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ENVIRONMENTAL DIVISION

THE E|D|G e GROUP

Prepared for:
MARTIN MARIETTA ENERGY SYSTEMS, INC.

RCRA FACILITY INVESTIGATION
C-400 TRICHLOROETHYLENE SPILL SITE
PADUCAH GASEOUS DIFFUSION PLANT

REVIEWED FOR CLASSIFICATION
Initials 14 July 04 Date
UNCLASSIFIED
QA HTA 2-6-13

Prepared by:
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MARCH 1988

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TRICHLOROETHYLENE C-400 SPILL SITE

1.0 INTRODUCTION

Martin Marietta Energy Systems, Inc., has contracted with Engineering Design and Geosciences Group, Inc. (EDGe), to prepare a RCRA Facility Investigation (RFI) work plan for the C-400 trichloroethylene (TCE) spill site at Paducah Gaseous Diffusion Plant (PGDP) located in Paducah, Kentucky. This work plan details the procedures and practices, including health and safety considerations and requirements, required for sampling, analysis and documentation.

2.0 OBJECTIVES

Since the existing storm sewer line adjacent to the C-400 Building is thought to be the most direct means by which TCE contamination spread, this study shall focus on obtaining and analyzing samples surrounding the section of storm sewer line downstream from the junction box into which TCE was known to have been pumped. In addition, background samples will be obtained for purposes of comparison and verification.

Since ground water is located well below the bottom of the storm sewer line, contamination of the soil around the storm sewer would have had to occur before ground water contamination could occur. For this reason, this investigation shall focus on identifying any soil contamination around the sewer. After any soil contamination present is defined, the investigation of the ground water regime can begin. No monitoring wells are proposed as a part of this initial investigation. The data obtained during this phase will be used to determine the necessity and scope of additional investigation work.

2.1 Data Use

The analytical results of the samples taken at PGDP shall be utilized to better identify the following:

1. Whether TCE leaks into the soil have occurred at points along the storm sewer line other than those previously identified.

2. The vertical extent of contamination within the soil.

3. The horizontal extent of contamination within the soil in the area of known contamination.

In addition, selected samples will be analyzed for uranium, PCBs and three known degradation products of TCE.

3.0 DESCRIPTION OF CURRENT CONDITIONS

3.1 Background information for this facility is contained in the facility Part B permit.

3.2 Facility Location

The C-400 Trichloroethylene Spill Site is located on the Paducah Gaseous Diffusion Plant in western Kentucky (Figure 3.1). The plant occupies 748 security-fenced acres located on a 3,400-acre tract in McCracken County. A portion of the area was originally part of the Kentucky Ordinance works which was operated in the early 1940s. Approximately 2,132 acres of the site are leased to the Kentucky Wildlife Department (Figure 3.2).

The largest cities within a 50-mile radius of the site are Paducah, Kentucky, located approximately 10 air miles east of the plant, and Cape Girardeau, Missouri, located approximately 40 air miles to the west. Portions of 28 counties are included within a 50-mile radius of the plant, 11 of which are in Kentucky, 4 in Missouri, 10 in Illinois and 3 in Tennessee.

The major access route to the Paducah Plant is U.S. Highway 60 which is intersected by Kentucky Highway 1154 (plant access road) approximately 16 road miles west of Paducah and 3 road miles south of the plant. Interstate Highway 24 is east of the plant and intersects U.S. Highway 60 near the present city limits of Paducah. The north, east and west boundaries are defined by the West Kentucky Wildlife Management Game Reserve on land which is managed by the Department of Fish and Wildlife Resources. Also adjoining the northern boundary is the Tennessee Valley Authority site of the Shawnee Steam Plant.

3.3 Spill Site Location

The C-400 Trichloroethylene Spill Site is located near the southeast corner of the C-400 Chemical Operations Building (Figure 3.3). The general topography of the site is shown on the map presented in Appendix I.

3.4 Description of Geology and Hydrogeology

The Paducah Gaseous Diffusion Plant is situated in the Jackson Purchase region of Western Kentucky and lies in the northern most reaches of the Mississippi Embayment. The Mississippi Embayment is characterized by Cretaceous, Tertiary and Quaternary sedimentation overlying indurated sediments of Paleozoic Age. The pre-Cretaceous erosional surface slopes south on truncated subcrop of northward-dipping Paleozoic rocks.

In the area immediately west of Paducah a formational unit designated as the Continental Deposits (Pliocene and Pleistocene) lies immediately beneath variable thicknesses of Pleistocene Loess which is typically an unstratified, silty clay or clayey silt. The Continental Deposits lie directly upon an ancient erosional surface (an unconformity) that truncates several formations. The truncated formations in ascending order are the McNairy Formation (Cretaceous), the Porters Creek Clay (Tertiary-Paleocene) and undifferentiated Eocene sands (Tertiary-Eocene). These formations dip gently to the southwest such that an angular unconformity exists at the contact with the younger Continental Deposits.

The angular nature of the unconformity coupled with the fact that the Eocene sands, Porters Creek Clay and McNairy Formation lie unconformably on each other creates a sequence idealized in Figure 3.4. The Eocene sands are thought to be thin and discontinuous beneath the northern part of the PGDP and lie unconformably upon either the Porters Creek Clay or the McNairy Formation. This scenario projects that a hole drilled through the Continental Deposits would next encounter the Porters Creek Clay, the McNairy Formation or Eocene sands, depending on where it was drilled.

Because the lower contact of the Continental Deposits lies upon an ancient erosional surface with variable amounts of relief, it could affect

FIGURE 1-1. PGDP VICINITY

FIGURE 3.1

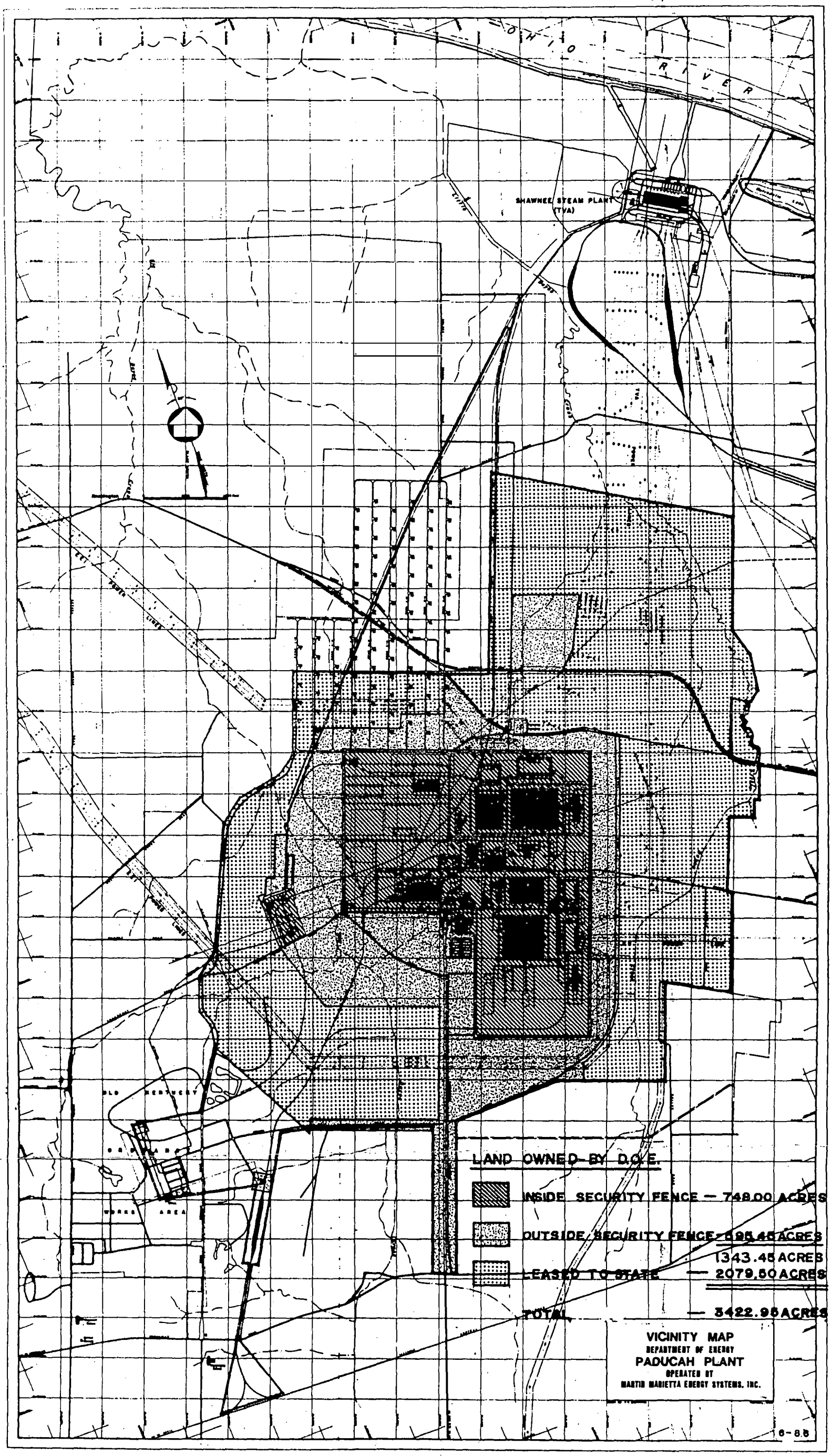

OHIO RIVER
SHAWNEE STEAM PLANT (TVA)
OLD KENTUCKY
WORKS AREA
LAND OWNED BY D.O.E.
INSIDE SECURITY FENCE — 748.00 ACRES
OUTSIDE SECURITY FENCE — 595.45 ACRES
1343.45 ACRES
LEASED TO STATE — 2079.50 ACRES
TOTAL — 3422.95 ACRES
VICINITY MAP
DEPARTMENT OF ENERGY
PADUCAH PLANT
OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
6-88

FIGURE 3.2

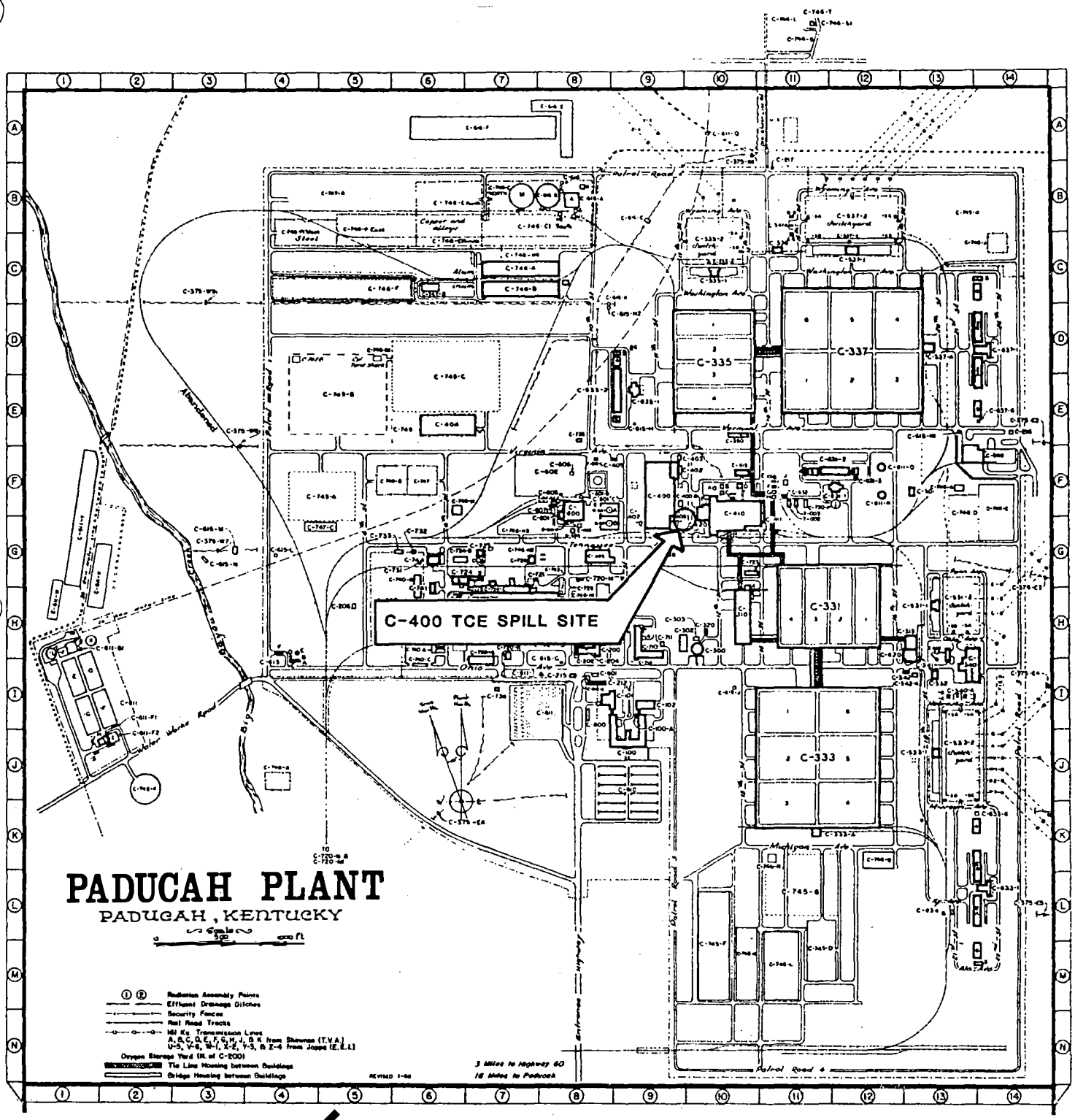


FIGURE 3.3

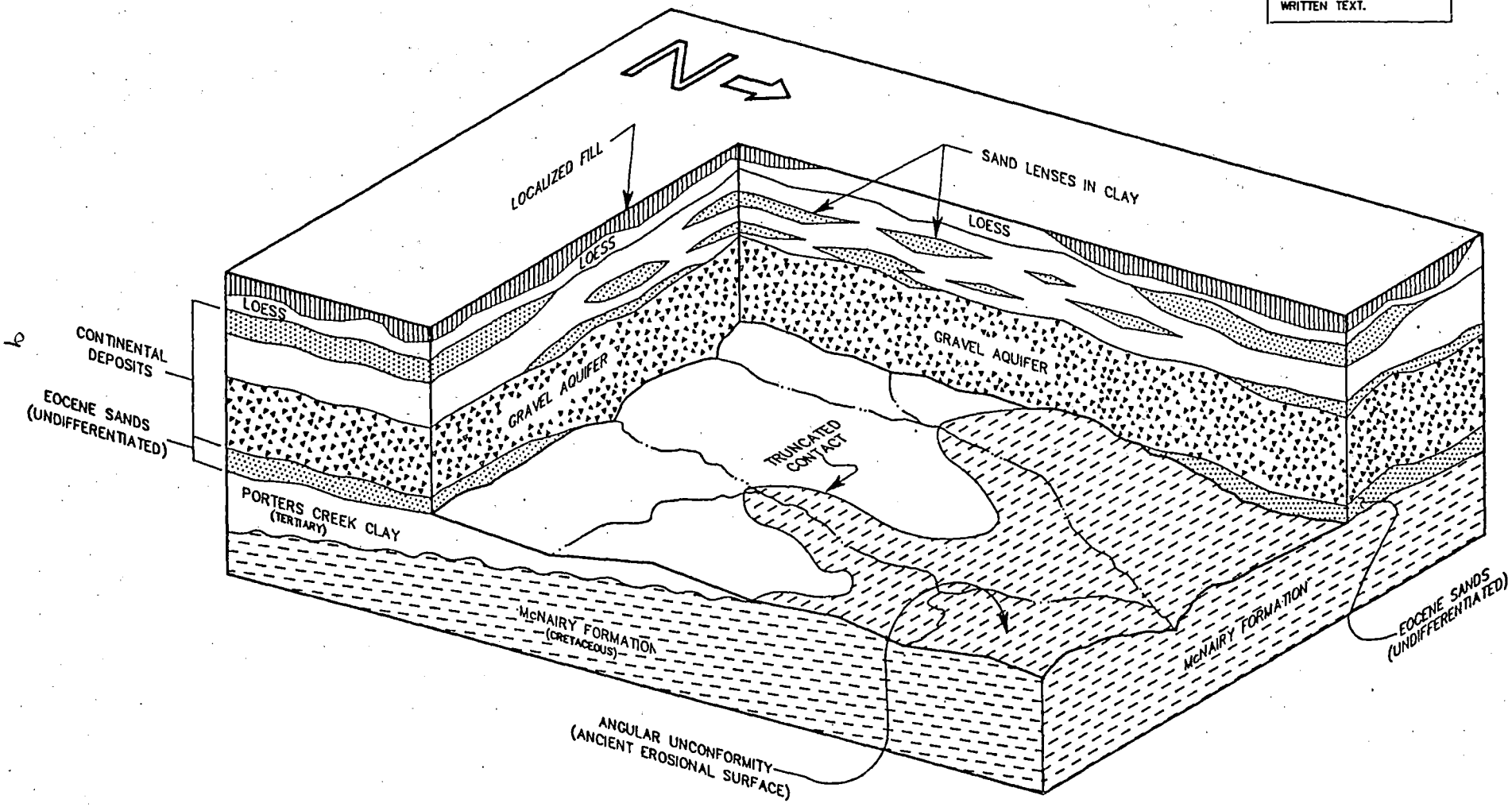
FIGURE 3.4

IDEALIZED STRATIGRAPHY AT THE PADUCAH GASEOUS DIFFUSION PLANT

PADUCAH, KENTUCKY

—— NO SCALE ——

THIS DRAWING IS PART OF A TECHNICAL REPORT AND SHOULD ONLY BE USED IN CONJUNCTION WITH THE WRITTEN TEXT.



THE EDGe GROUP INC. PROJECT NO. X505

the thickness of the Continental Deposits (and thus the regional gravel aquifer) by as much as fifteen feet or more beneath the Paducah Gaseous Diffusion Plant. The interval of fine, silty, clayey, Eocene sand up to fifteen feet thick (documented by MCI Consulting Engineers in Borings S-1 and S-2) underlies the lower contact of the gravel facies of the Continental Deposits and lies unconformably on both the Porters Creek Clay and the McNairy Formation at Borings S-1 and S-2, respectively.

