod, and ensure that the circular bubble is still centered. At this point, the instrument is set up to collect measurements.

Leveling Staff

The leveling staff is usually in three sections, each four or five feet in length. The leveling staff is extended to the desired length and carefully secured to prevent slipping of the sections. The leveling staffs which Roux Associates, Inc. (Roux Associates) uses are engineer's scale and graduated in 0.01 foot increments. The leveling staff is held at the desired location and a staff level (bubble) is used to confirm that the leveling staff is perfectly vertical. A turning plate should be used at turning point locations in grass, soft dirt, or bumpy areas. When on smooth hard surfaces, it is sometimes more suitable to use an "X" marked with chalk or crayon on a suitable location.

2.4 Elevations

When surveying to collect elevation data, a benchmark is required. The benchmark may be a known elevation (e.g., United States Geological Survey [USGS]) or an arbitrary elevation (e.g., assign 100.000 at a permanent location). Once the benchmark elevation has been established, the height of the properly leveled instrument is determined from a backsight. A backsight is taken from the instrument to the leveling staff at a point of known elevation (e.g., benchmark). The backsight reading added to the known elevation of the benchmark is the height of the instrument. When collecting elevation data, the leveling staff reading is always at the intersection of the vertical cross hair and the middle horizontal cross hair. The upper and lower horizontal cross hairs are for distance determination. Once the instrument height has been established, the leveling staff is moved to a location where the actual elevation will be determined. The automatic level is aligned with the new location, but is never releveled between a backsight and a foresight. A foresight is taken from the instrument to the leveling staff at a point where the elevation is to be determined (e.g., a monitoring well). The elevation of the new location (e.g., a monitoring well, turning point, etc.) is determined by subtracting the foresight reading from the height of the instrument. After collecting a foresight reading, the instrument person moves to a new location, levels the instrument, and collects a backsight reading. The leveling staff person remains at the location of known elevation. When the new backsight reading is collected, the height of the instrument is established and the leveling staff person moves to a new location. By repeating this procedure in a "leap-frog" manner, a "loop" is completed through all locations where elevations are desired and terminated with a foresight to the original benchmark for closure.

In order to determine the closure accuracy, the sum of all the backsights is subtracted from the sum of all the foresights. If the absolute difference is less than 0.02 foot, then the survey loop is considered accurate for determining the measuring points for monitoring wells. If the difference is greater than 0.10 foot and the calculations are correct, the survey loop must be repeated. If the difference is between 0.02 and 0.10 foot, then the project manager must determine if the accuracy is sufficient based on factors such as data needs, hydraulic gradient, topography, etc.

Items which can help ensure closure accuracy are discussed below. The length of any foresight or backsight must not exceed 100 feet. The length of the backsight and foresight for a given pair of readings must be approximately equal. By doing this, any minor internal adjustment problems are naturally eliminated. The instrument and the leveling staff must be carefully leveled and any instrument movement eliminated. If the leveling staff is not perfectly vertical, then a larger reading will result. On windy days, it is advisable to only extend the leveling staff as necessary. Both the instrument person and the leveling staff person must pay due attention to soft ground, grass, etc. and utilize "shoes" or turning plates where appropriate. Care must be taken during each reading to ensure that the middle horizontal cross hair is used. Errors from misreading the cross hairs are often made when the instrument is set too high or too low for the instrument person's natural line of sight. To eliminate reading errors, it is suggested that the reading be taken, written in the field notebook, and then confirmed with a second reading.

2.5 Distances

Horizontal distances can be easily measured with an automatic level. It is especially useful for measurements across busy roads, rivers, wetlands, hilly terrain, etc. However, if the distances are short and unobstructed it is often easier to use a 100-foot cloth tape measure.

The instrument person sets up and levels the instrument at point A. The leveling staff person places the leveling staff at point B. The top cross hair reading is subtracted from the bottom cross hair reading. The difference multiplied by 100 is the horizontal distance from point A to point B.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines surveying requirements.

b. Field notebook, field surveying forms, maps, benchmark information.

c. Automatic level in carrying case.

d. Leveling staff.

e. Staff level (bubble).

f. Tripod.

g. Turning plate.

h. Lumber crayon or chalk.

i. Feet (or small pieces of wood to be placed beneath tripod legs when set up on asphalt in hot weather, etc.).

j. Flogging tape and spray paint.

k. Machete.

l. Pocket transit.

4.0 CALIBRATION

The automatic levels which Roux Associates owns are high quality instruments which hold their adjustment extremely well. Calibration, therefore, is not necessary for field personnel. It is advisable, however, to check the circular bubble and horizontal line-of-sight occasionally (i.e., quarterly). The procedures are easy and can be found in the operator's manual.

5.0 PROCEDURES

5.1 The instrument person sets up the tripod at the first station (ST-1). DO NOT set up the stations any further than 100 feet from the benchmark or turning points because, to do otherwise, would compromise the accuracy of the measurements. The instrument is now ready to be leveled.

5.2 The instrument is leveled by adjustment of the three footscrews between the instrument and the instrument base plate. The adjustment is continued until the level bubble is centered. Once this has been done, the instrument is not releveled until it is set up at a new station. An exception to this is if the tripod is moved (kicked, etc.) or for some other reason the instrument is no longer level (i.e., tripod legs sink in asphalt), in which case the instrument must be releveled. DO NOT relevel the instrument between backsights and foresights.

5.3 The instrument, once leveled, is turned by use of the horizontal drive screw to come into line to sight the leveling staff at the benchmark. The instrument is adjusted until the leveling staff numbering and points are in sharp focus. The cross hairs of the instrument are focused by use of the knob on the eyepiece (if present).

5.4 The button below the eyepiece (if present) is pushed as a final check to ensure that the automatic internal compensator has brought the line of sight to horizontal. Now record the number that is read at the intersection of the vertical and middle horizontal cross hairs that extend across the entire field of view. This number is recorded in the field notebook to the nearest 0.001 foot. This establishes the height of the instrument.

5.5 The leveling staff person picks up their equipment and moves past the instrument station to the next turning point. A turning plate should be used to turn in grass or dirt areas. When on pavement, it is sometimes more suitable to use an X marked on a suitable area of the pavement. The intersection of the two lines is used as the point and the lines are used to line up the staff or rod, placing the line in the middle of each face or edge of the rods.

5.6 The instrument is not moved other than to rotate the instrument by use of the horizontal drive screw to sight the new location of the leveling staff and focusing of the instrument. The instrument is NOT releveled by use of the foot screws between backsights and foresights. Once the instrument has been focused on the staff at the new location, the compensator button is pushed (if present) and the leveling staff reading is recorded. This reading is a foresight that establishes the elevation at the turning point and is recorded in the foresight column.

5.7 The instrument is moved past the turning point and the procedures are repeated until the final destination is reached.

5.8 After the final destination has been reached and the foresight establishing its elevation has been recorded, a loop should be closed to the original benchmark to confirm that no errors were made (Exhibit B). This can be done by going back through the same stations and turning points or returning by a separate route. If the same stations and turning points are used, then the leveling staff person should stay on the final destination. The instrument stays at the same general location but is moved enough to require releveling (i.e., move the legs outward or inward several inches). The instrument is then releveled. This will make another turning point in the loop and will ensure that if an error was made in the final foresight reading, the loop to the original benchmark will not close. After the instrument has been releveled, a backsight is recorded and procedures 5.1 to 5.6 are repeated until the leveling staff person reaches the original benchmark and the instrument person performs a foresight to the staff at this location.

5.9 The field notebook should have the same number of backsights and foresights if the leveling was conducted as described above and no side shots were made. (A side shot is a case where two or more foresights are made from the same station and same instrument height. However, because the side shots are not an integral part of the loop as are turning points, an error in the staff reading will not be caught, yet, the loop will still close.) It is therefore recommended that each elevation to be established be treated as a turning point and that side shots not be utilized.

5.10 To check the loop for closure, sum the column of foresights, then sum all the backsights. The difference between these two totals is the closure error. If the closure error is within the tolerance limits set by the project manager, then the leveling is completed and the equipment should be packed up and returned to the office. If the closure error exceeds the tolerance limits set by the project manager, then the loop needs to be redone.

ATTACHMENT A-2

Field Forms

ENVIRONMENTAL CONSULTING & MANAGEMENT
ROUX ASSOCIATES, INC.

GEOLOGIC LOG

Study No. ______________ Date ______________
Project ______________
Client ______________
Page 1______________ of ______________
Logged By ______________
Well No. ______________
Location ______________
M.P. Elevation ______________
Drilling Started ______________ Ended ______________
Driller ______________
Type of Rig ______________

WELL DATA

Hole Diam. (in.) ______________
Final Depth (ft.) ______________
Casing Diam. (in.) ______________
Casing Length (ft.) ______________
Screen Setting (ft.) ______________
Screen Slot & Type ______________
Well Status ______________

G-W READINGS (1)

Date	DTW MP (2)	Elev. W.S.

SAMPLER

Type ______________
Hammer ______________ lb.
Fall ______________ in.

DEVELOPMENT

PID (ppm)	SAMPLE				Strata Change & Gen. Desc.	Depth (ft)	SAMPLE DESCRIPTION
	No.	Rec.	Depth	Blows 6			
						0	
						5	
						10	
						15	
						20	
						25	
						30	
						35	

REMARKS (1) in feet relative to a common datum
(2) from top of PVC casing

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

WELL SAMPLING DATA FORM

CLIENT ____________________
PROJECT NO. ____________________
LOCATION ____________________

WELL NUMBER ____________________
DATE ____________________
WEATHER ____________________
SAMPLED BY ____________________

TYPE OF WELL ____________________
STORAGE TANK ____________________
TIME OF START ____________________
TIME OF FINISH ____________________

DEPTH TO BOTTOM OF WELL ____________________ FT.
DEPTH TO WATER ____________________ FT.
WATER COLUMN ____________________ FT.
VOLUME OF WATER IN WELL ____________________ GAL.
VOLUME OF WATER TO REMOVE ____________________ GAL.
VOLUME REMOVED ____________________ GAL.

RATE OF PURGE ____________________
METHOD OF PURGE ____________________

PHYSICAL APPEARANCE/COMMENTS

FIELD MEASUREMENTS

TIME	pH	COND	TEMP	TURB	Eh	O^2

TYPES OF SAMPLES COLLECTED

LABORATORY NAME AND LOCATION

CUSTODY SEAL

DATE ______________________

SIGNATURE ______________________

ROUX

ROUX

CHAIN OF CUSTODY

Nº 02835Y

ROUX ASSOCIATES INC
Environmental Consulting
& Management

1377 MOTOR PARKWAY
ISLANDIA, NEW YORK 11788
(516) 232-2600 FAX (516) 232-9898

PROJECT NAME	PROJECT NUMBER
PROJECT LOCATION	
SAMPLER(S)	

ANALYSES

PAGE OF

SAMPLE DESIGNATION/LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX						TOTAL BOTTLES	NOTES

RELINQUISHED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N

DELIVERY METHOD	COMMENTS
ANALYTICAL LABORATORY	

QUALITY ASSURANCE PROJECT PLAN

Operable Unit 3
Sunnyside Yard
Queens, New York

Appendix B

June 23, 1997

(Revised January 13, 1999)

Approvals:
Project Manager — 1/14/99
Date

Project Quality Assurance Coordinator — Linda M. Wilson — 1-14-99
Date

CONTENTS

CONTENTS (Continued)

TABLES

FIGURE

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) outlines the measures that will be taken to ensure that the data generated are of quality sufficient to meet the data quality objectives of precision, accuracy and completeness.

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the field sampling plan (FSP) prepared as part of the Remedial Investigation (RI). This QAPP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain of custody, and laboratory and field analysis activities.

All QA/QC procedures have been developed and implemented in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP was prepared in accordance with USEPA QAPP guidance documents, with content and format based upon the "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" (EPA QA/R-5), and the "Guidance for the Data Quality Objectives Process" (EPA QA/G-4).

The primary objective of the QAPP is to provide a project specific "blueprint" for obtaining the type and quality of environmental data needed to accurately reflect actual conditions at Operable Unit 3 (OU-3), Sunnyside Yard, Queens, New York. Deviations from expected conditions will be noted, and appropriate corrective measures will be taken to maintain quality in the sample collection and analysis program.

1.1. Contents

As provided in the EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, the elements presented in this QAPP include Project Management (Sections 2 and 3), Measurement/Data Acquisition (Sections 4 through 10), Assessment/Oversight (Sections 11 through 13) and Data Validation/Usability (Sections 14 and 15).

1.2 Project Description

Soil and ground-water samples will be collected as part of the RI. The scope of work for each data gathering effort is described in more detail in the FSP prepared for this project (Appendix A).

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall management structure and a general summary of the responsibilities of project team members is presented below.

2.1 Field Management

The overall management structure for field activities is presented in an organizational chart (Figure B-1). A general discussion of the responsibilities of management and the field technical staff is provided below.

Project Manager

The Project Manager bears the primary responsibility for the successful completion of the work assignment within the budget and schedule. Provides overall management for the execution of the RI and directs the activities of the Site Manager and technical staff. Performs technical review of all field activities, data review and interpretation and the preparation of all investigation reports. Works closely with the analytical laboratory, data validation contractors, drillers, and surveyors during the execution of the field program. Activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Site Manager

The Site Manager bears the primary responsibility for the successful execution of the field program. Directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. Responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, works closely with the Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff

Field technical staff consists of hydrogeologists and technicians who will perform activities such as water-level measurements, soil and ground-water sampling, and preparation of any field documentation which may be necessary.

Laboratory Manager

The Laboratory Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analyses through oversight of the laboratory staff. The Laboratory Manager will ensure that quality assurance procedures are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Manager reports to the Project Manager.

Project Quality Assurance Coordinator

The Project Quality Assurance Coordinator (PQAC) is responsible for conducting reviews, inspections, and audits to assure that the data collection is conducted in accordance with the FSP. These responsibilities range from effective field equipment decontamination procedures, to proper sample collection, to review of all laboratory analytical data (including tentatively identified compounds, if analyzed) to ensure completeness and usefulness. The PQAC reports to the Project Manager.

3.0 PROJECT/TASK DESCRIPTIONS

Overall objectives for data generated as part of this investigation are described in the FSP (Appendix A). The FSP objectives which require collection of field data include the following:

- investigate the soil adjacent to transformers 31, 35, 36, and 37 to characterize soil quality;
- characterize soil quality to conclude vertical delineation of subsurface saturated soil;
- further delineate location(s) known to exceed soil cleanup levels;
- provide additional soil characterization and soil quality data; and
- further characterize deep ground-water quality.

The field investigation will include the following activities:

- soil and boring sampling; and
- ground-water sampling.

Ground-water samples will be analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, total dissolved solids (TDS) and chloride. Soil samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs), PCBs, lead, TCLP SVOCs, TCLP RCRA metals, ignitability, corrosivity, and reactivity. The projected sample media, analytical parameters and frequencies of field sample collection are provided in Tables B-1 and B-2.

Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G-4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;

- determine the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objectives of the sampling at OU-3 (Site) is to further assess soil quality conditions in areas not fully delineated to determine the nature, extent and gradients of the constituents of concern.

A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for potential areas of concern. A judgmental sampling design consists of directed samples at specific sampling locations to confirm the existence of contamination at these chosen locations based on visual or historical information.

Total study error is the combination of sampling and measurement error. Total study error is directly related to decision error. These decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline condition) is that the parameter of interest exceeds the action level. This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using more precise laboratory methods. Analyses will be performed using New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocols (ASP) and USEPA Contract Laboratory Program (CLP) protocols for the majority of parameters, and the Standard Methods for the Examination of Water and Wastewater for field parameters not analyzed under the ASP/CLP Statement of Work.

4.0 QUALITY ASSURANCE OBJECTIVES AND CRITERIA 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 results which maximize the likelihood that the data are collected, analyzed and documented such that it is defensible. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the project specific objectives for precision, accuracy, representativeness, completeness, and comparability, known as the "PARCC" parameters.

4.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

Accuracy, precision and completeness requirements will be addressed for all the data generated. Accuracy, the ability to obtain a true value, is monitored through the use of field and method blanks, spikes, and standards, and compared to federal and state regulations and guidelines. This will reflect the impact of matrix interferences. Precision, the ability to replicate a value, is monitored through duplicate (replicate) samples. It is assessed for each matrix. Corrective actions and documentation for substandard recoveries, or substandard precision, must be performed by the laboratory. These parameters will be based on ASP/CLP criteria for ASP/CLP analyses, or modified criteria for non-ASP/CLP analyses.

Instrument sensitivity must be monitored to ensure the data quality through constant instrument performance. Method detection limits depend on instrument sensitivity and matrix effects. Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near detection limit standards and response factors.

Quality control criteria for laboratory and field analyses are provided in Table B-3. Required field and laboratory QC samples and frequencies are summarized in Tables B-4 and B-5, respectively.

4.2 Completeness, Representativeness and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratory will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested using the ASP/CLP Routine Analytical Services (RAS) methods and 90 percent for other methods. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness (percent)} = \frac{\text{(Valid Data Obtained)}}{\text{(Total Data Planned)}} \text{ X } 100$$

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of Site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in the Work Plan. Representativeness will be satisfied by ensuring that the FSP is followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed in part by the analysis of field duplicate samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

5.0 SAMPLING PROCESS DESIGN AND METHOD REQUIREMENTS

Detailed sampling procedures in the FSP describe the sampling and data gathering methods. For the planned tasks (i.e., soil sampling, ground-water sampling), the FSP includes the following:

- description of the source matrix and sampling procedures;
- description of containers, preservation, holding times, etc., used in sample collection, transport, and storage;
- procedures for decontamination of equipment; and
- chain of custody procedures.

Table B-6 presents a summary of sample containers, preservation, and holding times.

6.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The possession and proper transfer of samples and sample-related information must be traceable from the time the samples are collected until the data have been accepted for analysis. The Work Plan describes the procedures for sample custody from the point where the sample is collected through the laboratory analysis. The following sections summarize the general aspects of custody and how they will be applied and managed during the course of the project.

A sample or sample-related information (sample or evidence file) is under your custody if it:

- is in your possession;
- is in your view, after being in your possession;
- is in your possession and you place them in a secured location; or
- is in a secured, designated place.

6.1 Field Chain of Custody Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering and other sample designation documentation are included in the FSP (Appendix A).

6.1.1 Field Procedures

a) The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

b) All bottles will be labeled with the appropriate sample numbers and locations.

c) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ball-point pen would not function in freezing weather.

d) The Field Team Leader will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

6.1.2 Field Logbooks/Documentation

Field logbooks will be used to document all data collecting activities performed in the field. As such, entries will be described in sufficient detail such that persons going to the Site could reconstruct a particular situation without reliance on memory. A summary of field documentation requirements is presented below.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control area when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered into the field logbook. The names of visitors to the Site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink (if possible) and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed by the person making the correction. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the FSP (Appendix A). The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, sample volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description (in the field logbooks but not the chain of custody).

6.1.3 Transfer of Custody and Shipment Procedures

a) Samples will be accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate, signed custody record enclosed in or on each sample box or cooler. Shipping containers will be locked and secured with strapping tape and USEPA custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

c) Whenever samples are split with another source (e.g., a government agency), a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

d) All shipments will be accompanied by the chain of custody record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office. Photocopies of the original record should be made before shipment, if possible, to ensure that clean copies can be made later.

e) If the samples are sent by common carrier, a bill of lading (airbill) must be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample cooler and the custody seals remain intact.

6.2 Laboratory Chain of Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the laboratory QA plan in Attachment B-1. All laboratory handling and custody procedures must conform to the ASP/CLP or USEPA requirements. A brief summary of the required laboratory custody and sample handling procedures is presented below.

The laboratory's QA officer will ensure that chain of custody records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory's QA officer will also ensure that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements.

7.0 ANALYTICAL METHOD REQUIREMENTS

Analytical procedures for this project have been selected to generate data meeting the DQOs required for the scope of work. A summary of the methods chosen and the rationale for each method selected is presented below. These methods are summarized in Table B-3. Sampling methods and procedures applicable to health and safety (e.g., personnel monitoring) are described in the HASP (Appendix C).

7.1 Laboratory Parameters

Methods published by USEPA will be used as the basis for all analyses for which such methods exist. The laboratory will follow methods detailed in the ASP for organic analyses and the CLP Statement of Work (SOW) for inorganic analyses. The methods specified in Table B-3 shall be followed for non-ASP/CLP analytical parameters. These methods have been chosen based on applicability to the investigation and the level of data quality provided by the method.

7.2 Field Parameters

The procedures for field measurement of pH, specific conductance, temperature, and organic vapors (PID) are described in the Standard Operating Procedures (SOPs) in the FSP (Appendix A). Method references are included in Table 3.

Portable probes operated according to the manufacturer's instructions and the Roux Associates' SOPs will be used for specific conductance, temperature, and pH. For these field measurements, ground water will be collected and transferred into clean containers. The separate specific conductance and temperature/pH probes will be inserted into the containers and allowed to equilibrate prior to recording the readings.

7.3 Analytical Quality Control

The analytical measurement QC for field and laboratory analyses will generally address the parameters of precision and accuracy. The required QC sample types, frequency and acceptance criteria for the laboratory and field measurements are summarized in Tables B-4 and B-5. Assessment of data quality based on the QC results is part of the data validation process and is discussed in Sections 14 and 15.

7.4 Proposed Analytical Laboratories

All analytical laboratories used for this work will meet the requirements of the laboratory QA plan and any other requirements for performing analyses to meet the required DQOs. The laboratory qualifications statement and/or QA plan are included in Attachment B-1.

7.5 Rationale for Analytical Method Selection

All analytical methods selected for use during this project have been chosen based upon the following criteria:

- ability of the method to meet the established data quality objective for the parameter;
- validity and reproducibility of the method;
- ability to report detection limits below the ASP/CLP RAS Contract Required Quantitation Limit (CRQL) for compounds with action levels below the CRQL;
- conformance of the method to standard USEPA methods and practices; and
- cost comparison between the method alternatives (if applicable).

After reviewing these criteria, the analytical methods summarized in Table B-3 were chosen for this project. The rationale for choosing the specific analysis method is presented below for field and laboratory analyses.

Physical Analysis of Water Samples

Water samples requiring analyses for pH, temperature, and specific conductance will be analyzed using Roux Associates' SOPs and/or manufacturer's specifications which are based upon the published USEPA methods for water. These analyses will be performed to provide supplementary and background data for off-site laboratory analyses and to assist in the overall water quality characterization. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chemical Analysis of Water Samples

Water samples requiring chemical analyses for TCL VOCs, TCL SVOCs, PCBs, and TAL metals will be analyzed using CLP protocols. These analyses will be performed to provide information regarding the Site characterization, remedial alternatives, and risk assessment. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chloride and TDS will be analyzed using the Standard Methods for the Examination of Water and Wastewater. These analyses will be performed to provide information regarding Site characterization and remedial alternatives. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chemical Analysis of Soil Samples

Soil samples requiring chemical analyses for PAHs, PCBs, and lead will be analyzed using ASP/CLP protocols. The ASP/CLP analyses will be performed to provide information regarding Site characterization, remedial alternatives, and risk assessment. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

8.0 QUALITY CONTROL CHECKS

The following sections describe the QC checks that are commonly applied to investigations and their definition and purpose. There are two main areas of the data gathering process which may be checked: the field procedures and the laboratory procedures. A summary of the various field and laboratory QC checks applicable to this project and their required frequencies are provided in Tables B-4 and B-5, respectively.

