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ADDITIONAL SAMPLING ACTIVITIES WASTE PIT AREA NOVEMBER, 1990

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WASTE PIT AREA
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This work plan addendum describes the collection of additional samples from the FMPC waste pits (Operable Unit 1). The existing March 1988 Work Plan for the RI/FS was developed with the assumption that the data generated by the Characterization Investigation Study (CIS) and other earlier studies would be sufficient for all RI/FS data needs for the waste pit area. The uncertainty in this assumption was recognized since the final data and reports form the CIS were not available at the time of the Work Plan's development.

A detailed review of the adequacy of the existing data was undertaken upon initiation of the risk assessment and feasibility study of Operable Unit 1. This analysis resulted in the identification of some inadequacies in the existing data. This addendum describes the sampling plan required to fill the identified data gaps.

1.0 OBJECTIVES AND JUSTIFICATION

This sampling program was developed to meet the following objective:

- Provide samples of leachate from within the lower portions of the waste pits.
- Provide samples to undergo geotechnical and treatability testing in support of the remedial alternative selection process of the feasibility study.
- Provide samples to assess the geochemical properties of the waste materials that effect the leaching characteristics of the waste.
- Provide materials for future testing conducted during the design phase of the remedial action.

This sampling plan was formulated and justified within the context of four decision factors. These include the relative importance of the data in satisfying the overall objectives of the RI/FS, the adequacy of the data currently available, the degree to which uncertainties will be reduced if additional data are collected, and the programmatic or technical difficulties in collecting any additional data.

1.1 Programmatic Needs

The validity of the risk assessment and feasibility study is highly dependent on the level of understanding of the volume, types, characteristics, and variability of the wastes that are the potential source of contaminants. Programmatically, additional data needs fall into two principal areas, the feasibility study and the risk assessment. This section contains an explanation of these needs and an overview of the degree to which they are met by existing data.

1.1.1 Feasibility Study Needs

The selection process used for the evaluation of alternatives within the feasibility study requires an adequate degree of knowledge of both the chemical and physical properties of the waste. While the required degree of understanding of these characteristics is somewhat subjective, it must be of sufficient detail to assure that an alternative selected for detailed evaluation can reasonably be expected to meet all applicable or relevant and appropriate requirements. The sampling program developed herein represents the combined efforts of individuals directly involved in the alternative evaluation process for Operable Unit 1. Execution of this plan in a timely manner will result in the development of an acceptable knowledge base to achieve this objective of the feasibility study.

1.1.2 Risk Assessment Needs

No currently available data describe the characteristics of the lower portions of the waste pits. The wastes in the various pits have been characterized as heterogenous, making representative sampling of the pits for the purposes of waste constituent characterization difficult, if not impossible, with any reasonable degree of sampling. From a human health perspective, it is unlikely that near-term direct exposures to the constituents for the pits will occur. This results in the potential for waste pit leachate to migrate from the pits into the surrounding environmental media as the principal concern. In order to evaluate this potential, the leachability of the pit contents must be quantified. Samples of leachate collected near the bottom of the waste pits provide the best and most direct evaluation of the leaching characteristics of the wastes.

Leachate is by its nature a composite of the leachable and, therefore, transportable waste constituents present within the pit. A single sampling of leachate does not, however, provide information on the time-dependent nature of contaminant release from the waste matrix. This time-dependency is best deduced from the chemical characteristics of the waste materials. Therefore, discrete samples of the waste must be collected to determine these chemical characteristics.

1.2 Review of Available Data

A comprehensive review of the available data was conducted prior to preparation of this work plan addendum. Data review was conducted on a wide range of data sources, but principally focused on the Waste Storage Area Characterization Investigation Study. After this review, the following deficiencies in the data were ascertained:

- Information is not available with which to determine the acceptability of proposed treatment methods for reducing the mobility of the waste pit constituents.
- Due to the heterogeneous nature of the waste, adequate information is not available to characterize the source term for migration from the lower portions of the waste pits, since no sampling was conducted in this region.
- Insufficient information is available with which to characterize the leaching potential of the waste materials.

