M-623

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey

US Army Corps of Engineers®

M-623

United States Government **Department of Energy**
Oak Ridge Operations Office

memorandum

DATE: April 28, 1997

REPLY TO ATTN OF: CC-10:ALRothrock

SUBJECT: **FREEDOM OF INFORMATION ACT REQUEST (OR 97-095)**

TO:

Janice Fife, FOIA Point of Contact, Procurement and Contracts Division
Steve Oldham, FOIA Point of Contact, Former Sites Restoration Division

The attached Freedom of Information Act (FOIA) request is being sent to you for action as responsive records appear to be in your organization.

If you expect that the scope of your response to this request will involve more than two hours search and review and/or if reproduction of one copy is expected to exceed 400 pages, please contact me with an estimate before actually beginning to accumulate records.

Please insure that an adequate search is made of the files under your jurisdiction and advise our office about the releasibility of documents found to be responsive. Please forward one undeleted copy of the responsive records to me.

If you need further guidance on locating and reviewing documents relating to this request or feel you cannot meet the due date of May 6, 1997. Please contact Linda Chapman at 576-2129 or me at 576-1216.

Thank you for your cooperation and assistance.

PLEASE REFERENCE THE NUMBER ASSIGNED TO THIS REQUEST IN ANY CORRESPONDENCE OR TELEPHONE INQUIRIES.

Amy L. Rothrock

Amy L. Rothrock
FOIA Officer

Attachment:
Request

M-623

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-91OR21949

Sampling and Analysis Plan for the Soil Washing Test Project of Wayne and Maywood Soils at the K-25 Site

Oak Ridge, Tennessee

October 1995

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SAMPLING AND ANALYSIS PLAN FOR THE SOIL WASHING TEST PROJECT OF THE WAYNE AND MAYWOOD SOILS AT THE K-25 SITE

October 1995

Prepared for

United States Department of Energy
Oak Ridge Operations Office
Under Contract No. DE-AC05-91OR21949

By

Bechtel National, Inc.
Oak Ridge, Tennessee

Bechtel Job No. 14501

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ACRONYMS

ASTM	American Society for Testing and Materials
BNI	Bechtel National, Inc.
DOE	Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
ID	identification number
LCS	laboratory control sample
NIST	National Institute for Standards and Technology
QA	quality assurance
QC	quality control
TCLP	toxicity characteristic leaching procedure
VORCE	volume reduction/chemical extraction

UNITS OF MEASURE

cc	cubic centimeter
°C	degrees Celsius
ft	feet
g	gram
gal	gallon
gpm	gallons per minute
h	hour
in.	inch
kg	kilogram
lb	pound
min	minute
mm	millimeter
pCi	picocurie
psig	pounds per square inch gauge
rpm	revolutions per minute
s	second

1.0 INTRODUCTION

The Formerly Utilized Sites Remedial Action Program (FUSRAP) is a U.S. Department of Energy (DOE) program created to manage radioactive contamination exceeding guidelines at a number of sites throughout the United States. These sites are contaminated with varying, but typically low, levels of radionuclides and other contaminants. Since FUSRAP began in 1974, numerous sites have been decontaminated by excavating contaminated soils and storing the soils in temporary or permanent storage facilities.

Remediation at selected FUSRAP sites is being conducted under guidelines of the Comprehensive Environmental Response, Compensation, and Liability Act that favor treatment (such as volume reduction) for remediation.

1.1 SOIL WASHING

A major portion of the material requiring remediation is contaminated soils, including the soils in storage piles and the soils likely to be generated during site remediation. Soil washing to reduce the volume requiring disposal has been demonstrated to provide significant technical and cost advantages at several sites.

DOE has instructed Bechtel National, Inc. (BNI) to conduct a pilot-scale treatability study using a soil washing [VORCE (volume reduction/chemical extraction)] plant originally designed and constructed by the U.S. Environmental Protection Agency (EPA). The main objective of this treatability study is to evaluate the use of physical separation systems as a means of separating contaminated soils from clean soils and determine the suitability of the unit for the FUSRAP sites. The test objectives and operation details of the soil washing are presented in the *Project Operations Plan for the Soil Washing Test Project of the Wayne and Maywood Soils at the K-25 Site* (BNI 1995). This sampling plan outlines the sampling objectives, sampling rationale and approach, and analytical methods.

The soil washing test will be conducted at DOE's K-25 site in Oak Ridge, Tennessee, as shown in Figure 1.. This site is part of the Oak Ridge Reservation where the gaseous diffusion process for uranium enrichment was formerly operated. Figures and tables supporting the text in this plan are located at the end of the document.

1.2 PRINCIPLES OF SOIL WASHING

Soil washing is an ex situ treatment process that involves the removal of contaminants from soils using combinations of classification and mechanical scouring. It is based on the principle that the contaminants are associated primarily with soil components finer than about 200 mesh (0.075 mm), including fine silts, clays, and soil organic matter. A schematic of the VORCE soil washing machine is presented in Figure 2.

This system consists of a grizzly to screen out and wash material larger than about 100 mm (4 in.) in diameter, an attrition scrubbing unit to abrade contaminants from larger particles (cobbles, gravel, and sand), a trommel and high-pressure water spray to wash and screen material larger than 6 to 8 mm (0.23 to 0.31 in.) in diameter, a classifier (hydraulic separation), a dewatering system consisting of a clarifier and filter, and a wash water treatment and recycle system. Fines and residues are stabilized, if necessary, before disposal.

1.3 SAMPLING OBJECTIVES

Samples will be collected and analyzed during the treatability study, and the resulting data will be used to support the overall objectives of the project as follows:

- verify the time required for the soil washing plant to reach steady-state operation after plant startup;

- determine whether the clean streams from the soil washing plant meet cleanup objectives of 15 pCi/g, with a goal of 5 pCi/g for the sum of radium-226 and thorium-232;

- verify the anticipated health and safety aspects of plant operation with regard to site workers and the local community;

- estimate costs of full-scale operation at various cleanup levels (i.e., 15 pCi/g and 5 pCi/g);

- determine whether chemical contaminants (i.e., metals) are becoming concentrated in the filter cake material to the extent that it becomes a mixed waste; and

- recommend possible modifications to improve full-scale performance for a production unit.

The approach for collecting analytical data to meet these objectives is presented below.

Objective 1: Verify the time required for the soil washing plant to reach steady-state operation after plant startup

Clean soil tests conducted on the plant were used to determine when steady-state conditions were reached. Additional tests will be performed using radioactively contaminated soils to verify the time required for the soil washing plant to reach steady-state conditions at the plant discharge points. Materials generated by the plant before it reaches steady-state operation may not be representative of the material generated when steady state is reached. It is important to identify steady-state conditions because a full-scale soil washing plant will operate in the steady-state mode most of the time.