8.1 Field Generated Quality Control Checks

Field generated QC checks are samples sent to the laboratory from the field by either the field sampling team (internal) or by a third party (USEPA, state agency). These types of samples serve as checks on both the sampling and measurement systems, and assist in determining the overall data quality with regard to representativeness, accuracy and precision. The number and type of field QC samples submitted varies with the intended data use and the level of contamination (i.e., sample analyte concentrations) expected.

8.1.1 Internal Field Checks

Trip blank

Trip blanks generally pertain to volatile organic samples only. Trip blanks are prepared by filling a sample container with analyte-free water prior to the sampling event. The trip blanks are then transported to the field and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and sent for analysis. There should be one trip blank included in each sample shipping container for shipments with aqueous samples. The samples are used to determine if any cross-contamination between sample containers occurs. At no time after their preparation are the trip blank sample containers opened before they reach the laboratory.

Field Blank

Field blanks (also called decontamination rinsate blanks) are defined as samples which are obtained by running analyte-free water through sample collection equipment (bailer, pump, auger, etc.) after decontamination, and placing it in the appropriate sample containers for analysis. These samples are used to determine if decontamination procedures are adequate.

Duplicates

Field duplicates (also called replicates or collocates) are individual portions of the same (replicates) or essentially the same (collocated) field sample. Collocates are independent samples collected in close proximity to one another such that they are essentially an equal representation of the parameter(s) of interest at a given point in space and time. Examples of collocated samples include: samples from two air quality analyzers sampling from a common sample manifold, two water samples collected at essentially the same time and place from the same source, and side-by-side soil core samples.

Collocated samples, when collected, processed, and analyzed by the same organization, provide intralaboratory precision information for the entire measurement system including sample acquisition, homogeneity, handling, shipping, storage, preparation and analysis. Collocated samples, when collected, processed and analyzed by different organizations, provide interlaboratory precision information for the entire measurement system.

Replicate samples are samples from the same sampling point that have been divided into two or more portions at some step in the measurement process after sample collection. An example of a field replicate sample would be a soil core sample that has been collected, split, and placed into two or more individual sample containers.

Replicate samples can be used to estimate the overall precision of a data collection activity. Sampling error can be estimated by the comparison of collocated and replicated results from the same sample. If a significant difference in precision between the two subsets is found, it may be attributed to sampling design error.

Blinds

Blind samples can be either internal or external field QC samples. Internal blind samples are samples of known (performance evaluation, reference) or unknown (field sample replicates) concentration sent to the laboratory as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. Split samples are usually replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision).

8.1.2 External Field Checks

Blinds

Blind samples can be either internal or external field QC samples. External blind samples are usually samples of known (performance evaluation, reference) concentration sent to the laboratory (usually by a regulatory agency) as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. External split samples are replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision). External split samples may be generated for regulatory agencies, local resident oversight groups, or other interested/responsible parties.

8.2 Laboratory Generated Quality Control Checks

Laboratory generated QC check samples are samples generated at the analytical laboratory by the laboratory personnel from the same (internal) or a different (external) laboratory. These types of samples serve as checks on the laboratory sampling and measurement systems and assist in determining the data quality with regard to laboratory accuracy and precision. The number and type of laboratory QC check samples varies with the intended data use and the level of contamination (i.e., sample analyte concentrations) expected.

Laboratory QC check samples may measure either method and/or instrument performance. Method (preparation) performance check samples collectively measure the entire laboratory analytical data generation process, from sample allocating in the laboratory through the analysis and data reduction. Instrument (analysis) check samples measure the laboratory performance from the point where analysis begins, generally excluding any preparation/extraction affects, through the analysis and data reduction.

8.2.1 Internal Laboratory Checks

Method Blank

Method blanks (also called preparation blanks) are usually aliquots of analyte free water which are processed through all procedures, materials, reagents, and labware used for sample preparation and analysis. However, a method blank may be an aliquot of a known low level analyte matrix (such as washed sand) in order to more appropriately match the matrix of interest. Method blanks are used to determine if contaminants are present in the reagents, laboratory preparation, or analysis systems.

Reagent Blank

A reagent blank is prepared in the same manner as a method blank but is not subjected to the preparation procedures (digestion and/or extraction). Reagent blanks are used to determine the purity of the reagents used in the preparation/extraction and to isolate other contamination present in the analysis system.

Matrix Spike Blanks

Matrix spike blanks (MSBs) are aliquots of reagent water spiked with known quantities of specific compounds and subjected to the entire analytical procedure. MSBs are used to determine the appropriateness of the spiking solution used for the matrix spikes/matrix spike duplicates (MS/MSDs).

Duplicates

Laboratory duplicate samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix duplicates) and samples run through only the analysis method (analysis or instrument duplicates). In either case a "duplicate" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Duplicate samples are used to define either method (preparation plus instrument) or instrument precision. In some organic methods, two additional duplicate aliquots of the same sample are prepared and spiked (matrix spike and matrix spike duplicate) in lieu of a normal matrix duplicate.

Spikes

Laboratory spike samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix spikes) and samples run through only the analysis method (analysis or instrument spikes). In either case a "spike" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method which is spiked (fortified) with a known quantity of analyte and carried from that point on through the rest of the method as a routine sample. Spiked samples are used to define either method (preparation plus instrument) or instrument accuracy.

System Monitoring Compounds

System monitoring compounds are similar to matrix spikes and generally apply only to organic parameters. System monitoring compounds are added to all samples and are used to measure the effect of the sample matrix on specific compound recoveries. System monitoring compounds generally do not effect the routine sample results since the surrogate compounds are isotopically labeled. Surrogates are used to help define accuracy.

Internal Standards

Internal standards are similar to analysis spikes and generally apply only to organic parameters and inorganic analyses by Inductively Coupled Plasma (ICP). Internal standards are added to all samples (after preparation/extraction) and are used to determine the amount of variance in a measurement system due to transport, spectral, and other affects. Since the internal standard is a known quantity of analyte(s) generally not found in the environment, the results of the other analytes may be corrected for measurement system effects based on the percent recovery of the internal standard.

Control Samples

Laboratory control samples fall into two basic categories: samples run through the entire sample allocating, preparation, and analysis method (method or matrix controls) and samples run through only the analysis method (analysis or instrument controls). In either case, control samples are samples of known or certified concentration which are introduced at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Control samples are used to define either method (preparation plus instrument) or instrument accuracy. Examples of laboratory control samples are standard reference materials (SRMs), performance evaluation (PE) samples, laboratory control samples (LCSs), and method control samples (MCSs).

Analytical Batch

An analytical batch is a group of field and associated QC samples which are prepared (and preferably analyzed) concurrently using the exact same method, techniques, materials, reagents, labware, etc. Generally, a laboratory analytical batch is defined as twenty or fewer field samples of the same matrix prepared and processed at the same time. All associated QC samples should be prepared concurrently, and in addition to, the twenty or fewer field samples.

8.2.2 External Laboratory Checks

Round Robin Samples

Round robin samples are samples generated at one laboratory and sent to other laboratories for confirmation analysis. The "true" sample concentration is determined based on the statistical analysis of the various results reported by each laboratory. These samples are usually used to gauge accuracy. Examples of these types of samples include interlaboratory confirmation samples, proficiency analytical testing samples (PATs), and in some cases PE samples (in order to assign "true" values for the PE sample).

Performance Evaluation Samples

Performance evaluation (PE) samples are samples of known or assumed (based on round robin analyses) known concentration which are submitted to the laboratories by certifying (e.g., American Industrial Hygiene Association) or contracting agencies (e.g., CLP). PE samples are used to test the laboratory's competence in sample analysis and/or data package documentation and assembly. In terms of data quality, the PE sample is used to measure accuracy.

8.3 Standards Preparation

Calibration standards are prepared in the laboratory by dissolving or mixing a known amount of nominally pure analyte in the appropriate matrix using volumetric containers. Calibration standards must be prepared from a standard source which is traceable to a certified primary reference material (National Institute of Standards and Technologies or other certifying agency). All calibration standards must be prepared so that the types and concentration of the reagents used in the standard preparation are equivalent to the types and concentration of the reagents used in preparing the samples to be analyzed. Calibration curves are then generated to quantify the field sample results by comparison of the field sample response against the calibration standard response.

8.4 Reagents Preparation

All reagents used for analysis must be documented to be free of significant analyte concentration (i.e., all analytes to be measured are present below required detection limits) during or prior to the use of the reagents for sample preparation or analysis. Reagent blanks or method blanks (as required by the specific method) and other associated QC samples must be prepared using the same reagent lot(s) used for the actual field sample preparation. All reagent lots used for sample and standard preparation and analysis must be documented so that any resulting contamination problems can be traced to the specific standards and samples which were prepared using the reagent lot(s).

8.5 Calibration Checks

Once the calibration of an analysis system has been established using calibration standards, it is necessary to check the analysis system initially and periodically to verify correct standard preparation and system performance. Important elements to verify before and during the course of sample analysis include the accuracy of the calibration across the range of concentrations to be measured, the sensitivity of the instrument during the specific analysis run, and other transient changes in instrument performance, such as drift and linearity. To accomplish this verification task, analytical protocols require the analysis of calibration QC samples which serve as instrument checks and as triggers for necessary corrective action.

Initial Calibration Verification Standards

The initial calibration verification standard (ICV) is usually prepared in the concentration range of greatest interest, using an agency supplied standard or an alternate standard source (i.e., a different standard manufacturer) than that used for the calibration standards. The ICV must be prepared utilizing the same reagents and reagent concentration used for both the calibration standards and field samples. The purpose of this standard is to verify the accuracy of the initial calibration before any samples are analyzed.

Continuing Calibration Verification Standards

The continuing calibration verification standard (CCV) is prepared in the same manner as the ICV, except that it generally may be from either the same source, or from an alternate source as the calibration standards. The purpose of the CCV is to provide a periodic check on the accuracy of the calibration curve during sample analysis.

Initial Calibration Blank

An initial calibration blank (ICB) is a reagent blank prepared utilizing the same reagent(s) and reagent concentration used for both the calibration standards and the field samples. The purpose of the ICB is to verify that the sensitivity of the instrument meets the required limit of quantification before any samples are analyzed.

Continuing Calibration Blank

The continuing calibration blank (CCB) is prepared in the same manner as the ICB. The purpose of the CCB is to verify both the lack of baseline drift and the instrument sensitivity during analysis.

Near Detection Limit Standard

This standard is a calibration standard prepared to be at or near the required limit of quantitation (detection limit) for the measurement system (typically at the required detection limit or two times the required detection limit). The purpose of this standard is to provide a gauge of the accuracy of the instrument/instrument calibration at or near the required limit of quantification.

Linear Range Verification Standard

The linear range verification standard is a calibration standard prepared at a concentration greater than any of the calibration standards. The purpose of this standard is to verify accuracy of the analytical system at analyte concentrations greater than the highest calibration standard. This standard is generally only applicable to analytical systems with wide ranges of linearity (typically three or more orders of magnitude), such as ICP, where calibration across the entire linear range is cumbersome or impractical.

Interference Check Sample

The interference check sample (ICS) is a standard material prepared by spiking (fortifying) a solution of analytes of interest (in the concentration range of interest) with interfering analytes of a much higher concentration. The purpose of this sample is to verify that the analytical system is free from interferences due to the interfering analytes at the concentrations of interfering analytes and analytes of interest present in the ICS.

8.6 Control Charts

Control charts are used to determine if acceptable method performance has been achieved. In general, control charts are developed for methods where a standard level of performance has yet to be established and/or set limits of performance have not been validated through multiple analyses and statistical manipulation.

The basis of a control chart is to determine an accepted mean result and the allowable variance around the accepted mean. Typically, the allowable variance is measured in terms of the "level of confidence" in a particular result. Based on a statistical analysis of the results obtained over a period of time, the mean and standard deviation of the measurements can be determined. Once these values are known, a control chart can be established using the mean as the "true" value and some multiple of the standard deviation (confidence level) as the allowable variance. For most control charts, the allowable variance is set at the 95 percent or 99 percent confidence level, meaning there is a 95 or 99 percent chance that the control sample value will fall within the range of the control window, if the method is performed correctly.

Where established limits of acceptability are not available for this project's analyses, a minimum criteria of ± 25 percent will be required for method accuracy in soil samples; and ± 35 relative percent difference (RPD) for soil samples will be required for method precision. Completeness will be established at 95 percent for ASP/CLP analyses and 90 percent for non-ASP/CLP analyses, based on the precision and accuracy criteria noted above. Table B-3 summarizes the required precision, accuracy and completeness requirements for the parameters anticipated for this project.

If no reference material with published acceptance limits meeting the criteria established above (for analyses without established limits of acceptability) is available for the specified analytical method, statistically valid control charts for the analytical method must be developed by the laboratory prior to analysis of any field samples. All field sample results reported from this analytical method must be concurrently prepared and analyzed with a laboratory generated control sample having a result within ± two standard deviations (95 percent confidence level) of the mean result established by the laboratory through the use of control charts.

8.7 Database/Electronic Media Quality Control Checks

For data entered into electronic media by laboratories and contractors other than Roux Associates, all electronic media will be verified through the data validation and authentication (if applicable) programs as described in Section 14. Hardcopy data from the laboratories and/or contractors will also be compared against the electronic media generated by these sources at the level and frequency specified in Section 14.

For data input into databases, or electronic media generated by Roux Associates, the quality of the data entry and output will be verified according to the Roux Associates' SOP for Project Quality Assurance/Quality Control Procedures.included in Attachment B-2.

9.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

The preventative maintenance procedures described below are designed to prevent injury and loss of time and data due to faulty equipment/instrumentation. The purpose of preventative maintenance is to address potential problems before they occur and to help assure that equipment/measurement systems operate adequately when used for routine project activities.

9.1 Field Equipment/Instruments

The planned field instruments for this project include PID, water-level indicator, interface probe, pH meter, Eh meter, specific conductance meter, and thermometer. Specific preventative maintenance procedures to be followed for this and other field equipment are those recommended by the manufacturer and described in the applicable Roux Associates' SOPs (FSP - Attachment A-1).

Table B-7 summarizes the relevant preventive maintenance procedures for specific pieces of field equipment to be used for sampling, monitoring, and documentation for this project.

Field instruments will be checked and calibrated in the office before they are shipped or carried to the field at the start of the project. These instruments will be checked and calibrated in the field on a daily basis before and after use. Calibration checks will be performed and will be documented in the field logbook.

9.2 Laboratory Instruments

As part of their QA/QC Program, the laboratory will conduct a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions.

These procedures will be documented in the laboratory QA plan (Attachment B-1). Roux Associates will perform oversight of the laboratory maintenance program through the audit functions described in Section 13.

9.3 Documentation

Appropriate documentation of all equipment/instrument maintenance shall be maintained by the field and laboratory personnel and shall include what was done, date, time (if appropriate), next scheduled maintenance, equipment status, anomalies, and person performing maintenance. This documentation shall be entered into field logbooks, or into specific maintenance log forms for off-site maintenance activities.

10.0 INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all measurements and measuring equipment which are used for conducting field tests and laboratory analyses. All equipment must be calibrated prior to each use and on a periodic basis.

10.1 Field Instruments/Equipment

Field instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The calibration and use of field instruments are described in the FSP (Appendix A).

Equipment to be used during field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that all maintenance requirements are being observed. Backup instrumentation will be sent into the field where possible. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required. Preventive maintenance will be conducted for equipment and instruments to ensure the accuracy of measurement systems, and to verify the availability of spare parts and backup systems (see Section 9.0).

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instrumentation may include an Organic Vapor Meter (OVM) or photoionization detector (PID), pH meter, water-level indicator, interface probe, specific conductance meter, and thermometer for water analyses. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved.

10.2 Laboratory Instruments

The ASP/CLP calibration procedures and frequencies are specified in the ASP procedures and CLP SOWs. In all cases where analyses are conducted according to the ASP/CLP protocols, the calibration procedures and frequencies specified in the applicable ASP/CLP RAS SOW will be followed.

Calibration of laboratory equipment for non-ASP/CLP analyses will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audits. For all instruments, the laboratory will retain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of laboratory calibration will be kept as follows:

- if possible, each instrument will have a record of calibration permanently affixed with an assigned record number;
- a label will be affixed to each instrument showing description, manufacturer, model numbers, date of last calibration, by whom calibrated (signature), and due date of next calibration. Reports and compensation or correction figures will be maintained with the instrument;
- a written stepwise calibration procedure will be available for each piece of test and measurement equipment; and
- any instrument that is not calibrated with the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

More detailed information on the calibration of laboratory equipment is presented in Section 8.0 of this QAPP and in the laboratory QA plan included as Attachment B-1.

10.3 Standards/Calibration Solutions Preparation

The standards/calibration solutions preparation will be performed in accordance with the ASP/CLP SOWs, if applicable, and using good laboratory practice (GLP) in all cases. More specific information on standards and reagent preparation is provided in Sections 8.3 and 8.4 of this QAPP.

11.0 ASSESSMENT AND RESPONSE ACTIONS

This section provides the types, frequencies and content of the various audits and audit functions to be applied to this project. Audits for the work generally consist of four types: management audits, data quality audits, technical systems audits and performance audits. These audits may be internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization). The purpose of these audits is to establish and verify that the sampling and analysis activities are performed in accordance with the QAPP.

Project audits are intended to provide information regarding:

- on-going assessment of the data quality;
- identification of areas with a need for improvement;
- verification of QA program implementation;
- assessment of applied resources to complete the assigned tasks; and
- address changes and/or variances to procedures necessitated by the actual field or laboratory conditions.

Roux Associates is dedicated to confirmation of the specific and overall QA/QC objectives for this project through the use of management, performance and systems audits. The specific content and frequency of audits anticipated for this project are delineated below.

11.1 Management Audits

Management audits will be performed by Roux Associates personnel to determine whether the management functions and responsibilities related to environmental measurements are performed in accordance with Roux Associates' QA procedures. Management audits will include a review of the QAPP implementation for this project in order to evaluate:

- the level of management support;
- the field and analytical tracking systems;
- the procedures for developing the project DQOs;
- the procedures for developing, approving and reviewing the QAPP;

- the procedures for developing and approving SOPs; and
- the procedures and schedules for conducting audits.

Management audits are an on-going function of the Roux Associates' QA/QC procedures. Project-specific management audits for this project are the responsibility of the Project Manager and will be implemented as required for each management function. The Project Manager will review the management program and the other audit functions on a routine basis.

11.2 Data Quality Audits

Data quality audits will be performed by Roux Associates or Roux Associates' contractor personnel to determine whether data derived as part of the work are of known quality. Data quality audits will be supported by the data validation effort to determine whether or not sufficient information exists with the data set to support an assessment of data quality. Through the use of data validation and authentication (if applicable), information provided by Roux Associates and its contractors will be used to audit and evaluate:

- if a data set, or all the data sets of a particular project, met the DQOs;
- if the contractor collecting or reducing the data performed their own data quality assessment; and
- if the contractor identified deficiencies (if they existed) and corrected the cause(s), both technical and managerial.

For data generated by laboratories and contractors other than Roux Associates, all data will be verified through the data validation and authentication (if applicable) programs as described in Section 8. Hardcopy data from the laboratories and/or contractors will be checked for completeness and accuracy of data reduction at the level and frequency specified in this section. For data validation performed by Roux Associates' subcontractors, key data may be subject to additional Roux Associates validation based on its importance in decision making for the project.

For data generated by Roux Associates, the quality of the data entry and reduction will be verified according to the Roux Associates' Evaluation and Validation of Data SOP in Attachment B-3 and the Roux Associates' QA/QC procedures SOP included in Attachment B-2.

All data quality functions will be subject to Roux Associates oversight to verify the accuracy and completeness of the data reduction and validation efforts. Data quality is the responsibility of the PQAC and will be implemented as required for each type of data generating activity. At a minimum, the PQAC will review the data validation effort, perform spot checks on the quality of the data validation effort, and document his/her findings.

11.3 Technical Systems Audits

Technical systems audits will be performed to determine if the field and laboratory sampling and analytical systems specified in the FSP and QAPP are sufficient to generate data which will meet the stated DQOs. These audits will include the on-site examination of field and laboratory activities for quality and conformance to the FSP and QAPP. Both internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization) audits will be performed for both the field and laboratory systems.

11.3.1 Field Audits - Internal

The internal field audits will include examination and review of field sampling records, field instrument operating records, sample collection, handling, packaging and shipping procedures, maintenance of QA procedures, chain of custody, etc. to determine conformity to the FSP and QAPP. Internal audits of field activities (sampling and measurements) will be conducted by the Roux Associates PQAC and/or Project Manager. Should any deficiencies be discovered during the course of the audit, the PQAC will have the authority to take any necessary action, including implementing a "stop work" order, to correct the deficiency.

These internal field audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits to correct deficiencies, and to verify that QA procedures are maintained throughout the investigation, will be conducted on a routine basis. The specific contents of these audits will be based on Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) guidelines.

11.3.2 Field Audits - External

At this time it is not anticipated that external audits of the field activities will be necessary. However, if the internal audits determine that deficiencies exist which require an outside organization or agent to resolve the problem(s), Roux Associates will employ the services of an outside subcontractor to audit the field activities and make/suggest corrections to the problem.

11.3.3 Laboratory Audits - Internal

The internal laboratory system audits will be performed by the Laboratory QA Officer on at least an annual basis (at a minimum) and will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc. as described in the laboratory QA Plan (if applicable) or according to the guidelines set forth in the CLP Bid Package documentation regarding laboratory QA requirements.

11.3.4 Laboratory Audits - External

For this project it is anticipated that only laboratories currently meeting the criteria set forth for the ASP/CLP will be used for off-site sample analyses. These laboratories will have already been subject to a laboratory audit by NYSDEC/USEPA personnel and it is not anticipated that an additional audit by Roux Associates or Roux Associates' subcontractor personnel will be required. However, should any laboratory be selected which has not been audited by the ASP/CLP, or an equivalent audit (state or other federal agency) in the last 12 months, Roux Associates or its contractor personnel will perform a laboratory audit using the guidelines set forth in the ASP/CLP Bid Package documentation prior to that laboratory performing any field sample analyses.

