EPA SUBMITTAL
VERIFICATION INVESTIGATION WORK PLAN
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

FEBRUARY 21, 1990

DAMES & MOORE

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1.0 INTRODUCTION

On September 27, 1989, the United States Environmental Protection Agency (EPA) issued a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit (EPA I.D. No. 049 791 098) to Chevron USA, Incorporated (Chevron) for the Philadelphia Refinery (Figure 1) with an effective date of October 27, 1989. Part II - Specific Conditions of that permit set forth certain requirements relating to "corrective action for all releases of hazardous waste or constituents from any solid waste management unit" (SWMU) as provided under Section 3004(u) of RCRA (Section 206 of the Hazardous and Solid Waste Amendments of 1984) and regulations promulgated in 40 CFR Section 264.101. Pursuant to and in compliance with Part II, Section (A), subsections (1), (2), (3), and (4) of that permit and all relevant EPA reference and guidance documents referenced therein, Chevron submits this required Verification Investigation Work Plan and accompanying documents.

This Verification Investigation Work Plan will serve as a means to control activities associated with the assessment of the SWMUs as set forth in the referenced permit. Specifically, procedures for field investigation, field sampling, laboratory analyses, quality assurance, and health and safety information that are provided in this document will be followed in carrying out the investigations.

The Verification Investigation Work Plan addresses specific SWMUs in the following order:

- o SWMU Nos. 1, 6, 30, 45, and 79 (Chapter 2)
- o SWMU Nos. 2, 9, and 13 (Chapter 3)
- o SWMU Nos. 11, 12, 29, and 71 (Chapter 4)
- o SWMU Nos. 16 and 17 (Chapter 5)

The locations and approximate extent of these SWMUs are depicted on Figure 2. For a discussion of the technical approach of this project, see Section 6.1 of this report.

Criteria, which will determine if further investigations are warranted, are not addressed specifically in the Work Plan. However, each SWMU will be evaluated on an individual basis using the data derived from the implementation of the Work Plan. Examples of concentration of substances meeting criteria for action levels may be used as presented in the Permit (Attachment F; Table 1). For substances that are absent from this list and are revealed to be present, criteria will be developed using the recommended exposure assumptions as provided in the Permit (Attachment F; Table 3).

2.0 VERIFICATION INVESTIGATIONS OF SWMUs NOS. 1, 6, 30, 45, AND 79

The Verification Investigation Work Plans for SWMUs No. 1 (Empty Lube Oil Drum Storage Area), No. 6 (Trash Incinerator), No. 30 (Additive Plant Drum Storage Area), No. 45

(Empty Drum Storage Area), and No. 79 (Drum Storage Area) are presented in this chapter in compliance with Part II, (A)(1) of the referenced permit. The objectives of these investigations are to:

- o Establish the presence or absence of hazardous waste or hazardous waste constituents in the area of each unit.

- o Establish whether there is or has been migration of hazardous waste or hazardous waste constituents from the units to the soil and/or ground water.

To achieve these objectives, a series of tasks will be performed, including surface and subsurface soil sample collection and analysis. These tasks will be performed in accordance with the accompanying Sampling Plan (Appendix A), Health and Safety Plan (Appendix B), and Data Quality Assurance Plan (Appendix C). The results of these tasks will verify the presence or absence of hazardous wastes or hazardous waste constituents associated with each of the SWMUs. Based on the results of these tasks, additional studies (RCRA Facility Investigations) will be performed, if warranted. The specific tasks proposed for each referenced SWMU are discussed in the remainder of this chapter, along with background information. The background information was derived from the Fact Sheet of the referenced permit, a review of aerial photographs, and interviews with Chevron employees.

2.1 VERIFICATION INVESTIGATION OF SWMU NO. 1

SWMU No. 1 (Empty Lube Drum Storage Area) is located east of Warehouse No.25 (Figure 3), in the southeastern section of the facility. SWMU No. 1 is underlain by gravel and has approximate dimensions of 100 by 200 feet. Commonly, empty lube oil drums were stored on the gravel for later reclamation. Storage activity is believed to have been concentrated in the northern section of the unit. Surface run-off is discharged to the Empty Lube Drum Sump (SWMU No. 2). Currently, drums are not stored in this area. Discolored gravel and drum bungs are present in this area.

In order to verify the presence or absence of the release of contaminants at the area, surface samples and soil boring samples will be collected for laboratory analysis. The resulting data will be used to determine the presence or absence of contaminants associated with this unit and whether further tasks or investigation(s) are required.

SWMU No. 1 encompasses SWMU No. 2, as depicted in Figure 3. The data collected from the soil boring planned for the southern section of SWMU No. 1 will also be used to assess SWMU No. 2 because of the units' spatial relationship. For a discussion of SWMU No. 2, see Section 3.1 of this report.

2.1.1 Surface Sampling

Three surface samples will be collected at SWMU No. 1. One of these samples will be collected from underneath the gravel in an area of visible discoloration. The second sample will be taken in an area that does not display visible discoloration. These samples will be collected from a depth of 0 to 6 inches, if possible. They will be random, discrete grab samples. The precise sampling locations for the biased samples will be field-determined by Dames & Moore personnel. The two samples will be analyzed for Skinner List constituents (Table 1) with the exception of volatile organic compounds (VOCs), which will have most likely volatilized. The third sample will be collected in the southern portion of SWMU No.1. For a discussion of that sample, see subsection 3.1.1 of this report.

2.1.2 Soil Boring Program

Three soil borings will be performed at SWMU No. 1. One boring will be placed in the approximate center of the unit, as depicted on Figure 3. Another boring will be placed 75 feet north of the center boring. The other boring will be located in the southern portion of SWMU No. 1. and immediately south of SWMU No. 2. These boring locations were selected in order to develop a spatial distribution that will allow for an initial assessment of the entire unit.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved in 1-foot, split-spoon intervals. Each boring will terminate at the approximate depth of that water table, which is anticipated to be at a depth of 1 to 2 feet.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete, grab soil sample will be collected from the last 2-foot section of each boring. This sample will be analyzed for the Skinner List constituents (Table 1).

2.2 VERIFICATION INVESTIGATION OF SWMU NO. 6

SWMU No. 6 (Trash Incinerator) is located northwest of Penrose Ferry Avenue in the southern part of the facility. During operation (Figure 4), the wastes were placed onto a conveyor that moved them to the main flame of the incinerator. Ash was removed by an ash hopper. The feed end and main frame of the incinerator are located on a concrete pad. The date of startup is not known; operation was stopped in approximately 1974. This unit incinerated oily sludges, oily debris, tank bottoms, and paper. This unit is aboveground and is located partially on concrete and on gravel.

In order to verify the presence or absence of contaminants at SWMU No. 6, surface soil and subsurface soil samples will be collected for laboratory analysis. The resulting data will be used to determine whether further investigation is necessary.

2.2.1 <u>Surface Sampling</u>

Two surface soil samples are initially planned for collection and analysis at SWMU No. 6. These samples will be biased discrete samples collected in an area of visible discoloration, if possible. They will be collected from a depth of 0 to 6 inches, conditions permitting. The precise sampling locations for the surface soil samples will be determined at the unit by Dames & Moore personnel. These samples will be analyzed for Skinner List constituents (Table 1), with the excepton of VOCs. The compounds will have most likely volatilized in the shallow soil.

2.2.2 <u>Soil Boring Program</u>

Four soil borings are proposed for SWMU No. 6. The borings will be located in the central area along each of the sides of the unit and beyond any surrounding concrete pad, as depicted in Figure 4. These boring locations were selected in order to develop a spatial distribution of the data that will allow for the assessment of each perimeter of the unit.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved in 2-foot, split-spoon intervals. The total depth of each boring will be the water table (approximately 3 feet).

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete soil sample for laboratory analysis will be collected from each of the borings and from the last 2-foot interval. The samples will be analyzed for Skinner List constituents (Table 1).

2.3 VERIFICATION INVESTIGATION OF SWMU NO. 30

SWMU No. 30 (Additive Plant Drum Storage Area) is located off Sixth Street and to the west of Tank 246, in the eastern part of the facility (Figure 5). The unit is currently covered with gravel. The approximate dimensions of this unit are 550 feet by 60 feet, based upon a review of aerial photographs. The start up date for this unit is unknown; however, the unit was in operation during 1965, while drum storage ceased in 1978. Prior to 1978, the storage area is believed to have received drums containing agents for use in the facility laboratory. The chemical composition of these agents is not known, but is believed to be both organic and inorganic in nature. Waste material is not believed to have been stored in this area.

2.3.1 Surface Sampling

Three surface samples will be collected at SWMU No. 30. One sample will be located in the approximate center point of the area; the other two points will be located 150 feet southeast and northwest of the center point (Figure 5). Samples will be collected from a depth of 0 to 6 inches. These discrete grab samples will be analyzed for Skinner List constituents (Table 1), with the exception of VOCs, which will have most likely volatilized in the shallow soil.

2.3.2 Soil Boring Program

Three soil borings will be performed at SWMU No. 30. One boring will be field-located at the approximate center of the unit. Two other borings, one to the southeast and one to the northwest, will be located approximately 150 feet from the center boring. These borings will be paired with the surface soil samples. The boring locations are depicted in Figure 5. These boring locations were selected in order to develop a spatial distribution that will allow for an initial assessment of the entire unit to be made.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved by split spoons in 2-foot intervals. The total depth for each of the borings will be to the water table (approximately 3 feet).

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete soil sample for laboratory analysis (Skinner List constituents; Table 1) will be collected from the last 2-foot section of each of the borings.

2.4 VERIFICATION INVESTIGATION OF SWMU NO. 45

SWMU No. 45 (Empty Drum Storage Area) is located north of the Penrose Avenue Bridge, off the western side of "H" Avenue (Figure 6). The unit was approximately 100 feet by 70 feet and contained empty 55-gallon steel drums. These drums contained water-treating chemicals, lube oils, and corrosion-inhibiting chemicals. The empty drums were placed on gravel. Drums were stored here before being sent for reclamation. The storage area began operation in 1978 and is currently inactive.

2.4.1 Surface Sampling

Two surface samples will be collected at SWMU No. 45 underneath gravel areas of visible discoloration. These samples will be collected from a depth of 0 to 6 inches, if possible. These samples will be random, discrete biased grab samples. The precise sampling locations will be field-determined by Dames & Moore personnel prior to collection. These samples will be analyzed for Appendix IX metals, volatiles, and semi-volatile constituents (Table 2). VOCs will not be analyzed for they will have most likely volatilized in the shallow soil.

2.4.2 Soil Boring Program

Two soil borings will be performed at SWMU No. 45. These borings will be located in the central area of the unit (Figure 6). These boring locations were selected in order to develop a spatial distribution of the resulting data that will allow for an initial assessment of the entire site.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved in 2-foot split-spoon intervals. The total depth of each boring will be to the water table or the top of a saturated zone.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section of each boring. This sample will be analyzed for Appendix IX metals, volatiles, and semi-volatiles (Table 2).

2.5 VERIFICATION INVESTIGATION OF SWMU NO. 79

SWMU No. 79 (Drum Storage Area) is located east of Unit No. 1232 Precipitator, in the northern part of the facility (Figure 7). The unit was used for the temporary storage of 55-gallon drums on wooden pallets, and is underlain by gravel. These drums contained residue from the FCC unit, trash, and spent catalyst. The approximate dimensions are 10 feet by 20 feet. The date of start up is unknown, and the site is currently inactive. The drums have been moved.

In order to verify the presence or absence of contaminants at this unit, soil surface samples and subsurface soil boring samples will be collected for analysis. Specific sampling information is provided below.

2.5.1 Surface Sampling

One surface sample will be collected at SWMU No. 79 underneath the gravel area with visible staining, if possible. This sample will be collected from a depth of 0 to 6 inches below the gravel. This sample will be a random, discrete biased grab sample. The precise sampling location will be field-determined by Dames & Moore personnel based on the presence of discoloration. This sample will be analyzed for Appendix IX metals, volatiles, and semi-volatiles (Table 2). VOCs will not be analyzed. These compounds will have most likely volatilized in the shallow soil.

2.5.2 Soil Boring Program

One soil boring will be performed at SWMU No. 79. This boring will be paired with the surface sample. A tentative location is the center of the former unit (Figure 7). The precise location will be selected by Dames & Moore personnel, with the bias toward areas of discoloration. One sample will be selected for the purpose of evaluation, due to the limited size of the unit.

This boring will be advanced by a hollow-stem auger. The soil sample will be retrieved in 2-foot, split-spoon intervals. The total depth of the boring will be to the water table (approximately 3 feet).

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section of the boring, if possible. This sample will be analyzed for Appendix IX metals, volatiles, and semi-volatiles (Table 2).

3.0 VERIFICATION INVESTIGATIONS OF SWMU NOS. 2, 9, AND 13

The Verification Investigations of SWMUs No. 2 (Empty Lube Area Sump), No. 9 (Product Storage Sump), and No. 13 (Tank 355) are presented in this chapter in compliance with Part II, (A)(2) of the referenced permit. The objectives of these investigations are to:

- o Establish the physical integrity of the units (when possible).
- o Establish whether there has been migration or continuing releases of hazardous wastes or constituents due to leaks from the units.

In order to achieve these objectives, a series of tasks will be performed, including surface and subsurface soil sample collection and analyses. These tasks will be performed in accordance with the accompanying Sampling Plan (Appendix A), Health and Safety Plan (Appendix B), and Data Quality Assurance Plan (Appendix C). The results of these analyses will reveal the presence or absence of hazardous wastes or constituents associated with each of these units. Based on the results of these tasks, additional studies (RCRA Facility Investigations) will be performed, if warranted. The specific tasks planned for each SWMU are discussed in the remainder of this chapter, along with background data.

3.1 VERIFICATION INVESTIGATION OF SWMU NO. 2

SWMU No. 2 (Empty Lube Area Sump) is located east of Warehouse 2 and within SWMU No. 1 (Figure 3). The dimensions of this unit are approximately 4 feet by 4 feet by 4 feet. The unit received run-off from SWMU No. 1. Surface water run-off flows from this unit to the wastewater treatment system via an underground pipeline. At times, the sump is surrounded by standing water, revealing the shallow depth of the ground water table. This active unit was constructed in 1967 and consists of a cinderblock/concrete frame. This frame is currently cracked at the surface and is of poor physical integrity.

Tests will not be performed to evaluate the physical integrity of the unit, as the unit is cracked at the surface. In order to evaluate the potential for waste migration from this unit, a soil boring will be placed in an immediately hydraulically downgradient position.

In order to verify the presence or absence of contaminants at this area, a soil surface sample and a soil boring sample will be collected and analyzed. As these sampling points are located within SWMU No. 1, the resulting data will be used to evaluate SWMU No. 1. For a discussion of that unit, see Section 2.1 of this report.

3.1.1 <u>Surface Soil Sampling</u>

One surface sample will be collected immediately south of SWMU No. 2 to assess the potential for contaminant introduction into the unit (Figure 3). This sample will be collected in an area of visible discoloration and a depth of 0 to 6 inches, if possible. This discrete grab sample will be analyzed for the Skinner List of constituents (Table 1) with the exception of VOCs, which will have most likely volatilized in the shallow soil.

3.1.2 <u>Soil Boring Program</u>

One soil boring is planned at SWMU No. 2. This boring will be located immediately south of the unit (Figure 3). This location is the most likely hydrogeologically downgradient position. Thus, this sampling point has a high potential for being affected by substances migrating from this unit. The data derived from this point will be used to evaluate the potential for contaminant migration from this unit.

The boring will be advanced by a hollow-stem auger. Soil samples will be retrieved by split spoons in 2-foot intervals. The boring will be advanced to the water table. The anticipated total depth of the boring is 3 feet, corresponding to the anticipated depth of the ground water surface.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section of the boring. This sample will be analyzed for the Skinner List of constituents (Table 1).

3.2 VERIFICATION INVESTIGATION OF SWMU NO. 9

SWMU No. 9 (Product Storage Sump) is located within the No. 8 Oil/Water Separator and has approximate dimensions of 10 feet by 10 feet, and a 15-foot depth (Figure 4). This active unit is constructed of concrete and is equipped with a water-control level instrument. This unit began operation in 1977. It receives run-off from the product (gasoline, petrochemicals, home heating oil, and jet fuel) storage area of the terminal and discharges to the No. 2B Separator.

Because this is an operating unit and lies within the No. 8 Separator, direct integrity testing (i.e., volumetric analysis) cannot be performed. The integrity of SWMU No. 9 will be assessed by several indirect methods. First, a Dames & Moore Professional Engineer (P.E.) will visually inspect the SWMU. Second, surface and subsurface soil samples (borings) will be collected and analyzed. The resulting data will verify the presence or absence of substances in the subsurface associated with this unit and will further supply data for assessing the integrity of the unit. Soil sampling tasks are described below.

3.2.1 Surface Soil Sampling

One surface sample will be obtained in an area near SWMU No. 9 from a visually discolored area and from a depth of 0 to 6 inches, if possible. This random, discrete biased sample will be analyzed for Skinner List constituents (Table 1), with the exception of VOCs, which will have most likely volatilized in the shallow side.

3.2.2 Soil Boring Program

One soil boring will be performed at SWMU No. 9. This boring will be located along the southwestern side of the unit (Figure 4). It will be advanced by hand-boring equipment such as a tripod or a hand auger. This sampling method was selected due to limited site access. Soil samples will be obtained for analyses from 1 to 2 feet above the water table and will be analyzed for Skinner List constituents (Table 1).

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

3.3 VERIFICATION INVESTIGATION OF SWMU NO. 13

SWMU No. 13 (Tank 355) was located east of "F" Avenue in the southern part of the facility (Figure 4). This unit was a concrete basin and had approximate dimensions of 21 feet by 23 feet with a 10-foot depth. A steel grate covered the unit. The walls were approximately 1.5 feet thick. The bottom was 2.5 feet thick. The gross capacity of the unit was 38,500 gallons. During operation, this unit received waste oil from vacuum trucks, oil spill clean-up operations, and oil skimmings from API separators. The waste oil was conveyed by pipeline from SWMU No. 13 to Tanks 357 and 358. The operational start up date of the subject unit is unknown.

In October 1989, SWMU No. 13 was modified. A fiberglass basin was installed within the original concrete unit. Furthermore, a steel basin was installed within the fiberglass basin creating a double lined tank. This modified tank is currently governed by underground storage tank (UST) regulations. This replacement unit was not operative as of the date of this report.

Since SWMU No. 13 has been modified as per the UST program, an integrity test cannot be performed. In order to assess the potential for contaminant migration from this previous unit, soil borings will be drilled. See subsection 3.3.2 for a discussion of the soil boring program.

3.3.1 Surface Soil Sampling

Surface samples will not be collected at former SWMU No. 13. Surface soil around this former unit was disturbed during removal of the concrete basin. Therefore, a surface sample would not be representative of conditions at the time of the unit's use.

3.3.2 Soil Boring Program

Two soil borings will be performed at the former SWMU 13. These borings will be located in the area of the southern boundary of the former unit (Figure 4). These sample locations were selected because they are located in a hydraulically downgradient position from the unit and thus, represent an area with a high potential for contamination.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved by split spoons in 2-foot intervals. The borings will be advanced to the water table. The anticipated total depth of each boring is 3 feet, corresponding to the anticipated depth of the ground water surface.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section of each boring, if possible. This sample will be analyzed for Skinner List constituents (Table 1).

4.0 VERIFICATION INVESTIGATIONS OF SWMU NOS. 11, 12, 29, AND 71

The Verification Investigations of SWMU Nos. 11, (Past Lagoon A), 12 (Crude Oil Topping Unit), 29 (Tank 200 Past Lagoon), and 71 (Past Lagoon B) are presented in this chapter in compliance with Part II, (A)(3) of the referenced permit. The objectives of these investigations are to:

- o Establish the presence or absence of hazardous waste or hazardous waste constituents in the area of each unit.
- o Establish whether there is or has been migration of hazardous waste or hazardous waste constituents from the units to soil and/or ground water.

In order to achieve these objectives, a series of tasks will be performed, including soil gas surveys and surface and subsurface soil sample collection and analyses. These tasks will be performed in accordance with the accompanying Sampling Plan (Appendix A), Health and Safety Plan (Appendix B), and Data Quality Assurance Plan (Appendix C). The results of these analyses will reveal the presence or absence of hazardous wastes or constituents associated with each of the referenced units, and will indicate whether additional studies (RCRA Facility Investigations) are warranted. The specific tasks planned are discussed in the remainder of this chapter, along with background information.

4.1 VERIFICATION INVESTIGATION OF SWMUs NOS. 11 AND 12

SWMU No. 11 (Past Lagoon A) and SWMU No. 12 (Previous Crude Oil Topping Unit) are addressed jointly in this section, as they existed in approximately the same area (Figure 4) in the southern portion of the refinery. This area is currently overlain by the Container Storage Area (SWMU No. 10). The relationship of these units is discussed below.

SWMU No. 11 was an unlined lagoon with approximate dimensions of 200 feet by 100 feet, based on analysis of an aerial photograph of 1975. The lagoon was used to separate and recover oil. The oil was pumped off, leaving the solids in the unit. The origin of the waste is not known. However, it is suspected that the unit received tank bottoms, sewer sludge, and spill clean-up material. The unit began operation in 1946 and stopped receiving waste in 1979.

SWMU No. 12 is believed to be located under SWMU No. 11 and SWMU No. 10, and necessarily predates both of them. The previous crude oil topping unit consisted of several small buildings and tanks. SWMU No. 12 had approximate dimensions of 200 feet by 100 feet. The start up date of this facility is not known. Documents reveal that this unit existed in 1946. The closure date is not known. The exact nature of the waste that was managed is also not known.

The area of former SWMU Nos. 11 and 12 is now covered by gravel and the Container Storage Area.

4.1.1 Surface Soil Sampling

No surface soil samples are proposed in the area of SWMU Nos. 11 and 12, as the soil in this area has been disturbed and is overlain by the current Container Storage Area, which has a concrete base. Thus, the current surface soil is not representative of the conditions that existed during unit operation.

4.1.2 Soil Gas Survey

A soil gas survey will be conducted around SWMU No. 10. Due to the superposition of those units, the results of the soil gas survey will be used to evaluate the potential for hazardous waste release from both units and the placement of soil boring locations. The sample points comprising the survey will be arranged generally in a grid pattern with a 50-foot spacing, along the perimeter of SWMU No. 10 (Figure 4). A total of 10 sampling points are initially planned. The sample point locations will be referenced from the corners of existing SWMU No. 10.

Each soil gas sample will be obtained in the manner discussed below. A 1-inch borehole will be drilled to 1.5 feet below ground surface (BGS). The borehole will be extended to 3 feet BGS by driving a 7/8-inch hollow rod (1/4-inch inner diameter) with a slotted drive point. A soil vapor sample will be extracted using a vacuum pump and analyzed with an OVA. When equilibrated OVA measurements exceed 10 ppm, soil vapors will be collected in a 1-liter Tedlar bag. The retained sample of the vapors will then be analyzed by a Photovac portable gas chromatograph (GC) within 10 minutes of sampling.

This task will be performed by personnel who are qualified and trained in field procedures and in health and safety protocol. The OVA and GC will be calibrated at the start of each working day. Calibration procedures will be followed and documented as presented in Appendix C.

4.1.3 Soil Boring Program

Four borings are planned in the area of SWMU Nos. 11 and 12. These borings will be located along each of the four sides of the Container Storage Area (Figure 4). The precise boring locations are subject to modification pending the soil gas survey results and EPA approval. Also, soil borings will not be located on or within the concrete containment pad of the Container Storage Area. The analytical data derived will be used to verify the presence or absence in the soil of constituents associated with SWMU Nos. 10, 11, and 12.

Each boring will be advanced by a hollow-stem auger drilling rig, if not obstructed by physical barriers. Soil samples will be retrieved by split spoons in 2-foot intervals. The boring will be advanced to the water table (approximately 3 feet).

If a physical barrier obstructs the movement of the drilling rig, the boreholes will be advanced by a tripod and/or hand auger. Samples will be obtained from the split spoons, as described in the preceding paragraph.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section, or from the 2-foot interval above the water table of each borehole. This sample will be analyzed for Skinner List constituents (Table 1).

4.2 VERIFICATION INVESTIGATION OF SWMU NO. 29

SWMU No. 29 (Tank 200 Past Lagoon) is located primarily under Tank 200 (Separator No. T-844; SWMU No. 28) in the western section of the facility (Figure 8). The approximate dimensions of SWMU No. 29 were 100 feet by 100 feet based on a review of 1970 and 1975 aerial photographs. The unit possibly received sludges from Separators 2, 2A, and 2B (SWMU Nos. 25, 26, and 27) and tank bottoms. The waste was placed directly into the lagoon. The start up data of unit operation is not known. The end date is believed to be in 1974. Currently, the unit is inactive, as it underlies Separator No. T-844.

In order to verify the presence or absence of hazardous waste and related constituents potentially attributable to a past release, a soil gas survey and subsurface soil sampling will be performed. The data derived from these tasks will be used to evaluate the requirement for additional assessment activities.

4.2.1 Surface Soil Sampling

No surface soil samples are proposed at SWMU No. 29, as the area has been disturbed during the installation of Separator T-844.

4.2.2 Soil Gas Survey

A soil gas survey will be conducted in the area of SWMU No. 29. The results of this survey will be used to evaluate the potential for contaminant releases and the placement of soil borings. A total of five sampling points are proposed. The points will be arranged generally in a grid pattern with a 50-foot spacing (Figure 8). The sample points will be referenced from the southwestern corner of Separator T-844. From that corner, two points will be extended to the north, and two other sampling points will be extended to the east.

