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May 6, 1992

Ms. Carol Manning (3HW33)
Enforcement On-Scene Coordinator
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

Reference: Management Options/Analysis Report
METCOA Restart Site
Pulaski, PA

Dear Ms. Manning:

On behalf of the METCOA Removal Response Group, this letter transmits three (3) bound copies and one (1) unbound copy of the Management Options/Analysis Report - Volume I. In addition, two (2) bound copies of Volumes II and III are herewith transmitted. Volumes II and III provide reports on data validation of laboratory results.

If you or your staff have any questions concerning the enclosed report, please do not hesitate to contact me or Wayne Barto at (615) 691-5052.

Sincerely,

Wayne F. Barto for

Mark A. Travers
Project Coordinator

WFB/mdm

cc: METCOA Removal Response Group
Karen Wolper, U.S. EPA
Kathleen Root, Esquire, USEPA

File:mannltr.92/dsk:9/3021

Except as provided below, I certify that the information contained in or accompanying this Management Options/Analysis Report is true, accurate, and complete. As to those portion(s) of this report for which I cannot personally verify their accuracy, I certify under the penalty of law that this report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Wayne M. Barth jr

Name: Mark Travers
de maximis, inc.

Title: Project Coordinator
METCOA Restart Site

File:metcert/dsk:9/3021

WORK PLAN NO. 2
MANAGEMENT OPTIONS/ANALYSIS REPORT
METCOA RESTART SITE
PULASKI, PENNSYLVANIA

PREPARED AT THE DIRECTION OF:
METCOA REMOVAL RESPONSE GROUP

Prepared By:

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May, 1992

Work Plan No. 2
Management Options/Analysis Report
METCOA Restart Site
Pulaski, Pennsylvania

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CHAPTER 1.0

INTRODUCTION

1.1 Authority for Work

The United States Environmental Protection Agency ("EPA") issued an Administrative Order ("Order") dated 17 August 1990 pursuant to Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986, to a list of 28 Respondents. The Order directed the Respondents to take steps to secure and to develop and implement two removal Work Plans at the Metallurgical Corporation of America ("METCOA") Restart Site. Eight of the Respondents formed the Removal Response Group ("Group") and collectively have performed the work set forth in the above-referenced Order.

The Group, with EPA's approval, selected de maximis, inc. ("de maximis") as its Project Coordinator and GSX Services, Inc./Laidlaw Environmental ("GSX/Laidlaw") as its contractor. The Group authorized GSX/Laidlaw to prepare Work Plan No. 1 ("Work Plan") as outlined in Section 8.4 of the Order and implement this work plan subsequent to EPA Region III's approval. This work was completed on April 30, 1991 and documented via a written report submitted to EPA on May 9, 1991.

In addition, Paragraph 8.5 of the Order required the Group to prepare Work Plan No. 2 and implement field activities subsequent to EPA Region III's approval which was received on July 25, 1991. The field activities for Work Plan No. 2 were completed on December 20, 1991. This Management Options/Analysis Report documents the Work Plan No. 2 activities and presents the management options and other information required by the Order.

1.2 Project Location, Description and Status

The Site is located on Route 551 and Metallurgical Way (Figure 1-1) approximately one-half mile north of the village center and Route 208 in Pulaski, Lawrence County, Pennsylvania. METCOA, now bankrupt, was in the business of receiving, producing, and handling metals at the Site from 1975 until 1983.

The area surrounding the Site is primarily rural and agricultural in nature. However an industrial facility occupies an adjacent parcel to the south of the Site.

The METCOA property is approximately 22.5 acres, of which six (6) acres, containing a building, is enclosed by a chain link fence. From all appearances and based on information developed in pending cost-recovery litigation these six (6) acres appear to be the only portion of the 22.5 acre site that has experienced industrial activity. The Site is bounded to the south and west by Buchanan Run, a tributary of the Shenango River, to the east by Route 551, and to the north by an area where a public flea market is held one (1) day a

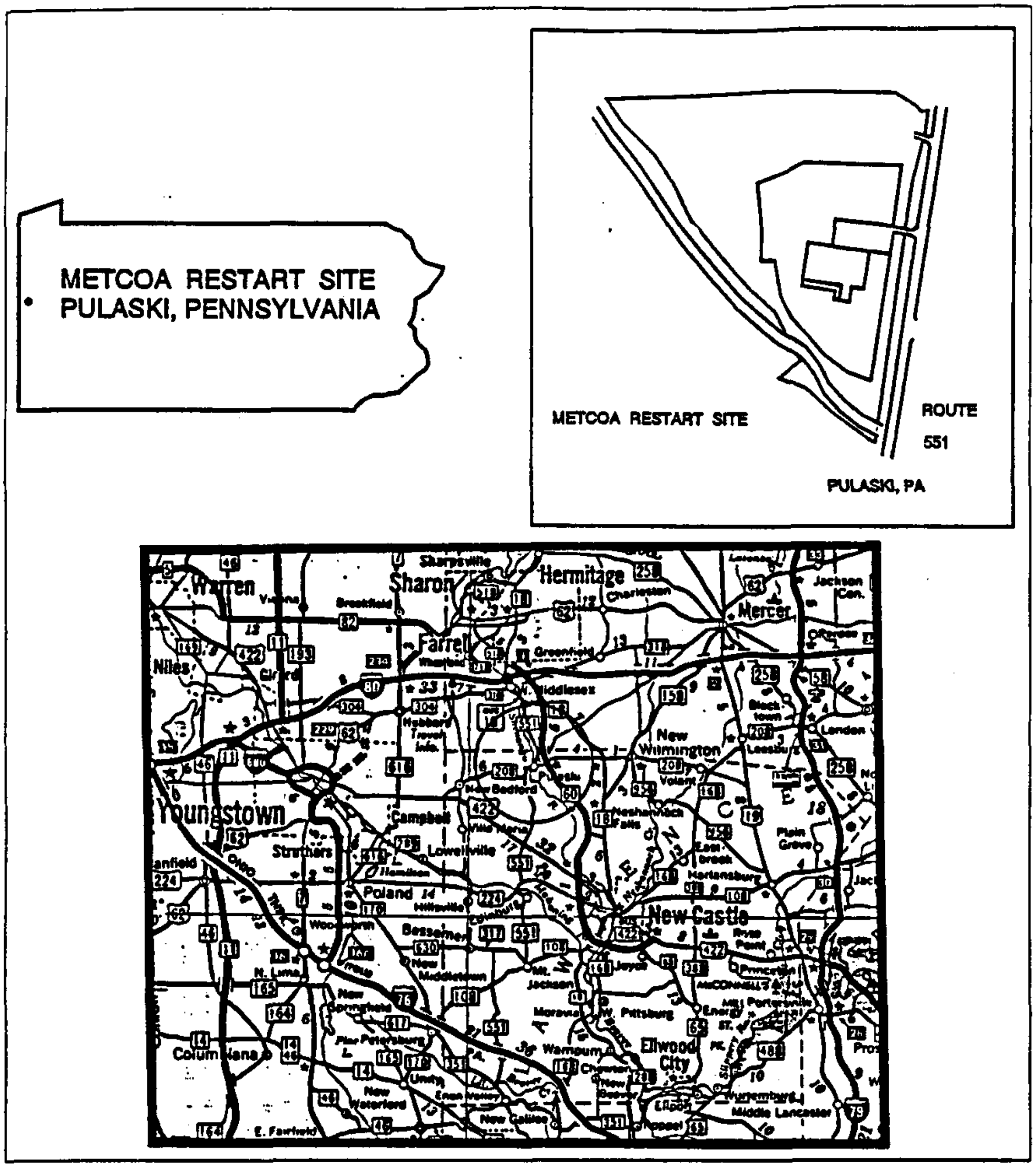

FIGURE 1-1: METCOA Restart Site location, approximately 1 mile north of Pulaski, PA on Route 551.

week.

EPA has reported that materials handled by METCOA during its years of operation, 1975 to 1983, included scrap metal containing lead, chromium, cobalt, copper, cadmium, magnesium, nickel, molybdenum, zinc, selenium, and thoriated compounds. Some of the thoriated compounds may be considered low-level radioactive materials. Debris and slag exist on the ground surface of the fenced portion of the Site.

1.3 Summary of Completed Response Activities

During its period of operation, METCOA received and handled thoriated material pursuant to a license issued by the Nuclear Regulatory Commission ("NRC"). On January 22, 1986, after conducting several inspections, the NRC issued an order to METCOA which modified the facility's license. The order requested preparation and implementation of a decontamination plan to address METCOA's alleged failure to "control" the presence of licensed radioactive material at the Site following the shut-down of plant operations. Subsequently, the NRC commissioned the Radiological Site Assessment Program of the Oak Ridge Associated Universities ("ORAU") to conduct a radiological and extent of contamination survey of the Site. This work was performed in April 1986 and provided a baseline assessment of the Site.

After issuance of the NRC/ORAU assessment report, the Pennsylvania Department of Environmental Resources ("PADER") conducted its own site assessment confirming the results of the ORAU report. PADER requested EPA to investigate potential threats to the public health and environment. As a result of this request, EPA's Technical Assistance Team ("TAT") and the Environmental Response Team ("ERT") performed a site assessment including site material sampling between June and September 1986. Geophysical surveys including a magnetometer survey and ground penetrating radar ("GPR") were performed as part of this assessment. Following the EPA site assessment, the EPA On-Scene Coordinator ("OSC") requested that a CERCLA Removal Action be performed to secure and stabilize the Site.

In March of 1987 EPA and its subcontractors again mobilized to the Site in an effort to secure and stabilize the Site. As part of this effort, EPA consolidated and sampled drummed material and bulked and staged other material into piles. These piles were staged outside and covered with plastic to protect them from the elements. Fencing to the immediate south and west of the originally fenced-off area was installed to secure areas where drums had formerly been staged and where debris and slag were evident in fill areas.

In October of 1989, ENSR Constructors acting pursuant to an EPA-issued Administrative Order and on behalf of the ad hoc METCOA Steering Committee performed additional site stabilization activities. This work included the movement of the drummed material located outside of the building to the building interior. The drums were placed on plywood covered with polyethylene sheeting. ENSR also installed sediment control silt fencing to prevent surface runoff from certain areas and re-covered piles of debris with geotextile fabric over double polyethylene layers.

On 13 August 1990, EPA and its contractors again re-mobilized to the Site to conduct further removal response activities. EPA's activities were discontinued on September 1, 1990 after the Group informed EPA that it would undertake the activities required by the Order. Work was performed by the Group at EPA's direction during 1990-91 to comply with the requirements stated in Section 8.4 of the Order for preparing, receiving approval, implementing and documenting Work Plan No. 1 removal response activities at the Site. These activities were completed in the field on April 30, 1991 and documented in the Work Plan No. 1 Final Report submitted to EPA on May 9, 1991.

Following receipt of EPA's approval of Work Plan No. 2, the Group authorized GSX/Laidlaw and their subcontractors to remobilize to the Site. A five (5) meter survey grid over the formerly utilized six (6) acres of the Site was established and radiological magnetometer and electrical conductivity surveys were completed. In addition, off-Site background and on-Site non-radiological analyte screening samples were collected. Based on the data obtained from this initial portion of Work Plan No. 2 field activities, the Group's contractor prepared the Interim Data Report which was submitted to EPA on October 16, 1991, and approved by the agency on December 11, 1991.

The Interim Data Report served a two-fold purpose. One was to screen the entire list of non-radiological analytes and narrow this list to those analytes of potential concern based upon a comparison of Site data to naturally occurring background concentrations and also to conservatively develop health-based criteria. The second purpose of the Interim Data Report was to analyze the field survey results to refocus and refine the proposed numbers and locations of invasive sampling points for the second phase of Work Plan No. 2. EPA approved the Interim Data Report recommendations and Laidlaw and its subcontractors re-mobilized to the Site. The remaining invasive investigation field activities for Work Plan No. 2 were completed on December 20, 1991.

1.4 Overview of Document

The primary purpose of this document is to comply with the requirements of Section 8.5(a) of the Order. Specifically this section states that the Respondents must prepare:

- An options/analysis plan for management and/or disposal and/or long term stabilization of the hazardous substances remaining on Site following completion of the work described in Work Plan No. 1, including mixed wastes. This analysis shall include proposed cleanup levels consistent with the NCP, subject to approval by EPA, for all hazardous substances remaining on-site following the completion of the work described in Work Plan No.1.

Discussion with EPA representatives concerning the language and intent of the Order have indicated their belief that the "options/analysis plan" mentioned in the Order may closely parallel the format of an "engineering evaluation/cost analysis" (EE/CA) report. The EE/CA is the documentation required by the National Contingency Plan (NCP) for comparing response action alternatives for non-time-critical removal actions [See 40 CFR 300.415(b)(14)] at Superfund sites. Accordingly, the Group has presented this Report in much the same manner as outlined in "Draft Engineering Evaluation/Cost Analysis Guidelines for Non-Time-Critical Removal Actions" (USEPA, 1987a, OERR, Washington, D.C.). The basic EE/CA format documented in this guidance is supplemented in this Management Options/Analysis Report with a section outlining the development of risk-based response levels to satisfy fully Section 8.5(a) of the Order.

The following provides a brief overview of the organizational format and content of individual chapters contained in this Report.

1.0 Introduction - This chapter provides a brief description of project background, history of completed response activities, and the purpose of the report.

2.0 Site Characterization - More detailed information on Site description, location and background is presented. In addition, the investigative activities of Work Plan No. 2 are described in detail along with the data results, findings, and interpretations.

3.0 Development of Response Levels and Response Action Objectives - This chapter presents the identification of potential clean-up levels for the Site consistent with the NCP along with the methodology employed to develop risk-based response levels. Comparison of analytical data results to the risk-based response levels is made to delineate potential response areas and define response action objectives.

4.0 Identification and Screening of Response Action Technologies/Options - Screening of appropriate technologies to address the type, extent and volume of potentially contaminated media is performed. Screening conclusions are presented to determine whether certain options and technologies should be eliminated from further consideration or evaluated in more detail as Site alternatives.

5.0 Analysis of Response Action Alternatives - Those technologies and options retained from the screening process in the previous chapter are analyzed in more detail. The analysis is based upon effectiveness, implementability, and cost criteria.

6.0 Comparative Analysis of Response Action Alternatives - This chapter of the Report weighs the advantages and disadvantages of the response action alternatives analyzed in Chapter 5.0 to provide the basis for selection.

7.0 Summary of Appropriate Response Action Alternatives - This chapter presents a summary of the various aspects of appropriate alternatives for each material category at the Site.

For the convenience of the readers and users, appendices included in this Report present certain items of information in more detail than is found in the body of the text. In addition, Volumes II & III present the report on data validation of laboratory results along with copies of all annotated pages from the CLP deliverable package referenced in the data validation report.

CHAPTER 2.0

SITE CHARACTERIZATION

2.1 Introduction

The METCOA Restart Site property boundary encompasses roughly 22-acres of partially wooded land located in a predominantly rural area 1 mile north of Pulaski, Lawrence County, Pennsylvania. The Site can be divided into 2 principal areas, a roughly 7-acre parcel of ground confined within a fence enclosing the former production area of the facility and the balance of the property located outside the fenced area. Of the grounds located outside the fenced area, all but an estimated 3-4 acres, located immediately north of the former production area, are wooded. The grounds within the fenced area are, for the most part, level and clear of heavy vegetation. The entire property is low-lying and, in areas, poorly drained. Within the fenced area is located a large industrial building, covering approximately 37,500 square feet, where the principal metal handling and processing activities of the former METCOA operation occurred. Except for a concrete pad along the southern side of the building and the entrance road/parking area on the north side of the building, the grounds within the fenced area are earthen and in places overgrown with brush. It appears that slag (including, reportedly, slag from a steel mill), metal scrap and assorted debris have accumulated in low-lying and poorly drained areas within the fenced portion of the property. Other areas are known to have been used historically for storage of incoming metal including scrap metal and production byproducts.

The objectives of the investigative portion of this study were to: identify if materials were buried on the Site; characterize the distribution of radioactive materials and non-radiological analytes across the Site; and determine, within the parameters of the approved sampling effort, if there has been movement or placement of these materials to areas within the boundaries of the property outside the fenced former production area.

2.2 Description of Investigative Activities

In accordance with the investigative methodology described in Work Plan No. 2 for the METCOA Restart Site, the property was defined in terms of 4 general areas to be characterized through sample collection and analysis. These 4 major subdivisions of the property are identified on Figure 1 of Appendix A. The largest of these was the open land located north and west of the fence surrounding the former production area (1-Acre Area Samples). Figure 2 in Appendix A shows the location of the 1-Acre Area samples and is immediately followed by a table of analytical results for these samples. Immediately outside the former production area, a 50-foot wide perimeter zone was established surrounding the fence (Perimeter Samples). Figure 3 in Appendix A shows the location of the Perimeter Samples and is immediately followed by a table of analytical results for these samples. Within the production area (fenced enclosure area), the investigation was divided between the exterior grounds and the building interior. The investigation of the grounds within the production area consisted of the advancement and collection of samples from 53 auger probes (Auger Probe Samples) and the excavation and sampling of 5 test pits (Test Pit Samples). The building investigation focused on the interior floor, a floor grate and 2 pits located within the building (Dust Samples, Floor Grate Sample and Sump Sample, respectively). Figure 4 in Appendix A provides an overview of the sampling locations within the fenced enclosure area and Figure 5 in Appendix A shows locations for the samples collected within the building interior. A key to the sample names and location points is presented in the beginning of Appendix A.

Based on the results of previous sampling and non-invasive investigations, as addressed in Work Plan No. 2 and the Interim Data Report, the grounds within the former production area were subdivided into 7 areas, labeled Areas A through G. From 1 to 10 auger probes were advanced in each of the areas. Areas D and F were further characterized by the excavation of 5 test pits. In addition, 7 areas of limited areal extent were identified outside the aforementioned areas and investigated through the advancement of a single auger probe (Discrete Point Samples). These areas are presented in Figure 4 of Appendix A. Areas A through G are further detailed in Figures 4-1 through 4-6.

The investigation of the property was conducted in stages beginning with the advancement of auger probes and the collection of soil samples from split-barrel samplers at each of the locations proposed in the Interim Data Report and also as shown in Figure 4 of Appendix A. Following the completion of the drilling activities, 5 test pits were excavated at the locations indicated in Figure 4. Concurrently, surface soil samples were collected from the center of each of the 1-acre area parcels and at 100-feet intervals along the aforementioned 50-feet perimeter line around the fenced portion of the property. Following this, the proposed samples from the floor and sumps inside the building were collected. Prior to concluding sampling activities, a sample was collected from the runoff channel beneath the outfall from the building roof drainage system. This additional sample was collected because none of the perimeter samples fell in this channel when measured in the field.

All environmental samples were of solid media and were collected in a manner consistent with the sampling protocols detailed in Work Plan No. 2. During the sampling events, appropriate quality assurance samples were collected in accordance with the approved Quality Assurance Project Plan, as detailed in Work Plan No. 2. Samples were recorded on chain-of-custody records in groups of 20. For this investigation, a sample designation group (SDG) was comprised of 18 environmental samples, 1 field duplicate sample (DUP) and 1 equipment rinsate sample, also referred to as a blank sample (BK). Additionally, one sample, usually a surface soil sample, was identified on the chain-of-custody record as requiring a matrix spike/duplicate analysis (MS/D). This designation required the analytical laboratory, Controls for Environmental Pollution (CEP), to analyze the sample in addition to duplicate matrix spikes of the sample, a total of 3 samples, as a measure of quality control. A total of 12 complete SDGs were submitted to the laboratory for analysis. A thirteenth SDG consisted of a single field sample and a duplicate sample. This is discussed in more detail in Section 2.2.4 (Perimeter Samples).

The sampling procedure was performed in accordance with the QAPP, as presented in approved Work Plan No. 2. All sample bottles and the water used for rinsate blank preparation were supplied by CEP. At each sampling point within the former production area, a micro R/hr meter reading was taken at the ground surface prior to sample collection. The actual sample was scanned with a micro R meter following its collection and the sample and/or the sample location photographed. Once per SDG, a rinsate sample was collected by pouring deionized water over the decontaminated sampling tools and collecting the water in a stainless steel pan. The water was then transferred to a polyethylene sample bottle and preserved with nitric acid. The tools and stainless steel pan were then covered with aluminum foil, in likewise fashion for all sets of sampling equipment, and designated with the sample number for the next sampling location. The rinsate blank was given the name of the next environmental sample location and the suffix BK was added to its name to designate that this was an aqueous quality control sample of the equipment to be used to collect the next environmental sample.

Field duplicate samples were also collected at a frequency of 1 per SDG. These samples were submitted "blind" to the laboratory, meaning that they were not identified as duplicate samples. All duplicate samples were collected by thoroughly homogenizing the environmental material, to the extent possible, and dividing it into two separate samples. All duplicate samples were collected from the surface soil (SS) horizon (0 - 0.5 feet), as this was considered to be the region requiring the greatest need for quality control on the analyses. Because no environmental samples were to be collected from the depth interval of 0.5 to 1 foot, this interval was assigned to the duplicate samples. Accordingly, all samples having the suffix 0.5-1 are duplicates of the corresponding sample designated 0-0.5.

The following sections present a description of the sampling activities conducted in each of the areas discussed previously. All relevant field observations were recorded in two (2) field log notebooks, which are maintained in the project file. Photographs of the sampling locations were compiled in a log which is also maintained in the project file.

2.2.1 Auger Probe Sampling

A standard hollow stem auger rotary drilling rig was used to advance auger probes inside the fenced enclosure area at selected grid locations, as predetermined in the Work Plan No. 2 Interim Data Report. All auger probe locations, corresponding sampling intervals, and analytical results are presented in a series of figures beginning with Figure 4 of Appendix A. At each auger probe location a surface soil sample was collected by hand prior to drilling. Using standard auger rotary and split-barrel sampling techniques, as detailed in approved Work Plan No. 2, soil samples were collected at depths of 1 to 3 feet and 3 to 5 feet below the ground surface. For the 6 auger probes that were advanced to a depth of 1.5 feet during the initial Work Plan No. 2 investigation, conducted in July, 1991, a new boring was advanced immediately adjacent to the original boring. Collection of the surface soil sample was omitted at these locations since the data was available from the Interim Data Report sampling and analysis. A 3-inch diameter split-barrel was used at all locations in order to increase sample recovery rates. A description of the materials penetrated in each auger probe is provided on the Auger Boring Logs in Appendix B.

As stated previously, a micro R meter was used to screen each surface sample location prior to sample collection. A second micro R meter reading was taken of the surface soil sample in the stainless steel bowl following collection. With respect to the split-barrel samples, a micro R meter reading was taken after the split-barrel sampler was opened to determine if any portions of the sample contained radioactive material. The contents of the split-barrel were then transferred to a stainless steel bowl and the sample was homogenized. Due to the composition of certain samples from the fenced enclosure area (i.e., slag, debris, clay), it was not possible to completely homogenize each sample prior to placement into the sampling jar. If possible, the entire sample was placed into a glass soil jar. If the entire sample could not be placed into a single jar, an attempt was made to transfer a representative sub-sample of the material homogenized in the stainless steel bowl.

In general, the auger probes revealed the Site profile within the production area to consist of a surficial layer of slag and soil mixed with debris consisting of metal turnings, metal scrap, wood and plastic. The thickness of this material varied from about 0.5 to about 2.5 feet. No discrete buried wastes were encountered. Native soils consisting of sandstone, gravel, silt, and dark-colored clay grading to orange and gray-colored clay were encountered beneath the fill material. This assemblage of unconsolidated native materials is characteristic of a stream terrace, and was probably formed by Buchanan Run located just west of the former production area. The sandstone is probably derived from the lower unit of the underlying Shenango Formation, which comprises the bedrock beneath the site. In the areas located toward the western, northwestern, and northern portions of the former production area, the surficial layer is underlain by a dark brown to black-colored clay layer, which grades to a very stiff and relatively impermeable orange to gray-colored mottled clay layer within three (3) feet of the ground surface. The clay sequence appears to be areally extensive over this region of the property and is consistent with the observed poor surface water drainage. The ground water table was not identified in the auger probe borings, although a small amount of water was encountered perched on top of the previously described clay layer.

2.2.2 Test Pit Samples

Following the completion of drilling activities, test pits were excavated to allow visual examination of the ground in profile. Each of 5 test pits was located along the axis of a radiological and/or magnetic anomaly, as proposed in the Interim Data Report. The actual position of each test pit in the field was adjusted, where possible, to center it over the highest micro R meter reading that could be detected in the vicinity of the test pit's proposed location. The surface soil sample was collected at the point where the micro R meter reading was the highest. Following the collection of the surface sample, the test pit was excavated to undisturbed native soil, typically 2.5 to 3 feet below the ground surface. The test pit walls were then scanned using a micro R meter to identify any elevated points of radioactivity. Subsequent samples were collected from those areas of the test pit with elevated micro R meter readings. Field judgment was used to move the mid-wall sample to those areas with the highest micro R meter readings. The approximate location of each sample collected from the test pits is shown on the Test Pit/Trench Soil Sample Logs provided in Appendix C. The size and orientation of the sample point identifier (a rectangular box on the test pit logs) indicates approximately the area from which the sample was collected.

The test pits generally revealed a profile of the Site in the northwest and northern portions of the fenced enclosure area that consists of about 0.5 to 2.5 feet of slag and soil mixed with metal turnings, metal scrap, wood, plastic, wire, drum lids, tires and glass. In some locations, what appeared to be a pale yellow to orange-colored sandstone-like material was identified. In the vicinity of Test Pits 3, 4 and 5, it appeared that the ground surface had been raised by slag and assorted debris. In the process of excavating Test Pit 4 a crushed 55-gallon drum containing a white powder cake was encountered about a foot below the ground surface in the fill layer. A sample of this material was collected (MRS-TP4-1.5) and submitted to CEP for a Toxicity Characteristic Leaching Procedure (TCLP) test to determine if it is above any regulatory limits. The crushed drum and all traces of the white material it contained were excavated and placed next to the excavation under a plastic cover.

Below the fill material at almost every location was a well defined layer of dark gray to black colored clay that was very stiff and moist. This layer ranged in thickness from about 2 to 6 inches and graded into an orange and gray-colored mottled clay that was very stiff and moist. In most instances the upper surface of the black layer appeared to contain material similar to the fill layer. No fill materials were encountered below the base of the black horizon. Furthermore, there was no visual evidence in the walls of the test pits that these areas of investigation had been excavated previously.

Occasionally, small amounts of water would run into an excavation where a layer of low permeability had apparently impounded infiltrating precipitation. No evidence was observed of a water table in any of the test pits. Following the completion of each test pit, the excavations were filled by returning the materials in the reverse order of their removal.

2.2.3 1-Acre Area Parcels

To ensure that the entire property was investigated, the grounds located outside the production area were divided into 11 parcels, each equalling approximately 1 acre in area, as shown on Figure 1 of Appendix A. With the exception of parcels 9, 10 and 11, the 1-Acre Area parcels are located in densely wooded terrain with moderate undergrowth. The open area north of the fenced enclosure was overgrown with brush and dense grass vegetation prior to the field work conducted under the initial Work Plan No. 2 investigations in the summer of 1991. This brush was cut to ground level in preparing the area for installation of the 5-meter grid stakes, as discussed in the Interim Data Report.

The samples collected in the 1-acre area parcels were fairly consistent in composition. All were rich in humus and composed chiefly of loam or silt-loam. No slag or obvious debris was encountered. A description of the material encountered at each of these surface soil sampling locations is provided in the 1-Acre Area Sample Logs located in Appendix D. During the process of locating these sampling points, no evidence was found to suggest that materials from the facility had ever been disposed of in the wooded areas (i.e., depressions, mounds, discolored soils, stressed vegetation and/or containers).

2.2.4 Perimeter Samples

In accordance with Work Plan No. 2, a beginning perimeter sample point was selected 50 feet distant from the fence line that surrounds the former production area. The beginning point was selected in the field to approximate one of the sampling point locations proposed in approved Work Plan No. 2. Sampling points were then located along a line through this point parallel with the existing fence and at 100 foot intervals. All of the samples were composed chiefly of loam or silt-loam. No slag or obvious debris was encountered. Samples collected in the wooded region along the western boundary of the production area tended to contain a greater amount of humus. A single sample (MRS-SS/P20-0-0.5) was taken in Buchanan Run. A description of the material encountered at each of these sample locations is provided in the Perimeter Sample Logs located in Appendix E.

Following the initial collection of the perimeter samples, an additional perimeter sample located in the center of the drainage ditch below the culvert outfall from the building roof drain was collected. Because this sample began a new SDG, a duplicate was also prepared and submitted for analysis.

2.2.5 Building Samples

As proposed in the approved Work Plan No. 2, dust samples were collected from 5 areas delineated in the Interim Data Report and as shown in Figure 5 of Appendix A. This was accomplished by using a new broom at each sampling location to sweep the dust into a pile. The pile of dust was then homogenized on the concrete floor and a representative sample collected in a sample jar. Additionally, a sample of ash-like material was collected from beneath the floor grate located near the eastern side of the building.

A visual and micro R meter inspection was performed on the interior of the two pits (sumps) located near the northeast corner of the building. Both sumps appeared to be intact without any openings or drains. The sumps each have a small pit at the base, which is fitted with a hose that extends to floor level. It appears that the sumps were emptied by pumping from the pit through the hose. Both sumps were virtually free of residual material at the time of inspection. Approximately 2 ounces of material were collected from each sump using a wire brush and homogenized to produce a composite sample (MRS-SUMPS). No unusual observations were made during the inspection of the sumps.

2.3 Summary of Findings

The discussions in this section use the term "elevated levels" which for the purpose of presenting the following information indicates concentrations and levels of analytes above background at and in the vicinity of the METCOA Site. Background levels were determined from the analytical results obtained during implementation of Work Plan No. 2, and reported in the Interim Data Report. It should be emphasized that although certain analytes are indicated as "elevated" above background levels, these analytes may not be present above the risk-based response levels developed in Chapter 3.0.

The results of analyses of samples collected at the METCOA Restart Site, indicate the presence of elevated levels of the analytes copper and nickel in the soil samples collected along the boundary between Area D and Area E and in Test Pits 2, 3 and 4. Also elevated levels of thorium were revealed in the material in auger probe 2 (Area A) and Test Pits 2, 3, and 5. Among the 1-acre area samples only the sample collected from parcel 3 was found to contain any elevated compounds, tungsten (133mg/kg). Because of the absence of other elevated compounds in this sample, it is likely that this result is erroneous. It should be pointed out that this was the highest level for tungsten found in any of the samples collected on the Site. The perimeter sample collected in the culvert runoff pathway revealed elevated levels of cadmium, copper, and nickel. Levels of lead and molybdenum were moderately elevated in the perimeter sample collected from the culvert drainage pathway. No elevated levels of thorium were revealed outside the fenced area. Elevated levels of all analytes tested were found in the material collected from the floor of the building. The sump sample revealed only elevated levels of copper and nickel. The thorium level collected from beneath the floor grate in the building indicated only 7 pCi/gm based upon laboratory measurement. Hand-held micro R meter readings taken during the first phase of the Work Plan No. 2 investigations and previous ORAU study analytical results indicate thorium values over 10 pCi/gm may be present beneath the floor grates.

During the course of the investigation three (3) materials were encountered that were considered to be related to former operations; an unidentified white-colored material inside a crushed 55-gallon drum; dust collected from the base of the two (2) sumps inside the building; and ashes collected from beneath the Floor Grate inside the building. A sample of each was submitted to CEP for a Toxicity Characteristic Leaching Procedure (TCLP) analysis for metals. As reported by CEP, the white-colored cake-like material collected from the crushed drum encountered in Test Pit 4 revealed no constituents exceeding TCLP thresholds. However, as reported by CEP, both the material collected from the Sumps and Floor Grate exceeded the 1 microgram per liter threshold for cadmium at 3.38 and 4.01 respectively. It should be noted that the sample collected from the sumps constituted almost all the sediment that could be gathered off its walls and floor. A table containing a summary of the analytical TCLP laboratory results is presented at the end of Appendix A.

2.4 Discussion of the Analytical Results

Collectively, the analytical results reveal that affected soils at the Site are confined to the surficial fill material within the fenced enclosure area. The ground surface in Areas D, E and F has been raised by about 0.5 to 2.5 feet of slag and miscellaneous debris material. Elevated concentrations of analytes at depths below 1 foot were only revealed in areas where the ground surface had been raised by slag, indicating that the source of the elevated analytes is the fill material. No areas of foreign/man-made materials that were physically buried below the natural ground surface were identified. Additionally, the analytical results indicate that downward migration of constituents into the native soils has not occurred.

With respect to the thorium analyses, a comparison of analytical data with field micro R meter readings show that analytically measured levels for thorium are typically lower than one would expect based upon those measurements taken with a hand-held meter prior to collecting the samples and of those taken of the sample itself. From visual observations and monitoring with a micro R meter during the field activities, it is apparent that the thoriated material is not finely and evenly distributed throughout the surface soil and fill material. Field observations indicate that the thoriated materials are generally small pieces of metal or slag that can be located within well defined points or pockets in the field measuring about a foot in diameter or less within the fenced enclosure area. These thoriated materials are of varying sizes (ie. thumbnail to grape fruit) and are not distinguishable by the eye from other surrounding slag materials and metal scrap without using a meter to measure radiation. Even then, without considerable effort, it was not possible to sift through the material in the field and identify the individual components emitting radiation. Because of the generally small but varying sizes of the thoriated materials, it was difficult to identify the actual piece of material affected. The strength of the radiation was observed to be great enough that a single piece of thoriated material could give a wider area the appearance of being radioactive.