11.4 Performance Evaluation Audits

The internal performance audits of the laboratory(ies) will be conducted by the Laboratory QA Officer. The performance audits will be conducted on at least a quarterly basis. Blind QC samples will be prepared and submitted along with project samples to the laboratory for analysis throughout the project. The Laboratory QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratories maintain a good performance.

External performance audits of the laboratories selected for the project will have already been performed by the NYSDEC/CLP for some or all of the analytes being tested. These performance evaluation audits may be supplemented by the use of field-generated blind QC samples (replicates) submitted by Roux Associates.

Internal performance evaluation audits of the field measurements performed by Roux Associates' personnel may be utilized if suitable reference solutions are available for the specific project activities. These types of checks could include analysis of "blind" calibration span gases for PID measurements, or analysis of USEPA Environmental Monitoring Systems Laboratory aqueous check samples for pH and specific conductance.

For laboratory checks, tolerance limits for the performance evaluation samples will be based on the accepted values supplied with the check sample/standard. For the field checks, the tolerance limits will also be based on the accepted values supplied with the check sample/standard, but may be modified as necessary to take into account the less quantitative (screening) nature of the field analytical measurements.

12.0 CORRECTIVE ACTIONS

Corrective action generally addresses the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. The following paragraphs describe the mechanics of how corrective action will be managed and implemented during the course of this project.

Corrective actions may be required for two classes of problems: analytical and equipment functional problems, and noncompliance problems. Analytical and equipment functional problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review. The need for laboratory analysis corrective actions is based on predetermined limits for acceptability (Section 4). By conducting system and performance audits, the Laboratory QA Officer will determine if the overall data generating systems are acceptable (Sections 14 and 15).

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the PQAC and/or Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the Laboratory QA Officer and method specific corrective actions will be implemented.

12.1 Field Corrective Action

Corrective actions will be implemented by field personnel and documented in the field record book. No staff member will initiate corrective action without notification through the proper channels. If corrective actions are insufficient, a stop-work order may be issued by the Project Manager.

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformance, or suspected deficiencies of any activity (or issued document) by reporting the situation to the Project Manager or designee. The Project Manager will be responsible for assessing the suspected problems in consultation with the PQAC, and for making decisions based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance and/or requires corrective action, then a nonconformance report will be initiated by the field personnel and submitted to the Project Manager for review.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and
- ensuring nonconformance reports are included in the Site documentation project files.

If appropriate, the Project Manager will ensure that no additional work which is dependent on the nonconforming activity be performed until the corrective actions are completed.

Corrective action for field measurements may include the following:

- repeat the measurement to check the error;
- check for all proper adjustments for ambient conditions such as temperature;
- check the batteries;
- recalibration;
- check the calibration;
- replace the instrument or measurement devices; and
- stop work (if necessary).

The Project Manager or his/her designee is ultimately responsible for all Site activities. In this role, the Project Manager at times is required to adjust the Site programs to accommodate the Site program specific needs. The change in the program will be documented on the Field Change Request form (Attachment B-4) that will be signed by the initiators and the Project Manager or designee. The Field Change Request shall be attached to the file copy of the affected document. The Project Manager and the PQAC must approve the change in writing or verbally prior to the field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and appropriate action will be taken by the Project Manager to document the significance of the problem.

The Project Manager is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties.

12.2 Laboratory Corrective Action

Corrective action is required whenever an out-of-control event or potential out-of-control event is noted. The corrective action taken will be somewhat dependent on the analysis and the event. These actions are to be implemented in accordance with the laboratory QA plan in Attachment B-1 and the ASP/CLP SOWs, as appropriate and applicable.

13.0 REPORTS TO MANAGEMENT

Quality assurance reports serve the purpose of identifying, tracking and summarizing any field and laboratory activities which occur during the project. These reports provide a permanent record which addresses the adequacy of the QAPP, problems or deficiencies noted during audits, and resolution of the identified areas of concern. The following sections provide a summary of the report contents and frequency requirements for the writing and submission of QA reports.

13.1 Specific Quality Assurance Reports

In addition to the audit reports submitted to the Project Manager in accordance with Section 11, a QA progress report will be submitted periodically to the Project Manager by the PQAC which addresses the identification or resolution of all QA issues occurring over that time period. If a project lasts less than two months, only a final QA report will be submitted. The final QA report will be incorporated into the final project report and will contain QA progress report sections that summarize data quality information collected during the project.

Each periodic or final QA report will include the following types of information: purpose and scope of report, time frame covered, project status (overall and by task if applicable), results of any data quality or other audits conducted during the time period, problem identification/updates/resolution, QAPP changes, project-related training activities, visits by third party organizations, sources of additional information, and who receives the reports.

13.2 Quality Assurance Report Management

The Project Manager will be responsible for assuring that the frequency and content of the report(s) are met. Applicable sections of the report will be sent to the PQAC and the Health and Safety Manager for approval/disapproval. Any deficiencies found in the QA reports will be brought to the attention of the PQAC and will require correction within 14 days for periodic reports, or within one month for final reports.

The submission of QA reports will be included in the overall project management schedule as critical path points to assist in meeting the QA objectives for this project.

14.0 DATA REDUCTION, VALIDATION AND REPORTING

Applicable methods/procedures will be required for the reduction, validation and reporting of data generated during all phases of this project. Please note that unless requested by the NYSDEC, an independent validation will not be performed. Both the field and laboratory data will be subjected to a level of data validation commensurate with the required data quality level. If required, all data will be validated using either the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (February, 1994), USEPA Region II CLP Organics Data Review and Preliminary Review (SOP No. HW-6, Revision 8), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (February, 1994) and/or the Evaluation of Metals Data for the Contract Laboratory Program (SOP No. HW-2, Revision #11) or the same guidelines modified for non-ASP/CLP analyses. The level of complete transcription checks (raw data to reporting for calculation checks) shall nominally be 10 percent, but this percentage may be increased or decreased depending on the nature and significance of the individual results.

14.1 Data Reduction

Data reduction involves the generation, interpretation and calculation of results from the field and laboratory analyses performed as part of the data gathering effort. In order to make the appropriate decisions, it is necessary to verify that the reported values are correct, both in the way they have been generated (instrument calibration, etc.) and the way they are calculated and reported. Due to the different quantities of documentation and the different quality levels of data generated in the field and the laboratory, somewhat different levels of effort are required for reduction verification for these different data sources.

14.1.1 Field Data Reduction

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. If the data are to be used in the project reports, they will be documented in the report. All measurement data recorded in field logbooks or field forms will be reviewed by the Project Manager for completeness and clarity. Any discrepancies noted will be resolved by the Project Manager. All calculation equations shall also be verified by the Project Manager and individual calculations will be verified at a minimum frequency of 30 percent by the PQAC. Any field information entered into data systems will be subject to the Roux Associates QA/QC procedures (Attachment B-2).

14.1.2 Laboratory Data Reduction

The off-site laboratory will perform in-house analytical data reduction and validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- raw data produced by the analyst is turned over to the respective area supervisor;
- the area supervisor reviews the data for attainment of QC criteria as outlined in CLP protocols and/or established USEPA methods and for overall reasonableness;
- upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the Laboratory QA Officer;
- the Laboratory QA Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency;
- the Laboratory QA Officer and area supervisors will decide whether any sample re-analysis is required; and
- upon acceptance of the preliminary reports by the Laboratory QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

Data reduction reporting procedures will be those specified in the ASP/CLP SOW for inorganic and organic analyses.

Laboratories will prepare and retain full analytical and QC documentation the same as (ASP/CLP analyses) or similar to that (non-ASP/CLP analyses) required by the Contact Laboratory Program.

The laboratory will report the data in chronological order along with all pertinent QC data. Laboratories will provide the following information to the prime contractor in each analytical data package submitted.

1. Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated results of inorganic and organic compounds identified and quantified.
3. Analytical results for QC samples, spikes, sample duplicates, initial and continuing calibration verification standards and blanks, standard procedural (method) blanks, laboratory control samples, and Inductively Coupled Plasma (ICP) interference check samples.
4. Tabulation of instrument detection limits determined in pure water.
5. Raw data system printouts (or legible photocopies) identifying: date of analyses, analyst, parameter(s) determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.
6. Sample preparation/extraction/analysis logs including weights, volumes and dilutions.

14.2 Field Data Validation

Field data assessment will be accomplished by the efforts of the PQAC and/or Project Manager. The data assessment by the Project Manager or his/her designee will be based on the criteria that the sample was properly collected and handled according to the FSP (Appendix A) and Section 6.

14.3 Laboratory Data Validation

Validation of laboratory generated data will be performed by Roux Associates or a Roux Associates' subcontractor. The Contractor data reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of data accuracy, precision, representativeness and completeness, based on criteria in Section 4, will be performed and presented in the summary report.

The data reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

Data validation for laboratory data will be performed in accordance with the above-mentioned documents for evaluating organic analyses and inorganic analyses for all samples analyzed using ASP/CLP methodology. Non-ASP/CLP analysis data will also be validated using the functional guidelines, but use of the guidelines will be modified according to the applicable method and required QA/QC. It is anticipated that all laboratory data will be validated (i.e., complete transcription checks, calculation checks, etc.) by the laboratory.

14.4 Data Reporting

All data generated for the Site will be computerized in a database format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided in accordance with the USEPA Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses and Inorganic Analyses, as well as additional comments of the data reviewer for ASP/CLP analyses. For non-ASP/CLP analysis, the data will include appropriate flags based on the data validation functional guidelines. . The data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank. Selected data reviewer comments will also become part of the database in order to indicate whether the data are usable as a quantitative concentration, usable with caution as an estimated concentration, or unusable due to out-of-control QC results.

The Site data set(s) will be available for controlled access by the Project Manager, and authorized personnel. The complete data set(s) will be incorporated into the report.

15.0 SPECIFIC AND ROUTINE PROCEDURES TO ASSESS DATA QUALITY OBJECTIVES

This section will describe the specific methods and equations used to assess the quality of the data with regard to precision, accuracy and completeness. Previous sections in the QAPP have defined the terms of the PARCC parameters, described the types and frequencies of the various audit activities and described the methods of data reduction and validation (see Sections 4, 11 and 14).

The procedures used to assess the DQOs as outlined in this QAPP were developed to generate data which meets the specific needs of the project. Through the use of a systematic method of data assessment, data of known quality will be produced and applied to the project needs based on the actual data quality.

By subjecting the data to standard calculations and validation guidelines, the usability of the data are enhanced when comparison against past, present or future data is necessary. Actual use of any data for specific project purposes will be determined by the Project Manager in coordination with the PQAC, based on the required data quality needs for a particular data set (e.g., matrix type, concentration level, intended data use, quantification accuracy and precision needs, etc.).

15.1 Specific Assessment Parameters

The following sections list the parameters which will be assessed and the calculations applicable to the specific measurement. The acceptable limits for the individual parameters (for both field and laboratory analyses) are discussed in Sections 4.0 and 7.0.

Accuracy:

Accuracy of laboratory results will be assessed using the analytical results of method blanks, reagent blanks, matrix spikes, field blanks, near detection limit and linear range standards, etc. The percent recovery (%R) of analysis and matrix spike samples will be calculated using the following equation:

$$\%R = \frac{A - B}{C} X\ 100$$

Where: A = The analyte concentration determined experimentally in the spiked sample;

B = The analyte concentration determined by a separate analysis of the unspiked sample; and

C = The amount of analyte added in the spike.

Precision:

Precision will be assessed by calculating the relative percent difference (RPD) between the field and/or laboratory duplicate samples (e.g., field duplicates and/or splits, laboratory matrix spike/matrix spike duplicate [MS/MSD] for organic analysis, and laboratory duplicate analyses for inorganic analysis). The RPD will be calculated for each pair of duplicates using the following equation:

$$RPD = \frac{S - D}{(S + D)/2} X\ 100$$

Where: S = First sample value (original or MS value)

D = Second sample value (duplicate or MSD value)

Completeness:

Completeness measures of the amount of valid data obtained from a measurement system compared to the amount of data expected to be obtained under normal conditions. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \text{ X } 100$$

Representativeness:

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, and parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network for this project was designed to provide data representative of Site conditions. During development of the sampling network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes.

Representativeness of the data will be assessed by the Project Manager and the PQAC through review and comparison of the applicable data (field and laboratory duplicates, splits, spikes, PE samples, etc.) and by verifying that the design set forth in the Work Plan was followed for all data generated during the project activities.

Comparability:

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends in part on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data for these project activities (i.e., intra-project comparison). These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Assessment of statistical comparability will be based primarily on the use of field splits and internal and external PE samples. Specifics regarding the assessment of comparability within sample sets can be found in the Roux Associates' Evaluation and Validation of Data SOP in Attachment A-3.

Required Limit of Quantitation (Detection Limit):

The required limits of quantitation for the various analyses are found in Table B-3. For ASP/CLP analyses, these detection limits shall be arrived at using the methodology set forth in the specific statement of work for that parameter. For non-ASP/CLP analyses, the detection limit(s) shall be arrived at using either the ASP/CLP methodology (as applied to a particular analysis other than the ASP/CLP specified methods) or using a "standard" method based on the general guidelines presented below.

- The limit of quantitation shall be based on the variability of the blank response for the complete analytical procedure, or the variability for the signal-to-background response in a processed sample when there is not a detectable blank response. The detection limit will be established as three times the standard deviation of the blank or background response, adjusted for the amount of sample typically extracted and the final extract volume of the method (i.e., all dilutions and sample weight variables must be included in the calculation).

- Best professional judgment shall be used to adjust the limit of detection upward in cases where the transient occurrence of high instrument precision (i.e., low variability) results in a calculated limit of detection less than the absolute sensitivity of the analytical instrument. When no significant blank response is detectable, the limit of detection shall be estimated based on the standard deviation of low-level standard (concentrations at or near the expected instrument detection limit) responses.

15.2 Management of DQO Assessment

Assessment of the on-going ability to generate data of a known quality will be the primary responsibility of the PQAC and will be overseen by the Project Manager. As discussed previously in Sections 11 and 14, Roux Associates will be responsible for performing audits for technical systems and data quality on an on-going basis.

Table B-1. Sample Types/Analyses by Task

Task	Matrix	Field Analyses	Laboratory Analyses
I. Soil Boring and Sampling	Soil	Photoionization Detector Screening	PCBs, cPAHs, lead, TCLP SVOCs, TCLP RCRA metals, ignitability, reactivity
II: Ground-Water Sampling	Water	pH, specific conductance, temperature	TCL VOCs, TCL SVOCs, PCBs (total and dissolved), TAL Metals (total and dissolved), Chloride, TDS

PCBs = Polychlorinated Biphenyls
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TCLP = Toxicity Characteristic Leaching Procedure
TCL = Target Compound List
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound
TAL = Target Analyte List
TDS = Total Dissolved Solids

Table B-2. Projected Number of Field Samples

Task	Parameter	Field Samples	Field Duplicates[a]	Field Blanks[a]	Trip Blanks[b]	MS/MSD/MSB[c]	Total Laboratory Samples
I: Soil Boring and Sampling (Soil)	PCBs	17	1	1	NA	3	22
	cPAHs	4	1	1	NA	3	9
	Lead	4	1	NA	NA	2	7
	TCLP SVOCs	4	NA	NA	NA	NA	4
	TCLP RCRA Metals	4	NA	NA	NA	NA	4
	Ignitability	4	NA	NA	NA	NA	4
	Reactivity	4	NA	NA	NA	NA	4
II: Ground-Water Sampling[d] (Water)	VOCs	3	1	NA	1	2	7
	SVOCs	3	1	NA	NA	2	6
	PCBs (total)	3	1	NA	NA	2	6
	PCBs (dissolved)	3	1	NA	NA	2	6
	Metals (total)	3	1	NA	NA	2	6
	Metals (dissolved)	3	1	NA	NA	2	6
	Chloride	3	1	NA	NA	NA	4
	TDS	3	1	NA	NA	NA	4

a. Frequency estimates based on one blank per twenty samples, or one per day minimum.
b. The number of trip blanks is estimated based on one trip blank per cooler.
c. Matrix Spike/Matrix Spike Duplicate Matrix Spike Blank - one per twenty samples.
d. Field parameters include pH, Eh, specific conductance, and temperature.

PCBs = Polychlorinated Biphenyls
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds
TDS = Total Dissolved Solids
NA - Not Applicable

Table B-3. Project Quality Control Summary

Parameter	Media	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision[b]	Completeness	Analysis Method
TCL Volatile Organic Compounds	Water	10 µg/L	58-137%	24 RPD	95%	ASP 95-1[c]
TCL Semivolatile Organic Compounds	Water	10 to 50 µg/L	10 - 111%	50 RPD	95%	ASP 95-2[c]
Polychlorinated Biphenyls	Water	0.05 to 1.0 µg/L	24 - 151%	27 RPD	95%	ASP 95-3[c]
TAL Metals	Water	0.2 to 5,000 µg/L	75- 125%	20 RPD	95%	ILM04.0[d]
Chloride	Water	0.1 to 2 mg/L	75-125%	15 RPD	90%	325.3[e]
Total Dissolved Solids	Water	10 to 20,000 mg/L	NA	NA	90%	160.1[e]
pH	Water	0.1 unit	NA	NA	90%	150.1[e]
Specific Conductance	Water	NA	NA	NA	90%	120.1[e]
Temperature	Water	NA	NA	NA	90%	170.1
Carcinogenic Polycyclic Aromatic Hydrocarbons	Soil	330 to 1,600 µg/kg	20-150%	50 RPD	95%	ASP 95-2[c]
Polychlorinated Biphenyls	Soil	8.0 to 160 µg/kg	20-150%	50 RPD	95%	ASP-95-3[c]
Lead	Soil	0.2 to 1,000 mg/kg	75-125%	50 RPD	95%	ILM 04.0[d]
RCRA Characteristics						
Ignitability	Soil	NA	NA	NA	90%	1010/1011[f]
Reactivity	Soil	NA	NA	NA	90%	9010/9030[f]
Toxicity						
SVOCs	Soil	NA	NA	NA	90%	1311/8270[f]
RCRA Metals	Soil	NA	NA	NA	90%	1311/6010/7471[f]

mg/L - milligrams per liter
µg/L - micrograms per liter
µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
RPD - relative percent difference
NA - Not applicable
SOP - Standard Operating Procedure

a. Quantitation limits are based on Contract Laboratory Program (CLP) Statement of Work requirements (where applicable), or on method references. Limits for soil are based on nominal wet weight of the sample. Dry weight limits will be higher.
b. Actual limits for matrix spikes, system monitoring compounds, and laboratory control samples are provided in the CLP Statement of Work or cited method.
c. Analytical Services Protocols
d. CLP Statement of Work
e. Standard Methods for the Examination of Water and Wastewater

Table B-4. Field Quality Control Sample Frequency

Parameters	Media	Trip Blank[a]	Field Blank[b]	Field Duplicates[c]	MS/MSD/MSB[d]
Carcinogenic Polycyclic Aromatic Hydrocarbons	Soil	NA	1/20	1/20	1/20
Polychlorinated Biphenyls	Soil	NA	1/20	1/20	1/20
Lead	Soil	NA	1/20	1/20	1/20
RCRA Characteristics	Soil				
Ignitability	Soil	NA	NA	NA	NA
Reactivity	Soil	NA	NA	NA	NA
Toxicity					
SVOCs	Soil	NA	NA	NA	NA
RCRA Metals	Soil	NA	NA	NA	NA
TCL Volatile Organic Compounds	Water	1/20	1/20	1/20	1/20
TCL Semivolatile Organic Compounds	Water	NA	1/20	1/20	1/20
Polychlorinated Biphenyls	Water	NA	1/20	1/20	1/20
TAL Metals	Water	NA	1/20	1/20	1/20
Total Dissolved Solids	Water	NA	NA	1/20	NA
Chloride	Water	NA	NA	1/20	NA
pH/Temperature/Specific Conductance[e]	Water	NA	NA	1/20	NA

NA - Not applicable
MS/MSD/MSB - Matrix Spike/Matrix Spike Duplicate/Matrix Spike Blank

a. Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only), whichever is more frequent.
b. Where applicable, one per twenty of fewer field samples, or one per day, whichever is most frequent.
c. Where applicable, one per twenty or fewer field samples.
d. Where applicable, one per twenty field samples or twice per week during sampling, whichever is more frequent.
e. Field parameters.

Table B-5. Laboratory Quality Control Sample Frequency

Parameter	Media	Method Blank[a]	MS/MSD[a]	Laboratory Replicate[a]	Analysis Method
Polycyclic Aromatic Hydrocarbons	Soil	1/20	1/20	NA	ASP 95-2[b]
Polychlorinated Biphenyls	Soil	1/20	1/20	NA	ASP 95-3[b]
Lead	Soil	1/20	1/20	1/20	ILM04.0[c]
RCRA Characteristics	Soil				
Ignitability	Soil	NA	NA	1/20	1010/1011
Reactivity	Soil	NA	NA	1/20	9010/9030
Toxicity	Soil				
SVOCs	Soil	1/20	1/20	1/20	1311/8270
RCRA Metals	Soil	1/20	1/20	1/20	1311/6010/7471
TCL Volatile Organic Compounds	Water	1/20	1/20	1/20	ASP 95-1[b]
TCL Semivolatile Organic Compounds	Water	1/20	1/20	1/20	ASP 95-2[b]
Polychlorinated Biphenyls	Water	1/20	1/20	1/20	ASP 95-3[b]
TAL Metals	Water	1/20	1/20	1/20	ILM04.0[c]
Total Dissolved Solids	Water	1/20	1/20	1/20	160.1[d]
Chloride	Water	1/20	1/20	1/20	325.3[d]

NA - Not applicable

a. Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent
b. Analytical Services Protocol
c. Contract Laboratory Program Statement of Work
d. Standard Methods for the Examination of Water and Wastewater

Table B-6. Preservation, Holding Times and Sample Containers

Parameter	Preservation	Holding Time[a]	Containers
Aqueous VOCs	HCl to pH<2 4°C store in dark	14 days	2 x 40 ml vials w/teflon septum
Aqueous SVOCs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous PCBs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous Metals (Mercury)	HNO_3 to pH<2	180 days (26 days)	1 liter plastic bottle (included above)
Total Dissolved Solids	4°C until analysis	7 days	300 ml plastic bottle
Chloride	NA	28 days	50 ml plastic bottle
Soil SVOCs (PAHs)	4°C until extraction and analysis	14 days until extraction 40 days until analysis	4 oz jar w/teflon lined lid
Soil Metals (Lead)	4°C until analysis	180 days	8 oz jar w/teflon lined lid (included above)
Soil PCBs	4°C until extraction and analysis	14 days until extraction 40 days until analysis	100 grams jar w/teflon lined lid
Soil RCRA Characteristics			
Ignitability	NA	NA	8 oz jar w/teflon lined lid
Reactivity	NA	NA	8 oz jar w/teflon lined lid
Toxicity			
SVOC	4°C until extraction and analysis	40 days[b]	4 oz jar w/teflon lined lid
RCRA Metals	4°C until extraction and analysis	180 days[c]	8 oz jar w/teflon lined lid

a. From collection until analysis unless otherwise specified.
b. 14 days from field to TCLP extraction, 7 days from TCLP extraction to preparative extraction, 40 days from preparative extraction to analysis
c. 180 days from field to TCLP extraction, 180 days from extraction to analysis

NA - Not applicable
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
ml - milliliter

Table B-7. Field Equipment Calibration Requirements and Maintenance Schedule

Equipment Type	Calibration Requirements	Maintenance Schedule
PID	Manufacturer's Directions	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
pH Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Specific Conductance Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Thermometer	Manufacturer's Directions	Regularly check for breakage.
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.
Magnetometer	Manufacturer's Directions	Replace batteries as necessary.
Surveying Instruments	Attachment A-1	Regularly clean instrument lenses.
Interface Probe/ Water-Level Indicator	Manufacturer's Directions	Replace batteries as necessary.