Objective 2: Determine whether the clean streams from the soil washing plant meet cleanup objectives of 15 pCi/g, with a goal of 5 pCi/g for the sum of radium-226 and thorium-232

Samples will be collected and analyzed for thorium-232 and radium-226 to determine whether the clean streams of the pilot-scale soil washing plant meet the cleanup objectives of 15 pCi/g and 5 pCi/g for the sum of the two radionuclides. This information will assist in determining the potential for soil washing as a treatment technology for the Wayne and Maywood, New Jersey, sites. In addition, the effectiveness of equipment components can be evaluated to determine whether they are appropriate for a full-scale soil washing plant. Samples will be analyzed in an onsite laboratory using a high-purity germanium detector for gamma spectroscopy. The sampling methods and analyses are discussed in Section 2.0.

Objective 3: Verify the anticipated health and safety aspects of plant operation with regard to site workers and the local community

Any potential health and safety effects on site workers and the community caused by the operation of the soil washing plant will be evaluated by continuously monitoring airborne concentrations of radionuclides at the site perimeter. The health and safety effects on site workers are addressed by evaluating project hazards, safety training, site safety meetings, and continuous monitoring by the site safety and health representative. Noise levels and breathing zone air will be monitored during plant operation to measure site workers' exposure. Environmental monitoring is discussed in Section 2.8.

Objective 4: Estimate costs of full-scale operation at various cleanup levels (i.e., 15 pCi/g and 5 pCi/g)

Data sheets will be used to track the operating costs of the soil washing plant. These data will provide cost information on plant operation, sampling and analysis, health and safety, and overhead. This information can then be used to estimate costs for a full-scale soil washing plant for comparison with other site cleanup options. Section 2.9 describes the method used to collect cost data.

Objective 5: Determine whether chemical contaminants (i.e., metals) are becoming concentrated in the filter cake material to the extent that it becomes a mixed waste

To determine whether metals are becoming concentrated in the smaller particle size streams (generating a new classification of wastes that are more difficult to dispose of), samples will be collected at the two output streams of the soil washing plant where metals are most likely to become concentrated. Provisions for collecting chemical samples are outlined in Section 2.0.

Objective 6: Recommend possible modifications to improve full-scale performance for a production unit

Data will be collected to assess the operating efficiency of the various plant components based on particle size distribution, wet bulk density, cleanup level, and percent solids. These data will be used to evaluate potential modifications to a soil washing plant to improve its performance. Data from the test will be evaluated for contaminant partitioning (to a limited degree) and to determine whether the strategy and unit processes used in this test are appropriate for a full-scale plant. Section 2.0 describes how the data will be collected and analyzed.

2.0 SAMPLING APPROACH AND RATIONALE

The soil washing test will be performed in two stages. Initially, clean soil will be tested for developing partitioning curves; during the second stage, New Jersey FUSRAP soil samples will be evaluated for efficiency in removing contaminants.

2.1 CLEAN SOIL TEST

During the clean soil test, samples will be collected around each process unit so that a mass balance can be performed and partition curves developed. Noise profiles and air sampling will be performed during these operations to determine whether there are any potential hazards that will require special attention during the contaminated soil tests.

Data from the clean soil test will be used to generate the partitioning curves for each process unit. Based on this information, process settings will be developed for providing the appropriate separations required by the machine. Separation efficiency over time will be measured to determine when the machine reaches steady state. These data will be invaluable when contaminated soil tests are conducted and when the cut points of the process are evaluated.

2.2 CONTAMINATED SOIL TEST

The radioactively contaminated soils from New Jersey will be received at the K-25 site in batches of six intermodal containers. For the purpose of the soil washing test, each container will be assumed to be homogeneous, but not necessarily between containers. Samples will be collected from each container for particle size and radiological analyses. The contaminated soil test will be performed in two phases: the equipment adjustment phase and the performance phase.

2.2.1 Equipment Adjustment Phase

At the beginning of the equipment adjustment phase, the machine will be set up using data obtained from clean soil tests conducted during the summer of 1995. After reaching steady state, the machine will be run for 4 hours. During this period, samples will be collected at regular intervals from the sampling locations identified in Table 1. The analytical requirements and the sample volumes are discussed in Table 1. Also during the equipment adjustment phase, selected fractions will be analyzed with quick turnaround for radium and thorium, using gamma spectroscopy. The coarse trash (>4 in.) is not expected to carry any contamination. However, for the purpose of evaluating the trommel, selected samples greater than 4 in. will be analyzed. A minimal number of samples will be required at this point because most of the preliminary data (except for radiological data) from the machine have been obtained from the clean soil tests.

Samples collected during this equipment adjustment phase will serve two purposes: (1) to determine effectiveness of the machine in treating radioactively contaminated soils, and (2) to establish the operating conditions of the process units for the soil so that the following performance phase can be conducted efficiently.

2.2.2 Performance Phase

During the performance phase, five to eight individual performance runs of approximately 8 to 10 hours each will be conducted. If required, an extended run of 12 to 16 hours will also be performed. Figure 3 shows the sampling locations during the performance phase. The analytical requirements are listed in Table 2. Samples will be collected at the following locations for each run during the performance phase: feed, trommel oversize (Bin #1), secondary classifier oversize (Bin #2), SWECO screen oversize (Bin #3), and filter press solids (Bin #4).

The sampling strategy will be used to verify system steady state and any process changes that may occur with time. The actual time required to reach steady state will be determined during the clean soil tests and verified during the performance phase. Samples will be collected at 15 to 30 minute intervals and composited approximately every hour to determine actual versus projected steady-state times.

After steady-state conditions are achieved, samples will be collected every 15 minutes during steady state and composited into one sample. The composite sample will be analyzec for radium and thorium, percent moisture, and particle size. Samples will be collected at al five locations identified above.

Samples will be analyzed by K-25 analytical services personnel for radioactive constituents, particle size distribution, wet bulk density, and percent solids. In addition, limited analyses for toxicity characteristic leaching procedure (TCLP) metal constituents, which are regulated by the Resource Conservation and Recovery Act, will be performed on composite samples collected at the locations identified previously in this section (Figure 3). These samples will be sent to a certified offsite laboratory for chemical analysis. Sampling frequency during the performance phase of testing is specified in Section 2.4. Real-time samples for mass flow rate and bulk density will also be collected using field equipment su as a bulk density scale, analytical balance, and stop watch.

The data from these samples will be used to determine removal efficiency as explaine in the test evaluation plan and to determine contamination levels in these streams. The dat developed from the clean soils and the equipment evaluation phase will be used to make process settings for each succeeding run and to perform a mass balance.

During both phases of operation, air monitoring for radioactive contaminants will be conducted to verify compliance with DOE Order 5480.11 (DOE 1988) as codified in 10 CFR 835. The order and final rule specify maximum allowable airborne radioactivity i unrestricted areas. Environmental monitoring is discussed in Section 2.8.