Each soil gas sample will be obtained in the manner discussed in subsection 4.1.2.

4.2.3 Soil Borings

Two soil borings are proposed in the area of SWMU No. 29. These borings are proposed to be located along the southern area of Separator T-844, where sections of the unit may exist in the subsurface (Figure 8). The precise boring location is subject to modification pending the soil gas survey results and EPA approval. The analytical data derived will be used to verify the presence or absence of substances associated with the unit.

Each boring will be advanced by a hollow-stem auger drilling rig, if not obstructed by physical barriers. When access is restricted, a hand auger will be used and the split spoons will driven by a hand-held hammer or by tripod methods. Soil samples will be retrieved in 2-foot intervals. The borings will be advanced to the water table (approximately 3 feet).

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last soil interval retrieved above the water table. This sample will be analyzed for the Skinner List of constituents (Table 1).

4.3 VERIFICATION INVESTIGATION OF SWMU NO. 71

SWMU No. 71 (Past Lagoon B) is located east of Third Street, partially under the present Bundle Cleaning Area (SWMU No. 72), in the northern section of the facility (Figure 7). The previous in-ground lagoon had approximate dimensions of 100 feet by 200 feet. The waste deposited in this unlined unit was reportedly removed in 1979. During this activity, four tank bottoms were discovered. The function of these former tanks is not known. The start up and shut down dates of SWMU No. 71 are unknown. However, the unit was operating in 1975 and operations were discontinued prior to waste removal in 1979. The unit is believed to have received separator sludges, cooling tower sludges, and coagulator alum sludge. No oily sludges were disposed in this unit. Currently, the area is covered with macadam, a concrete pad of the Bundle Cleaning Area, and gravel.

An additional lagoon was noted south of Separator No. 4, with approximate dimensions of 60 by 140 feet. This lagoon was noted on a 1975 aerial photograph; however, it was not present on the 1970 or 1980 aerial photographs. The precise start up and shut down dates are unknown. The lagoon may have received sludges similar to those in Past Lagoon B; however, the actual use of this lagoon is unknown. Currently, the area of this lagoon is overlain by gravel and Tank No. 1136. This lagoon will be designated SWMU No. 71A (Figure 7) and will be incorporated in the SWMU No. 71 investigation.

4.3.1 Surface Soil Sample

No surface soil samples are proposed in the area, because this area was regraded prior to placement of the overlying gravel, macadam, and concrete pad.

4.3.2 Soil Gas Survey

A soil gas survey will be conducted around SWMU No. 71. It will consist of 10 sampling points. These sampling points will be arranged in a grid pattern with a 50-foot spacing between points where possible (Figure 7). Along the Bundle Cleaning Area concrete pad, sampling points will be placed around the perimeter of the unit. Sampling points will not be placed in the concrete pad of the Bundle Cleaning Area.

Furthermore, three soil gas sampling points are planned for SWMU No. 71A. One point will be located in the approximate center of the unit, while the other two points will be located 50 feet from that center point to the east and west (Figure 7), if possible.

Each soil gas sample will be obtained in the manner discussed in subsection 4.1.2 of this report.

4.3.3 Soil Boring Program

Three soil borings are proposed at SWMU No. 71. One boring will be located in the center section of the unit; the other two borings will be located 75 feet to the northwest and 75 feet to the southeast (Figure 7). Soil borings will not be drilled in the concrete pad of the Bundle Cleaning Area. These boring points were selected in order to develop a spatial relationship of the resulting data that will be used to assess the entire unit.

One soil boring is proposed at SWMU No. 71A. This boring will be located in the center section of the unit. This location was selected in order to evaluate the presence of substances previously placed in this lagoon.

Each boring will be advanced by a hollow-stem auger. Soil samples will be retrieved by split spoons in 2-foot intervals. The borings will be advanced to the water table. The anticipated total depth of each boring is 3 feet, corresponding to the anticipated depth of the ground water surface.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample will be collected from the last 2-foot section of each boring. This sample will be analyzed for Skinner List constituents (Table 1).

5.0 VERIFICATION INVESTIGATION OF SWMU NOS. 16 AND 17

The Verification Investigations of SWMU Nos. 16 (Tank 357) and 17 (Tank 358) are presented in this chapter in compliance with Part II (A)(4) of the referenced permit. The objectives of the investigations are to:

- o Establish the presence or absence of hazardous waste or hazardous waste constituents in the area of each unit.

- o Establish whether there is or has been migration of hazardous waste or hazardous waste constituent from the units to the soil and/or groundwater.

In order to achieve these objectives, a series of tasks will be performed, including surface and subsurface soil sample collection and analyses. These tasks will be performed in accordance with the accompanying Sampling Plan (Appendix A), Health and Safety Plan (Appendix B), and Data Quality Assurance Plan (Appendix C). The results of the analyses will be used in evaluating the presence or absence of hazardous waste or constituents associated with each referenced unit, and whether additional studies (RCRA Facility Investigation) are warranted.

SWMU Nos. 16 and 17 lie adjacent to each other and are located east of "E" Avenue in the southern part of the facility (Figure 4). These tanks are constructed of steel according to API Standard 12-C and are supported by six legs each that rest on concrete blocks. They are underlain by gravel. A 6-inch-high concrete curb surrounds the units. Each has a capacity of 3,600 barrels and is part of the slop oil treatment system. The tanks receive a mixture of oil and water from Tank 355 (SWMU No. 13). The oil and water are gravity-separated, with the water settling into the conical bottom and the oil remaining overhead. An emulsion phase settles at the interface. The recovered water is discharged to the process sewer and the oil is used in the refinery. The interface/ emulsion layer is pumped to Tanks 1004 and 1005.

The start up date for these units is unknown. These units are currently active, with the tanks managing slop oil emulsion solids.

5.1 SURFACE SOIL SAMPLING

Two surface samples will be collected at SWMU Nos. 16 and 17 in the areas of observed staining, such as near the discharge sumps. These biased discrete samples will be collected from a depth of 0 to 6 inches, if possible, and will be analyzed for Skinner List constituents (Table 1), with the exception of VOCs. These compounds will have most likely volatilized in the shallow soil.

5.2 SOIL BORING PROGRAM

Eight soil borings are initially proposed at SWMUs 16 and 17. Four soil borings will be located along perimeter of each of the units (Figure 4). These locations were selected in order to develop a spatial relationship of the resulting data to assess the entire unit.

Due to physical obstructions, the borings will be advanced by hand auger. The split spoons will be driven by a hammer to the water table or saturated zone. The anticipated total depth of each boring is 3 feet, which is the anticipated ground water depth.

Each retrieved soil sample will be visually described and scanned by an OVA. The OVA will also be used to scan the borehole following boring completion. These readings and the visible description of the soil samples will be recorded on the daily field logs.

A discrete grab soil sample from each boring will be collected from the last soil interval retrieved above the water table. These samples will be analyzed for Skinner List constituents (Table 1).

6.0 PROJECT MANAGEMENT PLAN

6.1 TECHNICAL APPROACH

Chevron's RCRA Corrective Action Permit (EPA I.D. No. 049 791 098) Part II, Section (A), (1), subsection (2), (3), and (4) present a listing of specific solid waste management units (SWMUs) that require further investigation. The objectives of the investigations are to:

- o Establish the physical integrity of units (where appropriate).
- o Establish the presence or absence of hazardous waste or hazardous waste constituents in the area of each unit (where appropriate).
- o Establish whether there is or has been migration of hazardous waste or hazardous waste constituents from the units to the soil and/or ground water.

To accomplish these objectives, a series of tasks will be performed that are specified in the referenced permit. These tasks are:

- o Surface soil sampling and analyses (where appropriate)
- o Soil gas survey (where appropriate)
- o Soil boring program (where appropriate)

The designated sampling points for each of these referenced tasks has been selected with a bias toward encountering hazardous waste or hazardous waste constituents at each SWMU. This bias is based upon the following sources of information:

- o Field observations recorded during the Visual Site Inspection (VSI) of the Phase II RCRA Assessment Report, February 1989, and Dames & Moore site reconnaissance
- o Permit Fact Sheet
- o Chevron employee interviews
- o Aerial photograph review (photos dated 1960, 1965, 1975, 1980, 1985)

6.2 SCHEDULE

Within 180 calendar days of written receipt of approval by the Regional Administrator of the Verification Investigation Work Plan, Chevron will submit the results of the Verification Investigation (VI) to the Regional Administrator (EPA) and the Director (PADER). Figure 9 provides an outline of task implementation.

6.3 PERSONNEL

This section provides project management and organization for the Verififcation Investigation at Chevron's Philadelphia Refinery. The project organization with activities is presented in Figure 10.

The Project Coordinator will have overall responsibility for the project and for fulfilling regulatory requirements.

Assisting the Project Coordinator will be the Project Director. The Project Director will have responsibility for the project and will oversee contractual and technical matters. In conjunction with the Project Director, the Project Manager will oversee personnel, technical, and budgetary concerns. These personnel will also report to and receive input from Chevron. Health and safety and quality assurance staff will support the project management team with progress reports on program elements.

The Project Manager will be responsible for implementing project plans and managing the day-to-day activities of project resources to achieve schedule and technical goals.

The Quality Assurance/Quality Control (QA/QC) Officer will independently plan, schedule, and approve system and performance audits and will report directly to the Project Manager. The QA/QC program will be planned and updated through the Project QA/QC Officer.

The Health and Safety Officer will support the project team during site characterization.

Mr. M.T. Manigly will serve as Project Coordinator for Chevron. Mr. Manigly is currently an Environmental Specialist with Chevron.

Mr. Ralph T. Golia, P.G., will serve as Project Director. Mr. Golia is currently an Associate in Dames & Moore's Philadelphia office.

Mr. Bruce Amig will serve as Project Manager. Mr. Amig is currently a Project Hydrogeologist in Dames & Moore's Philadelphia office.

Dr. Donald Supkow, P.G., will serve as a principal investigator. Dr. Supkow has more than 20 years' experience in hydrogeology. He has dealt extensively with investigating contaminated soil and ground water sites.

Mr. Thomas D. Whitman will serve as the Health and Safety Officer. Mr. Whitman is currently a Staff Environmental Scientist in Dames & Moore's Philadelphia office.

Mr. John F. Kearns will serve as QA/QC Officer. Mr. Kearns is currently an Associate of Dames & Moore's in Annapolis, Maryland.

Curriculum vitae of the project team are presented in Appendix D. The key personnel will be assisted by other professionals of appropriate discipline from Dames & Moore's Philadelphia and other offices on an as-needed basis.

Subcontractors will be procured to perform the following services for this project:

- Soil borings
- Laboratory analyses

7.0 DATA MANAGEMENT PLAN

7.1 INTRODUCTION

This Data Management Plan presents a program for systematically managing information acquired during the Verification Investigation (VI) to be conducted at the Chevron

Refinery. This plan describes project organization and procedures for tracking information, documents for recording measurements and observations in the field, and the data base management system to be employed. In addition, data reduction aspects of the project are discussed, and exhibits of the anticipated data presentation formats to be used for both raw data and conclusions are addressed.

The Data Management Plan has been designed to satisfy the following objectives:

1) Identify and establish data documentation materials and procedures for the VI.

2) Develop and establish project file procedures to allow collection and tracking of all anticipated project documents and records.

3) Delineate project-related progress reporting procedures and deliverable documents.

4) Discuss the data base management system that will be employed.

5) Provide anticipated formats to be used to present raw data and conclusions of the VI.

7.2 DATA DOCUMENTATION AND PROCEDURES

There are four major categories of data that will be generated in the course of the Verification Investigation at the Chevron Refinery in Philadelphia, Pennsylvania. They are as follows:

- o Field samples and analytical results

  - Soil (geologic and geotechnical), air samples, chain of custodies, and unique identifiers

  - Laboratory data, including laboratory identifiers, analytical methodologies, analytical results, detection limits, and exceptions

- o Field data

  - Field records and observations, including sampling identifiers, geologic, spatial, geotechnical characteristics, and field methods and procedures for samples collected

- o Documents

  - Contracts, reports, field log books, etc.

- o Communications

  - Records of telephone conversations, letters, facsimile transmissions, memoranda, meeting notes, etc.

7.2.1 Project Data Flow

The four categories of data will be handled by four primary organizations: Chevron, EPA, and Dames & Moore and its subcontractors. Each of these organizations will act as one mode in the data flow network. Data handling will be accomplished as follows:

- o Dames & Moore and its subcontractors:

  Will collect field samples and submit them to a laboratory for analysis, and will record all field data. The data will include all geologic, geotechnical, and procedural notes regarding samples collected and conditions observed in the field. Unique identifiers will be assigned to all samples collected in the field, and chain of custody documentation forms will be completed for all samples shipped from the site for analysis.

  Will analyze results from a laboratory to be selected in the future. These data will be consolidated with the field data, and the combined input will be utilized for analysis of contaminant presence.

  Will develop and maintain computer data bases to catalog all documents and correspondence that pertain to the project. This information will be stored in project-specific filing cabinets.

  Will provide output in the form of graphics, tabular summaries of the data and calculations, and finished reports to Chevron.

- o Chevron:

  Will accept data input in the form of draft and final reports.

- o USEPA:

  Will be provided with access to all hard-copy data files and reports.

7.2.2 Data Management Organization

Dames & Moore has identified two separate position titles that will have primary responsibility for managing project data. The following provides a summary of the tasks that those individuals will be responsible for:

1. Project Manager - Has overall responsibility for all observations and information gathered as part of field investigational work and will oversee proper collection and recording of data, subcontractors' work in the VI, and provide the first review of all data collected in the field for completeness.

2. Quality Assurance Officer - Responsible for supervising the validation of field and laboratory measurements as described in the DQAP, and will ensure procedural compliance with all approved plans.

7.2.3 Project Documentation Materials

Standardized project forms and formats have been developed for the collection of field data and observations, recording of laboratory information, and routine project communications. Laboratory data will be reported in the Contract Laboratory Protocol format where it is applicable. Routine project communications will be documented on standardized forms for telephone communications, project memoranda, and regular reporting to Chevron.

Each plan or procedural document generated as part of the VI will include a document information block to indicate the revision number, the date of the most current revision, and the total number of pages in each document section. This document block will appear at the top of each document page and will appear follows:

Plan/Document Name	Section No. ________
Chevron Facility	Revision No. ________
	Date: ________________
	Page: ______ of ______

A signature page to record reviews, approvals, and distribution of numbered control copies will ensure the control of the VI documents. Each of the plans will be reviewed and approved by the Dames & Moore Project Director, Project Manager, and Quality Assurance Officer. As appropriate for individual plans, additional individuals will be required to review and sign the document approval page.

7.3 PROJECT FILES

The project files will be used to store and maintain all documents pertaining to the project including reports, data, field logs, communications, diagrams, and notes. The project files will be maintained at Dames & Moore's Philadelphia Regional office.

7.4 DATA RECORD

7.4.1 Data Record Requirements

A data record for information collected during the VI will be developed to provide all information needed to subsequently analyze and assess the results of the field and laboratory work. Data records require consistent labeling and recording of field observations to facilitate future data reduction and analysis. This is necessary to eliminate the need for speculation concerning the quality of observations and establish the influence of environmental factors on an ultimate result. The following requirements will be met by the laboratory data record:

1. Unique sample code
2. Sampling location and sample type
3. Sampling date and time
4. Laboratory analysis ID number
5. Sampling or field measurement of raw data
6. Laboratory analysis identification number
7. Property or component measured
8. Results of analysis (concentration)
9. Detection limit
10. Reporting units

All data collected during the investigation will need to be accounted for and reported to the agency, including suspected outliers or samples contaminated by improper collection, preservation, or storage procedures. Data that are invalidated during the quality control assessment will be marked as such, and will include explanations of the reasons for data invalidation. These values will be flagged in summary tables.

In addition to the above, certain field information will be recorded on standardized field data collection forms to document procedures used, and the prevailing conditions during the time of the sampling. This information includes:

1. Name of sampler
2. Date and time of sampling
3. Sample type (soil, sediment, surface water, ground water, air)
4. Sampling location description and purpose of sampling
5. Sampling method, sample containers and preservative used
6. Number and volume of samples taken
7. Sample identification numbers
8. Amount purged for ground water monitoring well sampling (if applicable)
9. Field observations (prevailing weather conditions and other relevant factors that might influence sample integrity)

10. Field measurements conducted such as pH, EC, and temperature
11. Name and signature of person responsible for observation

In addition to the above information, unusual conditions encountered during sampling will also be described to allow interpretation of potentially erroneous data at a later date.

7.4.2 Sample Code

7.4.2.1 Sample Code Requirements

Each sample collected as part of this investigation will be assigned a unique identification number. These identification numbers will be assigned prior to the commencement of any field explorations. Sample codes will contain the following components:

1. Sample media [vapor phase or air, surface soil, subsurface soil (1 digit)]
2. Sample point location number (4 digits)
3. Identification numbers to indicate sample number or the collection of replicate samples, field blanks, and other quality control samples (2 digits)

The coding sequence must be strictly adhered to on the sample labels and chain of custody forms to ensure proper entry into all data management systems.

7.4.2.1.1 Sample Media

The sample media will appear as the initial sample code designation. This single-digit code will employ letter designations to define the media as follows:

S - Surface soil sample
B - Subsurface boring sample
V - Soil gas sample

7.4.2.1.2 Sample Location

The sample location will be designated by four digits. The location number will be assigned as part of the investigations of each media prior to commencement of the work. All of the spaces must be completed in the sample sequence.

7.4.2.1.3 Identification Number

The two-digit sample identification number will be used to define the sample in terms of the precise location within the sample location defined in subsection 4.2.1.2 or to define the sample as a field quality control sample. The identification number will be assigned by the field personnel and will be clearly defined in the field workers' field records.

Identification numbers will be assigned an alphabetical code that will begin with A0 - A9, followed by B0 - B9, etc. through Z9. This system will provide a total of 359 unique sample sequences for each media and sample location.

Quality control samples will be assigned in the identification numbers so that they exist as blind samples to the laboratory. The identification will be assigned by the field personnel and will be clearly defined in the field workers' field records. For field duplicates, the same sample location number will be assigned with a unique identification number. Field blanks will be collected adjacent to the sample location believed to be the most contaminated based on previous investigations or field measurements. The sample location number will be the same location number as the collected sample. A unique identification number will then be assigned to designate the field blank. The trip blank may be assigned any sample location number that was sampled that day <u>and</u> that the trip blank was present. Again, a unique identification number will be assigned.

7.4.2.1.4 Code Sequence and Recording

The media, sample location, and unique identification number will be expressed in the following sequence:

_____ - _____ _____ _____ _____ _____

Media   Sample Location   ID No.

The sample code will appear as noted above on all sample containers and any chain of custody forms that will accompany the samples for laboratory analysis. Each space will be filled in completely and no dashes will be used to separate the media, sample location, and identification numbers.

7.4.3 Data Reduction

Data collected during the VI will be reported according to accepted practices of quality assurance, as outlined in the Data Quality Assurance Plan (DQAP). All information collected during the study will be tracked. Data that fail one or more quality criteria will be qualified and used to the extent feasible based on the nature of qualifications, and the effect the qualifications will have on ultimate reliability. Primary considerations in data reduction include the following:

1. Treatment of replicate measurements
2. Identification of outlier values
3. Reporting of results determined to be below detection limits.

The specific data reduction during the VI Work Plan implementation is outlined below.

Evaluated Media:	Data Collection:	Data Recording:	Data Presentation:
air monitoring/ soil gas	direct read/ direct read	log in field notebook/ GC print out	records stored in file/Data presented in tabular form with GC printout
surface soil	observation	logged in field notebook	record on file
subsurface soil	observation	logged in field notebook	boring logs presented in report

7.4.3.1 Replicates

As part of the proposed QA/QC program for sampling operations, random replicate samples will be collected for analysis, as described in the DQAP. Prior to the creation of summary data tabulations, including graphics presentations, all replicate analytical results will be statistically averaged and the resulting average value will be included in the summary data set as one value. This treatment of replicate values is intended to limit statistical bias in the summary data set. Acceptance criteria for replicate values are +/- 20%.

7.4.3.2 Outliers

Outliers, those data points that are believed to be inconsistent with actual conditions, will be identified during the QA/QC review of the data collected during the VI. As these values are discovered, attempts will be made to determine the cause of the inconsistency within the data set. Common causes of outlier values are entry errors, errors in sampling or contamination of sampling equipment, and actual, but extreme, conditions. Entry errors will be identified by comparison of field logs, chain of custody documents, and raw laboratory reports. Errors in sampling procedure or contaminated sampling equipment will likely result in several corrupt data values, or may be identified through comparison of replicate samples, which will help to identify extreme values.

Analytical data stored in the data base will be periodically reviewed utilizing the "confidence interval" technique as a means of identifying statistical outlier values, and as an aid in validating the results obtained.

In cases where the cause of the outlier value can be identified, and the data can reasonably be adjusted to correct for the error (e.g., entry errors and calibration errors), appropriate corrections will be made in the summary tabulations to reflect the true data value, and these values will be flagged as "Adjusted Outliers" in the footnotes of the table. In cases where the cause of the outlier value cannot be determined, the values will be flagged as "Outlier Error" in the footnotes of the table, and they will be omitted from summary calculations. Outlier values will always be included in the raw data tabulations, in their originally reported form, and will be flagged simply as "Outlier" in the footnotes of the table.

7.4.3.3 Values Below Detectable Limits

Analytical results that are reported to be below the limits of detection of the specified analytical method will be reported numerically (e.g., "<X.XX") where X.XX will be a numerical representation of the limit of detection of the methodology employed for the analysis. This format will be used in all data tabulations, and these values will be omitted from any summary calculations.

7.5 DATA BASE MANAGEMENT

Analytical and significant field data collected during the VI will be entered, stored, and evaluated using computerized data bases. The principal intent of the system will be to provide rapid access to the results of the field investigations, and to allow evaluations and comparisons to be made from a variety of references.

7.5.1 Field Data

Information concerning conditions and features observed during the field investigation will be recorded in daily logs by the field personnel. Copies of these logs will be provided to data management personnel on a weekly basis, and suitable data will be extracted and entered into the data base system. These data will include sample identifiers, sampling methodologies, conditions during sampling, and sampler identification information. The data will be merged in the data base with analytical results obtained from the laboratory to create a unified data set describing the results of the investigations. Original log books will be logged into the project files as they are filled, and will be maintained for future comparison and QA/QC review.

7.5.2 Analytical Data

Analytical data will be reported by the laboratory in one format, hard-copy reports. The hard-copy reports will be logged into and maintained in the project files for future comparison and QA/QC review.

Summary tables, graphs, and maps will be used to present the results of overall SWMU characterizations. These tables may provide statistical summaries (e.g., minima, mean, and maxima) of the analytical data for specific SWMUs or the entire site, and may be summarized by analyte classifications, strata, media, or sampling event. Example column headings for summary tables follow:

- o Analyte Class: metals, volatiles, semivolatiles, etc.
- o Specific Compound: Zn, Cu, Pb, Fe, etc., for metals
- o Units: units of measure specified for the analytical results
- o No. Samples: the total number of analyses performed for the indicated analyte, at the specified location
- o No. Detections: the total number of results reported above the detection limit
- o Minimum: the reported minimum concentration from the described analysis set
- o Average: the arithmetic mean concentration from the described analysis set
- o Maximum: the reported maximum concentration from the described analysis set
- o Location of Maximum Concentration: the geographic or geologic location of the specified maximum concentration
- o Selected ARAR, Concentration, Type: the regulatory guideline or limit used for comparison, and the issuing agency
- o Number of Exceedances: the total number of analytical results in excess of the regulatory guideline or limit
- o Relative Mobility: will be specified for analytes reported in excess of regulatory guidelines or limits

7.6 REPORTING

Periodic reports will be provided to Chevron and the EPA during the course of the project. These reoprts may include:

1. Description and estimate of the percentage of the VI completed
2. Summaries of all findings
3. Work completed in the previous month
4. Work in progress
5. Projected work for the next period
6. Out-of-scope work performed and justification
7. Problems encountered and corrective actions
8. Personnel changes during the reporting period
9. Summary of all communications with EPA

Within 180 days after written approval of the Verification Investigation, a report presenting the results of investigation will be submitted to EPA and PADER.

Emergency and priority situations will be reported to EPA by telephone and followed by a report within 24 hours. All communications will detail the nature of the situation, the proposed corrective measure, and the rationale for the proposed measure.

Completed draft task reports will be submitted as they are completed. Draft and final VI reports incorporating the results of all previous reports will also be submitted as required by the Permit. The final report will be sufficiently detailed to allow decisions to be made regarding the need for additional investigation.