Boring S-1 is located in the central portion of the plant approximately two hundred yards south of Building C-400. Boring S-2 is located in the extreme northwest corner of the plant.

The McNairy Formation is Cretaceous in age. In the Paducah region, it is micaceous and lignitic, typically a gray to dark gray clay interlaminated with silt and fine grained sand. Clay is the most common lithology in the upper part. Throughout western Kentucky and Tennessee, the McNairy Formation typically serves as an excellent high yield aquifer. However, this is not the case in the Paducah area since the formation has graded to predominately clay. Wells into the McNairy Formation are not prevalent in the immediate PGDP area and northward. The abundant yield of the gravel aquifer has obviated drilling wells below the Continental deposits and, consequently, little data is available on the gross characteristics of the McNairy Formation immediately beneath the plant.

The Porters Creek Clay is Tertiary Paleocene in age. It is a formational unit which consists primarily of clay facies with variable thicknesses of sand and silt which can locally make up a substantial part of the thickness of the Porters Creek Clay horizon. Porters Creek Clay is characterized by a dark bluish to medium greenish-gray and occasionally black color. It is the uppermost marine deposited unit in the section and is typically more consolidated (indurated) than overlying Tertiary and Quaternary deposits.

The undifferentiated Eocene sands are also Tertiary in age and are typically fine sand with variable amounts of silt and clay, interbedded and interlensing. The sands range from light to dark bluish-gray, brown to dark reddish-brown and can only be differentiated by pollen assemblages

or gross composition. Within the PGDP area, these sands are thin, and probably discontinuous, becoming thicker to the south.

The Continental Deposits consist of two distinct facies within the PGDP area. An upper clay facies consists predominately of clay with lenses of fine sand. The lower gravel facies of the Continental Deposits consists of coarse sand, gravel and cobbles which are typically deposited in a high energy braided stream environment and can exhibit dramatic and complex vertical and lateral gradation.

Data from Borings S-1 and S-2 indicate that the primary regional aquifer at the locations explored is typically forty to forty-five feet thick. Additional information from four exploratory auger borings drilled around the facility in the early 1960s indicate that the aquifer appears to lie directly on the Porters Creek Clay in the southern part of the plant and directly on the McNairy Formation in the northern part of the plant. A gravel aquifer thickness from eight to forty feet thick was encountered by these borings. The contact of the Porters Creek Clay and the McNairy Formation is truncated at the ancient erosion surface upon which discontinuous intervals of Eocene sand and the Continental Deposits were deposited. Figure 3.4 illustrates the general stratigraphic relationships within the plant as they are presently understood.

Southwest to southeast of the plant, the regional gravel aquifer probably thins as the Continental Deposits were deposited on the rising margin of an ancient terrace cut into the Porters Creek Clay and the McNairy Formation by the ancestral Ohio River or its tributary. The PGDP lies over a reentrant where the ancient river made a swing to the south cutting into the (then) surficial McNairy Formation and Porters Creek Clay. The thickest parts of the Continental Deposits and, hence, the gravel aquifer were deposited in this reentrant.

This highest density of subsurface data within the DOE /PGDP reservation is in the C-404 landfill area where numerous ground water monitoring wells have been installed. Continuously sampled borings advanced into the top of the regional gravel aquifer provide much of the stratigraphic information necessary to characterize the hydrogeology at that site. At

the C-404 landfill, two separate ground water systems are identified. The shallow system is contained within discontinuous, fine, sand lenses within the clay facies of the Continental Deposits. The deeper system is confined beneath the clay within the gravel facies of the Continental Deposits at a depth of approximately sixty-five feet. (See Figure 3.4.)

A total of nine wells were completed within the shallow ground water system at C-404. Four of these well borings were sampled continuously and provide continuous lithologies. The nine wells were completed above the top of the gravel aquifer. Water level data from these and other wells completed within the sand lenses which comprise the upper ground water system indicate that these sand lenses are not necessarily connected hydraulically. Furthermore, significant unpredictable variation in indicated potentiometric gradients precludes the determination of ground water flow directions, gradients and flow rates within the shallow system directly beneath the C-404 area. Historically, the wells completed within the shallow system of the C-404 area have extremely low yields described as "less than two gallons per quarter." This low yield indicates that these sand lenses are discontinuous and thin. These units are believed to be insignificant and are most appropriately characterized as perched aquifers.

In contrast to conditions at the C-404 landfill the clay facies of the Continental Deposits exhibit a markedly different character at the locations of Borings S-1 and S-2. In Boring S-1 near the center of the plant, fine sand intervals, fifteen feet thick, lie over a twenty-five foot interval of clay that contains no significant sand layers. At Boring S-2, at the extreme northwest corner of the plant,a similar situation is found. In both cases, wells placed within the shallow system yielded amounts of ground water estimated at one-half gallon per minute.

The shallow ground water system contained within the clay facies of the Continental Deposits could possibly be of local significance in some parts of PGDP. Saturated sand intervals within the clay facies might have adequate thickness, lateral extent and hydraulic conductivity to qualify as the uppermost "significant aquifer."

The lower ground water system is composed of coarse sand and gravel facies of the lower Continental Deposits. It is commonly referred to as the primary regional aquifer. Within the region, wells producing water from the primary regional aquifer typically produce yields from fifty to as much as four hundred gallons per minute. However, there is presently no pump test data available within the PGDP to ascertain the characteristics of this aquifer.

3.4 Site Background

On June 18, 1986, trichloroethylene (TCE) was discovered in an excavation to the southeast of the C-400 Building. The excavation was in the vicinity of an underground storm sewer line. Subsequent investigations revealed that TCE had leaked through joints in the concrete sewer line into the soil. The sewer line at that point was approximately twelve feet below grade. The source of the TCE was the floor drain system in the vicinity of a vapor degreaser in the C-400 Building. In the past, spills from the degreaser had drained to a floor sump from which the material was pumped to the storm sewer system. The situation had existed since the early 1950s, and it is highly probable that the majority of the TCE releases occurred during the early years of operation.

Soil samples were taken in the excavation upon the discovery of the TCE (see Drawing C5-16646-A, Appendix 2). Analyses indicated that TCE levels were as high as 7000 mg/kg near the sewer line. Excavation and containerization of contaminated soil generated forty 55-gallon drums of waste which were disposed of off-site as hazardous waste. Additional soil samples were taken following the excavation work. Analyses of these samples indicated that the presence of significant levels of TCE persisted below the level of the sewer line.

With the agreement of the Kentucky Division of Waste Management, it was decided to enter into a more extensive sampling program to determine: 1) the depth to which TCE had penetrated the soil, and 2) the extent to which TCE had spread beyond the immediate vicinity of the sewer line.

Soil core samples were obtained at four locations in the area of the

excavation (see report, Appendix III). The samples were obtained with a split-spoon sampler. At two-foot intervals, soil samples were removed from the core, packed into glass jars which were sealed and placed in an ice chest for transportation to the laboratory. TCE analyses were conducted according to Method 8010 of EPA SW-846. The results of the core testing indicated that levels of TCE at a distance of ten to fifteen feet from the centerline of the sewer were at or below the lower detectable limit of 1 mg/kg. Core samples within 1 to 2 feet of the sewer line indicated that detectable levels of TCE existed to a depth of 28 feet (see Table 3.1).

TABLE 3-1
C-400 CORE SAMPLES
TCE (ppm)

DEPTH*	NO.1	NO. 2	NO. 3	NO. 4
12	<1	<1	1.2	1.5
14	<1	1.5	<1	1.9
16	<1	<1	2.6	5.0
18	<1	<1	4.1	16.8
20	<1	<1	14.0	6.3
22	<1	<1	47.6	14.4
24	<1	1.9		19.9
26	<1	<1		16.2
28	<1	1.2		11.3
30	<1	<1		

*Depth from 11th Street grade.

To define the horizontal extent of TCE contamination, Tracer Research, Inc., was retained to perform soil-gas sampling in the vicinity of the sewer line. Because of the nature of the soils in the area, which consist mainly of clay, it was not possible to obtain soil-gas samples below a depth of three to four feet. The sampling probe could not penetrate below four to five feet and had to be partially withdrawn before a sample could be obtained. Because of the sampling problems, it is not believed that the data is relevant or representative of the actual site conditions.

Following the sampling program, the excavation was closed by backfilling the area and placing a two-foot thick layer of clay over the

site. Prior to closure, the accessible joints in the sewer line were repaired to prevent leakage. Modifications to the degreaser system were made to prevent further discharges of TCE.

4.0 RFI STRATEGY

4.1 Sampling and Analytical Rational

4.1.1 Constituent Analysis

Table 1 provides a list of the six potential contaminants present in the samples along with the analytical procedures required.

TABLE 1
METHOD OF ANALYSIS

CONSTITUENT	ANALYSIS
Trichloroethylene	EPA Method 8240
Vinyl Chloride	EPA Method 8240
1,1-dichloroethylene	EPA Method 8240
Trans-1,2-dichloroethylene	EPA Method 8240
PCBs	EPA Method 8080

4.1.2 Sampling Rational

4.1.2.1 Sample Locations

Samples shall be located according to the layout indicated in the Drawing in Appendix IV. A total of 235 soil samples shall be obtained at varying depths and horizontal distances from the existing storm sewer. The majority of the samples shall be taken in the vicinity of the known area of contamination in order to better define the horizontal and vertical extent of contamination.

The sample locations were selected in an attempt to sample the areas most likely to be contaminated. Since the storm sewer and its stone bedding were the most direct passages for the spread of TCE contamination, sample locations were selected adjacent to and beneath the storm sewer.

Each of the 235 samples will be divided and placed in three sample containers (1 container for analysis of TCE and its degradation products, 1 container for analysis of PCBs and 1 container for analysis of uranium). Therefore, excluding replicate samples and sampling blanks, a total of 705 sample containers will be filled.

Additional samples shall be taken along the Building C-400 drain line which carried TCE from the degreaser to the main storm sewer and along the downstream section of the storm sewer line. These samples shall be analyzed to determine if TCE is present within the soil outside the known area of contamination.

In addition, two background samples will be obtained to confirm that TCE contamination came from the degreaser located in the C-400 Building. One background sample shall be located adjacent to storm sewer line 2, upstream from the junction box into which TCE was pumped. The second background sample shall be located adjacent to storm sewer line 1, upstream from the location where storm sewer lines 1 and 2 intersect.

4.1.2.2 Representativeness of Sampling Media

Soil will be sampled at varying intervals to determine the extent of vertical contamination and the potential for present or future ground water contamination.

4.1.3 Analytical Rational

Because TCE was formerly identified as the existing contaminant, all samples shall be analyzed for TCE.

In addition, because there is the potential for some TCE degradation over time, one sample per borehole will be analyzed for the three TCE degradation products: vinyl chloride, trans-1,2-

dichloroethylene and 1,1-dichloroethylene. Because it is also known that trichloroethylene had been used to clean parts potentially contaminated with PCBs and uranium, testing will also be done for these constituents.

4.2 SAMPLING PROCEDURES

The drawing in Appendix IV provides the proposed layout of 21 boring locations along with proposed sampling intervals and depths for each boring. PGDP personnel will assist the subcontractor in locating the sampling points. Following the initial locating, PGDP will survey the points to ensure that there will be no interference with other underground utilities. PGDP engineering personnel will then issue an Excavation Permit for the drilling. Sampling locations may not be relocated without the concurrence of the Construction Engineer and the reissuance of the Excavation Permit. All samples shall be soil, obtained at varying depths through the use of a continuous-flight, hollow-stem auger, drill rig equipped with a CME continuous sampler or through the use of a split-spoon sampler.

The samples collected at a depth of approximately eight feet below the storm sewer invert in Borings 1, 2, 3, 4, 5, 6, 7, 8, 12, 16, 17, 18, 19, 20 and 21 and the samples collected at a depth of approximately sixteen feet below the storm sewer invert in Borings 9, 10, 11, 13, 14 and 15 shall be analyzed for uranium, PCBs, trichloroethylene and its degradation products, vinyl chloride, trans-1,2-dichloroethylene, 1-1-dichloroethylene. All other samples obtained at each boring shall be analyzed for TCE, uranium and PCBs.

4.2.1 Sample Locations

Sampling points B-1 through B-7 are located adjacent to storm sewer lines 1 and 2 as indicated in the Drawing in Appendix IV. Analysis of samples at these seven locations will be used to determine if a release of TCE occurred downstream from the known TCE leak area.

Sampling points B-8 through B-16 are positioned within and surrounding the known area of contamination in order to better

define the horizontal and vertical extent of TCE contamination.

Sampling points B-17 through B-19 are located along storm sewer line 3, the line which was formerly used to transport TCE from the C-400 Building to storm sewer line 2. The analytical results from the samples taken at these points shall be used to determine if TCE leakage may have occurred along this line in the past.

Sampling points B-20 and B-21 are positioned at background locations. They have been located along storm sewer lines 2 and 1, respectively, in areas believed to be free of TCE contamination related to the C-400 Building degreaser releases.

4.2.2 Sampling Depths and Intervals

Sampling at each borehole shall begin at the approximate sewer invert elevation given in the Drawing in Appendix IV. The number of samples obtained and the depth to which sampling continues will vary according to purpose.

Boring locations B-1 through B-7 and background boring locations B-20 and B-21 are proposed to determine the presence or absence of TCE. Sampling at these locations will, therefore, be less extensive than other areas. At these nine locations, sampling shall continue down at intervals five feet in length to the estimated top of the regional gravel aquifer's confining clay layer.

Since sampling points B-8 through B-19 will be used to establish vertical TCE transport characteristics through the soil, sampling at these locations shall continue through the confining clay to the estimated elevation of the regional gravel aquifer. The first seven samples at these sample locations shall be obtained at intervals three feet in length with the remaining samples taken at intervals five feet in length.

4.2.3 Sample Collection

Table 2 presents the appropriate container type required for each sample, dependent upon the constituent analysis necessary. An

adequate quantity of sample will be obtained from the upper portion of each specified sampling interval to fill these containers. Sample containers shall be filled slowly and completely leaving no air space. After the sample has been collected, the lid should be placed on the container, the outside cleaned with distilled water, the container labeled with a dedicated label and sealed. In addition, the depth of each sampling interval placed in each container shall be recorded in the field log book.

TABLE 2
SAMPLE CONTAINERS

ANALYTICAL CONSTITUENT	CONTAINER
TCE Degradation Products	1-4 oz. (120 ml.) wide -mouth glass jar with a teflon-lined cap
PCBs	1-8 oz. (240 ml.) wide-mouth glass jar with a teflon-lined cap

4.2.3.1 Sample Identification

Samples shall be labeled in the field with the following information:

1. Project Number
2. Location
3. Sample Number
4. Date
5. Time
6. Intended Analysis
7. Initials of Sampling Personnel
8. Company Name

4.2.3.2 Sample Transportation and Custody

Samples collected at the Paducah Gaseous Diffusion Plant will be classified and shipped to the appropriate laboratory under the direction of the site manager. Samples to be analyzed for PCBs and TCE and its degradation products shall be shipped off-site to a contract laboratory protocol (CLP) laboratory.

Samples to be analyzed for uranium shall be analyzed on-site by MMES. All samples shipped off-site shall be shipped as environmental laboratory samples in compliance with DOT regulations outlined in the " National Guidance Package for Compliance with Department of Transportation Regulations."

At the time of sampling, each sample shall be assigned a project control number. This number shall be recorded on the sample label, sample seal, field log book and chain-of-custody form (similar to the form shown in Figure 4.1). The outside of each container shall be decontaminated and placed in a self-sealing plastic "zip-lock" bag. The sample shall then be placed in an ice chest for preservation at the required 4°C. temperature. Should subsequent transport to the laboratory require overnight or delayed delivery exceeding ten hours in duration, blue ice shall be used as the method of sample preservation. Packing materials shall be used, as necessary, to prevent container damage or breakage during transport. The inventory of each cooler shall be recorded on the chain-of-custody form and in the field log book.

Prior to shipment, the chain-of-custody form shall be completed by the site manager, double sealed in plastic "zip-lock" bags and taped or otherwise fastened to the cooler lid. A copy of the chain-of-custody form shall be kept by the Site Manager. The cooler shall then be sealed and labeled. Two sample seals shall be placed at the lid/body interface, one each on opposite sides and executed by the Site Manager.

For samples shipped off-site, the outside of the ice chest will be labeled with "This Side Up" on all four sides. A label identifying the shipment as

environmental laboratory samples shall be attached to the top of the ice chest. In addition, a shipment bill shall be attached to the outside listing the origin of the shipment, destination, contact persons and addresses for both parties.

4.2.4 Sample Replicates

One replicate sample shall be obtained for every twenty soil samples collected. Replicate samples shall be removed from the split-spoon in such a manner that both halves give an even representation of the media present at that interval. Three of the replicate samples will be analyzed for trichloroethylene, vinyl chloride, trans-1,2-dichloroethylene, 1,1-dichloroethylene, uranium and PCBs. The remaining replicate samples will be analyzed for TCE, only. Replicate samples shall be collected at various sample depths and boring locations.

4.2.5 Sampling Blanks

Four sampling blanks of the continuous sampler or split-spoon sampler shall be obtained and analyzed to demonstrate that the sampling equipment is not causing contamination or cross-contamination of samples. Each sampling blank shall be analyzed for TCE, vinyl chloride, trans-1,2-dichloroethylene, 1,1-dichloroethylene, uranium and PCBs. Each sampling blank shall be obtained by passing reagent water (distilled water) through the sampler and into a sample container. Each sampling blank shall be collected after decontamination of the sampler is complete. Each sampling blank shall be collected in 2:40 ml VOA vials with Teflon lined septum caps. Sampling blanks shall be collected at uniform intervals throughout sample collection.

4.2.6 Documentation

Bound and sewn field notebooks shall be used by field personnel to record the following information:

1. Sample location
2. Date and time
3. Weather conditions
4. Procedures employed
5. Any variations from the approved sampling plan
6. Geologic loggings of the borings/samples
7. Ambient monitoring data, and
8. Sample custody information

Exact boring locations shall be field located by surveying subsequent to sampling. Adequate information shall be recorded in the field book to relocate the sampling point, if necessary, in relation to existing site features, i.e., roads, buildings, sidewalks, etc.