The difficulty in discerning the thoriated material from surrounding materials became evident during the collection of samples from the test pits. Although an attempt was made to locate the highest region of radiation and to collect a surface sample at that point, none of the soil samples collected revealed laboratory thorium results correlative with the levels measured in the field. In general, a relatively high micro R meter reading would be detected at the ground surface. A surface soil sample would be collected and monitored in a background area revealing a considerably lower micro R meter level. The lab analytical results, in turn, usually revealed an even lower value. This suggests that thoriated materials exist, primarily, in isolated pockets and that the radioactive strength of the isolated pieces of thoriated material is sufficient to give the appearance of a larger area of impact. This also suggests that thoriated material has not migrated through or below soils beneath the defined production area. It appears that when field samples were collected, a few pieces of the thoriated material may have been included. This probably constituted a portion of the isolated pocket of thoriated material. When the laboratory collected a sub-sample of the material submitted for analysis it may or may not have included the portion of the

Basis for the outlier

sample containing thoriated material. Hence, the reported analytical result was considerably less than that measured in the field. The outcome of the sampling p indicates that the thoriated materials exist as isolated pieces of slag or metal in the fill media in specific locations of the former production area.

Thorion - Migration!

CHAPTER 3.0

DEVELOPMENT OF RESPONSE LEVELS AND RESPONSE ACTION OBJECTIVES

3.1 Introduction

This chapter will present the methodology used for development of risk-based response levels for the constituents of concern at the Site. Identification of any other response levels will also be performed which may be applicable to the Site.

The definition of response levels for the Site will allow a comparison of these levels to the environmental investigative data presented in Section 2.0 and Appendix A of this report. From this comparison, response action objectives can be identified to be used as a basis for screening the response technologies and for developing response action alternatives. Meeting the response action objectives will allow the fulfillment of broader CERCLA program goals including:

- Protection of public health, welfare and the environment by reducing actual or potential exposures below risk-based response levels;
- Reduction of mobility, toxicity and/or volume of Site constituents at concentrations above identified response levels;

3.2 Identification of Response Levels

The first category of response levels investigated for applicability includes the subset of chemical-specific and location-specific requirements. Identifying these requirements was completed using checklists for potential ARARs and other requirements.

Secondly, action-specific requirements were investigated for their applicability based upon the potential of implementing various technologies and alternatives. Application of these response levels as appropriate is explained in Chapter 4.0 to screen potential technologies and in Chapter 5.0 for analyzing response action alternatives. The following provides a listing of potential response levels contained within the categories described above which have been identified in conjunction with the projected work and response actions at the METCOA Restart Site.

3.2.1 Chemical-Specific Response Levels

There are no chemical specific response levels that have been identified for potential contaminants associated with Site soils (the media of concern). A level of 10 pCi/gm of natural thorium 232 is the limit proposed by EPA for allowable radioactive contamination in soils at the Site. This level is consistent with Option 1 of the Nuclear Regulatory Commission's Branch Technical Position (A-NRC-A22089-00), dated October 23, 1981 as it relates to sites to be released for unrestricted use. Option 2 of the Branch Technical Position may also serve as an appropriate standard or chemical-specific response level for thorium. Option 2 allows a level of 50 pci/gm of natural thorium 232 in soils that are:

- Buried at a minimum depth of 4 feet
- Stabilized in place to prevent any transportation off-site.
- Buried to prevent any future exposure to the general public that would exceed the limits expressed in Option 1 (10μr/hr above background.)

As indicated in the approved Work Plan No. 2, Option 2 may also be proposed to be utilized if materials destined for hazardous waste burial sites exhibit non-uniform concentrations above this 10 pCi/gm, but less than 50 pCi/gm. A copy of the Nuclear Regulatory Commissions's Branch Technical Position is provided in Appendix F.

3.2.2 Location-Specific Response Levels

Location-specific response levels consist of restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in a specific location such as a wetland, floodplain, seismic zone, historic place, or sensitive ecosystem. These requirements relate to the geographical or physical position of the site rather than the nature of the contaminants or the proposed response actions.

A review of various State and Federal regulatory statutes has not revealed any apparent requirements associated with the specific location of the METCOA Restart Site which would trigger location-specific response levels.

3.2.3 Action-Specific Response Levels

Action-specific response levels are usually technology- or activity- based requirements or limitations relating to implementation of specific response actions. These requirements typically define acceptable treatment, storage, and disposal procedures for hazardous substances. In addition, the requirements generally set performance or design standards for site-specific activities related to implementing various response action technologies and alternatives.

Since the applications of action-specific response levels are dependent on the particular technology or response action to be implemented, they are discussed in Chapters 4.0 and 5.0. Specifically considered are requirements which correspond to implementation of specific response options such as health and safety and transportation-related regulations. Also technology specific regulatory requirements for such procedures as excavation, capping, etc. are identified as necessary for alternative evaluation.

3.3 Development of Risk-Based Response Levels

The following section will present the methodology used for development of risk-based response levels for the constituents of concern at the Site. The risk-based response levels have been developed in accordance with the protocols presented in Section 4.12 of the approved Work Plan No. 2. EPA guidance documents have been used where necessary to obtain appropriate exposure coefficients. In addition, EPA default values have been used where Site-specific information does not permit the use of empirical data.

3.3.1 Background/Introduction

Response levels can be defined as concentration goals for individual chemicals in a specific medium for the land use combinations that may be present at CERCLA sites. The first source of response levels is the collection of regulatory requirements that may be applicable at a given site. If these requirements are not available for all constituents of concern, risk-based response levels must be developed to determine if response is necessary, and to what extent the response should be performed. Response levels are developed from risk-based calculations that set concentration limits using carcinogenic and/or noncarcinogenic toxicity values under specific exposure conditions.

Calculation of risk-based response levels proceeds in the following manner:

1) Identification of media of concern, chemicals of concern, and future land use (Development of conceptual model)

2) Determination of appropriate exposure pathways, parameters, and equations (Exposure Assessment)

3) Determination of appropriate toxicity indices (Toxicity Assessment)

4) Identification of target risk levels/Calculation of risk-based response levels (Risk Characterization)

5) Determination of cleanup objectives that will provide a high level of confidence of satisfying targeted risk levels (Development of Response Objectives)

The following sections present the methodology employed in each of the listed steps, and the resulting risk-based response levels. Existing site soil concentration data are then analyzed to determine if it currently and adequately meets the response levels; if not, areas of the Site are identified for which response is warranted.

3.3.2 Development of Conceptual Model

The materials of concern at the METCOA Site are metals and inorganics which previous field and laboratory observations indicate are relatively immobile in the environment. Observations made at the Site indicate that the inorganic constituents in soil exist primarily in the form of turnings, slag particles, or pieces of miscellaneous metal material. In this state, the materials are inert and practically immobile under normal environmental conditions. Previous Site investigations performed by EPA and others have characterized the physical setting of the Site (e.g., climate, meteorology, geologic setting, soils, and hydrogeology) in sufficient detail, and have shown that the groundwater is not a potential recipient or pathway of Site-related constituents. The conceptual model, therefore, focuses on the remaining potential soil, surface water, sediment, and air pathways.

The Site is currently secured and vacant (with the exception of periodic government and Response Group activities). No current demand exists for future use of the Site. The current owner of the Site, the Lawrence County Industrial Development Authority, has not expressed any specific plans for the future use of the Site. As a result, it is most probable that the Site will remain unoccupied for some time.

The building on-Site is currently used to house drummed materials. Certain potential response action options, which are discussed further in Chapter 4.0 and 5.0, contemplate the continued use of the building as an integral part of a possible response action at the Site. As with the remainder of the Site, the probable reasonable future use of the building is that it will remain vacant, other than for its utilization as part of any response action. In light of the indications that the present owner will cooperate with deed restrictions and will notify EPA of any proposed change in its use, the conceptual model considers the building's future use to be an integral part of the response actions at the Site. This model is particularly applicable because, in the options analyzed herein, any future use of the building that is inconsistent with its use as part of the response will require notice to and approval by EPA.

Consideration of the potential for future residential use of a site is usually included in any assessment. However, proper consideration must be given to the Site-specific circumstances in accordance with the NCP and current guidance in considering whether this assessment should be made. In particular, communications with the Lawrence County Planning Commission indicate that the Site's current zoning designation is for industrial use and that there is no reasonable expectation that the designation will change. Moreover, the current surrounding land use indicates the lack of any economic pressure to convert the Site from its present state to residential use. Further, representatives of Lawrence County Industrial Development Authority, the present owner of the Site, have indicated that the Authority would cooperate in a response option that would include deed restrictions and would require their notification to EPA that a future user intended to change the Site's present status. Future users could be required to comply with any EPA requirements and to gain EPA approval before commencing any activities or operations on the Site. Future residential use can therefore be eliminated as a reasonable potential use scenario for the Site. This elimination is based upon the proper considerations of Site-specific circumstances, including zoning and neighboring land use.

Similarly, an assumption of future construction or industrial land use may not be justifiable if the probability that the Site will actually support such use in the future is exceedingly small. Although the probability of such uses of the METCOA Site does appear relatively small, at least for the near term future, this Report adopts a conservative approach and fully analyzes these land use scenarios for risk assessment purposes.

Based upon the above discussions of reasonable future potential use of the Site and in consideration of the potential completed exposure pathways, the conceptual model for the Site has been developed. The exposure scenarios documented in Table 3-1 are identified for the conceptual model under the current conditions and future potential activities at the METCOA Site. These scenarios provide the framework for determining the frequency, type, and duration of potential exposure to Site-related materials. The four (4) scenarios considered include present non-occupied conditions, future access and use restrictions utilizing institutional controls, future use of a newly-constructed building on the most contaminated portion of the Site, and future industrial land use. The first and second scenarios, for the purposes of this objective risk assessment, are equivalent in terms of exposure pathways, parameters and default values. They are therefore not separately indicated in Table 3-1 or analyzed separately in subsequent sections.

3.3.3 Exposure Assessment

The four (4) scenarios deemed appropriate for the development of risk-based response levels are: present non-occupied site conditions, future access and use restrictions utilizing institutional controls, future construction of a building on the most contaminated portion of the Site, and future industrial use of the property. The appropriate exposure pathways, equations, and parameters are discussed in the following text for each scenario. However, for purposes of the objective risk assessment, the first and second scenarios listed above are deemed equivalent in terms of exposure pathways, equations, and parameters and therefore, will not be addressed individually.

Under present conditions, children are selected as the most sensitive subpopulation with potential for current exposure to Site-related compounds, and are assumed to periodically visit the Site area outside of the existing fenceline. The following pathways were therefore considered as a comprehensive assessment of potential risks under present conditions:

- Direct soil contact by children outside the existing fenceline
- Fugitive dust emission via wind erosion, subsequently inhaled by near-by residents

Extensive sediment data in the drainage ditch to Buchanan Run has not been collected through earlier Site investigations or in the work required by EPA's Order; thus, this analysis

Table 3-1
Exposure Pathways Analysis
METCOA Restart Site, Pulaski, PA

Media	Source	Transport Mechanism	Exposure Point	Exposure Route	Exposed Population	Data Set to be Used	Exposure Assumptions
Soil/Sediments	Contaminated soil	Deposition	On-site	Dermal contact w/ Ingestion	Construction workers	Within-fence surface and subsurface soils	Occupational
	Contaminated soil	Deposition	On-site	Dermal contact w/ Ingestion	Future workers	Perimeter and within fence surface soils	Occupational
	Contaminated soil	Deposition	On-site	Dermal contact w/ Ingestion	Children	Perimeter surface soils	Recreational
Air	Fugitive dust	Dispersion	On-site	Inhalation	Construction workers	Vehicular: Perimeter and within-fence surface soils Excavation: Within-fence surface and subsurface soils	Occupational
	Fugitive dust	Dispersion	Off-site	Inhalation	Adult	Within fence surface soils	Occupational (flea market), residential

does not include a quantitative assessment of sediment-related pathways. Surface water quality data from previous EPA studies show no detectable concentrations of Site-related compounds. In addition, the drainage ditch from the Site to Buchanan Run exhibits only periodic intermittent flow and is not expected to pose a viable exposure pathway. Therefore, surface water was eliminated as a pathway of concern. Exposure parameters for the remaining pathways are listed in Table 3-2.

Additional, indirect exposure pathways were also considered. One of these is the potential transport of Site-related dust to nearby residences, possibly contributing both to surface soil and indoor dust deposition in these areas. Studies around smelters indicate that when indoor environments are relatively remote from a strong point source of pollution, indoor particle pollutant concentrations average 35% of those in airborne dusts outdoors and 75% of those in surrounding soils (EPA, 1991). Extensive off-site soil sampling shows no evidence of off-site surface soil contamination. This pathway was therefore eliminated from further consideration. Further analysis of the indoor dust pathway yields a similar conclusion; ingestion of fugitive dusts as indoor dust would pose no carcinogenic risk (none of the Site-related compounds is carcinogenic by the oral route), and would pose no significant noncarcinogenic hazard due to the relatively small and insignificant contribution of outdoor dust to indoor dust concentrations.

The future use scenario encompasses consideration of the risks posed to construction workers during Site preparation activities for a new building (excavation for building foundations), and occupancy of the Site by a future tenant engaged in light manufacturing activities. However, the potential of these scenarios actually occurring is remote, at least over the short-term, given current zoning, lack of pressure to build or conduct industrial activities at the Site, and continued recession in the local economy generally. Moreover, future construction or industrial activities at the Site can be precluded, controlled, or made subject to additional clean-up or other prerequisites through the imposition of institutional controls. The following pathways were considered as a comprehensive assessment of potential risks under possible future conditions:

- Direct soil contact by construction workers
- Fugitive dust emission via site preparation activities, subsequently inhaled by construction workers
- Direct soil contact by future employees
- Fugitive dust emission via normal workday activities, subsequently inhaled by future employees

It is assumed that any hypothetical future indoor industrial activities would be under the purview of OSHA. Because of multiple factors including the local economy, lack of pressure to utilize the Site, and the potential need to manage mixed-wastes on-Site, such industrial use of the existing building is not presently a plausible scenario. Prediction of exposure during hypothetical indoor activities is thus not within the scope of this assessment.

Table 3-2
Parameters Used in the Quantitative Assessment of Potential Intakes
METCOA Restart Site, Pulaski, PA

Scenario	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Ingestion of Soil via Recreational Use (associated with dermal contact) Children ages 6-15	100 mg/day (11)	15 days/yr (3)	Matrix effect: 1.0 for all	52 kg from (7)	For noncarcinogenic effects: Exposure is averaged over 9 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Ingestion of Soil via Occupational Use (associated with dermal contact) Construction Workers	50 mg/day (1)	125 days/yr (2)	Matrix effect: 1.0 for all	70 kg from (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Ingestion of Soil via Occupational Use (associated with dermal contact) Future Site Employees	50 mg/day (1)	250 days/yr (1) 25 years (1)	Matrix effect: 1.0 for all	70 kg from (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Dermal Exposure to Contaminants in Soil via Recreational Use Children ages 6-15	31.3% of total surface area (14,700 cm2) exposed (7, 8)	15 events/yr (3,5) 10 hours/event (9)	0.1% for inorganics (9)	52 kg from (7)	For noncarcinogenic effects: Exposure is averaged over 9 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Dermal Exposure to Contaminants in Soil via Occupational Use Construction Workers	10% of total surface area (20,000 cm2) exposed (7)	125 events/yr (2) 10 hours/event (9)	0.1% for inorganics (9)	70 kg from (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime

Table 3-2 (cont)

Parameters Used in the Quantitative Assessment of Potential Intakes

METCOA Restart Site, Pulaski, PA

Scenario	Contact Rate	Exposure Frequency and Duration	Absorption	Body Weight	Averaging Time
Dermal Exposure to Contaminants in Soil via Occupational Use *Future Site Employees*	10% of total surface area (20,000 cm2) exposed (7)	250 days/yr (1) 25 years (1)	0.1% for inorganics (9)	70 kg from (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of chronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Inhalation of Fugitive Dust during Occupational (Flea Market) and Residential Use *Lifetime*	1.2m3/hr (10)	4,800 hrs/lifetime (6)	Alveolar absorp.: 0.5 or 1.0 (4)	70 kg (5)	For noncarcinogenic effects: Exposure is averaged over 9 year period; exposure is of subchronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Inhalation of Fugitive Dust during Construction Activities *Construction Workers*	2.5 m3/hr (1)	8 hrs/day 125 days/yr (2)	Alveolar absorp.: 0.5 or 1.0 (4)	70 kg (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of subchronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime
Inhalation of Outdoor Dusts *Future Site Employees*	2.5 m3/hr (1)	250 days/yr (1) 25 years (1)	Alveolar absorp.: 0.5 or 1.0 (4)	70 kg (5)	For noncarcinogenic effects: Exposure is averaged over 1 year period; exposure is of subchronic duration For carcinogenic effects: Exposure is averaged over a 75-year lifetime

Notes:

(1) EPA Standard Default Exposure Assumption

(2) 250 days/yr from U.S. EPA, Human Health Evaluation Manual, Supplemental Guidance, 1991; assume a 6 months a 6-month exposure duration for construction work

(3) 152 days/yr from U.S. EPA, Exposure Factors Handbook, EPA/600/8-89/043; assume 10% of outdoor activity is spent at site

(4) Dependent upon whether toxicity indices were dervied on an absorbed or administered dose basis

(5) Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation

(6) Time-weighted average for outdoor microenvironment for all ages, sexes, and activity levels, from PB86-107067

(7) Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments, PB85-242667: lower arms, hands, lower legs, and feet comprise 31% of total surface area; hands, feet, and lower legs comprise 25%

(8) Lepow et. al., 1974

(9) Roy Smith, PhD., Toxicologist, EPA Region III, personal communication

(10) Exposure Factors Handbook, EPA/600/8-89/043

(11) Calabrese et. al., 1989

Exposure parameters for the construction scenario are presented in Table 3-2. Exposure parameters for future employees are standard default assumptions for industrial/commercial use, as presented in EPA, 1991.

The methodology underlying the calculations herein is designed to produce an estimate of the "reasonable maximum exposure". The "reasonable maximum exposure" is defined as the maximum exposure that is reasonably expected to occur at a site under a given set of conditions. The methodology is in accordance with that specified in current EPA guidance. Standard EPA default exposure assumptions were applied unless more appropriate scientifically defensible values were available. However, it should be noted that the exposure calculations are extremely conservative and employ some assumptions or default values which are far more demanding than actual anticipated conditions. Under these assumptions, the future worker scenario provides the most restrictive conditions for determining response goals for Site-related constituents in soil.

3.3.4 Toxicity Assessment

Toxicity assessment includes the determination of acceptable intakes for each of the selected chemicals, over the duration of the identified exposure pathway. The level of intake of a chemical that can be regarded as acceptable will depend upon the frequency and duration of the intake. The acceptable intake of a substance, which accumulates in the body, will be much lower when the dose is continuous over many years (such as ingestion of drinking water) than for a tolerable short-term exposure dose (such as inhalation of fugitive dust emissions during excavation). Thus, the appropriate acceptable intake must be matched with the applicable exposure pathway.

The constituents of concern for this investigation and assessment were previously determined through the Interim Data Report, and consist of cadmium, copper, lead, molybdenum, nickel, and tungsten. Thoriated materials are not addressed in the determination of risk-based response levels, since EPA has already indicated appropriate potential response levels for thorium.

A number of sources of toxicity information exist, and they may vary in the strength of their scientific evidence. A protocol was established to determine acceptable intakes, defining a hierarchy of sources to be consulted and the methodology for determining toxicity values. The protocol is intended to meet current EPA policy and to employ methodologies adopted and/or developed by the National Academy of Sciences. Toxicity values for the chemicals of concern at the METCOA Restart Site were obtained with reference to the following hierarchy of sources:

1) Toxicity values were obtained from the Integrated Risk Information System (IRIS) database. This database contains the chronic Reference Doses (RfDs) and Cancer Potency Factors (CPFs), which have been verified by EPA's RfD and Carcinogen Risk Assessment Verification Endeavor (CRAVE)

workgroups, and is, thus, the agency's preferred source for toxicity values. IRIS supersedes all other information sources except where better scientific information exists.

2) For toxicity values which are unavailable on IRIS, the next most current source of information is the Health Effects Assessment Summary Tables (HEAST), a quarterly publication from the EPA. HEAST contains interim as well as verified RfDs and CPFs. Supporting toxicity information for verified values is provided in an extensive reference section of HEAST.

3) Toxicity values that are not in either IRIS or HEAST were derived from data in toxicological profiles for individual compounds compiled by the Agency for Toxic Substances and Disease Registry (ATDSR). These documents provide results from a number of toxicological studies as well as the methodologies and assumptions used in these studies. Toxicological values for a given compound were derived from the study summarizing the best available data or the set of data which exhibited either the lowest value for Lowest-Observed-Effect-Level (LOEL), or the highest No-Observed-Effect-Level (NOEL). The LOEL is the lowest dosage at which some effect is shown. The NOEL is the dosage at which no observed effect or response is noted. Derivation of the acceptable daily intake incorporated uncertainty factors for extrapolation of data from animals to humans, calculation of the human-equivalent dose, and interspecies variability in sensitivity of the toxicant.

4) If a toxicological profile from ATSDR was not available, toxicity data were obtained in a literature search of EPA sources in the following order:

   a) Health Assessment Documents
   b) Health Effects Assessments
   c) Health Advisories
   d) Registry of Toxic Effects of Chemical Substances (RTECS) and Hazardous Substances Data Bank (HSDB).

5) If the above sources could not provide data, Toxline and other related databases and journals were searched for relevant dose-response studies upon which to derive toxicity values, using sound, defensible principles of toxicology.

6) If the above sources could not provide data, toxicity values were derived from Threshold Limit Values (TLVs). Acceptable intake levels can be derived from TLVs by correcting for continuous exposure and dividing by appropriate and conservative safety factors.

7) If toxicity data did not exist in any of the above sources, LD_{50} data for a given compound were compiled. The lowest oral LD50 value for any species was

divided by appropriate safety factors, depending upon the anticipated length of exposure.

8) For chemicals which lack any toxicity information, the concept of structure-activity relationships was applied. This concept allows the derivation of an acceptable intake for a chemical by inference and analogy to closely related compounds. Professional judgement is tempered with conservatism in these instances.

The process of determining acceptable intakes, where no toxicity values were available from IRIS or HEAST, is documented for each analyte of interest at the Site and is presented in Appendix G. Acceptable intakes for each chemical of concern corresponding to each type of exposure scenario (chronic or subchronic; oral or inhalation) are presented in Tables 3-3 and 3-4.

3.3.5 Risk Characterization

A "baseline" risk assessment is generated at this point as a screening tool. Four (4) scenarios have been postulated for current and future use of the Site and have been previously described. The most restrictive yet reasonable scenario under which the most exposure is incurred and the corresponding risk-based response levels would be the lowest is identified by performing a baseline risk assessment and selecting for further use that scenario which poses the greatest potential risk. The baseline risk assessment utilizes the exposure assumptions and toxicity values developed in the preceding sections, and the calculated upper 95% confidence intervals of the means of the appropriate soil data sets. Raw data are included as Table 5, in Appendix G. The statistical treatment of that data is discussed in greater detail in the following section. The attendant calculations and summaries are presented in Tables 6 through 17, in Appendix G. Based upon this information, the future industrial employee scenario emerges as the scenario on which further analysis of risk-based response levels will focus.

The target risk levels selected for use in the calculation of risk-based response levels are as follows:

- For carcinogenic effects, concentrations are calculated that correspond to a total incremental risk of 10^{-6} as a result of exposure to <u>all</u> potential carcinogens from <u>all</u> significant pathways for <u>all</u> media.

- For noncarcinogens, concentrations are calculated that correspond to a hazard index of 1, which is the level of combined exposure, with respect to the most sensitive <u>specific target organ</u>, to all chemicals of potential concern from <u>all</u> significant exposure pathways for <u>all</u> media, below which it is unlikely for even sensitive populations to experience adverse health effects.

Table 3-3

Summary of Chronic Toxicity Values for Chemicals of Potential Concern

METCOA Restart Site, Pulaski, PA

Chemical	EPA-derived Oral RfD values	Provisional Oral RfD values	Provisional Inhalation RfD values	Upper-Bound Cancer Potency Factors - Oral	Upper-Bound Cancer Potency Factors - Inhal.	Dermal Provisional RfD values	Kidney-specific Provisional RfD values
Cadmium	1.00E-03 (a)		5.80E-05 (b)	0	6.10E+00 (a)	1.00E-03 (c)	1.00E-03
Copper	3.70E-02 (a)		1.00E-02 (b)	0	0	6.17E-02 (c)	1.14E+00 (d)
Lead		2.80E-03 (b)	4.29E-04 (b)	0	0	1.87E-02 (c)	5.00E-03 (d)
Molybdenum	4.00E-03 (a)		1.00E-01 (b)	0	0	4.00E-03 (c)	1.40E-02 (d)
Nickel	2.00E-02 (a)		1.70E-05 (b)	0	8.40E-01 (a)	4.65E-01 (c)	5.00E-02 (d)
Tungsten		2.00E-02 (b)	5.10E-02 (b)	0	0	2.00E-02 (c)	2.00E-02 (e)

(a) IRIS or HEAST

(b) See Appendix G, Toxicity Profiles, for derivation of provisional toxicity values

(c) Dermal RfD values are expressed as absorbed doses and are calculated by adjusting oral RfD values for gastrointestinal absorption efficiency (EPA, 1989)

(d) See Appendix G, Toxicity Interactions and Derivation of Target Organ-Specific Toxicity Values

(e) Tungsten is regarded as physiologically inert except at very high dose levels (Carson et al., 1986). No kidney-specific toxicity data were located for tungsten. The provisional RfD for most sensitive adverse effect was, therefore, applied when considering interactive effects.

Table 3-4
Summary of Subchronic Toxicity Values for Chemicals of Potential Concern (a)
METCOA Restart Site, Pulaski, PA

Chemicals	EPA-derived Oral RfD values	Provisional Oral RfD values	Provisional Inhalation RfD values	Dermal Provisional RfD values
Cadmium		2.30E-03 (c)	5.80E-04 (c)	2.30E-03 (d)
Copper	3.70E-02 (b)		1.00E-02 (c)	6.17E-02 (d)
Lead		2.80E-03 (c)	4.29E-04 (c)	1.87E-02 (d)
Molybdenum	4.00E-03 (b)		1.00E-01 (c)	4.00E-03 (d)
Nickel	2.00E-02 (b)		1.70E-04 (c)	4.65E-01 (d)
Tungsten		2.00E-01 (c)	5.10E-02 (c)	2.00E-01 (d)

(a) Subchronic values are used for exposure durations between 2 weeks and 7 years, according to EPA guidelines. Subchronic values are appropriately applied to construction workers anticipated to be involved at the site for no more than a 6-month period.

(b) IRIS or HEAST

(c) See Appendix G, Toxicity Profiles, for derivation of provisional toxicity values

(d) Dermal RfD values are expressed as absorbed doses and are calculated by adjusting oral values for gastrointestinal absorption efficiency (EPA, 1989)

It should be noted that these target risk levels are significantly more restrictive than those presented in EPA's current guidance for development of risk-based preliminary remediation goals (U.S. EPA; RAGS, Parts B & C, 1991). This represents the EPA-recommended "point of departure," and does not attempt to approach a target cancer risk of 1 in 10,000 (i.e., 1×10^{-4}) that is within the range of acceptability according to the NCP and articulated in recent EPA policy guidance (OSWER Directive 9355.0-30).

Utilizing the selected target risk levels, risks from exposures to the six (6) analytes of possible concern are calculated under the future worker scenario (the most restrictive exposure scenario), and are presented in Table 3-5. Exposure assumptions utilized in the baseline risk assessment were replaced with default exposure assumptions as presented in EPA (1991) for the calculation of risk-based response levels. This was done so that a comprehensive, recognizable and conservative methodology would serve as the basis for response action. Documentation of the calculation process is presented in Tables 18 through 20 located in Appendix G. Table 18 in Appendix G, presents the calculation of response levels corresponding to an individual chemical hazard index of 1.0. Table 19 in Appendix G, presents a recalculation utilizing renal-specific provisional RfDs to produce response levels corresponding to a combined total hazard index of 1.0. Table 20 in Appendix G, calculates the final response levels for nickel and cadmium, additionally incorporating considerations of their relative contributions to Site-related risk.

3.3.6 Definition of Potential Response Action Areas

Definition of potential response action areas consists of two steps:

1) Comparison of the upper bound Site-wide average concentrations with response levels, in order to determine if further consideration of response action is warranted under the constraints of default assumptions concerning potential exposure to future employees.

2) Determination of areas requiring remediation, in order that a focused and effective response action strategy can be developed.

3.3.6.1 Comparison of Site-Wide Average Concentrations with Response Levels

Comparison of Site-wide concentrations with risk-based response levels first requires that appropriate calculation of mean and upper 95th confidence interval of the mean concentration for the constituents of concern be performed. Soil sampling data collected during the METCOA Restart Site investigation were statistically evaluated for use in this step. These data were discussed in Chapter 2.0 and are presented in Appendix A. Six (6) on-site soil samples collected during the Interim Data Report investigation were included in the analysis as well.

Table 3-5
Risk Based Response Levels
METCOA Restart Site, Pulaski, PA

Chemical	Target Soil Concentrations Corresponding to Individual Hazard Quotient of 1 (mg/kg)	Average Surface Soil Concetration (mg/kg)	Upper 95% of the Surface Soil Mean Concentration (mg/kg)	Final Adjusted Risk Based Levels (mg/kg)
Cadmium	2.04E+03	640	3.77E+03	1.31E+03
Copper	7.56E+04	2361	1.43E+04	
Lead	5.72E+03	220	9.71E+02	
Molybdenum	8.18E+03	222	9.06E+02	
Nickel	3.71E+04	5802	2.78E+04	1.86E+04
Tungsten	4.09E+04	35.1	8.68E+01	

For each constituent, the mean, standard deviation, and upper 95th percent confidence limit of the mean were calculated. Statistical evaluation indicated that in some instances constituent concentrations in Site soils approximated a log-normal distribution, while in other instances the distribution described a normal curve. For each constituent, therefore, the mean and upper 95th percent confidence interval of the mean were calculated under both an assumption of normal and log-normal distributions. Results of this analysis revealed that in approximately half of the cases, the upper 95th percent confidence interval of the mean concentration was lower if a log-normal distribution was assumed. In the other instances, the upper 95th percent confidence limit of the mean concentration of the normal distribution was lower than that calculated for a log-normal distribution.

In order to maintain a consistent approach to the data evaluation, it was necessary to assume some form of distribution for constituent concentrations at the Site. Since neither of the distributions consistently produced a higher value for the upper confidence limit of the mean concentration, the decision was made to assume conservatively that all contaminant concentrations exhibited a normal distribution. In the case of cadmium and nickel, the constituents contributing the majority of Site-related risk, the assumption of a normal distribution resulted in a conservative estimate, since in both cases the value of the upper confidence limit was higher when a normal distribution, as opposed to a log-normal distribution, was assumed.

Determination of the assumed distribution of the data is a critical step in all risk assessment exercises, but especially important when the data will be used to decide whether or not current or future site conditions attain a specified cleanup standard. Raw data are presented in Appendix G, Table 5. Tables 1 and 2, in Appendix G, depict the distribution and frequency histograms of concentration data for cadmium and nickel in surface soil, while Tables 3 and 4, also in Appendix G, graphically present the results of the Kolmogorov-Smirnov test for log-normal "goodness-of-fit". It should be noted that the design of the Site sampling survey resulting from the Interim Data Report recommendations leads to a bias of data; e.g., "hot spots" are intentionally sought and more intensively sampled than areas with little evidence of contamination. It is highly probable that such sampling bias will lead to an overestimation of average Site soil concentrations.

As discussed above, the assumption of normality was utilized in the calculation of mean and upper 95th confidence interval of mean concentrations. Upper 95th confidence intervals of the mean concentrations of cadmium and nickel in Site soils exceed their response levels of 1,307 and 18,554 mg/kg, respectively. Some further action is, therefore, indicated for these constituents.

3.3.6.2 Methodology for Determining Areas Requiring Response

Since the average Site soil concentrations are above the indicated response levels further investigation of potential response actions is warranted. In this context further investigation means the delineation of areas of the Site for which response would significantly decrease

Site-related risks. It is important to reiterate that the response levels calculated in the preceding section represent acceptable Site-wide average concentrations of constituents in soils that should not be exceeded. If the entire Site were remediated to this level, significant and unnecessary overcleaning would take place; the resulting Site-wide average concentration would fall well below the response level. The delineation of areas requiring response is therefore not a point-by-point comparison of sampling results to an appropriate response level. A number of methods do exist, however, each of which were considered in this analysis.