The VI Work Plan was prepared by:

DAMES & MOORE
A Professional Limited Partnership

Ralph T. Golia
Project Director

Bruce C. Amig
Project Manager

6999R

TABLE 1

SKINNER LIST
VERIFICATION INVESTIGATIONS
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

** Acetonitrile (Ethanenitrile)
** Acrolein (2-Propenal)
** Acrylonitrile (2-Propenenitrile)
Aniline (Benzenamine)
Antimony
Arsenic
Barium
Benz (c) acridine (3,4-Benzacridine)
Benz (a) anthracene (1,2-Benzanthracene)
** Benzene (Cyclohexatriene)
Benzenethiol (Thiophenol)
Benzidine (1,1-Biphenyl-4,4 diamine)
Benzo(b)Fluoranthene (2,3-Benzofluoranthene)
Benzo(j)Fluoranthene (7,8-Benzofluoranthene)
Benzo(a)pyrene (3,4-Benzopyrene)
** Benzyl chloride (Benzene,(chloromethyl)-)
Beryllium
Bis(2-chloroethyl)ether(Ethane,1,1-oxybis(2-chloro-))
Bis(2-chloroisopropyl)ether(Propane,2,2-oxybis(2-chloro-))
** Bis(chloromethyl)ether(Methane, oxybis(chloro))
Bis(2-ethylhexyl)phthalate(1,2-Benzenedicarboxylic acid, bis (2-ethylhexyl) ester)
Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester)
Cadmium
Carbon disulfide (Carbon bisulfide)
p-Chloro-m-cresol
** Chlorobenzene (Benzene, chloro-)
** Chloroform (Methane, trichloro-)
** Chloromethane (Methyl chloride)
2-Chloronapthalene (Naphthalene, beta-chloro-)
2-Chlorophenol (Phenol, o-chloro-)
Chromium
Chrysene (1,2-Benzphenanthrene)
Cresols (Cresylic acid) (Phenol, methyl-)
** Crotonaldehyde (2-Butenal)
Cumene (Isopropyl Benzene)
Cyanide
Dibenz(a,h)acridine(1,2,5,6-Dibenzacridine)
Dibenz(a,j)acridine(1,2,7,8-Dibenzacridine)
Dibenz(a,h)anthracene(1,2,5,6-Dibenzanthracene)
7H-Dibenzo(c,g)carbazole(3,4,5,6-Dibenzcarbazole)
Dibenzo(a,e)pyrene(1,2,4,5-Dibenzpyrene)
Dibenzo(a,h)pyrene(1,2,5,6-Dibenzpyrene)
Dibenzo(a,i)pyrene(1,2,7,8-Dibenzpyrene)
** 1,2-Dibromoethane (Ethylene dibromide)
Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)

TABLE 1
(Continued)

*	Dichlorobenzenes
**	1,2-Dichloroethane (Ethylene dichloride)
**	trans-1,2-Dichloroethene(1,2-Dichloroethylene)
**	1,1-Dichloroethylene (Ethene, 1,1-dichloro-)
**	Dichloromethane (Methylene chloride)
**	Dichloropropane
	Dichloropropanol
	Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
	7,12-Dimethylbenz(a)anthracene
	2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
	Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
	4,6-Dinitro-o-cresol
	2,4-Dinitrophenol (phenol, 2,4-nitro-)
	2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
	Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
**	1,4-Dioxane (1,4-Diethylene oxide)
	1,2-Diphenylhydrazine (Hydrazine, 1,2-Diphenyl-)
**	Ethyleneimine (Azridine)
**	Ethylene oxide (Oxirane)
	Fluoranthene (Benzo(j,k) fluorene)
**	Formaldehyde
	Hydrogen sulfide (Sulfur hydride)
	Indeno (1,2,3-cd)pyrene (1 10(1,2-phenylene)pyrene)
	Lead
	Mercury
	Methanethiol (Thiomethanol)
	3-Methylchlolanthrene (Benz(j)aceanthrylene, 1,2-dihydro-3-methyl-)
**	Methyl ethyl ketone (MEK)(2-Butanone)
	Naphthalene
	Nickel
	p-Nitroaniline(Benzenamine, 4-nitro-)
	Nitrobenzene (Benzene, nitro-)
	4-Nitrophenol (Phenol, pentachloro-)
	Pentachlorophenol (Phenol, pentachloro-)
	Phenol (Benzene, hydroxy-)
	Propyl benzene
	Pyridine
	Selenium
**	Tetrachloroethanes
**	Tetrachloroethylene (Ethene, 1,1,2,2-tetra chloro-)
**	Toluene (Benzene, methyl-)
*	Trichlorobenzenes
**	Trichloroethanes
**	Trichloroethene (Trichloroethylene)
*	Trichlorophenols
	Vanadium
	Xylene

TABLE 1
(Continued)

Non-Appendix VIII Constituents of Concern

Cobalt
1-Methylnapthalene
Styrene
Hydroquinone
Anthracene
Indene
5-Nitro acenaphthene
Quinoline
Phenanthrene
Pyrene

Footnotes:

* If any of these groups of compounds are found, the specific isomers listed in Appendix VIII should be identified.

** Use Test Method 8240 for these volatile compounds.

Note:

Use Test Method 3050 in SW-846 for all metals.

0594t

TABLE 2

SOIL ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX VOLATILE ORGANIC COMPOUNDS
EPA METHOD 8240

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
Acetone	<10.
Acetonitrile	<100.
Acrolein	<100.
Acrylonitrile	<100.
Allyl chloride	<5.
Benzene	<5.
Bromodichloromethane	<5.
Bromoform	<5.
Carbon disulfide	<5.
Carbon tetrachloride	<5.
Chlorobenzene	<5.
Chloroethane	<10.
Chloroform	<5.
Chloroprene	QU
Dibromochloromethane	<5.
1,2-dibromo-3-chloropropane	<20.
1,2-dibromoethane	<5.
trans-1,4-dichloro-2-butene	<20.
Dichlorodifluoromethane	<5.
1,1-dichloroethene	<5.
1,2-dichloroethane	<5.
1,1-dichloroethane	<5.
trans-1,2-dichloroethene	<5.
1,2-dichloropropane	<5.
cis-1,3-dichloropropene	<5.
trans-1,3-dichloropropene	<5.
1,4-dioxane	<150.
Ethylbenzene	<5.
Ethyl methacrylate	<5.
2-hexanone	50.
Isobutyl alcohol	200.
Methacrylonitrile	100.
Methyl bromide	10.
Methyl chloride	10.
Methylene bromide	5.
Methylene chloride	5.
Methyl ethyl ketone	100.
Methyl iodide	5.
Methyl methacrylate	10.
4-methyl-2-pentanone	50.
Pentachloroethane	QU

TABLE 2 (continued)

SOIL ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX VOLATILE ORGANIC COMPOUNDS
EPA METHOD 8240

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
Propionitrile	<10.
Pyridine	<500.
Styrene	<5.
1,1,1,2-tetrachloroethane	<5.
1,1,2,2-tetrachloroethane	<5.
Tetrachloroethene	<5.
Toluene	<5.
1,1,1-trichloroethane	<5.
1,1,2-trichloroethane	<5.
Trichloroethene	<5.
Trichlorofluoromethane	<5.
1,2,3-trichloropropane	<10.
Vinyl acetate	<10.
Vinyl chloride	<10.
Xylene	<5.

Note:

1. The Detection Limit is the reporting limit listed on a Lancaster Laboratories, Inc. analysis report. Actual limits may vary depending on sample matrix.

Explanation:

QU = Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported.

0654t

<u>TABLE 2</u> (Continued)

GROUND WATER ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX SEMIVOLATILE COMPOUNDS
EPA METHOD 8270

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
Acenaphthene	<10.
Acenaphthylene	<10.
Acetophenone	<10.
2-acetylaminofluorene	<10.
4-aminobiphenyl	<10.
Aniline	<10.
Anthracene	<10.
Aramite	<25.
Benzo[a]anthracene	<10.
Benzo[b]fluoranthene	<10.
Benzo[k]fluoranthene	<10.
Benzo[ghi]perylene	<10.
Benzo[a]pyrene	<10.
Benzyl alcohol	<10.
Bis(2-chloroethoxy)methane	<10.
Bis(2-chloroethyl)ether	<10.
Bis(2-chloro-1-methylethyl)ether	QU
Bis(2-ethylhexyl)phthalate	<10.
4-bromophenyl phenyl ether	<10.
Butyl benzyl phthalate	<10.
p-chloroaniline	<10.
Chlorobenzilate	<10.
p-chloro-m-cresol	<10.
2-chloronaphthalene	<10.
2-chlorophenol	<10.
4-chlorophenyl phenyl ether	<10.
Chrysene	<10.
o-cresol	<10.*
m-cresol	<10.*
p-cresol	<10.
Diallate	<10.
Dibenzofuran	<10.
Di-n-butyl phthalate	<10.
Dibenz[a,h]anthracene	<10.
o-dichlorobenzene	<10.
m-dichlorobenzene	<10.
p-dichlorobenzene	<10.
3,3'-dichlorobenzidine	<20.
2,4-dichlorophenol	<10.
2,6-dichlorophenol	<10.
Diethyl phthalate	<10.
0,0-diethyl-0-2-pyrazinyl phosphorothioate	NA

TABLE 2 (continued)

GROUND WATER ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX SEMIVOLATILE COMPOUNDS
EPA METHOD 8270

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
Dimethoate	QU
p-(dimethylamino)azobenzene	<10.
7,12-dimethylbenz[a]anthracene	QU
3,3'-dimethylbenzidine	<10.
alpha,alpha-dimethylphenethylamine	NA
2,4-dimethylphenol	<10.
Dimethyl phthalate	<10.
m-dinitrobenzene	<10.
4,6-dinitro-o-cresol	<25.
2,4-dinitrophenol	<50.
2,4-dinitrotoluene	<10.
2,6-dinitrotoluene	<10.
Di-n-octyl phthalate	<10.
Diphenylamine	<10.
Ethyl methanesulfonate	<10.
Fluoranthene	<10.
Fluorene	<10.
Hexachlorobenzene	<10.
Hexachlorobutadiene	<10.
Hexachlorocyclopentadiene	<10.
Hexachloroethane	<10.
Hexachlorophene	QU
Hexachloropropene	QU
Indeno(1,2,3-cd)pyrene	<10.
Isodrin	<10.
Isophorone	<10.
Isosafrole	<10.
Methapyrilene	NA
3-Methylcholanthrene	<10.
Methyl methanesulfonate	<10.
2-methylnaphthalene	<10.
Naphthalene	<10.
1,4-naphthoquinone	QU
1-napthylamine	<10.
2-napthylamine	<20.
o-nitroaniline	<50.
m-nitroaniline	<50.
p-nitroaniline	<50.
Nitrobenzene	<10.
o-nitrophenol	<10.
p-nitrophenol	<50.

TABLE 2 (continued)

GROUND WATER ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX SEMIVOLATILE COMPOUNDS
EPA METHOD 8270

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
4-nitroquinoline 1-oxide	QU
n-nitrosodi-n-butylamine	<10.
n-nitrosodiethylamine	<10.
n-nitrosodimethylamine	<10.
n-nitrosodiphenylamine	<10.
n-nitrosodipropylamine	<10.
n-nitrosomethylethylamine	<10.
n-nitrosomorpholine	<20.
n-nitrosopiperidine	<10.
n-nitrosopyrrolidine	<10.
5-nitro-o-toluidine	<10.
Pentachlorobenzene	QU
Pentachloronitrobenzene	<20.
Pentachlorophenol	<50.
Phenacetin	<10.
Phenanthrene	<10.
Phenol	<10.
p-phenylenediamine	QU
2-picoline	<10.
Pronamide	<10.
Pyrene	<10.
Safrole	<10.
1,2,4,5-tetrachlorobenzene	<10.
2,3,4,6-tetrachlorophenol	<10.
Tetraethyl dithiopyrophosphate	<10.
0-toluidine	QU
1,2,4-trichlorobenzene	<10.
2,4,5-trichlorophenol	<10.
2,4,6-trichlorophenol	<10.
0,0,0-triethyl phosphorothioate	<10.
sym-trinitrobenzene	<20.

*: Isomers cannot be analyzed individually.

QU: Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported.

NA: Uncontaminated neat material for this compound is unavailable. Therefore, this compound will not be reported.

0654t

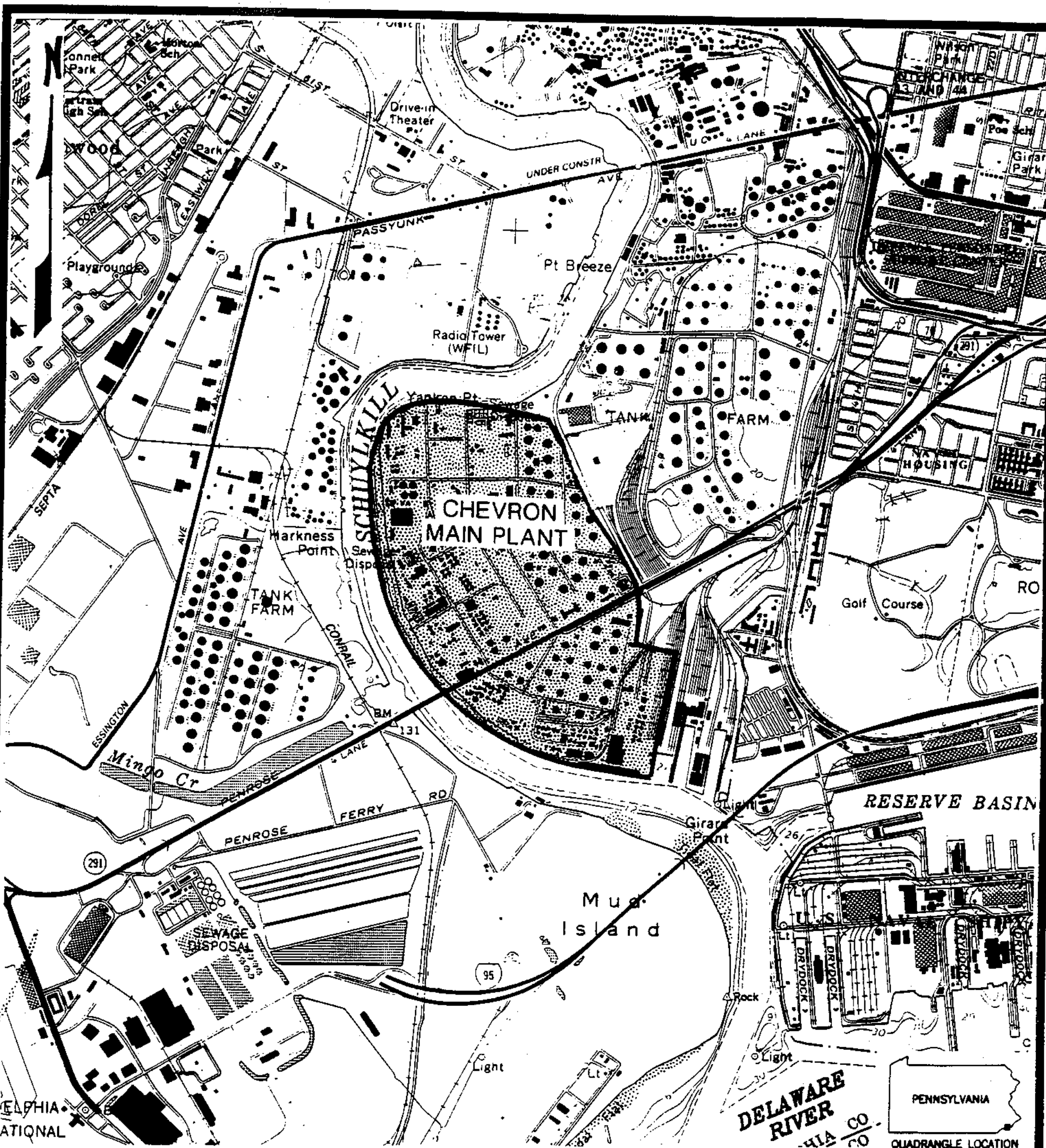
TABLE 2 (Continued)

GROUND WATER ASSESSMENT - CHARACTERIZATION PARAMETERS
SW 846 - APPENDIX IX INORGANIC COMPOUNDS
EPA METHOD 6010 (EXCEPTIONS LISTED BELOW)

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

COMPOUND	DETECTION LIMITS (ug/l)
Antimony	<50.
Arsenic (EPA #7061)	<10.
Barium	<5.
Beryllium	<5.
Cadmium	<5.
Chromium	<50.
Cobalt	<20.
Copper	<50.
Lead (EPA #7421)	<5.
Nickel	<15
Mercury (EPA #7470)	<0.5
Selenium (EPA #7741)	<5.
Silver	<10.
Thallium (EPA #7841)	<10.
Tin	<1,000.
Vanadium	<50.
Zinc	<20.
Cyanide (EPA #9010)	<5.
Sulfide (EPA #9030)	<1,000.

0654t



0 1000 2000 3000 FEET

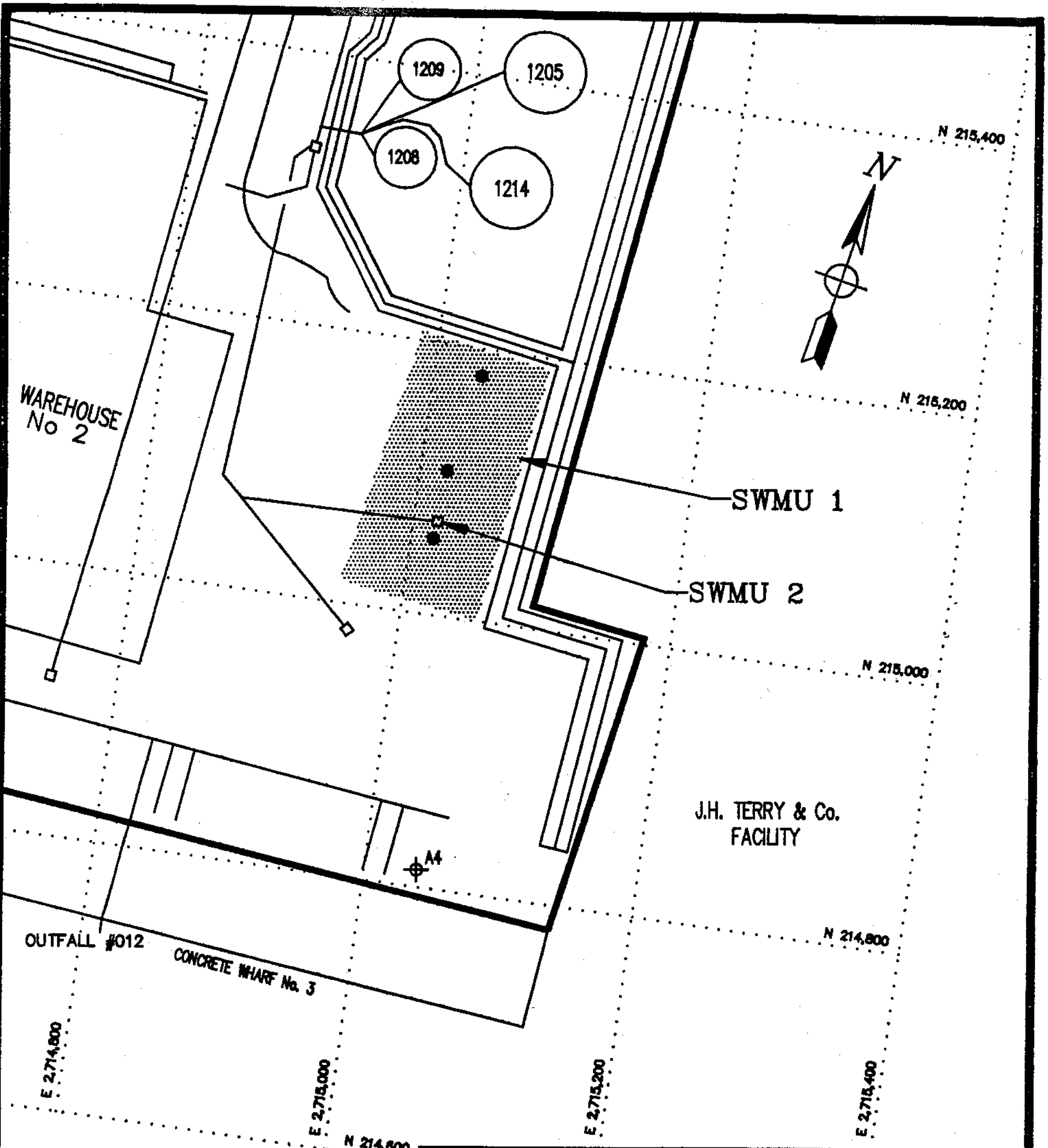
GRAPHIC SCALE

CONTOUR INTERVAL = 20 FEET

REFERENCE:
A PORTION OF USGS 7.5 MINUTE TOPOGRAPHIC MAP; PHILADELPHIA QUADRANGLE, PENNSYLVANIA, 1967, PHOTOREVISED 1985.

TITLE	SITE VICINITY MAP	
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA	
Dames & Moore WILLOW GROVE, PENNSYLVANIA		
SCALE AS NOTED	DWN. BY J.V.M.	JOB NO. 16000-188
DATE 7-14-89	APPR. BY D.W.	FIG. NO. 1

SCHUYLKILL RIVER
SWMU 71
SWMU 71A
SWMU 79
SWMU 30
SWMU 29
SWMU 45
SWMU 11
SWMU 12
SWMU 17
SWMU 13
SWMU 16
SWMU 6
SWMU 9
SWMU 1
SWMU 2
ATLANTIC REFINING CO. PROPERTY
ATHLETIC FIELD
MAIN ENTRANCE GATE #24
J.H. TERRY & Co. FACILITY
STOREHOUSE BLDG No 450
MAINTENANCE BLDG No 440
COOLING TOWER 490
TREATING PLANT
SCRAP YARD
WAREHOUSE No 2 620
CHEVRON PIPE LINES CROSSING RIVER
TWO 8" P.E. LINES CROSSING RIVER
TWO 8" SLUDGE LINES CROSSING RIVER
CONTAINER STORAGE AREA RCRA FACILITY
OUTFALL #001
OUTFALL #002
OUTFALL #003
OUTFALL #004
OUTFALL #005
OUTFALL #010
OUTFALL #012
OUTFALL #014
OUTFALL #015
LEGEND
PROPERTY BOUNDARY
MONITORING WELLS
PROCESS SEWERS
SANITARY SEWERS
OUTFALLS
XXX LOADING AREAS & EGRESS POINTS
XXX STORAGE AREAS
SOLID WASTE MANAGEMENT UNIT
0 75' 150' 300' 450' 600' 750'
SCALE: 1"=150'-0"
200 FOOT GRID BASED ON PENNSYLVANIA STATE RECTANGULAR COORDINATE SYSTEM, SOUTH ZONE 1927 N.A. DATUM
REFERENCE:
BASE MAP PROVIDED BY CHEVRON REFINERY, PHILADELPHIA, PENNSYLVANIA.
TITLE SOLID WASTE MANAGEMENT UNITS UNDER VERIFICATION INVESTIGATION
PROJECT CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA
Dames & Moore
WILLOW GROVE, PENNSYLVANIA
SCALE AS SHOWN
DWN. BY R.G.B.
JOB NO. 16000-164
DATE 2-9-90
APPR. BY B.C.A.
FIG. NO. 2



EXPLANATION:

- ● PLANNED SOIL BORING LOCATION
- ∴∴∴ APPROXIMATE SWMU EXTENT

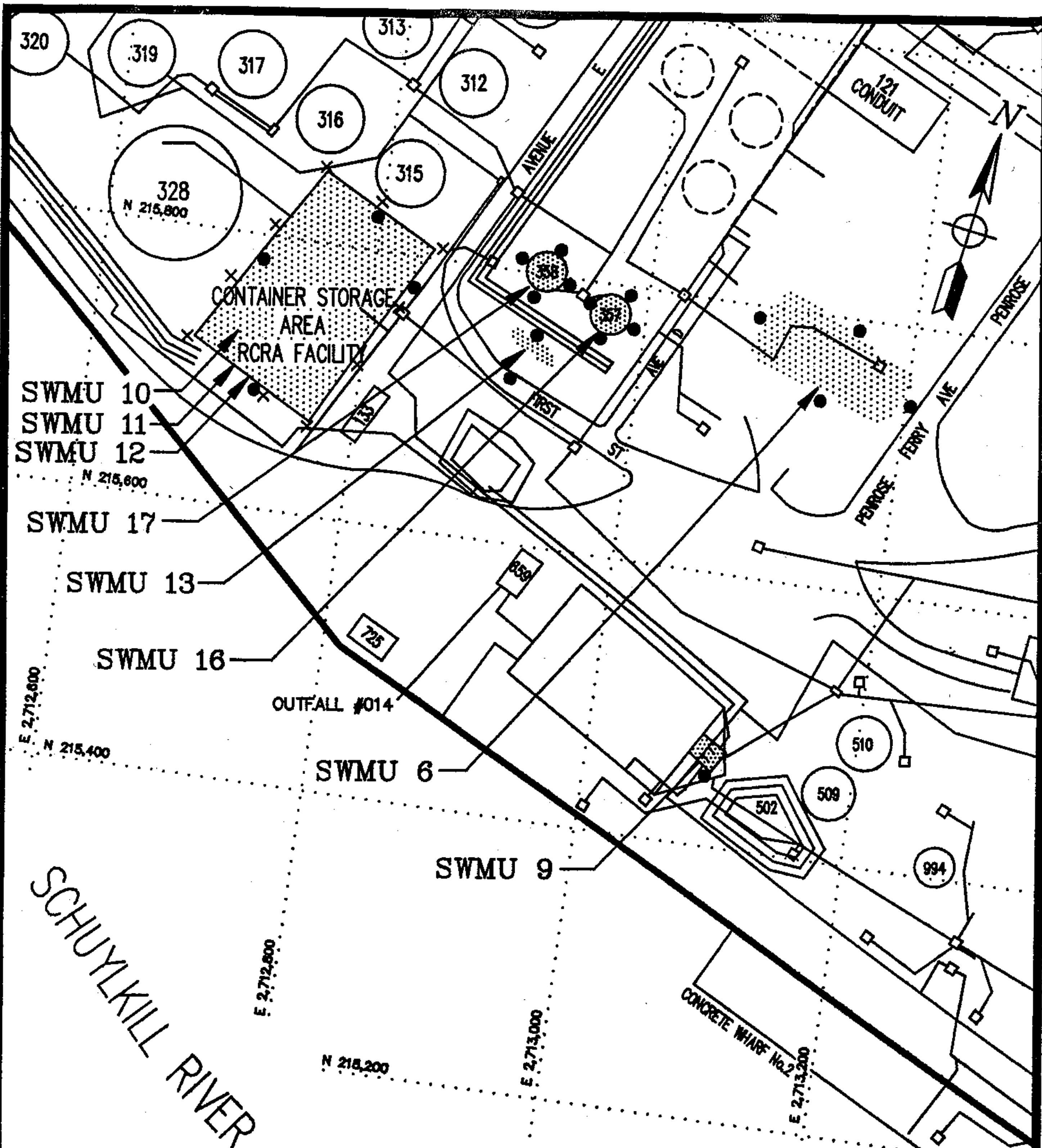
0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE	SOLID WASTE MANAGEMENT UNITS Nos. 1 & 2
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA
	Dames & Moore WILLOW GROVE, PENNSYLVANIA