2.0 SAMPLING STRATEGY

Unless specifically modified by this addendum, all activities shall be governed and conducted in accordance with the appropriate portions of the "U.S. DOE Feed Materials

Production Center Remedial Investigation and Feasibility Study Work Plan" including:

- Volume I - Sampling Plan
- Volume II - Health and Safety Plan
- Volume IV - Data Management Plan
- Volume V - Quality Assurance Project Plan

Work to be completed under this addendum includes the installation of 13 vertical borings which will be completed as monitor wells. Table 1 details the number and location of each boring/monitor well within each pit. The borings shall extend from ground surface to near the bottom of each pit.

2.1 METHODOLOGY

To assist in the collection of relatively undisturbed samples, an auger drilling rig and Shelby tubes shall be used for borehole placement and sample collection in the waste pits. Undisturbed samples cannot be collected using cable-tool drilling techniques because the heavy blows from percussion drilling will result in significant densification of cohesionless materials and remolding of cohesive soils.

Because the pits are thought to be lined with clay soils of low permeability which may afford some degree of containment of the waste constituents, drilling shall be conducted in a cautious fashion to prevent damage or penetration of this potential barrier. Drilling shall be conducted using 10-inch nominal outside diameter by 6.25-inch nominal inside diameter hollow-stem augers. A thin-walled Shelby tube (ASTM D 1587-83) or split-spoon (ASTM D 1586-84) samples shall be hydraulically driven in advance of the auger to permit collection of samples and to allow for the identification of the waste/host media interface at the bottom of the burial pit. A 3-inch diameter, 30-inch long Shelby tube shall be utilized for the collection of geotechnical/physical samples. Shelby tube samples shall be collected based upon the estimated waste depth at the one-third, one-half, and two-thirds points of the waste zone. At all other times, a three-inch O.D. split-spoon sampler shall be used for collecting samples and to allow the field geologist to determine the waste/host media interface. The field geologist shall ensure that the split-spoon sampler is advanced in

6 inch intervals, near the pit bottom to allow borehole termination as soon as possible after identification of the waste pit liner (if present or waste/host media interface otherwise).

This method of identification of the pit bottom is considered to be reasonably cautious based upon a knowledge of the host media from earlier RI/FS investigations. Boring 1073 was completed in Pit 3 as part of the RI/FS field program in 1988. Radiological surveys conducted on split-spoon samples indicate that the pit depth is 23.5 feet in this area. This finding was supported by visual examination of the sample core. Visual classification of soils made as part of the boring revealed five feet of yellow-brown clay underlying the pit.

The bottom elevations of Pits 3 and 4 are known from as-built drawings, the bottom elevations of Pits 1 and 2 are not accurately known, therefore, it is possible to prescribe the sample depth (and total depth of penetration) within the borehole in Pits 3 and 4. This is not possible for Pits 1, 2, and the burn pit since as-built drawings for Pits 1 and 2 are referenced to a lost reference monument and no construction records are available for the burn pit. However, by advancing a split-spoon sampler in short increments, it is anticipated that the borings will be terminated prior to the penetration of any clay liner present. If the pit bottom is partially penetrated by the split spoon sampler, then a bentonite plug shall be placed in the bottom of the borehole to reduce the possibility of pit leakage as a result of the boring.

Monitor wells will be installed in each boring at a depth such that saturated materials are encountered. The wells will be sampled for parameters listed in Table 4. Water levels will be measured in each well on a monthly basis for a minimum of one year. Well specifications will be consistent with those outlined in the RI/FS QAPP, Volume 5, Section 5.3.

2.2 BOREHOLE LOCATION

Table 1 presents the planned boring locations and the expected depths of each borehole. Figure 2 shows the approximate locations of each boring. These locations were selected to fall within the deepest portion of each pit as estimated from pit as-built drawings or CIS data. The Project Technical Manager shall be responsible making any changes in borehole location due to unexpected field conditions. Given the nature of the waste and the experience of the previous sampling effort, it is likely than an impenetrable object will be encountered. If field judgement suggests relocation of a boring will lead to a higher probability of successfully installing a well to near the bottom of a waste pit, such action will be taken and all interested parties, including OEPA, will be notified. One of the borings within each pit is located adjacent to the boring locations used during the Characterization Investigation Study for purposes of correlation of data results.