FIELD ORGANIZATION CHART

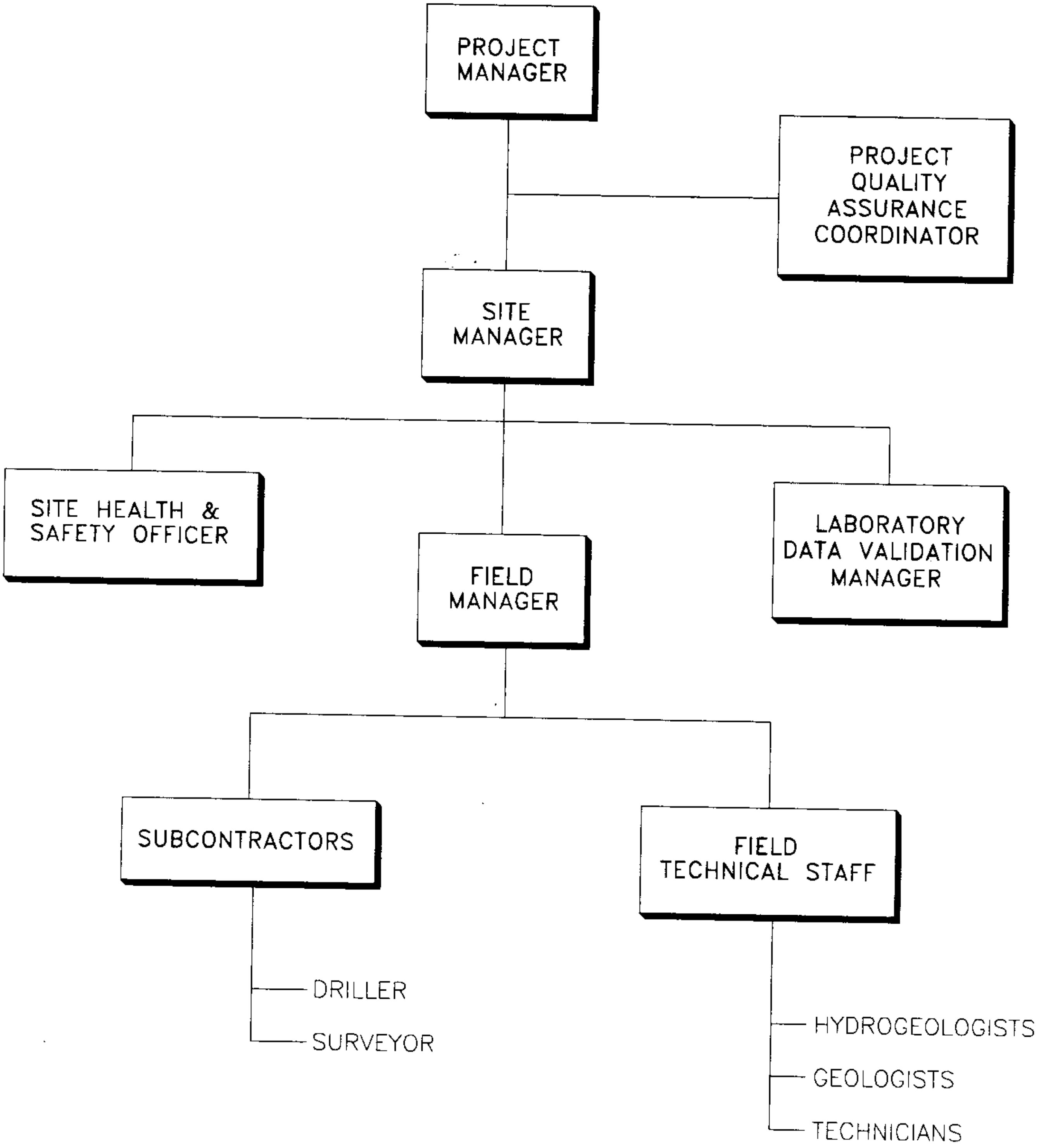

FIGURE B-1

ATTACHMENT B-1

Analytical Laboratory
Quality Assurance Plan

To Be Included

ATTACHMENT B-2

Roux Associates, Inc.
Standard Operating Procedure,
Quality Assurance/Quality Control Procedures

STANDARD OPERATING PROCEDURE FOR FIELD RECORD KEEPING AND QUALITY ASSURANCE/QUALITY CONTROL

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel onsite.

b. Name, date, and time of arrival onsite by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival onsite by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel onsite.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

ATTACHMENT B-3

Roux Associates, Inc.
Standard Operating Procedure,
Evaluation and Validation of Data

STANDARD OPERATING PROCEDURE
FOR EVALUATION AND VALIDATION OF DATA

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis EDD

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish the criteria to be followed for the evaluation of data quality and for data validation. Because valid media-quality data are integral to environmental investigations that characterize site conditions, the quality of the data generated by a laboratory is extremely important to the successful completion of a project. The level of data evaluation and validation required is determined by the project data quality objectives and must be outlined in the work plan/scope of work. Data collected to establish qualitative trends, for example, do not require the same level of validation as data generated to support litigation.

The data evaluation procedure described in Section 2.0 of this SOP is designed to provide a measure of comparability regarding quality control (QC) samples, i.e., between duplicate or replicate samples and to detect any contamination or bias in analyses of blanks. They may be used for both intra-laboratory and inter-laboratory comparisons.

The data validation procedure described in Section 3.0 of this SOP is designed to provide a stringent review of analytical chemical data with respect to sample receipt and handling, analytical methods used, and data reporting and deliverables.

Prior to performing any data evaluation or validation, it is crucial that all appropriate regulatory agencies be contacted and their data validation requirements be determined, as these requirements vary from agency to agency and may vary among different Regions of the United States Environmental Protection Agency (USEPA).

2.0 PROCEDURE FOR EVALUATION OF DATA

2.1 Not all analytical data packages will require a full data validation procedure as described in Section 3.0. The procedures described in this section provide an initial screening to help decide if full data validation is warranted. These data evaluation procedures are used as a quality assurance (QA) check for water-quality data, and are not generally applicable to soil-quality data. They are to be used when a full data validation procedure (described in Section 3.0) is not required.

2.2 Primary/Replicate, Primary Split and Primary/Laboratory Duplicate Comparisons

X = primary sample concentration

Y = replicate/split/laboratory duplicate sample concentration

$Z = \{(X-Y)/[(X+Y)/2]\} \times 100$

IDC = initial concentration requiring dilution, if samples have been diluted. If samples did not require dilution, then use the first range (i.e., QL-10[QL]).

QL = Quantitation Limit[1]

<u>Organic Constituents</u>

Range	Quantitative	Qualitative	Unusable
QL - 10(QL)	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
10(QL) - IDC	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
X or Y > IDC	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$

<u>Inorganic Constituents</u>

Analytical Method	Quantitative	Qualitative	Unusable
Wet Chemistry testing	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
Atomic Absorption (AA)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
Inductively Coupled Plasma (ICP)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$

2.3 Comparison of Blanks

X = primary sample concentration[2]

D = highest concentration in associated blank(s)

Y = X/dilution factor

	Quantitative	Qualitative	Unusable
Field Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Trip Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Lab Blank	$D \leq 0.1Y$	$0.5Y > D > 0.1Y$	$D \geq 0.5Y$

[1] The quantitation limit will be dependent upon the specific methodology and the matrix, and will be either the minimum detection limit (MDL) or the practical quantitation limit (PQL).

[2] Results reported as BDL (below the detection limit) will be considered Quantitative because the primary samples have not been affected by the bias(es) which resulted in concentrations reported in the blank sample(s).

3.0 PROCEDURE FOR DATA VALIDATION

3.1 Determine study-specific data quality needs and pertinent regulatory agency data validation requirements.

3.2 Contact the appropriate regulatory agency(ies) to obtain their data validation procedure manual. This manual will indicate acceptable ranges for QC parameters to be investigated and procedures to follow for data which do not meet these requirements.

3.3 For inorganic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Instrument calibration, including initial and continuing calibration verification.

c. Blank(s).

d. Laboratory control sample(s).

e. Inductively Coupled Plasma (ICP) interference check samples.

f. Duplicate sample(s).

g. Matrix spike sample(s).

h. Furnace atomic absorption QC.

i. ICP serial dilution(s).

j. Sample result verifications.

k. Field duplicates.

l. General data assessment.

3.4 For organic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Gas Chromatograph/Mass Spectrometer (GC/MS) tuning.

c. GC calibration, initial and continuing.

d. Blanks.

e. Surrogate recoveries.

f. Matrix spike/matrix spike duplicates.

g. Internal standards performances.

h. Target Compounds List (TCL) compound identifications.

i. Reported detection limits.

j. Tentatively identified compounds (TICs).

k. Overall system performance.

l. General data assessment.

3.5 The parameters which do not conform to requirements are then listed and the data are qualified according to the guidelines provided in the appropriate regulatory agency's data validation procedure manual. The qualified data package is then reviewed and the project data reviewer, the project geochemist and/or the project manager makes a professional judgement concerning the validity of the data package, and its usability for the project.

ATTACHMENT B-4

Field Change Request Form

FIELD PROCEDURE MODIFICATION AUTHORIZATION

Project/Task Number:

Procedure Reference:

Requested Modification:

Reason for Modification:

Special Equipment, Material or Personnel Required:

Modification Requested By: **Date:**

Approved By: **Date:**

Title:

Comments:

File original copy in project file. Copy to client.

HEALTH AND SAFETY PLAN

Operable Unit 3
Sunnyside Yard
Queens, New York

Appendix C

June 23, 1997

(Revised January 13, 1999)

Approvals:

Roux Associates, Inc.
Project Manager
Harry Gregory
1/14/99
Date

Roux Associates, Inc.
Health and Safety Manager
Thomas Dwyer
Thomas Dwyer
1/14/99
Date

Roux Associates, Inc.
Site Health and Safety
Officer
Harry Gregory
1/14/99
Date

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1.0 GENERAL

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Act (OSHA) Hazardous Waste Operations, Department of Transportation Roadway Worker Protection, and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities associated with the Sunnyside Yard, Queens, New York (Yard) and will be implemented by the designated Site Health and Safety Officer (SHSO) during work at the Yard.

Compliance with this HASP is required for all Roux Associates employees, subcontractor personnel, and third parties who enter the Yard. Assistance in implementing this HASP can be obtained from the Roux Associates Health and Safety Manager. The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by the Roux Associates Health and Safety Manager or her designee.

Scope of Work:

To meet the objectives of the Operable Unit 3 (OU-3) Remedial Investigation, the following scope of work will be performed:

- investigate the soil adjacent to transformers 31, 35, 36, and 37 to characterize soil quality;
- characterize soil quality to conclude vertical delineation of subsurface saturated soil;
- further delineate location(s) known to exceed soil cleanup levels;
- provide additional soil characterization and soil quality data; and
- further characterize deep ground-water quality.

2.0 EMERGENCY INFORMATION

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Amtrak Police		(212) 630-7113
Fire		(718) 847-6600
Hospital (Figure C-1 - Map)	Astoria General Hospital 25-10 30th Avenue Astoria, New York	(718) 932-1000
National Response Center		(800) 424-8802
Poison Control Center		(800) 962-1253
Penn Station Control Center		(212) 630-7465
Project Manager	Harry Gregory	Work: (516) 232-2600 Pager: 1-888-518-0833
Site Health and Safety Officer	Harry Gregory	Work: (516) 232-2600 Pager: 1-888-518-0833

Emergency route to Astoria General Hospital: from Honeywell Street make a right on Northern Boulevard. Turn left at 30th Avenue. The hospital is located at Crescent and 30th Avenue.

3.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

Personnel Designation	**Responsibilities**
Health and Safety Manager (HSM)	Implementation and modification of the HASP. Will assign health and safety duties. Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Yard conditions. Schedules adequate personnel and equipment to perform job safely.
Site Health and Safety Officer (SHSO)/ Site Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies HSM of accidents/incidents. Coordinates health and safety activities. Makes contact with local emergency groups prior to beginning work on-site. Responsible for evacuation, emergency treatment, and emergency transport of Yard personnel.
Field Technical Staff	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.

4.0 YARD HISTORY AND PHYSICAL DESCRIPTION

The Sunnyside Yard (Yard) is located in an urban area in northeastern Queens County in New York. The East River is located approximately one mile to the west. The Yard is surrounded by commercial, light industrial, and residential areas.

The Yard consists of an active railroad maintenance and storage facility which encompasses approximately 105 acres. It functions primarily as a maintenance facility for electric locomotives and railroad cars for both Amtrak and New Jersey Transit Corporation.

The Pennsylvania Tunnel and Terminal Company, a subsidiary of the Pennsylvania Railroad constructed the terminal in the early 1900s. On April 1, 1976, the Consolidated Rail Corporation (CONRAIL) acquired the Yard, and on the same day conveyed it to Amtrak, which has continued to operate it as a storage and maintenance facility for railroad rolling stack. Prior to September 29, 1961, a portion of the Yard was owned by the Long Island Rail Road (LIRR). Today, the LIRR maintains a right-of-way through the Yard.

OU-3 (Site) consists of soil and separate-phase petroleum accumulation above the water table in what was formerly referred to as Area 1 of the Yard. It is located at the northern border of the Yard, and includes the former Engine House, the former Metro Shop, drum storage areas, former workers' locker room, and the former diesel fuel storage area.

5.0 SITE-RELATED INCIDENTS, COMPLAINTS, AND ACTIONS

Investigations at the Yard have been ongoing since 1983. The previous investigations (1983 through 1986) for which Amtrak has records are described below.

- On November 1, 1983, representatives of Canberra RMC, Pottstown, Pennsylvania, collected thirty-eight soil samples to determine the extent of polychlorinated biphenyls (PCBs) contamination. These samples were taken from the beds of tracks 5 through 15, and from areas where soil from the beds of tracks 3 and 4 was known to be deposited. Soil found to be contaminated at a level above 50 parts per million (ppm) PCBs was disposed of offsite.

- On August 21 and 22, 1985, three soil samples were collected by Atlantic Environmental, Dover, New Jersey, in the area surrounding the Engine House. All three samples were determined to have PCB concentrations below 50 ppm.

- On November 12, 1985, RMC Environmental Services, Pottstown, Pennsylvania collected two wall scrapings from the Engine House. The test results indicated both samples to have PCB concentrations below 50 ppm.

- On November 21, 22, 23, 25, and 26, 1985, all stationary transformers located on Amtrak's New York Division, which includes the Yard, were tested for PCBs by RMC Environmental Services. Of the 49 on-site transformers, nine were determined to have PCB levels above 500 ppm, and five transformers had PCB levels between 50 and 499 ppm.

- Geraghty & Miller, Inc., Plainview, New York, was retained by Amtrak in February 1986 to conduct an investigation of the former underground storage tank area, the Engine House, the former Oil House, and the former fuel transfer area to determine if leakage of hydrocarbon compounds had occurred and, if so, to determine the extent of contamination in both soil and ground water. Their June 1986 report, titled "Results of Hydrogeologic Investigation at the Amtrak, Sunnyside, Queens, New York Train Yard" concluded that a plume of separate-phase petroleum exists in the area east of the Engine House, and that this plume appears to have originated at the underground storage tanks of the former fuel storage area and has migrated beyond the Yard's northern property boundary. PCB concentrations in this plume range from 5 to 360 ppm, with the highest concentrations being detected in samples collected immediately to the east of the Engine House. PCBs were also detected in soil samples, with concentrations ranging from 0.19 to 24 ppm in the 0 to 2 feet interval, but no PCBs were detected in ground water.

- A Phase I Remedial Investigation (RI) was performed by Roux Associates from October 1990 through March 1991. The RI was undertaken in accordance with the provisions of the Order On Consent (OOC), Index No. W2-0081-87-06 between the New York State Department of Environmental Conservation (NYSDEC), the National Railroad Passenger Corporation (Amtrak) and the New Jersey Transit Corporation. This investigation concluded that further investigations were warranted to delineate the nature and extent of contamination in 17 areas of concern and facility wide.

Investigations at the Yard have continued including a Phase II RI, Phase II Addendum RI, Interim Remedial Measure Designs, sewer repair, sampling and various other activities. A Limited Phase II Environmental Site Assessment Investigation during April and May 1996 was performed to characterize soil quality within the proposed footprint of the High Speed Trainset Facility (HSTF) Service and Inspection (S&I) Building, designated Operable Unit 1 (OU-1).

With the NYSDEC's concurrence, to accommodate the HSTF S&I Building construction schedule and still address remedial efforts sitewide in a timely and orderly manner, the Yard has been subdivided into six operable units described as follows:

- Operable Unit 1 (OU-1) designated as the soil above the water table within the footprint of the proposed HSTF S&I Building;
- Operable Unit 2 (OU-2) designated as the soil above the water table within the footprint of the HSTF S&I Building ancillary structures (i.e., the access road and utilities route, the parking area, the construction easement area which surrounds the building, and the construction laydown area);
- Operable Unit 3 (OU-3) designated as the soil and separate-phase petroleum accumulation above the water table in Area 1 of the Yard, as defined in the Phase I RI report;
- Operable Unit 4 (OU-4) designated as the soil above the water table in the remainder of the Yard;
- Operable Unit 5 (OU-5) designated as the sewer system beneath the Yard; and
- Operable Unit 6 (OU-6) designated as the ground water including the saturated soil beneath the Yard.

Records of Decision for OU-1 and OU-2 have been issued by the NYSDEC.

6.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated activities on hazardous waste sites include biological, chemical, and physical hazards. Based on the available information, the potential for encountering biological hazards on this Site is low. There is the potential for encountering both chemical and physical hazards due to the nature of the work location and the activities to be conducted. These are discussed below.

6.1 Chemical Hazards

Previous investigations have shown concentrations of inorganic compounds (metals), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and petroleum hydrocarbons (PHCs). The toxicological, physical, and chemical properties of these potential contaminants are presented in Table C-1. This table includes action levels (permissible exposure levels) which will establish the level of protection. The potential for encountering these hazards exists during intrusive activities such as drilling, soil borings, etc.

6.2 Physical Hazards

A variety of physical hazards may be present during OU-3 activities. These hazards are similar to those associated with any construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation, the use of power and hand tools, hazardous walking and working surfaces, and handling and storage of fuels. In addition, workers must be aware of electrical hazards, such as overhead and underground power lines, while performing their assigned tasks. These hazards are not unique and are generally familiar to most field personnel. However, the main hazards which are unique to this Yard are those involved with working on or near tracks over which trains move. The hazards are discussed below.

6.2.1 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. High noise operations will be evaluated at the discretion of the SHSO. Personnel with 8-hour time-weighted-average exposures exceeding 85 dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95.

6.2.2 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest and fluid replacement. Normally, the individual should recover within one-half hour. If the individual is not better within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids. If the individual is not better within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress is a significant hazard if any type of protective equipment (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the workload required to perform each task, type of protective equipment, temperature and humidity. Potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

6.2.3 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;
- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. <u>Do not cover the victim's face</u>. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

6.2.4 Track Safety

All employees assigned to work at the Yard must attend the Amtrak Contractor Employee Safety Program Course (CSG-101), which includes Roadway Worker Protection for compliance with 49 CFR Part 214. In addition, all employees will display the Amtrak Contractor Employee Safety Trained Badge.

As part of Amtrak's compliance efforts, each employee must understand the following:

- a job briefing with an Amtrak representative is required prior to commencing work;
- never foul any track without protection provided by Amtrak;
- immediately clear tracks upon signal from watchman;

- never return to tracks until clear signal is given by watchman; and
- follow all Amtrak on-track safety rules and instructions.

The two most common dangers involved with working on or about railroad tracks are moving trains and electrical power lines. The following procedures must be followed.

- Clear the tracks when a train approaches from either direction. A gang watchman will signal that a train is approaching by blowing a whistle or air horn, and by raising a black and white signal disc overhead.
- To avoid the dangers from electrical hazards, stay at least 15 feet away from any energized line. Do not approach closer than 15 feet to an electrical wire unless a class A employee tells you it is de-energized and properly grounded.

A copy of the Contractor Safety Course booklet and New York Division Supplement is included as Attachment C-1. Amtrak provides Contractor Responsibilities for conducting work and handling equipment and materials to prevent any part of equipment from fouling on operated track or wire line without written permission. The Contractor Responsibility is also included as Attachment C-1.

7.0 TRAINING REQUIREMENTS

The Hazardous Waste Operations and Emergency Response Rule (29 CFR 1910.120) requires that all personnel be trained to recognize on-site hazards, the provisions of this HASP and the responsible personnel. This section discusses the means to meet these requirements.

7.1 Basic Training

All Yard personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety trained prior to performing work on-site per OSHA 29 CFR 1910.120(e). Training records will be maintained by the SHSO on-site and as described in Section 7.4.

All employees will receive the Amtrak Contractor Employee Safety Program course.

7.2 Site-Specific Training

Health and safety related training that will specifically address the activities, procedures, monitoring and equipment for the Yard operations will be provided to all Yard personnel and visitors by the SHSO. It will include Yard and facility layout, hazards, emergency services at the Yard and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented and kept as part of the project records.

7.3 Safety Briefings

Project personnel will be given briefings by the SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be provided when new operations are to be conducted (such as soil borings; drilling, sampling), changes in work practices must be implemented due to new information made available, and before work is begun at each location (i.e., drilling). Records of safety briefings will be kept as part of the project records.

7.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, injury/incident reports, medical examination records and exposure monitoring records will be maintained by Roux Associates for a period of at least thirty years after the employment termination date of each Roux Associates' employee. Pertinent health and safety training and medical certifications will be kept onsite during the field operations. The SHSO shall maintain a daily written log of all health and safety monitoring activities, and monitoring results shall become part of the project records.

Each subcontractor will maintain the above-mentioned records for his/her employees.

8.0 MONITORING PROCEDURES FOR YARD OPERATIONS

During monitoring, the SHSO will record wind direction and temperature in the logbook. All monitoring equipment will be calibrated per the applicable owner's manual, which will be kept onsite.