SCALE	AS SHOWN	DWN. BY	R.G.B.	JOB NO.	16000-164
DATE	2-6-90	APPR. BY	B.C.A.	FIG. NO.	3

BCA-F3 (1)



EXPLANATION:

- ● PLANNED SOIL BORING LOCATION
- × PLANNED SOIL GAS SAMPLING POINT
- APPROXIMATE SWMU EXTENT

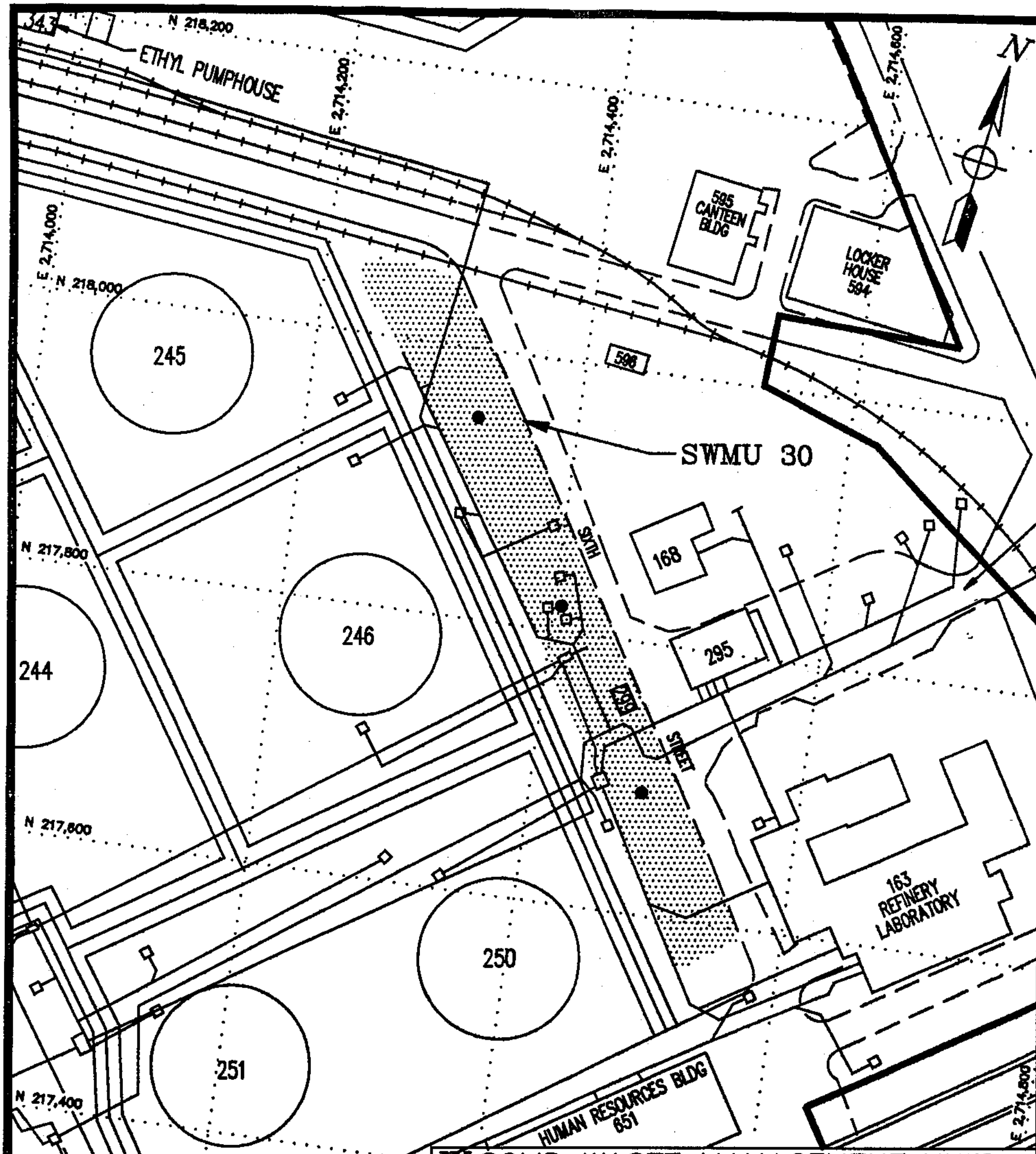
0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE	SOLID WASTE MANAGEMENT UNITS Nos. 6, 9, 11, 12, 13, 16 & 17
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA
	Dames & Moore WILLOW GROVE, PENNSYLVANIA

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-164
DATE 2-6-90	APPR. BY B.C.A.	FIG. NO. 4

BCA-F4 (1)



EXPLANATION:

● PLANNED SOIL BORING LOCATION

APPROXIMATE SWMU EXTENT

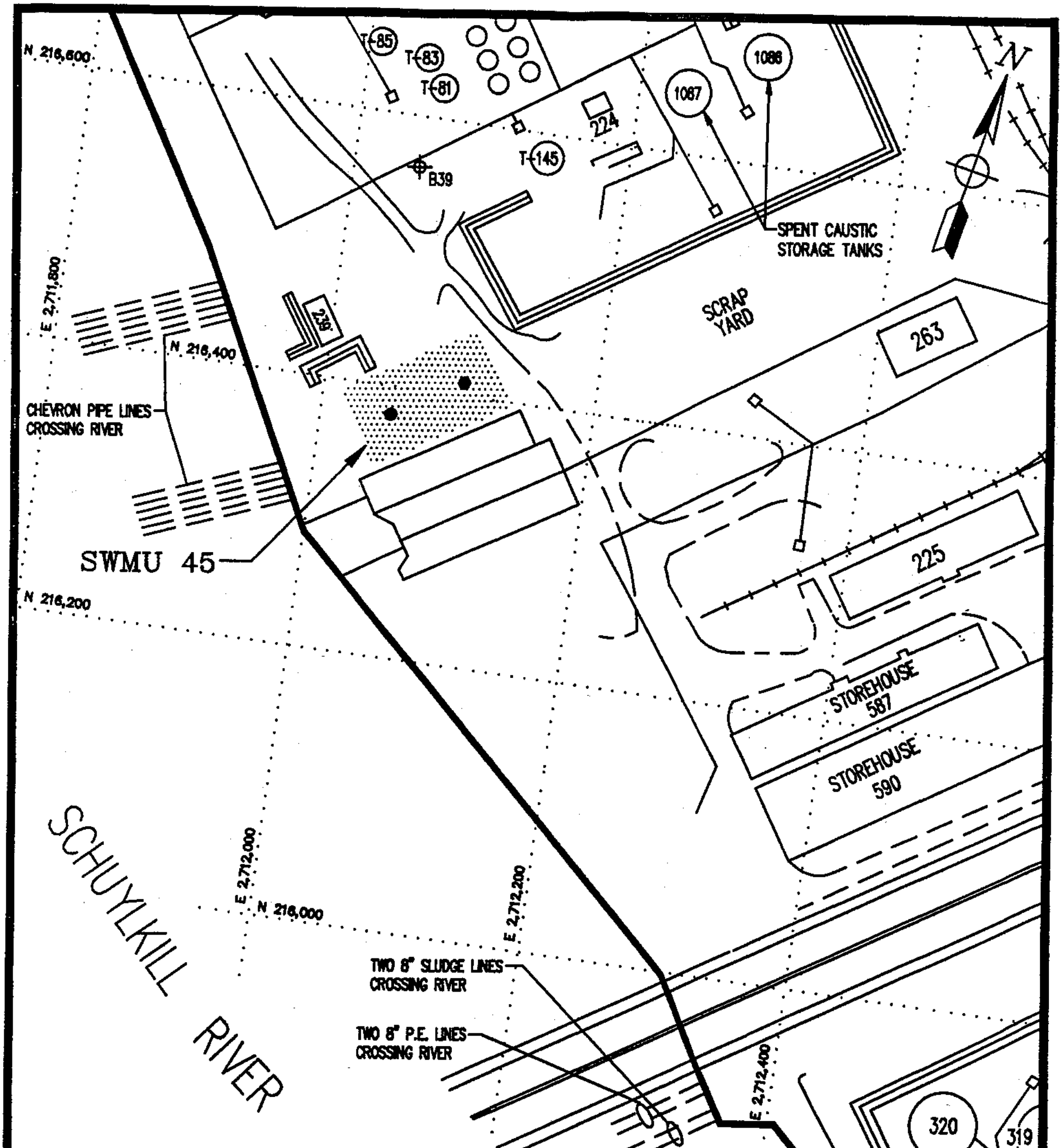
0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE	SOLID WASTE MANAGEMENT UNIT No. 30
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA
	Dames & Moore WILLOW GROVE, PENNSYLVANIA

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-164
DATE 2-6-90	APPR. BY B.C.A.	FIG. NO. 5

BCA-F5 (1)



EXPLANATION:

● PLANNED SOIL BORING LOCATION

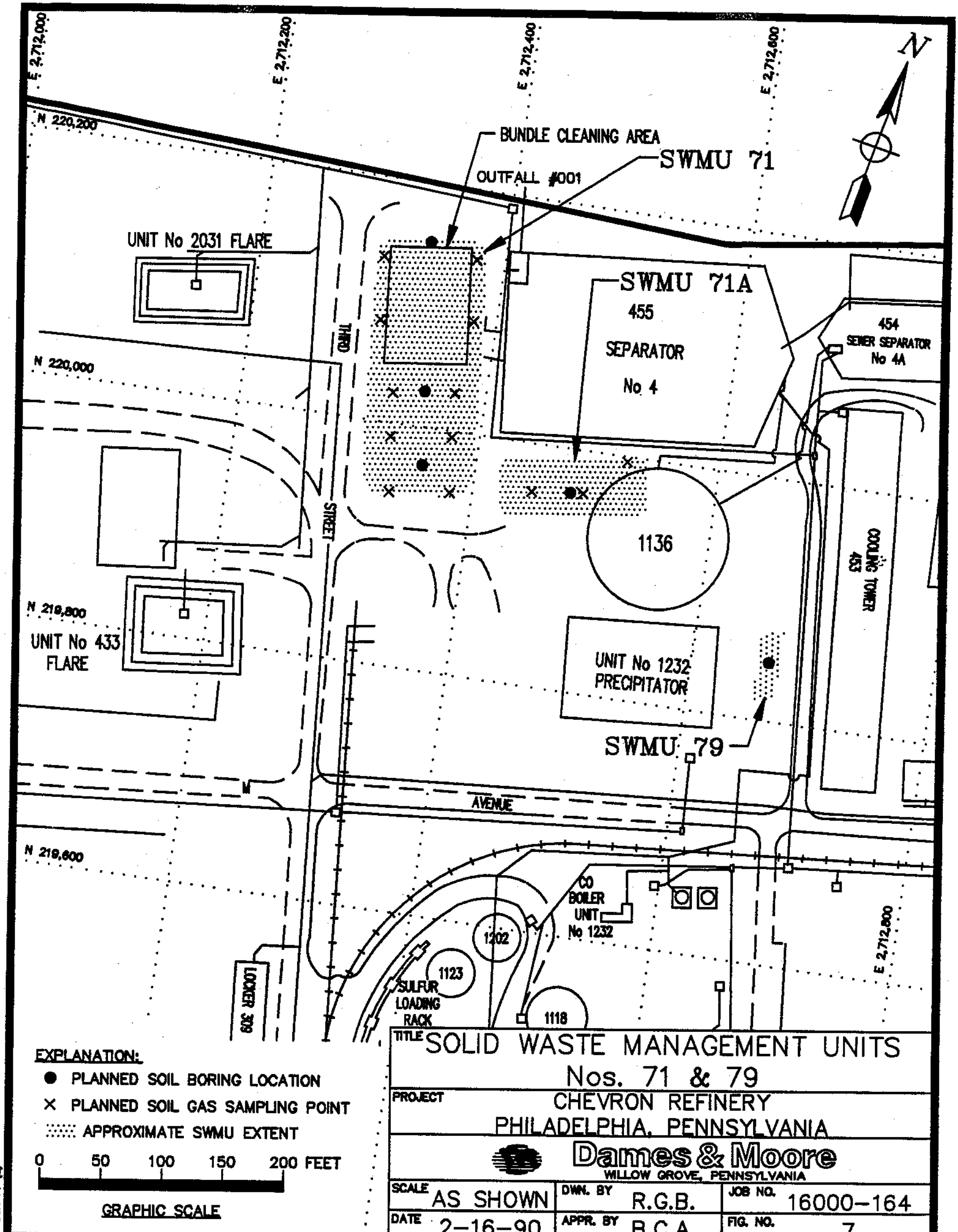
∴∴ APPROXIMATE SWMU EXTENT

0 50 100 150 200 FEET

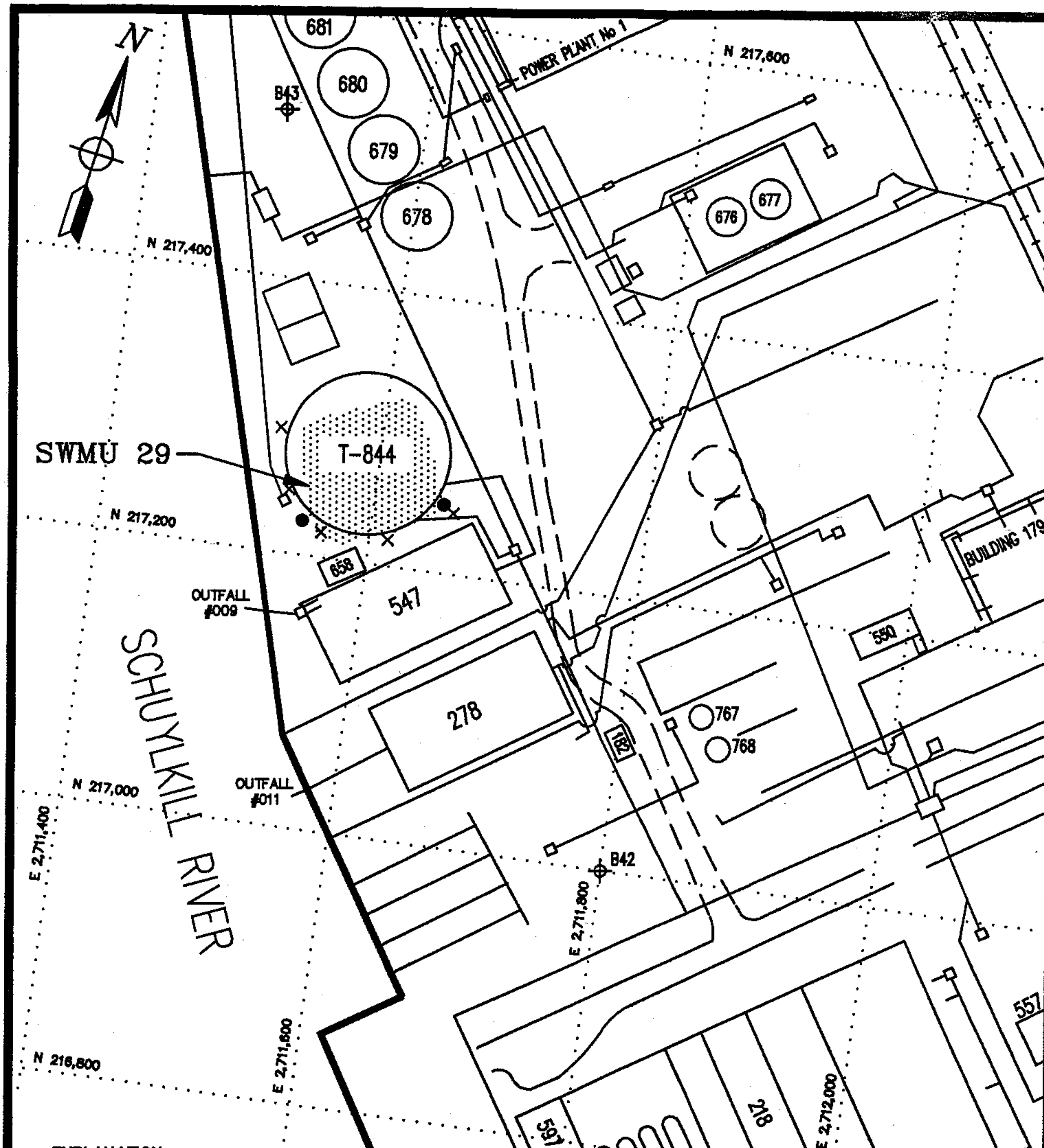
GRAPHIC SCALE

TITLE SOLID WASTE MANAGEMENT UNIT No. 45		
PROJECT CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
Dames & Moore WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-164
DATE 2-6-90	APPR. BY B.C.A.	FIG. NO. 6

BCA-F8 (1)


E 2,712,000
E 2,712,200
E 2,712,400
E 2,712,600
E 2,712,800
N
N 220,200
N 220,000
N 219,800
N 219,600
BUNDLE CLEANING AREA
SWMU 71
OUTFALL #001
UNIT No 2031 FLARE
SWMU 71A
455
SEPARATOR
No 4
454
SEWER SEPARATOR
No 4A
THIRD
STREET
1136
COOLING TOWER
453
UNIT No 433
FLARE
UNIT No 1232
PRECIPITATOR
SWMU 79
AVENUE
CO
BOILER
UNIT
No 1232
1202
1123
1118
SULFUR
LOADING
RACK
LOCKER 309
EXPLANATION:
● PLANNED SOIL BORING LOCATION
× PLANNED SOIL GAS SAMPLING POINT
APPROXIMATE SWMU EXTENT
0 50 100 150 200 FEET
GRAPHIC SCALE
TITLE SOLID WASTE MANAGEMENT UNITS
Nos. 71 & 79
PROJECT CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA
Dames & Moore
WILLOW GROVE, PENNSYLVANIA
SCALE AS SHOWN
DWN. BY R.G.B.
JOB NO. 16000-164
DATE 2-16-90
APPR. BY B.C.A.
FIG. NO. 7

BCA-F7 (2)



EXPLANATION:

- B42 ⊕ EXISTING MONITORING WELL LOCATION
- ● PLANNED SOIL BORING LOCATION
- × PLANNED SOIL GAS SAMPLING POINT
- ::::: APPROXIMATE SWMU EXTENT

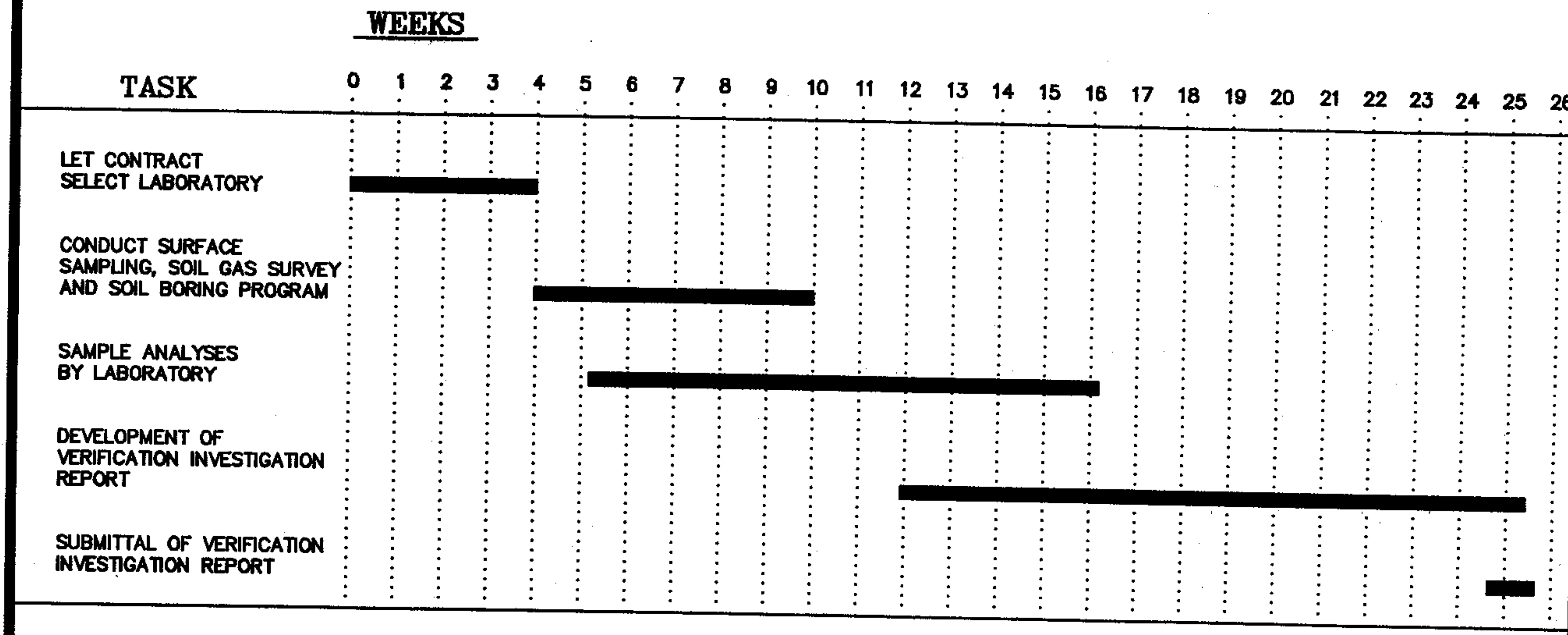
0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE SOLID WASTE MANAGEMENT UNIT No. 29		
PROJECT CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
Dames & Moore WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-164
DATE 2-6-90	APPR. BY B.C.A.	FIG. NO. 8

CRPP-S28 (3)

SCHEDULE FOR IMPLEMENTATION
VERIFICATION INVESTIGATION
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA



NOTE:

ALL SCHEDULES ARE FROM THE DATE OF WRITTEN APPROVAL FROM THE EPA REGION III OF THE VERIFICATION INVESTIGATION WORK PLAN.

CHEVRON\SCH-MP (2)

FIGURE 9
DAMES & MOORE

PROJECT ORGANIZATION/ACTIVITY CHART
VERIFICATION INVESTIGATION WORK PLAN
CHEVRON USA, INC.
PHILADELPHIA, PENNSYLVANIA

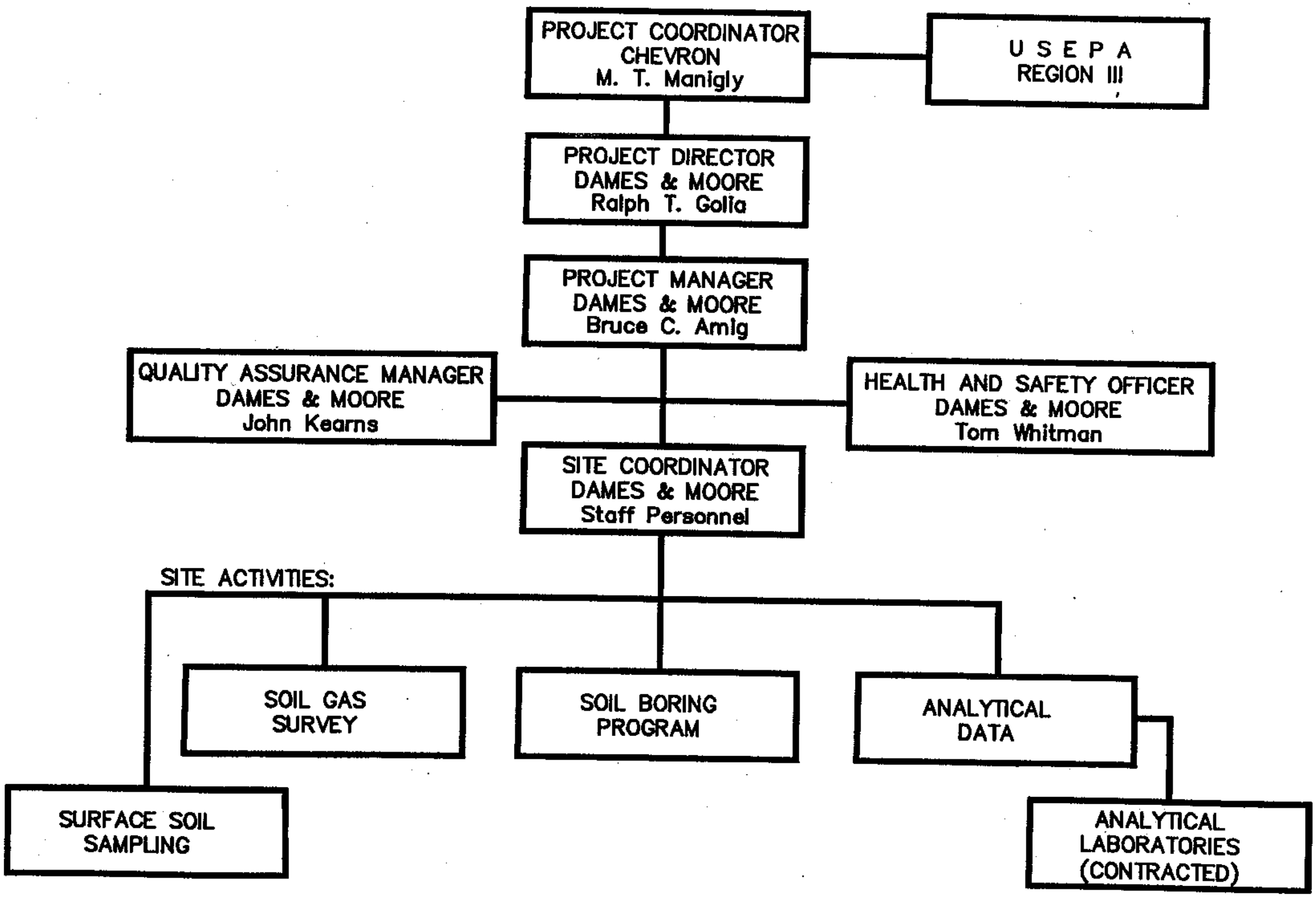


CHART (3)

FIGURE 10

APPENDIX A

SAMPLING PLAN
(Surface and Subsurface Soil Samples)

TABLE OF CONTENTS

6887R

APPENDIX A

SAMPLING PLAN

1.0 SURFACE SOIL SAMPLING

The purpose of the surface soil sampling is to characterize surface soil quality from 0 to 6 inches. The following sections detail the appropriate sampling, decontamination, custody, and sample blank procedures for surface soil sampling.