The first option is the calculation of a range of values around the response level, identifying with 95% confidence the maximum concentration that may remain in place without the Site-wide average concentration exceeding the response level. Only areas exceeding this upper tolerance limit need be addressed. However, EPA (1989) states: "The assumption that the data have a normal distribution (or that a suitable transformation of the data is approximately normal) is critical to this test." This methodology was judged to be inappropriate for use in this study. Tolerance limits were calculated as per EPA (1989b) for illustrative purposes, and disclose the nonapplicability of the methodology in this instance; for example, the tolerance limit for cadmium was estimated as 5040 mg/kg for a response level of 1307 mg/kg.

A second approach is the delineation of areas requiring action through an iterative process, with risk assessment being performed at every iteration to indicate when an appropriate level of cleanup has been defined. Concentrations of cadmium and nickel at various sampling points, starting with the sampling point posing the highest risk are assumed to be remediated to at least the target response levels and new 95% confidence limits of the mean concentrations are calculated. The risk potentially posed by these new conditions, using the exposure assumptions already defined during the calculation of response levels, is examined in comparison to the target risk levels. This process is repeated until the target risk levels are met. In this manner, discrete and explicit areas are defined for response, and it can be demonstrated that addressing these areas will ensure adequate protection of public health and the environment. The resulting effort is, therefore, more focused and effective in protecting human health. This approach requires no additional assumptions concerning distribution of data, and was selected for use in this analysis. The supporting documentation for the iterative risk assessments is given in Appendix G, Tables 21 through 28. References described in the preceding sections are listed in the bibliography at the end of this Chapter.

The application of this iterative approach to define areas of the Site appropriate for response action are depicted in the following four (4) figures. Figure 3-2 shows those areas of the Site selected for response action based upon the cadmium values from the data set and Figure 3-3 shows response action areas selected for nickel. The smallest "remediable unit" shown in these figures was assumed to be 2500 square feet based upon appropriate construction equipment considerations. Figure 3-1 depicts those areas of the Site selected for radiological response action based upon micro R meter readings taken in the field at the five (5) meter grid nodes during the Interim Data Report investigation. These field measurement values were used to delineate radiologic response action areas rather than the laboratory analytical values based on the belief that the field measurements more accurately depict the true distribution of radioactive materials at the Site, as discussed in Chapter 2.0, Section 2.4. The response action areas depicted on Figure 3-1 are very conservative in that they were selected to represent all Site areas above background and are therefore more extensive than is probably required to meet the 10 pCi/gm Site criteria discussed in Section 3.2.1 of this Chapter. More precise delineation of radiologic response action areas would be accomplished by additional field measurements taken prior to response at the Site. Figure 3-4 illustrates the positions of radiologic and non-radiologic response action areas in relation to one another.

3.4 Response Action Objectives

Based upon the foregoing description of response levels and development of risk-based response action levels, the objectives to be accomplished by the technologies and alternatives evaluated in subsequent chapters of this report are:

- For radiologic response action areas,
  - Comply with Option 1 or 2 of the Nuclear Regulatory Commission's Branch Technical Position (A-NRC-A22089-00) dated October 23, 1981.
  - Allow release of the Site for future unrestricted use (based on level of radioactivity).
- For non-radiologic response action areas,
  - Comply with the risk-based response levels for cadmium and nickel by addressing the action areas depicted on Figures 3-2 and 3-3.
  - Comply with any action-specific response levels associated with implementing a particular technology or alternative at the Site.
  - Prevent potential future exposures within the building interior through institutional controls.

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CHAPTER 4.0

IDENTIFICATION AND SCREENING OF RESPONSE ACTION TECHNOLOGIES/OPTIONS

4.1 Introduction

This chapter will discuss technologies that may be potentially applicable for addressing the type, form and volume of materials in various categories that have been identified above the response levels developed in the preceding chapter. A screening process will be performed on these technologies for each category of materials to eliminate those that are readily seen to be inappropriate for the Site.

As a result of the technology screening procedure, several potentially appropriate alternatives may be identified for each material category. These alternatives are examined in more detail in Chapter 5.0 of the Management Options/Analysis Report. The following sections identify and screen response action technologies and options for the three (3) material categories present at the METCOA Site.

4.2 Radioactive Materials

The presence of low-level radioactive materials at a CERCLA site present two special considerations. These are:

- Radioactive constituents cannot be altered or destroyed by treatment technologies like many other hazardous substance components.

- Measurement and detection of radioactivity can be performed by qualified personnel on a "real-time" basis (on-site) whereas hazardous substance components generally require off-site laboratory analysis for detection and accurate quantification.

Because of these factors and the type and distribution of radioactive materials remaining at the Site, technologies that provide on-Site separation of the radioactive components using detection instrumentation located at the Site are especially promising. These separation processes could be used to treat site residuals identified above response levels to produce a large amount of soils and debris below the 10pCi/gm regulatory requirement and a correspondingly small amount of material above this limit. In this way the volume of "radioactive material" can be significantly reduced for subsequent management.

The capability of performing this work on-site with "real-time" detection of levels of residual radioactivity indicates that this portion of a response action should be conducted first. Subsequent response actions to address distribution of non-radiological inorganic constituents above identified response levels could then proceed. These subsequent response actions would be performed on that portion of the material found to be below the 10 pCi/gm radioactive response level but above non-radiological inorganic constituent response levels.

Provided in Section 4.2 of the approved Work Plan No.2 is a listing and description of some remediation technologies that may be applicable to sites determined to have radioactive soil materials. This list which was obtained from "Assessment of Technologies for the Remediation of Radioactively Contaminated Superfund Sites"; Office of Solid Waste and Emergency Response, Office of Radiation Programs, USEPA, Washington, DC; EPA/540/2-90/001; January 1990, is repeated here for reference:

Description of Radioactive Soil Remediation Technologies

Capping....involves covering the contaminated site with a barrier sufficiently thick and impermeable to minimize the diffusion of radon gas and attenuate the gamma radiation associated with the radionuclides.

Vertical Barriers....are walls installed around the contaminated zone to help confine the material and prevent any further or future migration.

Land Encapsulation....addresses excavated contaminated soil which is redeposited at a site that has been provided with complete barrier protection (plastic liners and impermeable materials).

Stabilization/Solidification....immobilizes radionuclides (and could attenuate radon emanation) by trapping them in an impervious matrix. The solidification agent (Portland cement, silica grout, etc.) is injected in situ or mixed with excavated soils.

Vitrification....is a process that can immobilize radioactive contaminants by heating the contaminated material to its melting temperature and then cooling to a solid glassy mass.

Soil Washing...involves water (with or without additives) to wash contaminated waste. Some contaminants are soluble in water while others are washed free of soil particles. Physical separation techniques are then used to separate the soil into clean and contaminated fractions.

Chemical Extraction....removes contaminants by mixing soil with chemicals. The product is separated into cleaned and contaminated soil fractions and a liquid extract containing radionuclides. The soluble radionuclides are separated from the extractant by ion exchange, co-precipitation, or membrane filtration.

Physical Separation....uses screening, classification, flotation, and gravity concentration to separate fine soil particles which may contain radioactive contaminants. Screening is a mechanical separation based on particle size differences. Classification involves the separation of particles based on their settling rate in fluids, normally water.

The response action objectives for radioactive materials stated in Chapter 3.0 of this report indicate that the implementation of response actions should be designed to:

- Comply with Option 1 or 2 of the Nuclear Regulatory Commission's Branch Technical Position (A-NRC-A22089-00) dated October 23, 1981.
- In accordance with the above, allow release of the Site for future unrestricted use (based on the level of radioactivity).

Complying with Option 1 of NRC's Branch Technical Position, or releasing the Site for future unrestricted use may be adversely impacted by the potential closure of off-Site low-level radioactive disposal facilities or limitations on shipments from certain states to these facilities after December 31, 1992. Should these developments hinder the attainment of response action objectives, it may be necessary to re-evaluate and include on-Site management options for radioactive materials as provided for in Option 2 of NRC's Branch Technical Position or alternate on-Site management standards.

With these considerations and objectives in mind, the preceding list of potential technologies can be readily evaluated. The following table provides a summary of evaluation rationale and whether the technology will be analyzed further in this Report and if it should be retained for potential future analysis if conditions warrant.

Evaluation of Radioactive Soil Remediation Technologies

Technology	Evaluation Rationale	Further Analysis In This Report	Retain for Future Analysis
Capping	At a minimum require four (4) feet of cover to comply with Option 2 of NRC's BTP. Compliance with Option 1 not feasible.	No	Yes
Vertical Barriers	Non-compliance with both Option 1 and Option 2 of NRC's BTP.	No	No

Land Encapsulation	Non-radiological hazardous constituents would render off-site land encapsulation not feasible. On-Site would at a minimum require four (4) feet of cover to comply with Option 2 of NRC's BTP. Compliance with Option 1 not feasible.	No	Yes
Stabilization/ Solidification	At a minimum requires four (4) feet of cover over stabilized/solidified material to comply with NRC's BTP Option 2. Compliance with Option 1 non feasible.	No	Yes
Vitrification	At a minimum requires four (4) feet of cover over vitrified material to comply with NRC's BTP Option 2. Compliance with Option 1 not feasbile.	No	Yes
Excavation with Off-Site Disposal	Excavated materials potentially contain mixed-waste which cannot be handled by existing off-Site low-level radioactive disposal facilities.	No	Yes
Soil Washing	Radionuclides at the METCOA Site are insoluble and of differing size and density preventing removal by soil washing techniques.	No	No
Chemical Extraction	Radionuclides removed by chemicals into liquid extract after debris removal and grinding operations.	Yes	Yes
Physical Separation	Debris screening and subsequent physical separation of radionuclides by mechanical conveyor sorting devices utilizing radiation detection equipment.	Yes	Yes

Based upon the above evaluation process, technologies employing chemical extraction or physical separation have been retained for further analysis in the Report as radiological material response action alternatives. Both of these technologies employ a process by which the radionuclide content of the soil and debris is separated from the remaining soil and debris media. This would accomplish volume reduction and allow the non-radiological portion to be processed for those constituents above non-radiological response levels, if necessary.

4.3 Non-Radioactive Materials

The response action objectives for non-radioactive materials stated in Chapter 3.0 of this report indicate that the implementation of response actions should be designed to:

- Comply with the risk-based response levels developed for non-radiological inorganic constituents.
- Comply with any action-specific response levels associated with implementing a particular technology or alternative at the Site.
- Prevent potential exposures within the building interior through institutional controls.

In this section technologies are screened based upon their potential to meet these objectives and their general applicability and appropriateness for the type, volume and distribution of constituents at the METCOA Site. The identification of soil response action technologies involved a review of available literature including USEPA documents: "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Report"; "Handbook for Evaluating Remedial Action Technology Plans"; and "Engineering Evaluation/Cost Analysis Guidance for Non-Time Critical Removal Actions, Draft". These documents were reviewed to identify technologies that may be potentially applicable for soil response actions.

It should be emphasized, as stated in the previous section, that any response action implemented to address non-radioactive materials would only be undertaken after the selected response action is completed that addresses radioactive materials. Addressing the Site in this chronological order will minimize the potential for developing mixed-waste residuals as a result of implementing the response action alternatives.

Technologies that were readily identified from comprehensive lists as worthy of further consideration and screening analysis for the METCOA Site included the following subcategories and processes:

Containment

- Capping

In-Situ Treatment

- In-Situ Fixation/Stabilization
- In-Situ Soil Flushing/Chemical Extraction

Ex-Situ Treatment

- Ex-Situ Fixation/Stabilization
- Ex-Situ Soil Washing/Chemical Extraction

Removal

- Excavation and Treatment/Disposal Off-Site

To facilitate further screening of the above-listed technologies a brief description of the measures and technical procedures involved when implementing these specific technologies is warranted. The following subsections will present this information along with the rationale for the screening conclusions.

4.3.1 Containment Technologies - Capping

Capping technologies usually involve the construction of an impermeable cap over the area of affected soils. At the METCOA Site this would involve those soils found to be above the non-radiological risk-based response levels. A cap could be constructed as a Resource Conservation and Recovery Act (RCRA) cap with design and construction in accordance with the RCRA cap requirements found in 40 CFR Part 264. This type of cap along with other impermeable caps (i.e., concrete surfacing) are designed to prevent precipitation from infiltrating through affected site soils, thereby reducing the leaching of materials to the lower subsurface and/or groundwater.

As noted by the analytical results and interpretations presented in Chapter 2.0, the inorganic constituents above risk-based response levels are confined primarily to the very shallow (0'-1.5') surface soils. Because of the documented vertical distribution, the concern is not downward migration of constituents, but rather surface contact mechanisms and, to a lesser degree, inhalation of resuspended airborne particles from the surface. Thus, this Report considers capping technologies to prevent surficial exposures without inhibiting infiltration. Application of this type of cap would involve a shallow layer of clean fill, properly graded to prevent ponding and erosion, with subsequent revegetation to stabilize the surface.

Application of any capping procedures at the METCOA Site as a "stand-alone" response action would be potentially appropriate only to those areas that do not exhibit radioactive materials in excess of response levels. The NRC's Branch Technical Position, Option 2, requires four (4) feet of cover to allow burial of materials with activity levels between 10 and

50 pCi/gm. Given the topography at the METCOA Site, this depth of cover is infeasible. Therefore capping of areas in excess of NRC's Branch Technical Position, Option 1 level of 10 pCi/gm, without removal of radioactive materials is not acceptable.

Accordingly, multi-layered impermeable caps including RCRA-type caps have been eliminated from further consideration. Permeable, clean fill caps with vegetative cover have been retained for evaluation and use in conjunction with other technologies, and for on-Site areas not exhibiting radioactive materials over 10 pCi/gm.

4.3.2 In-Situ Treatment Technologies

All in-situ treatment technologies evaluated through this screening process would be applicable only to those areas and locations that do not exhibit radioactive materials above response levels. Locations exhibiting radioactive materials above 10pCi/gm would require the application of a technology to remove the radioactive components, thereby negating the applicability of any in-situ technologies.

4.3.2.1 Fixation/Stabilization

The fixation/stabilization process sometimes referred to as immobilization, solidification, or encapsulation uses additives or processes to physically or chemically immobilize hazardous constituents in soil. The basic procedure involves two (2) steps: mixing a reagent with the soil and curing the mixed product. For in-situ treatment, the soil and reagent are mixed by using a backhoe to apply and mix additives, or by using a more sophisticated injector device with augers to inject the reagent into the soil and a paddle assembly to mix the materials.

The applicability of this technology to the METCOA Site includes the following factors:

- Additives and reagents are widely available and relatively inexpensive.
- Resulting stabilized material should require no further treatment other than *protective cover.*
- Will not "trigger" compliance with Land Disposal Regulations (LDR's) due to in-situ nature of process (no excavation and subsequent placement of materials required).

Limitations of the technology include:

- Presence of miscellaneous surface and near-surface debris (i.e.; bulk debris, wood, stone, metal pieces, etc.) may interfere with delivery of reagent to the subsurface and subsequent mixing.
- Volume of treated material may increase with the addition of reagents.

- Site-specific, and possibly area-specific, treatability testing on pilot-scale level is required to establish types and amounts of reagents, cure times, etc.

With the above-noted disadvantages and potential limitations of in-situ fixation/stabilization, the applicability for this technology at the METCOA Site is limited. Most of the areas at the Site that require response, exhibit a high degree of miscellaneous debris within the surficial soils. In addition, most of these same areas will require removal of radioactive materials prior to treatment for other inorganic constituents. As stated earlier in this chapter, removal of radioactive materials can only be accomplished in an ex-situ fashion. Those limited areas of the Site which may qualify for these technologies also qualify for use of procedures which do not require treatability studies or other additional pilot testing. Therefore, in-situ treatment utilizing fixation/stabilization technology has not been retained for further evaluation.

4.3.2.2 Soil Flushing/Chemical Extraction

For the same reasons identified in the previous section, the application of this technology is considered to be potentially feasible only for those areas at the Site that do not have radioactive materials above response levels.

Soil flushing/chemical extraction is a technology that involves the addition of a solvent or surfactant to the affected soil to enhance contaminant mobility. Contaminants are then recovered in the ground water by strategically placed extraction wells and pumped to the surface for treatment. The feasibility of this technology is inappropriate for applications where: the water table is shallow; the soils have low-hydraulic conductivities; the depth to bedrock is shallow; and contaminants are strongly absorbed to soil particles (highly immobile). All of these conditions appear to be present at the METCOA Site based upon field observations, analytical data, and knowledge of local geologic and hydrogeologic conditions. Implementation of this technology also induces groundwater contamination, under controlled conditions, which for a site with previously undetected contaminants is considered highly undesirable. This technology was therefore eliminated from further evaluation.

4.3.3 Ex-Situ Treatment Technologies

Ex-situ treatment technologies, unlike the in-situ technologies previously described, should be applicable for all areas of the Site where the constituents are above response levels. The necessity of treating radioactive constituents in an ex-situ process makes that approach also applicable to non-radiological materials. After removal of the radioactive components, the remaining sidestream can then be treated in a separate ex-situ process to address non-radioactive materials above response levels.

4.3.3.1 Fixation/Stabilization

The ex-situ fixation/stabilization process is identical to the in-situ process previously described except that the addition of reagents and mixing of materials is carried-out in a vessel such as a drum, pug mill or ribbon blender. The treated soil is subsequently backfilled on-site in the area of initial excavation.

The advantages and disadvantages of this technology are also similar to those indicated for in-situ treatment. Differences include the fact that due to the ex-situ nature of the technology, the subsequent replacement of treated soil to the excavated area will "trigger" compliance requirements with LDRs or require a variance to these regulations. Miscellaneous debris in the surface and near-surface soils will also present potential problems. For those areas requiring response for radioactive materials, most of the larger fraction of debris will be removed by screening operations prior to treatment of the radioactive fraction. Treatability testing (probably on a pilot scale) will also be required.

Due to the wider applicability of this technology to all areas of the Site requiring response actions and the compatibilities that exist with radioactive material treatment actions, ex-situ fixation/stabilization has been retained for further evaluation through alternative analysis.

4.3.3.2 Soil Washing/Chemical Extraction

Soil washing/chemical extraction involves contacting excavated soils with an aqueous medium, solvent, or surfactant to release the contaminants into solution. Either the extracted contaminants can then be concentrated for treatment or the entire aqueous stream can be treated. Soil washing is similar to soil flushing except the process is applied to excavated soils rather than in-situ. Transfer of contaminants from the soil matrix to solution is accomplished in countercurrent extraction equipment. Good mixing is necessary for adequate mass transfer.

Following extraction, cleansed soils must be separated from solution. Soils are typically settled, dewatered, and returned to the excavation area. Dewatering may be complicated by high clay or silt content of the soil, the technology should be effective overall in reducing mobility, toxicity, and volume by removing the constituents from the affected soils.

Disadvantages include the necessity to produce an aqueous mixture, slurry, or waste stream which may require, at a minimum, periodic discharge of treated water to local surface water. The extraction of inorganic materials often requires the use of acidic chemicals, which would necessitate additional safety requirements and proper storage equipment at the Site.

The similarity of this technology to others utilized for chemical extraction of radioactive materials provides justification to retain this technology for further analysis during alternative analysis.

4.3.4 Removal Technologies - Excavation and Treatment/Disposal Off-Site

This technology involves the excavation and ultimate transport for treatment/disposal at an off-site EPA- or State-permitted hazardous waste facility. As explained in Section 4.4, after excavation, those soils located in areas of the Site with radioactive materials above response levels, must undergo on-site treatment to remove the radioactive component. The separated soil fraction with inorganic constituents above risk-based response levels may then be transported off-site for ultimate treatment/disposal. Off-site treatment is anticipated to be necessary in order to comply with LDRs.

This technology could also be readily utilized for those areas of the Site that do not exhibit radioactive materials but do possess inorganic constituents above response levels. Any excavated areas would be backfilled to grade with clean fill materials and properly re-vegetated. This technology has been retained for further evaluation during the alternative analysis process.

4.4 Radioactive /Non-Radioactive Materials

A third category of materials which must be addressed under the requirements of the Order is the combined category of radioactive and non-radioactive materials found at the Site above risk-based response levels. Most frequently the term "mixed-waste" is applied to this material classification. However, there are several important distinctions that should be made regarding this material classification before the term "mixed-waste" is loosely applied to all Site materials in this category. To make these distinctions, a clear concise definition of the term "mixed-waste" should first be made: "Mixed Low-Level Radioactive and Hazardous Waste (Mixed LLW) is defined as waste that satisfies the definition of low-level radioactive waste (LLW) in the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLWPAA) and contains hazardous waste that either (1) is listed as a hazardous waste in Subpart D of 40 CFR Part 261 or (2) causes the LLW to exhibit any of the hazardous waste characteristics identified in Subpart C of 40 CFR Part 261."

Furthermore, for a material to be classified under the above-stated definition it must just meet the definition of "RCRA Solid Waste" as provided for in Subpart A of 40 CFR Part 261. Without repeating the full text of that definition in this report, the important point to note is that a solid waste as defined by RCRA applies only to "discarded materials" and the various subsets of that category (see 40 CFR 261.2).

Therefore, unless a material is by definition is a "solid waste" under RCRA, it cannot be a "hazardous waste" under the same statute. Furthermore, without being a "hazardous waste" the material cannot be classified as a "mixed-waste".

This distinction is important at the METCOA Site as it applies to in-situ surface and subsurface soils. They do not meet the criteria for a mixed-waste. Although these soils, in some locations, contain radioactive material above Site guidelines and also exhibit concentrations of inorganic constituents above the risk-based response levels developed in Chapter 3.0, they do not meet the definition of a RCRA "solid waste" because in their in-situ form they cannot be considered a "discarded material". If however, the materials are excavated and not treated on-Site to remove either the radioactive component or the inorganic component is above response levels, the materials would require transport off-site for treatment and disposal. Under this scenario the soil material would become a "discarded material". Therefore, if testing revealed TCLP concentrations exceeding the RCRA limits and the presence of radioactivity above the regulatory criteria the materials would then be considered mixed-waste.

The implication of these distinctions are important, in that at the present time and for the foreseeable future there are very few off-site treatment and disposal options for mixed-waste materials. This point was emphasized in Section 4.2.2 of approved Work Plan No.2. For these reasons the on-site technologies outlined in the previous sections of this chapter provide the best opportunity for minimizing any potential problems with generating additional quantities of mixed-waste materials at the METCOA Site.

As stated in the previous section there are very few off-site options available for treatment and disposal of mixed-waste materials. At the current time there are only two (2) facilities in the United States that are licensed to receive and manage mixed-waste materials. Due to this restriction, off-site storage and potential treatment of some RCRA characteristic mixed-waste is available only at premium prices and only for selected materials.

4.4.1 Off-Site Storage/Treatment Option

One of the off-site facilities has drummed material storage capabilities and the ability to treat some RCRA characteristic mixed-wastes. Following treatment the material is tested and if found to no longer exhibit the RCRA characteristic feature for classification as a hazardous waste, it can be shipped for off-site disposal at a low-level radioactive waste landfill. Since the mixed-waste materials currently in storage at the METCOA Site apparently fit these classifications (ie. RCRA characteristic waste) this option will be retained for analysis in the following chapter. Any residual side streams generated from treatment of soils at the site could also be handled through this option, if after testing, it was found that the two criteria for defining mixed-waste were present. The complicating factor is that if the materials are not capable of being treated by this facility to remove the hazardous characteristic, they must be returned to the METCOA Site. Storage without treatment is only available at this facility for one (1) year from the date of receipt.

4.4.2 Off-Site Disposal Option

The other off-site facility currently licensed to receive and manage mixed-waste materials is not a treatment facility but instead is a landfill facility. Although the facility has been licensed by the appropriate state agency through their administration of the RCRA Part B permitting process, there are several issues concerning the facility's permit, license and operational status that preclude the use of this facility from further consideration at this time. It should be noted, that as of the writing of the report, the facility has not yet disposed of any materials in the landfill cell they have designated for mixed-waste.

4.4.3 On-Site Storage Option

The third option that warrants evaluation is on-site storage of mixed-waste materials. This alternative is authorized to May 8, 1992 through the capacity variance in the Third-Third Land Disposal Restrictions as it relates to slag,"scrap metal", and mixed- wastes (June 1, 1990, Federal Register, Vol 55, No. 106, Pg. 22673). EPA has more recently issued its policy statement that, given environmentally responsible operations, EPA will refrain from enforcing land disposal restrictions and related provisions with reqard to LDR-prohibited mixed waste through December 31, 1993 (August 29, 1991, Federal Register, Vol. 56, No. 168, pg 42730-42734). EPA has set forth several justifications for this policy including "...there are currently no facilities providing disposal capacity for commercially generated mixed-waste. Also, there are limited treatment options for much of the mixed waste generated by commercial generators (NRC fuel cycle and materials licensees) and by DOE ... Without available treatment or disposal capacity for many mixed-wastes, generators of these wastes are forced to violate the LDR storage prohibitions, since the development of treatment on-site is frequently not feasible." Based upon EPA's policy, the current variances, and lack of off-site alternatives, the on-site storage option has been retained for further evaluation. This on-site storage alternative would apply to existing drummed materials in storage as well as to any residuals that meet the mixed-waste criteria and are generated from the on-site treatment of soils and debris.

4.5 Summary of Response Action Technology/Option Screening

The preceding sections of this Chapter have provided a description of various technologies and options that were screened for their applicability to METCOA Site conditions. This screening process was based upon readily available information concerning the nature and distribution of constituents found to be above the response levels developed in Chapter 3.0. Technologies or material management options were evaluated for the three (3) broad categories of materials present at the Site. The technologies and options selected for the screening process were obtained from more comprehensive technology lists presented in the various EPA guidance documents previously described and also from contacts made with remediation companies involved in innovative radiologic restoration projects. It should be emphasized that the order of performance of technologies at the METCOA Site is an important consideration. Proper application of technologies and options in the correct sequence should minimize the potential "generation" of mixed wastes and the resultant problems associated with these materials.

The following Table 4-1, presents the results of the screening process and identifies response action alternatives for each material category and lists the technologies evaluated in Chapter 5.0.

TABLE 4-1
RESPONSE ACTION ALTERNATIVES

RESPONSE	RADIOACTIVE	NON-RADIOACTIVE	RAD/NON-RAD
No Action			
Institutional Controls/Site Security	Access and Use Restrictions	Access and Use Restrictions	On-Site Storage with Access and Use Restrictions
Containment		Capping (Note 1)	
Ex-Situ Treatment	Physical Separation Chemical Treatment	Fixation/Stabilization Soil Washing/Chemical Extraction	
Removal	Off-Site Disposal (Note 2)	Off-Site Treatment and Disposal	Off-Site Storage/Treatment and Disposal

Note 1 - Retained as clean fill, vegetative cover for final step in implementing other technologies and for areas without radioactive materials.

Note 2 - Separation of radioactive component from soil must precede off-site disposal.

CHAPTER 5.0

ANALYSIS OF RESPONSE ACTION ALTERNATIVES

5.1 Introduction

The preceding chapter identified and provided initial screening of various technologies and options that could potentially be applicable as response actions for various categories of materials at the METCOA Site. These technologies and options are assembled into the following response action alternative categories for further evaluation:

- No Action
- Institutional Controls/Site Security
- Containment
- Treatment
- Removal

Within each of these response action alternative categories the technologies and options shown on Table 4-1, located at the end of Chapter 4.0, have been identified.

5.2 Screening of Response Action Alternatives

Alternatives consisting of these identified technologies and options will be evaluated in this chapter based upon the following three criteria:

- Effectiveness
- Implementability
- Cost

The effectiveness of each response alternative refers to the degree to which the alternative reduces contaminant mobility, toxicity, or volume and the degree to which the alternative protects human health and the environment. The implementability of a response refers to the technical feasibility and availability of the response technology. Cost estimates were developed for each alternative and help form the basis for the comparative analysis of alternatives. Cost estimates are based on site specific data currently available and are considered to be within a +50/-30% accuracy range. The screening process for each response alternative within each material category is discussed in the following sections. Due to the fact that the response alternatives for No Action and Limited Action are independent of the type of material category, they will be evaluated first.

5.2.1 No Action Alternative

The National Contingency Plan (NCP) requires that a no action alternative be included as a response alternative, thereby providing a baseline for evaluating other response alternatives.

Technical Description: The no action alternative means no further actions would be undertaken to address Site soils above response level concentrations. Current interaction, if any, between the Site soils and the surrounding environment would be allowed to continue.

Effectiveness: The no action alternative will not preclude any potential movement of materials from the Site, or reduce the toxicity or the volume of materials above response levels. The no action alternative would be effective at maintaining the current level of risk to human health by existing exposure pathways if Site security fencing is maintained and deed restrictions initiated.

Implementability: The no action alternative is readily implementable.

Costs: Costs associated with the no action alternative would be lower than all other alternatives. They primarily consist of maintaining and insuring Site security.

Screening Conclusion: The no action alternative will allow potential current interaction between the Site soils and the environment to continue. The NCP suggests that the no action response alternative be retained for further evaluation during detailed analysis of response alternatives. Therefore, the no action alternative will be retained for use as a baseline to compare chosen response alternatives as a measure of their effectiveness.

5.2.2 Institutional Controls/Site Security Alternative

The institutional controls/site security alternative consists of security fencing around the perimeter of the Site along with access, deed, and other restrictions. At the METCOA Site this alternative would also include provisions for improving building security (new lockable doors) and for repairing the roof condition to prevent water infiltration to the interior. The option of continued on-site storage of mixed-waste drummed material can only be implemented with the provision that the building remain in place. Deed restrictions would include notices or annotations to the property deed to restrict future development of the Site. Additionally, the owner of the Site would agree or be compelled to restrict and control any new uses of the Site unless prior steps are taken to ensure that any additional cleanup is first implemented.

Effectiveness; Volume of contaminated material is not effectively reduced by this alternative. Mobility and toxicity would also not be reduced. Potential exposure pathways could however be eliminated by securing and restricting access to the building interior and thereby lowering the risk of dermal contact, dust ingestion, or migration of constituents to the exterior site grounds.

Implementability: The institutional controls/site security response alternative is readily implementable. Efforts to review this alternative with representatives of the Site owner have elicited positive and supportive responses.

Costs: The costs associated with this alternative would be in the lower range for all alternatives. They would include the provision of new lockable access doors, repairs to windows or other wall openings, and repairs to the building roof. Provision for maintaining site and building security would be an ongoing expense. Estimated costs for the limited action alternative range from $141,363 to $323,450 and are provided in Appendix H.

Screening Conclusion: Although access to the Site and/or building and thereby risk of exposure may be effectively reduced by this alternative, contaminant toxicity, mobility and volume are not reduced. Continuing to restrict Site access and securing the building would reduce the risk of dermal contact or ingestion of soils or dust. This alternative has been retained and considered as an addition to the no action alternative. Without construction of another building enclosure, the institutional controls/site security option is the only mechanism through which the alternative for on-site storage of mixed-waste can be considered.

5.2.3 Radioactive Material Response Alternatives

Response action alternatives for radioactive materials consist of on-Site ex-situ treatment technologies and also the alternative of removal for off-site disposal. Removal for off-site disposal will only be considered for radioactive materials that have undergone volume reduction and separation from the site soils and subsoils. Detailed evaluation will not be performed for off-site disposal as this is the only option for the separated radioactive material. A cost estimate to cover this item is presented and included with the cost for the overall response action recommended, based upon an estimate of the amount of the radioactive material to be separated from the Site soils.

5.2.3.1 Ex-Situ Treatment - Physical Separation

Technical Description: Ex-situ treatment of soils for radioactive materials utilizing a physical separation process at the METCOA Site would involve the following components and sequence of operations:

- Screening of large miscellaneous debris from the soil to remove items such as bricks, battery casings, ring tops, scrap metal, etc.

- Crushing operations to properly size the remaining soil and debris material.

- Placing screened soil and remaining debris on a mechanical conveyor which in turn passes the material through a bank of pre-calibrated radiation detectors and monitors.

- A self-contained multi-processor stores information on the physical locations of material on the conveyor above the Site radioactive criteria.

- The system then activates diversion gates to channel material above Site criteria levels to a separate conveyor system, holding area or hand-sorting operation.

Separated radioactive material is thus greatly reduced in volume. The separated material is tested and characterized prior to off-site disposal at a low-level facility.

Effectiveness: This process meets one of the CERCLA criteria by greatly reducing the volume of radioactive material prior to off-site disposal. There will be no reduction in mobility or toxicity, however, since radioactivity cannot be destroyed or altered. Therefore, this CERCLA criteria is not applicable to the radioactive material category. Since the nature of the radioactive materials at the Site is not subject to easy hand-sorting and manual separation (see discussion in Chapter 2.0, Section 2.3), a mechanical physical separation process is anticipated to be much more effective.

Implementability: This alternative could be readily implemented at the Site and is technically feasible. At the time of preparation of this report it has been implemented at one (1) other site under the auspices of the Department of Defense (DOD). Discussions with a potential vendor indicate that given the nature, type and distribution of radioactive materials at the METCOA Site, the technology appears to be highly suitable for Site conditions. Construction of a properly sized unit and mobilization to the Site would be prerequisites. Prior to this, off-site "pilot-testing" would be necessary to establish feed rates, detection instrument settings, debris screening procedures, and testing requirements on separated side-streams. Dust suppression measures during excavation and material sorting may be required as needed.