4.2.7 Decontamination Procedures

Specific decontamination procedures for personnel and equipment are outlined in the Health and Safety Plan included in this work plan. In general, small equipment shall be washed with tri-sodium phosphate detergent and rinsed. After air-drying, an isopropanol rinse shall be employed, and the equipment again air dried on a drop cloth. Larger equipment, augers, shovels, etc., shall be steam cleaned and air dried within the trichloroethylene receiving area. Disposable supplies shall be bagged and sealed for proper transport and disposal by field personnel. Drill tailings shall be containerized and labeled as hazardous material until the completion of sample analysis. Containers and tailing shall then be handled and/or disposed of by MMES in the appropriate manner. Residual wash and rinse water shall be taken to the TCE receiving area for subsequent testing and treatment, if necessary, by PGDP.

4.2.8 Borehole Grouting

Grout will be used to backfill boreholes. The grout mixture is

designed to seal the formation and reduce the potential for vertical migration of surface or subsurface water via the void created by the drilling operation. The grout will be mixed using the following proportions:

Type I Portland Cement	94 pounds
Powdered Wyoming Bentonite	50 pounds
Water	100 gallons

Additional water may be required to maintain the grout mixture in a pumpable state. All water used to prepare the grout mixture must be obtained from a potable supply.

A tremie tube will be inserted through the hollow-stem augers/casing to the appropriate depth. The grout mixture will then be forced down the tube so that it flows back up the borehole to the surface displacing any standing water. After the borehole is full of grout, the augers/casing will be brought up, and a section will be removed. Additional grout will be added, as necessary, to bring the grout up to the ground surface. The removal of the augers/casing and adding of grout will be repeated until the augers/casing are completely removed.

After the grout mixture has set a minimum of twenty-four hours, additional grout will be placed to account for any settlement/shrinkage.

4.3 SAMPLE ANALYSIS

A total of 705 samples, excluding replicate samples and sampling blanks, shall be collected. Of the samples collected, 235 shall be analyzed for TCE. In addition, 21 shall be analyzed for vinyl chloride, trans-1,2-dichloroethylene, and 1,1-dichloroethylene. Samples collected for uranium and PCBs analyses shall be analyzed in a sequential manner beginning with the uppermost sample collected at each borehole until two consecutive non-detected readings are determined. All analysis shall be conducted according to the procedures and standards specified in the following text.

Subsequent to analysis, all soil samples will be returned to MMES for disposal. Soil samples indicating the presence of trichloroethylene, vinyl chloride, trans-1,2-dichloroethylene, 1,1-dichloroethylene, uranium or PCBs will be disposed of in a manner appropriate for the type of contaminant and the level of contamination. Soil samples containing none of the above constituents at any detectable levels may be disposed of as conventional waste.

4.3.1 Chain-of-Custody Procedures

The laboratory supervisor shall sign for incoming field samples, obtain documents of shipment and verify the data entered onto the chain-of-custody record. In addition, a permanent laboratory log book shall be used to record all pertinent analytical information. A form similar to Figure 4.1 shall be used for documentation of laboratory sample custody procedures pertaining to sample handling, storage, and disbursement.

4.3.2 Sample Storage

All samples shall be maintained at a temperature of 4° C prior to analysis. Samples shall be held in storage no longer than 14 days from the time of collection to the time of analysis.

4.3.3 Analytical Procedures

All analysis for TCE, vinyl chloride, 1,1-dichloroethylene and trans-1,2-dichloroethylene shall be performed as required by EPA Method 8240, "Gas Chromatography/Mass Spectrometry for Volatile Organics", as described in, "EPA Test Methods for Evaluating Solid Waste" (SW 846 3rd Ed.). Preparation of the sample shall be performed according to EPA Method 5030, Purge-and-Trap, described in the same publication.

All analysis for PCBs shall be performed according to EPA Method 8080, "Organochlorine Pesticides and PCBs" as described in "EPA Test Methods for Evaluating Solid Waste" (SW 846 3rd Edition). Preparation of the sample shall be performed according to EPA

Method 3550, Sonication Extraction, described in the same publication.

5.0 IDENTIFICATION OF POTENTIAL PATHWAYS AND RECEPTORS

5.1 Pathways

Due to the subsurface TCE contamination present, potential contaminant transport resulting from the past TCE storm sewer leaks will be directly related to the geology and hydrogeology present at the site. In addition, because of the limited data available on the specific subsurface conditions in the area of the C-400 Building, TCE transport may take a variety of pathways.

One possibility is that transport of TCE may occur horizontally along the fill/loess interface until reaching a drainway or permeating the loess and clay layers.

If the clay or loess layers are permeated, travel may occur horizontally through the sandy shallow ground water system until reaching a drainway or reaching the regional aquifer either by permeating the aquifer's upper confining clay layer or through a direct shallow system/regional system connection.

Regardless, TCE should ultimately either reach a nearby drain or creek north to northwest of the site or be carried onward within the regional aquifer toward the Ohio River.

5.2 Receptors

Potential receptors of TCE contamination would most likely be limited to individuals in residences or industries north to northwest of the site who depend on wells for drinking or industrial process water purposes. Nevertheless, due to the point source nature of the contamination, specific identification of down-gradient receptors is not possible at this time.

6.0 QA/QC PROCEDURES

6.1 Organization

Responsibilities shall be assigned to CLP laboratory personnel as follows:

1. The Lab Project Manager shall ensure that the necessary materials, instruments and personnel are available to execute all analysis according to approved methods.

2. The Quality Assurance Coordinator shall assist the project manager in specifying proper QA/QC procedures, making evaluations of the laboratory work in progress, submitting audit samples and recommending any necessary corrective actions.

3. The Analysis Coordinator shall receive samples, verify proper chain-of-custody procedures, verify lab QC data and determine whether repeat samples or analysis are required.

4. The Sampling Coordinator will aid the Analysis Coordinator in choosing the appropriate sampling equipment and sample containers and ensuring that samples have been properly labeled and transported to the laboratory.

5. The Quality Control and Data Manager shall be responsible for QC activities and data management including maintenance of all sample tracking records, preparation of quality control samples for analysis and preparation of QC and sample data for review by the Analysis Coordinator and the Lab Project Manager.

6.2 QA Objectives

The overall measurement objective is to determine for each of the samples collected the concentration of specific parameters in various matrices, i.e., water, soil, etc. Numerical objectives for accuracy and precision for these analyses are based on previous experience in applying comparable procedures to these analyses in a variety of sample matrices. In the event that QA objectives given are not achievable in this matrix, revised objectives must be formulated and documented.

6.2.1 Accuracy

Accuracy is defined as the degree of agreement of a measurement, or average of measurements, with an accepted reference of true value. A reference material of each chemical will be obtained from a commercial supplier, usually Supelco, and/or National Bureau of Standards. They will be of the highest purity commercially available. Any analysis of these reference materials that is greater than 30% from the theoretical value will be judged to be out of control. The acceptable standard deviation is defined as 15%.

6.2.2 Precision

Precision is a measure of mutual agreement among individual measurements. In the analysis of replicate samples, which will constitute 10% of the analyses, values generated should not vary by more than 20%. This will also be applicable to replicate analysis of standard reference materials.

6.2.3 Completeness

The QA objective is to obtain results for a percentage of samples collected that will provide information for the entire operating system. This will employ the theory that the whole cannot exceed the sum of its parts.

6.2.4 Representatives

In any analysis, a representative aliquot of the sample is imperative. This is insured by mixing, blending, homogenizing, as necessary, to produce a uniform mixture which is then sampled.

All data will be reported in mg/L or mg/kg (ppm) of original sample. Quality control values for standard reference materials and duplicates will be provided.

6.2.5 Calibration Procedures and Frequency

For every batch of samples analyzed, standards will also be run. All analyses must be carried out within the working range of the instrument response, and sample extracts must be diluted to fall in this range. If possible, quantitation by instrument calibration will

be performed. If this is the case, calibration will be performed when analyses of QA/QC samples indicate necessity. Continual analysis of standards will be a part of any batch processing. This would normally be every 24 hours.

6.3 Data Validation

The principal criteria that are used to validate data integrity during data collection and reporting must be documented. These include:

1. Frequent verification by the QC and Data Manager that all raw data generated during the preceding week have been stored in hard copy and that all chain-of-custody records are secured;

2. Examination of at least 5% of the raw data on a frequent basis by the analysis coordinator to verify adequacy of documentation, confirm peak shape and resolution, assure that the automatic integrator was sensing peaks appropriately and so forth;

3. Verification of some fraction (10% minimum) of the calculations from raw data through the final result;

4. Confirmation that raw areas for internal standards and standards are within 50% of the expected value;

5. Reporting of all associated blank standard, and QC data along with results for analyses of each batch of samples; and

6. Reporting of all analytical data for all samples with no values rejected as outliners.

6.4 Data Reporting

A written summary of analytical results shall be submitted to MMES by the laboratory when 10% of the sample analysis has been completed and for each 10% portion completed thereafter. In addition, a final summary letter shall be submitted by the lab upon completion of all analysis. All data shall be submitted as final data.

6.5 Program Controls

Quality control samples are analyzed simultaneously with real samples. The results are used to document the validity of data and to control the quality of data within tolerance limits as described in the QA objectives. QC samples include blanks, replicates and standard reference materials.

6.5.1 Blanks

Method blanks are prepared in the laboratory and are analyzed to access possible laboratory contamination at the frequency of one every 24 hours or each batch.

Reagent and solvent blanks should be prepared in the lab and analyzed to determine background of each new lot number of solvent or reagents.

6.5.2 Analytical Replicates

Replicate analyses should be performed (one/ten samples) to demonstrate precision.

7.0 DATA MANAGEMENT PROCEDURES

7.1 Standard Reference Materials

To ensure ongoing accuracy, standard reference materials should be analyzed one/ten samples.

7.1.1 Audit Procedure and Frequency

An audit by the Project Manager and QC officer is made prior to the implementation of the analyses. Ongoing audits should be performed once a year, except when problems indicate the necessity of greater frequency. Audit samples should be submitted by the QA officer at any time deemed appropriate.

7.1.2 Preventive Maintenance and Frequency

Preventative maintenance should encompass good chromatography operating techniques including changing septums at least once per week, running performance checks on the instrument and maintaining all parts of the instrument in good working order.

7.1.3 Specific Routine Procedures to Assess Accuracy, Precision and Completeness

7.1.3.1 Calculations of Mean Values

The mean concentration, C, of a series of replicate measurements of concentration, C_i, for a given surrogate compound or analyte is calculated as:

$$C = \frac{\Sigma Ci}{n}$$

where:

n = number of replicate measurements, and

C_i = concentration in the sample (mg/L, mg/kg or mg/dscm)

7.1.3.2 Assessment of Precision

The estimate of precision of a series of replicate measurements can then be expressed as the relative standard deviation (RSD):

$$RSD: (\%) = \frac{s(100)}{Z}$$

where:

s = standard deviation

Z = mean concentration for the sample set.

Alternatively, for data sets with a small number of points, the estimate of precision may be expressed as a range percent, R:

$$R (\%) = \frac{C_1 - C_2 (100)}{Z}$$

where:

C_1 = highest concentration value measured in data set, and

C_2 = lowest concentration value measured in data set.

7.1.3.3 **Assessment of Accuracy**

Accuracy is evaluated by comparing the mean recovery of standard reference materials on a weekly basis. The recovery of surrogate compound is found by adding a known quantity (weight or volume) of a standard solution to a measured quantity (weight or volume) of a sample matrix (water, soil, etc.). This contrived sample is then subject to the extraction and analysis procedures which are specified in the method for the chemical species in question. The ratio, expressed as a percent, of the total volume or weight of the sample added to the detected standard solution (C_s) is known as recovery or:

$$R = \frac{C_s \times Vs \times 100}{Q_s}$$

where:

C_s = measured concentration of standard reference material in sample (mg/L or mg/kg),

V_s or W_s = total volume (or weight) of sample to which standard reference material was added (L or kg), and

Q_s = quantity of standard reference material added to sample (mg).

7.1.3.4 Procedures for Corrective Action

Corrective action includes, but is not necessarily limited to: recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents that give unacceptable blank values; additional training of laboratory personnel in correct implementation of sample preparation and analysis methods; and reassignment of personnel, if necessary, to improve the overlap between operator skills and methods requirements.

Whenever a long-term corrective action is necessary to eliminate the cause of nonconformance, the following closed-loop corrective action system should be used. As appropriate, the sample coordinator, analysis coordinator or the program manager ensures that each of these steps is followed:

1. The problem is defined.
2. Responsibility for investigating the problem is assigned.
3. The cause of the problem is investigated and determined.
4. A corrective action to eliminate the problem is determined.
5. Responsibility for implementing the corrective action is assigned and accepted.
6. The effectiveness of the corrective action is established and the correction implemented.

7. The fact that the corrective action has eliminated the problem is verified and documented.

7.1.3.5 Quality Assurance Reports

On a regular basis, the quality assurance officer meets with the project manager and key staff responsible for sampling, analysis, QC and data management to review QC data summaries, documentation and other aspects of the project quality assurance performance. The QA officer's assessment of the adequacy of project quality control/quality assurance performance is summarized in a memorandum which would be distributed to upper corporate/institutional management as well as to the project manager and his/her immediate superior in the line of management. The memorandum must identify any areas that appear to require corrective action and present the action that has been proposed. The results of any earlier corrective action should be described as well.

7.2 DATA PRESENTATION

RFI data should be arranged in a clear and logical fashion. Tables, graphs, maps, diagrams, profiles, etc. shall be used, as necessary, to present the data collected.

7.2.1 At minimum, the following raw data shall be presented in the RFI report.

Field Collected Data

1. Sample Type
2. Sample Location
3. Sampling Method
4. Date and Time of Sampling
5. Temperature
6. Weather

Laboratory Data

1. Field Sample Number
2. Sample Location and Type
3. Sample Date
4. Laboratory I.D. Number
5. Property or Component Measured
6. Result of Analysis (e.g. concentration)
7. Detection Limits
8. Reporting Units

In addition, copies of sample chain of custody forms shall be appended to the report.

7.2.2 At minimum, the following data shall be presented in a tabular format in the RFI report and sorted in a logical fashion to depict the site conditions.

1. Sample Location
2. Sample Type
3. Sample Depth
4. Reporting Units
5. Results of Analysis

7.2.3 At minimum, the following maps, graphical and/or pictorial displays shall be presented in the RFI report.

1. Area or plan map showing boring locations.
2. Profile drawing or cross-sectional plot of sewer lines 1 and 2 including isopleths showing the extent of vertical contamination below the sewer.
3. Area or plan map showing boring locations and isopleths depicting the horizontal extent of contamination.

8.0 HEALTH AND SAFETY PLAN

8.1 HAZARD EVALUATION

8.1.1 Trichloroethylene

Sampling at the PGDP will be conducted for TCE and its degradation products, vinyl chloride, trans-1,2-dichloroethylene and 1,1-dicloroethylene, uranium and PCBs. All samples shall be

obtained from the soil by augering and split spoon or continuous sampling. Analytical results from previous samplings indicate the presence of TCE in concentrations as high as 7720 mg/Kg. TCE is a halogenated volatile compound utilized by PGDP as a solvent. Characteristics and threshold values for TCE are as follows:

Physical State (as shipped): Liquid
Color: Colorless
Odor: Chloroform-like
Fire: Combustible - poisonous gases are produced
Threshold Limit in Air: 50 ppm
Odor Threshold: 50 ppm
Short Term Inhalation Limit: 200 ppm for 30 minutes
Immediately Dangerous To Life or Health: 1000 ppm

TCE becomes a threat to human health and safety through ingestion, inhalation or contact with skin.

8.1.1.1 Inhalation Hazards

Symptoms of TCE inhalation include nose and throat irritation, nausea, blurred vision, difficulty in breathing and loss of consciousness. Due to the unconfined working area, inhalation of TCE in concentrations exceeding threshold limits is not anticipated. Consequently, continuous respirator protection will not be required during drilling and sampling operations. However, as a safety precaution, frequent TCE vapor monitoring will be conducted within the breathing zone of all field personnel as described in Section 8.3.2. Should TCE levels rise above the specified 10 ppm, workers will immediately discontinue work and move upwind of sampling activities. In addition, air-purifying respirators equipped with organic vapor-acid gas cartridges will be on-site for use as described in Section 8.4.2.

8.1.1.2 Ingestion Hazards

Symptoms of TCE ingestion are similar to those of inhalation. Ingestion of TCE shall be controlled through the prohibiting of eating, drinking or smoking within the specified work zone. In addition, proper decontamination procedures, as described in Section 8.5, shall be utilized to prevent accidental ingestion subsequent to sampling activities.

8.1.1.3 Contact Hazards

Physical contact with concentrated TCE is indicated by a reddening and smarting of the skin. However, due to the nature of sampling to be conducted, contact with high concentrations of TCE is unlikely. Therefore, personal protection equipment (PPE) shall be limited to Level D, as described in Section 8.4. In addition, proper decontamination of personnel and equipment shall reduce the risk of TCE contact subsequent to sampling.

8.1.2 Uranium

Radioactive contamination in the form of uranium and low-level penetrating contamination (beta and gamma) is not expected. Should uranium be present it could be in a variety of forms, both soluble and insoluble. Characteristics and threshold values for uranium are as follows:

Physical State:	Solid, finely divided or aggregate
Color:	Variable from yellow to orange to green
Odor:	None
Fire Hazard:	None
Threshold Limits in Air:	0.05 mg/m^3
Immediately Dangerous to Life or Health:	30 mg/m^3 insoluble 20 mg/m^3 soluble

Uranium becomes a radiological and toxic threat to human health and safety through ingestion and inhalation.

8.1.2.1 Inhalation Hazards

For uranium of the assay used or produced at PGDP the main hazard is associated with the chemical toxicity of the material. The radiological hazard is not serious enough to warrant specific concern. Protection from the chemical toxicity of uranium will provide adequate protection from any radiological hazard.