2.3 SAMPLE COLLECTION

Materials collected during the installation of the boreholes within the waste zone of a pit shall be used for several purposes. The following sections describe the sampling methodology and volume requirements for each set of analyses. The samples shall be collected and, in some cases, composited as shown in Figure 1. Samples shall be stored in suitable containers as described in Section 4.5 of the RI/FS Sampling Plan with required compositing completed onsite prior to shipment. The compositing will be completed onsite due to laboratory license restrictions limiting quantities of waste pit materials allowed in the laboratory, per sample. Compositing will be completed as per the following guidelines.

The samples to be composited will be divided lengthwise into two equal portions after each sample has been field screened for radioactivity and volatiles. Only one-half of each split-spoon core will be used for compositing. This will allow for specific interval analysis of the remaining uncomposited material. When volatile organic analysis of the sample is required, the necessary volume will be collected immediately after dividing the sample.Non-mixable materials such as concrete, wood chips, paper, plastic, glass and rock fragments will be removed from the sample splits prior to compositing.

The compositing will be completed within a disposable glove bag. Samples will be placed in the bag after they have been split. Samples will not be removed from the glove bag until they have been composited and placed in appropriate containers. Only one composite will be prepared per bag. Splits of individual cores to be composited will be placed in a pyrex or stainless steel bowl of sufficient volume to allow for thorough mixing and insure that sample spillage does not occur. Mixing of the sample will be accomplished by one of two methods as follows:

- By hand, with a mixing tool composed of pyrex glass, stainless steel, or teflon.
- With a mechanical mixer utilizing stainless steel mixing blades.

A sample will be considered composited when uniform color and texture is observed throughout the sample. When uniformity has been achieved the composite will be spread evenly in the mixing bowl. The composite will then be quartered with equal portions taken from each quarter to provide the necessary volume of sample for the specified analyses. These portions will then be placed in the appropriate, labeled containers for shipment to the laboratory. Excess composite will be containerized and archived.

Compositing equipment will be decontaminated before/between each composite and rinsate samples will be collected as outlined in the RI/FS Work Plan, Volume V, Section 6.6, pgs. 26 and 27, dated March, 1988.

2.3.1 Physical and Geotechnical Sampling

Geotechnical/physical analyses will be completed in support of the FS alternative evaluation process. Some of these analyses require an undisturbed sample. Relatively undisturbed soil samples can be collected using thin-walled tubes in accordance with ASTM D 1587 methodologies.

Table 2 lists the geotechnical/physical analyses to be used to determine the following:

- Estimates of achievable placement densities during bulk packaging operations
- Estimates of existing or potential in situ waste settlement

- Assist in the preliminary selection of waste removal/treatment equipment and handling methods
- Estimate of the waste pit surface bearing capacity
- Estimates of infiltration characteristics for hydrogeologic modeling

A Shelby tube set consists of three tubes collected at one-third, one-half, and two thirds of the estimated boring depth (see Figure 1). One set of three Shelby tubes shall be collected from each of the thirteen borings included in this plan. At a minimum all borings will have Shelby tubes samples from the one-third and two-thirds intervals analyzed for density, moisture content, specific gravity, Atterberg limits and grain size distribution. After evaluation of the results of these tests; additional permeability, consolidation and triaxial tests may be completed on archived material from the Shelby tubes. Table 3 describes the analyses performed on each of these samples. Any sample remaining after the specified analyses are complete will be archived for future use in the design phase of the remedial action.

Sampling and analytical testing for physical properties shall be conducted under the appropriate ASTM standards and laboratory procedures using qualified geotechnical laboratory technicians and properly calibrated apparatus which meet the intent of ASTM D 3740-80, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction."