2.3 SAMPLE COLLECTION - EQUIPMENT ADJUSTMENT PHASE

Data will be collected during the equipment adjustment phase to assess the operating performance of individual plant components. The data collection forms shown in Figures 4 through 10 will be used to record data collected during this phase. The method outlined below will be used for collecting samples during the equipment adjustment phase.

Sampling locations, sample size, sieve sample size, and analyses are discussed in Table 1. The primary analytical method to be used during the equipment adjustment phase will be particle size distribution to determine the separation efficiency. Other analyses will be performed, as shown in Table 1, to assist in evaluating component performance.

2.4 SAMPLE COLLECTION - PERFORMANCE PHASE

Data will be collected during the performance phase of testing to assess steady-state operation of the plant, the ability of the plant to meet cleanup objectives, and the concentrations of metals in selected output streams.

The initial performance phase test runs will evaluate steady-state operation of the plant by analyzing samples at each sampling location listed in Table 2. The first sample will be taken as soon as flow has been established at each sampling location. The material collected after each hour of operation will be analyzed to determine whether the plant is operating within a stable range. The expected stable range of operation will be determined based on the variability of the feed material particle size distribution and the concentrations of radioactive materials.

After the steady-state evaluation test runs, additional performance phase test runs will be performed. Composite samples will be collected at the input and output streams of the soil washing plant as identified in Figure 3. Test runs will include evaluation of samples to determine whether the clean streams meet the cleanup objectives of 15 pCi/g and 5 pCi/g for the sum of radium-226 and thorium-232; selected performance runs will also be analyzed to determine whether metal contaminants are concentrating in the filter cake and other selected streams to the extent that they become a mixed waste.

At sampling location 1 (the input stream), grab samples will be collected from material in the front-end loader bucket before the material is placed in the hopper. The total amount of material collected (i.e., the sum of the samples collected from the front-end loader bucket) during the performance run will be at least 100 kg (220 lb). After each sample is collected, it will be placed in a 19-L (5-gal) container, which will then be sealed until another sample is collected from the front-end loader. When each 19-L (5-gal) container is full, it will be sealed and a new container will be provided. At the end of the performance test run, the material in the containers will be mixed to form one 100-kg (220-lb) composite sample. The composite sample will be riffled to provide a 1,000-g (2.2-lb) sample, which will be analyzed for radioactive material. The remaining material will be used for the physical properties test outlined in Section 2.5.2.

At sampling locations 3, 8, and 12, where output is continuous, samples will be collected every 30 minutes for approximately 12-24 h. The first sample will be collected approximately 30 minutes after flow has been established at each sampling location; the last sample will be collected approximately 30 minutes before the flow ceases. Samples will be collected from t = 30 minutes to t = steady-state conditions to ensure that these samples are not part of the final material. Each sample will be collected in a 7.6-L (2-gal) container following the procedure described below:

- The face of the container will be presented at right angles to the outfall of the stream.
- The opening of the container will be large enough to cover the entire stream.
- The container will be moved across the stream at a constant speed.
- After the sample is collected, the material will be emptied into a 19-L (5-gal) container, which will be covered with a lid to prevent contamination of the sample.

The minimum amount of material to be collected at each sampling location is summarized in Table 2. This sample size represents the total amount of material to be collected at each sampling location for the performance run (combined material collected every 15 minutes). At the end of the performance run, the material from each location will be riffled to make one 1,000-g (2.2-lb) sample for radiological analysis. The remaining material will be used for the physical properties test outlined in Section 2.5.2.

Sampling location 17 operates on a batch basis, with the filter cake press discharging to a conveyor belt approximately once every hour. Each time the filter press empties, the conveyor belt will be stopped, and a sample will be collected by scraping the material from several different locations on the belt and placing it in a container. The conveyor belt will then transport the remaining material to a collection bin.

A total of at least 5 kg (11 lb) of material will be collected from sampling location 17. At the end of the performance run, this 5-kg (11-lb) sample will be riffled to form one 1,000-g (2.2-lb) sample for radiological analysis. The remaining material will be used for the physical properties test outlined in Section 2.5.2.

Before startup of the soil washing plant (before the equipment adjustment and performance run phases), two samples of the smallest size fractions of contaminated soil will be prepared for chemical analysis and other soil characterization, as outlined in Table 1. This analysis will determine whether the contaminated material contains metals that can concentrate in the finer particle size streams and thereby create a mixed waste.

To analyze the feed material for metals concentration, a composite sample containing a minimum of 10 kg (22 lb) of material will be collected from the same location of the pile as the material to be used for the soil washing test. Samples will be collected using stainless steel equipment that has been decontaminated. The material will be wet sieved in accordance with American Society for Testing and Materials (ASTM) Procedure D422. One sample will contain at least 1,000 g (2.2 lb) of material that is less than 200-mesh particle size. The other sample will contain at least 1,000 g (2.2 lb) of material that is less than 325-mesh particle size. After the two samples have been prepared for analysis, they will be placed in glass jars provided by the subcontracted analytical laboratory and cooled to 4°C (39.2°F). The samples will then be shipped to the laboratory for TCLP metals analysis.

Additional samples will be collected and analyzed for TCLP metals. Output from sampling locations 3, 8, and 12 will be stored in one pile and the output from sampling location 17 in a separate pile until all performance runs are complete. After the performance run phase, a sample will be collected from each pile; the sample will consist of at least 10 kg of material. This material will be mixed and riffled to form one composite sample for each pile. At least 1,000 g of the composite sample will be placed in glass jars provided by the subcontracted analytical laboratory and cooled to 4°C (39.2°F). These samples will then be shipped to the laboratory for TCLP metals analysis.

A sample identification number will be assigned to each sample, using the method outlined in Section 2.7, except that the identifier field for the phase of operation will be replaced with the letter "M" to indicate that the sample was analyzed for metals; the sample location field will be replaced with "CL" for the sample containing material from locations 3, 8, and 12 and "DR" for the sample containing material from location 17. The remaining sample material not used for the metals analysis will be archived and stored onsite.

2.5 ANALYTICAL METHODS

Samples will be collected as previously described. This section identifies the analyses to be performed on the samples. Tables 1 and 2 summarize the sampling locations and analyses for each location during the equipment adjustment and the performance phases, respectively.

2.5.1 Radiological Analyses

Samples will be analyzed for radioactive material using the germanium detector by gamma spectroscopy.

During the equipment adjustment phase, selected samples will be analyzed for radioactive constituents. The first analysis will be performed on the wet sample (i.e., before the sample is prepared for laboratory analysis). These samples chosen by the senior technical representative will be analyzed to determine the radioactivity removal efficiency by a particular unit operation. Samples of particle greater than 0.64 cm (0.25 in.) will require size reduction before they are analyzed.

Samples collected during the performance phase will be counted after the sample has been prepared. Ten percent of the samples collected will be sent offsite for quality assurance verification at a certified laboratory.