Costs: The costs associated with this alternative include: excavation, screening and grading of Site materials; mobilization and demobilization of the unit to the Site; electricity, labor, and material testing requirements following separation. The estimated costs to implement this alternative range between $1,020,625 to $1,825,625 and are detailed in Appendix H.

5.2.3.2 Ex-Situ Treatment - Chemical Extraction

Technical Description: Chemical extraction removes contaminants by mixing soil with chemicals. The product is separated into cleaned and contaminated soil fractions and also a liquid extract containing radionuclides. The soluble radionuclides are typically separated from the extractant by ion exchange, co-precipitation, or membrane filtration. The extractant can vary between proprietary solvent mixtures and acidic leaching materials. The technology would require physical screening processes prior to chemical extraction to remove miscellaneous surface debris. In addition, the screened soil would require grinding of the radioactive slag particles into more finely distributed particles. This would be required in order to increase surface contact area for the extraction to remove and solubilize the radionuclides. End product sludges would require dewatering, testing, and off-site disposal as a low-level radioactive material. By-product liquid streams require re-cycling back into the process tankage, containerization for off-site disposal, or treatment and subsequent discharge to a local surface water body.

Effectiveness: This alternative would also meet only one of the three CERCLA criteria, reduction in volume, much as the alternative for physical separation. Reduction in toxicity and mobility would not occur as the radionuclides cannot be chemically altered or destroyed. This technology would, however, require downsizing of the radioactive slag into smaller and finer particles as well as eventually solubilizing the radionuclides via the selected extractant. Both of these operations could potentially provide a mechanism to create contaminant mobility through suspension of air particulates (grinding) or release of soluble radionuclides to the ground (spills). Proper engineering considerations would reduce these threats significantly.

The effectiveness of grinding the slag prior to extraction would require pilot-scale demonstration. Organic content of the soil and debris may also affect process chemistry. Sufficient removal efficiencies to ensure compliance with response levels for the Site would require extensive testing and demonstration.

Implementability: This alternative could be physically implemented at the Site. The technical feasibility would require Site-specific demonstration. The technology has worked well at sites with fine particle radionuclide distribution and low amounts of miscellaneous debris in the affected soil (contrary to METCOA Site conditions). Bench testing followed by pilot testing would be necessary to establish: the extent of screening operations; details of process chemistry; and logistics of site implementation (ie. power, water, discharge, freeze protection, etc.). Construction and mobilization of a full-scale unit to the Site would then proceed following the above procedures. Operation and maintenance requirements would require proper delineation as they would be more extensive than physical separation. Dust suppression measures during excavation and especially during slag grinding operations would require proper attention.

Costs: The costs associated with this alternative include: excavation, screening, and selective grinding of the slag contained in Site soils; bench and pilot testing; mobilization and demobilization of unit processes to the Site; and utilities, labor, and material testing of separated materials prior to off-site disposal. The estimated costs to implement this alternative range between $2,724,063 to $3,600,938 and are detailed in Appendix H.

5.2.4 Non-Radioactive Material Response Alternatives

Response action alternatives for non-radioactive materials consist of containment, treatment, and removal technologies. The following sub-sections present the evaluation criteria for these alternatives.

5.2.4.1 Containment - Capping

Technical Description: Use of this technology was discussed in detail in Chapter 4.0, Section 4.3.1. To summarize the information presented in that section, the use of RCRA-type impermeable caps is not appropriate for the type and distribution of constituents found at the METCOA Site. However, use of clean fill covers to prevent exposure to surficial soils, followed by revegetation of the cover surface are appropriate for evaluation. Capping of areas with levels of radioactivity over Site criteria would not be appropriate prior to removal of radioactive materials.

Effectiveness: Capping is an effective and reliable technology for sealing off surface contamination sources from the surrounding environment. By preventing re-suspension of materials from the ground surface with subsequent deposition elsewhere, the migration potential of contaminants is reduced. The CERCLA criteria of volume and toxicity reduction are not met through implementation of capping alternatives. Protection of human health and the environment would be accomplished providing that cap integrity is properly maintained. It would also be necessary to provide a deed restriction on the property to prevent excavation in all areas of the Site which had non-radioactive inorganic substances present above response levels.

Implementability: The capping alterative is technically feasible and could be implemented at the Site. Some excavation and/or regrading would be required for contouring. Those activities have the potential for release of materials to the atmosphere resulting in potential exposure risks to the Site and adjoining properties. Dust suppression measures performed on an "as needed" basis during excavation, regrading, and cap placement would minimize atmospheric re-deposition of materials.

Any capping procedures would be installed over the existing and imported fill materials. Obtaining compaction and maintaining cap integrity are important engineering considerations. Capping may also require future land use and/or deed restrictions and will require long-term maintenance activities.

In summary, the design standards for a cap would have to be Site specific and would involve soil and vegetative cover. This would effectively eliminate the direct contact exposure pathway for Site soils.

Costs: The cost associated with the installation of a cap at the Site would include: excavation, contouring, and regrading of surface soils to allow for the cap design, cap material costs, and all associated labor and equipment required for cap construction. The estimated costs to install a cap/cover range from $421,640 to $671,992 and are detailed in Appendix H. It should be emphasized that these costs are representative of capping only the areas of the Site that do not contain radioactive materials above response levels.

5.2.4.2 Ex-Situ Treatment - Fixation/Stabilization

Technical Description: This technology was described in Chapter 4.0, Section 4.3.2.1. Basically it involves the immobilization, solidification, or encapsulation of soils using additives. The procedure involves a two (2) step process: mixing a reagent with the soils and curing the mixed product. The addition of reagent and mixing of materials is carried-out in a pugmill, ribbon blender or similar vessel. Some forms of fixation/stabilization do accomplish a chemical transformation of the constituents of concern to less mobil and toxic forms. The treated soil is subsequently backfilled on-Site in the area of initial excavation.

Effectiveness: On-Site ex-situ fixation/stabilization has proven to be an effective technology at sites with inorganic constituents as the major concern. Reduction in mobility is the primary CERCLA criteria met by this alternative when the nature of the constituents is chemically altered. A reduction in toxicity would also be accomplished when the materials change form or are destroyed. Volume reduction would not be accomplished. A volume increase, to some degree, usually accompanies the addition of reagents to the soil, however, the volume of contaminant in the mixture would remain the same. Protection of human health and the environment would be afforded in much the same degree as the previously described capping alterative.

Implementability: This alternative is technically feasible and could be implemented at the Site. Since excavation would be required, the potential for atmospheric release of materials to the Site and adjoining properties is possible. In addition, the presence of reagents and/or chemicals on-site would require storage facilities and may increase the potential for material release. Treatability testing and probably pilot-scale testing would be required to determine the proper mixing ratios and equipment settings. The resulting stabilized material when placed back into the initial excavation should be protected from the elements and human exposure with a protective cover. Presence of miscellaneous debris in the surface soils, requirements for treatability testing, and compliance with Land Disposal Restrictions (LDR's) all present technical and administrative difficulties for implementing this alternative.

Costs: The costs associated with the implementation of ex-situ fixation/stabilization include: treatability testing; mobilization of equipment to the Site; excavation, treatment, and replacement of soils; and capping with a protective clean fill cover. Utilities, reagents and labor would also be factored into the cost of implementing this alternative. The estimated costs for ex-situ fixation/stabilization range from $348,594 to $675,625 and are detailed in Appendix H.

5.2.4.3 Ex-Situ Treatment - Soil Washing/Chemical Extraction

Technical Description: Ex-situ soil washing/chemical extraction involves contacting excavated soils with an aqueous medium, solvent or surfactant to release the contaminants into solution. The extracted contaminants then can be concentrated for treatment or the entire aqueous stream can be treated. Soil washing is similar to soil flushing except the process is applied to excavated soils rather than in-situ. Transfer of contaminants from the soil matrix to solution is accomplished in countercurrent extraction equipment. Good mixing is necessary for adequate mass transfer. Following extraction, cleansed soils must be separated from solution. Soils are typically settled, dewatered, and returned to the excavation area.

Effectiveness: On-Site ex-situ soil washing/chemical extraction was retained in the technology screening section (Chapter 4.0) because of its similarity to technologies potentially applicable for addressing radioactive materials at the Site. T[illegible] [illegible]ternative would be subject to extensive on-Site pilot testing in order to determin[illegible] its Site-specific effectiveness. It has only been proven to be affective at several sites with certain types and levels of contaminants and also the proper geologic conditions and soils. For example, good mixing with soil particles and the ability to dewater the cleansed soil are important considerations. The high degree of clay and silt in the METCOA soils may hinder these procedures and the overall effectiveness of this alternative. If found to be appropriate for Site conditions, this alternative would be effective in reducing the toxicity, mobility, and volume of constituents above the risk-based response levels.

Implementability: Implementation of this alternative at the METCOA Site could proceed only after field-scale pilot testing. Field scale testing would be based upon prior laboratory bench-scale testing to determine basic equipment sizing, feed rates, chemical types, etc. As in several of the previous alternatives described, excavation of the soil would require proper dust suppression procedures. On-Site storage of chemical extraction agents, many of which are acidic or contain organic materials would be required. To accommodate the liquified soil matrix and reagent addition vessels, installation of pumps and piping between reaction tanks and equipment would be required. In addition, freeze protection during cold weather operations would be an engineering consideration. Increased safety, utility, and trained labor requirements would result from implementing this alternative. By-product liquid waste streams would require recycling arrangements, containment for off-site disposal, or discharge of effluent to a nearby surface water body. Since the dewatered and cleaned soils would be placed back on-Site, testing of these materials would be required to demonstrate compliance with LDRs prior to placement. Addition of topsoil and revegetative growth would prevent the cleaned material from eroding and would stabilize the surface. In general, the presence of miscellaneous debris in the surface soils, requirements for treatability testing both on the bench scale and pilot scale and compliance with LDR's present similar but slightly more complex technical and administrative difficulties to the fixation/stabilization described previously.

Costs: The costs associated with the implementation of this alternative include: treatability testing (bench and pilot scale); fabrication of process treatment equipment; mobilization and demobilization from the Site; excavation, treatment, and replacement of soils; and providing cover and vegetative growth to prevent erosion. Utilities, process reagents, and trained labor would also be part of the cost estimate for implementing this alternative. The estimated costs for ex-situ soil washing/chemical extraction range from $729,531 to $1,358,438 and are detailed in Appendix H.

5.2.4.4 Removal - Excavation and Treatment/Disposal Off-Site

Technical Description: This alternative involves soil and debris excavation and ultimate transport for treatment/disposal at an off-site EPA- or State-permitted hazardous waste facility. After excavation, those soils located in areas of the Site with radioactive materials above response levels, must undergo on-site treatment to remove the radioactive component. The separated soil fraction with inorganic constituents above risk-based response levels will then be transported off-site for treatment/disposal. Off-site treatment is anticipated in order to comply with LDR's.

This technology would also be readily utilized for those areas of the Site that do not exhibit radioactive materials but do possess inorganic constituents above response levels. Any excavated areas would be backfilled to grade with clean fill materials and properly revegetated.

Effectiveness: This alternative would reduce the long-term mobility, toxicity, and volume of materials by permanently removing them from the Site. Protection of human health and the environment would likewise be provided by implementing this alternative.

Implementability: Excavation is technically feasible at this Site due to the shallow depth of affected materials. There also exists adequate areas for staging of stockpiled soils prior to loading for off-site transport. All stockpiled material would require characterization by representative sampling, lab analysis, and submittal of waste profile information to potential treatment/disposal companies. Dust suppression procedures would be required as necessary during all excavation. staging, and loading procedure. Material would be sent only to permitted facilities approved by EPA. Areas excavated would be filled with clean material and provided with vegetative cover growth to prevent erosion.

Costs: The costs associated with the implementation of this alternative include: excavation; stockpiling; sampling; lab analysis; transport; treatment/disposal; and materials and labor. The estimated costs range from $690,000 to $1,897,500 dependent upon treatment requirements and final off-site locations and are detailed in Appendix H.

5.2.5 Radioactive/Non-Radioactive Material Response Alternatives

Response action alternatives for this group of materials are quite limited. The screening of various options performed in Chapter 4.0 produced two alternatives that are evaluated in this section.

5.2.5.1 Off-Site Storage/Treatment Option

Technical Description: This option for handling of combined radioactive/non-radioactive materials involves the off-site shipment to NSSI Sources and Services, Inc., located in Houston, Texas. This facility currently is licensed for storage and treatment of certain types of mixed-waste.

The capabilities of this firm include the treatment of certain RCRA characteristic wastes to remove the hazard characterization, thereby rendering the material as low-level radioactive waste only (i.e., non-RCRA hazardous). The material can then be land disposed in an appropriately licensed low-level radioactive facility. Storage at the off-site location is available for one (1) year from the date of receipt.

Effectiveness: This option would be effective in the short term for removing the existing inventory of drummed mixed-waste from the building interior. In this manner the total volume, potential mobility, and toxicity of these materials would be eliminated from the Site. However, the potential exists that the off-site facility would not be able to treat all the drummed material to eliminate RCRA hazardous characteristics. Under this scenario, the material would require return to the METCOA Site after expiration of a one (1) year storage limitation at the off-site facility. The long-term effectiveness would therefore be minimized due to potential return of materials to the Site. Protection of human health and the environment in the vicinity of the Site would be positively impacted in the short-term and potentially remain as currently exists if materials were returned to the Site in the future.

Implementability: This option would be potentially implementable at the Site. Additional characterization of existing material within the building and any new materials generated from removal of radioactive materials from the Site grounds would be required. The results of these characterization efforts would establish the overall feasibility of this alternative. The characterization efforts could be performed while other activities are ongoing. It is recommended that if this option is implemented for the existing drummed mixed-waste that radioactive volume reduction be carried out on-site either through hand-sorting operations or by using a physical separation technology such as that described previously for radioactive materials. This volume reduction would be performed prior to additional characterization activities.

Costs: The costs associated with this option include: radiological content volume reduction; sampling, lab analysis, and material classification; transport to the off-site facility; off-site treatment; and ultimate disposal of treated materials at a low level radioactive facility. The estimated costs range from $499,490 to $1,201,993. The cost estimates do not make provisions for the potential return of material to the METCOA Site should they prove to be non-treatable by the off-site facility. Appendix H presents a breakdown of this cost estimate.

5.2.5.2 On-Site Storage Option

Technical Description: As previously mentioned, there currently are approximately 128 drums of material within the former METCOA processing building which, based upon preliminary characterizations, may be classified as mixed-waste material. These drummed materials were recently overpacked in sound, tight 85-gallon steel drums during the implementation of Work Plan No. 1. They are segregated for storage in the southwest corner of the existing building. Based upon the current regulatory capacity variances described in Chapter 4.0, Section 4.4.3, and the current lack of off-site alternatives, the continued on-Site storage option is viable. This option would also be applicable to any residuals that meet the mixed-waste criteria that are generated from the on-Site treatment of soils and debris.

Effectiveness: With regard to meeting the CERCLA goals of reducing volume, mobility and toxicity this option does not provide major advantages over existing conditions. It should be emphasized, however, that the current inventory of potential mixed-waste materials is presently stored in an environmentally sound and safe manner. The overpacked drums are completely secured with ring tops in place and tightened down, stored on the concrete interior building pad and covered with polyethylene sheeting to prevent condensation and water accumulation on the drum tops. Securing the building by installing new lockable doorways and repairing the roof structure would provide additional security for the on-site storage option. The long-term effectiveness may be enhanced by providing on-site storage for an interim period of time until off-site treatment and/or disposal alternatives become available. As discussed in the preceding section, current off-site treatment capabilities may not meet the requirements for all materials in storage. This could potentially necessitate the return of materials to the METCOA Site. Protection of human health and the environment is not adversely affected by the continued on-Site storage of drummed mixed-waste materials, especially if the building is left in-place, building security is maintained, and roof conditions are improved.

Implementability: The on-site storage option is implementable at the METCOA Site. The actions required are the improvements to the building and roof structure to secure the building more fully and further enhance the protectiveness of the on-Site storage option.

Costs: The estimated costs associated with implementation of this option are identical to those for the limited action option and range from $141,363 to $323,450. Appendix H presents a breakdown of the cost estimate.

CHAPTER 6.0

COMPARATIVE ANALYSIS OF RESPONSE ACTION ALTERNATIVES

6.1 Introduction

The preceding chapters of this report have presented and screened general response action technologies/options for the three (3) material classifications found at the METCOA Site. From this screening process several technologies/options were retained for each material classification for further analysis as alternatives. This chapter will provide a comparative analysis of those alternatives. This analysis will weigh the advantages and disadvantages of each alternative against each other. A numerical ranking system will be used to perform the comparisons of alternatives in each material classification. The following criteria are evaluated for each alternative.

- Effectiveness

  Short-Term
  Long-Term

- Implementability

  Technical
  Administrative

- Cost

6.2 Comparison Criteria and Summary Table

The ranking factors for each alternative and material classification are shown in Tables 6-1, 6-2, and 6-3. The total score for each alternative is based upon "weighing" the evaluation criteria. The total ranking score represents the summation of: three (3) times the alternative's effectiveness score; two (2) times the alternative's implementability score; and one (1) times the alternative's cost score. In this way, a greater emphasis is placed upon protection of human health and the environment (effectiveness) and corresponding less emphasis on the implementability and cost of an alternative. In addition to this information the following factors were considered under each of the specific evaluation criteria.

Under effectiveness the rankings for short-term considerations also factored in the alternative's ability to: mitigate potential threats; protect human health and the environment; and comply with risk-based response levels. Long-term effectiveness also considered the projected useful service life and the reduction or elimination of potential future threats.

Under implementability the rankings for technical considerations factored in the alternative's: suitability and/or constructability for site-specific environmental conditions (ie., temperature, terrain, climate); complexity and availability of labor, materials and equipment for proper operation and maintenance; demonstrated performance ability on similar projects; and timeliness associated with assembling, mobilizing, and performing the response action. Administrative considerations under implementability include: triggering of action-specific response levels (ie., LDRs); permitting requirements; public acceptability; impacts on adjoining or surrounding property; and transportation issues.

Rankings presented on the tables for cost are based upon the estimates detailed in Appendix H and, therefore reflect a general range of potential values only.

TABLE 6-1

COMPARATIVE ANALYSIS - RADIOACTIVE RESPONSE ACTION ALTERNATIVES

		EFFECTIVENESS x3		IMPLEMENTABILITY x2		COST x1	TOTAL see note 2
ACTION CATEGORY	ALTERNATIVE	SHORT-TERM	LONG-TERM	TECHNICAL	ADMINISTRATIVE		
No Action		5	5	1	3	1	39
Institutional Controls	Access and Use Restrictions	3	4	2	2	2	31
Treatment	Physical Separation Chemical Extraction	1 2	1 2	3 4	2 3	3 4	19 30
Removal	Excavation and Off-Site Disposal	See Note 1	See Note 1	See Note 1	See Note 1	See Note 1	See Note 1

Degree of Effectiveness	Degree of Difficulty	Cost	
1——————5	1——————5	1——————5	Lower Score
Most Effective … Least Effective	Easily Achievable … Not Achievable	Least Costly … Most Costly	Provides Higher Ranking

Note 1: This alternative not evaluated for comparison as it only applies to radioactive materials separated from soil and debris by treatment alternatives.

Note 2: The total weighed ranking for each alternative consists of the summation of: three (3) times the effectiveness score; two (2) times the implementability score; and one (1) times the cost score.

TABLE 6-2

COMPARATIVE ANALYSIS - NON-RADIOACTIVE RESPONSE ACTION ALTERNATIVES

		EFFECTIVENESS x3		IMPLEMENTABILITY x2		COST x1	TOTAL, see note 3
ACTION CATEGORY	ALTERNATIVE (See Note 1)	SHORT-TERM	LONG-TERM	TECHNICAL	ADMINISTRATIVE		
No Action		5	5	1	4	1	41
Institutional Controls	Access and Use Restrictions	3	4	2	2	2	31
Containment	Capping (See Note 2)	1	4	3	2	3	28
Treatment	Fixation/Stabilization	3	2	4	3	3	32
	Soil Washing/Chemical Extraction	4	3	5	4	4	43
Removal	Excavation and Off-Site Treatment and Disposal	2	1	3	2	5	24

Degree of Effectiveness	Degree of Difficulty	Cost	
1------------5	1------------5	1------------5	Lower Score Provides Higher Ranking
Most Effective — Least Effective	Easily Achievable — Not Achievable	Least Costly — Most Costly	

Note 1: All containment, treatment, and removal alternatives contained herein require prior removal of radioactive materials.

Note 2: Capping is presented for comparison purposes but is only applicable to areas not also requiring response due to radioactive materials.

Note 3: The total weighed ranking for each alternative consists of the summation of: three (3) times the effectiveness score; two (2) times the implementability score; and one (1) times the cost score.

TABLE 6-3

COMPARATIVE ANALYSIS - RADIOACTIVE/NON-RADIOACTIVE RESPONSE ACTION ALTERNATIVES

		EFFECTIVENESS x3		IMPLEMENTABILITY x2		COST x1	TOTAL (See Note 3)
ACTION CATEGORY	ALTERNATIVE	SHORT-TERM	LONG-TERM	TECHNICAL	ADMINISTRATIVE		
No Action		5	5	1	4	1	41
Institutional Controls (See Note 1)	On-Site Storage with Access and Use Restrictions	3	1	2	2	2	22
Removal (See Note 2)	Off-Site Storage/Treatment and Disposal	1	3	4	2-4 (See Note 4)	4	28-32 (See Note 4)

Degree of Effectiveness	Degree of Difficulty	Cost	
1------------5	1------------5	1------------5	Lower Score
Most Effective — Least Effective	Easily Achievable — Not Achievable	Least Costly — Most Costly	Provides Higher Ranking

Note 1: Institutional Controls alternative requires maintaining the presence of existing building enclosure.

Note 2: Removal alternative may require the return of materials to the Site if found to be non-treatable.

Note 3: The total weighed ranking for each alternative consists of the summation of: three (3) times the effectiveness score; two (2) times the implementability score; and one (1) times the cost score.

Note 4: The second ranking is provided to cover the potential return of materials to the Site if found to be non-treatable at the off-Site facility.

CHAPTER 7.0

SUMMARY OF APPROPRIATE RESPONSE ACTION ALTERNATIVES

7.1 Introduction

Based upon the comparative analysis performed in Chapter 6.0 and other criteria presented in preceding chapters, this chapter presents appropriate response actions at the Site for each material category and corresponding group of alternatives analyzed.

As stated previously in this Report, the chronological sequence of response actions for each material category is important. Performing response actions in the proper chronological sequence will help to control the: potential generation of mixed-waste; complexity of health and safety requirements for each subsequent response action; and corresponding cost of implementing any necessary response actions. Based upon these criteria the following sections describe appropriate response actions for each material category in the sequence of preferable chronological performance.

7.2 Appropriate Response Action Alternatives

7.2.1 Radioactive Materials

Based upon the comparative analysis of response action alternatives performed in Chapter 6.0, the treatment alternative employing the physical separation technology is appropriate to address the type and distribution of radioactive materials found at the METCOA Site. The technology would employ the following processes: screening miscellaneous debris; crushing material to properly size the remaining soil and debris; conveying the soil and debris through radiation detection equipment; and diverting material above Site criteria into a separate storage or holding area for subsequent off-Site disposal.

It is envisioned that in order to employ this technology properly, pilot-scale testing would be necessary. This would enable assessment of soil and debris separation requirements along with the proper design and layout of radiation detection equipment and mechanical conveyance devices. On-site radiation measurements with hand-held instruments and other analytical equipment would allow more precise definition of areas requiring response prior to actual field work. This same detection equipment would allow on-site determinations of the horizontal and vertical extent of response required as the work progresses. Analytical testing of radioactive material separated by the process would enable the proper packaging, labeling, and approval to be obtained for off-Site transport and disposal. It should be pointed out that due to potential closure of low-level radioactive disposal facilities or limitations on shipments from certain states, off-Site disposal options for separated material may be severely limited after December 31, 1992.

This alternative provides the greatest degree of short-term and long-term effectiveness among the alternatives analyzed. The achievement of response levels for the Site, as outlined in Chapter 3.0, would also be accomplished and therefore the corresponding response action objectives would be met. The ultimate off-site removal and disposal of separated radioactive materials would afford the greatest degree of protection for human health and environment.

Performance of the radioactive material response action as the first step is important for several reasons. Elimination of radioactive material above Site criteria from the soil and debris would minimize the potential for generation of mixed-waste material in subsequent response actions that may be required for non-radioactive materials. Furthermore, performing the radioactive material response first would eliminate radiologic training and medical surveillance requirements from subsequent health and safety plans prepared for response actions designed to address non-radioactive materials. Contractor bidding and selection processes for subsequent actions would therefore be less restrictive and more competitive. Performance of the radioactive material response action by a specialized radiological contractor with appropriately trained health physicists and radiation technicians would also enhance the effectiveness of the response action.

7.2.2 Non-Radioactive Materials

Based upon the comparative analysis of response action alternatives performed in Chapter 6.0, the removal alternative employing excavation and off-Site treatment and disposal is suitable to address those areas of the Site requiring response for non-radioactive materials. Portions of these areas, which overlap with the radiological response areas (see Figure 3-4) would have been excavated and rendered non-radioactive through the physical separation process described in the preceding section. Those materials would therefore only require proper characterization and off-site disposal approvals prior to loading for off-Site transport and disposal. These statements of course are premised on the prior performance of radioactive material response actions.

Other non-radioactive response areas not previously addressed for removal of radioactive materials, would require excavation and stockpiling activities prior to characterization. Obtaining off-Site approvals for disposal would allow loading and subsequent transport of the non-radioactive materials to an appropriate off-Site disposal facility. It is anticipated that large debris screened from the materials excavated during the radioactive response action would also be characterized for off-Site disposal during this phase of the response action. Generally the vertical extent of excavations would be approximately confined to the upper six (6) inches of soil and debris.

Based upon the characterization data obtained from representative sampling activities of excavated material and the availability and cost options for off-Site disposal at the time of response action performance, it may be feasible to re-evaluate on-Site stabilization (treatment) prior to shipment off-Site for disposal. Performing the stabilization (treatment) on-Site rather than at the off-Site disposal facility may prove to be less costly. Post-treatment testing following the on-Site stabilization may indicate that the materials can be disposed of at an appropriately permitted non-hazardous off-Site disposal facility. This may result in a sufficient amount of cost savings to offset any on-Site stabilization and treatment performed.

Following excavation activities and the off-Site transport for disposal, the excavated areas would receive a minimum of six (6) inches of clean fill cover. The extent of area to receive the clean fill cover would include those areas previously excavated for radioactive response activities. This material would be graded to restore Site contours and prevent, to the extent possible, ponding of water and/or excessive runoff or erosion. The surface of the clean fill would be reseeded with a vegetative growth designed to stabilize the surface, prevent erosion, and require little or no maintenance (mowing).

This alternative is appropriate primarily because it provides the greatest degree of long-term effectiveness and is ranked second in short-term effectiveness among all alternatives analyzed. In addition, this alternative is readily implementable at the Site and integrates well with the conclusion of previous activities for radioactive material response that have been recommended in the preceding section of this chapter. It is important that this alternative be implemented after the radioactive response action but before the radioactive/non-radioactive response action for the same reasons stated at the end of the previous section.

7.2.3 Radioactive/Non-Radioactive Materials

Chapter 6.0 presented the results of an analysis comparing three (3) alternatives for addressing the combined category of radioactive/non-radioactive materials at the Site. Based upon the results of this analysis, an appropriate alternative for this category of materials consists of employing continued on-Site storage along with access and land use restrictions. This alternative would apply to all currently stored drummed material existing within the building and any other materials found to be in this category based upon characterization following on-Site radioactive or non-radioactive response actions. As part of this alternative, additional improvements to the building and Site security would be made. These would consist of installation of new lockable doorways and repairing the roof structure to prevent leakage of precipitation to the building interior.

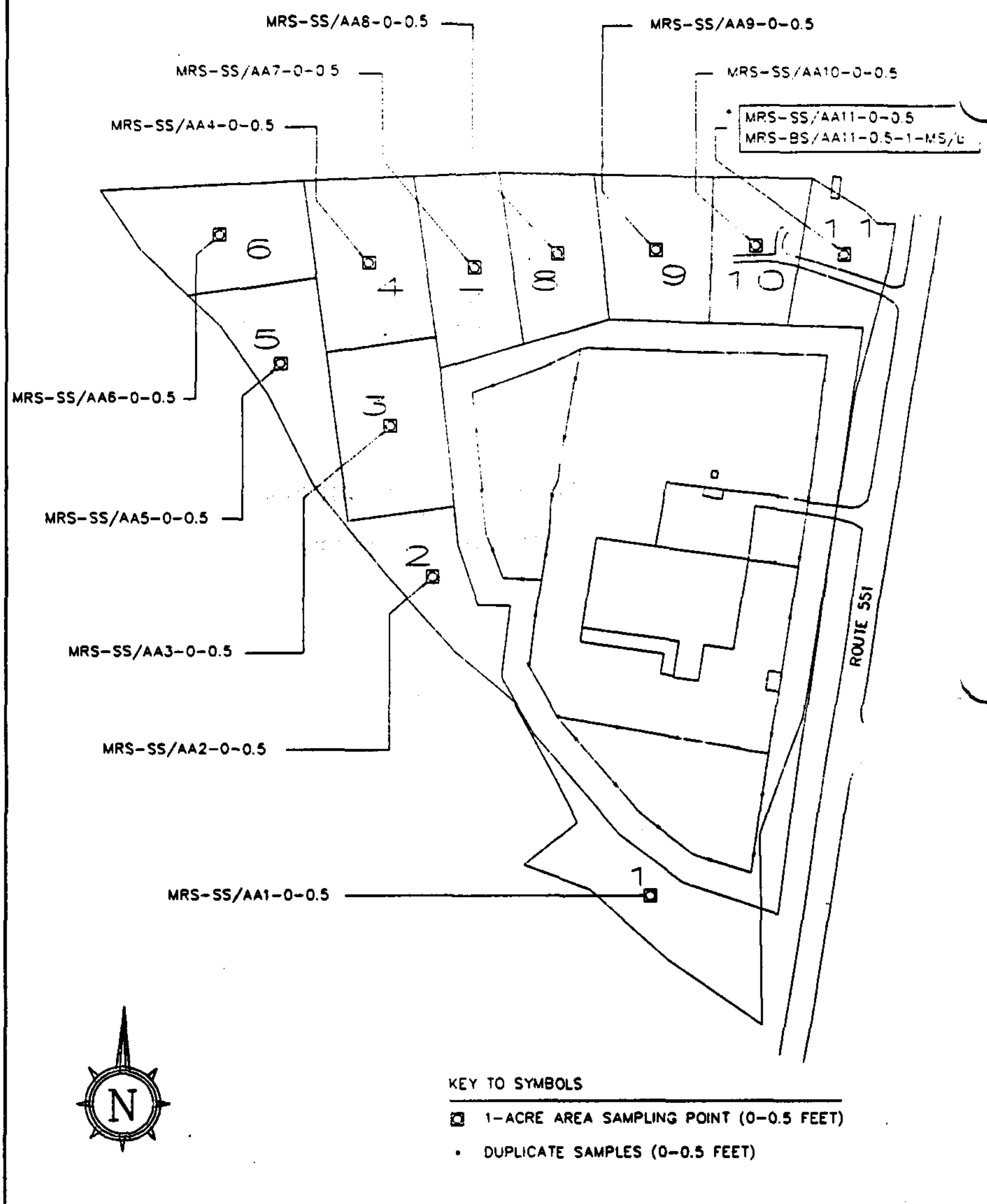
Land use restrictions would be cooperatively developed and implemented with the current property owner, Lawrence County Industrial Development Authority (LCIDA). Preliminary contacts with Authority representatives have indicated their willingness to cooperate in a response action that would include deed or land use restrictions. LCIDA also expressed willingness to cooperate in notifying EPA of a future use intended to change the Site's present status, and also require that future users comply with any EPA requirements and gain EPA approval before commencing any Site activities. These commitments would be an integral part of the on-Site storage option and could include contractual arrangement to insure compliance with proper land use restrictions as they apply to the existing building enclosure.

This alternative is suitable because it is readily implementable from both a technical and administrative perspective. Although the short-term effectiveness is not as great as the off-Site storage/treatment and disposal option (due to the fact that materials remain on-Site), this factor would be greatly minimized by the implementation of the proper institutional controls described above. Long-term effectiveness is judged to potentially be superior to current off-Site options due to the likelihood that materials may require return to the Site if found to be untreatable by the current off-Site storage/treatment facility. Over the next few years it is anticipated that additional off-Site facilities may become available for handling radioactive/non-radioactive materials without the future potential for return of materials to the Site. This may enhance the long-term effectiveness of currently implementing the on-Site storage alternative if, in fact, materials are shipped at a future date to an off-Site facility, and no return of materials to the Site results from this action.