2.3.2 Waste Treatability Samples

All auger cuttings exclusive of waste pit overburden shall be collected for use in waste treatability studies. Drilling operations shall be conducted in such a manner as to minimize the introduction of contaminants into the subsurface sample matrix. All materials shall be collected with a shovel and placed in plastic-lined, air-tight steel containers. The materials collected shall be delivered for analysis under a separate program. Sampling equipment will be decontaminated according to RI/FS Work Plan, Volume V, QAPP. These samples will be stored in a secure area where the temperature remains above freezing. RI/FS chain of custody protocols will be followed for the tracking of these samples.

Several borings are installed for collection of materials for future analytical needs during the design phase of the remedial action. A possible future use of this waste material may include the evaluation of solidification formula for on-site disposal of excavated waste.

2.3.3. Geochemical Samples

Additional geochemical information is needed in support of Issue 4 of the "Field Sampling and Laboratory Procedure Plan for the Geochemical Program In Support of the Remedial Investigations/Feasibility Study Feed Material Production Center Fernald, Ohio (May 5, 1989), IT Corporation" (IT 1989), and to provide information on the potentially mobility of hazardous contaminants for the risk assessment process. Justification for the geochemical portion of the sampling program is contained in the above-referenced document and has been previously reviewed and approved by DOE.

One sample from each borehole (see Table 4) shall be analyzed as follow:

- TCLP Extraction - an aliquot (1000 grams) of composited waste will undergo the Toxicity Characteristic Leaching Procedure (TCLP). The resulting leachate will be analyzed for the FMPC RI/FS radionuclides and CLP BNA/pesticides/PCB/metals. Detection limits shall be those required for RI/FS groundwater samples as opposed to the standard TCLP limits. TCLP VOA will be completed on one of the three discreet interval VOA samples.
- Uranium differential leaching procedure - more fully described in the geochemical program document (IT 1989)
- Total organic carbon (TOC)
- Grain size analysis

The TOC and grain size analyses are required to calculate a distribution coefficient for organic compounds. The results of this effort will be used in contaminant fate and transport modeling.

2.3.4 Source Characteristics

Samples collected by split-spoon technique shall be combined to form a composite for materials as shown in Figure 1. Samples for volatile organic analyses shall be collected from the six-inch sample interval with the highest HNu reading in each of the three intervals (refer to Figure 1). The samples shall be packaged as required by Section 4.5 of the RI/FS Sampling Plan.

All other materials shall be packaged in 500 ml wide mouth amber jars as sampling proceeds. Required compositing shall be completed on-site using procedures outlined under the sample collection. Radiological, HSL (other than the above described VOAs), and tributyl phosphate analyses shall be completed on two composites, one of Interval 2 and a second of Interval 3. Materials remaining after removal of all aliquots for source characteristic and geochemical sampling shall be appropriately repackaged and archived for possible later analysis. Table 4 contains a summary of all radiological, TCLP and HSL analyses.

2.3.5 Leachate Characteristics

Following the installation and purging of the previously described monitoring wells, a sample of the leachate from within the waste zone shall be collected and analyzed as described in Table 4.

The results from these analyses, in combination with existing data from the CIS, will be used to complete the contaminant fate and transport modeling for OU 1.

TABLE 1. Pit Borehole/Monitor Well Location and Estimated Depth

Pit	Boring	Easting	Southing	Estimated Depth
1	1	17+50	13+60	20
	2	17+00	13+90	20
	3	17+40	14+50	20
2	1	19+90	13+40	22
	2	19+25	12+55	22
3	1	16+10	10+60	27
	2	17+50	11+00	27
	3	19+50	9+60	27
4	1	23+15	10+25	24
	2	23+60	9+55	24
	3	22+85	10+35	24
Burn Pit	1	20+80	10+10	13
	2	21+00	9+50	13