Separate samples collected from each event during the performance phase will be archived and stored onsite until the test is completed and the final reports are approved and issued. After a sample is analyzed for radioactive contamination, the sample container will be sealed and stored. All the samples associated with a specific performance run will be stored in the same box with a copy of the data tracking form for each sample. The box will be sealed and labeled to indicate the date the samples were collected and the performance run during which they were collected.

The data quality objective (DQO) for wet samples is DQO II, and for dry samples it will be DQO III.

2.5.2 Other Analyses

In addition to radiological analysis, the remaining material from each sampling location will be analyzed for particle size distribution, specific gravity, percent solids, and wet bulk density (see Tables 1 and 2 for specific analyses for each sampling location). These data will be used to evaluate plant performance and to complete the mass balance. The test methods for each of these analyses are listed below; the data collection forms are shown in Figures 4 through 10.

TEST	METHOD
Particle Size Distribution[1]	ASTM[2] D422
Specific Gravity	ASTM[2] D854
Moisture	ASTM[2] D2216
Bulk Density	DOA EM[3] 1110-2-1906
TCLP Metals	Extraction using Method 1311 in SW-846

[1]For this test, the 200-mesh and 325-mesh size fractions will also be determined by sieving.
[2]American Society for Testing and Materials (ASTM 1991)
[3]Department of Army Engineering Manual (DOA 1970)

2.6 DECONTAMINATION

To ensure that samples are not cross-contaminated and that unwanted variables are not introduced to the sample, all sampling equipment and laboratory equipment will be decontaminated before reuse.

2.7 FIELD NOTES AND DOCUMENTATION

During operation of the soil washing plant, the following information will be recorded in the logbook for each performance test run:

- operating parameters;
- time and date of adjustments/modifications;
- length of performance test run;
- samples collected, including sampling location numbers, time, and date;
- sample identification number (ID) (assigned using the procedure outlined below) and the results of any onsite analyses performed on that sample; and
- any additional information that is deemed important (e.g., special occurrences, problems encountered, description of how the soil washing plant operated, equipment failures).

All samples collected during the soil washing project (for both the equipment adjustment and the performance phases) will be assigned a unique sample identification number. The ID will have the following form:

XXX-AA-BBE (or BBP)

where:	XXX	=	the WBS for the site where the soil originated; 137 for Wayne or 138 for Maywood
	AA	=	the sampling location number
	BBE or BBP	=	the sample number and the phase of the test project; **BB** will be an increasing sequential number for each sampling location; depending on the phase of operation, either an "E" (for the equipment adjustment phase) or "P" (for the performance run phase) will be used.

For example, the ID for the fifth sample collected while the plant is in operation using soil from the Wayne site at sampling location 8 during the performance runs will be:

137-08-05P

The sample ID for the third sample collected at location 5 using soil from the Maywood site would be:

138-05-03

Samples and their related equipment evaluation or performance run number will be recorded in the daily field log.

All field data collection forms needed for a performance run will be bound in a notebook. At the end of the soil washing demonstration project, all data collection forms, logbooks, and field notes created during field activities will be forwarded to the BNI Oak Ridge office and entered into the project document control system.

2.8 ENVIRONMENTAL MONITORING

During the soil washing demonstration project, continuous air monitors will be placed around the site boundary to assess offsite releases via air dispersion. Figure 11 shows the locations of the air monitors for the site. These locations were determined by reviewing prevailing wind patterns and placing the monitors downwind. The monitors work by continuously pulling air across a filter. Each filter will be removed after 8 hours and counted for gross alpha activity. Additionally, local monitoring will be conducted to evaluate worker exposure and releases from equipment.

2.9 COST DATA

Data will be collected to determine unit operating costs for plant operation, sampling and analysis, health and safety (including perimeter monitoring and personnel training), and overhead. Data collection forms (Figures 12 through 15) will be used to record information collected during the performance runs. These data will be evaluated and analyzed to project the costs of production-size soil washing plants. Using these data, judgments will be made on the scale-up factors that will be used to estimate full-scale operation costs. For example, the number of operators required to run a pilot plant may be the same as the number required for a full-scale soil washing plant. In that case, the scale-up factor would be a multiplier of one. Electricity usage is directly dependent on the size of motors used. For estimation of full-scale electricity costs, the multiplier would be based on the size of motors in a full-scale plant. The following cost data will be recorded:

- Plant operation
  - Number of plant operators and their duties
  - Length of test run
  - Utility usage (power, water)
  - Consumables (e.g., lubricating oils, replacement parts)
  - Support equipment used (e.g., front-end loader), support staff, and operating time

- Sampling and analysis
  - Laboratory personnel and their duties
  - Number of samples analyzed onsite
  - Number of samples analyzed offsite

- Health and safety
  - Health and safety personnel and their duties
  - Personal protective equipment requirements
  - Personnel monitoring requirements

- Overhead
  - Community relations support personnel
  - Other FUSRAP personnel present during the test
  - Vendor representatives present during the test
  - Any other personnel present during the test

3.0 QUALITY CONTROL

This section describes the quality assurance/quality control (QA/QC) procedures used to ensure that the data gathered from the soil washing plant performance runs are scientifically sound and of known precision. For radiological and chemical parameters, blanks, duplicates, spikes, and other QC samples will be used to measure field and laboratory performance.

3.1 QUALITY CONTROL REQUIREMENTS - RADIOLOGICAL

The QC requirements for laboratory control samples (LCSs), duplicate sample analyses, matrix blank analyses, minimum detectable activities, and aliquot sizes are described below. These requirements apply only to dry samples submitted for gamma spectral analysis.

3.1.1 Laboratory Control Samples

- LCSs will be analyzed at a frequency of 1 for every 20 samples analyzed or at least 1 each day during which a dry sample is analyzed.

- The LCS will have the same matrix, geometry, and aliquot size as the samples.

- Using the statistical counting error, the observed LCS value will be within the 3-sigma control limits of the expected LCS value.

3.1.2 Duplicate Samples

- Duplicate samples will be analyzed at a frequency of 1 for every 10 samples analyzed or at least 1 each day during which a dry sample is analyzed.

- The duplicate analysis will be made on two different aliquots of the same prepared, homogeneous sample. Therefore, when a performance run is completed, one extra 1,000-g (2.2-lb) sample will be collected. This sample will be collected from the sample material after it has been riffled. It may be taken from the material collected at any of the 5 sampling locations (1, 3, 8, 12, or 17) for a performance run. It will be prepared in the same manner as the other radiological samples.

- The count duration for duplicate samples will be the same as for other samples.

3.1.3 Matrix Blanks

- Matrix blanks will be analyzed at a frequency of 1 for every 20 samples analyzed or at least 1 each day during which a dry sample is analyzed.

- The matrix blank will consist of the same matrix, geometry, and aliquot size as the samples.

- The count duration for matrix blanks will be the same as for other samples.

3.1.4 Minimum Detectable Activities

Count durations for samples, duplicates, blanks, and background measurements will be optimized so that the minimum detectable activities achieve the required detection limit of 1 pCi/g for radium-226 and thorium-232 to achieve the cleanup goal of 5 pCi/g.