Symptoms associated with exposure to uranium will not be immediately noticeable. Chronic symptoms will include shortness of breath, coughing, nausea and vomiting. Renal damage may occur at high levels of exposure. Damage may also occur to the respiratory system, the blood, liver, bone marrow and lymphatic systems. Because the symptoms are not immediate GDP Health Physics personnel will provide periodic monitoring of the sampling site to determine the airborne uranium concentration. Should the uranium level rise above the Threshold Limit Value of 0.05 mg/m^3 respiratory protection shall be required.

8.1.2.2 Ingestion Hazards

Symptoms of uranium ingestion will be similar to those of inhalation. As is the case with inhalation the occurrence of symptoms will not be immediate upon exposure. Ingestion of uranium shall be controlled through the prohibiting of eating, drinking or smoking within the specified work zone. In addition, proper decontamination procedures, described in Section 8.5 shall be utilized to prevent accidental ingestion subsequent to sampling activities.

8.1.2.3 Contact Hazard

Skin contact with uranium will not result in noticeable symptoms unless inhalation or ingestion occur

subsequent to such contact. Proper protective equipment such as gloves and coveralls and proper decontamination procedures shall reduce the risk of such contact.

8.1.3 PCBs

Polychlorinated biphenyls (PCB's) are not expected to be encountered during the sampling operations. Should PCB's be present the material will most likely be adsorbed onto soil particles although free liquid PCB's could be present. Characteristics and threshold values for PCB's are as follows:

Physical State:	Oily liquid or solid powder
Color:	Light yellow liquid to a white powder
Odor:	Mild hydrocarbon odor
Fire Hazard:	No direct fire hazards. Breakdown products under heat include dioxins.
Threshold Limit in Air:	0.5 mg/m^3
Immediate Dangerous to Life or Health:	None

PCB's are bio-accumulative and persistent and become a threat to human health through ingestion, inhalation and direct contact.

8.1.3.1 Inhalation Hazards

PCB's are not readily volatile and no significant air concentrations due to volatilization are expected. PGDP Industrial Hygiene personnel will perform periodic air sampling to insure that significant levels of PCB's are not present.

8.1.3.2 Ingestion Hazards

Ingestion of PCB's will primarily affect the liver. Some impairment of liver function may result. PCB's are a suspected carcinogen with the organ primarily affected being the liver. A gray pigmentation of the skin may also result from ingestion.

8.1.3.3 Contact Hazards

The most common symptom of contact exposure to PCB's is the occurrence of chloro-acne, an acne-like skin condition resulting from long-term direct contact with PCB's. Proper protective equipment such as gloves and coveralls and the use of proper decontamination procedures shall reduce the risk of such contact. Dermatitis may also result from contact exposure.

8.2 PERSONNEL RESPONSIBILITIES

Responsibility for site safety, emergency response operations and protection of public health are assigned as follows:

I. Project Manager
   - A. Review and approval of the Health and Safety Plan;
   - B. Supervision of the Health and Safety Officer and Site Safety Officer to ensure that the duties of each are performed properly;
   - C. Allocation of adequate company resources to ensure implementation of all aspects of the plan.

II. Health and Safety Officer
   - A. Review and approval of the Health and Safety Plan;
   - B. Ensuring all field personnel are health and safety trained;
   - C. Training of the Site Manager/Site Safety Officer in the implementation of the Health and Safety Plan;
   - D. Maintaining records of employee training, documenting employee exposure to hazardous substances and maintaining records of occupational injuries or illnesses;
   - E. Ensuring all required health and safety related reports are submitted to the proper authorities.

III. Site Manager/Site Safety Officer (SM/SSO)
   - A. Ensuring that required safety equipment is available on-site;

B. Enforcing the use of proper safety equipment and implementation of other health and safety requirements during field activities;

C. Limiting access to the drilling site to properly trained personnel, including site visitors;

D. Revising equipment requirements and safety procedures based on new information obtained by field activities;

E. Upgrading the level of personal protection, as necessary;

F. Observing work party members for symptoms of exposure or stress;

G. Reporting of accident or incidents to the Health and Safety Officer and the PGDP Safety Coordinator;

H. Coordination with the PGDP Environmental Coordinator.

I. Coordination with the PGDP Site Construction Engineer to obtain necessary electrical or hazardous work permits and during the repositioning of sample points, if necessary.

8.3 WORK PRACTICES

8.3.1 General Safety Work Practices

1. No eating or drinking will be allowed within the immediate work area.
2. Smoking is prohibited within the work area.
3. All work shall be performed under the "buddy" system. Each "buddy" will monitor his partner for signs of contaminant exposure. In the event of an accident to a team member, the designated "buddy" shall remain with the injured party and signal the Site Safety Officer.
4. The air in the breathing zone above the borehole shall be frequently monitored using a Draeger gas detector kit and TCE detector tubes. If a TCE level of 10 ppm is detected, work at the borehole shall be discontinued until a portable field blower can be positioned to provide increased air velocity and air dilution in the area. Field personnel responsible for positioning the blower and taking subsequent TCE readings shall wear respirators equipped with organic vapor-acid gas canisters. At such a time that TCE levels fall below 10 ppm, work may resume at the borehole. If such

levels are not obtained, drilling at that location shall be discontinued and the Health and Safety Officer contacted.

5. During steam cleaning of equipment, all personnel shall remain upwind of the plume. In addition, a portable blower shall be used to ensure that the steam plume flows away from all personnel and buildings. TCE monitoring shall be conducted in the breathing zone of all field personnel involved in steam cleaning activities. Steam cleaning shall be discontinued and the Health and Safety Officer notified if air quality monitoring indicates TCE concentrations at or exceeding 10 ppm.
6. Wind direction shall be continuously monitored by the SM/SSO. One or more wind direction indicators shall be conspicuously located on site to permit monitoring of the wind direction.
7. All personnel performing drilling, sampling or steam cleaning shall wear approved PPE, as described in Section 8.4.
8. A first aid kit and A-B-C fire extinguisher shall remain at the work area during all activities.
9. Eye wash bottles shall be included in the first aid kit. If it is suspected that the eyes have been infected with contaminated, eyelids shall be held open and flushed with copious amounts of water. Flushing shall continue during transport to the Plant Medical Facility off Ohio Street.
10. A portable emergency shower shall be provided on site. Should skin contact occur, affected clothing shall be removed, and the affected area flushed with copious amounts of water. Sufficient water should be on hand for preliminary flushing procedures. Additional showers are available at the Plant Medical Facility, if necessary.

8.3.2 Trichloroethylene

Due to the nature of the sampling to be performed, i.e. open air, soil sampling for TCE, the delineation of exclusion zones, contamination reduction zones and support zones is inappropriate. Instead, the personal decontamination station shall be located upwind from the sampling area as described in Section 8.3.1. In addition, no unauthorized visitors or personnel shall be located within twenty feet of drilling operations. Drilling shall be

conducted downwind of PGDP personnel, work or travel areas, where possible. In the event that drilling must be conducted upwind of such areas, drilling activities shall be immediately discontinued should a TCE concentration level of 10 ppm or higher be detected at the borehole. After such a detection, further drilling and sampling operations shall not be performed until all PGDP personnel have been cleared from any downwind work or travel areas. The Site Safety Officer shall coordinate with the PGDP Safety Coordinator or PGDP Environmental Coordinator to clear and prohibit further access into such downwind areas during any continued drilling operations.

8.3.3 Uranium

Radioactive contamination in the form of uranium and low-level penetrating radiation (beta and gamma) is not anticipated. However, should contamination be detected in an area all work in that area shall be performed in accordance with the following contamination controls and special health requirements.

8.3.3.1 Radiation Exposure Monitoring

Radiation monitoring badges shall be worn by all subcontractor personnel to monitor exposure to low-level beta and gamma radiation. These monitoring devices will be furnished and analyzed by PGDP.

8.3.3.2 Urinalysis

Urinalysis sampling of selected subcontractor personnel working in a contaminated area will be conducted by PGDP at a rate of approximately: (a) once after one week's work in the area; (b) once per month thereafter; and (c) at the completion of the individual's work in the area. All facilities for the collection of urine specimens and their analysis will be furnished by GDP. Monitoring information from both urinalysis and radiation monitoring badges will be made available upon request to the worker involved and at any time exposure levels become significant.

8.3.3.3 Air Monitoring

PGDP Health Physics personnel will provide periodic monitoring of the sampling site to determine the airborne uranium concentration. Should the uranium level rise above the Threshold Limit Value of 0.05 mg/m^3 respiratory protection shall be required.

8.3.4 PCBs

PGDP Industrial Hygiene personnel will perform periodic air sampling to insure that significant levels of PCBs are not present.

8.4 PERSONAL PROTECTION EQUIPMENT

8.4.1 General

All field activities shall be conducted at a Level D respiratory and skin protection level. Under Level D protection, the following equipment will be required by all field personnel:

1. Safety glasses
2. Safety boots/shoes
3. Vinyl or neoprene boot covering (or equivalent)
4. Inner glove
5. Vinyl, neoprene or latex outer gloves (or equivalent)
6. Disposable tyvek coveralls

In addition, all field personnel involved in drilling operations shall wear hard hats. Personnel involved in steam cleaning shall wear safety goggles.

8.4.2 Respiratory Equipment

The use of respiratory equipment is not expected to be necessary. TCE and uranium monitoring will nevertheless be conducted. Field personnel shall conduct the air monitoring, as described in Section 8.3.2, and upgrade PPE to respirators equipped with organic vapor-acid gas canisters if necessary. In addition, the PGDP Health Physics Department will perform air monitoring for uranium. Respiratory

protection will be required if the level of uranium in air exceeds 0.05 mg/m^3.

8.4.2.1 Use and Care of Respirators

Respiratory devices used for protection from airborne uranium shall consist of a half-face or full-face mask equipped with an air filtration unit or units to remove gases, vapors or particulate matter or a combination of these from the ambient air prior to its inhalation. The type of air filtration unit to be used will be specified by GDP Health Physics and Industrial Hygiene personnel and shall be used in areas identified by PGDP. This mask will be supplied by PGDP and shall be issued for the exclusive personal use of one subcontractor employee.

Each subcontractor employee shall be responsible for maintaining the issued respirator in a usable and clean condition. Plastic bags will be provided for the storage of the respirator. Respirators no longer needed shall be returned to PGDP. Respirators may be cleaned daily and reissued if significant contamination is encountered.

8.4.2.2 Training

Subcontractor employees shall not be allowed to use respiratory equipment until the employee has been instructed in the use of the equipment, has been informed of the equipment's limitations, and has passed a quantitative fit-test while wearing the specified protective equipment.

All subcontractor employees who are required to wear respiratory equipment during their performance of work shall attend a two-hour respiratory training and testing course, provided by PGDP, prior to such work. All use of respiratory equipment shall be in

accordance with OSHA 29 CFR 1910.134(e)(5)(i), "Respiratory Protection," and ANSI Z88.2, "Practices for Respiratory Protection."

The subcontractor shall provide documentation of medical approval to wear respirators for those employees who are required to wear such protection. The requirements of such documentation shall be furnished prior to the start of work at the job site.

8.5 DECONTAMINATION

Decontamination of personnel and equipment shall be performed to prevent the spreading of contaminants from the work area and to minimize the possibility of cross-contamination between holes and samples. The personal and small equipment decontamination station shall be located upwind from the sampled borehole. Required equipment for the personal decontamination station include the following:

1. Polyethylene drop cloth for ground cover
2. Polyethylene drop cloth for equipment
3. Scrub brushes
4. Disposable cloths
5. Tri-sodium phosphate cleaning solution
6. Isopropanol
7. Rinse water
8. Two buckets
9. Disposable bags

The personal and small equipment decontamination station shall be set up prior to drilling operations. In addition, a polyethylene drop cloth shall be placed around the borehole to collect drill tailings generated during sampling activities.

During sampling operations, each continuous sample tube or split spoon sampler shall be washed with a tri-sodium phosphate solution, rinsed with distilled water, air dried, rinsed with isopropanol and again allowed

to air dry prior to use at each sample interval. In addition, the drill tailings shall be placed in a DOT 17-C (open top) steel drum (to be shipped by MMES) as they are generated. MMES will characterize the waste and dispose of it in an appropriate manner. All drums shall be labeled as hazardous waste until analyses are completed.

Subsequent to the sealing of each sampled borehole, all loose soil and mud shall be removed from drilling and sampling equipment, drummed, and handled as described above. The large equipment and sampling supplies which came into contact with potentially contaminated soil shall then be transported to the trichloroethylene receiving area near the C-400 Building for steam cleaning activities. The remaining personnel who are not involved in steam cleaning operations shall then complete the following personal decontamination procedures:

1. Small equipment shall be placed on a polyethylene drop cloth for later clean up.
2. Remove outer boots and tyveks, if soiled or damaged, and bag for disposal.
3. Decontaminate outer gloves with clean water rinse. Remove and bag outer gloves for disposal.
4. Remove safety glasses, hard hats and respirators (if used) and place on small equipment drop.
5. Wash any small equipment which displays evidence of soil contact with a tri-sodium phosphate solution. (Use buckets to capture all rinse and water during decontamination.)
6. Wipe all small equipment with isopropanol; allow to air dry prior to use.
7. Carry buckets to the trichloroethylene receiving area, empty and rinse with isopropanol.
8. Bag polyethylene drop cloths for disposal.
9. Remove inner gloves and bag for disposal.

Any field personnel involved in steam cleaning shall leave their safety glasses at the small equipment drop and don goggles. In addition, due to the potential for TCE volatilization during steam cleaning, special safety procedures shall be conducted as described in Section 8.3.1. Subsequent

to steam cleaning, personnel shall follow the personal decontamination procedures previously described.

The wash solution generated during cleaning activities shall be contained, sampled for the presence of TCE, Uranium and PCBs and shall be treated and/or disposed of in an appropriate manner, in accordance with NPDES permit requirements. MMES shall be responsible for the management of the wastewater. Solid material collected will be removed and managed in the same manner as the drill tailings.

All plastic bags containing materials for disposal shall be monitored by the PGDP Health Physics Department for uranium contamination. Contaminated materials shall be retained by PGDP for proper disposal.

All subcontractors equipment shall be checked by the PGDP Health Physics Department for radioactive contamination prior to being removed from the plant site. Equipment contaminated in excess of 1000α dpm/100 cm of transferable contamination shall be subjected to further decontamination before being released.

8.6 EMERGENCY PROCEDURES

In the event of an on-site emergency during sampling activities at the Paducah Gaseous Diffusion Plant, the Site Safety Officer shall be responsible for reporting the emergency and coordinating emergency response activities. In addition, the SSO shall have the authority to assign the necessary responsibilities to field personnel who will aid in emergency prevention or response.

The following procedures shall be used by the SSO and field personnel as guidelines in the event of site emergencies.

8.6.1 Fire/Explosion

The PGDP Fire Department shall be contacted by the SSO or by the PGDP safety coordinator prior to sampling activities and provided the following information:

1. Location of sampling activities;

2. Number of personnel involved;
3. Type of work being performed;
4. Steps being taken to reduce the fire hazard;
5. Potential presence of TCE in soil samples.

A rally point, in the event that a fire does occur, shall be designated by the SM/SSO on-site prior to drilling activities. In addition, a type A-B-C fire extinguisher shall remain near the work area at all times.

Fire alarm boxes are located at the corner of 10th Avenue and Tennessee Avenue, at the corner of Tennessee Avenue and 11th Street and on the west side of Building C-410. These boxes shall be used by field personnel to contact the PGDP Fire Department in the event of a fire. If necessary, the PGDP Fire Department shall be responsible for obtaining additional outside help. In addition, the PGDP Construction Engineer shall be immediately notified regarding any fires by field personnel, regardless of size.

8.6.2 Injury

Prior to drilling, the SM/SSO or the PGDP Safety Coordinator shall provide the PGDP Construction Engineer with the following information regarding field sampling activities:

1. Number of personnel involved;
2. Type of work being performed;
3. Potential for TCE, PCB and uranium exposure;
4. Contact to receive personnel medical records in the event of an emergency.

The construction engineer shall provide this information to the appropriate site PGDP personnel.

Ambulances and emergency response personnel are available on-site. Contact with emergency personnel shall be made by tripping one of the three fire alarms present at the work area. Locations of these alarms are described in Section 8.6.1.

At least one additional field personnel must accompany the injured party to the medical facility. This person must be capable of detailing the events leading to the injury and procedures for contacting the person holding the injured party's medical surveillance records.

All injuries shall immediately be reported to the Health and Safety Officer and the PGDP Safety Officer.

8.7 Chemical Hazards

No chemical or radiological hazards are anticipated at the work site. Nevertheless, a booklet prepared by Martin Marietta entitled "Basic Safety Orientation for Subcontractor Personnel" (copy provided in Appendix V) addresses the necessary response procedures in the event of an accident or required evacuation.

8.8 Records

The SM/SSO shall maintain the following records in bound field log books:

1. A list of all persons entering the work area;
2. Results of all monitoring activities;
3. Reports of all safety plan exceptions and amendments;
4. Reports on all incidents and accidents;
5. Summary of safety related decisions made on a daily basis along with the reason for the decisions.

9.0 ENVIRONMENTAL SURVEILLANCE

9.1 Ambient Monitoring

Prior to entering and set up of drilling equipment within each proposed work area, air quality monitoring for TCE shall be conducted. One member of the field party shall conduct this monitoring under the supervision of the SM/SSO. When a field TCE measurement of less than 10 ppm is obtained, entry and equipment set up may proceed.

Air quality monitoring shall continue throughout drilling operations until

sampling at the hole is completed. In addition, the SM/HSO and team member "buddies" shall monitor each other for visual signs of TCE exposure.

Additionally, PGDP Health Physics and Industrial Hygiene personnel will provide periodic air monitoring for PCBs and uranium. Additional details on ambient monitoring are given in Section 8.3.

9.2 Heat Stress Monitoring

9.2.1 Heat Stress

Adverse weather conditions are important considerations in planning and conducting site operations. Of particular importance is heat stress resulting when protective clothing decreases natural body ventilation. Heat stress can occur even when temperatures are moderate.

9.2.2 Effects of Heat Stress

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur. They can range from mild reactions such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement to death. Specific first aid treatment for mild cases of heat stress is provided in the American Red Cross first aid book. Medical help must be obtained for the more serious cases of heat stress.