1.1 SOIL SAMPLING PROCEDURES

Soil sampling procedures will be as follows:

1. The laboratory "shuttle" will be opened and the sample bottles will be inspected to ensure that all of the required bottles are present and properly labeled.

2. Soil sampling locations will be designated in accordance with the Work Plan. (Samples will not be collected during periods of significant rainfall).

3. The sampling area will be cleaned of gravel and/or twiggs. Collection of soil samples will be performed using a clean stainless steel trowel. Each trowel will be cleaned using the procedures outlined in Section 1.2. At each sample location the soil will be placed into the sample vials or jars using the trowel. When collecting a composite sample, equal proportions from each sample location will be combined.

4. For each sampling event, samples will be handled with a new pair of disposable plastic surgical gloves.

5. Upon the completion of sampling at each location, the sampler will be decontaminated in accordance with the procedures described in Section 1.2.

6. Each bottle will be labeled with the following information:

   a. Job number
   b. Owner/client
   c. Location
   d. Sample number or designation
   e. Date
   f. Time
   g. Type of laboratory analysis (i.e., metals, pH, etc.)
   h. Name of person collecting the sample

7. The sample bottles will be placed in the shuttle and packed with ice or chemical ice packs to maintain the temperature at 4^{O}C.

8. The Chain-of-Custody and Field Parameter Forms from the analytical laboratory will be completed and signed. The Sampling Record will also be completed.

9. The shuttle will be sealed and stored.

10. If applicable, a field blank will be collected in accordance with procedures described above.

11. The shuttles will be transported by Federal Express or car to the laboratory within 24 hours of collection. The laboratory will be notified by the project manager in a timely manner of the impending arrival of the samples. The laboratory will be prepared to receive the samples and to perform preliminary extractions or analyses within the recommended holding times.

1.2 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

All sampling equipment will be constructed of inert materials and will be decontaminated in the field prior to use. The sampling device and equipment decontamination method will involve a non-phosphate detergent, tap water, deionized water, methanol, and air drying.

Samplers and sample containers will be cleaned and prepared for field use according to the following procedures:

1. Non-phosphate detergent and tap water wash

2. Tap water rinse

3. Distilled/deionized water rinse

4. 10% nitric acid rinse

5. Distilled/deionized water rinse

6. Methanol (reagent grade) rinse*

7. Total air dry or nitrogen blow out*

8. Distilled/deionized water rinse

Note: * Methanol is an acceptable cleaning solvent provided that it is allowed to <u>totally</u> evaporate via air drying or a nitrogen blowout and if is followed by a distilled/deionized rinse.

1.3 SAMPLE CUSTODY PROCEDURES

Sample chain of custody is initiated by the laboratory with the selection and preparation of the sample containers. To reduce the chance for error, the number of personnel that assume custody of the sample will be held to a minimum.

In-situ or on-site monitoring and sampling data will be controlled and entered onto appropriate records. Personnel involved in the chain-of-custody and transfer of samples will be trained regarding the purpose and procedures prior to implementation.

1.3.1 Field Sample Custody

Dames & Moore personnel receiving the sample containers will check each cooler for the integrity of the seals. Coolers with broken seals will be returned to the laboratory with the containers unused. The receiving Dames & Moore personnel will break the seal, inspect the contents for breakage, sign the Chain-of-Custody Form as their receipt of the sample containers. A temporary seal will be affixed to each cooler until the sample containers are filled.

A Chain-of-Custody Form will accompany the samples from initial sample container selection and preparation at the laboratory to the field for sample containment and preservation, through its return to the laboratory. Under no circumstances will sample coolers and bottles be left unattended in the field unless stored in a secured area.

The project manager will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped and the samples' anticipated date of arrival. Insulated sample shipping containers (coolers) will be provided by the laboratory. All sample bottles within each shipping container will be individually labeled.

When the sample containers have been filled, they will immediately be placed in the cooler with sealed bags of ice or chemical ice to maintain the samples at 4^oC. The field sampler will indicate the sample designation/location number in the space provided on the appropriate Chain-of-Custody Form for each sample of water or sediment. The Chain-of-Custody Forms will be signed and placed in the cooler. The completed shipping container will be closed and a seal will be affixed to the latch or lid. This seal must be broken to open the cooler, and will indicate tampering if the seal is broken before receipt at the laboratory. The samples will be delivered via car or Federal Express to the laboratory not later than one day after sample collection.

If samples are split and sent to different laboratories, a separate Chain-of-custody Form will be sent with the replicate sample. The original Chain-of-Custody Form will accompany the sample to the primary laboratory. The "remarks" column of the Chain-of-Custody Form will be used to record specific considerations associated with the samples, such as sample type, container type, sample preservation methods, and analyses to be performed. The laboratory will maintain the completed original forms on file. Copies will be submitted as part of the final analytical report.

1.3.2 Laboratory Sample Custody

Receipt, storage, and tracking of samples submitted to the laboratory is conducted according to strict protocol in order to prevent sample contamination or loss, and to avoid the production of invalid laboratory data as a result of sample deterioration or tampering.

1.4 SAMPLE BLANKS

For quality assurance, blanks will be prepared or collected and analyzed in order to:

1. Provide a check on sample bottle preparation

2. Evaluate the effectiveness of the field cleaning procedures

Field blanks will be collected at the discretion of the sampling team during the course of the project. The blank will be analyzed as another sample for the same test parameters as the soil samples where the blank was collected. The blanks will consist of water.

A field blank consists of two sets of laboratory-cleaned sample containers. One set of containers is empty and serves as the sample containers that will be analyzed. The second set of containers are filled at the laboratory with laboratory-demonstrated analyte-free water. At the field location, this analyte-free water is passed through the sampling device, after the device has been cleaned with solvent and water, and is placed in the empty set of sample containers for analysis. This sample will be labeled as a unique individual sample and packaged with the other samples for analysis. The field blank will evaluate the effectiveness of the field cleaning procedures for sampling equipment.

Trip blanks will be submitted periodically for laboratory analysis of VOCs in accordance with the Data Quality Assurance Plan (Appendix C).

2.0 SOIL BORING PROCEDURES

A soil boring program will be conducted in order to provide data to:

- o Evaluate the degree and extent of soil contamination.
- o Evaluate contamination source areas.

Specification for materials and procedures for soil borings are described in this Appendix. Section 2.1 describes preparatory activities; Section 2.2 lists field equipment; Section 2.3 presents the site management responsibilities; and Section 2.4 gives the field activities.

2.1 PREPARATORY ACTIVITIES

The field geologist shall locate and stake all soil boring locations, at the area of the facility under investigation, prior to the commencement of boring activity. The boring locations shall be in accordance with locations presented in the VI or RFI Workplan. If site conditions preclude boring placement, alternative locations will be proposed. Furthermore, borings will not be drilled during periods of significant rainfall.

2.2 FIELD EQUIPMENT

Geological field equipment to be used for this task includes:

- o Organic vapor analyzer (flame ionization detector)
- o Stainless steel trowel, spatula or spoon
- o Boring logs and sampling records
- o Decontamination detergents and methanol
- o Tap water
- o Distilled water
- o Sample bottles
- o Cleaning brushes
- o Stakes, marking flags, and paint
- o Depth-sounding tape
- o Required health and safety clothing and equipment

2.3 PROCEDURES AND SITE MANAGEMENT

The field geologist will supervise the soil borings, as discussed in Section 2.4. The field geologist will also be responsible for logging field notes, for obtaining soil samples, and for ensuring that both decontamination and health and safety procedures are observed in the field.

2.4 SOIL BORING PROCEDURES

Soil borings must be performed in accordance with the specifications given below.

2.4.1 Cleaning

The drilling contractor shall certify, and the project manager/geologist shall confirm, that the tools, and any downhole components or materials have been steam-cleaned immediately before work begins. An on-site controlled decontamination area will be selected for equipment cleaning. Rinse water from cleaning will be released to the ground surface at the decontamination area. Decontamination of the drill rig and drilling equipment will consist of:

- o Decontaminating all equipment that will be introduced into the borehole by steam cleaning or other appropriate decontamination procedures followed by a spray rinse with deionized water.

- o Decontaminating split-spoon samplers and related sampling equipment by rinsing them with the tap water, followed by a rinse with deionized water, 10% nitric acid rinse, deionized water rinse, methanol, and a final rinse of deionized water. The samplers will be allowed to totally air-dry after the methanol rinse.

- o Washing and decontaminating the split-spoon samplers in accordance with the procedures stated in step 3 after collection of each soil sample.

- o Storing all augers, split-spoon samplers, and equipment used in drilling on clean plastic until they are required for use.

- o Decontaminating and handling the boring and sampling equipment, as described in steps 2 through 5, prior to augering at each successive borehole.

- o Using dedicated latex gloves when handling augers, split-spoon samplers, etc. Gloves will be collected in garbage bags and disposed of at the conclusion of daily operations.

These cleaning and decontamination procedures will be employed for all drilling activities in potentially contaminated environments. Their purpose is to minimize the potential for transferring possible contaminants from one borehole to another.

2.4.2 Boring Operations

The use of hollow-stem augers for borehole development is expected. Hand augers and tripod-driven split spoons may also be used. Stainless steel split-spoons will be used to collect soil samples.

Split-spoon samples will be collected and described every two (2) feet if possible, to the final depth of the boring. The samples will be described and logged by a qualified geologist. Additionally, OVA readings will be made of the sample immediately after collection. Further, OVA readings will also be collected in the completed borehole.

Once the sample has been collected, blow counts recorded, sample described, OVA reading measured and recorded, a grab/discrete sample will be obtained for sampling from a designated section of recovery. The designated sample intervals are proposed in the Work Plan. The sample(s) will be immediately placed in jar(s) pre-supplied by a qualified laboratory using a dedicated or decontaminated stainless steel trowel, spatula or spoon.

After each use, split-spoon samplers and sampling spoons/trowels etc., will be cleaned as per subsection 2.4.1.

At the conclusion of each boring, the borehole will be tremie grouted from the bottom to the ground surface.

3.0 SUBSURFACE SOIL SAMPLING

The purpose of the subsurface soil sampling plan is to characterize the soil quality with depth. The following sections detail the appropriate sampling, decontamination, custody, and sample blank procedures.

3.1 SUBSURFACE SOIL SAMPLING PROCEDURES

The subsurface soils will be retrieved from below ground in accordance with the procedures outlined in this Appendix, Chapter 2. The soil samples will be collected and containerized for laboratory analysis as per the procedures of subchapter 1.1 in this appendix, except for step 2. Since the subsurface soils will be collected from a split-spoon by a (latex) gloved hand, trowels may not be needed.

3.2 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

Subsurface equipment will be decontaminated in accordance with Appendix A, subchapter 2.4.1.

3.3 CUSTODY PROCEDURES

Applicable custody procedures are included as subchapter 1.3 of this appendix.

3.4 SAMPLE BLANKS

The procedures included as subchapter 1.4 of this appendix are also appropriate for subsurface soil sampling.

4.0 QUALITY ASSURANCE PROCEDURES

The quality assurance procedures for soil sampling and analyses described in this plan are provided in Dames & Moore's Data Quality Assurance Plan (Appendix C).

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APPENDIX B

HEALTH AND SAFETY PLAN

DAMES & MOORE

HEALTH AND SAFETY PLAN AMENDMENT

Project Name:	Chevron-Gulf Refinery
Project Number:	16000-230
Project Site Location:	Philadelphia, Pennsylvania
Project Manager:	Bruce C. Amig
Site Safety Officer:	Laurie D. Hall
Plan Preparer:	Thomas Whitman
Preparation Date:	February, 1990

APPROVED:

Regional Health and Safety Manager

____
Kathryn A. Sova
(Date)

Office Safety Coordinator

Thomas E. Whitman 21 Feb 90
Thomas E. Whitman
(Date)

Project Director

Roger D. Moose for 2-20-90
Ralph T. Golia
(Date)

Project Manager

Bruce C. Amig 21 Feb 90
Bruce C. Amig
(Date)

H&S Approval No.

CONTENTS

<u>CONTENTS</u>
(continued)

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1.0 PURPOSE

The purpose of this Health and Safety Plan is to assign responsibilities, establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise while operations are being conducted at the Chevron Refinery in Philadelphia, Pennsylvania.

2.0 APPLICABILITY

The provisions of the Health and Safety Plan are mandatory for all on-site Dames & Moore employees and Dames & Moore subcontractors engaged in on-site operations who will be exposed or have the potential to be exposed to on-site hazardous substances.

Dames & Moore policy states that Dames & Moore subcontractors shall provide a Health and Safety Plan for their employees to cover any exposure to hazardous materials and shall complete all work in accordance with that plan. The subcontractor may choose to use Dames & Moore's Health and Safety Plan as a guide in developing his own plan, or he may choose to adopt, in full, Dames & Moore's plan. In either case, the subcontractor shall hold Dames & Moore harmless from, and indemnify Dames & Moore against, all liability in the case of any injury. Dames & Moore reserves the right to review and approve the subcontractors plan at any time. All subcontractor's will, at a minimum, follow all provisions of the Dames & Moore Health and Safety Plan.

Inadequate health and safety precautions on the part of the subcontractor or the belief that the subcontractor's personnel are or may be exposed to an immediate health hazard, can be the cause for Dames & Moore to suspend the subcontractor's site work, and ask the subcontractor's personnel to evacuate the hazard area.

Dames & Moore's subcontractor will be responsible for operating in accordance with current Occupational Safety and Health Administration (OSHA) regulations contained in 29 CFR part 1910.120 - hazardous waste operations and emergency response. These regulations include the following provisions for employees exposed to hazardous substances, health hazards, or safety hazards: training as described in 120(e); medical surveillance as described in 120(f); and personal protection equipment as described in 120(g).

3.0 SITE DESCRIPTION

3.1 GENERAL INFORMATION

<u>Site</u>: Chevron Refinery, Philadelphia, Pennsylvania

<u>Job No.</u>: 16000-230

Objectives: To perform a verification/investigation, performing soil gas surveys, surface soil sampling, and soil borings

Proposed Date of Activities: July through August, 1990

Background Review of the Site: Preliminary:____ Complete:__X__

Documentation/Summary: Overall Hazards: Serious: _____ Moderate:_____ Low: __X__ Unknown: _____

3.2 SITE HISTORY

Historical reports of refinery operations indicate waste disposal at several locations. Ongoing recovery well operations indicate free product on the water table. In some areas, tank bottoms were dispersed in diked areas around storage tanks. Separator sludge and phosphoric acid catalysts were placed in waste disposal sites.

The site histories for each of the SWMUs to be addressed is further discussed in the following section.

3.3 DAMES & MOORE ACTIVITIES

Dames & Moore's on-site activities will include the identification and quantification of compounds present in soils within and around selected solid waste management units in the main plant area.

We will collect soil samples from the ground surface and from the subsuface by conducting a soil boring program. Stained samples from areas near process tanks, pipes, and sumps will be collected. The samples will be analyzed for the 40 CFR 264, Appendix IX metals, volatiles, and semi-volatiles, and/or for the "Skinner List" of analytes.

Specifically, the following SWMUs will be assessed in the following manner.

SWMU No. 1 (Empty Lube Drum Storage Area) is located east of Warehouse No. 2, in the southeastern section of the facility. With approximate dimensions of 100 by 200 feet, SMWU No. 1 is believed to have been used as a storage area for empty lube oil drums. Three surface soil samples and three soil boring samples will be collected for laboratory analysis.

SWMU No. 6 (Trash Incinerator) is located northwest of Penrose Ferry Avenue, in the southern part of the facility. When the unit was active, the SWMU incinerated oily sludges, oily debris, tank bottoms, and paper. Soil sampling for laboratory analysis will include two surface soil samples and four soil boring samples.

SWMU No. 30 (Additive Plant Drum Storage Area) is located off Sixth Street and to the west of Tank 246, in the eastern part of the facility. The approximate dimensions of the unit are 550 feet by 60 feet. While the drum storage area is believed to have received drums containing organic and inorganic agents for use in the facility laboratory, more detailed chemical compositions of the agents is not known. Waste material is not believed to have been stored in this area. Three surface soil samples and three soil boring samples will be collected for laboratory analysis.

SWMU No. 45 (Empty Drum Storage Area) is located north of the Penrose Avenue Bridge, off the western side of "H" Avenue. With approximate dimensions of 100 feet by 70 feet, the unit was used to store empty, 55-gallon steel drums that once contained water-treating chemicals, lube oils, and corrosion-inhibiting chemicals. Two surface soil samples and two soil boring samples will be collected for laboratory analysis.

SWMU No. 79 (Drum Storage Area) is located east of Unit No. 1232 Precipitator, in the northern part of the facility. With approximate dimensions of 10 feet by 20 feet, the unit was used to store 55-gallon drums that contained sludge residue from the FCC unit, trash, and spent catalyst. One surface soil sample and one soil boring sample will be collected for laboratory analysis.

SWMU No. 2 (Empty Lube Area Sump) is located east of Warehouse 2 and within SWMU No. 1. The unit's dimensions are approximately 4 feet by 4 feet by 4 feet. Surface water run-off from SWMU No. 1 flows to SWMU No. 2 and is pumped to the wastewater treatment system via an underground pipeline. Soil sampling includes one surface soil sample and one soil boring sample for laboratory analysis.

SWMU No. 9 (Product Storage Sump) is located within the No. 8 Oil/Water Separator and has approximate dimensions of 10 feet by 10 feet, and 15-foot depth. The unit receives run-off from the product (gasoline, petrochemicals, home heating oil, and jet fuel) storage area of the terminal and discharges to the No. 2B Separator. One surface soil sample and one soil boring sample will be collected for laboratory analysis.

SWMU No.13 (Tank 355) was located east of "F" Avenue, in the southern part of the facility. Formerly a concrete basin, the unit's approximate dimensions were 21 feet by 23 feet with a 10-foot depth. The unit received waste oil from vacuum trucks, waste from oil spill clean-up operations, and oil skimmings from API separators. The waste oil was then piped from Tank 355 to Tanks 357 and 358. Two soil boring samples will be collected for laboratory analysis.

SWMU No. 11 (Past Lagoon A) and SWMU No. 12 (Previous Crude Oil Topping Unit) existed in approximately the same area, in the southern portion of the facility. The area is currently overlain by SWMU No. 10. SWMU No. 12 and, subsequently, SWMU No. 11 were approximately 200 feet by 100 feet. SWMU No. 11, an unlined lagoon, was used to separate waste into oil and solids. The origin of the waste is not known; however, suspected waste types include tank bottoms, sewer sludge, and spill clean-up material. SWMU No. 12 consisted of several small buildings and tanks. SWMU NO. 12 is believed to be located under SWMU No. 11 and SWMU No. 10, and it predates both units. Soil gas samples will be collected for field analysis, and four soil boring samples will be collected for laboratory analysis.

SWMU No. 29 (Tank 200 Past Lagoon) is located primarily under Tank 200 (Separator No. T-844; SWMU No. 28) in the western section of the facility. The approximate dimensions were 100 feet by 100 feet. The unit possibly received sludges from Separators 2, 2A, and 2B (SWMU Nos. 25, 26, and 27) and tank bottoms. Soil gas samples will be collected for field analysis, and two soil borings will be collected for laboratory analysis.

SWMU No. 71 (Past Lagoon B) was located east of Third Street, partially under the present Bundle Cleaning Area (SWMU No. 72), in the northern section of the facility. The previous in-ground lagoon had approximate dimensions of 100 feet by 200 feet. The unit is believed to have received separator sludges, cooling tower sludges, and coagulator alum sludge. Tank bottoms were also found in the lagoon in 1979 during waste removal activities.

An additional lagoon with approximate dimensions of 60 feet by 140 feet was noted in historic photographs south of Separator No.4. This second lagoon may have received sludges similar to Past Lagoon B. The second lagoon, designate SWMU No. 71A, is partially overlain by Tank No. 1136 and gravel. SWMU No. 71A will be included in the SWMU No. 71 investigation, which will include soil gas samples for field analysis and three soil boring samples for laboratory analysis.

SWMU Nos. 16 (Tank 357) and 17 (Tank 358) are adjacent to each other and are located east of "E" Avenue in the southern part of the facility. Each steel tank has a capacity of 3,600 barrels and is part of the slop oil treatment system. The tanks gravity-separate oil and water. Soil sampling for laboratory analysis includes two surface soil samples and eight soil boring samples .

3.4 FACILITY DESCRIPTION

Waste Types: Liquid _____ Solid __X__ Sludge __X__ Gas _____

Characteristics: Corrosive __X__ Ignitable __X__ Radioactive _____
Volatile __X__ Toxic __X__ Reactive _____
Unknown _____

Status: (active, inactive, unknown) ___active___

3.5 HAZARD EVALUATION

Based on Dames & Moore's initial background search, the suspected contaminants to ground water are: benzene, ethylbenzene, toluene, and xylenes in low ppm concentrations. A suspected contaminant to the soil is tetraethyl lead (TEL).

Previously, soil samples were collected at locations posted for TEL disposal. The samples were analyzed for total lead, an indicator analysis for TEL. The maximum concentrations of total lead detected were approximately 1,000 ppm. While formerly investigated locations may contain TEL, the areas of present investigation do not include areas posted or formerly posted for TEL disposal.

The exposure limits, recognition qualities, acute and chronic effects, and first aid treatment for these contaminants are presented in Table 1 and 2.

The main routes of exposure associated with the volatile organic compounds are via skin contact or inhalation of vapors. The main routes of exposure associated with metals are inhalation and ingestion of contaminated dusts. Therefore, a minimum of Level D+ protection is recommended to perform work on site. If the organic vapors exceed the established action levels (see Table 3), the area will be evacuated, and the site conditions and respiratory protection will be reassessed prior to continuation of field activities. If dry or dusty conditions exist, implement dust suppression methods. Tables 3 and 4 provide hazard monitoring methods, action levels, and protective equipment required for on-site activities.

Standard Safe Work Practices employed by Dames & Moore are listed in Appendix B, and must be adhered to at all times. Entry into the site area will be coordinated with the appropriate site contacts.

4.0 DAMES & MOORE MONITORING REQUIREMENTS

Table 3 presents the monitoring requirements for the February 1990 Health and Safety Plan. Table 4 presents the required protective equipment for the February 1990 Health and Safety Plan.

4.1 EMERGENCY CONTACTS AND PROCEDURES

Should any situation or unplanned occurrence require emergency services, the Chevron security office and medical facility should be contacted and the appropriate contact should be made from the following list:

Contact	Person or Agency	Telephone
Police	Philadelphia	911
Fire	Philadelphia	911
Ambulance	Philadelphia	911
Hospital	Methodist Hospital	215-952-9000
Chevron Contact	Mike Manigly	215-339-7466
D&M Project Manager	Bruce Amig	215-657-5000
D&M MPIC	Roger D. Moose	215-657-5000
Firmwide H&S Director	Gary Kreiger	303-294-9100
D&M Regional Health & Safety Manager	Kathy Sova (office)	201-272-8300
Office Safety Coordinator	Tom Whitman	215-657-5000
Medical Surveillance	Jefferson Medical Center	215-928-6914

4.2 LOCATION OF SITE RESOURCES (for emergency use)

Water Supply: Security Building, and at drilling location (supplied by Dames & Moore or subcontractor).

Telephone: Security Gate at Lanier and Pennypack and in lobby of Security Building

4.3 EMERGENCY ROUTE TO HOSPITAL

Directions to the nearest hospital are as follows:

- From the Gate 24 entrance/exit of Chevron's refinery, turn right (south) onto Lanier Avenue.
- Turn left under bridge and exit onto Penrose Avenue (Route 291).

- Penrose Avenue will become Moyamensing Avenue.
- At the Broad Street intersection, turn left (north) onto Broad Street.
- The Methodist Hospital is the third city block on the right-hand (east) side.