Table 2. Engineering Properties Parameters

Method Title	Reference
Water Content Determination	ASTM D2216-80, "Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures, "1987 Annual book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
Atterberg Limits	ASTM D4318-84, "Standard Test Method for Liquid Limit, Plastic Limit, and Plastic Index of Soils," 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
Specific Gravity Determination	ASTM D854-83, "Standard Test Method for Specific Gravity of Soils," 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
Grain Size Distribution with Hydrometer Analysis	ASTM D422-63, "Particles Size Analysis of Soils," 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rocks; Building Stones; Geotextiles
One-Dimensional Consolidation	ASTM D2435-80, "One Dimensional Consolidation Properties of Soils", 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
Unconsolidated Undrained Triaxial	ASTM D2850-82, "Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Solids in Triaxial Compression", 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles

Table 2. Engineering Properties Parameters (Continued)

Method Title	Reference
Permeability of Granular Soils	ASTM D-2434-6B, "Test Method for Permeability of Granular Soils (Constant Head)", 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
Permeability of Cohesive Soils (Falling Head)	No designation
Classification of Soils	ASTM D2487-85, "Test Method for Classification of Soils for Engineering Purposes", 1987 Annual Book of ASTM Standards Vol. 04.08 Soil and Rock; Building Stones; Geotextiles
In Situ Soils Density Determination	No ASTM Designation

TABLE 3. GEOTECHNICAL/PHYSICAL TEST SCHEDULE

ASTM Designation	Performed By	Minimum No. of Tests	Required Completion Date	Minimum Sample Size	Sample Location Within Pit
D2216-80	Geotechnical Subcontractor	39	8 weeks after receipt of samples	a	a
D4318-84	Geotechnical Subcontractor	39	8 weeks after receipt of samples	a	a
D854-83	Geotechnical Subcontractor	39	8 weeks after receipt of samples	a	a
D422-63	Geotechnical Subcontractor	39	8 weeks after receipt of samples	a	a
D2435-80	Geotechnical Subcontractor	6	8 weeks after receipt of samples	6 core sections, 6" length, one each pit 1-4 and two from burn pit	MID waste depth at each pit boring

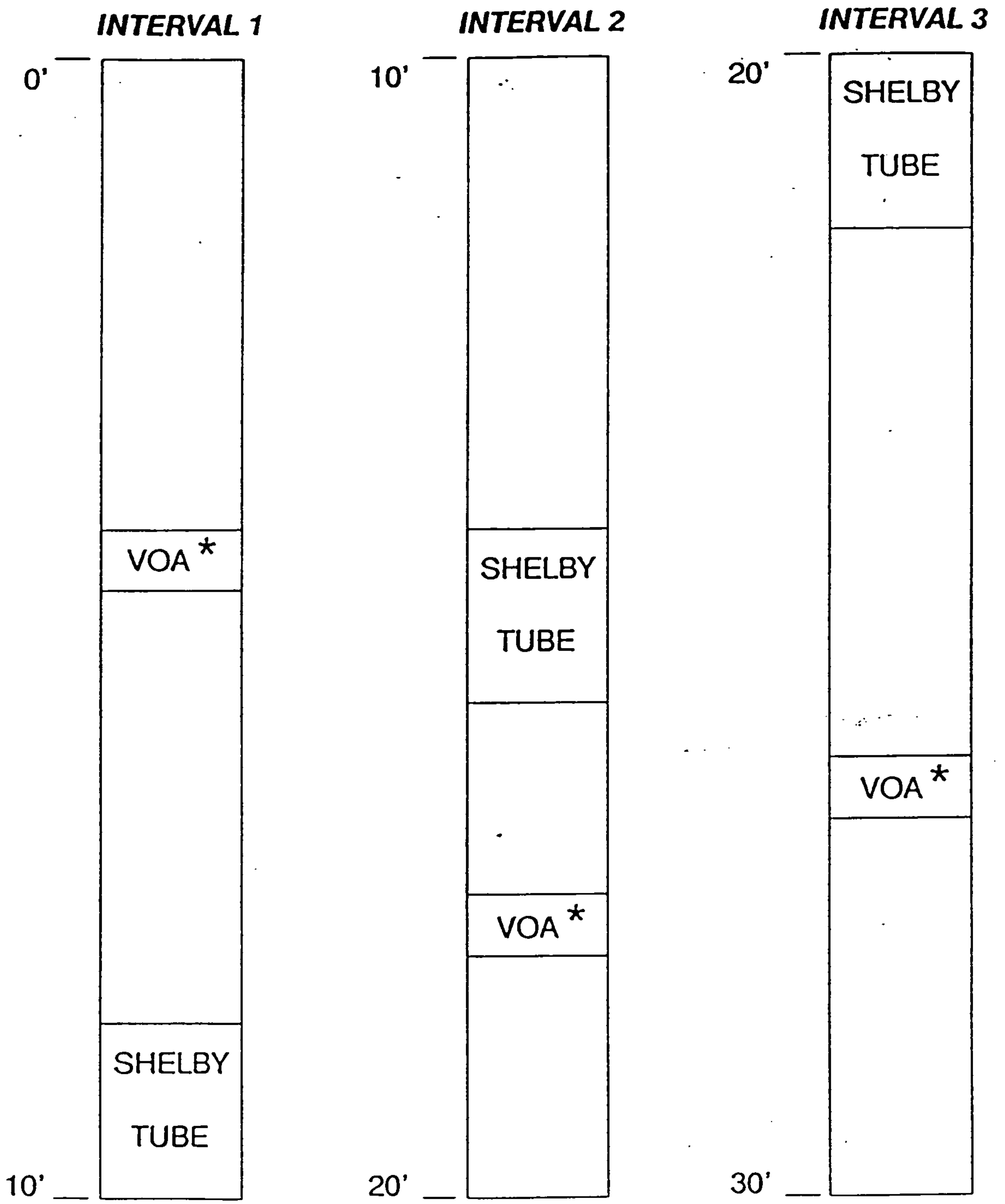
NOTE
(a) This test is performed on material obtained from in situ density determination tests.