3.2 QUALITY CONTROL REQUIREMENTS - CHEMICAL

For samples sent offsite for chemical analysis, matrix spikes and matrix spike duplicates will be used. Matrix spikes and matrix spike duplicates will be provided at the rate of 1 for every 20 samples analyzed or one per batch.

3.3 EQUIPMENT CALIBRATION

All equipment and instruments used in the field sampling program will be maintained and calibrated to operate within manufacturers' specifications and to ensure that the required traceability, sensitivity, and precision of the equipment and instruments are maintained. Reference calibration standards will be certified to be traceable to the National Institute for Standards and Technology (NIST) or equivalent.

For the high-resolution gamma detector system, the following specifications for calibration will be used.

- The standard reference materials used to prepare the efficiency curves, energy calibration curves, and check sources will be traceable to NIST or equivalent.

- The characteristic efficiency curve of the detector will be determined by analyzing standards for each sample matrix and geometry that have strong gamma lines covering the energy range desired. This curve will be determined before any samples are analyzed, and the detector will be recalibrated at least annually thereafter.

- Instrument background spectra will be measured with the matrix blank in the counting chamber showing background counts obtained in each peak of interest for a count duration that is at least as long as the sample count duration. The background spectra will be measured at least weekly.

For chemical analyses, all laboratory analytical equipment will be calibrated by the methods and frequencies specified in the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 1986).

A calibration/maintenance file will be kept on all equipment used for field analyses. The file will include the following information for equipment requiring periodic calibration and instruments requiring daily calibration:

- name of the equipment;
- equipment identification/serial number;
- manufacturer;
- calibration frequency;
- date of last calibration and date when next calibration is due; and
- manufacturers' operating, calibration, and maintenance instructions.

3.4 OFFSITE VERIFICATION ANALYSES

To evaluate the performance of the onsite analytical procedures for radioactive material, at least 10 percent of the total soil samples collected during the entire campaign will be sent offsite for verification analysis.

REFERENCES

American Society for Testing and Materials, 1991. *1991 Annual Book of ASTM Standards, "Soil and Rock; Dimension Stone; Geosynthetics,"* Vol. 04.08, Philadelphia, Pa.

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Department of Army, Corps of Engineers, 1970. *Engineer Manual*, EM 1110-2-1906, Washington, D.C. (November 30).

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Environmental Protection Agency (EPA), 1983. *Methods for Chemical Analysis of Water and Wastes*, Section 200, "Metals," EPA/600/4/70/020, Cincinnati, Ohio (March).

EPA, 1988. *EPA Contract Laboratory Program, Statement of Work for Inorganics Analysis*, Washington, D.C. (July).

EPA, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Volume II, SW-846, Washington, D.C. (November).

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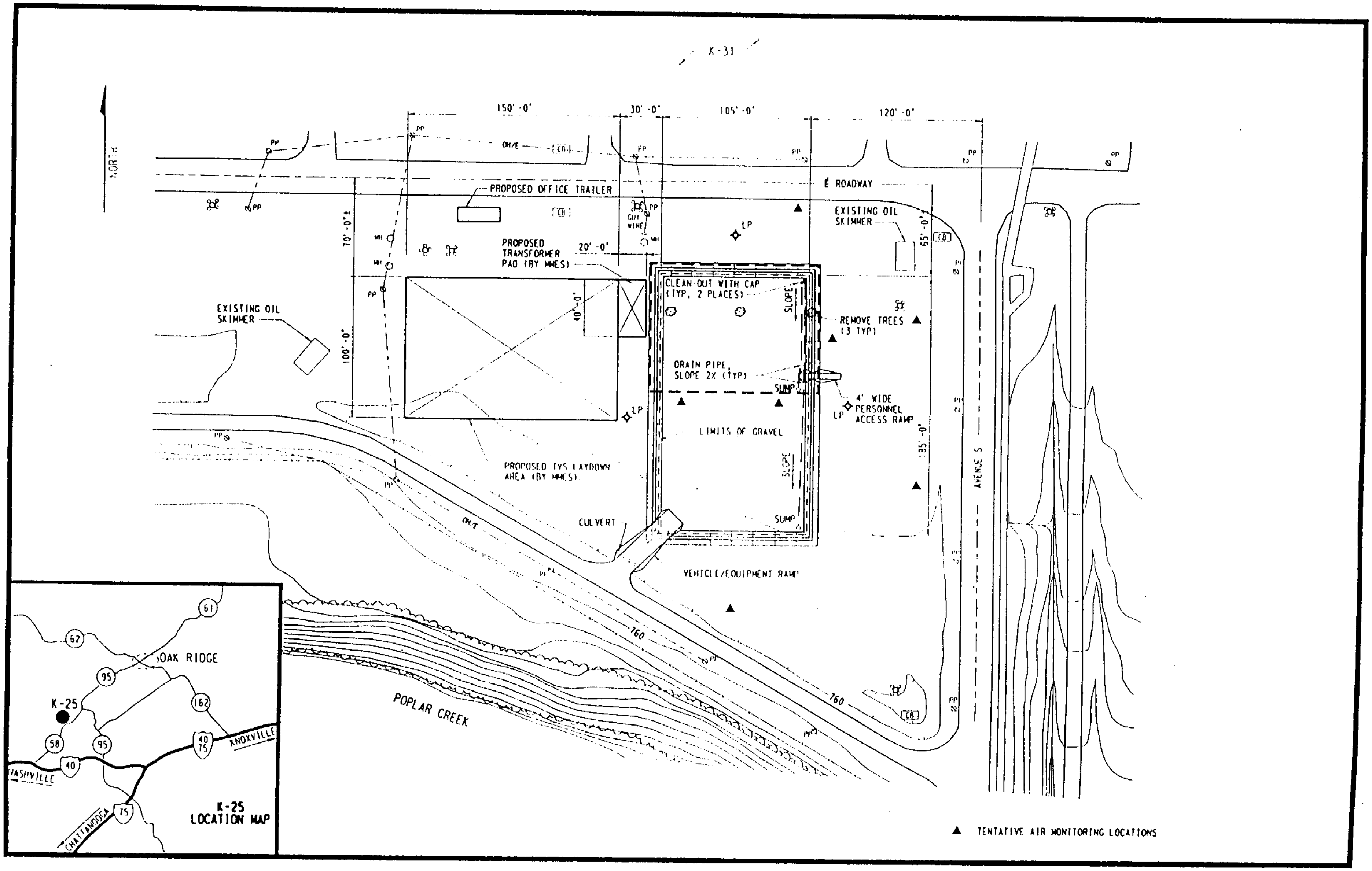
FIGURES