8.1 Intrusive Operations

Data from previous investigations have identified low concentrations of specific VOCs in soil and ground water. Air monitoring will be performed to establish the concentrations of these constituents during intrusive activities using a photoionization detector (PID).

The PID will be used to provide direct readings at the time of the drilling, sampling, etc. to determine that the level of personal protection being applied is adequate.

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the permissible exposure level (PEL) for all constituents of concern. If the PID indicates the 5 ppm level is exceeded, the SHSO will order cessation of the activity until all personnel within the exclusion zone have donned a full face air purifying respirator, or until the nature of the hazard has been more thoroughly evaluated.

8.2 Non-Intrusive Operations

Based on the current understanding of Yard conditions, monitoring may be performed using a PID on the first day of non-intrusive operations and periodically thereafter.

9.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates' personnel and subcontractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- complete medical and work histories;
- EKG;
- urinalysis;
- physical exam;
- eye exam;
- blood chemistry;
- pulmonary function test; and
- audiometry.

The examination will be taken annually, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the HSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, or if other Yard conditions warrant further medical surveillance.

10.0 ZONES, PROTECTION AND COMMUNICATIONS

10.1 Site Zones

Roux Associates employs the following three zone approach to Yard operations:

- the Work Zone;
- the Contamination Reduction Zone; and
- the Support Zone.

10.1.1 Work Zone

The Work Zone is the area where work will be conducted. The Work Zone will be designated by a temporary barrier (e.g., cones, caution tape, etc.). No personnel shall work in the Work Zone without a buddy. All workers within the Work Zone shall wear the proper personal protective equipment (see Section 10.2). No unauthorized persons will be allowed in the Work Zone during Yard activities.

No personnel are allowed in the Work Zone without:

- a buddy;
- the proper personal protective equipment;
- medical authorization; and
- training certification.

10.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Work Zone and the Support Zone. The CRZ will provide for full personal and portable equipment decontamination (Section 10.3). The CRZ will also contain safety and emergency equipment such as first aid equipment (bandages, blankets, eye wash) and containment equipment (adsorbent, fire extinguisher).

10.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will provide for team communications and emergency response. Appropriate safety and support equipment will be located in this zone. The Support Zone will be located upwind of Yard operations, if possible and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/decontaminated and labeled samples and drummed wastes.

10.2 Personal Protection

This section describes the levels of protection which will be required by personnel during the field sampling activities at the Yard.

10.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO with approval of the HSM. Where more than one hazard area is indicated, further definition shall be provided by review of Yard hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

During all intrusive activities, continuous monitoring will be performed using the PID. Protection may be upgraded or downgraded by the SHSO in conjunction with the HSM based upon the PID instrument results.

Tasks which will require continuous monitoring to ensure that exposure levels are below the required action levels include the following:

- hand soil borings;
- drilling activities; and
- sampling activities.

All non-intrusive activities which preclude contact with contaminated media will be performed in Level D protection without continuous monitoring, unless monitoring results indicate additional monitoring is warranted.

10.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

<u>Level D Protection</u>

1. Personal protective equipment
   - Cotton coveralls
   - Cotton gloves
   - Boots/shoes, leather or chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable*)
   - Safety glasses or chemical splash goggles
   - Hard hat
   - Escape mask*

* Optional

2. Criteria for selection

   PID instrument (such as Photovac Microtip) readings in the breathing zone are less than 5 ppm. Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

NOTE: Modifications of Level D will be used to increase the level of skin protection during activities which increase the degree of contact with chemical hazards. These modifications include the use of chemical resistant coveralls (e.g., tyveks) and chemical-resistant gloves.

Level C Protection

1. Personal protective equipment
    - Full face, air-purifying, cartridge-equipped respirator (Mine Safety and Health Administration [MSHA]/National Institute for Occupational Safety and Health [NIOSH] approved)
    - Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)
    - Cotton or synthetic coveralls*
    - Gloves (outer), chemical-resistant nitriles
    - Gloves (inner), chemical-resistant latex
    - Boots (inner), chemical-resistant, steel toe and shank
    - Boots (outer), chemical-resistant (disposable*)
    - Hard hat (face shield*)
    - Escape mask*
    - 2-Way radio communications (intrinsically safe)*

*Optional

2. Criteria for selection
    - Continuous total vapor readings register between 5 ppm and 25 ppm on PID instruments (such as the Photovac Microtip).
    - Measured air concentrations of identified substances (organic vapors) will be reduced by the respirator to at or below the substance's permissible exposure limit, and the concentration is within the service limit of the canister.
    - Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.
    - Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
    - Job functions have been determined not to require self-contained breathing apparatus.

Level B Protection

1. Personal Protection Equipment
   - Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved)
   - Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical splash suit; disposable chemical-resistant coveralls)
   - Coveralls
   - Gloves (outer), chemical-resistant, nitriles
   - Gloves (inner), chemical-resistant, latex
   - Boots (inner), chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable)
   - Hard hat (face shield)
   - 2-way radio communications (intrinsically safe)

2. Criteria for Selection

   Meeting any one of these criteria warrants use of Level B protection:

   - PID instrument (such as Photovac Microtip) readings in the breathing zone are greater than 25 ppm and less than 500 ppm.
   - The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
     -- with concentrations Immediately Dangerous to Life and Health (IDLH)
     or
     -- exceeding limits of protection afforded by a full face, air-purifying mask
     or
     -- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.
   - The atmosphere contains less than 19.5% oxygen.
   - Site operations make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
   - If work is performed in an enclosed space.

10.3 Decontamination Procedures

A steam cleaner will be utilized to decontaminate the drilling equipment. Personnel should exercise caution when using a steam cleaner. The high pressure steam can cause severe burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

10.3.1 Contamination Prevention

Adequate contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include the following.

Personnel

- Do not walk through areas of obvious or known contamination;
- Do not handle contaminated materials directly;
- Make sure all personal protective equipment (PPE) has no cuts or tears prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants;
- Do not carry cigarettes, gum, etc. into contaminated areas; and
- Use disposables to cover nondisposables when contact is probable.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving openings for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
- Excavated soils should be contained and kept out of the way of workers.

10.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures C-2, C-3 and C-4 illustrate decontamination procedures for Levels D, C and B, respectively. Safety briefings shall explain the decontamination procedures for personnel and portable equipment for the various levels of protection. Heavy equipment will be decontaminated with a steam cleaner.

10.3.3 Disposal Procedures

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left at the Site. All potentially contaminated materials (e.g., soil, clothing, gloves, etc.) will be bagged or drummed, as necessary, and segregated for disposal. All contaminated materials shall be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste. All waste disposal operations conducted by Roux Associates will be monitored by the SHSO and carried out under the appropriate level of personal protection.

10.4 Standard Operating Procedures/Safe Work Practices

This section discusses safe work practices to be used during all activities. In addition, non-monitoring safety-related procedures are described.

10.4.1 COMMUNICATIONS

- Telephones -- A telephone will be available for communication with emergency support services/facilities.

- Hand Signals -- To be employed by personnel required to have Level C protection. They shall be known by the entire field team before operations commence and covered during site-specific training.

The following hand signals will be used, if needed:

Signal	Meaning
Hand gripping throat	Out of air, can't breathe
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

10.4.2 General Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth contact and ingestion of material is prohibited in the Work Zone or CRZ.

- Hands must be washed thoroughly upon leaving the Work Zone or before eating, drinking, or any other activities.

- Contaminated protective equipment shall not be removed from the Yard until it has been decontaminated and properly packaged and labeled.

- Portable eyewash stations shall be located in the decontamination staging area in the Support Zone.

- No facial hair, which interferes with a satisfactory fit of respiratory equipment, will be allowed on personnel that may be required to wear respiratory protective equipment.

- An emergency first aid kit and fire extinguisher shall be onsite in the Support Zone at all times.

- All respiratory protection selected to be used onsite shall meet NIOSH/MSHA requirements for the existing contaminants.

- Any skin contact with surface and ground water shall be avoided.

- No contact lenses may be worn in the Work Zone or CRZ.

10.4.3 Sampling

All field sampling will be performed under the level of personal protection described in Section 10.2. Non-monitoring, safety-related procedures are described below.

Personnel must wear prescribed clothing, especially eye protection and chemical resistant gloves when sampling. The sampling team must be aware of emergency evacuation procedures described in this HASP, and the location of all emergency equipment (Section 10.1.2) and emergency contacts prior to sampling (Section 11.0). Contamination avoidance shall be practiced at all times. In some situations, additional monitoring by the SHSO may be needed to confirm or establish the proper level of protection before the sampling team can proceed.

10.4.4 Sample Handling

Personnel responsible for the handling of samples shall wear the prescribed level of protection described in Section 10.2. Samples shall be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions should be noted. Laboratory personnel shall be advised of sample hazard level and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or inclusion of a written statement with the samples. It may be necessary for the SHSO to review safety procedures in handling Yard samples to assure that these practices are appropriate for the type of suspected contaminants in the sample.

10.4.5 Waste Disposal

All waste disposal operations shall be monitored by the SHSO and performed using the appropriate level of personal protection. Personnel shall wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance shall be practiced at all times.

10.4.6 Confined Space Entry

The proposed scope of work does not require personnel to enter any confined space during the conduct of this project. Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pit and diked areas, vessels, and silos.

A permit required confined space is one that meets the definition of confined space, and has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- contains any other recognized serious safety or health hazards (29 CFR 1910.146 b).

A non permit confined space "does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm (29 CFR 1910.146 b).

Although no confined space entry is scheduled for work at OU-3, there is a possibility that "out of scope" work requires entering a manhole, recovery well, etc. Should this occur, the following activities will be performed prior to entry.

1. The cover protecting the vault, manhole, etc. will be removed several hours before the sampling activity (e.g., water-level measurement, sampling, etc.) occurs to allow for natural ventilation. (NOTE: Provide a temporary barrier around this area to prevent an accidental fall, or foreign objects from entering this space.)
2. Before entering, the internal atmosphere shall be tested with direct reading instruments for the following:

   - oxygen content - oxygen meter;
   - flammable gases and vapors - combustible gas indicator; and
   - potential toxic air contaminants - PID or flame ionization detector (FID).

3. If a hazardous atmosphere is detected during entry, the employee shall leave the space immediately and procure protective equipment before any re-entry takes place.

10.4.7 Additional Safe Work Practices

Refer to the SHSO for specific concerns on each individual OU-3 task. The safety rules listed below must be strictly followed:

- employ the "buddy system" for any Work Zone activities;
- practice contamination avoidance, both onsite and offsite; and
- plan activities ahead of time.

11.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA 29 CFR 1910.120 to be available for use and is included below. A copy of this plan shall be posted in the Support Zone at each work site.

11.1 Site Emergency Coordinator(s)

The SHSO shall act as the Site Emergency Coordinator to make contact with the local fire, police and other emergency units prior to beginning work onsite. In these contacts, the SHSO will inform the emergency units about the nature and duration of work expected on the Site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants.

The SHSO or his designee shall implement this emergency plan whenever conditions at the Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of Yard personnel as necessary, and notification of emergency response units and the appropriate management staff.

11.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn or other appropriate device will be sounded by the SHSO for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified in advance by the SHSO. Under no circumstances will incoming personnel or visitors be allowed to proceed into the evacuated area once the emergency signal has been given. The SHSO must see that access for emergency equipment is provided and that all combustible apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. The hospital route will be posted onsite (Figure C-1). Any other evacuation routes will be specified by the appropriate emergency personnel.

11.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Work Zone as described above (Section 11.2); and
- notify fire department and security.

11.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person onsite to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups should be contacted. Those groups will alert National or Regional Response Teams as necessary. The personnel listed below shall be notified as necessary.

Type	Name	Telephone #
Fire Department		(718) 847-6600
Hazardous Material Emergency Response		911
Police Department	Amtrak Police Department	(212) 630-7113
Ambulance		911
Poison Control Center		(800) 962-1253
Hospital	Astoria General Hospital	(718) 932-1000
Penn Station Control Center		(212) 630-7465
National Response Center (Release or Spill)		(800) 424-8802
Site Health and Safety Officer	Harry Gregory	Work: (516) 232-2600 Beeper: 1-888-518-0833
Health and Safety Manager	Thomas Dwyer	(516) 232-2600
Project Manager	Harry Gregory	Work: (516) 232-2600 Beeper: 1-888-518-0833

11.5 Personal Injury

Emergency first aid shall be applied onsite as deemed necessary to stabilize the patient. Notify the emergency units as deemed necessary.

11.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated onsite as follows.

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided onsite at the CRZ and/or support zone as appropriate. Eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration	Decontaminate and transport to emergency medical facility. SHSO will provide medical data sheets to medical personnel as requested.

11.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without sacrificing the health and safety of any field workers. Some of the items to be considered prior to determining if work should continue are:

- heavy rainfall;
- potential for heat stress;
- potential for cold stress and cold-related injuries;
- limited visibility;
- potential for electrical storms;
- potential for malfunction of health and safety monitoring equipment or gear; and
- potential for accidents.

12.0 AUTHORIZATIONS

Personnel authorized to enter the Site while operations are being conducted must be approved by the SHSO and the Project Manager. This document will be completed when the subcontractors have assigned trained personnel for this Site. Authorization will require completion of appropriate training courses, medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates personnel are authorized to perform work onsite:

1. Joseph Duminuco
2. Harry Gregory
3. Peter Barczak
4. Linda Wilson
5. Jeffrey Makowski
6. Noelle Clarke
7. Nicole Gorelick
8. Kurt Klotzer
9. Tom Lindberg
10. Andrew McVicker
11. Joshua Orris
12. Omar Ramotar
13. Michael Roux
14. Joanne Yeary

6. Peter Gerbasi
7. Christopher Clark
8. William Fisher
9. Robert Tweeddale
10. George Topany
11. Thomas Dwyer
12. Justin Kennedy
13. Eric Kramer
14. Charlie McGuckin
15. Neil O'Halloran
16. Jennifer Parisi
17. Marie Rangel
18. Edward Wong
19.

Other personnel authorized to enter the Site are:

1. Amtrak Employees
2. Drilling Contractors
3. Waste Disposal Contractors
4. Surveyors
5. LIRR Employees

6. NYSDEC Representatives
7. NYSDOH Representatives
8.
9.
10.

13.0 FIELD TEAM REVIEW

Each person entering the Yard and each field member shall sign this section after site-specific training is completed and before being permitted to work onsite.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provisions contained therein.

Site/Project: ______________________________

Name Printed	Signature	Date

Table C-1. **Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Operable Unit 3, Sunnyside Yard, Queens, New York**

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Trichloroethene	79-01-6	270 50 ppm	None	270 50 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Kidney damage Liver damage Heart damage	CNS skin eyes kidney liver CVS	Liquid BP = 189°F flammable LEL = 12.5% UEL = 90%
Toluene	108-88-3	375 100 ppm	2,000	375 100 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP = 232°F flammable LEL = 1.2% UEL = 7.1%
1,2-Dichloroethene	540-59-0	790 200 ppm	4,000	790 200 ppm	Dermal; ingestion; inhalation	CNS depressant Epigastric cramps Sensory irritant Dermatitis	CNS stomach skin	Colorless liquid BP = 118-140°F LEL = 9.7% UEL = 12.8%
Petroleum hydrocarbons (Petroleum distilled)	8002-05-9	1,600 400 ppm	10,000	1,600 400 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP = 86-460°F UEL = 5.9% LEL = 1.1% Flammable
Chromium	7440-47-3	0.5	None	1	Dermal; inhalation; ingestion	Decreased pulmonary function Sensory irritant	lung skin eyes	Steel gray metal

LV - Threshold Limit Value
ng/m^3 - milligrams per cubic meter
DLH - Immediately dangerous to life or health
pm - parts per million
EL - Permissible Exposure Limit
NS - Central Nervous System
VS - Cardiovascular System
I - Gastrointestinal

BP - Boiling Point
LEL - Lower Explosive Limit
UEL - Upper Explosive Limit
°C - degrees Celcius
°F - degrees Fahrenheit

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Operable Unit 3, Sunnyside Yard, Queens, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Arsenic	7440-38-2	0.2	None	0.5 organic 0.01 - inorganic	Dermal; inhalation; ingestion	Sensory irritant Lung & skin cancer Aplastic anemia Numbness	skin eyes lungs blood peripheral nervous system	Silver gray - tin white BP = sublimes
Lead	7439-92-1	0.15	700	0.2	Dermal; inhalation; ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP = 3,164°F
Zinc	7440-66-6	10	None	10	Dermal; inhalation; ingestion	Skin irritant Cough	skin lungs	Bluish-white metallic element BP = 908°F
Copper (dusts and mists)	7440-50-8	1	None	1	Dermal; inhalation; ingestion	Sensory irritant GI irritation CNS depressant	skin eyes GI tract CNS	Reddish metal BP = 4,730°F Powdered form may ignite
Aroclor 1254	11097-69-1	0.5 (Skin)	None	0.5 (Skin)	Dermal; inhalation; ingestion	Eye, skin irritation Acne form dermatitis Potential carcinogen	skin eyes liver	Colorless to pale yellow mild hydrocarbon odor nonflammable

LV - Threshold Limit Value
g/m^3 - milligrams per cubic meter
)LH - Immediately dangerous to life or health
om - parts per million
EL - Permissible Exposure Limit
NS - Central Nervous System
VS - Cardiovascular System
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BP - Boiling Point
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Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Operable Unit 3, Sunnyside Yard, Queens, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Chrysene	218-01-9	0.1	None	0.2	Dermal	Mutagen Carcinogen	NA	White crystals
Aroclor 1260	11096-82-5	0.001	None	None	Dermal; inhalation; ingestion	Liver damage Nausea Abdominal pain	liver skin	Colorless Mild hydrocarbon odor
Benzo(a)pyrene	50-32-8	None	None	None	Dermal; inhalation; ingestion	Teratogen carcinogen	Reproductive lung skin	Yellowish needles; BP = 312°F
Manganese	7439-96-5	1.0 fume	10,000	5.0	Inhalation; ingestion	Metal fume fever Apathy Anorexia Insomnia Headaches	Resp. system CNS blood kidneys	Lustrous, brittle, silvery solid BP = 3,564°F

V - Threshold Limit Value
g/m^3 - milligrams per cubic meter
LH - Immediately dangerous to life or health
m - parts per million
L - Permissible Exposure Limit
S - Central Nervous System
S - Cardiovascular System
- Gastrointestinal

BP - Boiling Point
LEL - Lower Explosive Limit
UEL - Upper Explosive Limit
°C - degrees Celcius
°F - degrees Fahrenheit

References

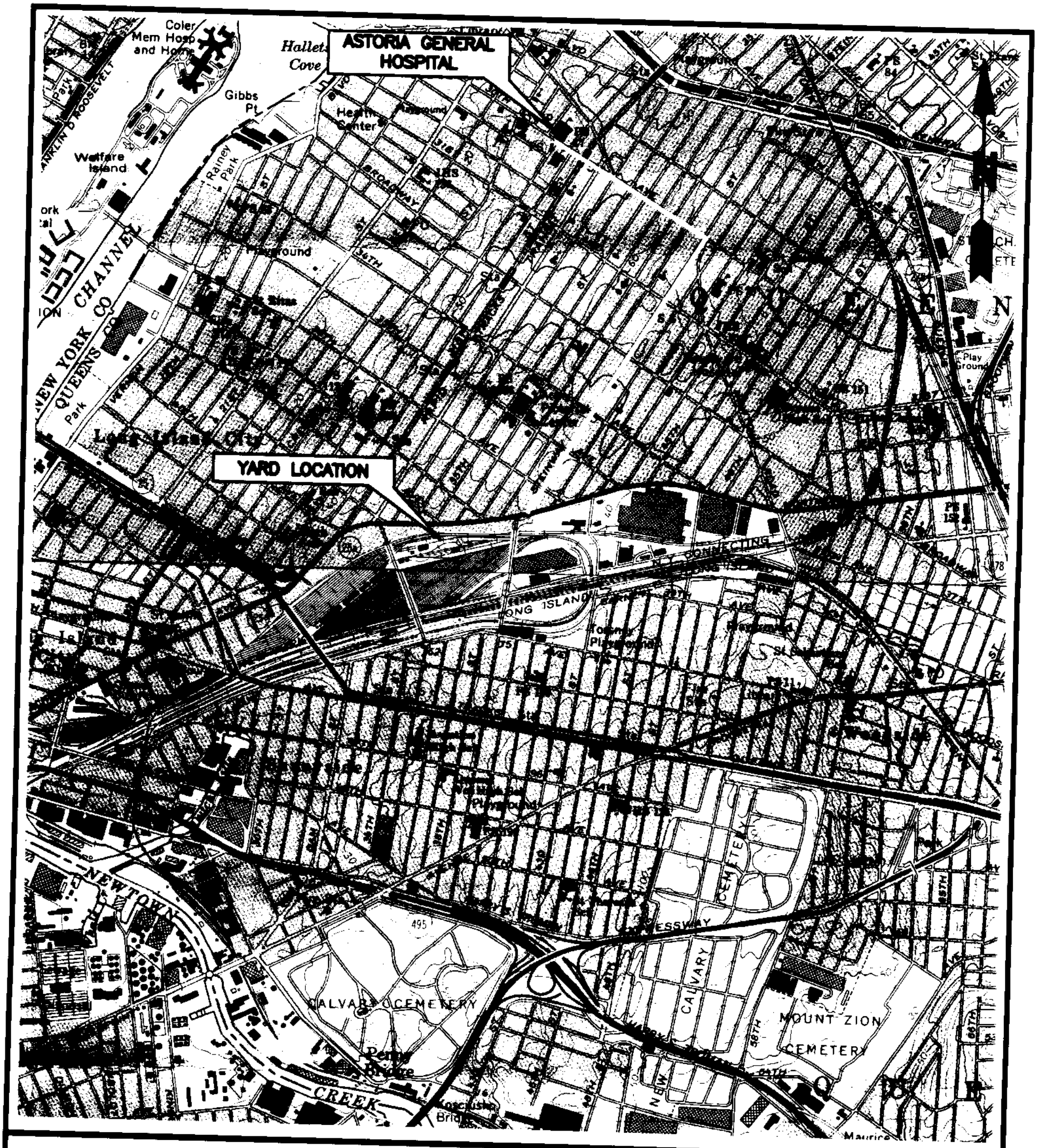
Guide to Occupational Exposure Values. 1990. American Conference of Governmental Industrial Hygienists.

Proctor, N.H., J.P. Hughes and M.L. Fischman. 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.

Sax, N. 1987. Hawley's Condensed Chemical Dictionary. 11th Edition Van Nostrand and Reinhold Company.

Sax, N.I. and R.J. Lewis. 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.

U.S. Department of Labor. 1990. OSHA Regulated Hazardous Substances, Industrial Exposure and Control Technologies Government Institutes, Inc.