This alternative should be chronologically performed after the radioactive and non/radioactive response actions. In this way, building roof repairs can be made by roofing contractors that would not require specific OSHA 1910.120 or radiologic training. In addition, health, safety, and medical surveillance program requirements would be greatly minimized. Repair and/or replacement of building doorways should be performed or supervised by a contractor with workers trained in OSHA 1910.120 requirements due to the remote potential of exposure to building interior dust.

APPENDIX A

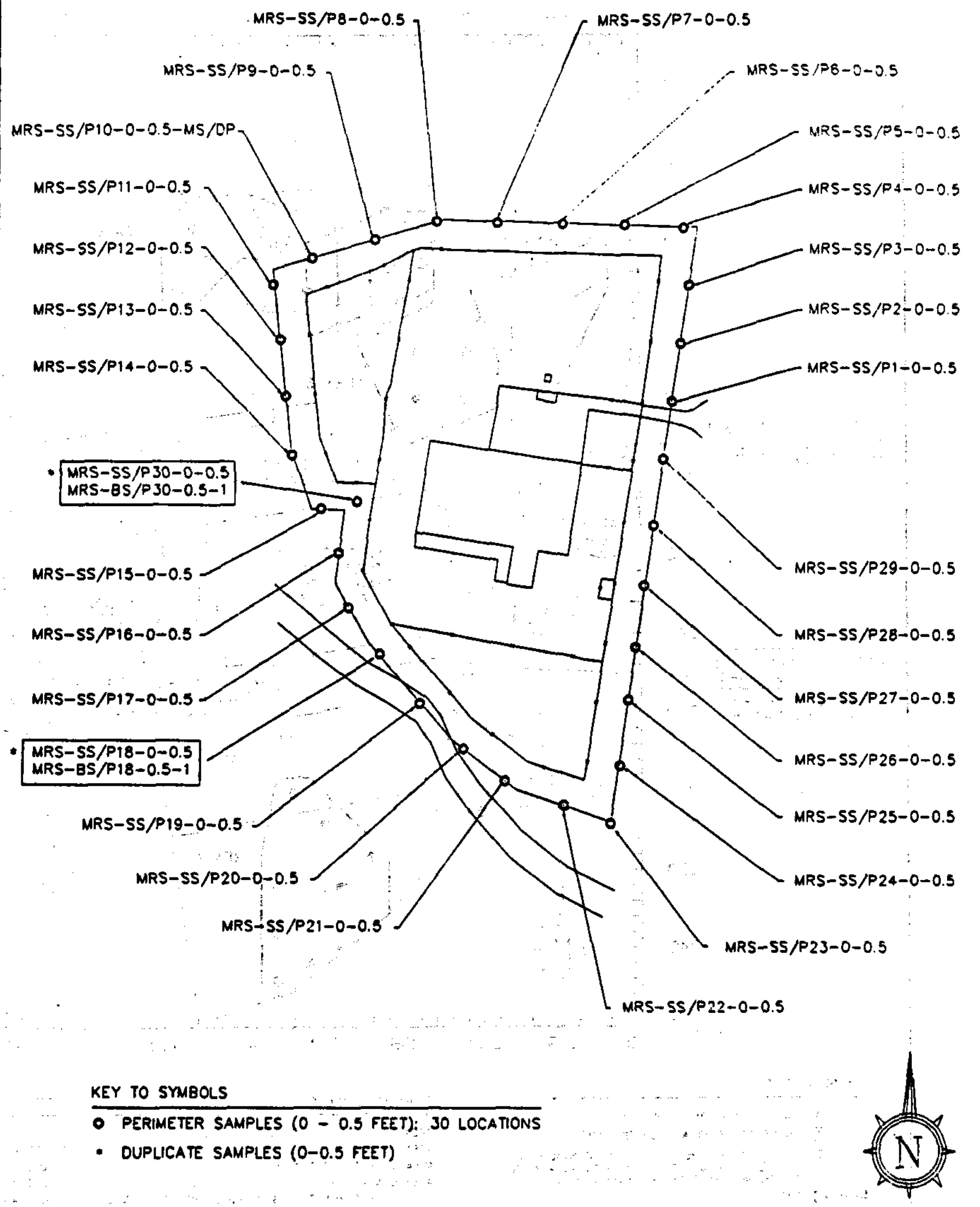
SAMPLE LOCATION FIGURES
AND
ANALYTICAL RESULTS



SUBJECT: METCOA RESTART SITE
LOCATION OF 1-ACRE AREA SURFACE SAMPLING POINTS

0' 250' 500'

FIGURE 2	DWG BY: R DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.



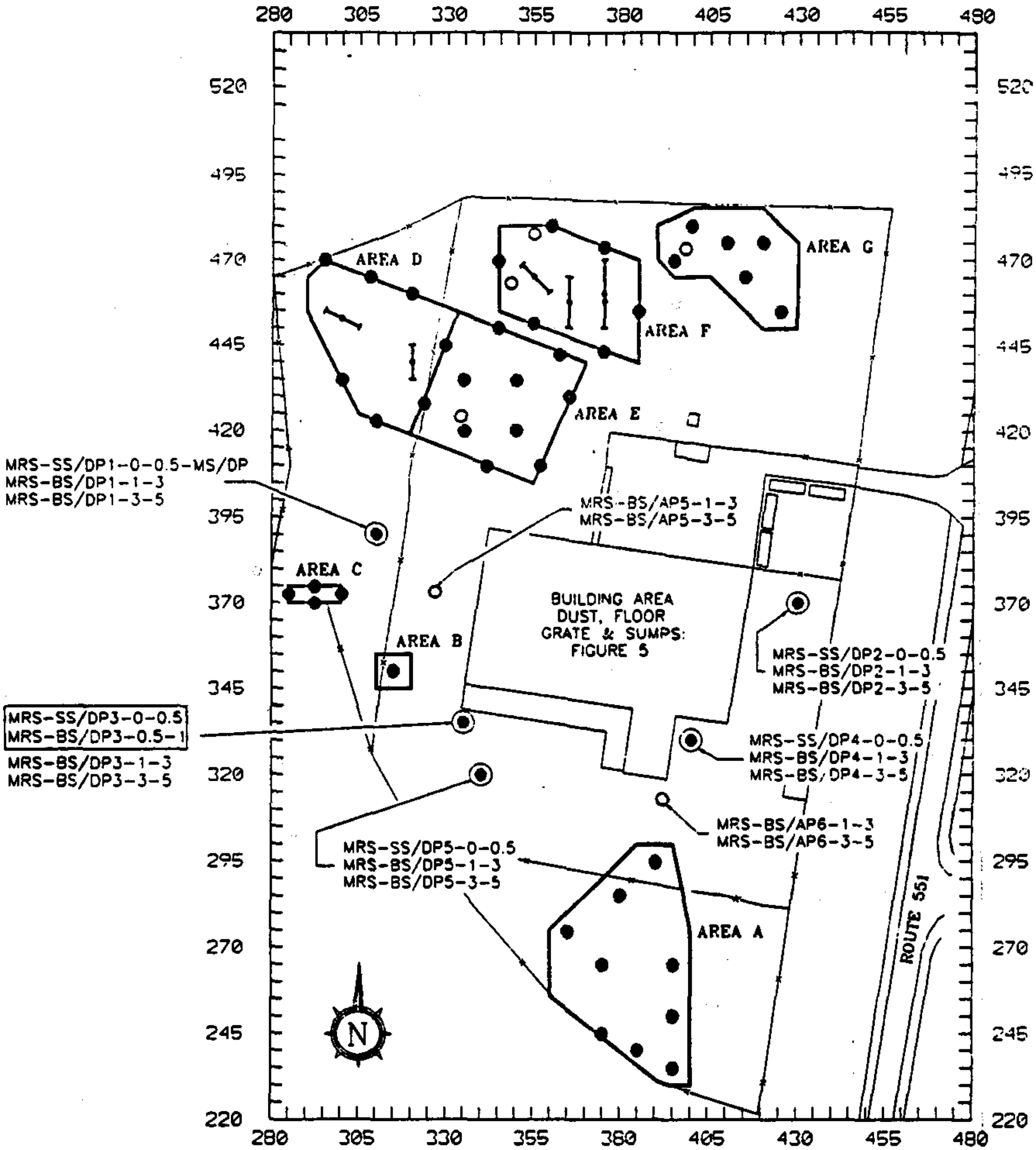
KEY TO SYMBOLS

- ○ PERIMETER SAMPLES (0 - 0.5 FEET): 30 LOCATIONS
- * DUPLICATE SAMPLES (0-0.5 FEET)

SUBJECT: METCOA RESTART SITE
LOCATION OF PERIMETER SAMPLES

0' 250' 500'

FIGURE 3	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.



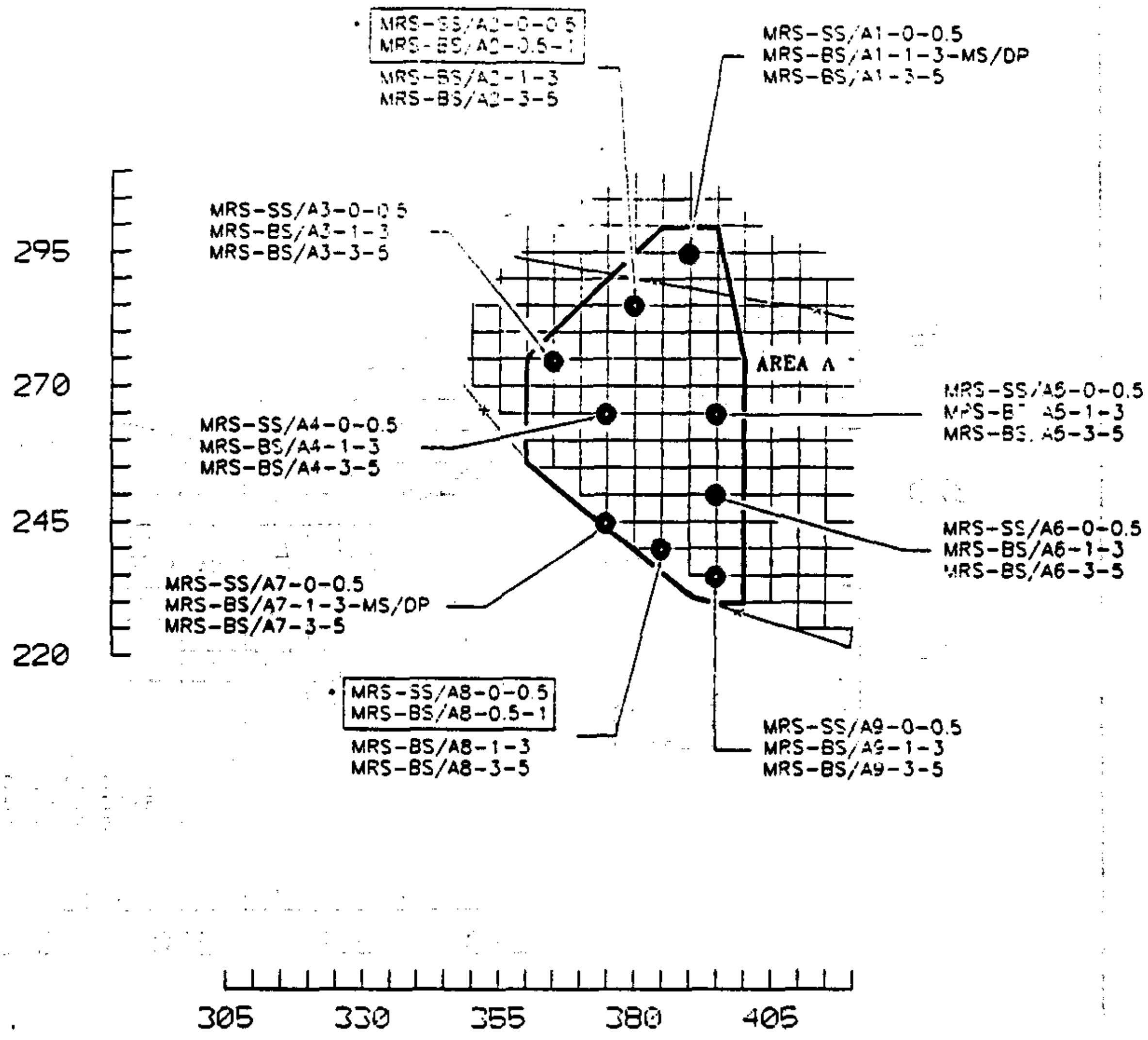
KEY TO SYMBOLS

- ● AUGER PROBE WITHIN AN AREA
- ◉ AUGER PROBE AT A DISCRETE POINT
- ○ AUGER PROBE (THE 0-0.5 FEET INTERVAL WAS SAMPLED DURING THE NONRADIOLOGICAL ANALYTE SCREENING PHASE OF THE INVESTIGATION)
- ├──┤ TRENCH
- * DUPLICATE SAMPLES (0-0.5 FEET)

SAMPLING LOCATIONS	FIGURE REFERENCE
AREA A:	FIGURE 4-1
AREAS B & C:	FIGURE 4-2
AREA D, TEST PITS 1 & 2:	FIGURE 4-3
AREA E & AUGER PROBE 4:	FIGURE 4-4
AREA F, TEST PITS 3, 4, & 5, AUGER PROBES 1 & 2:	FIGURE 4-5
AREA G & AUGER PROBE 3:	FIGURE 4-6

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
OVERVIEW OF SAMPLING LOCATIONS INSIDE THE FENCED ENCLOSURE AREA

FIGURE 4	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.



KEY TO SYMBOLS

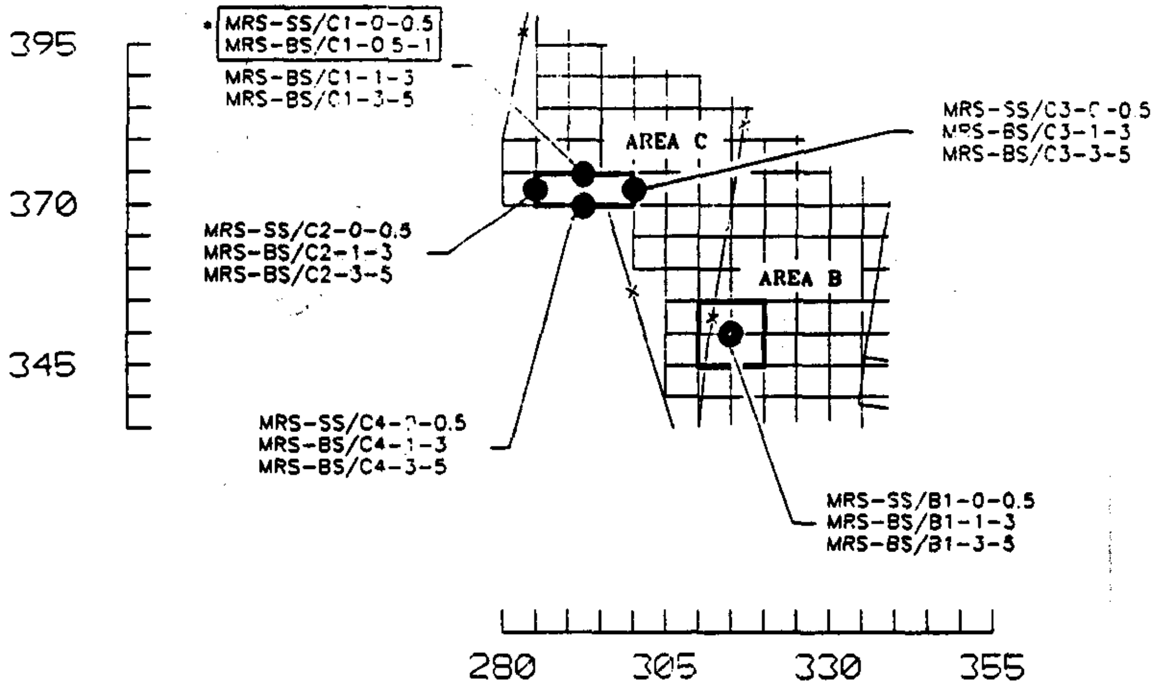
- ● AUGER PROBE WITHIN AN AREA
- * DUPLICATE SAMPLES (0-0.5 FEET)

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID) SAMPLING POINT LOCATIONS IN AREA A

FIGURE 4-1

DWG. BY: R. DIMATTEO
DATE: 02-28-92

Environmental Standards, Inc.



KEY TO SYMBOLS

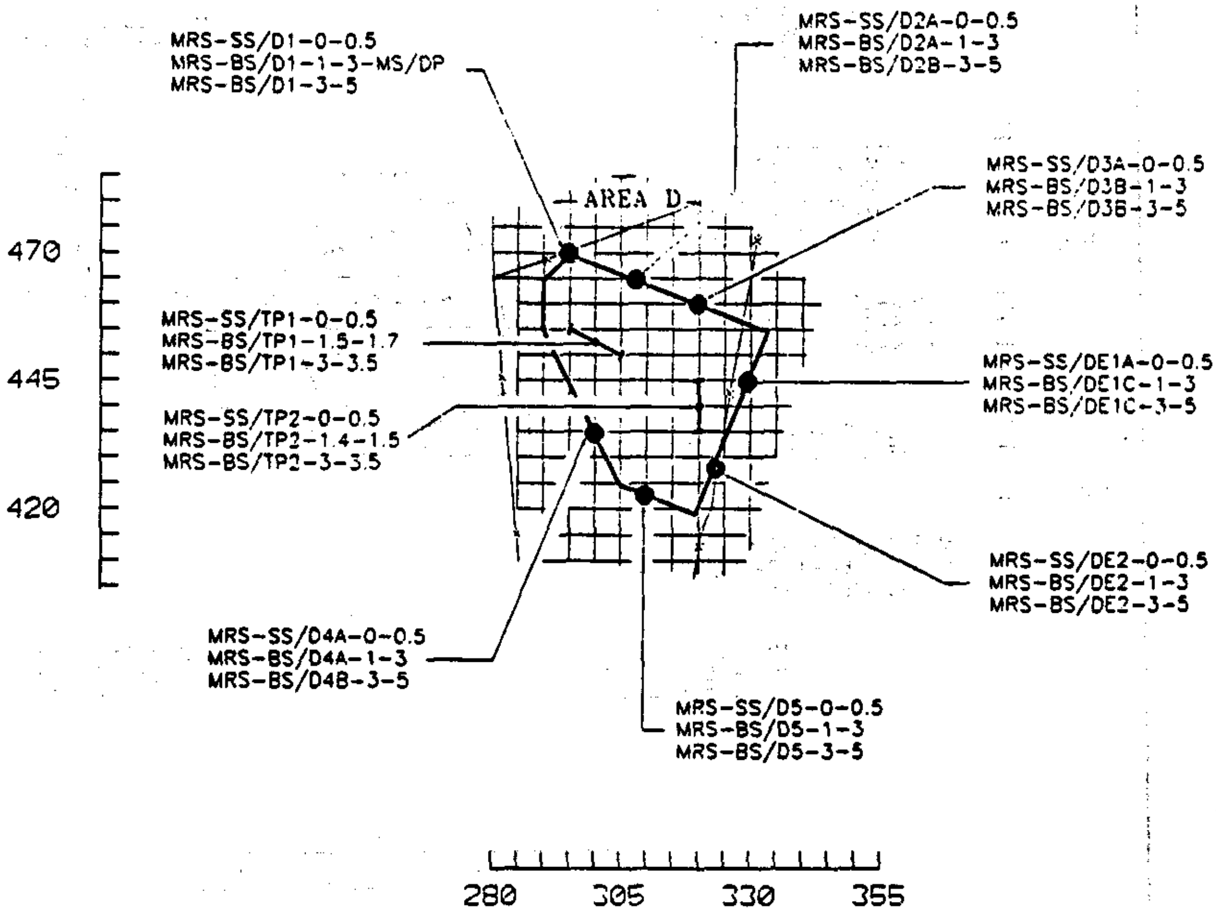
● AUGER PROBE WITHIN AN AREA

* DUPLICATE SAMPLES (0-0.5 FEET)

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
SAMPLING POINT LOCATIONS IN AREAS A & B

FIGURE 4-2	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.

AR102552



KEY TO SYMBOLS

● AUGER PROBE WITHIN AN AREA

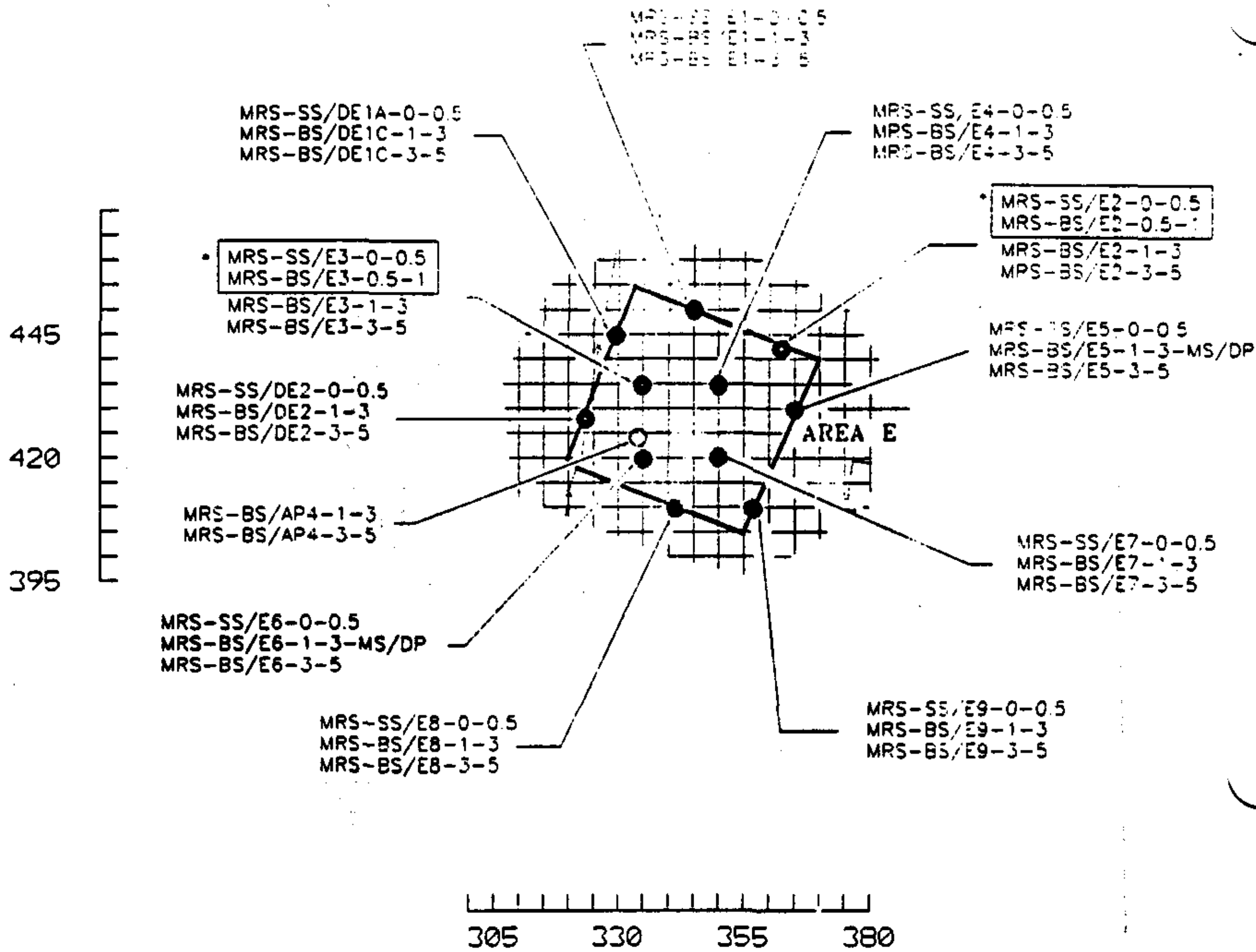
├──┤ TRENCH

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
SAMPLING POINT LOCATIONS IN AREA D. TEST PITS 1 & 2

FIGURE 4-3

DWG. BY: R. DIMATTEO
DATE: 02-28-92

Environmental Standards, Inc.



KEY TO SYMBOLS

● AUGER PROBE WITHIN AN AREA

○ AUGER PROBE (THE 0-0.5 FEET INTERVAL WAS SAMPLED DURING THE NONRADIOLOGICAL ANALYTE SCREENING PHASE OF THE INVESTIGATION)

TRENCH

* DUPLICATE SAMPLES (0-0.5 FEET)

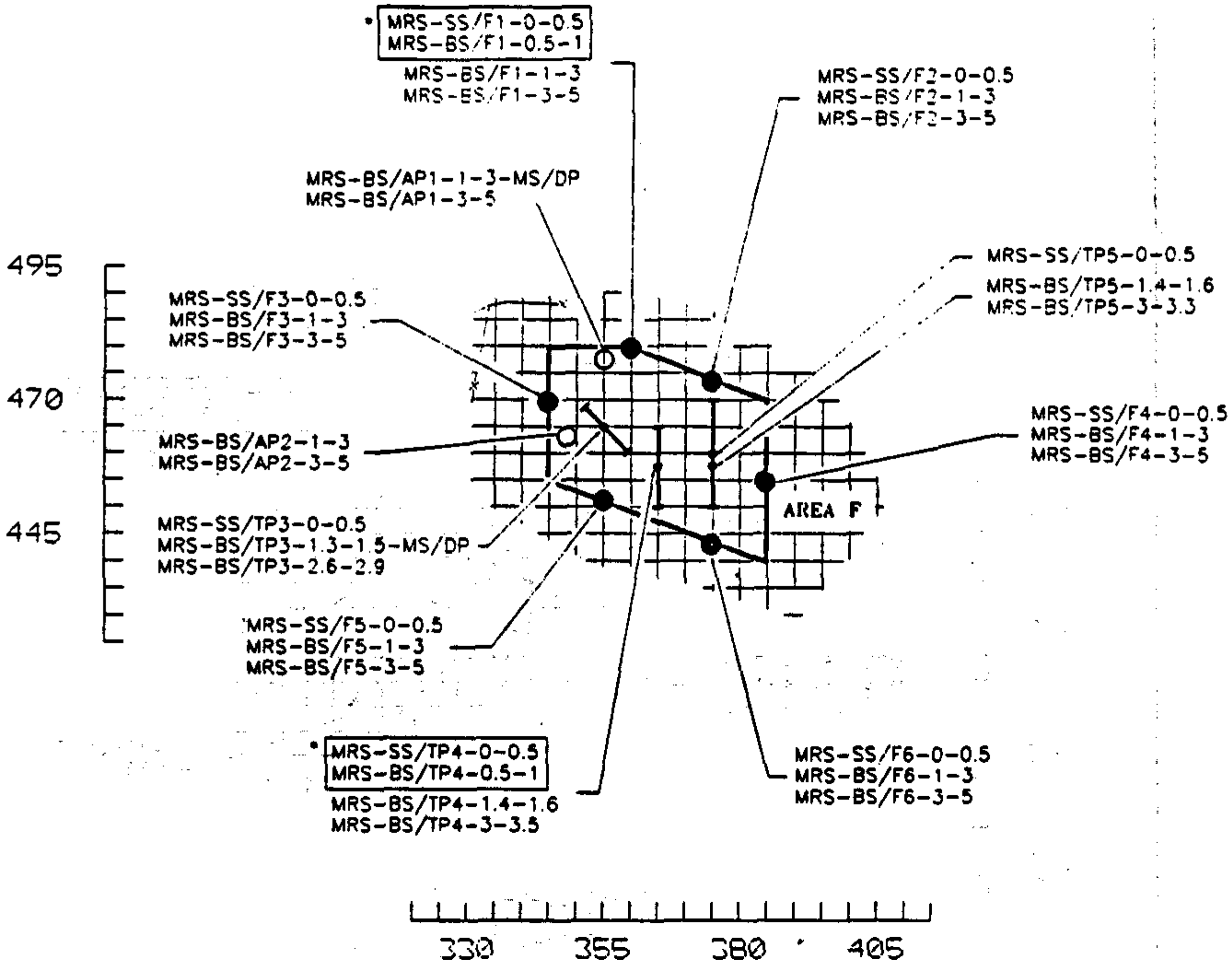
SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
AREA E & AUGER PROBE 4

FIGURE 4-4

DWG. BY: R. DIMATTEO
DATE: 02-28-92

Environmental Standards, Inc.

AR102554

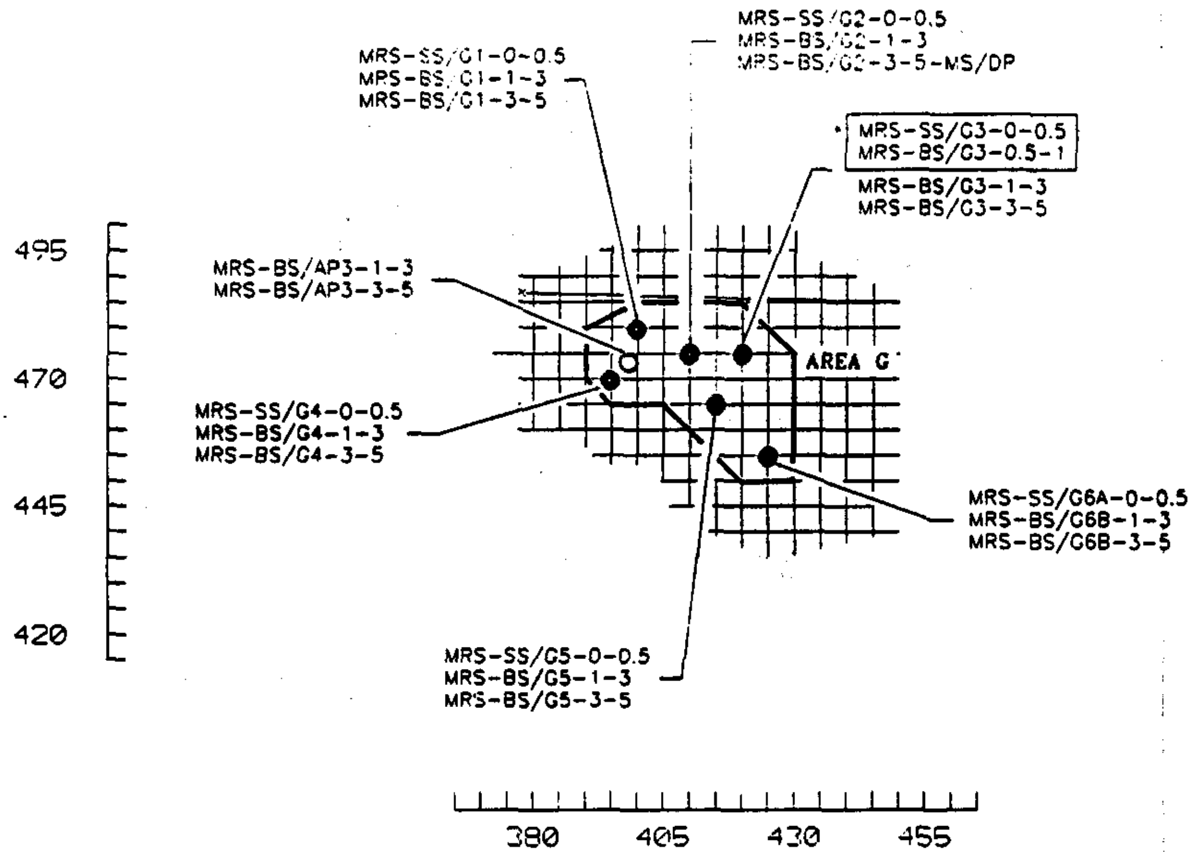


KEY TO SYMBOLS

- ● AUGER PROBE WITHIN AN AREA
- O AUGER PROBE (THE 0-0.5 FEET INTERVAL WAS SAMPLED DURING THE NONRADIOLOGICAL ANAYLTE SCREENING PHASE OF THE INVESTIGATION)
- |——| TRENCH
- • DUPLICATE SAMPLES (0-0.5 FEET)

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
SAMPLING POINT LOCATIONS IN AREA F, TEST PITS 3, 4, & 5, AUGER PROBES 1 & 2

FIGURE 4-5	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.