138F166.DGN

Figure 1
Location of Soil Washing Test at the K-25 Site Using Contaminated Soil

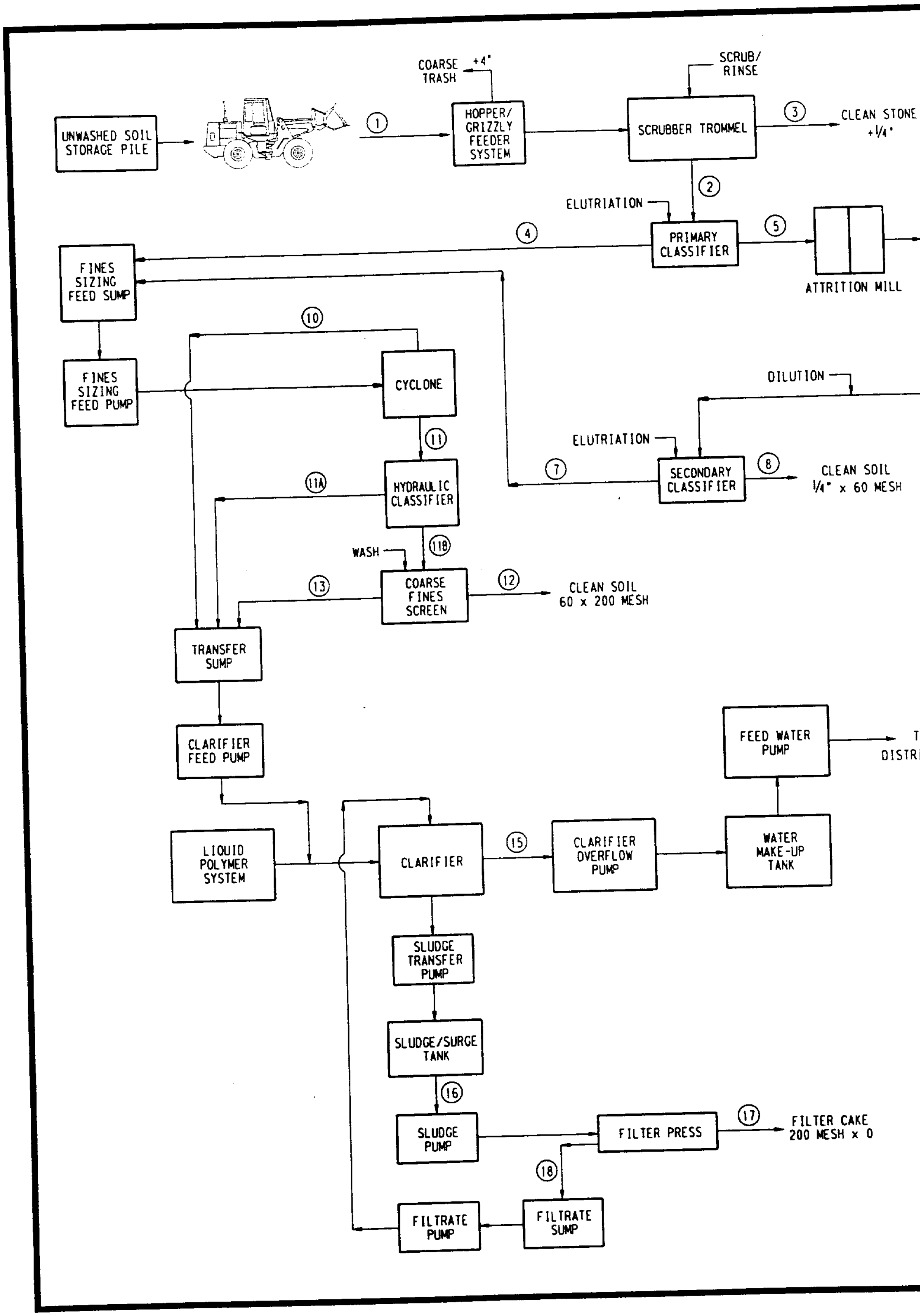


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Figure 2
Sampling Locations for the Equipment Adjustment Phase

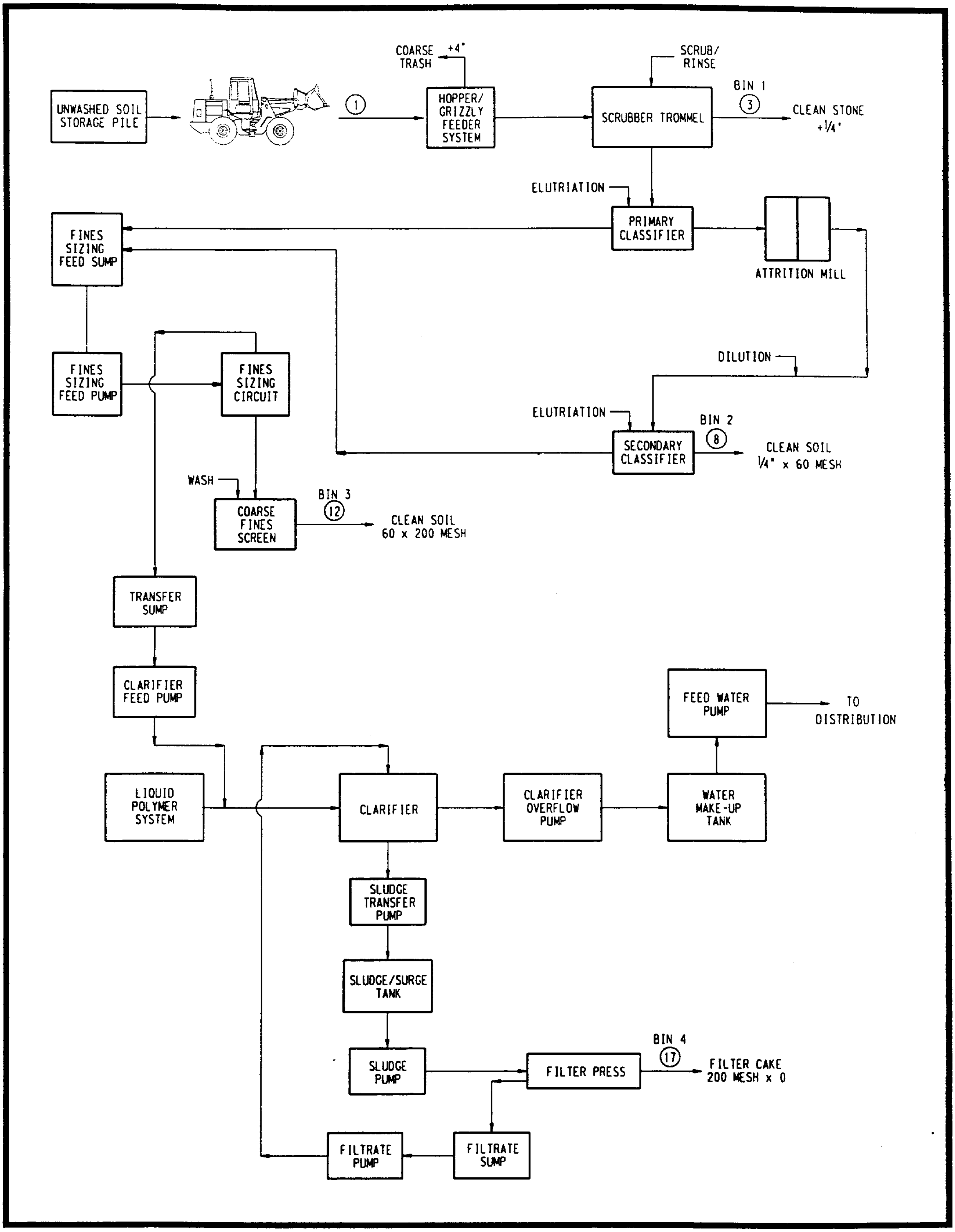

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Figure 3
Sampling Locations for the Performance Phase