TABLE 3. GEOTECHNICAL/PHYSICAL TEST SCHEDULE (continued)

ASTM Designation	Performed By	Minimum No. of Tests	Required Completion Date	Minimum Sample Size	Sample Location Within Pit
D2850-82 (UU Triaxial)	Geotechnical Subcontractor	6	8 weeks after receipt of samples	6 core sections, 9″ length, one each pit 1-4 and two from burn pit	MID waste depth at each pit boring
D2434-68 Constant Head Permeability	Geotechnical Subcontractor	6	8 weeks after receipt of samples	6 core sections, 6″ length, one each pit 1-4 and two from burn pit	MID waste depth at each pit boring
In situ density determination (No ASTM designation)	Geotechnical Subcontractor	39	8 weeks after receipt of samples	39 core sections, 8″ length, all 13 borings	1/3 and 2/3 waste depth thickness from waste surface, each pit boring

TABLE 4

Location	Required Analyses	No. of Samples	Reference Section
All borings, composite of intervals 2 and 3, respectively	Full Radiological	26	2.3.4 Source Characteristics
	Full HSL, less VOA Dioxins Furans and Tributyl Phosphate	26	
All borings discreet six-inch samples from intervals 1, 2 and 3	HSL VOA	39	2.3.4 Source Characteristics
All borings, composite of entire borehole less Shelby tube intervals	TCLP Extraction: Full Radiological/ VOA/BNA/Pesticides/ PCB/Metals	13	2.3.3 Geochemical
	Uranium Differential Leaching	13	
	Total Organic Carbon	13	
	Grain Size Analysis	13	
All monitor wells	Full Radiological	13	2.3.5 Leachate Characteristics
	Full HSL, dioxins, furans, and TBP	13	



NOTES:

- All Shelby Tubes for Geotechnical/Physical Properties
- All other unlabeled materials within an interval are composited for that interval.
- Assume estimated Waste Zone of 30 feet with identifiable overburden discarded.

* - VOA are from the highest HNu reading in the interval.