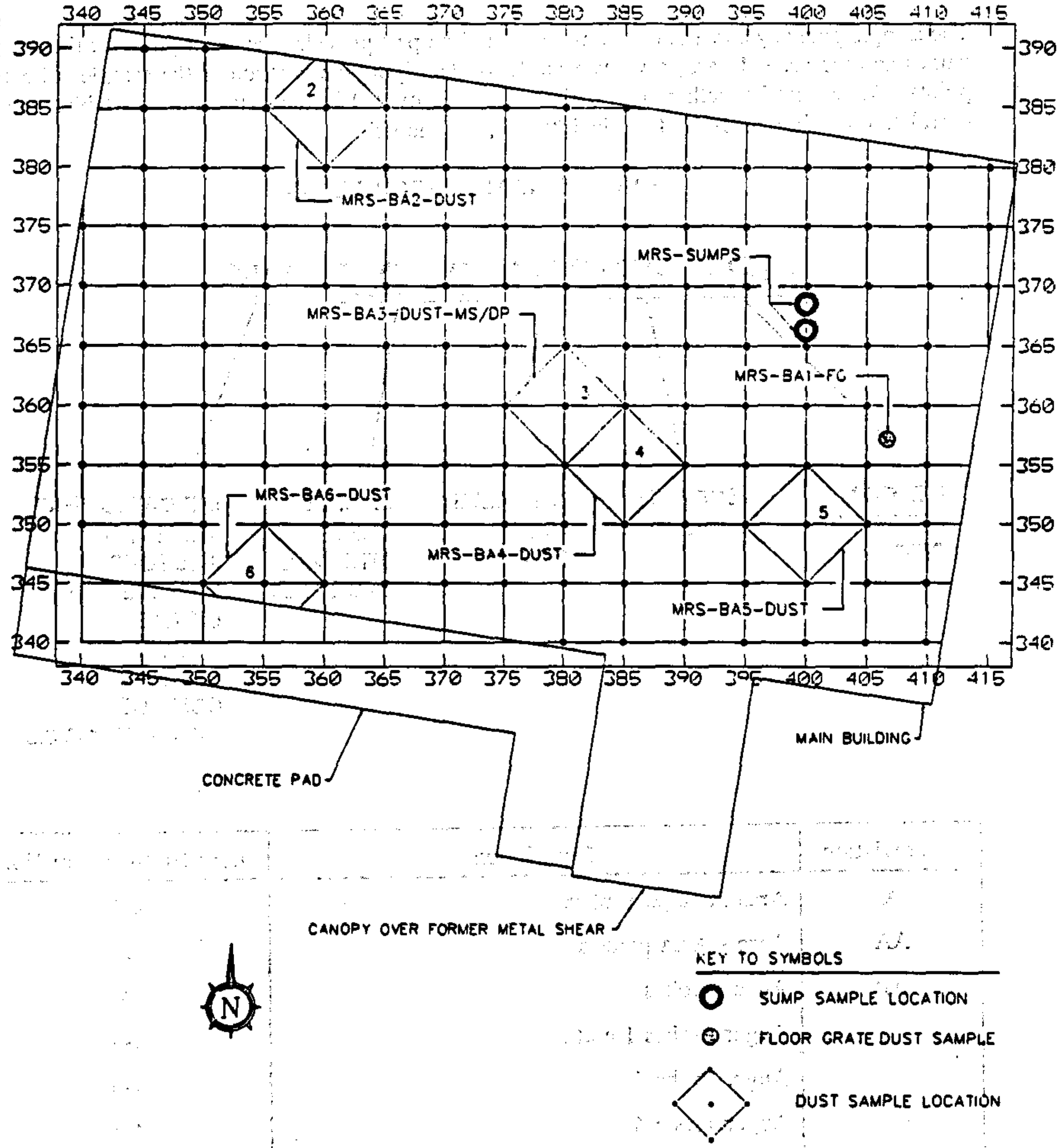


KEY TO SYMBOLS

- ● AUGER PROBE WITHIN AN AREA
- O AUGER PROBE (THE 0-0.5 FEET INTERVAL WAS SAMPLED DURING THE NONRADIOLOGICAL ANALYTE SCREENING PHASE OF THE INVESTIGATION)
- • DUPLICATE SAMPLES (0-0.5 FEET)

SUBJECT: METCOA RESTART SITE (FIVE-METER GRID)
SAMPLING POINT LOCATIONS IN AREA G & AUGER PROBE 3

FIGURE 4-6	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.



SUBJECT: METCOA RESTART SITE
BUILDING AREA DUST, FLOOR GRATE AND SUMP SAMPLES

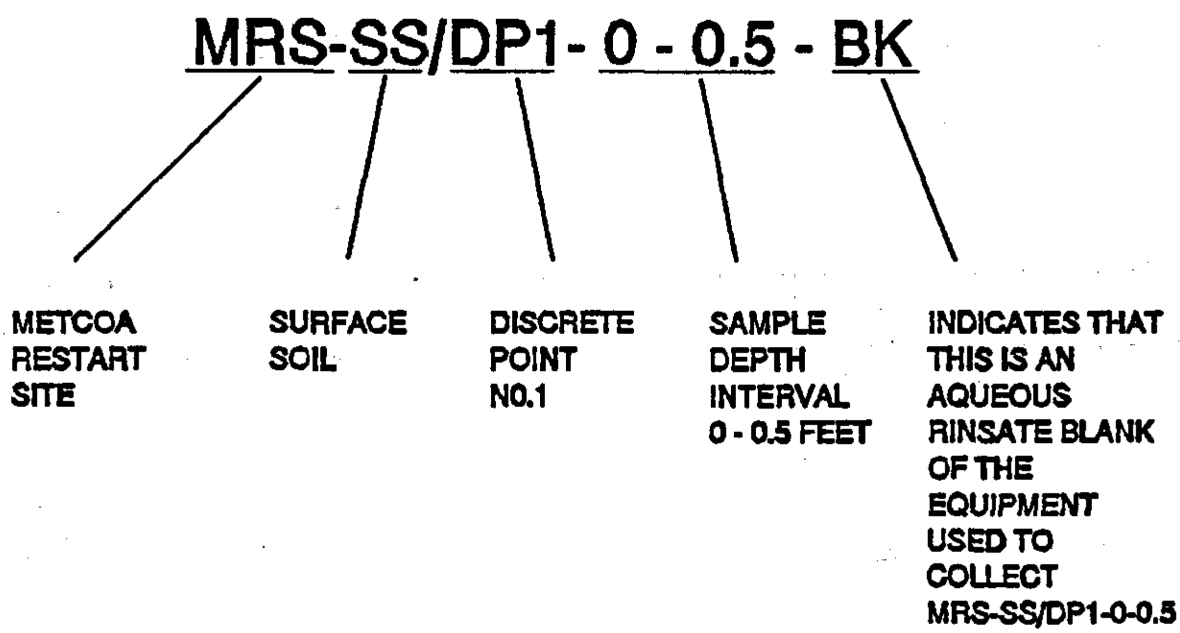
FIGURE 5	DWG. BY: R. DIMATTEO DATE: 02-28-92	Environmental Standards, Inc.

METCOA RESTART SITE

KEY TO SAMPLE NAMES AND LOCATION POINTS

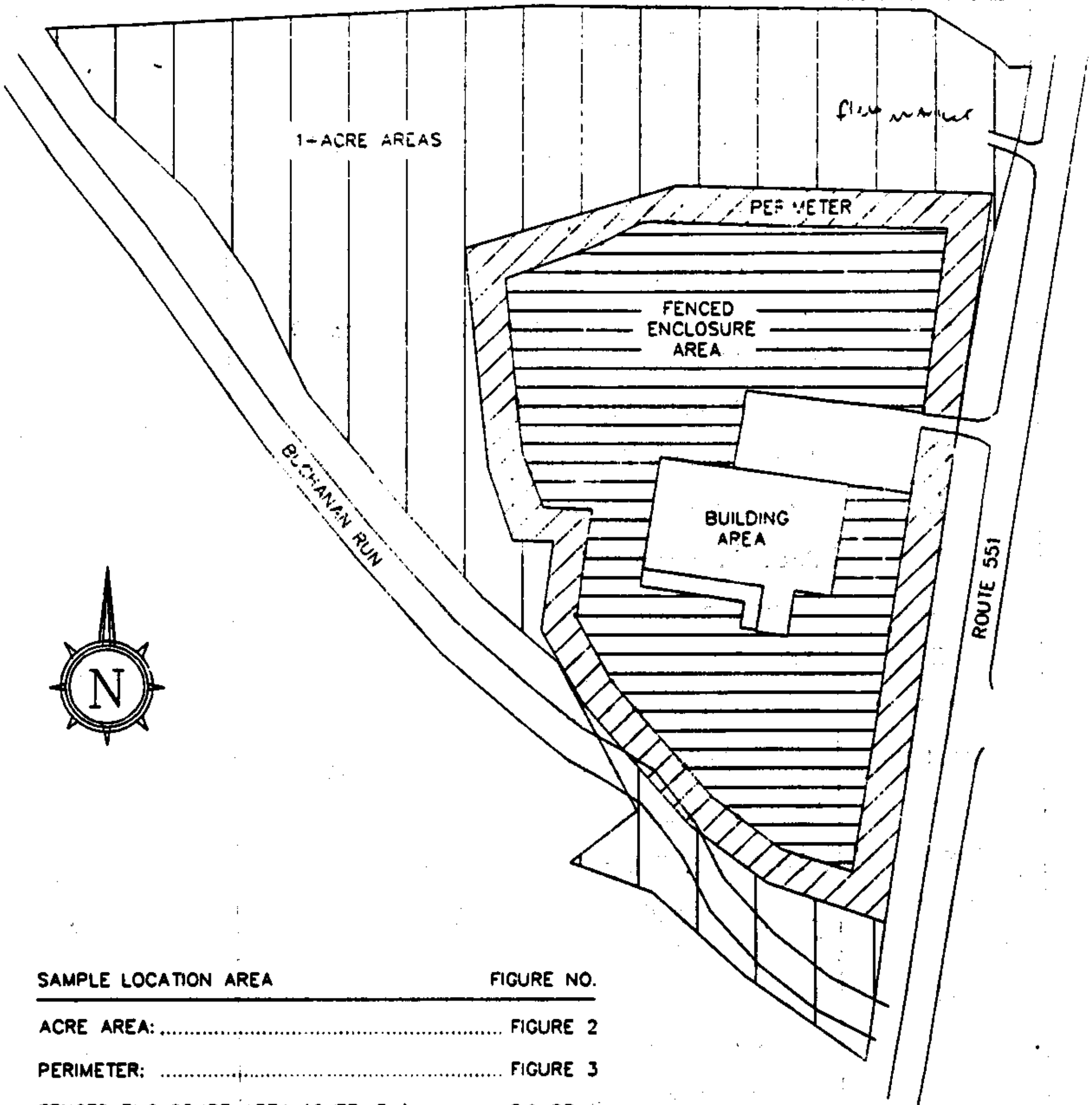
The sample plan key consists of two parts. The first part provides the descriptors for the sample names and the second part provides a guide to identifying the location of the sample collection points. When used together, the analytical data provided in the data summary tables can be correlated to a horizontal and vertical location on the site.

SAMPLE NAME DESCRIPTION



Abbreviation	Description	Located on Figure No.
A	Area A auger probes	4-1
AA	Acre - Area parcels	2
AP	Auger Probes	4
	Auger Probes 1 and 2	4-5
	Auger Probe 3	4-6
	Auger Probe 4	4-4
	Auger Probes 5 and 6	4
B	Area B auger probes	4-2

Abbreviation	Description	Located on Figure No.
BA	Building Area dust samples	5
BK	Equipment rinsate blank	NA
BS	Below Surface soil sample (greater than 0.5 feet)	NA
C	Area C auger probes	4-2
D	Area D auger probes	4-3
DE	Auger probes on boundary between Area D and Area E	3-3
DP	Discrete Point auger probe	3
DUST	DUST Sample from floor of Building Area	4
E	Area E auger probes	3-3
F	Area F auger probes	3-5
FG	Floor Grate sample from Building Area	5
G	Area G auger probes	4-6
MRS	METCOA Restart Site	NA
MS/DP	Matrix Spike/Duplicate (Quality Control)	NA
P	Perimeter Sample	3
SS	Surface Soil Sample (0 to 0.5 feet)	NA
SUMP	Composite sediment samples from two "sumps" in the Building Area	5
TP	Test Pit	4
	Test Pits 1 and 2	4-3
	Test Pits 3, 4 and 5	4-4



SAMPLE LOCATION AREA	FIGURE NO.
ACRE AREA:	FIGURE 2
PERIMETER:	FIGURE 3
FENCED ENCLOSURE AREA (OVERVIEW):	FIGURE 4
BUILDING AREA, FLOOR CRATE & SUMPS:	FIGURE 5

SUBJECT: METCOA RESTART SITE
KEY TO SAMPLE COLLECTION LOCATIONS

0' 250' 500'

FIGURE: 1

DWG. BY: R. DIMATTEO
DATE: 02-28-92

Environmental Standards, Inc.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 2 Auger

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/AA1-0-0.5	8.4 B	16.1 J	24.1	58.8 B	7.0 B	<42.8 UL	0.76±0.32 J
MRS-SS/AA2-0-0.5	4.1 B	12.8 J	22.2	15.9 B	6.0 B	<43.3 UL	0.72±0.26 J
MRS-SS/AA3-0-0.5	4.5 B	16.0 J	41.7	20.4 B	11.7 J	133 J	0.69±0.32 J
MRS-SS/AA4-0-0.5	4.4 B	15.4 J	23.6	18.7 B	4.9 B	<44.9 UL	0.42±0.33 J
MRS-SS/AA5-0-0.5	1.9 B	13.7 J	23.5	14.2 B	4.0 B	<45.4 UL	0.77±0.44 J
MRS-SS/AA6-0-0.5	4.6 B	16.3 J	26.5	19.3 B	13.3 J	<46.5 UL	0.76±0.40 J
MRS-SS/AA7-0-0.5	35.2 B	22.7 J	38.9	10.4 J	34.6 J	<47.7 UL	1.0±0.20 J
MRS-SS/AA8-0-0.5	16.0 B	18.9 J	41.6	26.9 B	7.9 B	<52.4 UL	2.2±0.40 J
MRS-SS/AA9-0-0.5	23.0 B	14.3 J	29.1	20.5 B	6.1 B	<47.7 UL	0.78±0.46 J
MRS-SS/AA10-0-0.5	3.5 B	12.4 J	29.4	16.6 B	4.8 B	68.9 J	0.65±0.42 J
MRS-SS/AA11-0-0.5	5.3 B	9.3 J	18.4	15.3 B	3.6 B	<43.8 UL	0.82±0.38 J
MRS-BS/AA11-0.5-1-MS/DP	5.5 B	10.2 J	23.4	18.4 B	3.5 B	<43.8 UL	0.80±0.38 J

NOTES:

This analyte was not detected at or above the associated numerical value.
B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
R Unreliable result - Analyte may or may not be present in this sample.
J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 3

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/P1-0-0.5	131 J	30.4 J	35.7 J	2[illegible]	8.3 J	<46.5	<1.0 UL
MRS-SS/P2-0-0.5	182 J	28.1 J	52.1	83.0 J	6.5 J	<47.1	<1.0 UL
MRS-SS/P3-0-0.5	11.5 J	11.2 J	17.2 J	17.0 J	4.8 J	<46.0	0.79±0.51 J
MRS-SS/P4-0-0.5	13.9 J	10.1 J	21.5 J	23.2 J	4.8 J	<46.0	2.6±0.53 J
MRS-SS/P5-0-0.5	19.9 J	9.0 J	22.4 J	17.6 J	5.0 J	<41.0	1.0±0.24 J
MRS-SS/P6-0-0.5	33.0 J	12.1 J	25.2 J	26.4 J	6.2 J	<51.6	0.69±0.42 J
MRS-SS/P7-0-0.5	44.3 J	47.7 J	434	126 J	15.[illegible] J	<50.3	0.74±0.45 J
MRS-SS/P8-0-0.5	14.7 J	15.3 J	64.2	1.7 UL	10.5 J	<50.3	0.63±0.32 J
MRS-SS/P9-0-0.5	44.0 J	12.6 J	27.8 J	37.5 J	8.4 J	<49.0	0.45±0.43 J
MRS-SS/P10-0-0.5	71.9 J	27.1 J	38.4 J	126 J	48.4 J	<51.6	0.54±0.43 J
MRS-SS/P11-0-0.5	192 J	61.6 J	215	237 J	45.3 J	<49.0	0.78±0.50 J
MRS-SS/P12-0-0.5	106 J	42.1 J	59.8	142 J	189 J	<56.3	2.2±0.54 J
MRS-SS/P13-0-0.5	15.6 J	13.4 J	32.8	20.4 J	11.1 J	53.7 J	0.89±0.23 J
RS-SS/P14-0-0.5	10.9 J	16.8 J	42.6 J	24.1 J	11.0 J	<48.3	0.61±0.32 J
MRS-SS/P15-0-0.5	0.92	8.7 J	9.8 J	14.2 J	13.1 J	<44.4	0.44±0.26 J
MRS-SS/P16-0-0.5	7.1 J	13.9 J	20.2 J	21.5 J	6.0 J	<43.3	0.81±0.31 J
MRS-SS/P17-0-0.5	0.69	11.9 J	16.7	12.2 J	2.6 J	<46.5	0.79±0.47 J
MRS-SS/P18-0-0.5	0.36	11.1 J	13.9	9.2 J	3.6 J	<41.4	1.2±0.29 J
MRS-BS/P18-0.5-1	0.42	12.2	<0.13	4.4 B	4.4 J	<41.9	0.65±0.26 J
MRS-SS/P19-0-0.5	15.1 B	12.1 B	20.0 J	23.5 B	4.5 B	<42.3	<0.40 UL
MRS-SS/P20-0-0.5	24.2 B	13.9 B	25.2 J	52.1 B	13.2 B	<42.6	<0.40 UL
MRS-SS/P21-0-0.5	28.5 B	14.4 B	56.9 J	38.8 B	13.3 B	<44.6	0.92±0.23 B
MRS-SS/P22-0-0.5	30.9 B	15.5 B	55.2 J	51.7 B	17.7 B	<44.1	0.61±0.31 B
MRS-SS/P23-0-0.5	12.3 B	12.8 B	25.4 J	24.4 B	4.1 B	<42.0	<0.80 UL
MRS-SS/P24-0-0.5	16.9 B	12.1 B	19.9 J	19.4 B	4.7 B	<39.9	1.5±0.39 B
MRS-SS/P25-0-0.5	23.8 B	17.7 B	27.4 J	57.5 B	4.8 B	<38.5	0.91±0.43 B
MRS-SS/P26-0-0.5	44.8 B	13.3 B	24.5 J	30.2 B	4.7 B	<40.5	0.59±0.44 B
MRS-SS/P27-0-0.5	88.0 B	11.1 B	32.3 J	30.0 B	6.1 B	<44.1	0.83±0.50 B
RS-SS/P28-0-0.5	95.3 B	12.2 B	26.3 J	36.7 B	5.0 B	<45.0	2.2±0.45 J

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METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 3 (Cont.)

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/P29-0-0.5	61.7 B	14.6 B	21.1 J	34.7 B	4.6 B	<39.1	0.83±0.45 B
MRS-SS/P30-0-0.5	3520 J	39,900 J	777 J	47,000 J	494 J	<45.0	0.92±0.38 B
MRS-BS/P30-0.5-1	13,900 J	12,000 J	580 J	13,000 J	492 J	<43.4	1.0±0.26 B

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/DP1-0-0.5-MS/DP	865	214	78.2 J	500 J	301	<53.1 R	0.99±0.53
MRS-BS/DP1-1-3	11.6 J	10.4 B	15.5 J	<13.9	32.4 J	<43.7 UL	1.1±0.4 J
MRS-BS/DP1-3-5	0.43 J	12.5 B	18.7 J	<13.6	<8.5 UL	104 J	0.81±0.22 J
MRS-SS/DP2-0-0.5	27.1 J	55.8 J	14.5 J	224 J	9.9 B	51.3 J	0.52±0.25 J
MRS-BS/DP2-1-3	<0.31	14.0 B	11.3 J	<12.9	10.7 B	<40.5 UL	0.76±0.26 J
MRS-BS/DP2-3-5	0.97 J	12.8 B	17.3 J	26.7 B	<8.0 UL	42.2 J	0.75±0.20
MRS-SS/DP3-0-0.5	12,100 J	600 J	493 J	8220 J	496 J	<43.2 UL	2.6±0.5 J
MRS-BS/DP3-0.5-1	16,800 J	943 J	1720 J	36,000 J	864 J	107 J	4.5±1.6 J
MRS-BS/DP3-1-3	46.0 J	12.1 J	18.2 J	27.4 B	5.9 B	<43.0 UL	2.1±1.2 J
MRS-BS/DP3-3-5	659 J	31.5 J	31.1 J	177 J	13.9 B	<42.9 UL	3.5±1.7 J
MRS-SS/DP4-0-0.5	735 J	285 J	128 J	1890 J	52.4 J	46.0 J	0.76±0.36
MRS-BS/DP4-1-3	8.5 J	12.9 J	16.8 J	30.2 J	4.3 B	43.2 J	0.60±0.29
MRS-BS/DP4-3-5	32.6 J	25.0 J	19.8 J	74.9 B	11.9 B	43.5 J	0.75±0.20
MRS-SS/DP5-0-0.5	826 J	758 J	738 J	1790 J	237	133 J	<0.7 UL
MRS-BS/DP5-1-3	7.8 J	25.6 J	29.8 J	22.3 B	21.2 B	174	0.56±0.44 J
MRS-BS/DP5-3-5	22.4 J	101 J	22.8 J	80.2	13.0 B	<42.9 UL	1.2±0.5 J
MRS-BS/AP5-1-3	6.9	9.5 J	28.4 J	19.4 J	17.9	<43.2 R	1.1±0.4
MRS-BS/AP5-3-5	4.0	9.2 J	25.5 J	12.5 J	5.2 B	<43.0 R	0.78±0.44
MRS-BS/AP6-1-3	8.2 J	27.1 J	4.8 J	125 J	9.3 B	55.0 J	0.50±0.20
MRS-BS/AP6-3-5	3.6 J	16.8 J	17.7 J	53.3 J	5.0 B	47.0 J	0.77±0.27

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-1

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/A1-0-0.5	133 J	63.2 J	39.3 J	402 J	31.4 J	52.1 J	<0.6 UL
MRS-BS/A1-1-3-MS/DP	1.1 J	14.3 J	16.3 J	18.3 B	7.4 B	<41.6 UL	1.5±0.31 J
MRS-BS/A1-3-5	3.6 J	15.9 J	14.9 J	27.0 B	23.4 J	<41.4 R	0.88±0.31
MRS-SS/A2-0-0.5	2380 J	2370 J	861 J	32,500	1550 J	45.2 B	18±1 J
MRS-BS/A2-0.5-1	2120 J	17,700 J	1600 J	27,500	1830	43.8 B	9.5±0.62 J
MRS-BS/A2-1-3	6.6 J	25.8 J	20.0 J	52.9 B	31.8 J	<42.4 R	1.0±0.4
MRS-BS/A2-3-5	20.7 J	26.9 J	18.9 J	44.8 B	30.2 J	<42.9 R	0.64±0.26
MRS-SS/A3-0-0.5	993 J	840	551 J	3360	439 J	<42.9 R	1.2±0.3
MRS-BS/A3-1-3	134 J	42.4 B	35.3 J	149 B	40.2 J	<41.0 R	0.74±0.58
MRS-BS/A3-3-5	26.3 J	31.4 J	28.0 J	70.6 B	26.7 J	<40.6 R	0.89±0.5
MRS-SS/A4-0-0.5	133 J	65.7 J	78.1 J	297 J	31.0 J	<42.4 R	0.51±0.23
MRS-BS/A4-1-3	44.4 J	24.4 B	16.9 J	26.7 B	20.0 B	<41.9 R	0.82±0.25
MRS-BS/A4-3-5	3.4 J	13.6 J	13.2 J	18.4 B	6.2 B	<41.5 R	0.80±0.3
MRS-SS/A5-0-0.5	1350 J	1220 J	1120 J	9210 J	124 J	<41.9 R	<0.6
MRS-BS/A5-1-3	29.0 J	46.2 B	45.2 J	113 B	15.1 B	<40.6 R	0.86±0.24
MRS-BS/A5-3-5	9.9 J	9.6 B	8.8 J	31.2 B	3.9 B	<41.0 R	0.41±0.21
MRS-SS/A6-0-0.5	128 J	1290 J	46.7 J	1220 J	34.3 J	<41.9 R	1.2±0.2
MRS-BS/A6-1-3	0.37 J	29.3 B	14.1 J	<13.0	10.9 B	<41.0 R	0.79±0.44
MRS-BS/A6-3-5	3.5 J	15.2 J	11.1 J	19.5 B	4.0 B	<41.0 R	0.40±0.21
MRS-SS/A7-0-0.5	88.1 J	82.6 J	31.0 J	2240 J	94.8 J	<44.9 R	0.70±0.23
MRS-BS/A7-1-3-MS/DP	<0.32 R	10.1 B	11.2 J	12.1 B	10.0 B	<41.9 R	<0.5
MRS-BS/A7-3-5	<0.32 R	13.6 J	9.8 J	13.2 J	5.2 B	<41.2	0.76±0.3

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-1 (Cont.)

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/A8-0-0.5	<0.33 R	10.2 J	14.1	15.2 J	6.7 B	<42.8 UL	1.1±0.4
MRS-BS/A8-0.5-1	<0.33 R	10.2 J	12.8	15.3 J	5.5 B	44.2 J	1.1±0.3
MRS-BS/A8-1-3	0.73 B	9.1 J	15.6	10.3 J	4.3 B	41.9 J	0.72±0.22
MRS/BS/A8-3-5	<0.31 R	15.8	11.4	<13.2	15.8 B	<39.8 UL	0.64±0.28
MRS-SS/A9-0-0.5	46.8 J	20.2 J	13.1	103 J	35.1 J	<44.1 UL	1.4±0.4
MRS-BS/A9-1-3	0.36 B	10.8 J	12.7	16.4 J	6.3 B	<42.9 UL	1.6±0.4
MRS-BS/A9-3-5	<0.32 R	15.4 J	18.5	20.9 J	25.3 B	<41.5 UL	1.1±0.5

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-2

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/B1-0-0.5	5370	8850 J	389 J	5070 J	2200	89.8 J	0.72±0.22
MRS-BS/B1-1-3	42.1	29.1 J	97.2 J	45.6 J	34.3	<41.7 R	0.88±0.24
MRS-BS/B1-3-5	140	39.6 J	58.6 J	74.5 J	26.3	<41.7 R	1.2±0.5
MRS-SS/C1-0-0.5	23.7	30.7 J	41.3 J	42.7 J	32.9	<45.8 R	0.86±0.26 J
MRS-BS/C1-0.5-1	32.5	35.0 J	43.5 J	52.5 J	29.3	<48.3 R	0.59±0.43 J
MRS-BS/C1-1-3	1.4	8.9 J	10.5 J	13.2 J	7.0 B	<42.6 R	<0.5
MRS-BS/C1-3-5	1.3	21.7 B	11.2 J	29.7 B	11.4 B	<43.0 R	1.2±0.8
MRS-SS/C2-0-0.5	2570	65.2 J	290 J	766 J	72.8	<45.8 R	1.1+/0.3 J
MRS-BS/C2-1-3	32.8	9.1 J	13.4 J	14.1 J	39.2	<42.6 R	0.56±0.20
MRS-BS/C2-3-5	21.7	15.7 J	43.0 J	20.0 J	31.6 J	<42.0 R	1.1±0.9
MRS-SS/C3-0-0.5	34.0	69.9 J	34.7 J	41.8 J	18.8	<42.0 R	0.64±0.37
MRS-BS/C3-1-3	61.6	58.1 J	43.2 J	47.5 J	25.6	<44.3 R	1./2±0.7
MRS-BS/C3-3-5	17.2	28.1 J	21.9 J	31.7 J	21.0	<46.1 R	0.81±0.33
MRS-SS/C4-0-0.5	354	46.5 J	114 J	66.4 J	49.4	<45.6 R	1.1±0.4
MRS/BS/C4-1-3	3.3	12.2 J	11.3 J	11.9 J	6.3 B	<41.5 R	0.83±0.22
MRS-BS/C4-3-5	1.9	13.4 J	8.4 J	17.7 J	8.1 B	<41.5 R	1.0±0.6

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-3

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm,
MRS-SS/D1-0-0.5	90.5 J	29.4 J	23.7	417 J	51.5 J	<43.6 UL	0.68±0.42
MRS-BS/D1-1-3-MS/DP	60.2 J	13.5 J	27.6	542 J	27.8 J	<45.3 UL	0.82±0.24
MRS-BS/D1-3-5	4.8 J	11.9 J	34.7 J	69.0 J	39.4 B	<44.9	0.79±0.55
MRS-SS/D2A-0-0.5	21.9 J	17.3 J	24.3 J	41.9 J	36.0 J	<44.9	0.63±0.29
MRS-BS/D2A-0.5-1	28.9 J	14.8 J	25.4 J	44.2 J	36.9 J	<45.4	0.59±0.26
MRS-BS/D2A-1-3	4.2 J	8.9 J	22.7 J	16.2 J	31.8 J	<44.4	0.85±0.28
MRS-BS/D2B-3-5	4.8 J	13.2 J	18.4 J	2.4 J	59.0 J	<45.4	0.81±0.26
MRS-SS/D3A-0-0.5	28.5 J	29.6 J	23.8 J	255 J	77.0 J	<46.0	0.68±0,56
MRS-BS/D3B-1-3	0.60 J	8.4 J	27.1 J	<15.1	28.9 B	<45.4	0.58±0.27
MRS-BS/D3B-3-5	<0.34 UL	21.2 J	16.8 J	<14.7	25.9 B	46.9 B	0.80±0.29
MRS-SS/D4A-0-0.5	15.0 J	308 J	41.3	397 J	149 J	<51.9 UL	0.76±0.[illegible]
MRS-BS/D4A-1-3	<0.35 R	23.7 J	16.6	65.5 J	31.4 J	<46.1 UL	1.3±0.4[illegible]
MRS-BS/D4B-3-5	0.49 B	21.9 J	15.8	9.7 J	13.5 B	<49.0 UL	1.1±0.30
MRS-SS/D5-0-0.5	81.7 J	1030 J	35.3	1610 J	185 J	48.5 J	1.3±0.3
MRS-BS/D5-1-3	0.84 B	8.9 J	13.7 J	16.4 J	15.2 B	<44.5 UL	0.62±0.37
MRS-BS/D5-3-5	<0.34 R	7.7 J	9.5 J	9.1 J	15.2 B	<44.0 UL	0.66±0.23
MRS-SS/DE1A-0-0.5	266 J	2580 J	258.2	19,400 J	380	<47.7	1.6±0.4
MRS-BS/DE1C-1-3	7.2	779 J	19.9	847 J	5.1 B	<44.4	1.0±0.3
MRS-BS/DE1C-3-5	322 J	3560 J	294 J	9760 J	385	75.8 J	1.1±0.3
MRS-SS/DE2-0-0.5	917 J	29,900	278	67,800 J	1000	120 J	0.98±0.4
MRS-BS/DE2-1-3	10.0 J	38.0 J	30.7	193 J	40.2 J	56.0 J	1.0±0.28
MRS-BS/DE2-3-5	<0.32 R	35.5	18.2	49.9 J	30.0 B	<41.8 UL	0.91±0.26
MRS-SS/TP1-0-0.5	440 J	52,500 J	308 J	33,500 J	711 J	87.1 J	2.3±0.[illegible]

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-3 (Cont.)

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-BS/TP1-1.5-1.7	2.3 J	56.7 J	28.0 J	135 J	3.9 J	<44.9	0.66±0.39
MRS-BS/TP1-3-3.5	<0.35	12.7 J	15.6 J	6.7 J	2.9 J	<44.9	0.66±0.32
MRS-SS/TP2-0-0.5	434 J	2930 J	48.0 J	10,800 J	262 J	135 J	14.2±0.6
MRS-BS/TP2-1.4-1.5	7.2 J	14.8 J	20.4 J	82.4 J	3.9 J	<50.3	68.6±1.4
MRS-BS/TP2-3-3.5	<0.34	14.0 J	11.0 J	25.0 J	1.3 J	<43.9	0.58±0.38

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

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METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-4

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/E1-0-0.5	375 J	2080 J	328	12,800 J	1540	74.1 J	2.7±0.3
MRS-BS/E1-1-3	2.6	15.7 J	12.1	60.0 J	5.3 B	<43.8	0.79±0.38
MRS-BS/E1-3-5	128 J	2860 J	80.2	10,200 J	345	43.9 J	1.0±0.2
MRS-SS/E2-0-0.5	1900 J	286 J	247 J	4020 J	187	<41.3	<1.0
MRS-BS/E2-0.5-1	4200 J	267 J	141 J	1590 J	132 J	<41.0	<1.0
MRS-BS/E2-1-3	514	57.0 J	124	346 J	26.8 J	<41.0	0.82±0.24
MRS-BS/E2-3-5	0.41 B	20.0 B	16.7 B	<13.9	10.0 B	53.2 J	0.77±0.24
MRS-SS/E3-0-0.5	98.9 J	288 J	83.9	1230 J	40.9 J	<40.5	0.58±0.21
MRS-BS/E3-0.5-1	172 J	3730 J	83.9	843	38.7 J	<40.5	0.46±0.21
MRS-BS/E3-1-3	4.2	6.0 J	9.0	11.1 J	2.7 B	<41.9	1.0±0.3
MRS-BS/E3-3-5	0.51 J	8.8 J	8.9	<13.7	<8.2	<41.4	1.2±0.3
MRS-SS/E4-0-0.5	247 J	222 J	259	1370 J	135 J	<46.5	0.83±0.26
MRS-BS/E4-1-3	6.7 J	17.7 J	15.6	59.4 J	7.3 B	<42.8	1.1±0.3
MRS-BS/E4-3-5	2.1 J	11.4 J	12.0	47.0 J	4.6 B	<41.4	0.88±0.33
MRS-SS/E5-0-0.5	0.57	17.7 J	14.7	25.3	12.7 B	<47.7	0.70±0.25
MRS-BS/E5-1-3	0.41	6.1 J	13.1	6.7 J	4.0 B	<43.3	0.85±0.28
MRS-BS/E5-3-5-MS/DP	0.33	9.3 J	10.6	12.7 J	3.6 B	<42.8	0.94±0.25
MRS-SS/E6-0-0.5	449 J	1360 J	612 J	5170 J	665	64.8 B	0.61±0.20
MRS-BS/E6-1-3-MS/DP	1.6 J	13.6 J	18.4 J	25.3 J	6.8 B	<41.4 R	0.53±0.22
MRS-BS/E6-3-5	1.1	15.2 J	27.7	20.4 J	5.3 B	<41.0	0.95±0.26
MRS-SS/E7-0-0.5	550 J	416 J	880 J	1470 J	203	88.8 B	0.65±0.20
MRS-BS/E7-1-3	4.7 J	14.8 J	20.9 J	27.6 J	7.9 B	60.4 B	0.82±0.55
MRS-BS/E7-3-5	3.7 J	18.0 J	20.0 J	17.6 J	7.1 B	62.3 B	0.70±[illegible]

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-4 (Cont.)