TEST NO. ____________

SAMPLE ID: ______________

DATE: _____________

PARTICLE SIZE DISTRIBUTION[a] - Analysis No. 1

Size Interval	Weight (grams)	Weight (%)	C Cum
4" x 1/4"			
1/4" x 8 mesh			
8 x 20			
20 x 60			
60 x 100			
100 x 200			
200 x 325			
-325			
TOTAL			

[a]Dry basis

Figure 4
Particle Size Distribution Data Collection Form

TEST NO. ____________

SAMPLE ID: ______________

DATE: _____________

PERCENT SOLIDS - Analysis No. 3

Slurry + Tare Wt. (kg)	
Tare Wt. (kg)	
Slurry Wt. (kg)	
Dry Solids + Filter Paper Wt. (kg)	
Filter Paper Wt. (kg)	
Dry Solids Wt. (kg)	
Percent Solids (%)	

Figure 5
Percent Solids Data Collection Form

TEST NO. ____________

SAMPLE ID: ____________

DATE: ____________

MASS FLOWRATE - Analysis No. 4

EQUIPMENT ADJUSTMENT PHASE

A. LAB DATA

Time (sec)	
Slurry + Tare Wt. (kg)	
Tare Wt. (kg)	
Slurry Wt. (kg)	
Dry Solids + Filter Paper Wt. (kg)	
Filter Paper Wt. (kg)	
Dry Solids Wt. (kg)	
Percent Solids (%)	

B. CALCULATED DATA

Slurry Flowrate (kg/sec)	
Slurry Flowrate (lb/min)	
Solids Flowrate (lb/min)	

Figure 6
Mass Flow Rate Equipment Adjustment Phase Data Collection Form

TEST NO. ____________

SAMPLE ID: ______________

DATE: _____________

MASS FLOWRATE - Analysis No. 4

PERFORMANCE TEST

A. RECORDED DATA

Time - commencement of flow	
Time - termination of flow	
Time - flow duration (min)	
Area of Bin (ft^2)	
Height of Product (in)	

B. CALCULATED DATA

Volume (ft^3)	
Wet Bulk Density - Analysis #5	
Percent Solids - Analysis #3	
Solids Mass Flowrate (lb/min)	

NOTE: Solids Mass Flowrate = Volume x Wet Bulk Density x Percent Solids

Figure 7
Mass Flow Rate Performance Run Phase Data Collection Form

TEST NO. ___________

SAMPLE ID: ____________

DATE: ____________

BULK DENSITY - Analysis No. 5

Wet Solids + Tare Wt. (kg)	
Tare Wt. (kg)	
Wet Solids Wt. (kg)	
Volume of Wet Solids (cc)	
Wet Bulk Density (kg/cc)	
Wet Bulk Density (lb/ft^2)	

Figure 8
Wet Bulk Density Data Collection Form

TEST NO. ___________

SAMPLE ID: ___________

DATE: ___________

SPECIFIC GRAVITY - Analysis No. 7

Parameter	Value
Weight of dry sample (kg)	
Weight of pycnometer filled with water at T_x (kg)	
Weight of pycnometer filled with water and soil (kg)	
Temperature of pycnometer when W_b was determined (C)	

Figure 9
Specific Gravity Data Collection Form

TEST NO. ___________

DATE: ___________

EQUIPMENT OPERATING PARAMETERS

A. GENERAL

Description	Value[a]
Drag Conveyor Speed (ft/min)/Hz setting	
Trommel Screen Speed (RPM)/Hz setting	
Primary Classifier Speed (RPM)	
Attrition Mill Speed (RPM)	
Secondary Classifier Speed (RPM)	
Cyclone Operating Pressure (psig)/Vortex Diameter (IN)	
Sweco Screen Weight Lead Setting	
Clarifier Feed Magnetic Flow Meter (gpm)	
Feed Water Strainer No./Pressure Drop (psig)	

[a]Averaged over the day's run

B. WATER ADDITION

Location	Description	Flow (gpm)[a]
A	Grizzly	
B	Scrubber Feed Chute	
C	Scrubber Wash	
D	Trommel Rinse	
E	Trommel Back Wash	
F	P. Classifier Packing/Elutriation	
G	P. Attrition Mill Dilution	
H	S. Classifier Dilution	
I	S. Classifier Packing/Elutriation	
J	P. Classifier U/S Push Water	
K	S. Classifier U/S Push Water	
L	Cyclowash	
M	Hydraulic Classifier Teeter Water	