Heat-related problems include:

1. Heat rash: Caused by continuous exposure of heat and humid air and aggravated by chafing clothes. Decreases ability to tolerate heat as well as being a nuisance.
2. Heat cramps: Caused by profuse perspiration with inadequate fluid intake and chemical replacement, especially salts. Signs include muscle spasm and pain in the extremities and abdomen.
3. Heat exhaustion: Caused by increased stress on various organs to meet increased demands to cool the body. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness and lassitude.

4. Heat stroke: The most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and possible coma. Medical help must be obtained immediately.

One or more of the following recommendations will help reduce heat stress:

1. Provide plenty of liquids. To replace body fluids (water and electrolytes) lost due to sweating, use a 0.1 percent salt water solution, more heavily salted foods or commercial mixes. The commercial mixes may be preferable for those employees on a low sodium diet.
2. In extremely hot weather, conduct non-emergency response operations in early morning or evening.
3. Ensure that adequate shelter is available to protect personnel against heat, cold, rain, snow or other adverse weather conditions which decrease physical efficiency and increase the probability of accidents.
4. In hot weather, rotate workers wearing protective clothing.
5. Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Workers who notice skin problems should immediately consult medical personnel.

9.3 Cold Exposure

Should work be performed during cold weather, personnel shall be monitored by SM/SSO for symptoms of cold exposure including shivering, sleepiness, listlessness and respiratory rate. Any member of the team exhibiting characteristics of exposure shall be promptly decontaminated and taken to a warm shelter.

In addition, the Site Safety Officer shall periodically receive updates on ambient temperatures and wind speed, if necessary. This information shall be used in conjunction with Table 3 to protect workers against frostbite.

TABLE 3
Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (of)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (of)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-19	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In less than an hour with dry skin, maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

* Developed by U. S. Army Research Institute of Environmental Medicine, Matick, Massuchasetts
Source: ACGIW, Threshold Limit Values for Chemical Substances in the Work Environment for 1984-1985.

9.4 Inclement Weather Conditions

Although work should not be impaired during periods of light precipitation, work shall not be performed during heavy rain or snow falls. Furthermore, in the event of a lightning storm, work shall immediately cease, personal decontamination conducted and appropriate shelter sought.

10.0 TRAINING AND EDUCATION

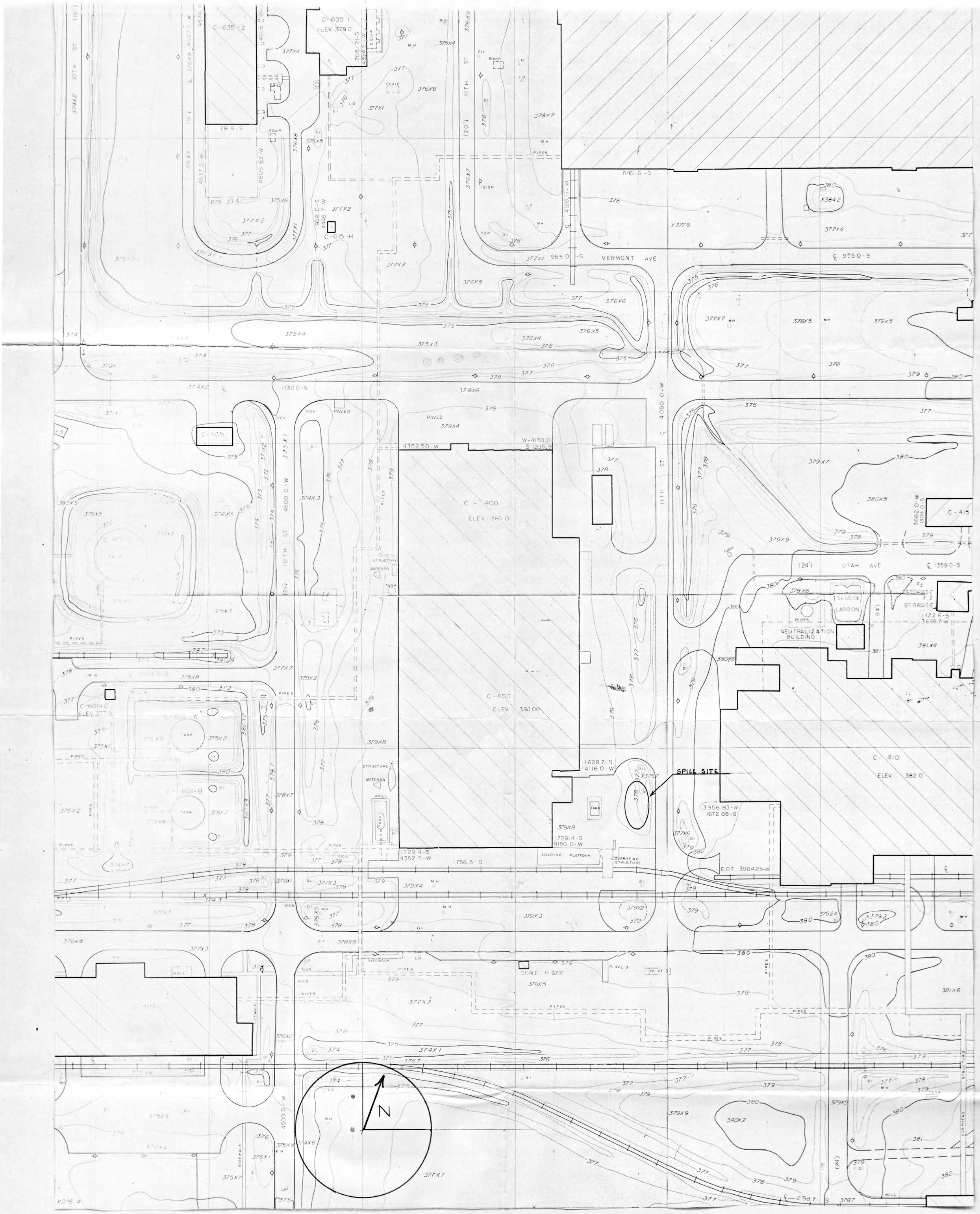
All field personnel involved in drilling and sampling at PGDP shall complete the following requirements prior to initiation of drilling activities.

1. Detailed presentation of the requirements of this plan along with specific training related to the chemical hazards of TCE;
2. Testing for fitness to wear a respirator;
3. Medical examinations to determine fitness for performing assigned tasks;

4. First aid training;
5. Examination of the attached, "Basic Safety Orientation for Subcontractor Personnel" (Appendix V of this report).
6. Attendance at the PGDP Preconstruction Conference and Safety Orientation Meeting held prior to commencement of field work. At this meeting, field personnel shall be informed of any special hazards related to field work.

In addition, site specific briefings shall be conducted by the Site Safety Officer prior to beginning work at each new sampling point.

APPENDIX I



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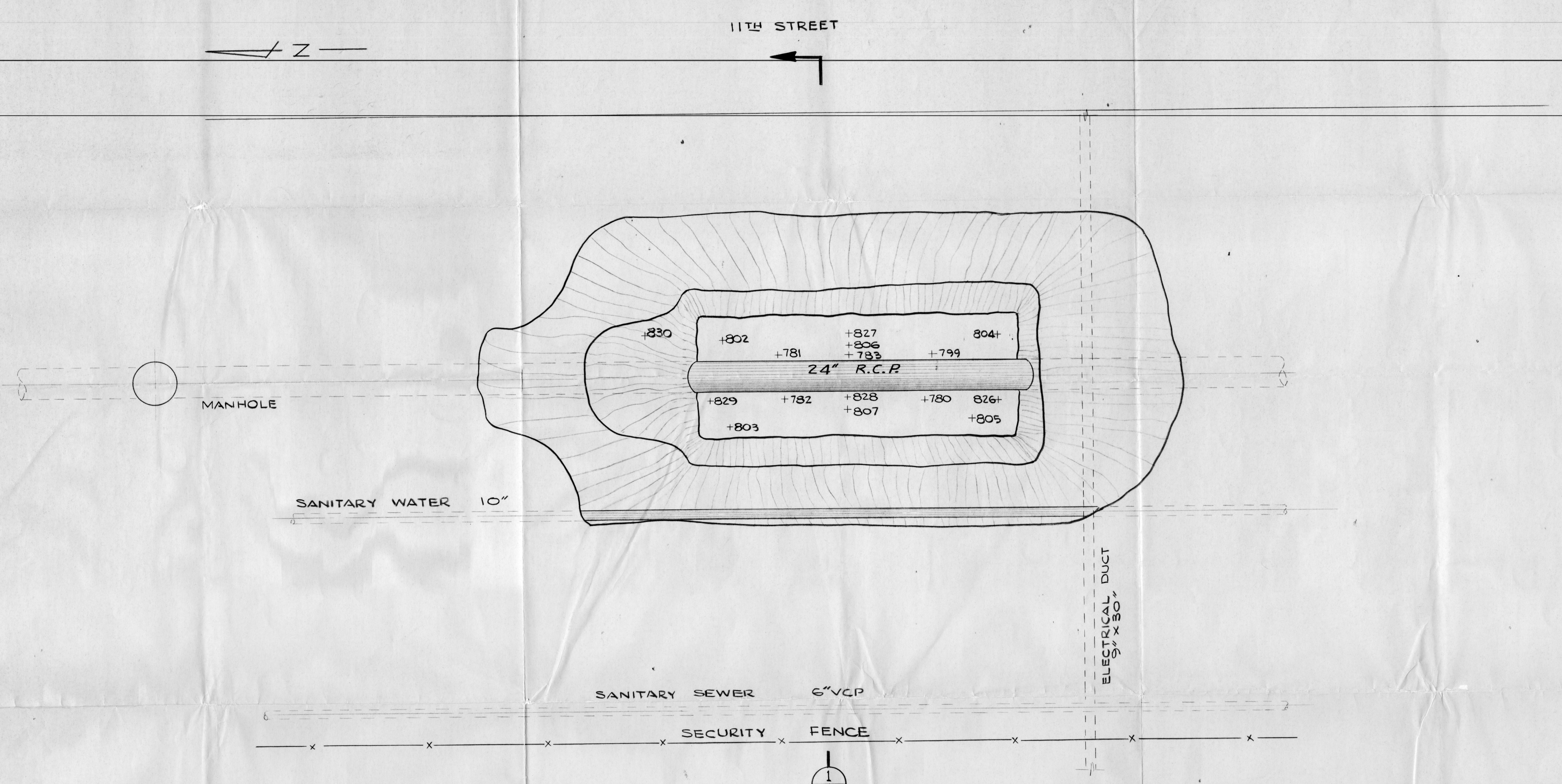
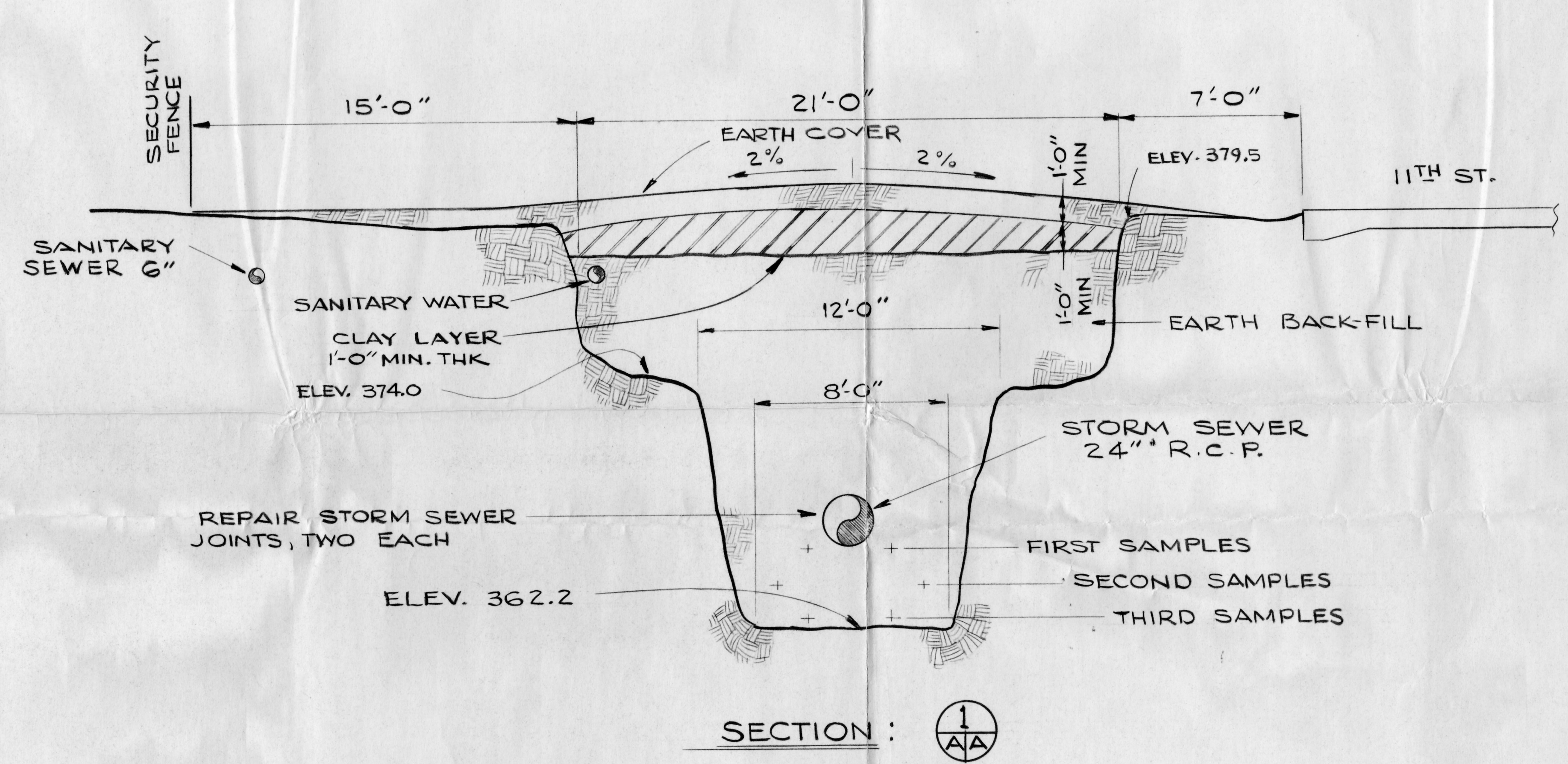
APPENDIX II



PLAN VIEW
SCALE: 1/4"=1'-0"



SECTION: 1/AA

NOTE:
SEED AREA AFTER PLACING EARTH COVER.

SAMPLING SCHEDULE

DATE	SAMPLE №		LOCATION	TCE (Mg/g)	PCB (PPM)	URANIUM (PPM)
6/18	779	FIRST SAMPLES	SOUTH EAST	3030		
6/18	780	FIRST SAMPLES	SOUTH WEST	262		
6/18	781	FIRST SAMPLES	NORTH EAST	7720		
6/18	782	FIRST SAMPLES	NORTH WEST	191		
6/18	783	FIRST SAMPLES	EAST CENTER	18		
6/19	802	SECOND SAMPLES	NORTH EAST	135		
6/19	803	SECOND SAMPLES	NORTH WEST	27		
6/19	804	SECOND SAMPLES	SOUTH EAST	4		
6/19	805	SECOND SAMPLES	SOUTH WEST	22		
6/19	806	SECOND SAMPLES	EAST CENTER	5		
6/19	807	SECOND SAMPLES	WEST CENTER	145		
6/23	826	THIRD SAMPLES	SOUTH WEST	229		
6/23	827	THIRD SAMPLES	EAST CENTER	81		
6/23	828	THIRD SAMPLES	WEST CENTER	202		
6/23	829	THIRD SAMPLES	NORTH WEST	375		
6/23	830	THIRD SAMPLES	NORTH EAST (TOP)	4.1		

REVIEWED FOR CLASSIFICATION
WS 14 July 04
Initials Date
UNCLASSIFIED

SECTION & DETAIL LEGEND
SECTION NUMBER OR DETAIL LETTER
SHEET WHERE DETAIL OR SECTION IS CUT
SHEET WHERE DETAIL OR SECTION IS SHOWN

REV	DESCRIPTION	BY	CHK	APVD
0	FOR TITLE II APPROVAL & CFC	DFS	CMJ	CMJ

REVISION OR ISSUE PURPOSE — REVISION OR ISSUE APPROVALS — SQUAD CHECK — AS BUILT

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ±
XX DECIMALS ±
XXX DECIMALS ±
ANGLES
BREAK SHARP EDGES MAX.
FINISH

DRAWING APPROVALS		DATE
DES	C.M. JOHNSON	1986
DRW	D.F. SPENCER	1986
CHK	C. M. Johnson	10-17-86
SECT	[signature]	10/17/86
DEPT & PLANT	[signature]	11/4/86
DIVISION	[signature]	11/4/86
REQUESTER	R.K. DIEROLF / WALT WHINNERY	10-30 / 10-31
FIRE / SECURITY	JRW / CJV	10-30 / 10-21
SAFETY	M. MOORE	10-22-86
IND. HYGIENE	CWT	10-23-86
MAINT.	J.H. RENFRO	10-21-86

MARTIN MARIETTA — MARTIN MARIETTA ENERGY SYSTEMS, INC.
operated for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT contract DE-AC-05-840R21400
Oak Ridge, Tennessee • Paducah, Kentucky

C-400 TRICHLOROETHYLENE LEAK SITE

C-400 TCE LEAK SITE

1	48	49	50	PLANT	BLDG	FL	SHT. OF	TYPE	CLASS
3	C	P	T	PGDP	C-400			P	U

SCALE	ID			REV
NONE	16646	C5E16646	A	0

APPENDIX III

Attachment 1

MARTIN MARIETTA ENERGY SYSTEMS
SOIL SAMPLING FOR C-400 CONTAMINATION SITE
PGD PLANT, PADUCAH, KENTUCKY
MMES NO. 86B47970V REL. P -

GEOTEK PROJECT NO. 83-1370

GEOTEK
ENGINEERING COMPANY

August 21, 1986

Mr. A. F. Johnson
Martin Marietta Energy System
Nuclear Division
P. O. Box M.
Oak Ridge, Tennessee 37830

SUBJ: Soil Sampling for C-400 Contaminated Site, PGD Plant,
Paducah, Kentucky, MMES Order No. 86847970V Rel. P -
Geotek Project No. 83-1370

Dear Mr. Johnson:

Please find below our report on the above referenced project. We have completed the subsurface soil sampling and herein present our findings. This report includes a description of our investigation of the subsurface soil by borings and field monitoring.