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/E8-0-0.5	3100 J	1570 J	615 J	6760 J	498	122 B	0.59±0.42
MRS-BS/E8-1-3	2.7 J	9.7 J	14.9 J	25.4 J	9.4 B	54.1 B	0.70±0.23
MRS-BS/E8-3-5	19.1 J	28.1 J	20.7 J	119 J	32.6 B	50.7 B	0.73±0.33
MRS-SS/E9-0-0.5	1220 J	3270 J	310 J	5880 J	1040	66.5 B	0.85±0.56
MRS-BS/E9-1-3	1.1 J	5.8 J	11.3 J	7.5 J	5.7 B	<41.4	0.89±0.63
MRS-BS/E9-3-5	2.3 J	9.7 J	12.4 J	13.0 J	6.7 B	116 B	0.48±0.19
MRS-SS/DE1A-0-0.5	266 J	2580 J	258.2	19,400 J	380	<47.7	1.6±0.4
MRS-BS/DE1C-1-3	7.2	779 J	19.9	847 J	5.1 B	<44.4	1.0±0.4
MRS-BS/DE1C-3-5	322 J	3560 J	294 J	9760 J	385	75.8 J	1.1±0.3
MRS-SS/DE2-0-0.5	917 J	29,900	278	67,800 J	1000	120 J	0.98±0.40
MRS-BS/DE2-1-3	10.0 J	38.0 J	30.7	193 J	40.2 J	56.0 J	1.0±0.28
MRS-BS/DE2-3-5	<0.32 R	35.5	18.2	49.9 J	30.0 B	<41.8 UL	0.91±1.26
MRS-BS/AP4-1-3	2.4	17.6	22.5	<13.7	11.0 J	<41.4	1.2±0.2
MRS-BS/AP4-3-5	4.9	9.9 J	11.8	18.3 J	3.8 B	<41.9	0.83±0.34

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

Area F Test Pit Area

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-5

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/g)
MRS-SS/F1-0-0.5	7.7 J	12.5 J	38.8 J	51.4 J	127 J	<45.4	0.70±0.33 J
MRS-BS/F1-0.5-1	12.9 J	21.1 J	30.8 J	129 J	124 J	<45.4	1.1±0.4 J
MRS-BS/F1-1-3	<0.33 UL	8.1 J	9.4 B	7.5 J	5.1 J	<42.4	0.76±0.35 J
MRS-BS/F1-3-5	0.45 J	16.1 J	14.8 J	<14.4	<8.6 UL	<43.3	1.4±0.2 J
MRS-SS/F2-0-0.5	4.2 J	10.9 J	14.7 J	14.7 J	85.5 J	<43.9	0.86±0.19 J
MRS-BS/F2-1-3	0.80 J	11.9 J	14.7 J	18.4 J	10.8 J	<42.9	1.0±0.3 J
MRS-BS/F2-3-5	0.70 J	12.5 J	10.1 B	<13.6	11.4 J	<42.9	0.47±0.27 J
MRS-SS/F3-0-0.5	26.3	21.0 J	35.9	64.2 J	81.8 J	<48.4	0.44±0.22
MRS-BS/F3-1-3	<0.35 UL	13.2 B	18.6 B	9.5 B	4.8 B	<44.9	0.80±0.51
MRS-BS/F3-3-5	0.61 B	5.1 B	13.9 B	23.5 B	3.9 B	<44.9	0.98±0.22
MRS-SS/F4-0-0.5	62.6	232 J	106 J	818 J	231	<43.4	0.73±[illegible]
MRS-BS/F4-1-3	7.5 B	36.1 J	29.8 J	79.6 J	26.0 J	<44.9	1.0±0.[illegible]
MRS-BS/F4-3-5	0.80 B	9.8 B	18.6 B	12.3 B	5.0 B	<43.9	1.0±0.3
MRS-SS/F5-0-0.5	775	559 J	299	3310 J	352	57.7 J	0.88±0.38
MRS-BS/F5-1-3	1040	3720 J	2190	4460 J	521	<42.4	<1.0
MRS-BS/F5-3-5	13.9	42.8 J	52.5	132 J	10.0 J	<47.2	1.1±0.4
MRS-SS/F6-0-0.5	337	8880 J	105 J	31,300	206	<39.7	0.49±0.22
MRS-BS/F6-1-3	1.6 B	7.9 B	11.0 B	31.3 B	52.1 J	<43.4	0.69±0.22
MRS-BS/F6-3-5	1.6 B	19.2 J	13.8 B	23.3 B	9.5 J	<41.5	1.1±0.3
MRS-SS/TP3-0-0.05	477 J	3530 J	231 J	25,200 J	1390 J	<41.9	12.1±0.4
MRS-BS/TP3-1.3-1.5-MS/DP	114 J	5460 J	95.7 J	9,900 J	1270 J	109 J	40.8±1.0
MRS-BS/TP3-2.6-2.9	<0.36	14.0 J	28.8 R	57.6 J	10.8 J	<47.2	0.92±0.37

Environmental Standards, Inc.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-5 (Cont.)

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/TP4-0-0.5	920	3670	188	16,200	1790 J	<41.0 UL	315±2.0 J
MRS-BS/TP4-0.5-1	664 J	3810 J	152	14,600 J	592 J	<41.0 UL	152±2.0 J
MRS-BS/TP4-1.4-1.6	4870	680 J	385 J	12,800 J	699	<42.4 UL	0.83±0.32 J
MRS-BS/TP4-3-3.5	2.3 B	13.3 J	13.5	27.1 B	4.8 B	<46.0 UL	1.6±0.4 J
MRS-SS/TP5-0-0.5	262	11,000 J	76.8	22,700 J	120 J	<41.0 UL	53±0.80 J
MRS-BS/TP5-1.4-1.6	65.3	6510 J	60.3	41,400 J	170	<40.1 UL	2.7±0.32 J
MRS-BS/TP5-3-3.3	<0.37	31.6 B	27.1	58.2 B	20.3 B	<47.7 UL	0.98±0.27 J
MRS-BS/AP1-1-3-MS/DP	<0.33 UL	13.5 B	19.3 B	16.4 B	4.2 B	<42.4	0.64±0.38
MRS-BS/AP1-3-5	<0.33 UL	12.8 J	13.9 J	12.1 J	4.2 J	<42.4	0.54±0.28 J
MRS-BS/AP2-1-3	38.4 B	6420	158	1070	54.7 J	<43.9	<1.0
MRS-BS/AP2-3-5	51.4	53.5 J	136	184 J	14.5 J	<43.9	1.1±0.4

NOTES:

- < This analyte was not detected at or above the associated numerical value.
- B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
- R Unreliable result - Analyte may or may not be present in this sample.
- J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
- UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 4-6

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-SS/G1-0-0.5	18.3 J	29.0 J	242 J	147 J	<8.1 UL	<40.6	0.36±0.21 J
MRS-BS/G1-1-3	<0.32 UL	9.5 J	8.6 B	10.5 J	3.2 J	41.8 J	0.51±0.28 J
MRS-BS/G1-3-5	<0.33 UL	12.6 J	11.5 J	<14.4	<8.6 UL	<43.4	0.62±0.32 J
MRS-SS/G2-0-0.5	69.6 J	90.2	223 J	1990 J	52.2 J	<41.0	0.53±0.37 J
MRS-BS/G2-1-3	<0.32 UL	2.0 J	8.0 B	7.7 J	0.98 J	<41.0	1.8±0.3 J
MRS-BS/G2-3-5-MS/DP	1.0 J	8.5 J	17.7 J	37.2 J	3.8 J	<42.9	0.96±0.15 J
MRS-SS/G3-0-0.5	27.5 J	30.0 J	59.7 J	847 J	10.5 J	<49.0	<1.0
MRS-BS/G3-0.5-1	47.9 J	32.6 J	71.1 J	748 J	13.4 J	<49.6	0.70±0.39
MRS-BS/G3-1-3	1.1 J	7.6 J	11.6 J	20.2 J	2.6 J	<42.4	0.59±0.36
MRS-BS/G3-3-5	0.78	9.6 J	20.9 J	40.1 J	3.7 J	<42.4	1.8±0.4
MRS-SS/G4-0-0.5	17.9 J	67.4 J	43.2 J	84.2 J	<7.9 UL	194	2.0±0.4
MRS-BS/G4-1-3	2.3 J	40.6 J	20.2 J	43.1 J	15.1 J	44.0 J	1.4±0.2 J
MRS-BS/G4-3-5	0.83 J	14.7 J	9.9 B	15.2 J	4.2 J	<42.4	0.59±0.23 J
MRS-SS/G5-0-0.5	51.2 J	96.4 J	855 J	465 J	52.4 J	<44.9	<1.0
MRS-BS/G5-1-3	1.5	11.9 J	36.9 J	15.5 J	<8.9 UL	<44.9	1.0±0.4
MRS-BS/G5-3-5	<0.33	9.2 J	19.8 J	<14.4	<8.6 UL	<43.4	0.69±0.25
MRS-SS/G6A-0-0.5	2.2	15.5 J	12.4 J	25.0 J	<8.9 UL	<44.9	<1.0
MRS-BS/G6B-1-3	2.6	6.5 J	16.2 J	14.7 J	2.6 J	<42.9	2.0±0.3
MRS-BS/G6B-3-5	<0.33	4.7 J	9.6 J	6.4 J	1.2 J	52.8 J	0.78±0.18
MRS-BS/AP3-1-3	1.6 J	36.0 J	23.6 J	61.8 J	21.3 J	<42.4	0.75±0.34 J
MRS-BS/AP3-3-5	0.35 J	6.8 J	18.8 J	<14.2 UL	<8.5 UL	<42.9	0.93±0.46 J

Building

METCOA RESTART SITE ANALYTICAL RESULTS FOR FIGURE 5

Sample No.	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Mo (mg/kg)	W (mg/kg)	Th (pCi/gm)
MRS-BA1-FG	283 J	16,600 J	159 J	176,000 J	635 J	39.8 J	7.0±0.28 J
MRS-BA2-DUST	12,400 J	14,200 J	2920 J	38,100 J	2090 J	330	3.4±0.38 J
MRS-BA3-DUST-MS/DP	5920 J	12,700 J	14,600 J	26,700 J	1730 J	182	1.7±0.27 J
MRS-BA4-DUST	4630 J	15,300 J	10,500 J	33,400 J	1650 J	173	1.5±0.24 J
MRS-BA5-DUST	3350 J	11,600 J	2420 J	56,300 J	649 J	159	2.1±0.27 J
MRS-BA6-DUST	18,000 J	9850 J	2280 J	36,100 J	3660 J	586	2.3±0.23 J
MRS-SUMPS	519 B	129,000 J	310	48,600 J	233 B	188 B	0.6±0.5

NOTES:

< This analyte was not detected at or above the associated numerical value.
B This result is qualitatively suspect since this constituent was detected in field and/or laboratory blanks at similar levels.
R Unreliable result - Analyte may or may not be present in this sample.
J Quantitation is approximate due to limitations identified during the quality assurance review (data validation).
UL This analyte was not detected, but the detection limit is probably higher due to a low bias identified during the quality assurance review.

METCOA RESTART SITE TCLP* ANALYTICAL RESULTS

Sample No.	Sb mg/L	As mg/L	Ba mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Ni mg/L	Se mg/L	Ag mg/L	Zn mg/L
MRS-BA7-SUMPS	0.22	<0.01	0.27	3.38	<0.05	14.0	<0.05	<0.0004	38.9	<0.016	<0.05	5.82
MRS-BS/T4-1.5	0.10	<0.01	<0.05	<0.05	0.19	<0.03	<0.05	<0.0004	0.06	<0.01	<0.05	<0.03
MRS-BA1-FG	0.33	<0.01	3.89	4.01	<0.05	2.02	<0.05	<0.0004	46.6	<0.01	<0.05	3.33
TCLP Reg. Limit	NE	5.0	100.0	1.0	5.0	NE	5.0	0.2	NE	1.0	5.0	NE

* Toxicity Characteristics Leaching Procedure
NE Not Established

APPENDIX B

AUGER BORING LOGS

AR102577

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Wet sand silt (mud) with gravel (compacted subbase-type fill)*	*MRS-SS/A1-0-0.5*	*5*
0.5–1.0						
1.0–1.5			*16*	*Orange-brown sand, silt and clay with broken sandstone*		
1.5–2.0			*11*			
2.0–2.5	*2*	*1.5*	*23*		*MRS-BS/A1-1-2-MS/DP*	*5*
2.5–3.0			*14*			
3.0–3.5			*28*	*Same as above*		
3.5–4.0			*42*			
4.0–4.5	*2*	*1.5*	*50*		*MRS-BS/A1-3-5*	*5*
4.5–5.0			*57*	*4" piece of granite in end of split-barrel*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
390 METERS EAST, *295* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Wet sand, silt and gravel (slag/cinders)*	*MRS-SS/A2-0-0.5*	7
0.5–1.0					*MRS-BS/A2-0.5-1*	
1.0	2	1.5	8	*Same as above*		7
1.5			7	*Compacted light brown sandy, silty clay*	*MRS-BS/A2-1-3*	
2.0			10			
2.5			13			6
3.0	2	1.1	8	*Light brown to orange-brown sandy, silty clay*	*MRS-BS/A2-3-5*	
3.5			11			
4.0			13			5.5
4.5			10			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 6
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
380 METERS EAST, *285* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *4*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark gray to brown sand, silt, and gravel with pieces of metal*	*MRS-SS/A3-0-0.5*	*7-12*
0.5–1.0						
1.0–1.5	*2*	*1.9*	*9*	*Dark gray sand and silt*	*MRS-BS/A3-1-3*	*6.5*
1.5–2.0			*18*	*Brown sand with sandstone*		
2.0–2.5			*36*			
2.5–3.0			*29*			
3.0–3.5	*2*	*1.9*	*21*	*Same as above*	*MRS-BS/A3-3-5*	*6*
3.5–4.0			*19*			
4.0–4.5			*18*			
4.5–5.0			*11*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
365 METERS EAST, *275* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A4*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark gray-brown sand, silt, and gravel, some yellow brown clay*	*MRS-SS A4-0-0.5*	*7*
0.5–1.0						
1.0–1.5			*6*	*Orange-brown sand and stone* *Gray sand and stone*		*6*
1.5–2.0	*2*	*1.55*	*8*	*Moist brown sand and silt, some clay*	*MRS-BS/ A4-1-3*	
2.0–2.5			*10*			
2.5–3.0			*7*			*5*
3.0–3.5			*7*			
3.5–4.0	*2*	*1.9*	*10*	*Brown sand, silt and stone, little clay*	*MRS-BS/ A4-3-5*	*6*
4.0–4.5			*11*	*Wet at bottom of split-barrel*		
4.5–5.0			*10*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
375 METERS EAST, *265* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.)

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Brown sand, gravel, silt, little clay Large (>6") stones in top 0.5'*	*MRS-SS/ A5-0-0.5*	*6*
0.5–1.0						
1.0–1.5			*17*			
1.5–2.0			*20*	*Brown sand, little silt, and clay with sandstone*	*MRS-BS/ A5-1-3*	
2.0–2.5	*2*	*1.1*	*23*			*6*
2.5–3.0			*18*			
3.0–3.5			*37*			
3.5–4.0			*43*			
4.0–4.5	*2*	*1.2*	*51*	*Broken sandstone (brown, white, red, and light gray) and sand*	*MRS-BS/ A5-3-5*	*6*
4.5–5.0			*54*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
395 METERS EAST, *265* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: A6

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*Brown and light gray sand, silt, little clay, little rounded gravel*	*MRS-SS/A6-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*1.4*	*17*	*Brown clay, gravel and sand (fill)*	*MRS-BS/A6-1-3*	*4.5*
1.5–2.0			*20*			
2.0–2.5			*23*	*Brown and light gray sandstone and sand*		
2.5–3.0			*18*			
3.0–3.5	*2*	*1.0*	*11*	*Brown sandstone and sand*	*MRS-BS/A6-3-5*	*5*
3.5–4.0			*14*			
4.0–4.5			*17*			
4.5–5.0			*9*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
395 METERS EAST, *250* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A7*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark gray-brown sand, clay, silt little gravel (humus-like soil with grass roots*	*MRS-SS/A7-0-0.5*	*5*
0.5–1.0						
1.0–1.5	2	1.5	6	*Brown sandy, silty clay, very wet at top 0.25'*	*MRS-BS/A7-1-3-MS/DP*	*5*
1.5–2.0			7			
2.0–2.5			7	*Moist brown and light gray sandstone and sand*		
2.5–3.0			10			
3.0–3.5	2	1.75	20	*Same as above*	*MRS-BS/A7-3-5*	*5*
3.5–4.0			19			
4.0–4.5			24			
4.5–5.0			27			

5.0 — END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *375* METERS EAST, *245* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A8*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Dark brown-gray clay, silt, little gravel (humus-like soil)*	*MRS-SS/ A8-0-0.5*	
0.5–1.0					*MRS-BS/ A8-0.5-1*	*5*
1.0–1.5	*2*	*2.0*	*12*	*Brown sand, silt little clay*	*MRS-BS/ A8-1-3*	*5*
1.5–2.0			*11*			
2.0–2.5			*6*	*Brown and light gray sandstone and sand*		
2.5–3.0			*9*			
3.0–3.5	*2*	*1.9*	*15*	*Same as above*	*MRS-BS/ A8-3-5*	*5*
3.5–4.0			*17*			
4.0–4.5			*19*			
4.5–5.0			*22*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
385 METERS EAST, *240* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *4*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *A9*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Dark brown sand, silt, some clay (humus-like soil)*	*MRS-SS/ A9-0-0.5*	*5*
0.5–1.0						
1.0–1.5			*7*	*Brown sand, silt, some clay*	*MRS-BS/ A9-1-3*	
1.5–2.0			*9*			
2.0	*2*	*1.45*				*5*
2.0–2.5			*11*			
2.5–3.0			*13*			
3.0–3.5			*26*	*Brown and gray sandstone and sand*	*MRS-BS/ A9-3-5*	
3.5–4.0			*38*			
4.0	*2*	*1.3*				*5*
4.0–4.5			*41*			
4.5–5.0			*56*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
395 METERS EAST, *235* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.): ____

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *B1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Wet dark gray sand and silt with pieces of rusted metal and shiny metal*	*MRS-SS/ B1-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*1.85*	*11*	*Dark gray sand, silt, and stone Pieces of slag in top 0.2"*	*MRS-BS/ B1-1-3*	*5*
1.5–2.0			*13*			
2.0–2.5			*19*	*Light brown sand, silt, and stone grading to light brown sandy clay*		
2.5–3.0			*15*			
3.0–3.5	*2*	*2.0*	*6*	*Yellow-brown sandy clay with some stone*	*MRS-BS/ B1-3-5*	*5*
3.5–4.0			*7*			
4.0–4.5			*10*			
4.5–5.0			*10*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
315 METERS EAST, *350* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT LOCATION: *PULASKI, PA*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*

PROJECT NO.: *9105-449*
DATE DRILLED: *12-6-91*
DRILLER: *KURT WADDELL*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Moist black humus topsoil with rounded gravel*	*MRS-BS/ C1-0-0.5*	*5*
0.5–1.0						
1.0–1.5			*8*	*Moist brown sand, silt, and clay with some rounded gravel*		
1.5–2.0			*9*			
2.0–2.5	*2*	*1.35*	*21*		*MRS-BS/ C1-1-3*	*5*
2.5–3.0			*14*			
3.0–3.5			*8*	*Orange-brown sandstone and sand, some silt and clay*	*MRS-BS/ C1-3-5*	
3.5–4.0			*14*			
4.0–4.5	*2*	*2.0*	*19*			*5*
4.5–5.0			*25*			

5.0 — END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
297.5 METERS EAST, *375* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *4*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Moist black humus topsoil*	*MRS-SS/C2-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*5*	*Dark brown sand, silt, clay, gravel, some humus*	*MRS-BS/C2-1-3*	*4*
1.5–2.0			*6*	*Grading from dark to light brown sand and clay with much gravel and stone*		
2.0–2.5			*16*			
2.5–3.0			*21*			
3.0–3.5	*2*	*1.9*	*10*	*light brown and yellow sand and gravel (broken sandstone)*	*MRS-BS/C2-3-5*	*5*
3.5–4.0			*31*			
4.0–4.5			*27*			
4.5–5.0			*19*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
285 METERS EAST, *372.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Light brown to yellow-brown clay topsoil with roots, grass, and leaves*	*MRS-SS/ C3-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*11*	*Brown and yellow-brown clay topsoil*	*MRS-BS/ C3-1-3*	*5*
1.5–2.0			*19*	*Light brown to gray to dark brown sandstone with sand and silt*		
2.0–2.5			*27*			
2.5–3.0			*29*	*Water in sample*		
3.0–3.5	*2*	*1.8*	*12*	*Water in sample*	*M. -BS/ C3-3-5*	*5*
3.5–4.0			*23*	*Same as from 1.4' to 3.0'*		
4.0–4.5			*26*			
4.5–5.0			*17*	*Moist brown to gray silty clay*		

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
300 METERS EAST, *372.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: C4

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark brown humus topsoil - roots and leaves, sand, clay, silt, few stones*	*MRS-SS/ C4-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*1.9*	*8*	*Dark brown humus topsoil*	*MRS-BS/ C4-1-3*	*6*
1.5–2.0			*17*	*Light brown sand with 1"-3" pieces of sandstone, some red shale*		
2.0–2.5			*29*			
2.5–3.0			*34*			
3.0–3.5	*2*	*1.8*	*22*	*Same as above*	*MRS-BS/ C4-3-5*	*5*
3.5–4.0			*27*			
4.0–4.5			*27*	*Light brown grading to gray silty clay*		
4.5–5.0			*33*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
292.5 METERS EAST, *370* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FT DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Moist brown silty clay topsoil*	*MRS-SS/ D1-0-0.5*	*6*
0.5–1.0						
1.0–3.0	*2*	*1.5*	*12, 14, 17, 15*	*Dark grayish-brown silty clay with large sandstones (2"), some gravel and sand*	*MRS-BS/ D1-1-3*	*5*
3.0–3.5	*2*	*2.0*	*18*	*Same as above*	*MRS-BS/ D1-3-5*	*5*
3.5–5.0			*20, 16, 19*	*Orange-brown and gray mottled sandy, silty clay*		
5.0	END AUGER BORING					

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
295 METERS EAST, *470* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___x___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___5___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___3___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D2A*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE* — PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA* — DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.* — DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)* — SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Moist brown clay, little silt (with grass roots)*	*MRS-SS/ D2A-0-0.5*	*5*
0.5–1.0					*MRS-BS/ D2A-0.5-1*	
1.0–1.5	*2*	*2.0*	*4*	*Dark grayish-brown silty caly, some sand*	*MRS-BS/ D2A-1-3*	*5*
1.5–2.0			*4*			
2.0–2.5			*6*	*Orange-brown and light gray mottled silty clay, some sand*		
2.5–3.0			*8*			
3.0–5.0	*2*	*0.4*		*Less than 1' recovery, hole re-drilled (REFER TO D2B)*	*No Sample Collected*	*No Reading Taken*
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE
(2) PRESCREENING uR/hr READING: *7* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)
(3) BOREHOLE COORDINATES: *307.5* METERS EAST, *465* METERS NORTH
(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *3*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D2B*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*REFER TO D2A*		
0.5–1.0						
1.0–3.0				*REFER TO D2A*		
3.0–3.5			*11*	*Dark brown sandy clay and gravel*		
3.5–5.0	*2*	*2.0*	*14*, *22*, *31*	*Orange-brown and gray mottled sandy clay (very compact and hard) with gravel*	*MRS-BS/ D2B-3-5*	*5*
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
307.5 METERS EAST, *465* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *1*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D3A*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Dark bown silty clay with much humus*	*MRS-SS/ D3A-0-0.5*	*6*
0.5–1.0						
1.0–3.0	*2*	*0.3*		*Less than 1' recovery, hole re-drilled (REFER TO D3B)*	*No Sample Collected*	*No Reading Taken*
3.0–5.0						
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
320 METERS EAST, *460* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *0.5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *1*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D3B*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET[1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS[2]
0.0–0.5				*(REFER TO D3A)*		
0.5–1.0						
1.0–1.5	2	2.0	11	*Dark orange-brown and gray mottled silty clay*	*MRS-SS/ D3B-1-3*	5
1.5–2.0			10			
2.0–2.5			9			
2.5–3.0			19			
3.0–3.5	2	2.0	9	*Moist brown sandy, silty clay*	*MRS-SS/ D3B-3-5*	5
3.5–4.0			10			
4.0–4.5			13			
4.5–5.0			17	*Gray sandstone, sand and clay*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *320* METERS EAST, *460* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *1*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D4A*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Moist dark gray to black clay with roots (humus)*	*MRS-SS/ D4A-0-0.5*	*7*
0.5–1.0						
1.0–1.5	*2*	*1.65*	*6*	*Dark gray clay, some silt and sand*	*MRS-BS/ D4A-1-3*	*6*
1.5–2.0			*7*			
2.0–2.5			*12*	*Gray and orange-brown broken sandstone, sand and sandy clay*		
2.5–3.0			*11*			
3.0–3.5	*2*	*0.4*	*6*	*Less than 1' recovery, hole re-drilled (REFER TO D4B)*	*No Sample Collected*	*No Reading Taken*
3.5–4.0			*6*			
4.0–4.5			*5*			
4.5–5.0			*8*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
300 METERS EAST, *495* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *3*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *2*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D4B*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*(REFER TO D4A)*		
0.5–1.0						
1.0–3.0				*(REFER TO D4A)*		
3.0–3.5			*3*			
3.5–4.0	*2*	*1.7*	*4*	*Orange-brown sandy cla· sand and broken sandstone*	*MRS-BS/ D4B-3-5*	*5*
4.0–4.5			*4*			
4.5–5.0			*2*	*Wet gray sandy clay*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 7
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
300 METERS EAST, *435* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *1*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *D5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-8-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Dark brown and black silt and clay with roots (humus-like)*	*MRS-SS/ D5-0-0.5*	*7*
0.5–1.0						
1.0–1.5	*2*	*1.65*	*2*	*Brown and gray to orange and gray, mottled, sandy, silty clay*	*MRS-BS/ D5-1-3*	*6*
1.5–2.0			*4*			
2.0–2.5			*3*			
2.5–3.0			*5*			
3.0–3.5	*2*	*1.3*	*3*	*Orange-brown silty clay*	*MRS-BS/ D5-3-5*	*5*
3.5–4.0			*7*	*Wet, brown with a little gray and red broken sandstone, with sand, silt and a little clay*		
4.0–4.5			*11*			
4.5–5.0			*9*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
310 METERS EAST, *422.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___x___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___5___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___3___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: DE1A

PAGE: 1 OF 1

PROJECT: METCOA RESTART SITE
PROJECT NO.: 9105-449
PROJECT LOCATION: PULASKI, PA
DATE DRILLED: 12-9-91
DRILLING CONTRACTOR: PENNSYLVANIA DRILLING CO.
DRILLER: KURT WADDELL
DRILLING METHOD: AUGER ROTARY
SAMPLING METHOD: 3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)
SAMPLED BY: DON CERNANSKY
LOGGED BY: DON CERNANSKY

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				Wet black sand, gravel, some clay with roots (humus-like soil)	MRS-SS/DE1A-0-0.5	5
0.5–1.0						
1.0–3.0	2	0.25		Less than 1' recovery, hole re-drilled Second attempt, DE1B, also produced similar recovery results, hole re-drilled a third time (REFER TO DE1C)	No Sample Collected	No Reading Taken
3.0–5.0						
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 5
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
330 METERS EAST, 445 METERS NORTH

(4) ANALYTICAL SERVICE: CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: 0.5

NUMBER OF SAMPLES SENT FOR ANALYSIS (Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM): 1

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DE1C*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–1.0				(REFER TO DE1A)		
1.0–1.5	2	1.4	23	Gray gravel (broken limestone); Brown sandy clay	MRS-BS/DE1C-1-3	4.5
1.5–2.0			26	Dark gray to black sandy silty clay with gravel		
2.0–2.5			30	Wood		
2.5–3.0			24	Black sand and silt		
3.0–3.5	2	1.25	15	Moist black clay, very tight and sticky	MRS-SS/DE1C-3-5	5
3.5–4.0			11			
4.0–4.5			26	Rock		
4.5–5.0			22	Moist brown silty clay		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *330* METERS EAST, *445* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ✓
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* *2*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DE2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT LOCATION: *PULASKI, PA*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*

PROJECT NO.: *9105-449*
DATE DRILLED: *12-8-81*
DRILLER: *KURT WADDELL*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5				*Dark gray to black wet sand, silt, little clay (mud)* *Very small pieces of metal in soil*	*MRS-SS/ DE2-0-0.5*	*7*
1.0						
1.5			*4*	*Same as above*		
2.0	*2*	*1.6*	*5*	*Very moist dark gray-black to greenish-white to gray and orange-brown sandy, silty clay*	*MRS-BS/ DE2-: -3*	*7*
2.5			*5*			
3.0			*3*	*Orange-brown sandstone, sand, silt, and little clay*		
3.5			*3*	*Wet brown sandstone, sand, silt, little clay*		
4.0	*2*	*0.7*	*3*		*MRS-SS/ DE2-3-5*	*6*
4.5			*4*			
5.0			*5*	END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
322.5 METERS EAST, *427.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Moist black sand, silt and gravel with sod and roots, and slag (3-5")*	*MRS-SS/ E1-0-0.5*	*5*
0.5–1.0						
1.0–1.25	*2*	*1.9*	*9*	*Wet black sand, silt and stone (2")*	*MRS-BS/ E1-1-3*	*5*
1.25–2.0			*8*	*Grading from wet black silty sandy clay with gravel to moist green-black-gray sandy clay*		
2.0–3.0			*8*, *13*	*Grading from green-gray to brown sandy, silty clay*		
3.0–3.5	*2*	*1.8*	*12*	*Wet greeen-gray, black, yellow-brown, and light gray mottled sandy silty clay*	*MRS-SS/ E1-3-5*	*4*
3.5–4.0			*11*	*Wet black sand, silt and gravel*		
4.0–5.0			*15*, *20*	*Orange-brown sandstone, sand and some clay*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *7*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
345 METERS EAST, *450* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET[1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS[2]
0.0–0.5				*Brown and gray sand and silt, rounded slag and sandstone gravel (1-3")*	*MRS-SS/ E2-0-0.5*	*7*
0.5–1.0					*MRS-BS/ E2-0.5-1*	
1.0–1.5	*2*	*1.0*	*19*	*Brown sand and silt w/ gravel & rock*	*MRS-BS/ E2-1-3*	*6.5*
1.5–2.0			*24*	*Moist gray and brown sand silty clay with rounded gravel and sandstone towards bottom*		
2.0–2.5			*21*			
2.5–3.0			*26*			
3.0–3.5	*2*	*2.0*	*16*	*Same as above*	*MRS-BS/ E2-3-5*	*5*
3.5–4.0			*20*	*Orange-brown to brown sandstone, sand, gravel and little clay, wet towards bottom*		
4.0–4.5			*14*			
4.5–5.0			*18*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
362.5 METERS EAST, *442.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___x___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___5___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___4___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: E3

PAGE: 1 OF 1

PROJECT: METCOA RESTART SITE
PROJECT LOCATION: PULASKI, PA
DRILLING CONTRACTOR: PENNSYLVANIA DRILLING CO.
DRILLING METHOD: AUGER ROTARY
SAMPLING METHOD: 3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)

PROJECT NO.: 9105-449
DATE DRILLED: 12-9-91
DRILLER: KURT WADDELL
SAMPLED BY: DON CERNANSKY
LOGGED BY: DON CERNANSKY

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				Moist gray gravel, sand, silt, little clay (compacted subbase), very small pieces of shiny metal	MRS-SS/ E3-0-0.5	5.5
0.5–1.0					MRS-BS/ E3-0.5-1	
1.0–1.5	2	1.65	21	Greenish-black slag in orange-brown clayey sand	MRS-BS/ E3-1-3	5
1.5–2.0			19	Orange-brown clayey sand		
2.0–2.5			26	Gray-brown and orange-brown sandstone, sand and gravel (wet at bottom of sample)		
2.5–3.0			24			
3.0–3.5	2	1.85	7	Grayish brown sandy clay	MRS-BS/ E3-3-5	5
3.5–4.0			3	Orange-brown, red-brown and light brown sandstone, sand and silt (wet at bottom of sample)		
4.0–4.5			11			
4.5–5.0			19			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 6
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
335 METERS EAST, 435 METERS NORTH

(4) ANALYTICAL SERVICE: CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.): ____

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS (Cd, Cu, Mo, Ni, Pb, W AND RADIC-ANALYSIS FOR THORIUM): 4

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: [illegible]4

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Moist brown sand, silt [illegible] clay, little gravel (topsoil), with s[illegible] gravel (2-3") (subbase materi[illegible])*	*MRS-SS/ E4-0-0.5*	*4*
0.5–1.0						
1.0–1.5	2	1.7	44	*Light brown sandstone and sand, little clay*	*MRS-BS/ E4-1-3*	*4*
1.5–2.0			49			
2.0–2.5			52	*Orange-brown sandstone and gravel, some sand and silt, little clay*		
2.5–3.0			58			
3.0–3.5	2	0.4	45	*Orange-brown sandstone, sand and silt (split-barrel sampler driven into bedrock)*	*MRS-BS/ E4-3-5*	*4*
3.5–4.0			53			
4.0–4.5			57			
4.5–5.0			59			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
350 METERS EAST, *435* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: E5

PAGE: 1 OF 1

PROJECT: METCOA RESTART SITE
PROJECT LOCATION: PULASKI, PA
DRILLING CONTRACTOR: PENNSYLVANIA DRILLING CO.
DRILLING METHOD: AUGER ROTARY
SAMPLING METHOD: 3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)

PROJECT NO.: 9105-449
DATE DRILLED: 12-9-91
DRILLER: KURT WADDELL
SAMPLED BY: DON CERNANSKY
LOGGED BY: DON CERNANSKY

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5				0.3' of asphalt 0.2' of red-brown sand and silt with little gravel (ashes and/or sand fill	MRS-SS/E5-0-0.5	5
1.0						
1.5	2	1.5	8	Same as above, w/ slag gravel (2-3")	MRS-BS/E5-1-3	5
2.0			5	Brown to greenish brown sandy silty clay and gravel		
2.5			10			
3.0			12			
3.5	2	1.8	17	Brown sandy silty clay with gravel	MRS-BS/E5-3-5-MS/DP	5
4.0			25			
4.5			33	Greenish-grayish-tan silty clay with little gravel		
5.0			31	Brown sandstone and sand		

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 5
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES.
365 METERS EAST, 430 METERS NORTH

(4) ANALYTICAL SERVICE: CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED x
- DEPTH ENCOUNTERED (FT.)