4.4 ADDITIONAL ARTICLES TO BE TAKEN INTO FIELD

1. First Aid Kit
2. Disposable Eye Wash (1 liter or more)

5.0 SITE SAFETY WORK PLAN

5.1 MONITORING

5.1.1 Monitoring Requirements

The Site Safety Officer (SSO) will conduct air monitoring for the hazards presented in Table 1. Equipment necessary for air monitoring at this site consists of an Organic Vapor Analyzer (OVA), detector tubes (benzene), and an explosimeter. The type of monitoring instruments specified by the hazard and the action levels to upgrade personal protection are shown on Table 3. All monitoring equipment shall be maintained following procedures outlined in the owner's manual for the specified monitoring equipment.

5.1.2 Monitoring Schedule

5.1.2.1 Instrument Calibration

All applicable instruments shall be calibrated daily. Readings shall be recorded on the Instrument Calibration Check-Out Sheet provided in Appendix F.

5.1.2.2 Background Readings

Before any field activities commence, background levels at the site will be monitored and noted on the Air Monitoring Forms in Appendix F. Daily background readings shall be taken away from areas of potential contamination in order to obtain accurate results.

5.1.2.3 Air Monitoring Frequency

All site readings may be noted on the Air Monitoring Form provided in Appendix F, with the date, time, weather conditions, wind direction and speed, if possible, and location where the background level was recorded.

The following schedule should be followed for air monitoring activities as specified for each monitoring method.

Air Monitoring Equipment	Monitoring Frequency
OVA	Monitor every 30 minutes
Explosimeter	Monitor every 30 minutes
Detector Tubes	As per Table 3

5.2 LEVELS OF PROTECTION

A minimum of Level D+ protection is needed to perform work on-site.

5.3 RESPIRATORY PROTECTION

Sampling activities associated with contaminants listed in Table 1 will be initiated in Level D+, with Level C capability. However, if organic vapors exceed 50 ppm (as measured with the OVA), or exceed the action levels for the detector tubes (1 ppm), the area will be evacuated and the Project Manager will be notified. If dry or dusty conditions exist, dust control procedures will be implemented (wetting the soil). Site conditions and personal protective equipment (including respiratory selection) will be reassessed before site activities continue.

All ambient air measurements taken in order to evaluate personnel exposure will be taken within the individuals' breathing zone and shall be fairly frequent or constant for a duration of at least 30 seconds.

5.4 WORK LIMITATIONS

In general, field work will be conducted during daylight hours only. At least two personnel (one must be a Dames & Moore representative) will be in the field at all times. The Dames & Moore Project Manager (PM) or Regional Health and Safety Manager (RHSM) must grant special permission for any field activities to be conducted beyond daylight hours. All Dames & Moore personnel working in the field have completed the Dames & Moore Hazardous Material Sites Training Course (or its equivalent). Additionally, all Dames & Moore field personnel have been declared medically fit for duty and, where respiratory protection is necessary, have been properly trained, fit-tested and declared fit for respirator use. No drilling activities shall take place unless the absence of subsurface utility lines, or other buried metal objects, has been confirmed.

5.5 FIELD PERSONNEL

The responsibilities of the Project Manager, the On-Site Safety Officer, and project personnel are listed in Appendix D and must be adhered to at all times.

A work party consisting of the following persons will perform the tasks:

Project Manager: Bruce C. Amig

Site Safety Officer: Laurie D. Hall

The work party was briefed on the contents of this Health and Safety Plan at Dames & Moore's Philadelphia office in February, 1990.

5.6 HEAT STRESS/COLD STRESS

If on-site activities are conducted during extreme weather conditions, procedures for minimizing heat stress/cold stress will be followed.

6.0 DECONTAMINATION PROCEDURES

6.1 GENERAL

Personnel should follow the decontamination procedures outlined below:

1. locate a decontamination area;
2. establish a personnel decontamination station consisting of a basin with soapy water, a rinse basin with plain water, and a can with a plastic bag;
3. wash and rinse boots;
4. remove outside gloves and discard in plastic bag;
5. remove disposable suit and discard in plastic bag;
6. upon leaving the contamination area, all personnel will proceed through the appropriate Contamination Reduction Sequence as described above;
7. All protection gear should be left on-site during lunch break following decontamination procedures.

The maximum decontamination layout for Level C is shown on Figure 6-1, and a description is given below.

6.2 MAXIMUM MEASURES FOR LEVEL C DECONTAMINATION

Station 1: Segregated Equipment Drop

Deposit equipment used on-site (tools, sampling devices and container, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area.

Station 2: Boot Cover and Glove Wash

Scrub outer boot covers and gloves with decon solution or detergent and water.

Station 3: Boot Cover and Glove Rinse

Rinse off decon solution from Station 2 using copious amounts of water.

Station 4: Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Station 5: Boot Cover Removal

Remove boot covers and deposit in containers with plastic liner.

Station 6: Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Station 7: Suit and Boot Wash

Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.

Station 8: Suit and Boot, and Glove Rinse

Rinse off decon solution using water. Repeat as many times as necessary.

Station 9: Cartridge or Mask Change

If worker leaves exclusion zone to change cartridges (or mask), this is the last step in the decontamination procedure. Worker's cartridges are exchanged, new outer gloves and boot covers donned, and joints taped worker returns to duty.

Station 10: Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Station 11: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Station 12: Inner Glove Rinse

Rinse inner gloves with decon solution.

Station 13: Inner Glove Wash

Wash inner gloves with water.

Station 14: Face Piece Removal

Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.

Station 15: Inner Glove Removal

Remove inner gloves and deposit in lined container.

Station 16: Inner Clothing Removal

Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the disposable coveralls.

Station 17: Field Wash

Shower if highly toxic, skin-corrosive, or skin-adsorbably materials are known or suspected to be present. Wash hands and face if shower is not available.

Station 18: Redress

Put on clean clothes.

Minimal Decontamination

Less extensive procedures for decontamination can be subsequently or initially established when the type and degree of contamination become known or the potential for transfer is judged to be minimal. These procedures generally involve one or two washdowns only.

Closure of the Personnel Decontamination Station

All disposable clothing and plastic sheeting used during the operation should be double-bagged and contained on-site or removed to an approved off-site disposal facility. Decon and rinse solution can be contained on-site or removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use. (If gross contamination had occurred, additional decontamination of these items may be required.) All wash tubs, pail containers, etc., should be thoroughly washed, rinsed, and dried prior to removal from the site.

7.0 FORMS

The following forms are located in Appendix F:

Plan Acceptance Form
Plan Feedback Form
Accident Report Form
Exposure History Form (to be completed by PM only)
Calibration Check Sheet
Air Monitoring Form
Contractor Statement of Compliance

The Plan Acceptance Form should be filled out by all employees working the site. The Plan Feedback Form should be filled out by the Site Safety Officer and any other on-site employee who wishes to fill one out. The Accident Report Form should be filled out by the Project Manager in the event that an accident occurs.

ALL COMPLETED FORMS SHOULD BE RETURNED TO THE PHILADELPHIA OFFICE SAFETY COORDINATOR.

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TABLE 1

EXPOSURE LIMITS AND RECOGNITION QUALITIES

Compound	Exposure[a] Limit (ppm unless otherwise indicated)	IDLH[b] Level (ppm unless otherwise indicated)	Odor	Odor Warning Concentration (ppm)	LEL[c] %	UEL[d] %	Ionization Potential (ev)
Ethyl benzene	100(1)(2)	2,000	Aromatic	0.25-200 (200)	1.0	6.7	8.76
Benzene	1(1) 5-15 min STEL(1) 10(2)	2,000	Aromatic	1.5-5	1.3	7.1	9.25
Toluene	200(1) 100(2)	2,000	Aromatic	0.17-40 Fatigue (300-400)	1.3	7.1	8.82
Xylenes (o-, m- and p-isomers)	100(1)(2)	10,000	Aromatic	1.8/1.1-3.7/ 0.47-0.53(R)	1/1.1/1.1	6/7/7	8.56/8.56/ 8.44
Lead	0.05 mg/m3(1) 0.15 mg/m3(2)	Variable	Variable	—	Variable	Variable	--
Chromium	1 mg/m3 (1)(2)	500 mg/m3	Variable	-	Variable	Variable	--

(a) *OSHA Permissible Exposure Limit or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

(b) Immediately Dangerous to Life or Health Level

(c) Lower Explosive Limit

(d) Upper Explosive Limit

(1) OSHA Time Weighted Average

(2) ACGIH Time Weighted Average

STEL = Short-Term Exposure Limit (averaged over a 15-minute period)

NOTE:

The odor warning concenrations given are generally odor thresholds with irritation thresholds given in parenthesis.

TABLE 2

ACUTE AND CHRONIC EFFECTS AND FIRST AID TREATMENT

Compound	Routes of Entry	Eye Irritant	Acute Effects	Chronic Effects
Ethylbenzene	Inhalation Ingestion Skin and/or eye contact	Yes	Irritates mucous membranes, headache, dermatitis, narcosis, coma	Eyes, upper respiratory system, skin, CNS
Benzene	Inhalation Ingestion Skin Absorption Skin and/or eye contact	Yes	Giddy, hadache, nausea, staggered gait, fatigue	Leukemia, potential human carcinogen, blood, CNS, skin, bone marrow, eyes, respiratory system
Toluene	Inhalation Ingestion Skin Absorption Skin and/or eye contact	--	Fatigue, weakness, confusion, euphoria, dilated pupils, lacrimation	Central nervous system, liver kidneys, skin
Xylenes (o-, m- and p-isomers)	Inhalation Ingestion Skin Absorption Skin and/or eye contact	Yes	Dizziness, excitement, drowziness, incoordination, staggering gait	Central nervous system, blood, liver, liver, kidneys, eyes, GI tract
Lead	Inhalation Ingestion Skin and/or eye contact	--	Lassitude, insomnia, eye grounds, pallor, abdominal pain, gingival lead line	GI tract, CNS, kidneys, blood, gingival tissue
Chromium	Inhalation Ingestion	--	Histologic fibrosis of lungs	Respiratory system, potential human carcinogen

General First-Aid Treatment (A first-aid kit will be kept in the site vehicle.)

Eye	Irrigate Immediately (A portable eye-wash unit will be kept in the site vehicle.)
Skin	Soap Wash Promptly
Inhalation	Move to Fresh Air
Ingestion	Get Medical Attention

TABLE 3

HAZARD MONITORING METHOD, ACTION LEVELS, AND PROTECTIVE MEASURES

Hazard	Monitoring Method	Action Level	Protective Measures	Monitoring Schedule
Toxic Vapors	OVA/PID (10.2 EV lamp) Benzene Detector Tubes	(1) Measurable Above Background Based on Judgement of SSO up to 50 ppm and <1 ppm	Level D+ (see Table 4)	o Continue drilling o Continuous monitoring/ every sample retrieved
	OVA/PID (10.2 EV lamp) Benzene Detector Tubes	Measurable Above Background Based on Judgement of SSO 50-100 ppm and <1 ppm	Level C (see Table 4)	o Continue drilling o Continuous monitoring/ every sample retrieved
	OVA/PID (10.2 EV lamp) Benzene Detector Tubes	Measurable Above Background Based on Judgement of SSO >100 ppm or >1 ppm	STOP WORK EVACUATE AREA NOTIFY PROJECT MANAGER	
Toxic Dust	Visual Observation	Dry or dusty conditions	Level C (see Table 4)	
Explosive Atmosphere	Explosimeter	0-10% LEL	Continue Drilling	o Continue monitoring every 10 minutes/ every sample retrieved.
		10-25% LEL		o Continuous monitoring every sample retrieved
		>25% LEL	**EVACUATE AREA EXPLOSION HAZARD NOTIFY PROJECT MANAGER	

NOTES:

(1) The above action levels are not solely based on the criteria for selecting levels of protection by the 1984 EPA Standard Operating Procedures, but also on the professional judgement and experience of the On-Site Safety Officer (OSSO).

* Super windy or dusty conditions exist. The area should be hosed down to try to minimize the potential for the inhalation of contaminated dust.

** If encountered in a boring hole or monitoring well, purge boring or well with nitrogen until safe levels (< 10% LEL) are obtained. If >25% LEL persists, abandon boring and evacuate area temporarily. After at least 1/2 hour, re-approach borehole from an upwind direction while continuously monitoring well explosimeter. If levels are still unsafe, backfill hole and abandon.

TABLE 4

PROTECTIVE EQUIPMENT FOR ON-SITE ACTIVITIES

Activity	Level	Protective Equipment
Drilling; Sampling	D+	o Safety glasses o Hard hat o Chemical-resistant (Tyvek) clothing o Outer (nitrile or neoprene) and inner (latex) gloves o Neoprene steel-toe/steel-shank boots o Hearing protection (either foam plugs or ear muffs)(1)
Drilling; Sampling	C	o Same as above plus o Full-face respirator with(2) organic vapor cartridge and high-efficiency dust and mist filters o If OVA/PID reading is greater than 100 ppm, or benzene detector tube is greater than 1 ppm, STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER

(1) Optional during drilling or other noise intensive activities.

(2) If the OVA/PID reading is measurable above background up to 50 ppm or dusty conditions exist.

APPENDIX A

CHEMICAL HAZARD EVALUATION

**(Material Safety Data Sheets
are maintained in the
Office Safety Coordinator's files.)**

APPENDIX B

STANDARD SAFE WORK PRACTICES

STANDARD SAFE WORK PRACTICES

1. GENERAL

1. Eating, drinking, chewing gum or tobacco and smoking are prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surface (i.e. ground, etc.).

3. Prevent, to the extent possible, spillage. In the event that a spillage occurs, contain liquid, if possible.

4. Prevent splashing of contaminated materials.

5. All field crew members shall make use of their sense (all senses) to alert them to potentially dangerous situations in which they should not become involved (i.e. presence of strong, irritating or nauseating odors).

6. Field crew members shall be familiar with the physical characteristics of investigations, including:

   - o Wind direction in relation to the ground zero area;
   - o Accessibility to associates, equipment, vehicles;
   - o Communications;
   - o Hot zone (areas of known or suspected contamination);
   - o Site access;
   - o Nearest water sources.

7. The number of personnel and equipment in the contaminated area should be minimized, but only to the extent consistent with workforce requirements of safe site operation.

8. All wastes generated during D&M and/or subcontractor activities at the site will be disposed of as directed by the PM.

2. DRILLING AND SAMPLING PROCEDURES

For all drilling and sampling activities, the following standard safety procedures shall be employed:

1. All drilling and sampling equipment shall be cleaned before proceeding to the site.

2. At the drilling or sampling site, sampling equipment shall be cleaned after each use.

3. Work in "cleaner" areas should be conducted first where practical.

4. The minimum number of personnel necessary to achieve the objectives shall be within 25 feet of the drilling or sampling activity.

5. If emergency and back-up subcontracted personnel are at the site, they should remain 25 feet from the drilling or sampling activity, where practical.

6. Exclusion zones will be established within designated hot lines. Delineation of a hot line will reflect the interface between areas at or below a perdetemined threshold contaminant concentation, based on available data including the results of monitoring and chemical analyses, information from site personnel regarding historical site activities, and general observations. This determination will be made by the PM in conjunction with the OSSO and site personnel.

3. BOAT SAFETY PRACTICES (LAGOON SAMPLING)

1. Two persons will man the sampling boat and an on-shore supervisor will be present at all times.

2. All field personnel shall wear life preservers.

3. The on-shore supervisor should be equipped with in-plant communication in case an accident requiring emergency services occurs.

4. In-plant safety and medical personnel should have complete notification of the boat sampling schedule and locations.

5. A tow line will be attached to the boat and maintained on land at all times if practicable.

6. Boarding and unloading the sampling boat will be conducted from a dry and stable location if practible, without necessitating contact by personnel with the contaminated waste water.

7. Personnel shall position themselves accordingly in the boat to maintain a stable condition at all times (counter balancing bow and stern or port starboard).

8. Sampling equipment should be drained thoroughly before being brought into the boat.

9. If sampling equipment falls into the water, do not make any attempt to retrieve it.

4. DRILLING IN A LANDFILL

1. Specific monitoring methods and protective equipment indicated in Tables 3 and 4 should be utilized. Monitoring with detector tubes for H_2S, HCN, and vinyl chloride shall be carried out. Monitoring for exposure to CH_4 shall be conducted as well.

2. Established clean area just outside of the landfill consisting of a decontamination area and backup support health and safety and firefighting equipment (fire extinguishers). This area will be continuously monitored by the OSSO who will have visual contact with personnel in the landfill and radio contact with the plant. In addition, the OSSO will be prepared to enter the landfill in protection Level B protective gear in case of an emergency.

3. Prior to the start of drilling a probe within the landfill, a protective steel sheeting or blasting mat, about 20 feet by 10 feet will be placed over the area to be probed. The probe will be drilled through a hole cut in the center of the sheeting.

4. Appropriate emergency and backup subcontracted personnel should remain 25 feet from the drilling or sampling activity where practical.

4. Appropriate emergency and backup subcontracted personnel should remain 25 feet from the driling or sampling activity where practical.

5. CONFINED SPACE ENTRY

All personnel will treat Confined Space Entry as a special hazard, and all tanks, similar vessels and partially or entirely closed spaces shall be regarded as being potentially dangerous.

Before entering a confined space, the OSSO must see that the following is adhered to:

1. All mechanical apparatus such as agitators and pumps within the confined space, which if activated could injure the worker, is locked out.

2. The atmosphere within the confined space is tested for oxygen (O_2) deficiency and flammable gas or vapor, LEL, and the test results recorded.

The area will be continuously vented to dissipate any vapors or gases (five air changes are required). The percent O_2 and LEL will be redetermined and recorded and upon reaching safe levels, as indicated on the meter, the space may be entered. The area shall be continuously, positively (blow air in) ventilated prior to and during entry. The following equipment will be used in lieu of standard equipment.

A. Flashlights, lanterns or alternating current (AC) or direct current (DC) electric powered lighting which is approved for Class 1, Division 1, Group C or D Atmosphere (explosion-proof).

B. Hand tools constructed of non-sparking metal alloys.

3. Workers are provided and required to use protective equipment as follows:

A. For worker entering confined space:

- gloves
- rubber steel toed boots
- impermeable coveralls
- safety harness with attached lifeline
- escape packs
- hard hat with safety glasses.

B. For worker observing operation:

- hard hat
- safety glasses or goggles
- gloves
- boots and safety shoes
- impermeable coveralls
- immediate access to self-contained breathing apparatus with full face mask
- immediate access to safety harness and lifeline
- two-way radio for summoning assistance and emergency communication.

4. D&M employees are not permitted to enter a confined space in which levels in excess of acceptable standards (see exposure standard in Health and Safety Plan) are present.

5. Air supply lines are inspected for leaks or cracks which could result in breakage during use. Face mask respirators are checked for proper flow rate. Two-way radios are tested to assure proper working order and reception of signal transmitted. Safety harnesses and eye lines are checked for proper integrity.

6. The permit should also contain the following information:

   A. name of person entering the confined space
   B. name of observer(s)
   C. date and time of entry
   D. reason for entry.

   This permit will be prominently displayed in the area of the continued space to be entered.

6. "BUDDY SYSTEM"

1. All operations involving confined space entry will be performed by a team of not less than two (2) persons with specific duties as follows:

   Person #1 — Securing of lifeline to winch or stationary object and entry into confined space to perform necessary operations(s). Maintain communication with Person #2.

   Person #2 — Remain outside the confined space and observe and/or communicate with Person #1 until the operation is complete and Person #1 has exited the confined space.

   During the period in which the confined space operation is being performed, Person #2 will be equipped with a full-face positive pressure demand, self-contained breathing apparatus and safety harness with lifeline.

   Person #2 will tend to Person #1's lifeline during the entire operation.

2. Communications

Person #1 and Person #2 will communicate with each other during the entire operation, if visual contact cannot be maintained. The following code shall be used when utilizing the lifeline:

Person #2 to Person #1		Person #1 to Person #2	
1 Pull	- Are you okay?	1 Pull	- I am okay
2 Pulls	- Advance	2 Pulls	- I am going ahead
3 Pulls	- Back out	3 Pulls	- Keep slack out of line
4 Pulls	- Come out immediately	4 Pulls	- Send help

If Person #1 does not respond to the pull code, assume that there is trouble and begin effecting emergency procedures.

3. Emergency Plan

If it becomes necessary to effect rescue efforts to remove a worker from a confined space, the following procedures will be followed:

A. Person #2 will communicate via two-way radio to a base station and request assistance. The following information will be given:

1. Location

2. Bring emergency oxygen supply and first-aid kit.

3. Bring self-contained air supply with full face mask, safety harness, and lifeline.

4. Call for professional medical assistance.

BEFORE BEGINNING RESCUE, CONFIRM THAT COMMUNICATION WAS RECEIVED AS TRANSMITTED AND THAT ASSISTANCE IS FORECOMING.

B. If Person #1's lifeline is secured to a winch, begin hauling Person #1 out of the confined space. This procedure must be performed at speed that will not further injure Person #1.

C. If the lifeline is not secured to a winch, Person #2 will secure lifeline and enter the continued space, wearing SCBA.

ALWAYS SUMMON ASSISTANCE BEFORE BEGINNING A RESCUE ATTEMPT.

4. Reporting

Upon completion of the confined space entry operation, the permit should be completed indicating the amount of time the worker or workers were inside the confined space. This report (permit) is sent to RHSM.

APPENDIX C

CONTACTS AND PROCEDURES

CONTACTS AND PROCEDURES

1. CONTACTS

Should any situation of unplanned occurrence require outside or support services, the appropriate contacts should be made. The list of appropriate contacts is listed in Section 4 of the Health and Safety Plan.

2. PROCEDURES

In the event that an emergency develops on-site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- o Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site; or

- o A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

A. Personnel on-site should use the "buddy system" (pairs). Buddies should pre-arrange hand signals or other means of emergency signals for communication in case of lack of radios or radio breakdown (see the following item).

   - o Hand gripping throat: out of air, can't breathe.

   - o Grip partner's wrist or place both hands around waist: leave area immediately, no debate.

   - o Hands on top of head: need assistance.

   - o Thumbs up: okay, I'm alright, I understand.

- Thumbs down: no, negative.

B. Site work area entrance and exit routes should be planned, and emergency escape routes delineated by the OSSO.

C. Visual contact should be maintained between "pairs" on-site with the team remaining in close proximity in order to assist each other in case of emergencies.

D. In the event that any member of the field crew experiences any adverse effects of symptoms of exposure while on-site, the entire field crew should immediately halt work and act according to the instructions provided by the OSSO.

E. Wind indicators visible to all on-site personnel should be provided by the PM to indicate possible routes for upwind escape.

F. The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should results in the evacuation of the field team and re-evaluation of the hazard and the level of protection required.

G. In the event that an accident occurs, the PM is to complete an Accident Report Form for submittal to the Office Safety Coordinator (OSC), who will forward a copy to the RHSM and the FWHSD. The OSC should assure that the follow-up action is taken to correct the situation that caused the accident.

H. In the event that an accident occurs, the PM is to complete an Accident Report Form for submittal to the MPIC of the office, with a copy to the health and safety program office. the MPIC should assure that follow-up action is taken to correct the situation that caused the accident.

APPENDIX D

RESPONSIBILITIES

RESPONSIBILITIES

1. PROJECT MANAGER

The Project Manager (PM) shall direct on-site investigations and operational efforts. The PM, assisted by the On-Site Safety Officer (OSSO), has primary responsibility for:

1. Making certain that appropriate personnel protective equipment and monitoring equipment is available and properly utilized by all on-site personnel;

2. Making certain that personnel receive this plan and are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies;

3. Making certain all field personnel have had the Dames & Moore Core Health and Safety Training Course or its equivalent;

4. Making certain that personnel are aware of the potential hazards associated with site operations;

5. Monitoring the safety performance of all personnel to ensure that the required work practices are employed;

6. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances;

7. Preparing any accident/incident reports (see attached Accident Report Form) and routine job exposure records;

8. Assuring the completion of Plan Acceptance and Feedback Forms attached hereto.

2. ON-SITE SAFETY OFFICER

The On-Site Safety Officer (OSSO) shall:

1. Implement project Health & Safety Plans and report to the Site Safety Coordinator and the PM for action if any deviations from the anticipated conditions described in the plan and has the authorization to stop work at any time;

2. Calibrate all monitoring equipment (except radiation detection equipment) on a daily basis and record results on the attached sheets; (See Section 7.0 - Daily Instrument Calibration Check Sheet and Daily Radiation Instrument Operability Check Sheet.)

3. Making certain that all monitoring equipment is operating correctly according to manufacturers instructions and provide maintenance if it is not;

4. Confirm that personnel working on-site have the proper medical surveillance program and Health & Safety training which qualifies them to work at a hazardous waste site. Also be responsible for identifying all WMS site personnel with special medical problems (i.e. allergies).

3. PROJECT PERSONNEL

Project personnel involved in on-site investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees;

2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the OSSO;

3. Notifying the PM and OSSO of any special medical problems (i.e. allergies) and making certain that all on-site personnel are aware of any such problems.

APPENDIX E

HEAT STRESS/COLD STRESS

HEAT STRESS/COLD STRESS

HEAT STRESS

If site work is to be conducted during the summer or in other hot environments, heat stress is a concern in the health and safety of personnel. For workers wearing permeable clothing, follow recommendations for monitoring requirements and suggested work/rest schedules in the current American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Heat Stress. For workers wearing semipermeable or impermeable clothing, the ACGIH standard cannot be used. For these situations, workers should be monitored when the temperature in the work area is above 70°F (21°C).

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.

  If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

  If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

  If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.