EMERGENCY ROUTE

DIRECTIONS TO ASTORIA GENERAL HOSPITAL:

FROM HONEYWELL STREET MAKE RIGHT ON NORTHERN BOULEVARD. MAKE LEFT AT STEINWAY STREET, THEN LEFT AT 30th AVENUE. HOSPITAL AT CRESCENT AND 30th AVENUE.

Title:

ROUTE FROM SUNNYSIDE YARD TO ASTORIA GENERAL HOSPITAL

SUNNYSIDE YARD
39-29 HONEYWELL STREET
QUEENS, NEW YORK

Prepared For:

AMTRAK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.R.	Date: 1/99	FIGURE 1
Prepared by: G.M.	Scale: 1"=2,000'	
Project Mgr: H.G.	Office: NY	
File No:		

TYPICAL DECONTAMINATION LAYOUT
LEVEL D DECONTAMINATION PROCEDURES

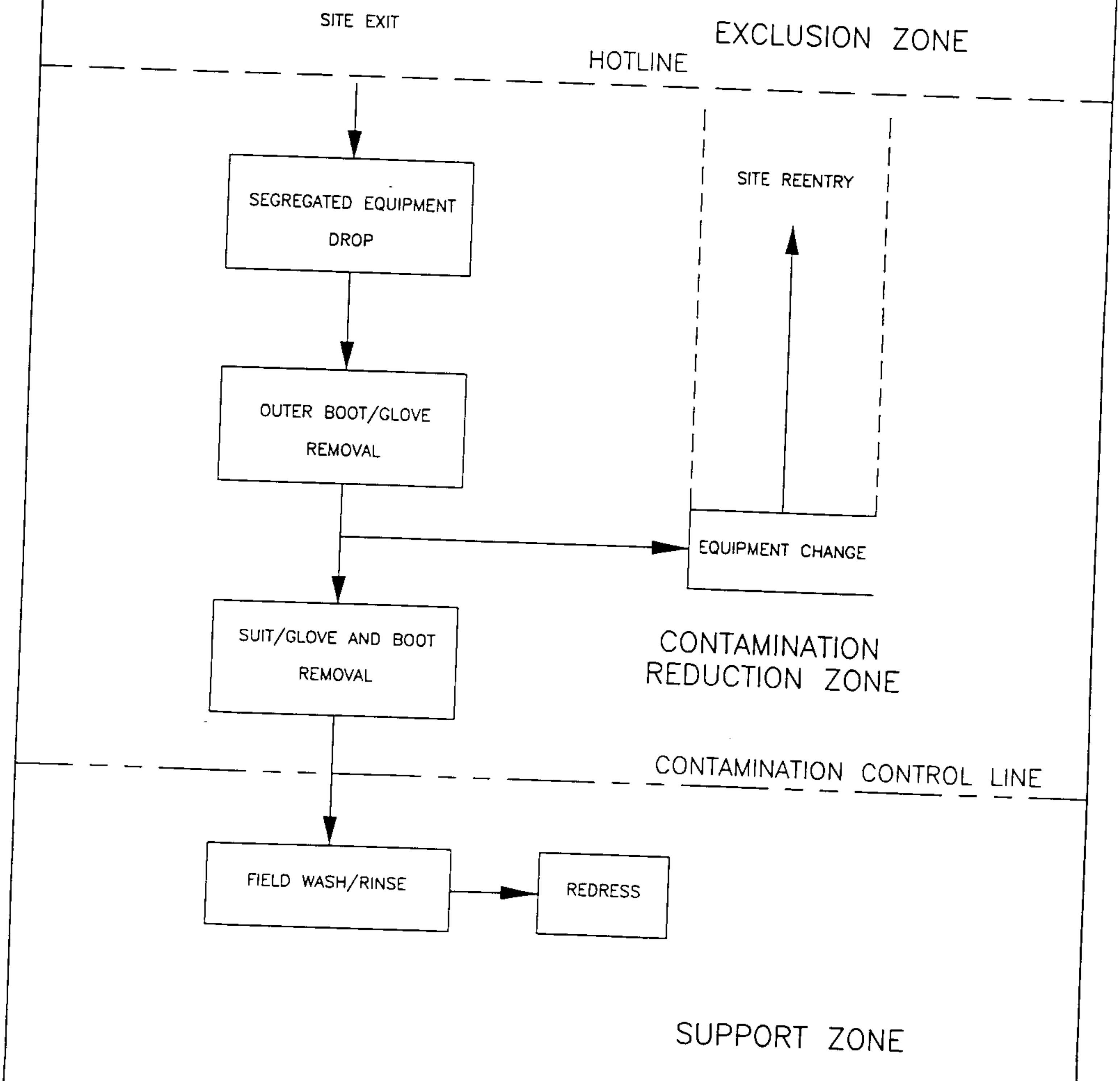


FIGURE C-2

TYPICAL DECONTAMINATION LAYOUT

LEVEL C PROTECTION

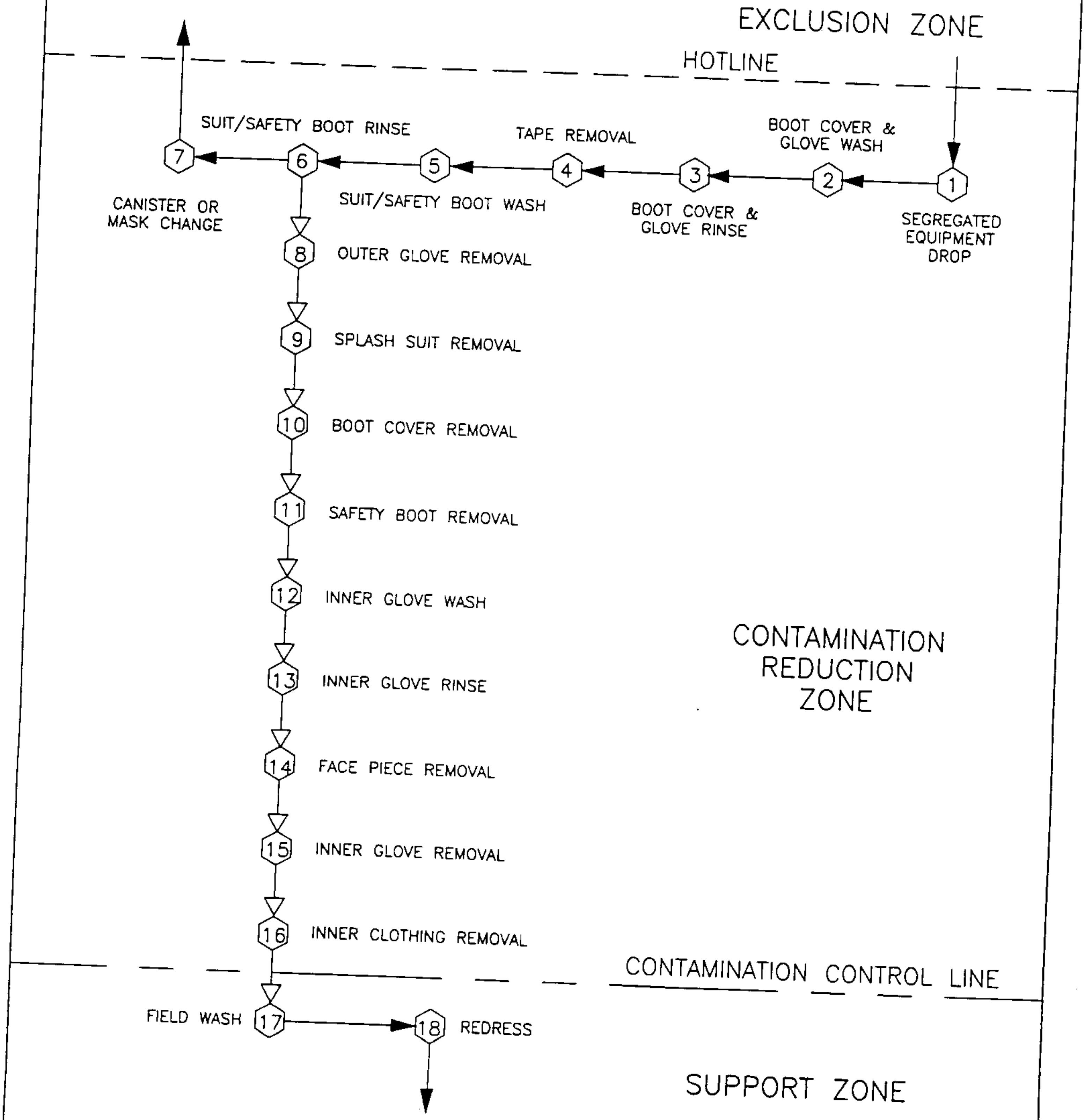


FIGURE C-3

TYPICAL DECONTAMINATION LAYOUT

LEVEL B PROTECTION

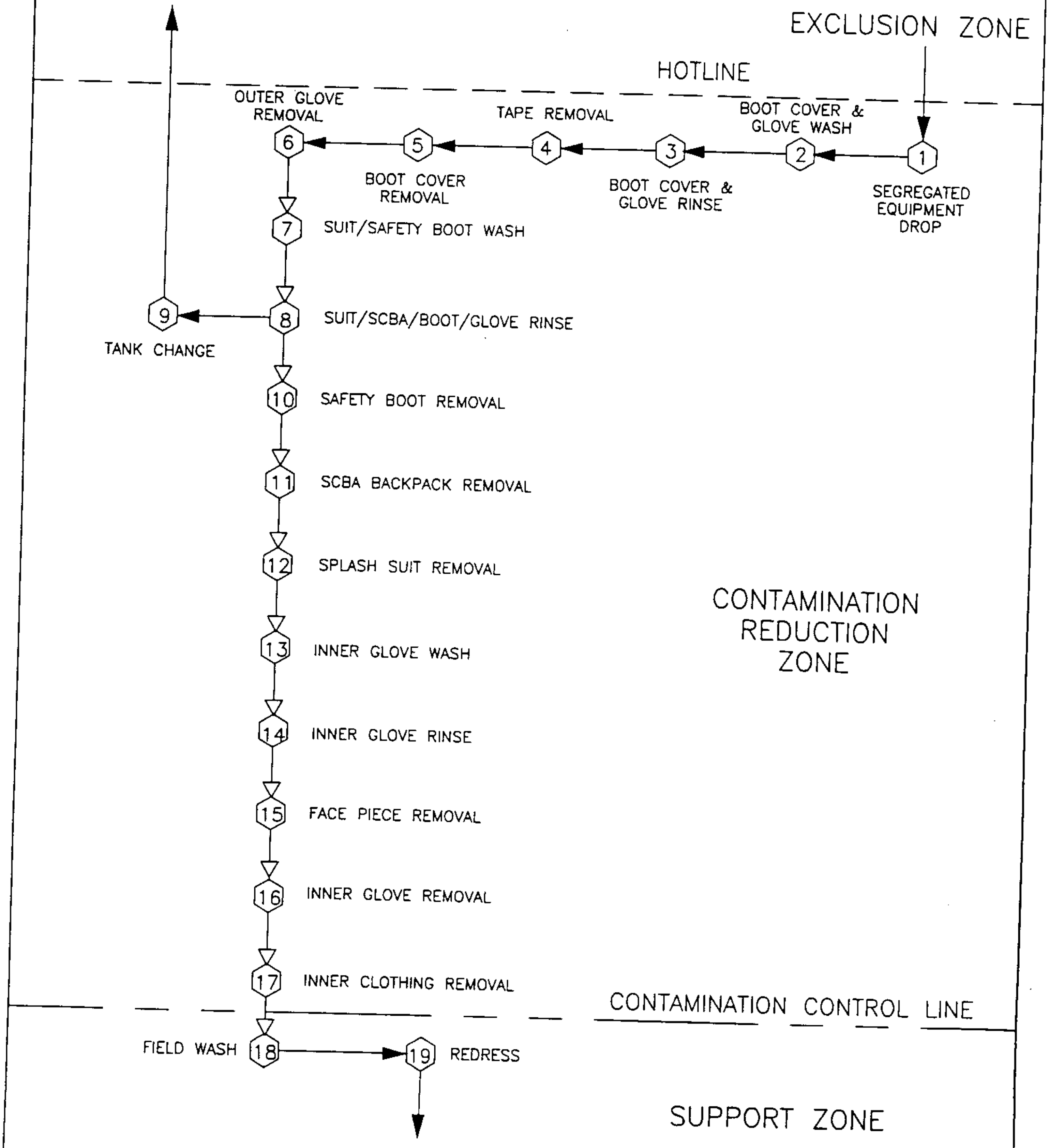


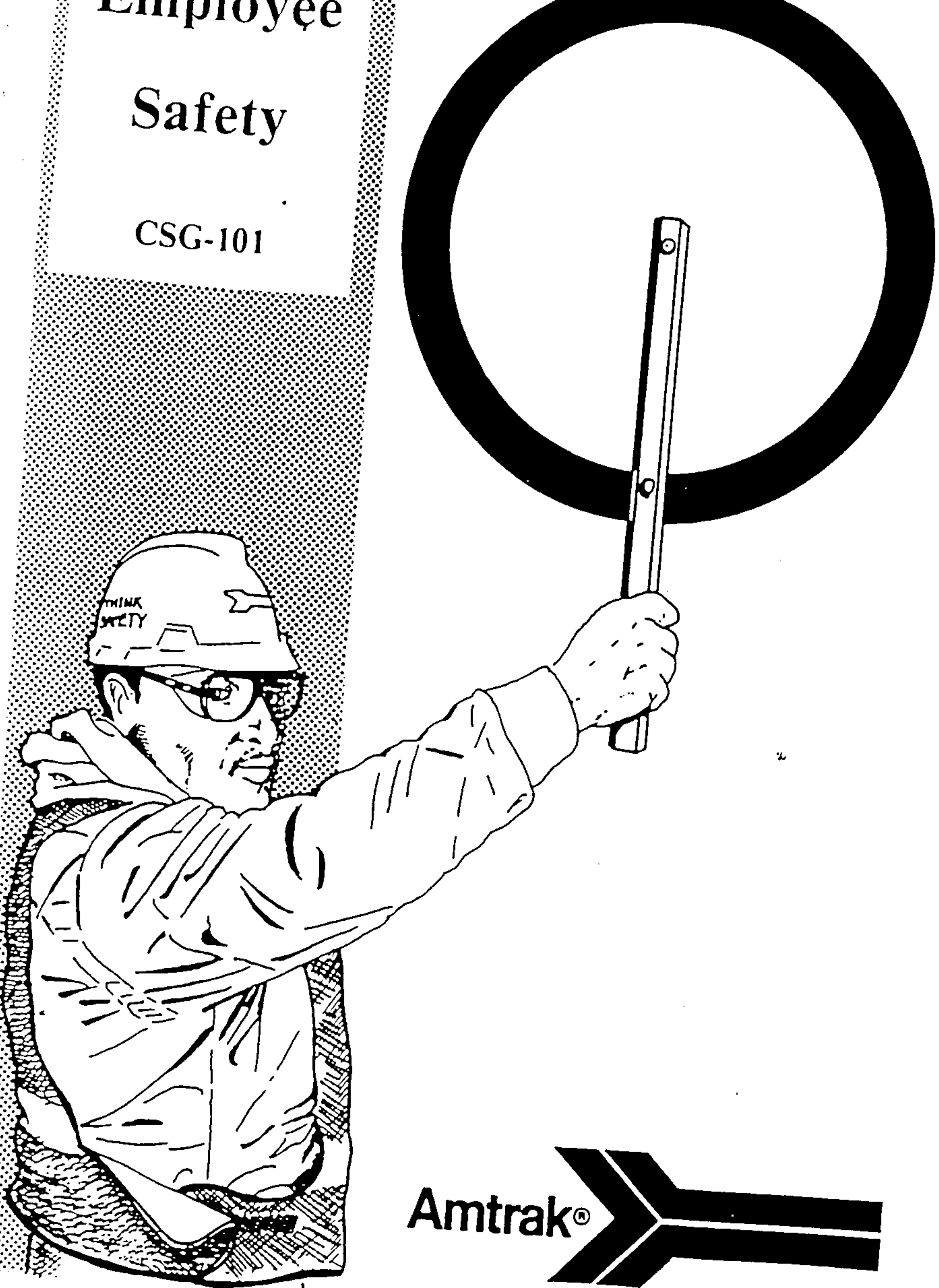
FIGURE C-4

ATTACHMENT 1

Amtrak Contractor Employee Safety Program

Contractor Employee Safety

CSG-101

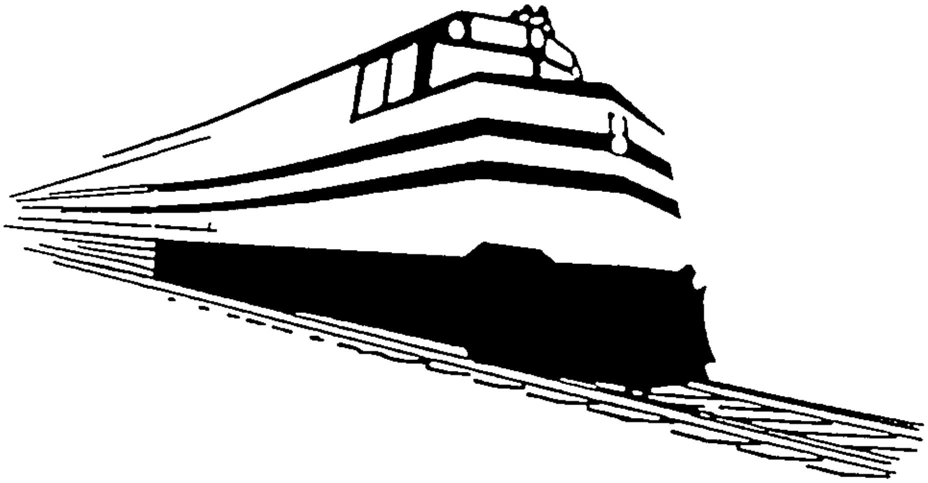


Amtrak®

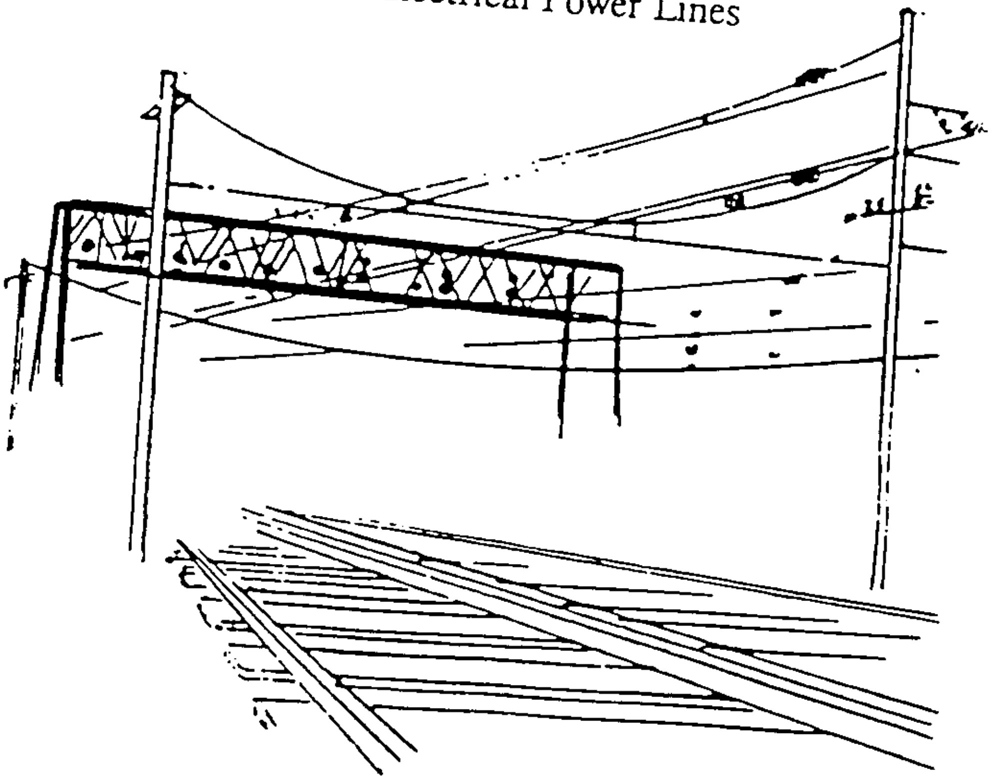
National Railroad Passenger Corporation,
Washington, D.C. 20001.

Danger! Danger! Danger!

Two of the biggest dangers involved with working on or about railroad tracks are:



Moving Trains
and
Electrical Power Lines



Basic Terminology (Continued)

Occupancy — Any use of track other than direct crossing at right angles or infrequent use.

Infrequent Use — Crossing a track or tracks at a right angle by personnel only, or the infrequent fouling of an outside rail by a person or persons.

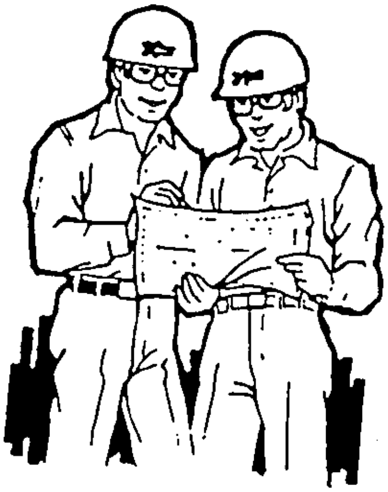
Obstruction or Fouling — An entering into the traffic envelope; also referred to as fouling.

Traffic Envelope — Area between clearance points and rails and overhead power lines.

Clearance Points — A point 15 feet from the centerline of outside track for employees and standing equipment.

Right-of-Way — The limits of railroad property ownership on either side of tracks.

Clothing and Personal Protective Gear



Your clothing must fit well and not be torn badly.

Your shoes must be at least six inches high, preferably leather, and completely laced, buckled, zipped, or otherwise fastened. The shoe must have a definite heel.

Do NOT wear shoes with loose, thin, cracked, rippled, or wedge type soles. Do NOT wear shoes with a metal plate or cleat on the sole or heel. Do NOT allow shoe laces to dangle far enough to be a hazard.

Do NOT wear sandals, open toe, canvas, or other shoes that cannot be fastened.

Basic Rules of Conduct

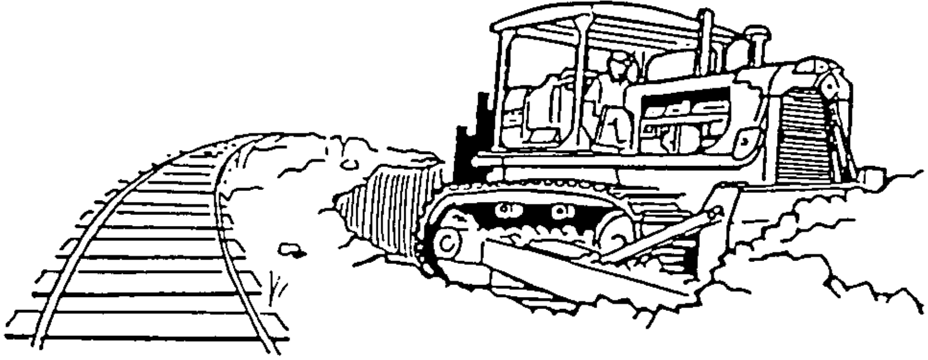
1. You may <u>NOT</u> possess, consume, or be under the influence of intoxicants, narcotics, or other mood altering substances, including medication.