[a]Volumetric flow through each piece of the unit

Figure 10
Equipment Operating Parameters Data Collection Form

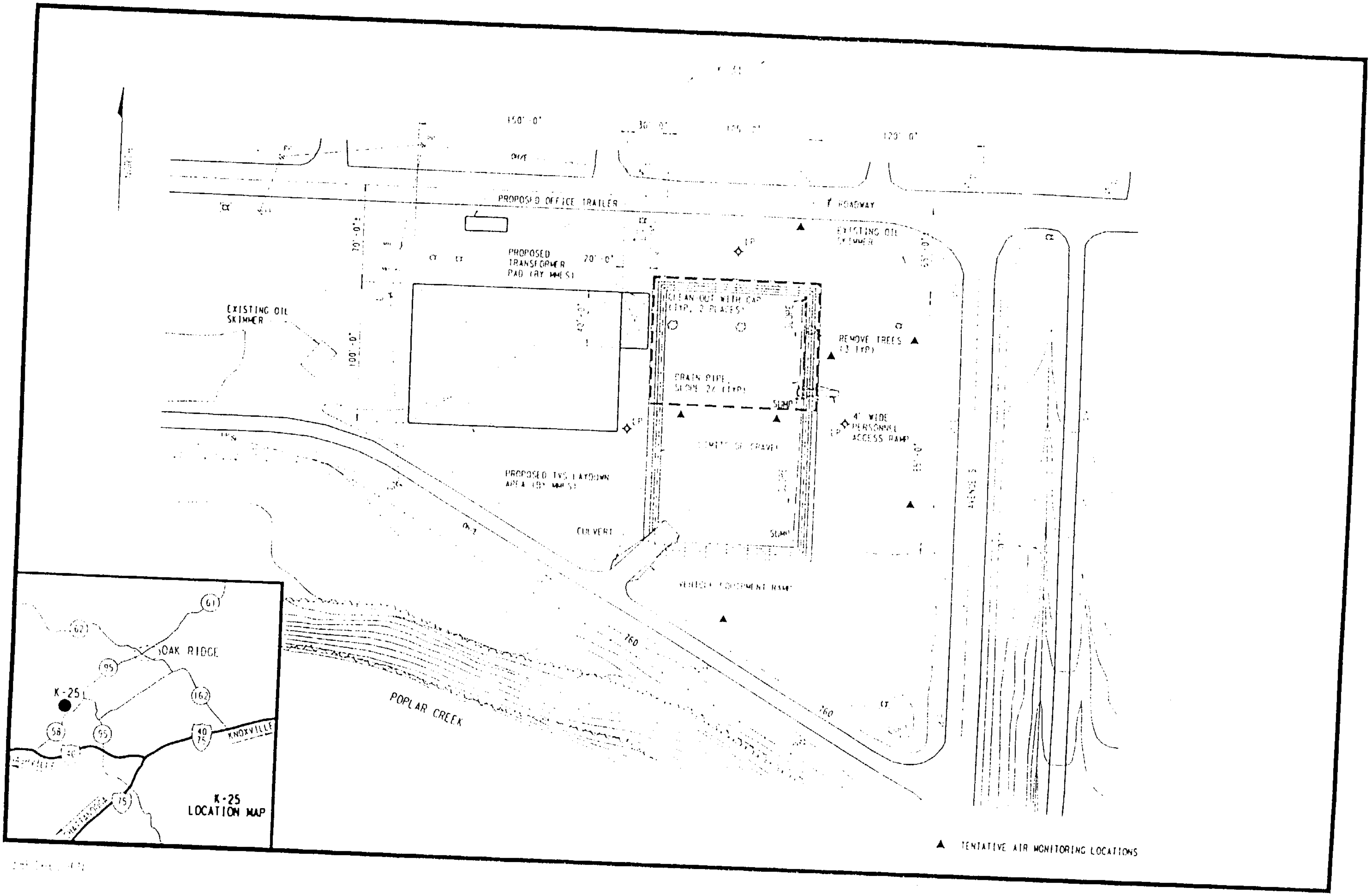

Figure 11
Air Monitoring Locations

TEST NO. ___________

DATE: ___________

LENGTH OF RUN: ______

PLANT OPERATION COST DATA

A. PLANT OPERATION PERSONNEL

Operator	Duty

B. UTILITY USAGE

Utility	Amount Consumed

C. CONSUMABLE USAGE

Consumable	Amount Consumed

D. EQUIPMENT AND SUPPORT STAFF

Support Staff	Duty

Equipment	Hours Used

Figure 12
Plant Operation Cost Data Collection Form

TEST NO. __________

DATE: __________

LENGTH OF RUN: ______

SAMPLING AND ANALYSIS COST DATA

A. LABORATORY PERSONNEL

Personnel	Duty

B. SAMPLES ANALYZED

Samples Analyzed		Cost per Sample[1] (dollars)	Total cost[1]
Onsite	Offsite		

[1] Cost for offsite samples only.

Figure 13
Sampling and Analysis Cost Data Collection Form

TEST NO. __________

DATE: __________

LENGTH OF RUN: ______

HEALTH AND SAFETY COST DATA

A. HEALTH AND SAFETY PERSONNEL

Personnel	Duty

B. PERSONNEL PROTECTION EQUIPMENT

Equipment	Number Used

C. PERSONNEL MONITORING

Monitoring Equipment

D. AIR MONITORING

	Perimeter	Local
Equipment		
Consumables		
Analyses		

Figure 14
Health and Safety Cost Data Collection Form

137_0052 (10/06/95)

TEST NO. ____________

DATE: _____________

LENGTH OF RUN: _______

OVERHEAD COST DATA

A.

Other Personnel	Duty

Figure 15
Overhead Cost Data Collection Form

TABLES

Table 1

Equipment Adjustment Phase

Sampling Locations and Analyses

Sampling Location	Unit	Sample Size (kg)	Description	Sieve Sample Size	Analyses[a]	
					Primary	Secondary
1	N/A	100	Feed	1 Kg	1	2,3,5,6,7
2	Trommel	20	Undersize	200 g	1	2,3,4
3	Trommel	100	Oversize	1 Kg	1	2,3,4,5
7	Sec class	0.5	Undersize	100 g	1	2,3,4
8	Sec class	20	Oversize	200 g	1	2,3,4,5
10	Cyclone	0.5	Overflow	100 g	1	2,3,4
11	Cyclone	5	Underflow	100 g	1	2,3,4
11A	Hyd class	0.5	Overflow	100 g	1	2,3,4
11B	Hyd class	5	Underflow	100 g	1	2,3,4
12	Screen	5	Oversize	100 g	1	2,3,4,5
17	Filter	5	Filter cake	100 g	1	2,3,4,5

[a]Analysis codes:

1. Particle size distribution
2. Radionuclides analysis
3. Percent solids
4. Mass flowrate
5. Bulk density
6. Metal concentration
7. Specific gravity

Table 2

Performance Phase

Sampling Locations, Frequency, and Analyses

Sampling Location	Sample Description	Sample Size (kg)	Sampling Frequency[a]	Analysis[b]
1	Feed	100	Each loader bucket	1,2,3,4,5
3	Trommel oversize	100	15 min	1,2,3,4,5
8	Sec class oversize	20	15 min	1,2,3,4,5
12	Screen oversize	5	15 min	1,2,3,4,5,6[c]
17	Filter cake	5	Each filter discharge	1,2,3,4,5,6[c]

[a]During the performance phase, composite samples will be formed over different total times for the steady-state tests and the performance tests as described below.

Steady-State Test: For sampling locations 3, 8, and 12, the first cut will be taken when flow is established at each location. The samples will be composited on an hourly basis for sample analysis. For a 4-hour test, this will yield four composite samples from each sampling location:

1st hr	2nd hr	3rd hr	4th hr
4 cuts	4 cuts	4 cuts	4 cuts

For sampling locations 1 and 17, each cut will be analyzed separately.

Performance Test: For sampling locations 3, 8, and 12, the first cut will be taken after steady-state flow has been established at each location. The cuts will be composited over the entire length of the test. For sampling locations 1 and 17, all cuts will be composited over the entire length of the test to form a composite sample for each location. This test will yield one composite sample for each sampling location.

[b]Analysis codes:

1. Particle size distribution
2. Radiological concentration
3. Percent solids
4. Mass flowrate
5. Bulk density
6. Metal concentration

[c]Metals analysis will be conducted after all performance tests are complete.