If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

- Body water loss, if possible. Measure weight on a scale accurate to ±0.25 lb at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing or, ideally, is nude. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see following Table). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS

ADJUSTED TEMPERATURE(1)	NORMAL WORK ENSEMBLE	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45-min of work	After each 15 min of work
87.5°-90°F (30.8°-32.2°C)	After each 60 min of work	After each 30 min of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min of work	After each 60 min of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min of work	After each 90 min of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min of work	After each 120 min of work

(1) Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

If workers are not monitored for heat stress, work activities in hot environments can result in dehydration, heat exhaustion, heat stress or even heat stroke.

Signs and Symptoms of Heat Stress

- **Heat rash** may result from continuous exposure to heat or humid air.

- o **Heat cramps** are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - -- muscle spasms
  - -- pain in the hands, feet and abdomen.

- o **Heat exhaustion** occurs from increased stress on various body organs including inadequate blood circulation due to cardio-vascular insufficiently or dehydration. Signs and symptoms include:
  - -- pale, cool, moist skin
  - -- heavy sweating
  - -- dizziness
  - -- nausea
  - -- fainting

- o **Heat stroke** is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:
  - -- red, hot, usually dry skin
  - -- lack of or reduced perspiration
  - -- nausea
  - -- dizziness and confusion
  - -- strong, rapid pulse
  - -- coma

COLD STRESS

Frost Bite

Frostbite is an injury resulting from exposure to cold. The extremities of the body (fingers, toes) are most often affected. The signs of Frostbite are:

- Skin turns white or grayish-yellow.

- Pain is sometimes felt early, but subsides later. Often there is no pain.

- The affected part feels intensely cold and numb.

<u>**Hypothermia**</u>

If site work is to be conducted during the winter, cold stress is a concern in the health and safety of the personnel. Additional insulated clothing will be provided to field personnel. Of special note for cold stress on this site is the wearing of tyvek suits. Disposable clothing does not breath; therefore, perspiration is not provided with a means of evaporation. During strenuous physical activity, an employee's clothes can become wet. Wet clothes combined with cold temperatures can lead to hypothermia. If the air temperature is less than 40°F and an employee becomes wet, the employee must change to dry clothes. The on-site heated trailer facility or a personnel vehicle may be utilized as a change area.

Hypothermia is characterized by shivering, numbness, drowsiness, muscular weakness and a low internal body temperature when the body feels warm externally. This can lead to unconsciousness and death.

In either case (frostbite or hypothermia), seek immediate medical attention.

To present these effects from occurring, persons working in cold environments should wear adequate clothing and reduce the time spent in the cold area.

APPENDIX F

FORMS

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

<u>INSTRUCTIONS:</u> This form is to be completed by each person to work on the subject project work site and returned to the Office Safety Coordinator.

Job No.: ______________________________

Client/
Project: ____

Date: ________________________________

I represent that I have read and understand the contents of the above Plan and agree to perform my work in accordance with it.

____
Signed

____
Print Name

____
Company/Office

____
Date

PLAN FEEDBACK FORM

Job Number: ____________________

Job Name: ____________________

Date: ____________________

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for future revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT			DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (include area code)		
NAME OF INJURED OR ILL EMPLOYEE			
DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT	
NARRATIVE DESCRIPTION OF ACCIDENT			
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED			LOST TIME YES ☐ NO ☐
PROBABLE DISABILITY (Check One) FATAL ☐ LOST WORK DAY WITH DAYS AWAY FROM WORK ___ ☐ LOST WORK DAY WITH DAYS OF RESTRICTED ACTIVITY ___ ☐ NO LOST WORK DAY ☐ FIRST AID ONLY ☐			
CORRECTIVE ACTION TAKEN BY REPORTING UNIT			
CORRECTIVE ACTION WHICH REMAINS TO BE TAKEN (by whom and by when)			
NAME OF SUPERVISOR		TITLE	
SIGNATURE		DATE	

PROJECT EXPOSURE HISTORY FORM
(To Be Completed by Project Manager)

JOB NAME: ______________________________

JOB NUMBER: ______________________________

DATES FROM/TO: ______________________

D&M PERSONNEL ON SITE:

1. ______________________ 5. ______________________

2. ______________________ 6. ______________________

3. ______________________ 7. ______________________

4. ______________________ 8. ______________________

SUSPECTED CONTAMINANTS	VERIFIED CONTAMINANTS AND AIRBORNE CONCENTRATION THEREOF

DAILY INSTRUMENT CALIBRATION CHECK SHEET

INSTRUMENT: ______________________

SERIAL # ______________________

DATE	PURE AIR Y/N	CALIBRATION GAS (PPM)	BATTERY CHECK (GOOD/BAD)	CALIBRATED BY	REMARKS

AIR MONITORING

GENERAL INFORMATION

Name(s): ______________________ Background Level: ______________

Date: ______________________ Weather Conditions: ______________

Time: ______________________

Project: ______________________

Job No: ______________________

Estimated Wind Direction: ______________________

Estimated Wind Speed (i.e., calm, moderate, strong, etc): ______________

Estimated Air Temperature and % Relative Humidity: ______________

Location Where Background Level Was Obtained: ______________

EQUIPMENT SETTINGS

HNU

Range: ______________

Span Pot: ______________

Calibration GAs: ______________

EXPLOSIMETER

Alarm Trigger-%LEL : ______________

Alarm Trigger-%02 : ______________

Calibration GAs: ______________

FIELD ACTIVITIES

Field Activities Conducted: ______________________

____

TIME	HNU	EXPLOSIMETER %LEL	EXPLOSIMETER %02	DRAGER TUBE	RADIATION METER
	Equivalent			ppm-constituent	

CONTRACTOR STATEMENT OF COMPLIANCE

This is to confirm that the employees working at ______________ are qualified by virtue of training and experience to engage in field activities in connection with the Contract Agreement between Dames & Moore and _________________, dated _______________, 19___. Further, all said employees have been determined to be properly trained and medically fit to perform those field activities prescribed by said Contract and to utilize the respiratory protective equipment necessary to perform the job safely in accordance with Title 29 of the Code of Federal Regulations, Parts 1910 and 1926.

____

Authorized Contractor Representative/Date

2988A

APPENDIX C

DATA QUALITY ASSURANCE PLAN

Verification Investigation
Chevron USA, Inc.
Philadelphia, Pennsylvania

Project Number: 16000-230

Prepared By: John Kearns, Quality Assurance Officer

Data Quality Assurance Plan
February 1990

Approvals:

Roger D. Moore for
Ralph T. Golia
Project Director

Bruce C. Amig
Bruce C. Amig
Project Manager

John F. Kearns
John F. Kearns
Quality Assurance Manager

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LIST OF FIGURES

The key personnel of the Chevron project are:

Organization	Name/Title	Address/Phone Number
Chevron	Mr. M.T. Manigly Environmental Specialist	Chevron Refinery 30th Street and Penrose Avenue Philadlephia, PA 19101 (215) 339-7466
USEPA	Linda Carlson Project Officer	Region III 841 Chestnut Building Philadelphia, PA 19107 (215) 597-1601
Dames & Moore	Mr. Bruce C. Amig Project Manager	2360 Maryland Road Willow Grove, PA 19090 (215) 657-5000
Dames & Moore	Mr. Ralph T. Golia Project Director	2360 Maryland Road Willow Grove, PA 19090 (215) 657-5000
Dames & Moore	Mr. John F. Kearns Quality Assurance Manager	2360 Maryland Road Willow Grove, PA 19090 (215) 657-5000

7102R

DATA QUALITY ASSURANCE PLAN

1.0 INTRODUCTION

Chevron's RCRA Corrective Action Permit (EPA I.D. No. 049 791 098) Part II Section (A), subsections (1), (2), (3), and (4) present a listing of specific solid waste management units (SWMUs) that require further investigation. The objectives of the investigations are to:

- Establish the physical integrity of unit (where appropriate)
- Establish the presence or absence of hazardous waste or hazardous waste constituents in the area of each unit (where appropriate)
- Establish whether there is or has been migration of hazardous waste or hazardous waste constituents from the units to the soil and/or ground water

To accomplish these objectives, a series of tasks will be performed that are specified in the referenced permit and have been outlined in the Verification Investigation (VI) Work Plan, Chapters 2 through 5, inclusive. These tasks are:

- Surface soil sampling and analyses (where appropriate)
- Soil gas survey (where appropriate)
- Soil boring program (where appropriate)

Table C-1 is a list of tasks planned at each SWMU. The designated sampling points for each of these referenced tasks has been selected with a bias toward encountering hazardous waste or hazardous waste constituents at each SWMU. This bias is based upon the following sources of information:

- Field observations recorded during the Visual Site Inspection (VSI) RCRA Facility Assessment Report, February 1990, and Dames & Moore's site reconnaissance
- Permit Fact Sheet
- Chevron employee interviews
- Aerial photograph review (photos dated 1960, 1965, 1975, 1980, 1985)

This Data Quality Assurance Project Plan (DQAP) addresses the program requirements to ensure that the data generated during the VI at the Chevron USA, Inc. (Chevron) Refinery in Philadelphia, Pennsylvania, conform to the specifications agreed to by Chevron and the United States Environmental Protection Agency (EPA).

Attachment C of the referenced permit sets forth specific requirements of the DQAP. These specific requirements are addressed below.

1) Data Collection Strategy

   a. The description of the intended data use is provided in Table C-2.
   b. Precision, accuracy, and completeness are discussed in Chapter 2 of this appendix.
   c. A rationale for sample selection is provided in the VI Work Plan, Chapters 2 through 5.
   d. Data will be consistently managed and logged as outlined in Chapter 7 of the VI Work Plan. This will allow for a comparison of data through time and with outside laboratories and consultants.
   e. Quality assurance reports are addressed in Chapters 8 and 10 of this appendix.

2) Sampling

   a. A discussion of sample locations and depths is provided in Chapters 2 through 5 of the VI Work Plan.
   b. A justification of sampling locations is provided in Chapters 2 through 5 of the VI Work Plan.
   c. Ancillary data measurements are described in Chapters 2 through 5 of the VI Work Plan.
   d. Sampling conditions are described in Appendix A.
   e. The determination of the media to be sampled was specified in the subject Corrective Action Permit. The determination of media to be sampled is discussed in the VI Work Plan, Chapters 2 through 5. A summary of sampling activities is provided on Table C-2 of this appendix.
   f. Parameters to be measured are discussed in the VI Work Plan, Chapters 2 through 5, and summarized in Table C-2 of this appendix.
   g. Sampling frequency is discussed in Chapters 2 through 5 of the VI Work Plan.
   h. The type and number of samples are specified in Chapters 2 through 5 of the VI Work Plan and summarized in Table C-1 of this appendix.
   i. Decontamination procedures are discussed in Appendix A.

j. Field documentation procedures are discussed in Chapters 2 through 5 and Chapter 7 of the VI Work Plan and Appendix A. Quality Assurance data are summarized in Table C-2 of this appendix.
k. A summary of sample containers is provided in Table C-3 of this appendix.
l. A summary of preservation techniques is provided in Table C-3 of this appendix.
m. Sample custody issues are addressed Chapter 4 of this appendix.

3. Field Measurements (OVA Readings/GC Readings)

a. Field sampling locations and measurements are discussed in the VI Work Plan, Chapters 2 through 5.
b. The justification for sampling locations is provided in Chapters 2 through 5 of the VI Work Plan.
c. Ancillary data collection is discussed in Appendix A. Calibration of the OVA and GC is provided in Subsection 5.0 of this appendix.
d. A discussion regarding field conditions is provided in Appendix A.
e. Parameters to be measured in the field are specified in the VI Work Plan, Chapters 2 through 5.
f. Locations of field measurement are addressed in the VI Work Plan, Chapters 2 through 5.
g. Sampling frequency is discussed in Chapters 2 through 5 of the VI Work Plan.
h. Field documentation procedures are provided in Chapters 2 through 5, and Chapter 7 of the VI Work Plan, and Appendix A. This appendix addresses quality assurance issues.

4. Sample Analysis
a. Chain of custody procedures is provided in Chapter 4 of this appendix.
b. Sample storage procedures and holding times are discussed in Table C-3 of this appendix.
c. Sampling procedures are outlined in Appendix A.
d. Analytical procedures are outlined in Tables C-2 and C-3 of this appendix. Actual laboratory procedures will be addressed in the future Laboratory Quality Assurance Plan to be submitted at a later date, once a laboratory has been selected.

The DQAP addresses field and laboratory functions that may affect the quality of data generated in the course of the VI so that all parties will be assured that the objectives of the VI have been met upon completion.

2.0 DATA QUALITY OBJECTIVES (DQOs)

DQOs for the project will be established in terms of precision, accuracy, comparability, representativeness, and completeness of the data sets generated. A summary of the DQOs is provided in Table C-2.

"Precision" is defined as the degree of mutual agreement among individual measurements of the same property under similar conditions, and is expressed as relative percent difference (RPD).

$$RPD = \frac{[REP1 - REP\ 2]}{[(REP\ 1 + REP\ 2) \times 0.5} \times 100\%$$

"Accuracy" is defined as the degree of agreement between a known value and a measured value.

$$Accuracy = \frac{Measured\ Value}{Known\ Value} \times 100\%$$

"Comparability" of data is ensured through the consistent use of appropriate units of measure for all measurements of the same property under similar conditions.

"Representativeness" expresses the degree to which data reflect actual environmental or process conditions. It is determined, in large measure, by the degree to which appropriate sampling procedures are followed.

"Completeness" is a measure of the amount of valid data obtained compared to the ideally expected amount of data to be obtained.

Methods of sample analysis are define in the work plan as:

A) Skinner List Analyses
   As listed below
B) Appendix IX Analyses
   Volatile organics - Method 8240
   Semivolatile organics - Method 8270
   Inorganics - Method 6010
   Method 7061
   Method 7421
   Method 7470
   Method 7741
   Method 7841

All methods are taken from the third edition of SW-846. The accuracy and precision objectives are as stated in SW-846. They will be detailed in the laboratory Quality Assurance Plan to be provided at a later date, once a laboratory has been selected.

The objective for completeness is 100 percent. Each data point sampled is expected to generate acceptable data.

Approved sampling procedures will be used in order to ensure representativeness of the data set. Field duplicate precision should be ±20 percent.

In order to ensure comparability, consistent units of measure will be used throughout the sampling events for all analyses of the same parameter on similar matrixes.

3.0 SAMPLING PROCEDURES

3.1 SOIL (SURFACE) - See Appendix A, Section 1.0, for detailed procedures.

3.2 SOIL (GAS) See Work Plan, Subsection 4.1.2, for detailed procedures.

3.3 SOIL (SUBSURFACE/BORING) See Appendix A, Sections 2.0 and 3.0, for detailed procedures.

See Table C-3 for details of container, preservation, and holding time specifications. All sample containers related to analyses will be supplied by the laboratory to be selected. Samples that require chemical preservation will be placed in prefixed containers provided by the selected laboratory. All reagents will be analytical grade.

4.0 SAMPLE CUSTODY

Detailed log entries, identification, and chain of custody procedures will be used in order to ensure the evidentiary validity of the data generated.

4.1 ON-SITE

Sample identification procedures are given in the VI Work Plan, Chapter 7. This identification sequence will be used consistently in field notebooks and on chain of custody documentation.

When samples have been obtained for transport to the off-site laboratory for analysis, a chain of custody record will be generated by field personnel. The Project Manager will notify the laboratory in advance of a sampling event, providing the laboratory with a schedule and the approximate number of samples by type and parameter. Field personnel will release the samples to the laboratory courier by exchange of signatures on the chain of custody form, retaining one copy for field records. A sample chain of custody form is given as Figure 1. A sample identification label is given as Figure 2.

4.2 LABORATORY

Laboratory sample custody and internal chain of custody procedures will be addressed in detail in the selected laboratory's Quality Assurance Plan, to be submitted once a laboratory has been selected.

5.0 CALIBRATION

5.1 ON-SITE

A calibration program will be implemented to ensure that routine calibration is performed on all field instruments. Field team members familiar with the field calibration and operations of the equipment will maintain proficiency and perform the prescribed calibration procedures outlined in the Operation and Field Manuals accompanying the respective instruments.

The air monitoring instrument (OVA) used in the field to gather data for health and safety purposes, and for sample monitoring, will be calibrated each day prior to the initiation of field work. The instrument will be calibrated using appropriate ultra-zero and indicator gases. Following calibration, each instrument will be tagged to identify the person who calibrated the instrument and the calibration date.

The following procedures will be utilized to calibrate and operate the Century Systems OVA. These procedures will be followed when the OVA is used in the survey mode to obtain qualitative data.

The OVA will undergo routine maintenance and calibration by the manufacturer prior to shipment to the project.

Daily calibration and instrument checks will be performed by a trained team member at the start of each day. Daily calibrations will be performed as follows:

1) Turn on electronics and zero instrument on X-10 scale. Gas select dial to 300.
2) Turn on pump and hydrogen, and ignite flame.
3) Attach span gas standard (approximately 100 ppm of methane) to probe via Teflon tubing.
4) Adjust R-32 trim pot on circuit board to make meter read to standard.
5) Turn off flame and adjust meter needles to read 4 ppm.
6) Switch to X1 scale and adjust R-31 trim pot to make meter read 4 ppm.
7) Return to X10 scale and adjust to 40 ppm.
8) Switch to X100 scale and adjust R-33 trim pot to make meter read to 40 ppm.

9) Make sure with pump and OVA upright that ball level on pump is 2 or above.
10) If problems are encountered, go through system checks and perform routine maintenance.
11) If OVA fails calibration steps, notify Project Manager.

Calibrations of the gas chromatograph will be performed at the beginning and end of each day and after every 4 hours of GC operation. Calibrations are performed by injecting a sample (injection technique is identical to injection technique used for sampling) of a certified laboratory standard. The concentrations and retention times of the standards are programmed into the GC's memory until the next calibration is performed. The calibration will be recorded daily in the field log.

Calibration records for each field instrument used on the project will be maintained on-site and a copy will be kept in the contractor's project files.

5.2 LABORATORY

Laboratory calibration procedures will be addressed in detail in the laboratory Quality Assurance Plan, which will be submitted once a laboratory has been selected.

6.0 ANALYTICAL PROCEDURES

6.1 ON-SITE

On-site procedures for soil gas analysis are addressed in detail in subsection 4.1.2 of the VI Work Plan.

6.2 LABORATORY

Laboratory analytical procedures will be taken from the third edition of SW-846, "Test Methods for Evaluating Solid Waste." These methods will be used for all samples related to the site, including surface water. In certain circumstances, the compound lists may be modified to meet work plan specifications. This modification will in no way alter the execution of the methods. Library search data may also be used. The laboratory will maintain and have available for the appropriate operators standard operating procedures related to sample preparation and analysis according to the stipulated methods.

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

7.1 DATA REDUCTION

See Chapter 7 of the VI Work Plan for information pertaining to data reduction. Reduction will also be discussed in the laboratory Quality Assurance Plan to be submitted at a later date, once a laboratory has been selected.

7.2 DATA VALIDATION

The Quality Assurance Manager will provide data validation upon receipt of the data from the laboratory by the consultant. This validation will include a check on completeness and an audit of associated quality control data to evaluate the overall data quality. Data validation procedure will be based on functional guidelines published February 1988 for organics and July 1988 for inorganics.

7.3 DATA REPORTING

The reporting format will allow for data validation. At a minimum, the reporting format will include:

a. Sample identification
b. Chronology
c. Analytical results/Detection limits
d. QA summary

    1. Tuning and calibration (as required)
    2. Surrogate recoveries
    3. MS/MSD summary
    4. Blank reported
    5. Narrative information
    6. LCS reported (as required)

e. Chain of custody
f. Library search information (as required)

    1. Tentative identification
    2. Approximate concentration
    3. Degree of purity

g. Labeled chromatograms/RICs

8.0 INTERNAL QC CHECKS/SYSTEM AUDITS

8.1 ON-SITE

The QA/QC officer assigned to the project will conduct periodic audits of operations at the site to ensure that work is being performed in accordance with the work plan and standard operating practice (see the appendices). A checklist appropriate to the activities scheduled during the audit will be used. An example checklist is provided in Figure 3. The audit will cover but not necessarily be limited to such areas as:

- Conformance to SOPs
- Completeness and Accuracy of Documentation
- Chain of Custody Procedures
- Compliance with HASP
- Construction Specifications

These audits will occur a minimum of once per month or at the start or end of each significant phase of the project, whichever is greater.

8.2 LABORATORY

Internal QA checks/system audits will be performed by the selected laboratory. Procedure details will be submitted on a later date once a laboratory has been selected.

9.0 PREVENTIVE MAINTENANCE

9.1 FIELD EQUIPMENT

The OVA (organic vapor analyzer) and the GC (gas chromotograph) will require preventive maintenance. They will be maintained in accordance the manufacturers' specifications.

9.2 LABORATORY

Laboratory equipment maintenance will be discussed in a future laboratory Quality Assurance Plan once a laboratory has been selected.

10.0 ASSESSING DATA QUALITY OBJECTIVES

10.1 FIELD

The impact of field activities on data quality relates primarily to sampling technique and sample point location. Audits as described in Section 9 of this document will provide the principal means of assessing the conformance of field personnel to SOPs. These will be reported as part of the QA reports to management.

10.2 LABORATORY

The procedures for assessing laboratory DQOs will be discussed in the laboratory Quality Assurance Plan, which will be submitted at a future date once a laboratory has been selected.

11.0 CORRECTIVE ACTIONS

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant non-conforming condition is noted at the site, or at laboratory or subcontractor locations, the cause of the condition will be determined and corrective action will be taken to preclude recurrence. Condition identification, cause, reference documents, and corrective actions planned to be taken will be documented and reported to the Project Manager, Quality Assurance Manager, and subcontractor management, at a minimum. Implementation of corrective action will be verified by documented follow up to the Quality Assurance Manager. All project personnel have the responsibility, as part of their normal work duties, to promptly identify, solicit approved correction, and report non-conforming conditions. Project management and staff, such as field investigation teams, remedial response planning personnel, quality assurance auditors, document and sample control personnel, and laboratory groups must monitor ongoing work performance in the normal course of daily responsibilities.

Work will be audited at the sites, laboratories, and subcontractor locations by the Quality Assurance Manager or designated auditors. Items, activities, or documents ascertained to be in noncompliance with quality assurance requirements will be documented and corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings will be logged, maintained, and controlled by the Quality Assurance Manager.

A Corrective Action Request (CAR), shown on Figure 4, should be used to identify the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible management in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the Quality Assurance Manager, affixing his signature and date to the corrective action block, after stating the cause of the conditions and the corrective action to be taken. The Quality Assurance Manager maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The Quality Assurance Manager will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Project Manager, and the involved subcontractor, at a minimum. CARs are transmitted to the project file for the records.

12.0 QA REPORTS TO MANAGEMENT

Periodic reports during the time of field activities from the QA/QC Coordinator will address:

1. Overview of activities and significant events related to QA/QC
2. Summary of audit results
3. Review of corrective action request status
4. Laboratory QA/QC report
5. Data validation QA/QC report
6. Summary of significant changes in SOPs or QA/QC programs
7. Recommendations

Reports will be submitted to the Project Manager.

Upon project completion, a Final QA Report will be issued, assessing the overall degree of project conformance to specifications and the impact of any non-conforming conditions on data quality that may affect management decisions.

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TABLE C-1

SUMMARY OF SOIL SAMPLING ACTIVITIES
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

SWMU NUMBER	SS	SGS	SB	ANALYSES
1	3	-	3	Skinner List[1]
6	2	-	4	Skinner List[1]
30	3	-	3	Skinner List[1]
45	2	-	2	Appendix IX[2] metals, volatiles, and semi-volatile constituents
79	1	-	1	Appendix IX[2] metals, volatiles, and semi-volatile constituents
2[3]	1	-	1	Skinner List[1]
9	1	-	1	Skinner List[1]
13	-	-	2	Skinner List[1]
11 and 12	-	10	4	OVA and GC Field Analyses (SGS) Skinner List[1] (SB)
29	-	5	2	OVA and GC Field Analyses (SGS) Skinner List[1] (SB)
71	-	10	3	OVA and GC Field Analyses (SGS) Skinner List[1] (SB)
16 and 17	2	-	8	Skinner List[1]

Explanation:

SS = Surface soil sample
SGS = Soil gas survey sample
SB = Soil boring sample
OVA = Organic vapor analyzer
GC = (Portable) gas chromotograph

Notes:

1. The Skinner List of constituents is included as Table 1 of the VI Work Plan.
2. The Appendix IX list of constituents is included as Table 2 of the VI Work Plan.
3. Sampling points (surface and boring) are included in the SWMU No. 1 investigation.