SUBSURFACE INVESTIGATION

Four borings were made at the site in the locations and to the depth selected by Ms. Colleen Johnson of Martin Marietta Energy Systems of Paducah, KY, as shown in Fig. 1.

All borings were drilled into the soil with a Mobile B-53 truck-mounted drill rig using 6 in. continuous flight hollow-stem power augers in accordance with ASTM Specifications D-1452.

Continuous soil sampling was performed by using standard penatration tests and driving a 1.4-in. I.D., 2-in. O.D. split-barrel sampler into the undisturbed soil by means of a 140-lb weight falling 30 in. The penetration resistance

(N-Value) in terms of blows per foot of penatration was logged and appears in the logs of borings. Samples of soil recovered in the penatration spoon were examined by our technician and given to PGDP personnel.

After drilling, boreholes were grouted to the ground surface with a mixture of type II Portland cement, bentonite powder and water.

Final boring logs are attached as an Appendix to this report. Field drilling logs and visual inspection of samples by our driller were used in preparation of these final logs. The logs presented therefore represent a field interpretation and description of the conditions encountered.

We appreciate this opportunity to have been of service to you.

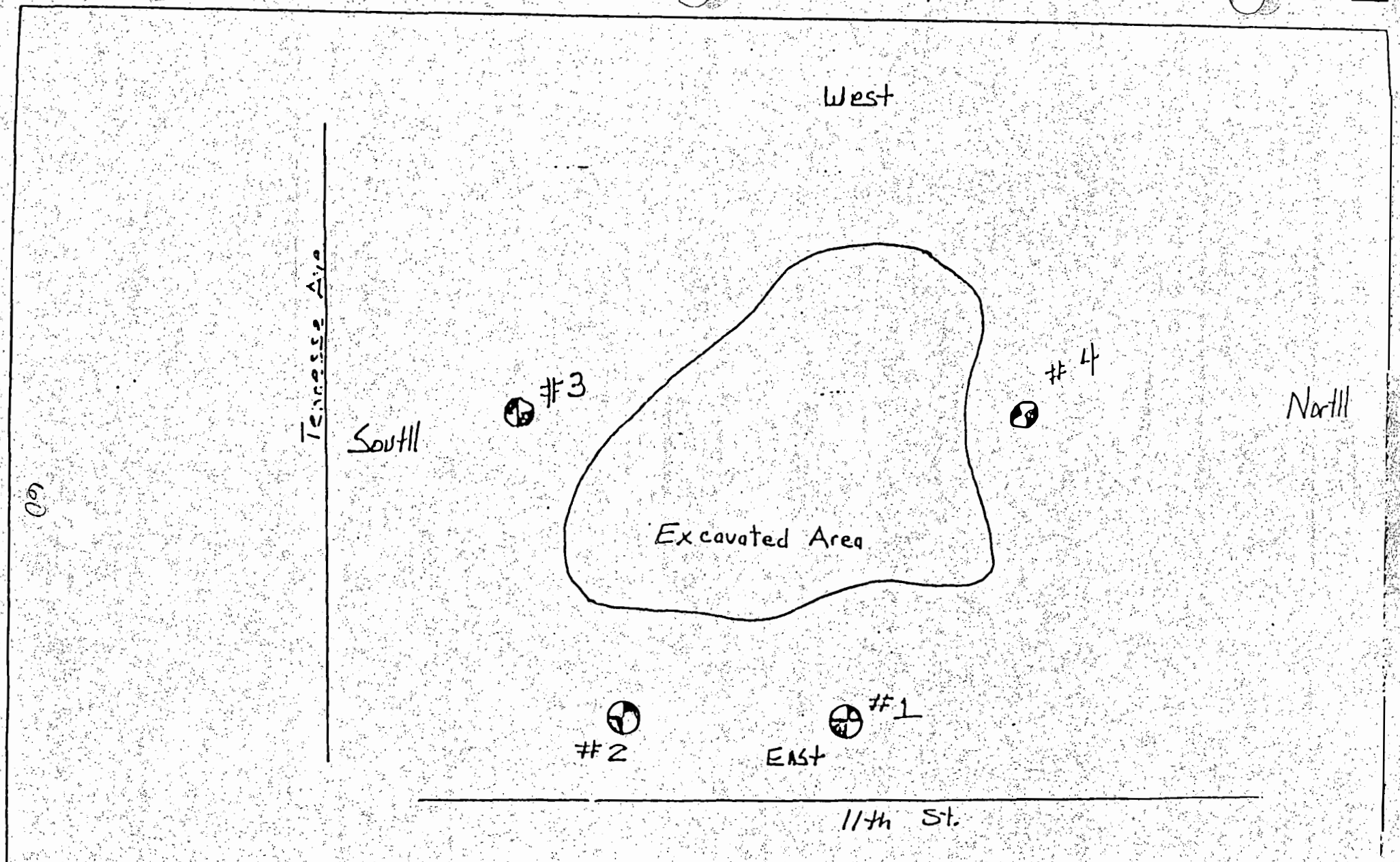
Yours truly,

GEOTEK ENGINEERING COMPANY, INC.

Louis Mishu

Louis Mishu, P.E.
Nashville Office

LM/sp



GEOTEK ENGINEERING COMPANY

Date: 8/05/86 MARTIN MARIETTA

Project: C-400 Contamination

Scale: Approximate 6"=25'

Fig. #1

2720 NOLENSVILLE ROAD • NASHVILLE, TENNESSEE 37211 • (615) 256-6891
GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring: C-420 West
Water Level
Time
Date

Boring No. 1 Date 8/05/86 Sheet 1 of 2
Type of Boring 6" contin Rig LME
Casing used No Size ____ Drilling mud used ____
Boring begun 8/05/86 Boring completed 8/07
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft.	% Recovery	Drilling Time, min.	% Drill Water Return	ROD %	Sample Type*	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	101.0	12		0		Light brown clay mixed with 75%
								12	24			limestone fill gravel 3/4 inch
								16				diameter
								12	28	2		
						N	102.0	12				
								15	27			
								21				
								16	37	4		
						N	104.0	30				Gray clay mixed with brown clay
								15	45			
								15				
								12	27	6		
						N	106.0	10				Gray clay
								12	22			
								12				
								11	23	8		Gray clay mixed with brown clay
						N	108.0	10				
								6	16			
								8				
								9	17	10		
						N	110.0	12				
								10	22			
								10				
								9	19	12		
						N	112.0	6				
								7	13			
								7				No change in soil
								12	19	14		
						N	114.0	5				
								6	11			
								6				
								7	13	16		
						N	116.0	12				
								14	26			
								7				
								9	16	18		
						N	118.0	10				
								12	22			
								12				
								16	32	20		

* N = Standard Penetration, S = Shelby Tube

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GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No. 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring	C-420 West
Water Level	
Time	
Date	

Boring No. 1 Date 8/05/86 Sheet 2 of 2
Type of Boring 6" Contin Rig CME
Casing used No Size ___ Drilling mud used ___
Boring begun 8/05 Boring completed 8/07
Ground Elevation ___ referred to ___ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft	% Recovery	Drilling Time, min.	% Drill Water Return	R Q D %	Sample Type*	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	120.0	16		0		Gray clay mixed with brown clay
								15	31			
								13		1		
								13	26			
						N	122.0	12		2		
								12	24			
								13		3		Chert Layers
								10	23			
						N	124.0	10		4		Gray clay mixed with brown clay
								12	22			50% sand
								14				
								14	28	5		
						N	126.0	14				
								14	28			Brown sandy clay with 10% gray
								16		6		mixture, very hard
								16	32			
						N	128.0	18				
								33	51	7		
								33				Chert Layers
								50	83	8		Brown moist sandy clay (Hard)
												No refusal at 30.0', end of boring
										9		
										10		Note: Grouted hole to top of ground
												3 bags Portland II cement
												1 bag Bentonite powder

* N = Standard Penetration, S = Shelby Tube

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GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring: C-420 West

Water Level	
Time	
Date	

Boring No. 2 Date 8/11/86 Sheet 1 of 2
Type of Boring 6" SPT Rig B-53 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & FARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft	% Recovery	Drilling Time, min.	% Drill Water Return	R O D %	Sample Type	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	200.0	21		0		Gravel fill road bed
								16				
								16				Brown clay 50% mixed with limestone gravel fill
								16	32	2		
						N	202.0	17				
								17	34			
								21		4		Brown clay mixed with sand & chert material
								21	42			
						N	204.0	6				
								6	12			
								7		6		Brown & gray clay mixed 50% - 50%
								7	14			
						N	206.0	6				
								7	13			
								12		8		
								16	28			
						N	208.0	16				
								15	31			
								7				No soil changes
								10	17	10		
						N	210.0	6				
								10	16			
								17		12		
								19	36			
						N	212.0	19				
								19	38			
								16		14		
								12	28			
						N	214.0	10				
								12	22			
								12		16		
								14	26			
						N	216.0	10				
								9	19			
								9		18		
								7	16			
						N	218.0	9				
								10	19			
								9		20		
								9	18			

* N = Standard Penetration S = Shelby Tube

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GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring C-420 West
Water Level
Time
Date

Boring No. 2 Date 8/11/86 Sheet 2 of 2
Type of Boring 6" SPT Rig B-53 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data						
Length cored Ft	Recovery Ft.	% Recovery	Drilling Time, min.	% Drill Water Return	R Q D %	Sample Type*	Sample No	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	220.0	7		0		Brown and gray clay mixed, 5% chert
								9	16			
								9		1		
								11	20			
						N	222.0	10		2		
								11	21			
								11		3		Sandy area
								9	20			Brown sandy clay 50% sand
						N	224.0	7		4		
								9	16			
								9		5		
								9	18			
						N	226.0	10		6		
								10				
								50	60			Chert Layers, No sampling, very
										7		Hard
						N	228.0	12				
								21		8		Brown sandy clay, 25% chert
								50	71			
						N	229.5	26		9		90% sand brown & tan 10% clay
								50	76			
										10		No refusal @ 30'6", end of boring
										1		
										2		Note: Grout hole to top of grade
										3		3 bags grout 94'lbs
												1 bag bentonite 50 lbs
										4		1 hr. grout time
										5		
										6		
										7		
										8		
										9		
										0		

* N = Standard Penetration, S = Shelby Tube

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GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No. 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring	C-420 West
Water Level	
Time	
Date	

Boring No. 3 Date 8/12/86 Sheet 1 of 2
Type of Boring 6" SPT Rig B-56 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft	% Recovery	Drilling Time, min.	% Drill Water Return	RQD %	Sample Type*	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
										0		Road bed rocky limestone fill
						N	301.0	17				
								17	34	3		
						N	302.0	16				Brown & gray clay mixed with 10% gravel fill
								16	32			
								15				
								16	31	4		
						N	304.0	9				
								8	17			Brown & gray clay mixed 50% each
								8				
								8	16	6		
						N	306.0	9				
								10	19			
								10				
								12	22	8		
						N	308.0	12				
								11	23			
								11				
								10	21	10		
						N	310.0	9				
								9	18			
								10				
								10	20	12		
						N	312.0	10				
								11	21			
								11				
								12	23	14		
						N	314.0	11				
								10	21			
								9				
								8	17	16		
						N	316.0	9				
								10	19			
								10				
								12	22	18		
						N	318.0	9				
								9	18			
								10				
								10	20	20		

* N = Standard Penetration, S = Shelby Tube

2720 NOLENSVILLE ROAD • NASHVILLE, TENNESSEE 37211 • (615) 256-6891
GEOTEK
ENGINEERING COMPANY

Log Of Boring

Job No. 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring: C-420 West
Water Level
Time
Date

Boring No. 3 Date 8/12/86 Sheet 2 of 2
Type of Boring 6" SPT Rig B-56 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft	% Recovery	Drilling Time, min.	% Drill Water Return	R O D %	Sample Type*	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	320.0	10		20		Brown & gray clay 50% - 50%
								12	22	21		
								16				
								17	33	23		Brown sandy clay 50% sand
												No refusal @ 22.0', end of boring
										3		Note: 2 bags grout
										4		1 bag bentonite
										5		grout to ground surface
										6		
										7		
										8		
										9		
										0		
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

* N = Standard Penetration, S = Shelby Tube

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Log Of Boring

Job No 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring. C-420 West	
Water Level	
Time	
Date	

Boring No. 4 Date 8/12/86 Sheet 1 of 2
Type of Boring 6" SPT Rig B-53 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data: Length Cored Ft.	Rock Data: Recovery Ft.	Rock Data: % Recovery	Rock Data: Drilling Time, min.	Rock Data: % Drill Water Return	Rock Data: RQD %	Soil Data: Sample Type	Soil Data: Sample No.	Soil Data: Blows per 6" Drive	Soil Data: N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
										0		Cut 6' with dozer before drilling
										1		Brown and gray clay
										2		
										3		
										4		
										5		
										6		
						N	406.0	6				Begin drilling @ 6.0'
								6	12			Brown and gray clay
								7				
								7	14	8		
						N	408.0	7				
								7	14			
								9		9		
								10	19	10		
						N	410.0	10				Brown and gray clay 50% - 50%
								7	17			10% chert
								7		11		
								6	13	12		
						N	412.0	5				
								6	11			
								6		13		
								7	13	14		
						N	414.0	7				
								9	16			
								10		15		
								12	22	16		
						N	416.0	12				
								12	24			
								13		17		
								13	26	18		
						N	418.0	12				
								12	24			
								11		19		
								13	24	20		

* N = Standard Penetration, S = Shelby Tube

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ENGINEERING COMPANY

Log Of Boring

Job No 83-1370

Client MARTIN MARIETTA
Project C-400 Contamination, Soil

Location of Boring	C-420 West
Water Level	
Time	
Date	

Boring No. 4 Date 8/12/86 Sheet 2 of 2
Type of Boring 6" SPT Rig B-53 Mobile
Casing used No Size ____ Drilling mud used ____
Boring begun ____ Boring completed ____
Ground Elevation ____ referred to ____ Datum
Field Party: WILLIAMS & EARNEST

Rock Data						Soil Data					
Length cored Ft	Recovery Ft.	% Recovery	Drilling Time, min.	% Drill Water Return	RQD %	Sample Type*	Sample No.	Blows per 6" Drive	N-Value	DEPTH IN FEET	GRAPH	Description of soil or rock & notes on drilling operation
						N	420.0	11		20		Brown and gray clay 10% sand
								12	23	21		
								12				
								13	25	22		
						N	422.0	10				
								12	22	23		
								15				
								15	30	24		
						N	424.0	15				Brown sandy clay 25% sand
								15	30	25		
								17				Brown sandy clay with creek pebbles 50% sand
								17	34	26		
						N	426.0	17				
								18	35	27		
								30				Sandy with creek pebbles 90% sand
								50	80	28		
												No refusal @ 28.0', end of boring
										29		
										30		Note: 2 bags grout
										1		1 bag bentonite
												grout to ground surface
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

* N = Standard Penetration, S = Shelby Tube

APPENDIX IV

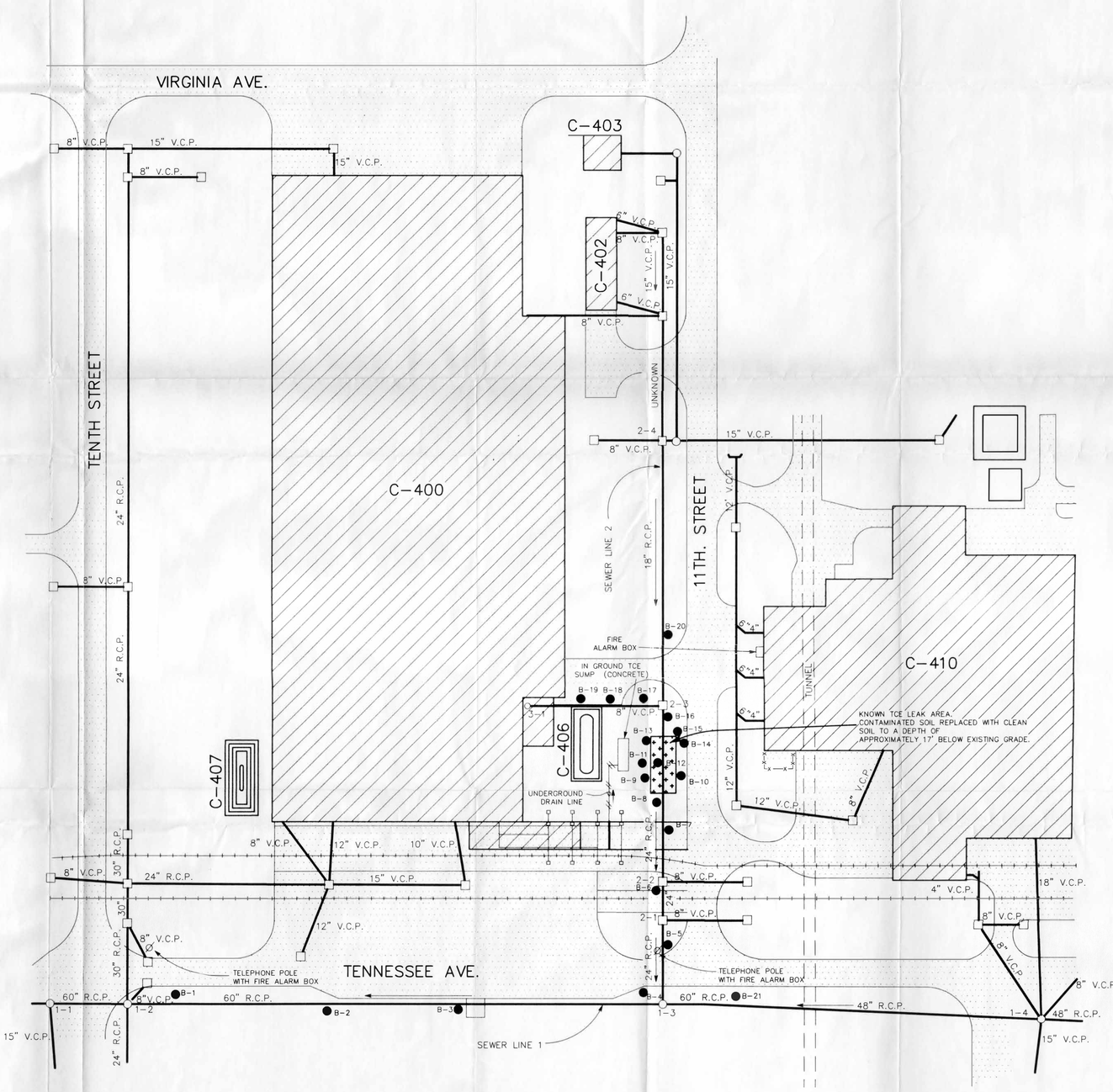
SAMPLING SCHEDULE				
BORING NO.	DEPTH BEGIN (ft.)	DEPTH* END (ft.)	SAMPLE INTERVAL (ft.)	NO. OF ** SAMPLES
B-1	16.0	42.0	5	6
B-2	16.0	42.0	5	6
B-3	16.5	42.5	5	6
B-4	16.5	42.5	5	6
B-5	14.5	40.5	5	6
B-6	14.0	40.0	5	6
B-7	13.5	39.5	5	6
B-8	13.5	32.5	3	7
	36.5	72.5	5	8
B-9	13.0	32.0	3	7
	36.0	72.0	5	8
B-10	13.5	32.5	3	7
	36.5	72.5	5	8
B-11	13.0	32.0	3	7
	36.0	72.0	5	8
B-12	12.5	31.5	3	7
	35.5	71.5	5	8
B-13	13.0	32.0	3	7
	36.0	72.0	5	8
B-14	14.0	33.0	3	7
	37.0	73.0	5	8
B-15	12.5	31.5	3	7
	35.5	71.5	5	8
B-16	11.5	30.5	3	7
	34.5	70.5	5	8
B-17	11.5	30.5	3	7
	34.5	70.5	5	8
B-18	12.5	31.5	3	7
	35.5	71.5	5	8
B-19	12.5	31.5	3	7
	35.5	71.5	5	8
B-20	12.0	43.0	5	7
B-21	15.5	41.5	5	6

* THE ENDING DEPTH ASSUMES THAT ONE FOOT SAMPLES ARE OBTAINED FROM THE TOP OF EACH SAMPLE INTERVAL, BEGINNING WITH THE DEPTH SPECIFIED IN COLUMN TWO.