FIGURE 1 - TYPICAL BOREHOLE SAMPLE SEQUENCE

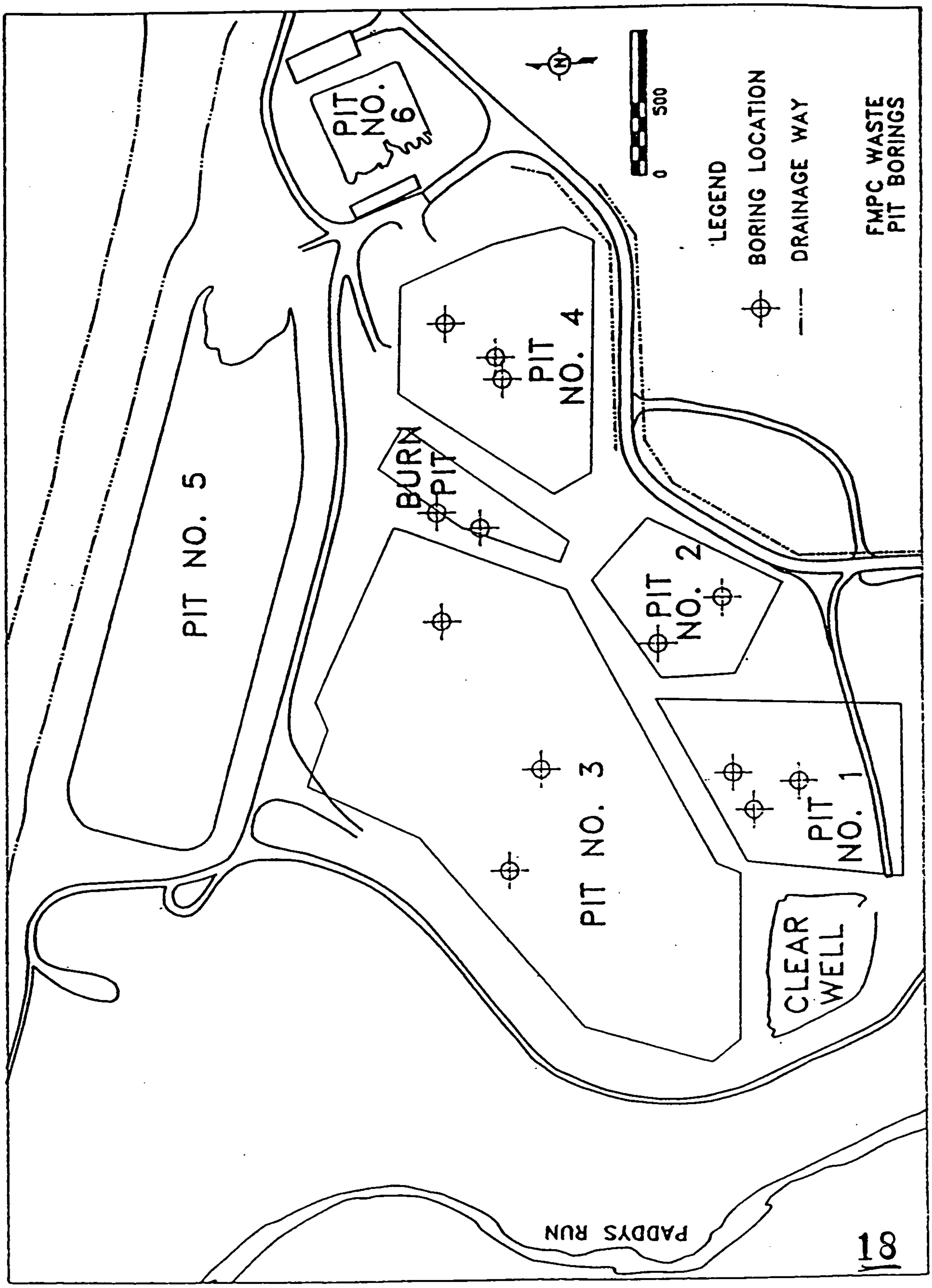

PIT NO. 6
PIT NO. 5
PIT NO. 4
BURN PIT
PIT NO. 3
PIT NO. 2
PIT NO. 1
CLEAR WELL
PADDYS RUN
0
500
LEGEND
BORING LOCATION
DRAINAGE WAY
FMPC WASTE PIT BORINGS
18

FIGURE 2.