TABLE C-2

SUMMARY OF DATA QUALITY OBJECTIVES
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

Task	Objective	Data Use	Selected Analytical Options	Sensitivity	Analytical Parameters	Number of Samples	Duplicates	Trip Blanks	Field Blanks
Surface Soil Sampling	Characterize extent of surface soil contamination	1,2,3	III	ENG	Skinner List Appendix IX List	11 3	1 1	1/day 1/day	1 1
Soil Gas Survey	Evaluate volatilizing gases present in the soil	1,5	I, II	Low ppm VOA	FID/GC	25	NA	NA	NA
Soil Boring Program	Characterize extent of subsurface soil contamination	1,2,3	III	ENG	Skinner List Appendix IX	31 3	2 1	1/day 1/day	1 1
Air Monitoring for Health and Safety	Monitor air quality in and near the breathing zone	1,4	I	Low ppm VOA	Low ppm VOA FID	Prior to and during each field task as a health and safety surveil-lance, field screening tool.	NA	NA	NA
Borehole Scan with OVA	Initial qualitative characterization of subsurface soil contamination	1,2	I	Low ppm VOA	Low ppm VOA FID	34	NA	NA	NA

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TABLE C-2 (Continued)

SUMMARY OF DATA QUALITY OBJECTIVES
CHEVRON REFINERY

PHILADELPHIA, PENNSYLVANIA

Task	Objective	Precision	Accuracy	Representativeness	Completeness	Comparability
Surface Soil Sampling	Characterize extent of surface soil contamination	SW 846	SW 846	Based upon specific field conditions to evaluate all surface soils.	95%	The use of standard operating procedures should ensure comparability.
Soil Gas Survey	Evaluate volatilizing gases present in the soil	NA	NA	A sampling grid has been designed to obtain a representative picture.	Since this is a field technique 95% can be achieved.	Use of standard soil sampling and recognized field analytical procedures assures comparability.
Soil Boring Program	Characterize extent of subsurface soil contamination	CLP/RAS Precision	CLP/RAS Accuracy	Based upon specific field conditions to detect off-site migration.	CLP/RAS is 95%	The use of standard operating procedures should ensure comparability.
Air Monitoring for Health and Safety	Monitor air quality in and near the breathing zone	NA	NA	Sampling will obtain site characterization and health and safety data.	Baseline worst case & final round require 100% completeness.	The use of standard operating procedures manuals should ensure comparability.

Notes:

DATA USE:

1. Site Characterization
2. Risk Assessment
3. Evaluation of Alternatives
4. Health and Site Safety
5. 95% completeness is anticipated because interference may be high due to highly contaminated samples.

NA = Not Applicable
CLP = Contract Laboratory Program
RAS = Routine Analytical Services
FID = Flame Ionization Detector
ENG = Engineering Judgement
SW 846 = Objectives as stated in the SW 846 Manual

ANALYTICAL OPTIONS:

Level I = Field screening analysis using portable instruments.

Level II = Field analysis using more sophisticated portable analytical instruments.

Level III = Analysis performed in an off-site laboratory which may not use CLP protocol. Level III does not require the extensive validation or documentation required for CLP Level IV.

Level IV = CLP routine analytical services. All analysis are performed in a CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

Level V = Analysis by non-standard methods. Method development or method modification may be required.

TABLE C-3

SUMMARY OF SOIL ANALYSES, CONTAINERIZATION AND PRESERVATION

CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

	Skinner List		Selected Appendix IX Constituents	
	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Number of Samples	12	22	3	3
Number of QA Samples				
Duplicates	1	1	1	1
Trip Blanks[1]	1	1	1	1
Field Blanks	1	1	1	1

EPA Analytical Methods (Skinner List and Appendix IX Constituents)	VOAs by 8240 with library search	SVAs by 8270 with library search	Metals[3] by 6010 and 7000
Preservative[4]			
Soil	4°C	4°C	4°C
Water	4°C, possibly HCl pH <2	4°C	4°C, HNO_3 pH <2
Container[4]			
Soil	1-120g glass with teflon lid (wide-mouth)	1-500g amber glass	1-500g plastic
Water	3-40 ml vials with teflon lid	3-1 liter glass	1-1 liter plastic
Holding Time[4] (from collection)			
Soil	14 days	14 days to extraction 40 days to analysis	120 days except for Mercury (28 days)
Water	14 days if HCl preserved 7 days without HCl	7 days to extraction 40 days to analysis	120 days except for Mercury (28 days)

Explanation:

VOAs = volatile organic compounds
SVAs = semivolatile organic compounds

Notes:

1 - One trip blank will be collected daily.
2 - Several Skinner List and Appendix IX volatile and semivolatile organics may require a library search for possible detection.
3 - For the specific EPA methods of analysis, refer to Table 2. All metals analyses for soil will include a preparatory digestion by Method 3050.
4 - These handling procedures may vary depending upon the selected laboratory to be chosen.

Chain of Custody

Client:

Work Order No.: P.O. No.:

Submit Report to: Project Name:

Sampler: FSC:

Project Location:

Sample Type:

HZ	Hazardous
SO	Soil
PW	Potable Water
GW	Ground Water
SW	Surface Water
WW	Waste Water
SL	Sludge

Field sample number / sample identification	Date	Time	COMP	GRAB	Number of Containers (Total)	Sample Type (use reference)	Analyses						Remarks:

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer

FIGURE 1

Appendix c

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

I-CHEM RESEARCH

CHEM (800) 443-1689 (800) 553-3696

SITE NAME | DATE

ANALYSIS | TIME

PRESERVATIVE

SPECIALTY CLEANED CONTAINER

FIGURE 2

Appendix C

QUALITY ASSURANCE
AUDIT CHECKLIST

Project ______________________ Project Manager ______________________

Site Location ______________________

Auditor ______________________ Date ______________________

Question	Yes	No	Comment/Documentation
FIELD:			
1. Was an on-site safety officer appointed?			
2. Did site personnel receive a copy of the site specific sampling and analytical plan in a timely manner to allow for sufficient review?			
3. Are copies available in the field during sampling?			
4. Was a briefing held off-site, before any site work was begun to acquaint personnel with sampling equipment, assign field responsibilities and review safety procedures?			
5. Do field personnel have a field notebook?			
6. Are the site survey grid stakes present?			
7. Are the number and location of samples collected following procedures as specified in the site specific sampling and analytical plan?			
8. Are samples labeled as described in the POP?			
9. Are samples being collected following the procedures specified in the POP?			
10. Was a chain of custody form filled out for all samples collected?			
11. Are samples preserved as specified in Appendix A of the POP?			

FIGURE 3

Appendix C

DAMES & MOORE
A PROFESSIONAL LIMITED PARTNERSHIP

FIGURE 4

Appendix C

CORRECTIVE ACTION REQUEST

NUMBER ______________________ DATE ______

TO ______________________

YOU ARE HEREBY REQUESTED TO TAKE CORRECTIVE ACTIONS INDICATED BELOW AND AS OTHERWISE DETERMINED BY YOU (A) TO RESOLVE THE NOTED CONDITION AND (B) TO PREVENT IT FROM RECURRING. YOUR WRITTEN RESPONSE IS TO BE RETURNED TO THE PROJECT QUALITY ASSURANCE MANAGER BY ______________

CONDITION

REFERENCE DOCUMENTS

RECOMMENDED CORRECTIVE ACTION

ORIGINATOR	DATE	APPROVAL	DATE	APPROVAL	DATE

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B1) PREVENTION

(B2) AFFECTED DOCUMENTS

SIGNITURE ______________________ DATE ______

Q.A. FOLLOW-UP

CORRECTIVE ACTION VERIFIED: BY ______________________ DATE ______

0-A-R (3)

APPENDIX D

CURRICULUM VITAE

Curriculum Vitae

BRUCE CLEMENT AMIG

Title: Project Hydrogeologist

Expertise: Site Assessments
Regulatory Interpretation

Experience with Firm:

- o Prepared a work plan for an off-site hydrogeologic investigation by an industrial development in Union, New Jersey.
- o Prepared a preliminary submission (siting evaluation) for a hazardous waste landfill in Pennsylvania.
- o Prepared and negotiated a RCRA Facility Investigation Plan for waste disposal areas at a solvent treatment plant in Chester County, Pennsylvania.
- o Sited a ground water monitoring system at seven RCRA facilities in Independence, Missouri. The facilities included surface impoundments, landfills, detonation grounds, and thermal treatment areas.
- o Managed a hydrogeologic investigation, site assessment, and remedial design to address metals and solvent contamination at a manufacturing complex in Reading, Pennsylvania.
- o Provided emergency response services for a fuel oil release from an underground storage tank in King of Prussia, Pennsylvania.

Past Experience: Regional Hydrogeologist, Compliance and Monitoring Section
Pennsylvania Department of Environmental Resources

- o Reviewed hydrogeologic reports of accidental discharges and permitted/unpermitted municipal and industrial landfills.
- o Reviewed landfill applications to determine compliance with the Municipal Waste Management Regulations.
- o As Project Coordinator, assisted in writing consent order agreements, and provided oversight of all aspects of field work and environmental sampling.
- o Acted as public spokesman at community meetings.
- o Reviewed and assisted in development of the Municipal Waste Management Regulations, promulgated April 9, 1988.

Consulting Geologist

- Performed gas, oil, and coal property appraisals by standard reservoir engineering techniques (volumetric and decline-curve analyses with cash-flow analyses); orifice testing (open flow) of gas wells; well site geology; and gas storage field evaluations in Idaho, Wyoming, Utah, Kentucky, Tennessee, West Virginia, Illinois, and Virginia. Also performed geophysical log interpretations and prepared underground mine maps and stratigraphic correlations.

Academic Background:	M.S., Geology (1988) University of Kentucky, Lexington, Kentucky
	B.S., Geology (1980) Juniata College, Huntingdon, Pennsylvania
Citizenship:	United States
Language Proficiency:	English
Professional Publications:	Shepherd, R.G., Amig, B.C., et al., 1984, Genetic Identification of Disconformities: (Abstract) Annual Convention, Geological Society of America
	Ettensohn, F.R., Amig, B.C., et al., 1985, Paleoecology and Paleoenvironments of the Bryozoan Rich Sulphur Well, Lexington Limestone (Middle Ordovician), Central Kentucky: Southeastern Geology, Vol. 265, No. 4, pp. 199-219
	Amig, B.C., 1986, Lithofacies Analysis of the Middle Carboniferous Clastics, South-Central Kentucky: Appalachian Basin Industrial Assoc., Vol. 11, pp. 33-69

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Curriculum Vitae

RALPH T. GOLIA, P.G.

TITLE: Associate

EXPERTISE: Hydrogeology
Engineering Geology

EXPERIENCE WITH FIRM: Mr. Golia has considerable experience in conducting and managing hydrogeologic and environmental investigations. He has evaluated hydrogeologic properties through subsurface exploration, aquifer testing, and geophysical investigations, and is experienced in the interpretation of aerial photographs.

In addition, Mr. Golia has extensive experience installing monitoring wells, sampling ground water and soil, and coordinating sampling programs for a wide variety of analytical parameters in accordance with stringent QA/QC procedures. He has designed numerous field investigations and has trained personnel in conventional field techniques. Mr. Golia has counseled clients with respect to regulatory compliance and has routinely interacted and negotiated with state and federal agencies on many projects.

Mr. Golia's participation in specific projects since he joined Dames & Moore in 1984 are presented below.

- Project Director/Manager on a hydrogeologic characterization and ground water quality assessment for a RCRA Part B Permit Modification for a landfill and land treatment area. Work included upgrading the existing monitoring well system to meet state standards, characterizing hazardous and non-hazardous waste disposed of at the site, and developing a statistical analysis, ACLs, and a corrective action plan.

- Project Director for a hydrogeologic investigation at a solvent packaging facility. Work included the installation of an extensive ground water monitoring well network to define the vertical and horizontal extent of TCE and toluene ground water contamination plumes in a karst limestone area. Interim correction measures were employed at the completion of the Phase I investigation. Subsequent phases defined the plumes for ultimate remediation.

- Project Director for a RCRA Corrective Action Permit at a petroleum refinery. Work included the identification and background information survey of several Solid Waste Management Units (SWMUs) and the preparation of work plans and implementation of; Verification of Release studies (VORs), RCRA Facility Investigations (RFIs) and Corrective Measures Studies (CMSs) in accordance with EPA guidelines.

- Project Director/Manager for an extensive environmental assessment at an oil refinery in Philadelphia, Pennsylvania. Work included the installation of 102 shallow monitoring wells, 6 deep monitoring wells, and the excavation of numerous test pits. The purpose of the investigation was to evaluate stratigraphy and hydrogeologic conditions at the site, including hydraulic gradients, ground water flow rates and direction, and product thickness and distribution. Conceptual alternative methods for free-product recovery were subsequently identified. In addition, a soil characterization study was conducted at tetraethyl lead disposal sites and other waste disposal sites.

- Project Director/Manager on an environmental assessment of a large manufacturing plant. Work included evaluation of previous environmental studies, including closure of a RCRA-regulated facility, evaluation of ground water and soil contamination, assessment of aerial and ground reconnaissance, and development of remedial alternatives. Remedial actions were implemented, and decontaminated approximately 2,000 tons of volatile organic-contaminated soil on-site.

- Project Manager and Principal Investigator for an investigation of TCE ground water contamination affecting ground water supply wells at a large manufacturing facility, and remediation of on-site dry wells. Responsibilities included program planning and coordination with NJDEP, project management, monitoring well installation and sampling, source identification, aquifer testing, design of remedial measures, and selection and supervision of subcontractors.

- Project Manager and Principal Investigator for a ground water contamination investigation and ground water recovery system design. Work included monitoring well installation, ground water sampling, source evaluation, and pumping tests. The proposed ground water recovery system was submitted and approved by state authorities. Subsequent work involved monitoring and documentation of the system's performance.

- Project Manager and Principal Investigator for a subsurface investigation at an abandoned gasoline station in Texas. Work included the installation of a ground water and vadose zone monitoring system to define the extent of floating free-phase product and to evaluate potential health and safety risk associated with future use of the site. Based upon hydrogeologic conditions at the site, a recommended method for product removal was presented to the state and subsequently implemented.

- Project Manager and Assistant Investigator for an environmental impact assessment of a proposed sanitary landfill in Rockaway, New Jersey. Work included research of existing related studies in the area, and preparing a report that reviewed potential impacts to ground water and surface water associated with potential leachate release.

- Project Manager and Principal Investigator for state-wide environmental assessments at railroad locomotive terminals in New Jersey. Work included site reconnaissance, surface soil sampling, and preparation of a report addressing areas of noncompliance with federal, state, and local regulations. Also provided recommendations to minimize the potential for future contamination and to comply with violated regulations.

- o Project Manager for review and assessment of an Environmental Cleanup Responsibility Act (ECRA) submission for a refinery in Westville, New Jersey. Work included delegation to and compilation of comments regarding various aspects of the submission and a proposed cleanup plan for ground water and soil contamination.

- o Project Manager and Principal Investigator for New Jersey Pollutant Discharge Elimination System (NJPDES) permitting to ground water for a new surface impoundment and closure for an existing surface impoundment in Cranberry, New Jersey. Work included characterization of impounded sludge, installation of a ground water monitoring system, and performance of quarterly sampling to establish background information.

- o Project Manager and Principal Investigator for an investigation of PCB and petroleum hydrocarbon contamination of soil and ground water at several D.C. substations. Work included developing a sampling plan, analyzing data, and preparing a cleanup plan and cost estimate.

- o Principal Investigator for a ground water contamination study at a site located near a TCE-contaminated municipal water supply. Work included evaluating the effect of nearby municipal water withdrawal on ground water flow conditions beneath the site. Also, a leaking underground solvent tank was investigated as a potential source of ground water contamination at the site.

PAST EXPERIENCE: Three and one-half years of experience in geology and engineering geology.

Staff Engineering Geologist, Applied Earth Consultants, Inc. San Jose, California

- o Assistant Investigator of a ground water contamination investigation in northern California. Assisted in determining stratigraphy and the relation to possible leakage between confined and water table aquifers. Also assisted in pumping tests and analysis of pumping test data to determine extent and migration direction of the plume.

- o Project Manager and field geologist for a soil stratigraphy investigation for archaeological purposes in San Jose, California. Work involved analysis of pedogenic development, age estimates, and paleo-occupation potential.

- o Project Manager and Principal Investigator for an engineering geologic review of proposed borrow site operations in northern California. Work included the development of recommendations to minimize environmental impact of the operations.

- o Project Manager and field geologist of several geologic and geotechnical soil and foundation investigations involving both residential and commercial sites.

Geologist, U.S. Geological Survey, Menlo Park, California

- o Published geologic several papers pertaining to areas in Nevada, California, and Oregon.

ACADEMIC BACKGROUND:	M.S. (1983), Geology, California State University, San Jose B.S. (1980), Geology, Southampton College of Long Island University
CITIZENSHIP:	United States
COUNTRIES WORKED IN:	United States
LANGUAGE PROFICIENCY:	English
PROFESSIONAL AFFILIATION:	Association of Ground Water Scientists and Engineers
PROFESSIONAL REGISTRATIONS:	Registered Professional Geologist No. 289, State of South Carolina Registered Environmental Assessor No. 00297, State of California
PUBLICATIONS:	Author of several papers in geology. List available upon request.

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7/89

Curriculum Vitae

JOHN F. KEARNS

TITLE:	Associate
EXPERTISE:	Environmental Chemistry Quality Assurance
EXPERIENCE WITH FIRM:	Mr. Kearns plans and coordinates the activities of field and office personnel in support of current requirements and programs under RCRA and CERCLA, and real estate transfer assessments and underground storage tank management. He is responsible for reviewing in-house and subcontracted work products; he validates and interprets analytical data submitted by contracted laboratories, and critiques field procedures. He also develops and implements in-house QA programs, and manages client liaison.
PREVIOUS EXPERIENCE:	During previous engagements, Mr. Kearns acquired in-depth knowledge of laboratory instrumentation and methods. He developed and taught seminars covering such topics as laboratory selection, environmental regulations, analytical protocols, data quality assessment, and laboratory data interpretation. He became familiar with method development and validation procedures for analysis of speciality chemicals and the registration/reregistration procedures of pesticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). He also gained experience related to the Clean Water Act and Clean Air Act. Mr. Kearns' previous experience includes service with the following:

Biospherics Inc., Laboratory Division, Beltsville, MD
Compuchem Laboratories, Inc., Research Triangle Park, NC
Capital District Regional Planning Commission, Albany, NY

- Provided consultation to support the development and/or review of field and laboratory work plans for CERCLA and RCRA remedial investigations at sites nationwide, at the federal and state levels.
- Coordinated laboratory services related to all federal laws and regulations in support of industrial and engineering clients. Gained familiarity with state regulations in EPA Regions II, III, IV and VI.
- Served as Project Director for a RCRA Facility Investigation (RFI) at a steel mill in Pennsylvania.

- Served as Quality Assurance Officer for multiple RI/FS projects and RFIs in EPA Regions II and III.

- Conducted laboratory comparison and selection studies for two major industrial concerns.

- Participated in the design and management of an analytical program for the analysis of polynuclear aromatic compounds (PACs) using both HPLC and GCMS technology. Very low levels of PACs were identified and quantified using a modified GC/MS drinking water method (S24.2).

- Participated in field analytical testing and permit research related to NPDES enforcement.

- Acted in the capacity of team leader for quality enhancement at a major computer manufacturing firm. Included implementation of a zero-defects program, and worked on the software design and development team for the firm's $8-million robotic factory.

- Conducted numerous laboratory audits to ensure analytical quality, cost-effectiveness, and appropriate levels of service. Audits included review of laboratory experience, personnel, quality assurance plans and procedures, standard operating procedures, work loads and capacity, and on-site inspection.

- Conducted a recreational land use study and plan of the city of Amsterdam, New York, using remote sensing techniques.

- Conducted a residential land use study for the Capital District Regional Planning Commission, Albany, New York.

ACADEMIC BACKGROUND: B.S., Environmental Science
State University of New York at Albany (1976)

CITIZENSHIP: United States

COUNTRIES WORKED IN: United States

LANGUAGE PROFICIENCY: English

PROFESSIONAL AFFILIATIONS: American Chemical Society
(Environmental and Agricultural Chemistry Sections)

0257p
12/89

Curriculum Vitae

DONALD J. SUPKOW, Ph.D.

TITLE: Senior Hydrologist

EXPERTISE: Geology
Ground Water Hydrology
RCRA Monitoring and Closure

PROFESSIONAL SUMMARY: Nationwide and international project experience related to ground water hydrology, ground water contamination, potable water resources, and RCRA and CERCLA projects.

EXPERIENCE WITH FIRM:

- Consultant to the Superior Court of New Jersey regarding ground water contamination and remediation at a site in Middlesex County, New Jersey. The project involved heavy metals and solvent contamination of a major aquifer that supplied potable water to the town of Perth Amboy. The study also addressed contamination in soil and stream sediments.

- Principal ground water investigator for Getty Oil during hydrogeologic investigations for an industrial waste landfill, a land treatment facility for refinery sludges, and a fly ash disposal site.

- Principal ground water investigator for various ground water resources studies and ground water contamination prevention/remediation studies in New Jersey, New York, Delaware, Illinois, and other states. Investigations included landfill leachates, spray irrigation of treated waste water, and ground water contamination/remediation investigations.

- Senior site hydrologist during excavation and dewatering for construction of the Hope Creek Nuclear Generating Station. Supervised field activities, site monitoring, and quality control.

- Technical reviewer for the Burnt Fly Bog NPL site in Monmouth County, New Jersey.

- Principal investigator during water resource evaluations for two SANG city sites in Saudi Arabia.

- Principal ground water investigator for water supply studies in Jordan.

- Prepared RCRA monitoring plans for waste management facilities in Delaware, Texas, New Jersey, and Illinois.

PREVIOUS EXPERIENCE: Senior Hydrologist and Director of Research Hydrogeologic Investigations, Hydrotechnics, Albuquerque, New Mexico

- o Used geothermic techniques at the Tarbela Dam site in Pakistan to locate zones of high transmissivity and the age of ground water in the reservoir area.
- o Conducted a water resources survey in Equador by applying geothermic techniques.
- o Performed hydrologic investigations to assess water resources for the government of Mexico.
- o Performed hydrologic investigations to assess water resources in Mali, Africa.
- o Conducted a monitoring program to assess the migration of leachate from a uranium tailings disposal in New Mexico.
- o Conducted an extensive study of ground water hydrology in the Tuscon Basin, Arizona. Developed geothermic techniques to analyze ground water flow systems based upon temperature and heat flow measurements made at and below the land surface in saturated and unsaturated zones.

ACADEMIC BACKGROUND: B.A., Geology
Rutgers University, 1958

M.S., Geology
University of Maine, 1965

Ph.D., Hydrology
University of Arizona, 1971

PROFESSIONAL REGISTRATION: Registered Professional Geologist, Arizona and Delaware

PROFESSIONAL AFFILIATIONS: American Association for the Advancement of Science
Arizona Academy of Sciences

PROFESSIONAL PUBLICATIONS: Several technical papers in the field of geohydrology. List available upon request.

0270p
10/89

Curriculum Vitae

THOMAS E. WHITMAN

TITLE: Staff Environmental Scientist

EXPERTISE: Environmental Site Assessments/Audits
Environmental Compliance Programs
Asbestos Management

EXPERIENCE WITH FIRM:

Two years' experience as an Environmental Scientist. Responsibilities include performance of environmental audits and assessments for property transactions. Also serves as Office Health & Safety Coordinator.

- o Performed numerous site assessments in the eastern United States for Ford Motor Company. Key issues included in the assessment program included:
  - Location and identification of underground storage tanks
  - Hazardous waste handling, storage, and disposal practices
  - Waste oil handling and disposal practices
  - Identification of asbestos-containing material
  - Spill prevention and control procedures for aboveground storage tanks
  - Sludge and solid waste disposal practices
  - Location and identification of PCB-bearing electrical transformers

- o Performed an environmental assessment and compliance audit for the proposed Penn's Landing development project in Philadelphia, Pennsylvania. Key compliance issues included:
  - Sanitary waste disposal practices for vessels ported at Penn's Landing
  - Electrical transformers containing PCBs
  - Underground storage tank inventory procedures
  - Wetland and floodplain delineation
  - Waste oil handling and disposal practices

- o Performed several pre-purchase environmental evaluations/site assessments for real estate developers and property mortgagors, including:
  - Auto Spa/Auto Care Centers, Atlanta, GA
  - Deer Valley Airport Center, Phoenix, AZ
  - Office and apartment complexes, Baton Rouge, LA
  - Thomas & Betts manufacturing facility in Doylestown, PA
  - Thrift Drug retail warehouse, Langhorne, PA
  - Devon Apparel, Philadelphia, PA

- o Performed multiple pre-purchase site assessments in western Pennsylvania for a commercial real estate developer, including the identification of a potential NPL site.

- Developed an ECRA sampling plan for an Inductotherm Industries facility in Pleasantville, New Jersey.

- Installed and sampled ground water monitoring wells at a J.C. Penney facility in Wayne, New Jersey, and at a construction site in Conshohocken, Pennsylvania.

- Conducted ground water well monitoring, sample collection, and field analysis at a petroleum refinery in Delaware.

- Performed soil sampling and field analysis for underground storage tank management at a Mobil service station in Kulpsville, Pennsylvania.

- Conducted quarterly well monitoring and sampling at a General Electric facility in Durham, North Carolina.

- Assisted in developing asbestos remediation specifications for the IBM Building in Philadelphia, Pennsylvania.

- Managed asbestos abatement monitoring activities at the former Regency Theater in Philadelphia, Pennsylvania.

- Conducted asbestos inspection surveys at residential, commercial, and industrial facilities, including:

  - Apartment complexes, Baton Rouge, LA
  - Hall's Plaza Shopping Center, Knoxville, TN
  - Industrial printing facility, Lancaster, PA

- Serves as Office Health & Safety Coordinator responsible for employee medical monitoring. Also develops site-specific Health and Safety Plans that specify air monitoring equipment necessary for the evaluation of personal and public exposure to toxic and hazardous substances.

EDUCATIONAL BACKGROUND: B.A., Geoenvironmental Studies
Shippensburg University, Pennsylvania (1987)

Asbestos Supervisors Handling Course
National Asbestos Training Institute, NJ

CITIZENSHIP: United States

COUNTRIES WORKED IN: United States

LANGUAGE PROFICIENCY: English and German

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7/89