** TOTAL NO. OF SAMPLES (EXCLUDING REPLICATES AND SAMPLING BLANKS) = 235

TOTAL NO. OF SAMPLE CONTAINERS (EXCLUDING REPLICATES AND SAMPLING BLANKS) = 705

DRAINAGE STRUCTURE TABLE			
STRUCTURE NO.	TYPE	INVERT IN	INVERT OUT
1-1	MANHOLE	UNKNOWN	UNKNOWN
1-2	MANHOLE	362.56	362.06
1-3	MANHOLE	364.61 (60") 365.58 (24")	363.08
1-4	MANHOLE	366.16 (42") 371.50 (8") (NE) 370.53 (18") 369.25 (15") 370.00 (8") (NW)	365.16
2-1	INLET MANHOLE	365.65 (24") 373.00 (8")	365.65
2-2	INLET MANHOLE	365.68 (24") 373.00 (8")	365.68
2-3	INLET MANHOLE	366.32 (18") 366.75 (8")	365.85
2-4	INLET MANHOLE	366.94 (18") 371.00 (8") 370.66 (15")	366.67
3-1	CLEANOUT	UNKNOWN	367.72



LEGEND

- PROPOSED SAMPLE BORING
- DRAINAGE INLET
- MANHOLE
- CLEANOUT
- FENCE
- RAILROAD
- HEADWALL
- EXISTING BUILDING
- EXISTING PAVEMENT

NOTES

1. ALL UTILITIES SHALL BE FIELD LOCATED AND MARKED PRIOR TO DRILLING ACTIVITIES.
2. LOCATIONS GIVEN ARE APPROXIMATE. FIELD ADJUSTMENTS MAY BE NECESSARY TO AVOID EXISTING SITE FEATURES OR UTILITIES.
3. SAMPLES B-20 AND B-21 ARE BACKGROUND SAMPLES.

REVIEWED FOR CLASSIFICATION
Initials UNCLASSIFIED Date 10 Sep 04

REVIEWED FOR CLASSIFICATION
Initials UNCLASSIFIED

SAMPLING LOCATIONS
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KENTUCKY

TRICHLOROETHYLENE INVESTIGATION
C-400 BUILDING

PREPARED FOR:
MARTIN MARIETTA ENERGY SYSTEMS, INC.

Engineering, Design & Geosciences Group, Inc.
Nashville – Knoxville – Louisville – Huntsville

DRAWN: RAC	SCALE: 1" = 50'	PROJ: 1321-1
CHECKED: EGW	DATE: 03/09/88	SHEET 1 OF 1
REVIEWED: TDM		

APPENDIX V

BASIC SAFETY ORIENTATION

FOR

SUBCONTRACTOR PERSONNEL

MARTIN MARIETTA

IF ANY PROVISIONS OR REQUIREMENTS OF THIS "BASIC SAFETY ORIENTATION" CONFLICT WITH SPECIFIC PROVISIONS OF THE SUBCONTRACT DOCUMENTS, THE SUBCONTRACT DOCUMENTS (e.g., SPECIAL CONDITIONS) SHALL GOVERN.

BASIC SAFETY ORIENTATION

FOR

CONSTRUCTION SUBCONTRACTOR

PERSONNEL

Prepared By
Paducah Gaseous Diffusion Plant
Environmental, Safety and Health Departments
Fire Protection Engineering Department
Plant Emergency Director
Construction Management Department

PREFACE

This pamphlet briefly presents some of the basic safety policies and practices of the Paducah Gaseous Diffusion Plant (PGDP). It is not intended to be a substitute for the safety requirements contained in construction subcontracts. Rather, it establishes basic responsibilities and guidelines for your activities at PGDP, relative to operational, environmental, safety, health, and emergency requirements.

Our construction-related safety objectives are:

1. To protect you, our employees, and the general public from hazards arising from construction activities.

2. To prevent damage to property at or adjacent to construction sites.

3. To protect the environment.

4. To prevent interruptions or delays resulting from accidents or fires.

These objectives are in agreement with the Martin Marietta Energy Systems, Inc., policy to make SAFETY our number one priority; whenever a conflict arises between other objectives and SAFETY, SAFETY shall always be our first consideration.

Ralph Donnelly

Ralph Donnelly, Manager
Paducah Gaseous Diffusion Plant

CONTENTS

SECTION I

BASIC SAFETY ORIENTATION FOR

CONSTRUCTION SUBCONTRACTOR PERSONNEL

While you are engaged in work at PGDP, you will certainly become aware of the very high standards which have been set with regard to personnel safety. It is just these standards which have maintained PGDP's excellent injury frequency experience. This is evidenced by the fact that both PGDP and subcontractor injury experience have remained at levels well below the average of the chemical and construction industries.

As you begin your work at PGDP, consider the goal of these safety requirements and their proven success. Your efforts in meeting these requirements will be appreciated and mutually beneficial.

A. SAFETY STANDARDS

All construction work done under subcontract at PGDP shall be in compliance with the Environmental, Safety, and Health sections of the subcontract Special Conditions document. This includes the requirements of Title 29 CFR 1926, "OSHA Safety and Health Standards for the Construction Industry."

B. VEHICULAR SAFETY

1. *SAFE OPERATION* - - All vehicles operated on plant/DOE property shall be equipped with all safety devices as required by OSHA and applicable Commonwealth of Kentucky laws. The vehicle shall be maintained in a safe operating condition, and driven by an operator with a valid state driver's license.

2. *OBEY TRAFFIC SIGNS* - -

3. *SLOW DOWN AT CONGESTED AREAS* - - Unless otherwise posted, the maximum speed limit within the plant is 25 mph and 5 mph within buildings. Congested areas (e.g., south side of C-400) where a lower speed limit is required, are posted in a prominent manner.

4. *WATCH FOR VEHICLES* - - Bicycles, Cushman type industrial vehicles, forklift trucks, towmotors and other special purpose vehicles are routinely operated on plant streets. Their presence requires special precaution by all vehicle operators.

5. *YIELD TO EMERGENCY VEHICLES* - -

6. *THREE TO A CAB* - - Transport of personnel in the cabs of trucks or front seat of automobiles shall not exceed three to a seat. Personnel transported in the bed of a truck shall be seated in designated seats or on the bed of the truck with endgates in a closed position.

   Under no circumstances shall any person be permitted to ride with arms or legs outside of truck body; in a standing position on the body or on running boards; or seated on side fenders, cabs, cab shields, rear of truck or on the load.

7. *DO NOT BLOCK FIRE PROTECTION EQUIPMENT* - - Access must be maintained at all times to fire hydrants, sprinkler valves, and portable fire extinguishing equipment.

8. *ONLY NECESSARY TRAVEL INTO BUILDINGS* - - Vehicles shall not be driven inside buildings except when necessary to transport tools and materials. In such cases, vehicles and materials shall be cleaned of all excess mud and debris before entering the building. Vehicles with excessive lube or hydraulic oil leaks shall not be used within buildings. No vehicles powered by liquid petroleum gas shall be used inside buildings. Headlights and/or flashing lights must be on during all travel inside buildings.

9. *DO NOT REFUEL INSIDE OR WITHIN 25 FEET OF BUILDINGS* - -

10. *VEHICLE ACCIDENTS* - - Vehicle accidents inside the perimeter fence must be reported and are investigated by the PGDP Safety Department. Accidents on access roads and parking areas are investigated by appropriate authorities (e.g., Kentucky State Police, Sheriff Department) upon request.

C. PERSONNEL SAFETY

1. *HARD HATS AND EYE PROTECTION REQUIRED* - - Hard hats and eye protection (safety glasses, goggles, and/or face shields) shall be worn by all construction subcontractor personnel when performing work or in the area of construction activities.

2. *HEARING PROTECTION* - - Hearing protection shall be worn by personnel when entering areas so posted or whenever the following construction noise levels and exposure time are reached:

84 dBA	- 8 hours
85 dBA	- 7 hours
86 dBA	- 6 hours
87 dBA	- 5 hours
88 dBA	- 4 hours
89 dBA	- 2 hours
90 dBA and above	- (hearing protection is mandatory)

Commercially available ear plugs are an acceptable method for providing hearing protection.

3. *RESPIRATORY PROTECTION* - - In the event that respiratory protection is required either by the nature of the construction work or as a precautionary measure due to the location of the work, respiratory protection devices shall be used and personnel shall be trained and certified by the PGDP Industrial Hygiene Department.

4. *CLOTHING* - - Since clothing provides the basic safety protection needed for most everyday hazards, construction subcontractor personnel shall wear clothing suitable for the weather and work conditions. The minimum shall be short-sleeve shirt, long trousers, and leather or other protective work shoes or boots. Sandals, open-toed shoes, canvas, tennis, or deck shoes shall not be worn.

5. *HAND PROTECTION* - - Construction workers handling rough, sharp-edged, abrasive materials or where the work subjects the hands to lacerations, punctures, burns, or bruises shall use hand protection.

D. TOOLS AND EQUIPMENT

1. *DEFECTIVE TOOLS SHALL NOT BE USED* - - All tools and equipment used by construction subcontractor personnel shall be maintained in a safe condition and used in a safe manner. Defective tools and equipment shall be tagged out and not used until the necessary corrections are made.

2. *LIFTING EQUIPMENT* - - All lifting equipment shall have been inspected and certified within the past twelve months. A certificate so indicating shall be furnished to the Construction Engineer prior to using the equipment.

3. *ELECTRICAL SAFETY* - - All temporary 120-volt, single-phase, 15- and 20-ampere receptacles and cord sets shall be protected by ground fault circuit interrupters (GFCIs), or an assured equipment grounding program.

4. *GROUNDING OF TOOLS AND EQUIPMENT* - - Whenever electrical utilities may be encountered, the housing of all hand-held drilling or cutting equipment used in excavation or wall penetrations shall be grounded. Mobile excavating equipment shall also be grounded whenever electrical utilities may be encountered.

5. *SCAFFOLD TOWERS* - - In addition to the safety requirements of OSHA 1926.451, all stationary and rolling scaffold towers shall be erected with one horizontal, diagonal brace between an inner and outer vertical frame member, near the bottom of the tower, and at every 25 feet of scaffold height.

6. *WORK NEAR OVERHEAD ENERGIZED LINES* - - Crane and high profile equipment shall be positioned and operated at least 15 feet from all energized circuits. All operations and travel in the vicinity of high voltage power lines shall be observed by a qualified observer (flagman) who can give timely warning to the operator to prevent an accident or encroachment into the 15-foot minimum clearance zone and prevent anyone on the ground from touching the equipment. Cranes and other high profile equipment which could come into contact with energized lines shall be effectively grounded with a trailing, insulated No. 4/0 welding cable.

E. FLAGGING

In addition to required barricades and warning signals, all excavations and construction operations which are adjacent to or over sidewalks, aisles, corridors, streets, and other pedestrian or vehicle thoroughfares shall be marked with multicolored flags on a white streamer ("flag pennants").

F. EMPLOYEE ACCOUNTABILITY

NOTIFY BUILDING SUPERVISOR - When work is to be performed on or in any building, the building supervisor is to be kept informed of the number and location of construction subcontractor personnel at all times. This notification procedure should be coordinated with the Construction Engineer and may be waived only on authority of the Construction Engineer.

G. PERMIT SYSTEM

1. The PGDP permit system is for the protection of personnel from potential hazards resulting from work on or near electrical or mechanical equipment or utility lines. The particular permit requirements for each construction project are contained in the Special Conditions of each subcontract's specifications. A general description of each follows:

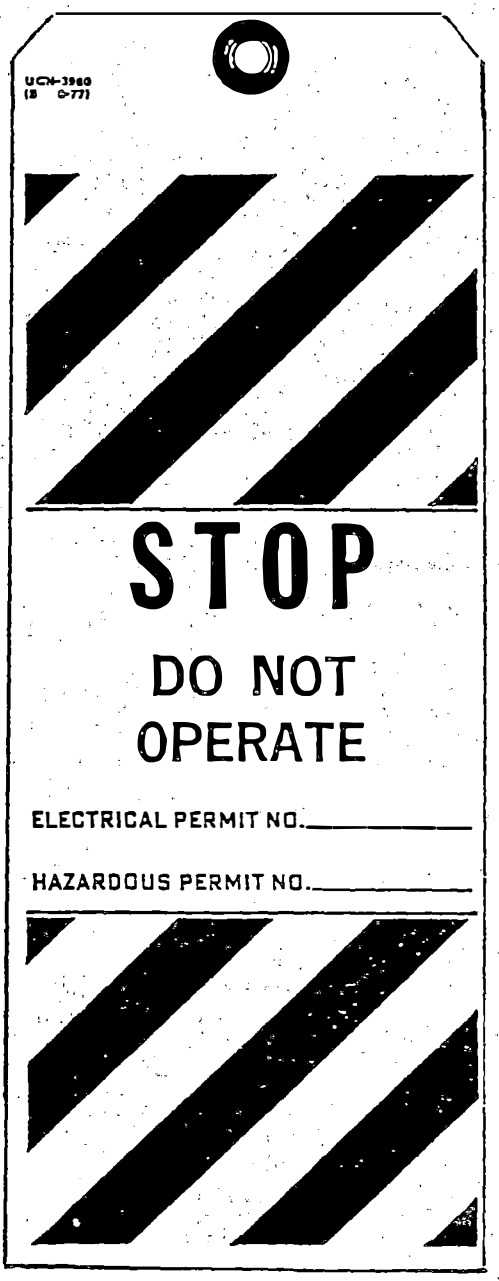
   a. *EXCAVATION PERMIT* - - An excavation permit is required whenever any excavation and wall or floor penetration is to be made. Additionally, a separate permit is required for each drawing when the scope of work to be performed is such that more than one drawing is required to show areas that are to be excavated/penetrated. An excavation permit will list type and location of obstructions within the area and may prescribe special safeguards or additional permits which are required prior to commencing any excavation or penetration operation.

b. *ELECTRICAL WORK PERMIT* - - An electrical work permit (EWP) is required whenever construction, maintenance, modification, test, and/or inspection work may expose personnel to hazardous electrical conditions or where operation of electrical equipment may expose personnel to mechanical hazards. An EWP will certify that specific safeguards have been placed on a portion of the electrical system and/or specify precautions to be observed to allow specified work to proceed safely from the standpoint of electrical hazards. Some of the safeguards required by the subcontract documents are a review of the EWP and verification of the applied protection by subcontractor personnel. All subcontractor personnel working under EWP protection should be familiar with the procedure.

c. *HAZARDOUS WORK PERMIT* - - A hazardous work permit (HWP) is required whenever construction, maintenance, modification, test, and/or inspection work may expose personnel to hazardous conditions. This will include situations where the operation of systems or equipment may jeopardize personnel working on associated equipment. Additionally, a HWP will be required for excavations near high pressure lines. Certain welding and cutting operations will

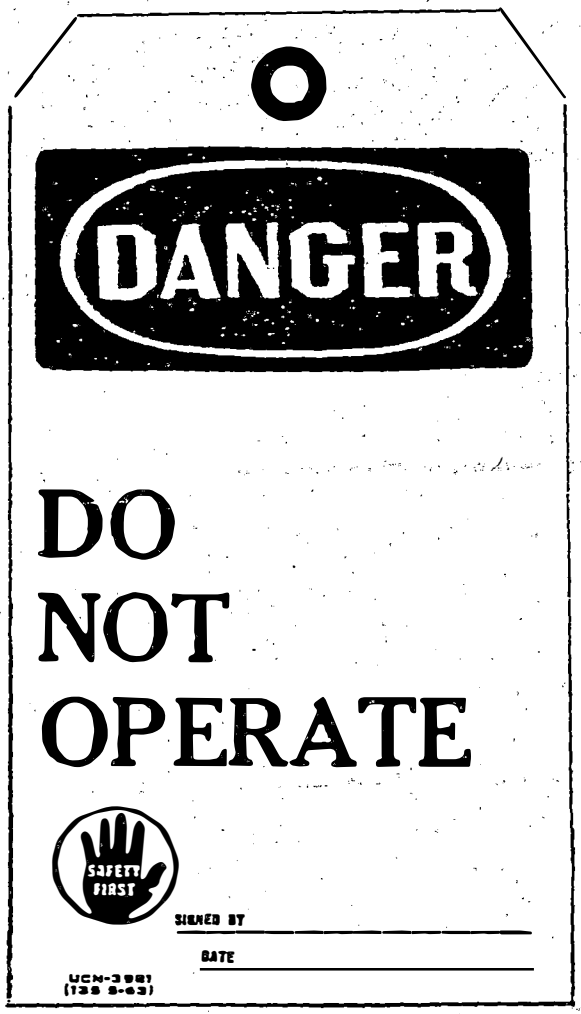
require a HWP (e.g., cutting and welding on: flammable and combustible gas container and associated piping systems; in locations where exposed combustibles are present and cannot be removed or shielded; and on systems or equipment operating under pressure, vacuum, or containing acids, toxic gases, or alkaline solutions). A HWP will certify that specific safeguards have been applied and/or specify precautions to be observed while performing the work.