2. Horseplay, fighting, practical jokes, scuffling, or wrestling are not tolerated.

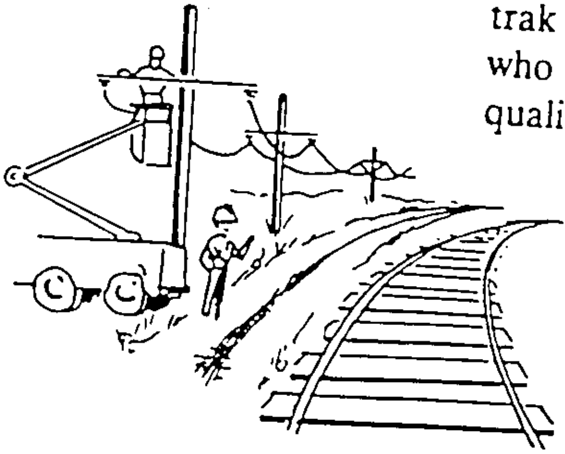
3. You must report any unsafe or hazardous conditions to your supervisor so that corrective actions can be taken.

Contractor's Responsibilities
(Continued)

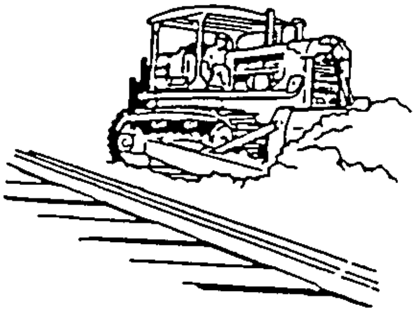
Equipment must be in first-class condition to prevent delays to the trains. Contractors must have permission before placing or putting into service equipment near the track.



Contractor's employees and equipment may work near overhead wires and electrical apparatus ONLY when protected by a Class A Amtrak employee (that is, one who has been trained and qualified to protect you).

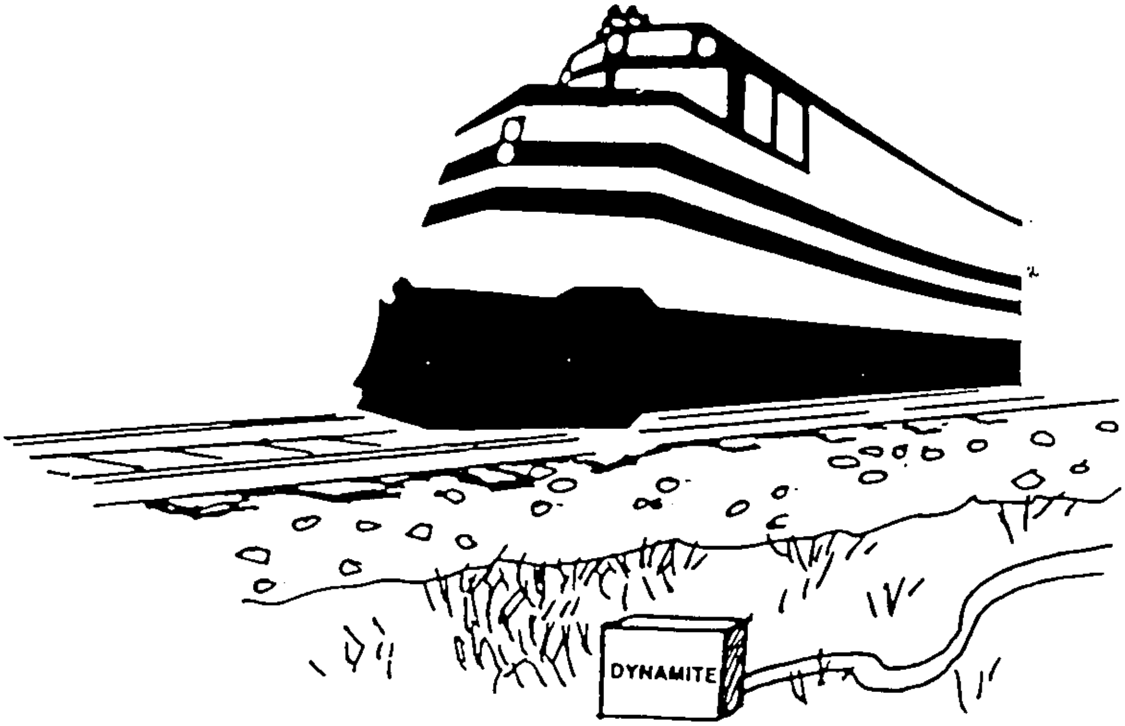


Removing Track from Service
(Continued)



4. Excavations are made under operating tracks or excavations affect the stability of adjacent tracks.

5. Any other conditions, circumstances, or situations that may present a danger to the safe movement of trains.



Main Points for
"No Second Chance"

1. People are killed too frequently because they try to cross active track.

2. Crossing active track is difficult for several reasons:

    a. Tracks and rails offer poor footing.

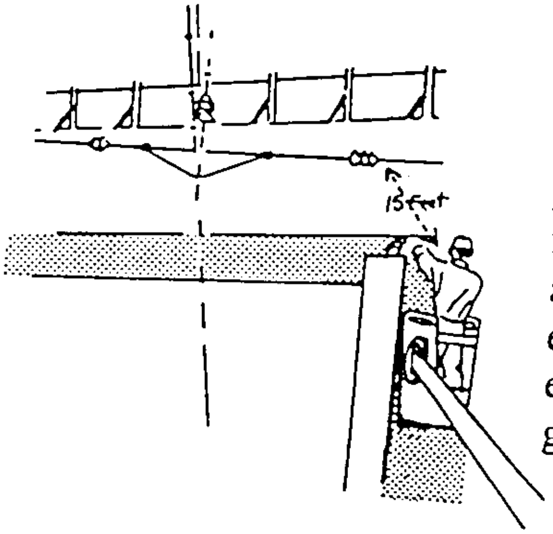
    b. As many as 200 trains run each day in certain areas.

    c. There may be high voltage electric lines nearby or underfoot.

Working Near Electrical Lines

Many Amtrak trains operating in the northeastern states are electrically powered. The source of this electricity can be either wires running over the track or a "third rail" on the track. These and all electrical lines near the railroad are very dangerous and should be considered energized, or live.

To avoid the hazards of these wires, there are several work practices you must follow.

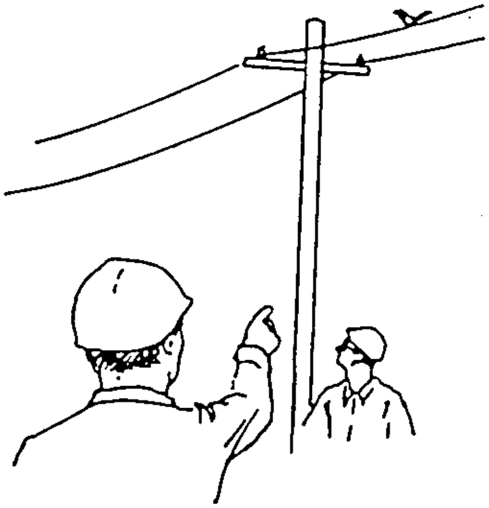


Stay at least 15 feet away from any energized line. Do NOT approach closer than 15 feet to an electrical wire or apparatus unless a Class A employee tells you it is de-energized and properly grounded.

You must follow all instructions from the Class A employee. If you do not understand the instructions, you will not be permitted to work or observe.

Working on De-Energized Lines

When you must work within 15 feet of electrical lines, you must make certain the lines are de-energized and properly grounded.



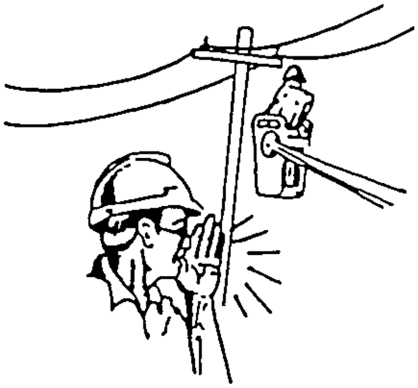
At the start of each tour of duty, the Class A employee will instruct the contractor foreman in how to avoid the dangers that may exist.

Before work can be started on or about power lines, an electrical clearance must be obtained by the Class A employee. All equipment must be de-energized and grounded. The Class A employee will then inform the contractor foreman about wires, equipment, and/or apparatus which are de-energized and the physical limits in which work can be done safely.

The contractor foreman must sign a standard clearance form. His/her signature is assurance that he/she fully understands the instructions given by the Class A employee and has accepted the responsibility of conveying these same instructions to his/her gang.

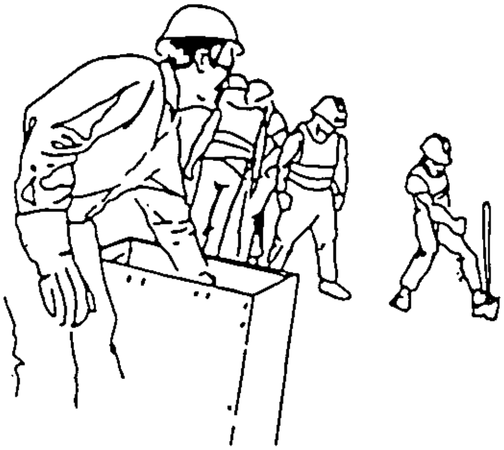
Re-Energized Electrical Lines

When the electrical lines, equipment, etc. are to be re-energized, you must move away at least 15 feet.



When the clearances are to be released and the lines re-energized, the Class A employee will inform the contractor foreman and each employee.

The Class A employee must be sure that everyone has moved away a safe distance before removing the grounding devices.



The Class A employee also will get the signature of the contractor foreman, showing that he and the workgang have been told the wires, etc., will be re-energized and that they will stay a safe distance until informed otherwise by the Class A employee.

National Railroad Passenger Corporation, Pennsylvania Station, New York, NY 10001

Amtrak

AMTRAK

CONTRACTOR SAFETY PROGRAM

NEW YORK DIVISION

SUPPLEMENT

AREA CONSTRUCTION ENGINEER

212-630-7328

AMTRAK TUNNELS

Amtrak has six tunnels. Under the East River are Lines 1, 2, 3 & 4. Under the Hudson River, there is the North and South Tubes. When walking the tunnels, there are bench walls on each side of the tunnel that are used for walking. Along the entire length of the bench walls (2 per tunnel) there is a handrail. Between Lines 1 & 2, 3 & 4, and the North and South Tubes, there are crosspassages equipped with fire doors.

In Lines 1, 2, 3 & 4 there are marked emergency exits to street level at 1st Avenue and at Long Island City. In the North and South Tubes, there is an emergency exit between 10th Avenue and 11th Avenue at 33rd Street, and also at Weehawken.

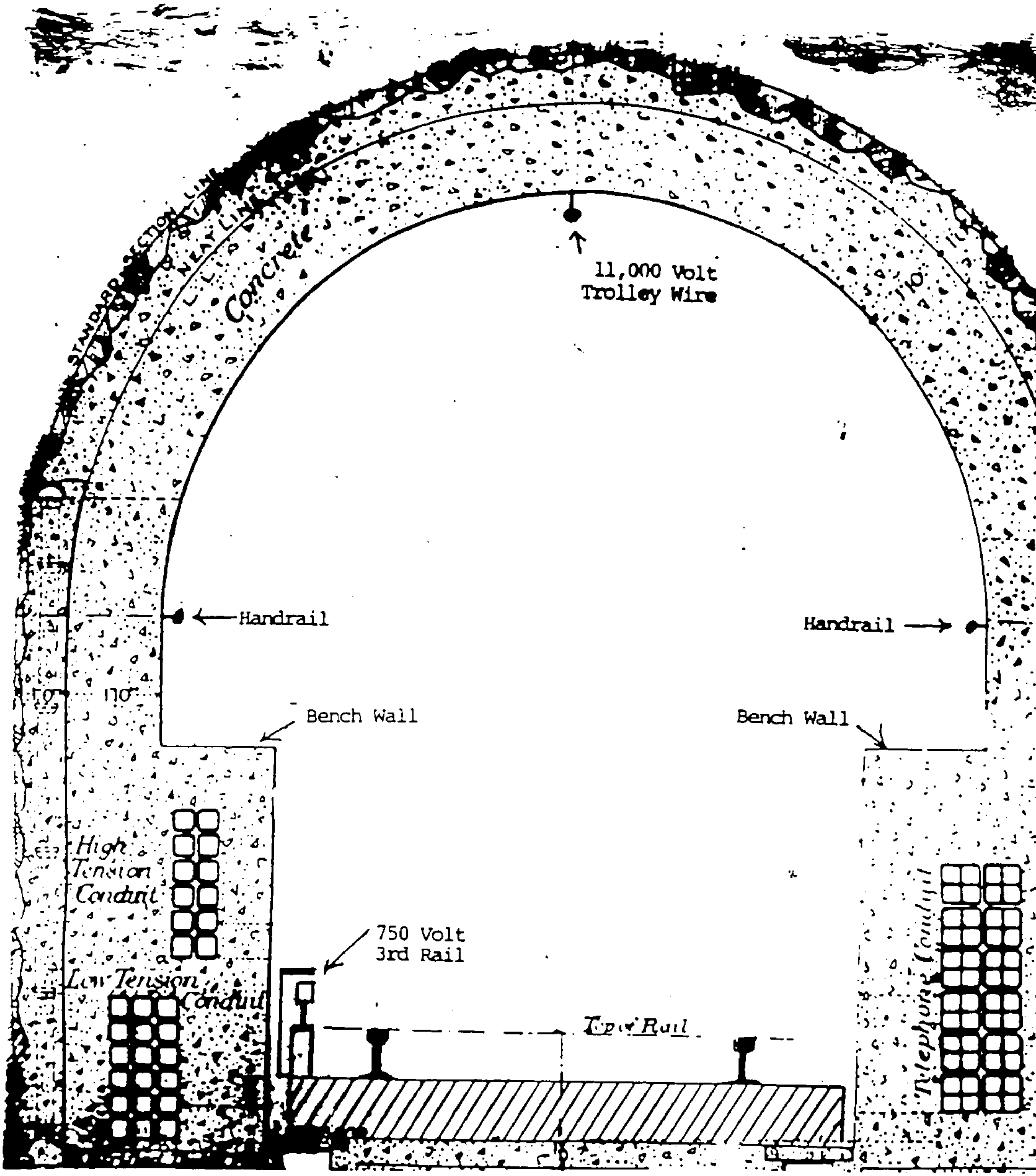
Trolley wire supported from the arch of the tunnel is 11,000 volts. At track level, there is a 750 volt 3rd rail, which is also located throughout Penn Station. Also at track level are man holes set into the bench wall, along with hand holds used to lower oneself to track level.

When walking through any of the Tunnels, have a strong flashlight to guide your passage. As the train enters the tunnel, a rush of air will be felt, getting stronger as the train gets closer. Hold onto the handrail until the train passes and the rush of air subsides, you can continue walking. The train <u>will not</u> pull you into its path. Along some sections of the benchwall, there are leaks that have made the benchwall slippery. Use <u>extreme caution</u> in these areas. Use <u>extreme caution</u> along the edges of the benchwall, and walking over the steel gratings set in the top of the benchwall.

When coming to a crosspassage, if the firedoors are open or missing, <u>DO NOT</u> go into the crosspassage or stand in front of it if a train is coming. There will be a <u>strong</u> wind going through the crosspassage that will knock you off your feet and cause possible injury. Only go into the crosspassage if one or both doors will be closed.

DO NOT use a steel tape or any steel measuring device in the tunnel because of the 11,000 volt catenary suspended from the arch of the tunnel, and the 750 volt 3rd rail at track level.

When at track level, handholds are set into the top and sides of the benchwall to be used when decending to track level. When at track level and a train enters the tunnel, and there is insufficient time to get back up onto the benchwall, man holes are set into the sides of the benchwall for protection against the train. These man holes are not DEEP, but there is room enough to position yourself for protection against the train. <u>DO NOT PANIC</u>, just keep your wits about you. If common sense prevails, your work will be done safely.



Typical view of Amtrak's Tunnels

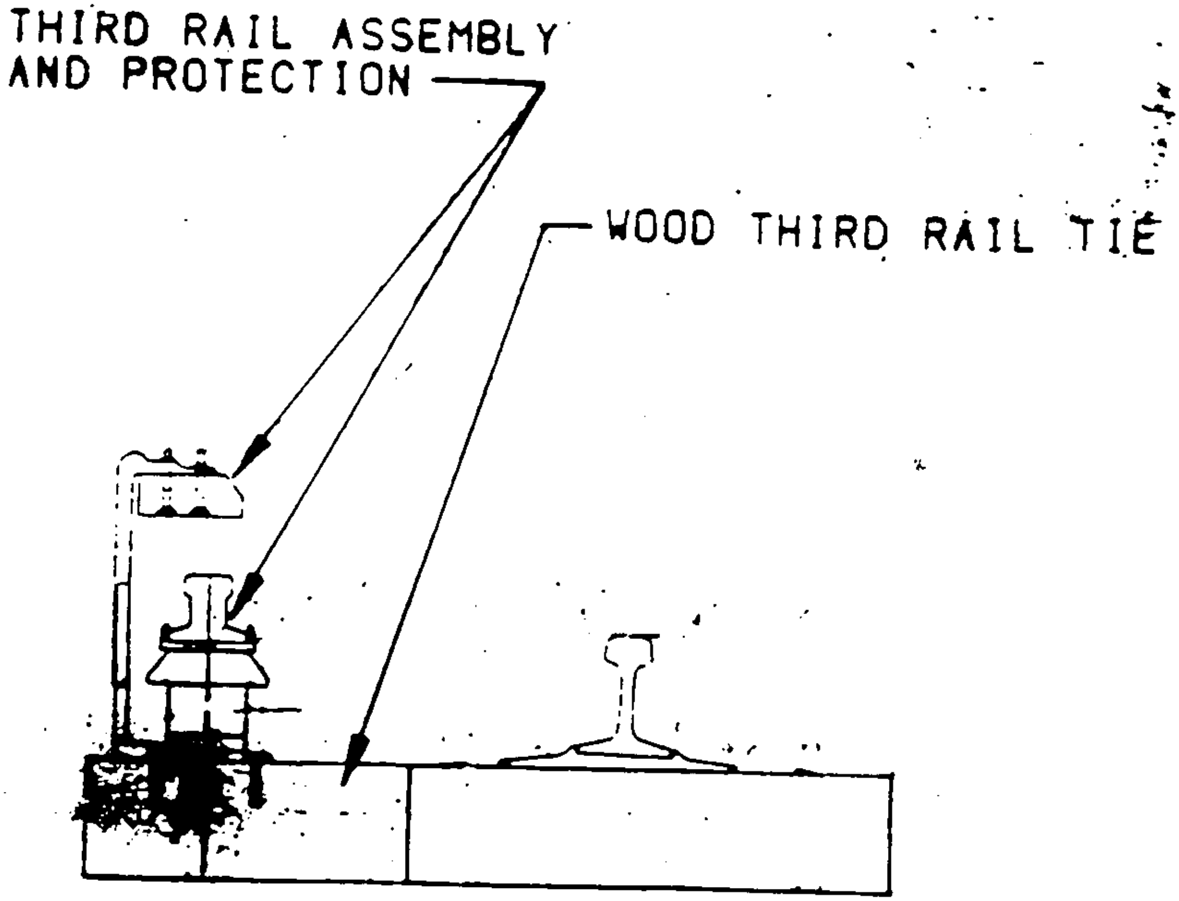
Lines 1, 2, 3 & 4 under the East River

North and South Tubes under the Hudson River

TYPICAL 3rd RAIL INSTALLATION

IN AMTRAK'S TUNNELS

AND IN PENN STATION



CONTRACTOR RESPONSIBILITY

During the demolition procedure, the Contractor must provide an approved shield to prohibit all debris from falling onto Railroad right-of-way. A grounded temporary protective barrier must be provided if the existing protective barrier is removed during the demolition procedure. In addition, if any openings are left in the existing deck, a protective fence must be erected at both ends of the bridge to prohibit trepassers from entering over the unprotected area of the Railroad.

The Contractor shall conduct his work and handle his equipment and materials so that no part of any equipment shall foul an operated track or wire line without the written permission of the Assistant Chief Engineer, Design and Construction, of the Railroad. When the Contractor desires to foul an operated track, he must give the Assistant Chief Engineer, Design and Construction of the Railroad, written notice of his intentions twenty-one (21) days in advance, so that if approved, arrangements may be made for proper protection of the Railroad.

Cranes, shovels, or any other equipment shall be considered to be fouling the track when located in such position that failure of same with or without load, brings the equipment within the fouling limit. The Contractor's employees and equipment will not be permitted to work near overhead wires or apparatus, except when protected by a Class "A" employee of the Railroad who will take necessary precautions for their safety before starting and during the progress of such work. The Contractor must supply a grounding cable (4/0 copper or equivalent ACSR) for each piece of equipment working adjacent to any electrified lines.

Equipment of the Contractor to be used adjacent to the tracks shall be in first-class condition so as to fully prevent failures of defective equipment that might cause delay in the operation of trains or damage to Railroad facilities. His equipment shall not be placed or put into operation adjacent to tracks without first obtaining permission from the Assistant Chief Engineer, Design and Construction of the Railroad, or his duly authorized representative. Under no circumstances shall any equipment or materials be placed or stored within fifteen (15) feet from the centerline of the outside track. To insure compliance with this requirement, the Contractor must establish a fifteen (15) foot foul line prior to start of work by either driving stakes and taping off the work area, erecting a temporary fence, or providing an alternate method approved by the Railroad. The Contractor will be issued warning stickers which must be placed in the operating cab of all equipment as a constant reminder of the fifteen (15) foot clearance envelope.

ATTACHMENT 2

Incident Report

INCIDENT REPORT

Site ______________________________

Site Location ______________________________

Report Prepared By ______________________________

Name Printed Title

Incident Category (Check all that apply)

______ Injury
______ Near Miss
______ Motor Vehicle
______ Mechanical
______ Illness
______ On-Site Equipment
______ Fire
______ Other
______ Property Damage
______ Chemical Exposure
______ Electrical

Date and Time of Incident ______________________________

Names of Persons Injured (see end of report for details)

____

____

____

NARRATIVE REPORT OF INCIDENT

(Provide sufficient detail so that the reader may fully understand the actions leading to or contributing to the incident, the incident occurrence, and actions following the incident. Append additional sheets of paper if necessary.)