2. *STOP TAGS - - STOP TAGS SHALL NOT BE VIOLATED!* In conjunction with both electrical and hazardous work permits, stop tags are attached to any switch, control point, valve, or piece of equipment which is either taken out of service, open, closed, or otherwise secured to provide a safeguard for the protection of personnel. *STOP TAGS ARE USED ONLY FOR THE PROTECTION OF PEOPLE! A STOP TAG IS TO BE RECOGNIZED AS THE PHYSICAL EQUIVALENT OF A LOCK OR PHYSICAL BARRIER! THE STOP TAG SHALL NOT BE REMOVED NOR SHALL THE PHYSICAL OR ELECTRICAL STATUS OF ANY EQUIPMENT OR DEVICE THAT THE STOP TAG IS ATTACHED TO BE ALTERED UNTIL THE ASSOCIATED EWP OR HWP IS RELEASED OR TEMPORARILY SUSPENDED.* Only the PGDP supervisor-in-charge or specific, designated personnel may affix or remove any stop tag.

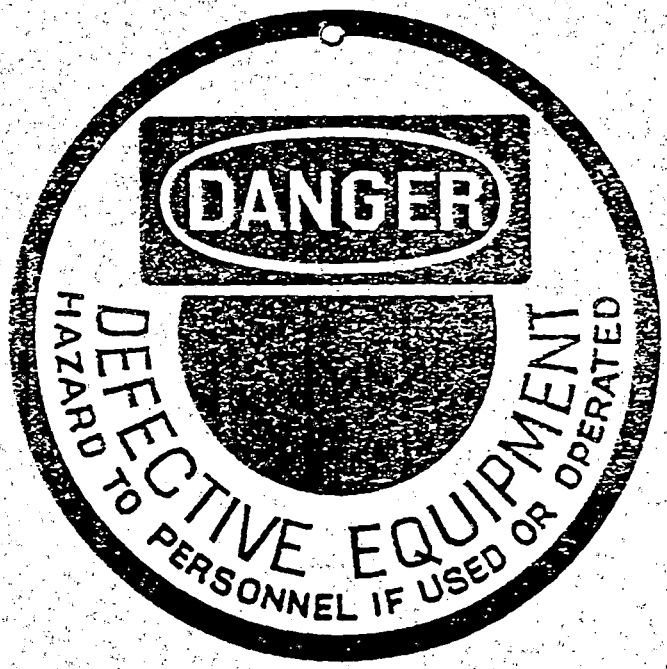

UCN-3980
(8 0-77)
STOP
DO NOT
OPERATE
ELECTRICAL PERMIT NO._____
HAZARDOUS PERMIT NO._____

10

3. *DO NOT OPERATE TAG* - - Do not operate tags are used for the protection of equipment. Subcontractor personnel shall not alter the status of equipment on which a do not operate tag is attached.



4. *DANGER - DEFECTIVE EQUIPMENT TAGS* - - Defective equipment tags are used to restrict or remove hazardous equipment from service. Subcontractor personnel shall not use or operate any equipment to which a defective equipment tag is attached.



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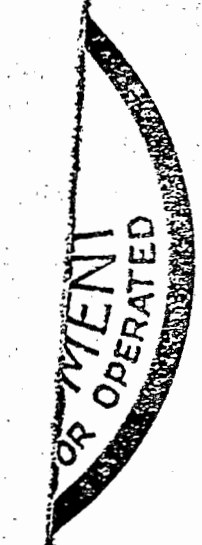

5. *DANGER - UNSAFE DO NOT USE TAGS* - - These tags are used to remove hazardous subcontractor equipment from service. Subcontractor personnel shall not use equipment with this tag attached on subcontract work. Any tagged equipment shall be repaired or removed from the job site.

SECTION II

EMERGENCY INSTRUCTIONS FOR

CONSTRUCTION SUBCONTRACTOR PERSONNEL

In order to protect personnel, plant property, and the environment, it is the PGDP policy to conduct the necessary planning to enable plant forces to efficiently cope with any reasonable contingency resulting from radiological, operational, natural, civil, and national emergencies.

The PGDP maintains specialized equipment, personnel, and facilities to cope with emergencies. The Shift Superintendent on duty is the Plant Emergency Director and directs emergency actions. Trained emergency personnel are on duty at all times. Members of the Plant Emergency Squad wear orange coveralls for identification. Instructions announced on the plant public address system must be followed during emergency situations.

A. REPORTING EMERGENCIES

During the course of your work, you may experience or observe an emergency situation; some of these types of emergencies may include a *FIRE, EXPLOSION, RELEASE OF CHEMICALS OR TOXIC GASES, SERIOUS ACCIDENT AND/OR INJURY.* The following information is provided as a guide for your actions in the event of such an emergency:

1. *REPORT* all emergencies by the most appropriate and expedient means to the C-300

Plant Control Center/Shift Superintendent via one of the following methods:

a. *FIRE ALARM BOX* - A fire alarm box should always be used, if available, since this notifies all emergency personnel simultaneously. Their locations are identified by red lights and/or white with red border painted signs on columns, walls, or poles.

b. *TELEPHONE* - Dial the emergency number listed on the nearest available telephone.

c. *MESSENGER* - Contact the nearest plant facility and/or personnel with the means (e.g., fire alarm box, telephone, or radio) to relay the message.

2. *AFTER REPORTING THE EMERGENCY:*

a. Help *evacuate personnel*, if necessary, from the immediate danger area. All exits are marked by painted or lighted exit signs.

b. *ARRANGE* for someone to *MEET AND DIRECT EMERGENCY PERSONNEL* to the emergency scene. If a fire alarm box has been activated, the Emergency Squad will automatically respond to that point. When reporting the emergency via either telephone or messenger, be sure to give a location where you or someone else will meet the Emergency Squad.

c. The Plant Emergency Squad, equipped with rescue and medical equipment, is prepared to render on-site first-aid treatment.

Seriously injured personnel will be transported to the Plant Dispensary for initial medical treatment. The plant ambulance will transport them to local medical facilities when requested by the subcontractor.

B. PLANT EMERGENCY ALARMS AND SIGNALS

In the event of plant emergencies, notification may be given over the plant public address system or via the plant's Emergency Signals. These signals, their meaning and action to be taken are given below.

SIGNALS

Continuous blast on special high-pitched air whistle. Flashing red lights on building exterior (C-310, -331, -335, -360, -400, -409, -420).

MEANING AND ACTION

Radiation Emergency. Evacuate the building from which the signal is coming and assemble in one of the three assembly areas, 1) area south of C-631-1 (west of water towers), 2) north of C-200 and west of C-750 if the alarm is activated at C-409, and 3) Post 47 if the alarm is activated in the C-360 area. Account for all personnel and notify Construction Engineering.

SIGNALS

Intermittent 2-second blast on plant horns.

MEANING AND ACTION

Air attack or tornado imminent. Either evacuate the plant (gates will be open for exit, but not entry) or take cover. Emergency plant cover areas include: C-100 Basement, C-200 Basement, C-300 Basement, C-310 Control Room Basement, C-331 Control Room Basement, C-333 Control Room Basement, C-335 Control Room Basement, C-337 Control Room Basement, C-531 Basement, C-532 Basement, C-533 Basement, C-535 Basement, C-536 Basement, C-537 Basement, and C-710 Basement.

SIGNALS

Continuous blast on plant horns - duration 3 to 5 minutes.

MEANING AND ACTION

Air attack, tornado, or other emergency possible, but not imminent. Evacuate building and listen to plant PA system for instructions.

SIGNAL

Cascade Buildings (C-310, -315, -331, -333, -333A, -335, -337, -337A): Three blasts on building horns or howlers.

MEANING AND ACTION

Local Emergency. Contact area control room for instructions.

SIGNAL

Other Buildings (C-100, -710, -720): One 10-second blast on building horns or sirens.

MEANING AND ACTION

Local Emergency Notification. Evacuate building and listen to PA, except C-720 which will evacuate on PA announcement.

SIGNAL

C-600: Continuous blast on building steam whistle.

MEANING AND ACTION

Local Emergency Notification. Evacuate building.

SIGNAL
Miscellaneous Areas. Public address system announcement.
MEANING AND ACTION
Follow direction of the announcement.

NOTE: IN THE EVENT THAT ANY UNUSUAL ODORS, GASES, OR SMOKE ARE OBSERVED, EVEN WITHOUT AN ALARM, EVACUATE THE AREA IMMEDIATELY AND REPORT THIS SITUATION TO THE NEAREST PGDP SUPERVISOR, THE C-300 PLANT CONTROL CENTER/SHIFT SUPERINTENDENT, OR THE CONSTRUCTION ENGINEER.

C. EMERGENCY PERSONNEL ACCOUNTABILITY

It is the responsibility of each subcontractor supervisor to be prepared to account for all personnel while working in the PGDP. Additionally, the building or area supervisor shall be notified of your presence prior to working in the area. In the event of a local emergency, report your presence to the

building or area supervisor. In the event of a radiation emergency or a toxic gas release, a plant-wide accountability may be requested over the plant PA system. If such an announcement is made, construction subcontractor supervision shall account for all personnel possible and report their presence to the Construction Engineer, along with the names of all missing personnel.

D. ACCIDENT REPORTING

The Construction Engineer shall be notified immediately of any accident, incident, or injury which occurs. The site should be protected and not disturbed until all the facts, circumstances, and documentation of the scene have been obtained by PGDP Construction and Safety Department personnel.

NOTE: DON'T HESITATE: WHEN YOU NEED HELP, ASK FOR IT!

SECTION III

BASIC FIRE PROTECTION INFORMATION FOR

CONSTRUCTION SUBCONTRACTOR PERSONNEL

Although the potential hazards and loss of life and property as a result of an explosion or fire at the PGDP are remote, the possibility does exist. For this reason, we have and maintain very sophisticated fire protection systems and rigidly enforce our fire protection requirements at all times. The plant is protected by fixed fire protection systems of many types, fire extinguishers, our own Fire Department, and a series of procedures (e.g., hazardous work permit) which must be followed during all construction activities.

During construction each subcontractor is obligated to furnish and properly maintain portable fire extinguishing equipment sufficient to protect construction and plant equipment and facilities from construction-related fire hazards and to abide by the fire protection requirements contained in each construction subcontract. A brief description of the plant fire protection facilities, equipment, and procedures are listed below:

A. REPORTING AND EXTINGUISHING FIRES

1. In the event of a fire which cannot be readily extinguished by local means, report this emergency to the C-300

Plant Control Center/Shift Superintendent by one of the following methods:

a. *FIRE ALARM BOX* - A fire alarm box should always be used, if available, since this notifies all emergency personnel simultaneously. Their locations are identified by red lights and/or white with red border painted signs on columns, walls, or poles.

b. *TELEPHONE* - Dial the emergency number listed on the nearest available telephone.

c. *MESSENGER* - Contact the nearest plant facility and/or personnel with the means (e.g., fire alarm box, telephone, or radio) to relay the message.

NOTE: DON'T HESITATE: WHEN YOU NEED HELP, ASK FOR IT!

2. Notify the Plant Fire Department, through the Construction Engineer, of any fires which occur on the construction site, regardless of their size and whether they were contained and extinguished by construction personnel or not.

3. There are several types and sizes of fire extinguishers in use throughout the plant. Instructions for operation are posted on each extinguisher. Location of fire extinguishers are identified. The presence of these fire extinguishers does not relieve the subcontractor of his respon-

sibility to furnish his own extinguishers; however, this does not preclude the use of the plant fire extinguishers.

4. Notify the Construction Engineer after using any of the plant's fire protection equipment so they can be serviced or replaced immediately. *NEVER HANG AN EMPTY OR USED EXTINGUISHER BACK ON THE WALL BRACKET.*

B. FIRE LANES AND ACCESS

Access to all buildings, fire lanes, and fire hydrants must be maintained at all times. Construction and construction activities which might obstruct Fire Department personnel and vehicles on any of the plant streets and to buildings or fire hydrants must first be coordinated and approved by the Shift Superintendent's office and Fire Department, through the Construction Engineer. As a general rule, all excavation work across plant streets is to be accomplished in such a manner to allow a minimum of one-way traffic at all times.

C. AUTOMATIC SPRINKLER SYSTEMS

Construction locations which are protected by automatic sprinkler systems require special precautions. Equipment, material or supplies must never be stacked around sprinkler heads in such a manner that discharge and distribution of water is obstructed. Sprinkler heads must be kept clean and never covered with paint. Sprinkler piping must not be used for support of ladders, equipment, or other material. Free access to sprinkler control valves must be maintained at all times.

D. TRANSPORTATION AND STORAGE OF FLAMMABLE LIQUIDS

1. Flammable liquids should not be stored inside buildings without the permission of the Fire Protection Engineer or his designated representative and then in only the minimum quantities necessary. All safety cans shall be listed either by UL or approved by FM. Specific requirements on flammable liquid storage are contained or referenced in the subcontract documents.

2. Any vehicle transporting flammable liquids shall not enter any plant building, or park closer than 25 feet to any building. Refueling of any vehicle will not be permitted within any building nor closer than 25 feet to a building. Specific requirements for transporting flammable liquids are contained or referenced in the subcontract documents.

3. No vehicles powered by liquid petroleum gas shall be used inside buildings.

E. SMOKING IS NOT ALLOWED IN POSTED "NO SMOKING" AREAS

F. CONSTRUCTION AREA HOUSEKEEPING

Removal of wastes and debris is to be accomplished on a regular and frequent basis. Burning is not permitted within the plant and all spoil material is to be disposed of in accordance with the specific provisions contained in the subcontract documents.

SECTION IV

BASIC HEALTH PROTECTION FOR

CONSTRUCTION SUBCONTRACTOR PERSONNEL

A. There are specific job and/or operational areas in the plant where involved personnel are required to use protective measures to reduce exposures from toxic and low level radioactive materials. If the nature of your construction activities requires you to be in these areas, special precautionary measures will be included within the subcontract documents and additional orientation on the hazards and requirements will be provided to you.

1. We do insist that you use aisleways provided in buildings to reach your destination and restrict your presence to the prescribed work areas shown on the subcontract drawings.

2. Certain jobs performed by personnel in PGDP requires that respiratory protection be routinely worn. Generally, this is for protection from localized contaminants and a respirator would not be necessary outside the immediate area.

3. Generally, all areas of previous radioactive contamination will be decontaminated prior to your work in the area.

In the event that this is impractical or impossible, special requirements will be included within the subcontract documents. In these cases, protective measures could include, but not be limited to: issuance of radiation dosimeters to monitor exposure to low-level beta and gamma radiation, requirement to wear and retain shoes and coveralls in the plant, and urinalysis sampling. Monitoring information from both urinalysis and radiation dosimeters/packets will be made available upon request to the workmen involved and at any time exposure levels should become significant; however, this is not expected.

B. The probability of an accidental criticality producing high-level radiation at the PGDP is extremely remote.

1. Buildings where such an event might occur are continuously monitored by a radiation alarm system. These buildings are C-310, C-331, C-335, C-337-A, C-360, C-400, and C-409.

2. The radiation warning signal is a continuous blast on a high-pitched air whistle, along with flashing red lights on the buildings.

3. If you hear this signal, evacuate the building immediately and follow instructions from the PA system and proceed with other personnel to the assembly point and be prepared to account for all personnel in accordance with information contained in Section II.

C. There are specific operational areas in the PGDP, especially on the second floor of Buildings C-310, C-315, C-331, C-333, C-335, and C-337, where temperatures can be expected to be in a range of 90-125°F. Work in these higher temperatures may result in heat stress if certain precautions are not taken. These include:

1. More frequent than usual rest periods may be needed.

2. Water intake must be increased. In lieu of salt tablets, it is generally agreed that salt replacement is best achieved by either (1) adding more salt to one's food, or (2) a mixture of one tablespoon of salt to three gallons of water. Commercial (salt supplement) drinks are also available for this purpose.

SECTION V

ENVIRONMENTAL PROTECTION INSTRUCTIONS

FOR CONSTRUCTION SUBCONTRACTOR PERSONNEL

It is PGDP policy to ensure that oil and hazardous materials are stored and handled in such a manner as to anticipate and prevent the release of these materials into the environment.

A. Oil, gasoline, asphalt, tar, paint, solvents, or any other chemicals shall not be disposed or allowed to empty into drains or ditches.

B. Construction subcontractor personnel shall immediately notify the Construction Engineer of any spills of oil or chemicals.

C. Oil and chemicals or material that has absorbed oil and/or chemicals are not to be disposed of by construction subcontractor personnel. If an oil or chemical disposal problem occurs, assistance is to be requested through the Construction Engineer to the Plant Material Terminal Management Department.

D. Disposal of wastes generated on the plant site by construction subcontractor personnel is to be arranged through the Construction Engineer with the Material Terminal Management Department prior to the start of any construction project.