____

____

____

____

____

____

WITNESSES TO INCIDENT

1. Name ______________________ Company ______________________
   Address ______________________
   Telephone No. ______________________
   ____

2. Name ______________________ Company ______________________
   Address ______________________
   Telephone No. ______________________
   ____

PROPERTY DAMAGE

Brief Description of Property Damage ______________________
____
____
____

Estimate of Damage ______________________
____

INCIDENT LOCATION

____
____

INCIDENT ANALYSIS

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions): ______________________
____

Was weather a factor? ______________________________

Unsafe mechanical/physical/environmental condition at time of incident (be specific) ______________________________

Unsafe act by injured and/or others contributing to the incident (be specific, must be answered) ______________________________

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue) ______________________________

ON-SITE INCIDENTS

Level of personal protection equipment required in Site Safety Plan ______________________________

Modifications ______________________________

Was injured using required equipment? ______________________________

INCIDENT FOLLOW-UP

Date of Incident ______________________________

Site ______________________________

Brief Description of Incident ______________________________

____

____

Outcome of Incident ______________________________

____

____

Physician's Recommendations ______________________________

____

____

Date Injured Returned to Work ______________________________

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT 3

Site Safety Follow-Up Report

SITE SAFETY FOLLOW-UP REPORT

This section must be filled out and returned to the Site Safety Officer after each site visit or task.

Person Responsible for Follow-up Report ______________________

Actual Date of Work ______________________

ACTUAL SITE INVESTIGATION TEAM

Roux Personnel	Responsibility

Other Interested Parties	Affiliation	Purpose of Visit

PERSONAL PROTECTIVE EQUIPMENT

Level of Respiratory Protection Used	Activity Performed

Field Dress	Activity

MONITORING EQUIPMENT

HNU/OVA/CGI

- Background reading ____________________
  - Readings above background? ____________________
  - Location of high readings ____________________

Radiation

- Readings above background? ____ Yes ____ No
- If yes, specify where readings were found and what action was taken

____

____

GENERAL SAFETY

Were any safety problems encountered while on site?

Explain ____

____

____

____

____

ACCIDENT REPORT INFORMATION

Did Any Team Member Report	Yes	No
• Chemical exposure	_____	_____
• Illness, discomfort, or unusual symptoms	_____	_____
• Environmental problems (heat, cold, etc.)	_____	_____

Explain ____

____

____

____

____

Was an Employee Exposure/Injury Incident Report Completed? _____ Yes _____ No

ATTACHMENT 4

Field Change Request Form

FIELD CHANGE DOCUMENTATION

DATE: ____________________ FIELD CHANGE #: ________________

PERSON REQUESTING CHANGE: ____

COMPANY/TITLE: ____

FIELD CHANGE: ____

____

____

____

REASON FOR FIELD CHANGE: ____

____

____

____

____

ACKNOWLEDGEMENT: ____

WORK PLAN ADDENDUM REQUIRED (Y/N): ______________________________

ADDENDUM SUBMITTED TO: ____

ADDENDUM SUBMITTED TO: ____

CITIZENS' PARTIPATION PLAN

Operable Unit 3
Sunnyside Yard
Queens, New York

Appendix D

June 23, 1997

(Revised January 13, 1999)

ROUX ASSOCIATES, INC.

CITIZEN PARTICIPATION PLAN

SUNNYSIDE RAIL YARD, QUEENS, NY

This Citizen Participation Plan (CPP) has been developed specifically for the Remedial Investigation/Feasibility Study at Amtrak's Sunnyside Rail Yard in Queens, NY. The Study is being performed pursuant to an Order on Consent entered into by Amtrak, New Jersey Transit and the New York State Department of Environmental Conservation (NYSDEC) dated September 21, 1989. The CPP will be carried out in accordance with the "New York State Inactive Hazardous Waste Site Citizen Participation Plan", published by NYSDEC in August of 1988.

The CPP will entail informing the community and appropriate public officials of activity and progress at the site. Information will be provided by establishing a local document repository, a document repository at NYSDEC offices in Long Island City, through public notice provided to the media, and by mailings to interested parties who will comprise a contact list. Fact sheets summarizing progress will be prepared periodically and placed in the repositories and sent out to the contact list.

The CPP will entail the following activities at the stated milestones in the project:

Work Plan Approval

- At least one copy of the Order on Consent and of the approved Work Plan will be available at a local document repository, the Sunnyside Public Library, 43-06 Greenpoint Avenue, Long Island City, New York, and at the office of Mr. Salvatore Ervolina, P.E., Regional Hazardous Waste Remediation Engineer, New York State Department of Environmental Conservation, 47-40 21st Street, Long Island City, New York.

- Concurrent with the initial deposit of documents in the document repositories, public notice will be published in the Long Island City Journal and Newsday. The public notice will consist of a fact sheet that will:

  * Briefly describe the site
  * Discuss objectives of the RI/FS
  * Identify location of the document repositories
  * Request information and comments useful in completing the RI/FS
  * Identify NYSDEC contact person

The fact sheet will be mailed to those on the contact list. The preliminary contact list is found at the end of this plan. The list will be added to, as warranted, throughout the study.

Remedial Investigation/Feasibility Study

RI

A copy of the Remedial Investigation Report will be placed in the document repositories. An Executive Summary of that report, one that invites comments, will be deposited and will be distributed to those on the contact list.

FS

- A copy of the draft Feasibility Study will be placed in the document repositories and notification of its availability sent to those on the contact list.

- Public notice of the availability of the RI and FS reports will be sent to those on the contact list, will be published in the Long Island City Journal and Newsday and will describe:

    * The proposed remedial options
    * The justification for the preferred option

- A public meeting will be scheduled through the Borough President's office. The agenda of the meeting will include:

    * Presentation of final RI/FS reports
    * Discussion of remedial options
    * Detailed discussion of the preferred option
    * Receiving public comment

  A transcript will be prepared of the meeting and will made available at the document repositories. A 30-day comment period will be established for public comments.

- A public notice will be printed that will discuss:

    * The preferred remedial option
    * Significant changes from the originally-proposed option

  - * Public comment and its effect on changes from the original proposed option.

- A brief responsiveness summary will be sent to those on the contact list. The purpose of the responsiveness summary is to:

  - * Provide a brief analysis of the preferred remedial option
  - * Discuss any significant changes from the proposed remedial option, and the reasons for such changes
  - * Provide a response to significant comments, criticisms and new data

CONTACT LIST
CITIZEN PARTICIPATION PLAN
SUNNYSIDE RAIL YARD, QUEENS, NY

Councilman Walter L. McCaffrey
62-07 Woodside Ave.
Woodside, NY 11377
(718) 639-1400

Assemb. Catherine Nolan
879 Woodward Ave.
Ridgewood, NY 11385
(718) 456-9494

Sen. George Onorato
28-11 Astoria Boulevard
Astoria, NY 11102
(718) 545-9706

Cong. Thomas J. Manton
46-12 Queens Boulevard
Sunnyside, NY 11104
(718) 706-1400

Ms. Claire Shulman
President
Borough of Queens
120-55 Queens Boulevard
Kew Gardens, NY 11424
(718) 520-3200

Mr. Enoch Williams
Chairman, NYC Council Comm. on
Environmental Protection
250 Broadway
New York, NY 10007
(212) 788-4002

Mr. Arthur Kell
NYPIRG
9 Murray St.
New York, NY 10007
(212) 349-6460

Ms. Joseph Conley
Chair - Communicty Board #2
43-31 39th St.
Sunnyside, NY 11104
(718) 361-0750

Mr. Andrew Stein
President - NY City Council
City Hall
New York, NY 10007
(212) 566-5200

Ms. Pam Ransom
Mayor's Office of Planning and
Environmental Coordination
52 Chambers St., Rm. 315
New York, NY 10007
(212) 788-4960

Mr. Eric Goldstein
Senior Attorney
NRDC
40 W. 20th St.
New York, NY 10010
(212) 727-2700

Mr. Michel Gelobter
Director of Environmental
Quality - NYCDEP
59-17 Junction Blvd.
Elmhurst, NY 11373
(718) 595-4417

Ms. Peggy Kurtz
Queens Environment Campaign
110-65 64th Rd.
Forest Hills, NY 11375
(718) 896-9416

Ms. Jane Bloom
NYS Superfund Mgt. Board
320 E. 23rd St./#17D
New York, NY 10010
(212) 373-3091

Ms. Rose Marabetti
Director, Office of Community
Outreach - NYCDEP
59-17 Junction Blvd.
Elmhurst, NY 11373
(718) 595-3496

Ms. Marilyn Elseroad
Chair - Transportation Committee
Community Board #2
43-31 39th Street
Sunnyside, NY 11104
(718) 361-0750

Mr. Vinicio Donato
Chair - Community Board #1
36-01 35th Avenue
Astoria, NY 11106

Ms. Margaret Hays Young
Conservation Chair
Sierra Club - NYC Group
625 Broadway
New York, NY 10012
(718) 789-0038

Mr. Salvatore Ervolina, P.E.
Regional Hazardous Waste Remediation Engineer
NYSDEC
47-40 21st St.
Long Island City, NY 11101
(718) 482-4995

Mr. Jack Rainey
Long Island City Business
Development Corp.
29-11 Queens Plaza North
Long Island City, NY 11101

cc: Joe Dimenino

New York State Department of Environmental Conservation
47-40 21st Street, Long Island City, New York 11101

Thomas C. Jorling
Commissioner

July 19, 1991

Mr. Jared I. Roberts
Associate General Counsel
National Railroad Passenger Corporation
60 Massachusetts Ave., NE
Washington, DC 20002

Dear Mr. Roberts:

Thank you for your letter of June 17. The CP Plan looks perfectly in order, except for a few very minor errors which I have noted in red.

I know that this project and its community outreach program will proceed well. If I can be of any assistance at any time, please feel free to call me.

Thank you again.

Sincerely,

William F. Hewitt
Director of Public Affairs
Region 2

cc: Salvatore Ervolina
Charles Warren

RECEIVED
JUL 24 1991
JARED I. ROBERTS
ASSOCIATE GENERAL COUNSEL

Fact Sheet

SUNNYSIDE RAIL YARD, QUEENS, NEW YORK

Sunnyside Rail Yard is an approximately 100-acre site located in Queens, New York. It is owned by the National Railroad Passenger Corporation (Amtrak) and is used for the maintenance of rail passenger equipment that is operated by Amtrak and New Jersey Transit (NJT). The site has been designated by the New York State Department of Environmental Conservation (NYSDEC) as an inactive hazardous waste disposal site primarily because of leaking underground fuel tanks. Pursuant to a Order on Consent with NYSDEC, Amtrak and NJT have agreed to perform certain tasks. These tasks include:

A. Performing certain interim remedial measures so as i) to implement immediate, temporary action to control the flow of petroleum hydrocarbons from the diesel fuel storage area; ii) to collect, treat and dispose of contaminated soil and/or ground water as may be necessary in connection with controlling such flow of petroleum hydrocarbons; iii) to evaluate the effectiveness of such action in containing petroleum hydrocarbons on-site; and iv) to monitor the impacts and effectiveness of the interim remedial measures.

B. Preparing a work plan to investigate the field environmental conditions on-site and off-site and to address all elements of a remedial investigation.

C. Upon approval of the work plan, performing a remedial investigation, and submitting a remedial investigation report, which report shall include all data generated and all other information obtained during the remedial investigation and provide all legally required evaluations and assessments of the site.

D. As part of the remedial investigation, providing a timetable of a feasibility study evaluating on-site and off-site remedial options to abate and eliminate any significant threat to the environment or public health. When the timetable is accepted by NYSDEC, the feasibility study shall be submitted within such timetable.

Documents relating to the remedial investigation and feasibility study are available for public inspection at two locations:

Sunnyside Public Library
43-06 Greenpoint Avenue
Long Island City, New York

Office of Mr. Salvatore Ervolin~~e~~a, P.E.
Regional Hazardous Waste Remediation Engineer
New York State Department of Environmental Conservation
47-40 21st Street
Long Island City, New York

Because the remedial investigation and feasibility study are not yet completed, information and comments that might be useful in completing such documents are requested by Amtrak. Please forward any such information and comments to Jared I. Roberts, Esq., Amtrak Law Department, 60 Massachusetts, N.E., Washington, D.C. 20002

NYSDEC has assigned a contact person to this project: Mr. William F. Hewitt, Director of Public Affairs, Region 2, New York State Department Environmental Conservation, 47-40 21st Street, Long Island City, New York, NY 11101. Mr. Hewitt's telephone number is (718) 482-4949.

NEW YORK CITY TRANSIT
GROUND-WATER MONITORING DATA

Operable Unit 3
Sunnyside Yard
Queens, New York

Appendix E

June 23, 1997

(Revised January 13, 1999)

130 Livingston Street
Brooklyn, NY 11201

New York City Transit

RECEIVED
NOV 1 6 1998

November 4, 1998

ROUX Associates, Inc.
1377 Motor Parkway
Islandia, New York 11788

Attn: Mr. Harry Gregory
Project Hydrogeologist

Subject: 63RD STREET LINE TO QBL TUNNEL CONNECTION PROJECT GROUNDWATER SAMPLING TEST RESULTS

Gentlemen:

As requested, New York City Transit (NYCT) is pleased to provide AMTRAK and ROUX Associates, Inc. (ROUX) with copies of groundwater sampling test results collected during the above referenced project. Groundwater samples were collected between December 5, 1996 and August 13, 1998, and tested by NYCT and their environmental sub-consultants.

Attached please find summary tables for each sampling event. Keep in mind that these tables only include parameters with detectable levels.

NYCT hopes this information satisfies your request. If you have any questions or need additional information, please do not hesitate to contact me at (718) 361-4601.

Sincerely,

Richard L. Mitchell, P.E.
Technical Director
Capital Program Management/New Routes

Attachments

cc:
J. Siano
S. Sinha
A. Parikh
L. Genkins
T. Abdallah
R. Mohlenhoff

MTA New York City Transit is an agency of the Metropolitan Transportation Authority, State of New York
E. Virgil Conway, Chairman

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of December 5, 1996 Groundwater Sampling Test Results

Parameter	Sample Identification		
	P-37	P-9	P-50
Polychlorinated Biphenyl, µg/L	ND	ND	ND

NOTES:

1. Groundwater samples collected and tested by Testwell Craig Laboratories, Inc.
2. ND - Indicates "Non-Detect".

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of December 19, 1996 Groundwater Sampling Test Results

Parameter	Sample Identification		
	P-37	P-9	P-50
Total Suspended Solids, mg/L	5.5	8	57
Total Petroleum Hydrocarbons, mg/L	0.20	4.20	0.80
Polychlorinated Biphenyl, µg/L	ND	ND	ND
BTEX, µg/L			
Toluene	12.20	ND	ND
M&P Xylene	3.12	ND	ND

NOTES:

1. Groundwater samples collected and tested by Testwell Craig Laboratories, Inc.
2. Table includes only parameters with detectable levels.
3. ND - Indicates "Non-Detect".

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of January 20, 1997 Groundwater Sampling Test Results

Parameter	Sample Identification						
	P-26	**P-37**	**P-37 (DUP-1)**	**P-9**	**P-50**	**ET-1**	**FB-1**
Total Suspended Solids, mg/L	14	320		53	7.5	4.5	
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
<u>Semi-Volitiles (Base-Neutrals), µg/L</u>							
Bis (2-Ethylhexyl) phthalate	ND	ND	ND	ND	ND	4.83	ND
Naphthalene	2.85	ND	ND	ND	ND	ND	ND

NOTES:

1. Groundwater samples collected and tested by Testwell Craig Laboratories, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. ET - Indicates Dewatering System Effluent Sample.
5. FB - Indicates Field Blank.
6. ND - Indicates "Non-Detect".

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of February 6, 1997 Groundwater Sampling Test Results

Parameter	**Sample Identification**					
	MW-19	**MW-35**	**P-9**	**P-50**	**P-50 (DUP-1)**	**FB-1**
Total Suspended Solids, mg/L	1600	69	360	1600	1800	
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L						
Bis (2-Ethylhexyl) phthalate	44B	8JB	ND	ND	3JB	2JB
2-Methylnaphthalene	ND	11	ND	ND	ND	ND
Acenaphthene	ND	3J	ND	ND	ND	ND
Dibenzofuran	ND	1J	ND	ND	ND	ND
Fluorene	ND	4J	ND	ND	ND	ND

NOTES:

1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect".
6. J - Indicates Estimated Concentrations.
7. B - Indicates Compound Detected in Field/Method Blank.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of February 21, 1997 Groundwater Sampling Test Results

Parameter	Sample Identification						
	MW-19	MW-35	MW-35 (DUP-2)	P-9	P-50	EFF-1	FB-2
Total Suspended Solids, mg/L	560	87	83	7100	180		
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L							
Bis (2-Ethylhexyl) phthalate	ND	ND	ND	1J	ND	ND	ND
2-Methylnaphthalene	ND	13	13	ND	ND	ND	ND
Acenaphthene	ND	3J	3J	ND	ND	ND	ND
Dibenzofuran	ND	ND	1J	ND	ND	ND	ND
Fluorene	ND	3J	3J	ND	ND	ND	1J
Di-n-octylphthalate	ND	ND	ND	1J	ND	ND	ND

NOTES:
1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. EFF - Indicates Dewatering System Effluent Sample.
5. FB - Indicates Field Blank.
6. ND - Indicates "Non-Detect".
7. J - Indicates Estimated Concentrations.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of March 27, 1997 Groundwater Sampling Test Results

Parameter	Sample Identification					
	MW-19	**MW-35**	**MW-35 (DUP-3)**	**P-9**	**P-50**	**FB-3**
Total Suspended Solids, mg/L	1,100	110	64	2,300	57	33
Polychlorinated Biphenyl, µg/L	ND	1.4	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L						
2-Methylnaphthalene	3J	12	13	ND	ND	ND
Acenaphthene	ND	3J	3J	ND	ND	ND
Fluorene	2J	4J	4J	ND	ND	ND
Phenanthrene	ND	1J	1J	ND	ND	ND

NOTES:
1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect".
6. J - Indicates Estimated Concentrations.
7. Amtrak's split samples for MW-35 indicated "ND" for PCBs.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of September 18, 1997 Groundwater Sampling Test Results

Parameter	Sample Identification						
	MW-19	MW-35	P-9	P-50	P-50 (DUP-4)	EFF-2	FB-4
Total Suspended Solids, mg/L	780	22	310	340	250	21	
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L							
2-Methylnaphthalene	2J	33	ND	ND	ND	ND	ND
Acenaphthene	ND	4J	ND	ND	ND	ND	ND
Anthracene	ND	1J	ND	ND	ND	ND	ND
Dibenzofuran	ND	3J	ND	ND	ND	ND	ND
Fluorene	2J	6J	ND	ND	ND	ND	ND
Phenanthrene	ND	3J	ND	ND	ND	ND	ND
TICs, µg/L							
Tetrachloroethylene	ND	ND	ND	75NJ	130NJ	20NJ	ND
Others	68NJ	331NJ	33NJ	ND	49NJ	2NJ	3NJ

NOTES:

1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect".
6. J - Indicates Estimated Concentrations.
7. TIC - Indicates Tentatively Identified Compound.
8. NJ - Indicates Tentatively Identified Compound Estimated Concentration.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of November 14, 1997 Groundwater Sampling Test Results

Parameter	Sample Identification						
	MW-19	MW-35	MW-35 (DUP-5)	P-9	P-50	EFF-3	FB-5
Total Suspended Solids, mg/L	330	58	67	250	320	15	
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L							
Naphthalene	ND	1J	1J	ND	ND	ND	ND
2-Methylnaphthalene	ND	22	20	ND	ND	ND	ND
Acenaphthene	ND	4J	4J	ND	ND	ND	ND
Dibenzofuran	ND	3J	3J	ND	ND	ND	ND
Fluorene	2J	7J	7J	ND	ND	ND	ND
Phenanthrene	ND	4J	4J	ND	ND	ND	ND
Anthracene	ND	1J	1J	ND	ND	ND	ND
Volitiles Organics, µg/L							
cis-1,2-Dichloroethylene	ND	ND	ND	ND	96	240	ND
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	4J	ND
Trichloromethane[7]	ND	ND	ND	ND	1J	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	8	ND	ND
Benzene	ND	4J	4J	ND	ND	ND	ND
Trichloroethylene	2J	ND	ND	ND	190	5100	ND
Toluene	ND	1J	ND	ND	ND	1J	ND
Tetrachloroethylene	ND	ND	ND	ND	1200	87	ND
Xylene (Total)	ND	5	5	ND	ND	ND	ND

NOTES:
1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only parameters with detectable levels.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect".
6. J - Indicates Estimated Concentrations.
7. Chloroform.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of April 9, 1998 Groundwater Sampling Test Results

Parameter	Sample Identification						
	MW-19	MW-35	MW-35 (DUP-6)	P-9	P-50	EFF-4	FB-6
Total Suspended Solids, mg/L	310	44	34	1,500	170	ND	ND
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L							
2-Methylnaphthalene	ND	8J	7J	ND	ND	ND	ND
Acenaphthene	ND	2J	2J	ND	ND	ND	ND
Dibenzofuran	ND	2J	1J	ND	ND	ND	ND
Fluorene	ND	3J	3J	ND	ND	ND	ND

NOTES:

1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only detectable analyte measurements.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect" above the sample quantitation limit.
6. J - Indicates Estimated Concentrations.

New York City Transit
63rd Street Line to QBL Tunnel Connection Project
Summary of August 13, 1998 Groundwater Sampling Test Results

Parameter	**Sample Identification**						
	MW-19	**MW-35**	**MW-35 (DUP-7)**	**P-9**	**P-50**	**EFF-5**	**FB-7**
Total Suspended Solids, mg/L	1,200	66	80	3,900	240	ND	ND
Polychlorinated Biphenyl, µg/L	ND	ND	ND	ND	ND	ND	ND
Semi-Volitiles (Base-Neutrals), µg/L							
2-Methylnaphthalene	ND	ND	9J	ND	ND	ND	ND
Acenaphthene	ND	6J	3J	ND	ND	ND	ND
Dibenzofuran	ND	ND	2J	ND	ND	ND	ND
Fluorene	ND	9J	4J	ND	ND	ND	ND
Phenanthrene	ND	4J	2J	ND	ND	ND	ND
Anthracene	ND	2J	ND	ND	ND	ND	ND

NOTES:

1. Groundwater samples collected and tested by Louis Berger & Associates, Inc.
2. Table includes only detectable analyte measurements.
3. DUP - Indicates Duplicate Sample.
4. FB - Indicates Field Blank.
5. ND - Indicates "Non-Detect" above the sample quantitation limit.
6. J - Indicates Estimated Concentrations.