TOTAL DEPTH OF BORING 5

NUMBER OF SAMPLES SENT FOR ANALYSIS (Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM) 3

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E6*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Gray cobbles and gravel (slag), brown sand, very small pieces of shiny metal*	*MRS-SS/ E6-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*38*	*Grayish brown sand and gravel*	*MRS-BS/E5-1-3-MS/DP*	*5*
1.5–2.0			*29*	*Brown and orange-brown sandstone, sand, gravel, some silt*		
2.0–2.5			*31*			
2.5–3.0			*25*			
3.0–3.5	*2*	*1.7*	*11*	*Brown sandstone, sand, little rounded gravel and silt*	*MRS-BS/ E6-3-5*	*5*
3.5–4.0			*9*			
4.0–4.5			*8*			
4.5–5.0			*12*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
335 METERS EAST, *420* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E7*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Wet gravel (3-4") and slag fines, little silt and sand, very small pieces of shiny metal*	*MRS-SS/ E7-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*27*	*Wet gray mud*	*MRS-BS/ E7-1-3*	*5*
1.5–2.0			*30*	*Moist brown to orange-brown sandstone, sand, silt, little clay, and rounded gravel*		
2.0–2.5			*26*			
2.5–3.0			*24*			
3.0–3.5	*2*	*2.0*	*12*	*Light brown and orange sand, sand, little clay*	*MRS-BS/ E7-1-3*	*5*
3.5–4.0			*17*	*Wet brown sand and gravel*		
4.0–4.5			*14*	*Brown and orange-brown sandstone and sand*		
4.5–5.0			*19*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
350 METERS EAST, *420* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E8*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED B..: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Gray slag gravel (up to 2"), sand and silt (compacted subbase fill)*	*MRS-SS/ E8-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*34*	*Same as above*	*MRS-BS/ E8-1-3*	*5*
1.5–2.0			*29*	*Brown and orange-brown sandstone, sand, silt and little clay*		
2.0–2.5			*28*			
2.5–3.0			*31*			
3.0–3.5	*2*	*2.0*	*32*	*Same as above*	*MRS-BS/ E8-3-5*	*4*
3.5–4.0			*35*			
4.0–4.5			*31*	*Wet brown sand and rounded gravel, little clay*		
4.5–5.0			*46*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
342.5 METERS EAST, *410* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING ____

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* ____

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *E9*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE* — PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA* — DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.* — DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)* — SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Brown clay, sand and silt with gray gravel slag (2-3") and pieces of shiny metal (compacted subbase fill)*	*MRS-SS/ E9-0-0.5*	*6*
0.5–1.0						
1.0–1.5	2	1.45	21	*Same as above*	*MRS-BS/ E9-1-3*	*6*
1.5–2.0			19	*Brown clay, sand and silt with some sandstone and rounded gravel*		
2.0–2.5			32			
2.5–3.0			27	*Orange-brown sandstone and sand*		
3.0–3.5	2	2.0	36	*Light brown and orange-brown sandstone, sand, silt, little clay and gravel*	*MRS-BS/ E9-3-5*	*5*
3.5–4.0			41			
4.0–4.5			49			
4.5–5.0			45			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES.
357.5 METERS EAST, *410* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *F1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark brown clay, some silt and sand and sod (humus topsoil)*	*MRS-SS/ F1-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*38*	*Orange-brown sandy clay and gravel*	*MRS-BS/ F1-1-3*	*6*
1.5–2.0			*43*			
2.0–2.5			*56*	*Orange-brown and light brown sandstone and sand*		
2.5–3.0			*42*			
3.0–3.5	*2*	*2.0*	*19*	*Brown sandstone, sand and silt, little clay*	*MRS-BS/ F1-3-5*	*6*
3.5–4.0			*39*			
4.0–4.5			*16*	*Water in split-barrel (Does not appear saturated)*		
4.5–5.0			*20*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. *uR/hr = micro R/hour*)

(3) BOREHOLE COORDINATES: *360* METERS EAST, *480* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.): ____

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: 4

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *F2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE* — PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA* — DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.* — DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)* — SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS / 0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Brown clay with sod, some rounded gravel and 2' stone, little black humus*	*MRS-SS/ F2-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*26*	*Brown sandy clay, some gravel*	*MRS-BS/ F2-1-3*	*6*
1.5–2.0			*56*			
2.0–2.5			*43*	*Light brown and orange-brown sandstone, sand and silt*		
2.5–3.0			*41*			
3.0–3.5	*2*	*1.6*	*14*	*Brown sandy clay*	*MRS-BS/ F2-3-5*	*6*
3.5–4.0			*23*	*Wet, brown sandstone and sand*		
4.0–4.5			*34*			
4.5–5.0			*22*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE
(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)
(3) BOREHOLE COORDINATES:
375 METERS EAST, *472.5* METERS NORTH
(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *F3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark brown clay with grass and roots (humus topsoil)*	*MRS-SS/F3-0-0.5*	*6*
0.5–1.0						
1.0–3.0	*2*	*2.0*	*18*, *15*, *11*, *19*	*Same as above*; *Dark orange-brown and gray mottled clay with little sand and trace gravel*	*MRS-BS/F3-1-3*	*6*
3.0–5.0	*2*	*1.85*	*39*, *41*, *43*, *47*	*Brown sandy, silty clay* (3.0–4.0); *Light brown and orange-brown sandstone and sand, some clay* (4.0–5.0)	*MRS-BS/F3-3-5*	*6*
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *345* METERS EAST, *470* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___*x*___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___*5*___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___*3*___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: F4

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE* — PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA* — DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.* — DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)* — SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Wet dark gray slag gravel (2"-4") with sand and gravel, very small pieces of shiny metal, trace white sand*	*MRS-SS/ F4-0-0.5*	*6*
0.5–1.0						
1.0–1.5			*11*	*Red sandstone-like rock with white specs (slag?)*		
1.5–2.0			*10*			
2.0	*2*	*2.0*	*8*	*Gray-brown, orange-brown and light brown mottled clay, sandy towards bottom*	*MRS-BS/ F4-1-3*	*6*
2.5–3.0			*12*			
3.0–3.5			*9*			
3.5–4.0			*11*	*Orange-brown and gray mottled sandy clay*		
4.0	*2*	*2.0*	*15*		*MRS-BS/ F4-3-5*	*5.5*
4.5–5.0			*13*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 6
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
385 METERS EAST, *455* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)*: 3

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *F5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark brown sand, silt (humus), little rounded gravel and 3" gravel*	*MRS-SS/ F5-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*1.8*	*17*	*Dark brown and black sand and silt with few 2" pieces of white or green rock (slag)*	*MRS-BS/ F5-1-3*	*5*
1.5–2.0			*14*			
2.0–2.5			*8*	*Moist to dark gray silty clay (very tacky)*		
2.5–3.0			*6*			*6.5*
3.0–3.5	*2*	*2.0*	*5*	*Same as above*	*MRS-BS/ F5-3-5*	*7*
3.5–4.0			*5*	*Black sand and silt* / *Orange-brown and gray mottled sandy, silty clay*		
4.0–4.5			*4*	*Note: small strands (1"-2" long) of needle size copper wire coated with shiny metal, throughout boring*		
4.5–5.0			*6*			*5*

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *355* METERS EAST, *452.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *F6*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				Dark gray sand, silt and gravel with 2" slag gravel	MRS-SS/F6-0-0.5	7
0.5–1.0						
1.0–1.5	2	1.8	9	Angular gravel and rock	MRS-BS/F6-1-3	6
1.5–2.0			14	Dark gray grading to light grayish-brown sandy silty clay with rounded gravel		
2.0–2.5			23			
2.5–3.0			47	Orange-brown and gray sandstone, sand and gravel		
3.0–3.5	2	2.0	29	Orange-brown to light brown sandstone, sand, gravel, little silt, some clay in bottom 0.3' Wet at bottom of split barrel	MRS-BS/F6-3-5	6
3.5–4.0			33			
4.0–4.5			31			
4.5–5.0			33			

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *375* METERS EAST, *442.4* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___x___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___5___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___3___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*Gray angular gravel, sand and clay (subbase fill)*	*MRS-SS/ C1-0-0.5*	*6*
0.5–1.0						
1.0–1.5	*2*	*1.6*	*46*	*Light red sandstone and white furnace brick in gray sand and gravel*	*MRS-BS/ C1-1-3*	*6*
1.5–2.0			*50*	*Gray clay*; *Brown and red sandstone in clay*		
2.0–2.5			*57*	*Brown silty clay*		
2.5–3.0			*55*	*Moist to wet brown sand and clay*		
3.0–3.5	*2*	*1.7*	*38*	*Brown sandstone and sand, little silt and clay*	*MRS-BS/ C1-3-5*	*5*
3.5–4.0			*41*			
4.0–4.5			*45*			
4.5–5.0			*49*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *400* METERS EAST, *480* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: C2

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Gray and brown sand and clay, angular gray gravel and sod*	*MRS-SS/C2-0-0.5*	*5.5*
0.5–1.0						
1.0–1.5			*21*	*Dark brown silty clay, little gravel (humus-like)*		
1.5–2.0	*2*	*2.0*	*18*	*Gray and brown mottled silty clay*	*MRS-BS/C2-1-3*	*5*
2.0–2.5			*24*			
2.5–3.0			*20*	*Gray and brown mottled clayey sand*		
3.0–3.5			*27*	*Hardpan brown clay*		
3.5–4.0	*2*	*1.7*	*34*	*Moist to wet, brown sandstone with sand and little clay*	*MRS-BS/C2-3-5-MS/DP*	*5*
4.0–4.5			*31*			
4.5–5.0			*33*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *410* METERS EAST, *475* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr. READINGS [2]
0–0.5				*Brown sand and clay, some gravel with sandstone cobbles (5-8")*	*MRS-SS/ C3-0-0.5*	*5*
0.5–1.0					*MRS-BS/ C3-0.5-1*	
1.0–1.5	*2*	*1.8*	*23*	*Brown clay and sand (topsoil)*	*MRS-BS/ C3-1-3*	*5*
1.5–2.0			*18*	*Brown silty sandy clay with some gravel at bottom*		
2.0–2.5			*21*			
2.5–3.0			*29*			
3.0–3.5	*2*	*1.1*	*27*	*Same as above*	*MRS-BS/ C3-3-5*	*5*
3.5–4.0			*34*	*Brown sandstone, gravel, sand and some clay*		
4.0–4.5			*33*			
4.5–5.0			*30*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
420 METERS EAST, *475* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED ___*x*___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___*5*___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* ___*4*___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: C4

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				Dark gray sand amd clay in gravel (subbase fill), some sod	MRS-SS/ C4-0-0.5	6
0.5–1.0						
1.0–1.5	2	0.8	47	Same as above	MRS-BS/ C4-1-3	5
1.5–2.0			56	Light brown to white sandstone, possibly furnace brick		
2.0–2.5			60	Brown sandstone Bedrock at approximately 2'		
2.5–3.0			61			
3.0–3.5	2	1.3	60	Wet, brown sandstone and sand	MRS-BS/ C4-3-5	5
3.5–4.0			68			
4.0–4.5			72			
4.5–5.0			70			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 6
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
395 METERS EAST, 470 METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.): ____

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS (Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM): 3

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Gray sand and silt, some large gravel, slag and furnace brick*	*MRS-SS/ C5-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*1.3*	*36*	*Dark brown clay with slag*	*MRS-BS/ C5-1-3*	*5*
1.5–2.0			*25*	*Dark to light brown clay with gray mottling towards the base of the split barrel*		
2.0–2.5			*20*			
2.5–3.0			*17*			
3.0–3.5	*2*	*1.7*	*29*	*Orange-brown and gray mottled sandy clay*	*MRS-BS/ C5-3-5*	*5*
3.5–4.0			*21*			
4.0–4.5			*21*			
4.5–5.0			*22*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
415 METERS EAST, *465* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C6A*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*Gray sand and gravel with pieces of broken furnace brick*	*MRS-SS/ C6A-0-0.5*	*5*
0.5–1.0						
1.0–1.5			*98*	*Drilled into hard slag, very low recovery (<8 ounces of sample)*	*No Sample Collected*	*No Reading Taken*
1.5–2.0	*2*		*92*	*Re-drill hole (C6B)*		
2.0–2.5			*86*			
2.5–3.0			*95*			
3.0–5.0				*Refer to Borehole No. C6B*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
425 METERS EAST, *455* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *3*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *1*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *C6B*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-11-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.0–0.5				*(Refer to Borehole No. C6A)*		
0.5–1.0						
1.0–1.5	2	1.9	36	*Dark brown clayey sand with gravel*	MRS-BS/ C6B-1-3	5
1.5–2.0			47			
2.0–2.5			46	*Light brown and gray mottled hard sandy clay*		
2.5–3.0			53			
3.0–3.5	2	1.6	31	*Dark brown hard silty, sandy clay with gravel*	MRS-BS/ C6B-3-5	5
3.5–4.0			24	*Orange-brown hard sandy clay with sandstone gravel*		
4.0–4.5			25			
4.5–5.0			20			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
425 METERS EAST, *455* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER

- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *2*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DP1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0–0.5				*Dark gray to black humus topsoil with roots and leaves*	*MRS-SS/DP1-0-0.5-MS/DP*	*5*
0.5–1.0						
1.0–1.5	*2*	*1.5*	*37*	*Dark gray clay, sand, silt and gravel*	*MRS-BS/DP1-1-3*	*5*
1.5–2.0			*58*			
2.0–2.5			*46*	*Yellow-orange sand with some broken sandstone*		
2.5–3.0			*43*			
3.0–3.5	*2*	*1.0*	*20*	*Wet brown clay, sand and gravel, including a 2.4" piece of broken yellow sandstone*	*MRS-BS/DP1-3-5*	*5*
3.5–4.0			*26*			
4.0–4.5			*30*			
4.5–5.0			*34*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
360 METERS EAST, *390* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DP2*

PAGE: 1 OF 1

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				1" of gray clay mud with cinders on ground surface over brown sand silt, gravel and cobbles (5")	MRS-SS/ DP2-0-0.5	4
0.5–1.0						
1.0–1.5	2	1.5	28	Brown clay, silt, sand, and gravel with roots	MRS-BS/ DP2-1-3	4
1.5–2.0			29	Brown clay, sand, silt, with large sandstone		
2.0–2.5			35	Sandstone and some sand		
2.5–3.0			38			
3.0–3.5	2	1.9	36	Same as above	MRS-BS/ DP2-3-5	4
3.5–4.0			32			
4.0–4.5			37			
4.5–5.0			41			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 5
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
430 METERS EAST, 370 METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED x
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* 3

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DP3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE* | PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA* | DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.* | DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)* | SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr. READINGS [2]
0–0.5				*Moist dark gray to brown sand, silt & slag gravel (0.5") with small slivers of metal*	*MRS-SS/ DP3-0-0.5*	*5*
0.5–1.0					*MRS-BS/ DP3-0.5-1*	
1.0–1.5			*19*	*Orange-red sandstone*		
1.5–2.0			*22*	*Dark gray to brown silty clay and sand with sandstone (2"-5")*		
2.0–2.5	*2*	*2.0*	*20*		*MRS-BS/ DP3-1-3*	*5*
2.5–3.0			*21*			
3.0–3.5			*12*	*Same as above*		
3.5–4.0			*11*			
4.0–4.5	*2*	*1.85*	*14*		*MRS-BS/ DP3-3-5*	*5*
4.5–5.0			*15*	*Orange-brown silt and clay, some sand*		
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5 to 6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *335* METERS EAST, *335* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *4*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DP4*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				1" layer of gray clay and slag/cinders 5" layer of yellow-brown clay, some sand and gravel	MRS-SS/ DP4-0-0.5	5
0.5–1.0						
1.0–1.5	2	1.8	14	Orange-brown clay with silt, sand and gravel (limestone?) (fill)	MRS-BS/ DP4-1-3	4.5
1.5–2.0			20			
2.0–2.5			24	Brown sand and clay with sandstone		
2.5–3.0			27			
3.0–3.5	2	1.9	12	Brown clay with sand and sandstone	MRS-BS/ DP4-3-5	4
3.5–4.0			14	Brown and gray sand mixed with sandstone		
4.0–4.5			17			
4.5–5.0			22			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE
(2) PRESCREENING uR/hr READING: *5* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)
(3) BOREHOLE COORDINATES: *400* METERS EAST, *330* METERS NORTH
(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *DP5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0–0.5				*Dark brown to gray sand, silt and gravel with 5" cobbles*	*MRS-SS/DP5-0-0.5*	*5*
0.5–1.0						
1.0–1.5	*2*	*2.0*	*9*	*Orange-brown sandy silty clay with sandstone gravel*	*MRS-BS/DP5-1-3*	*5*
1.5–2.0			*13*	*Light gray, grading to dark gray sandy clay with sandstone (1"-3")*		
2.0–2.5			*11*			
2.5–3.0			*16*			
3.0–3.5	*2*	*2.0*	*10*	*Dark brownish gray silty, sandy clay with sandstone gravel (white-, gray-, and red-colored)*	*MRS-BS/DP5-3-5*	*4*
3.5–4.0			*8*			
4.0–4.5			*15*			
4.5–5.0			*19*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
340 METERS EAST, *320* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: *x*
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: *3*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP1*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5						
1.0						
1.5	2	2.0	21	*Orange-brown and light gray mottled sandy clay with sandstone (1"-3")*	*MRS-BS/AP1-1-3-MS/DP*	6
2.0			25			
2.5			32			
3.0			28			
3.5	2	2.0	14	*Brown sandy clay*	*MRS-BS/AP1-3-5*	6
4.0			31	*Brown sandstone, sand and clay with white sandstone at bottom*		
4.5			21			
5.0			18	END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
355 METERS EAST, *478* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.): ____

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: 2

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP2*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5						
1.0						
1.5	2	1.8	14	Red and white sand in black silt with a 2" white-colored rock	MRS-BS/AP2-1-3	6
2.0			10	Dark gray clay		
2.5			12	Orange-brown and gray mottled silty, sandy clay		
3.0			8			
3.5	2	2.0	17	Same as above	MRS-BS/AP2-3-5	5
4.0			19			
4.5			16			
5.0			20	END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: 6
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
345.5 METERS EAST, 462.5 METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: 2

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP3*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-10-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5						
1.0						
1.5	2	2.0	52	Dark gray to black sand and silt (cinders?)	MRS-BS/ AP3-1-3	6
2.0			58	Gray and brown mottled sandy clay with 2" piece of soft white-colored rock		
2.5			42	Orange-brown sandstone, some rounded gravel, sand, silt and clay		
3.0			37			
3.5	2	0.4	46	Orange-brown snadstone and sand Split-barrel sampler driven into bedrock	MRS-BS/ AP3-3-5	6
4.0			47			
4.5			53			
5.0			10	END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
389 METERS EAST, *474* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *2*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP4*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-9-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIF-ICATION	uR/hr READINGS [2]
0.0–0.5						
0.5–1.0						
1.0–1.5	2	1.9	*17*	*Gray gravel (limestone?) sand & silt (compact subbase fill)*	*MRS-BS/ AP4-1-3*	5
1.5–2.0			*12*	*Orange-brown and brown sandstone, sand and silt*		
2.0–2.5			*13*			
2.5–3.0			*15*			
3.0–3.5	2	1.9	*10*	*Same as above*	*MRS-BS/ AP4-3-5*	5
3.5–4.0			*9*	*Wet, brown sand and gravel, some clay*		
4.0–4.5			*7*	*Moist, light brown sandstone, sand and gravel*		
4.5–5.0			*7*			
5.0				END AUGER BORING		

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *6* (BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES: *334* METERS EAST, *424* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED *x*
- DEPTH ENCOUNTERED (FT.) ____

TOTAL DEPTH OF BORING *5*

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)* *2*

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP5*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-6-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5						
1.0						
1.5	2	1.6	8	*Dark brown clay with silt, sand and gravel (broken sandstone) grading to darker brownish gray clay and gravel*	*MRS-BS/ AP5-1-3*	5
2.0			14			
2.5			11			
3.0			13			
3.5	2	1.35	22	*Dark gray clay*	*MRS-BS/ AP5-3-5*	5
4.0			34			
4.5			21	*Gray sandstone*		
5.0			18			

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE. uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
325.5 METERS EAST, *472.5* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED ___x___
- DEPTH ENCOUNTERED (FT.) ______

TOTAL DEPTH OF BORING ___5___

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM)* ___2___

FIGURE 3 (REVISED)
FIELD AUGER BORING LOG

BOREHOLE NO.: *AP6*

PAGE: *1* OF *1*

PROJECT: *METCOA RESTART SITE*
PROJECT NO.: *9105-449*
PROJECT LOCATION: *PULASKI, PA*
DATE DRILLED: *12-7-91*
DRILLING CONTRACTOR: *PENNSYLVANIA DRILLING CO.*
DRILLER: *KURT WADDELL*
DRILLING METHOD: *AUGER ROTARY*
SAMPLING METHOD: *3" I.D. SPLIT-BARREL SAMPLER (140 LB. HAMMER)*
SAMPLED BY: *DON CERNANSKY*
LOGGED BY: *DON CERNANSKY*

DEPTH IN FEET [1]	FEET DRIVEN	FEET RECOVERED	BLOWS/0.5	SOIL AND ROCK DESCRIPTION	SAMPLE IDENTIFICATION	uR/hr READINGS [2]
0.5						
1.0						
1.5	2	1.6	35	Brown silt and sand with sandstone	MRS-BS/ AP6-1-3	5
2.0			37	Compact orange-brown clayey, silty sand		
2.5			41	Light orange-brown sandstone and sand		
3.0			44			
3.5	2	1.2	45	Brown sand and broken sandstone, little silt	MRS-BS/ AP6-3-5	5
4.0			52			
4.5			58			
5.0			56			

END AUGER BORING

COMMENTS

(1) ALL DEPTHS ARE FROM GROUND SURFACE

(2) PRESCREENING uR/hr READING: *5*
(BACKGROUND AT SAMPLE PREPARATION STATION IN THE FIELD PRIOR TO SCREENING AN ENVIRONMENTAL SAMPLE, uR/hr = micro R/hour)

(3) BOREHOLE COORDINATES:
391 METERS EAST, *313* METERS NORTH

(4) ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

SUMMARY

GROUNDWATER
- NOT ENCOUNTERED: x
- DEPTH ENCOUNTERED (FT.):

TOTAL DEPTH OF BORING: 5

NUMBER OF SAMPLES SENT FOR ANALYSIS *(Cd, Cu, Mo, Ni, Pb, W AND RADIO-ANALYSIS FOR THORIUM)*: 2

APPENDIX C

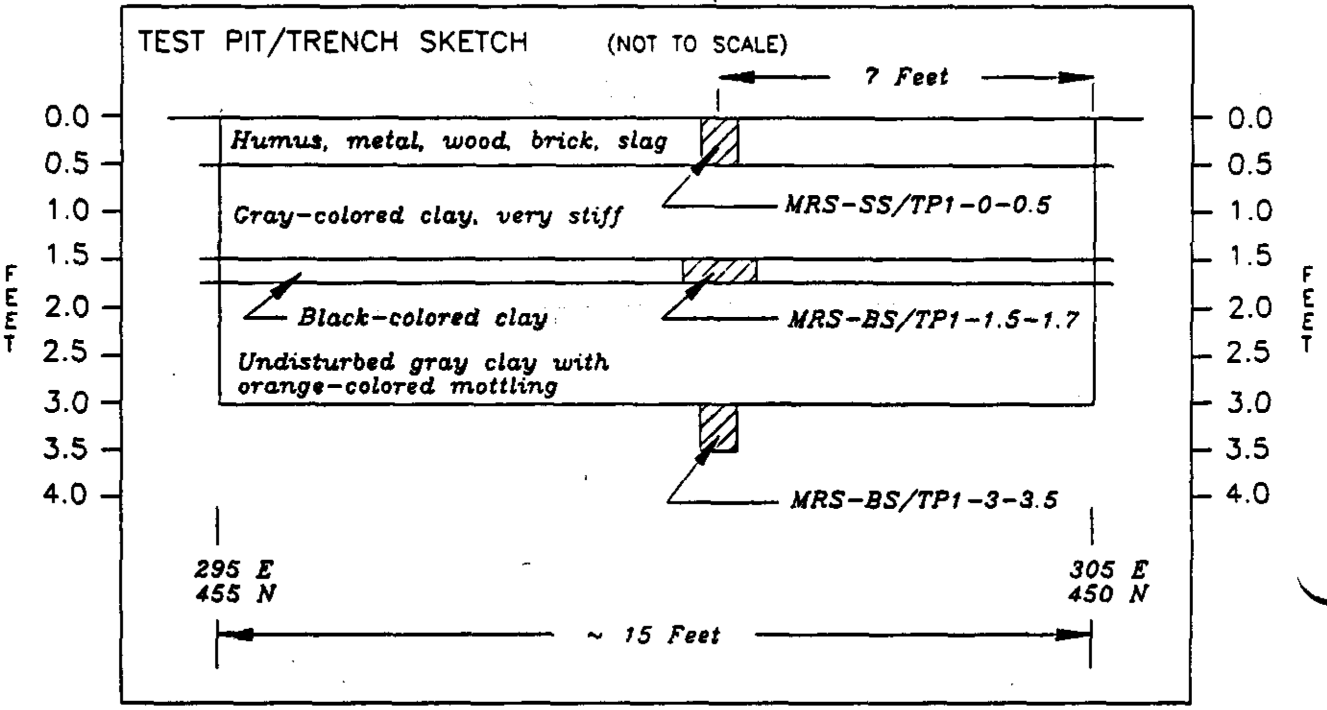
TEST PIT/TRENCH SOIL SAMPLE LOGS

FIGURE 2 (REVISED)
TEST PIT/TRENCH SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
TEST PIT NO.: *1*	COLLECTOR'S NAME: *M. Howe*
DATE: *12-12-91*	LOG PAGE NUMBER *31* OF *53**

TEST PIT DESCRIPTION: *Surfical humus and scrap metal debris grades quickly to clays that appear to be undisturbed. Moist sediments. No buried material below about 0.5 feet.*

** Field Logbook No. 2*



SAMPLE ANALYSES: *Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL SCOOP AND MIXING BOWL*

NO. OF SAMPLES COLLECTED: *3*	CONTAINER SIZE: *8 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/TP1-0-0.5	*0930*	*0-0.5*	*Humus, scrap metal, slag. 20 uR/hr*
MRS-BS/TP1-1.5-1.7	*0950*	*1.5-1.7*	*Black to dark green-colored clay. 7 uR/hr*
MRS-BS/TP1-3-3.5	*0940*	*3.0-3.5*	*Native gray-colored clay with orange-*
			colored mottling. Moist soil. 7 uR/hr

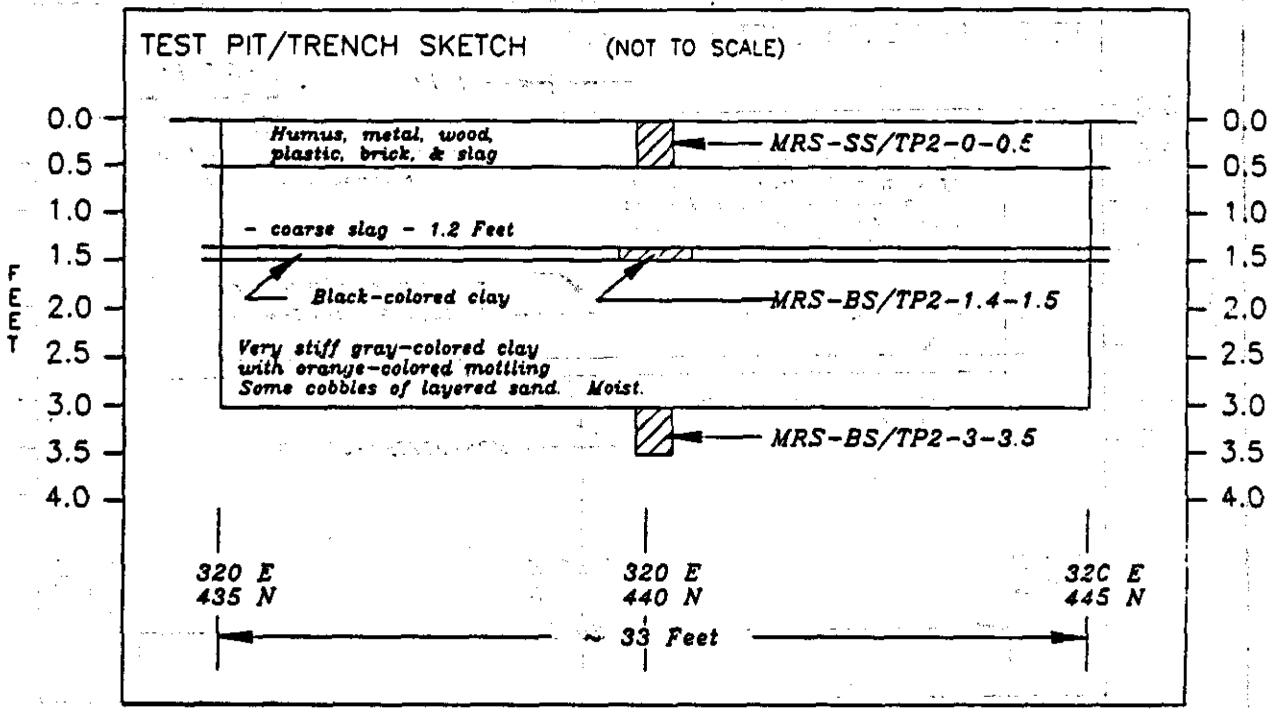
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 2 (REVISED)
TEST PIT/TRENCH SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
TEST PIT NO.: *2*	COLLECTOR'S NAME: *M. Howe*
DATE: *12-12-91*	LOG PAGE NUMBER *33* OF *53**

TEST PIT DESCRIPTION: *Oriented along and centered on line with the highest micro-R/hr reading*

** Field Logbook No. 2*



SAMPLE ANALYSES: *Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL SCOOP AND MIXING BOWL*

NO. OF SAMPLES COLLECTED: *3*	CONTAINER SIZE: *8 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/TP2-0-0.5	*1035*	*0-0.5*	*Humus, metal scrap, slag, moist. 30 uR/hr*
MRS-BS/TP2-1.4-1.5	*1100*	*1.4-1.5*	*Stiff black-colored clay, moist. 7 uR/hr*
MRS-BS/TP2-3-3.5	*1050*	*3.0-3.5*	*Native gray-colored clay with orange-*
			colored mottling, moist. 7 uR/hr

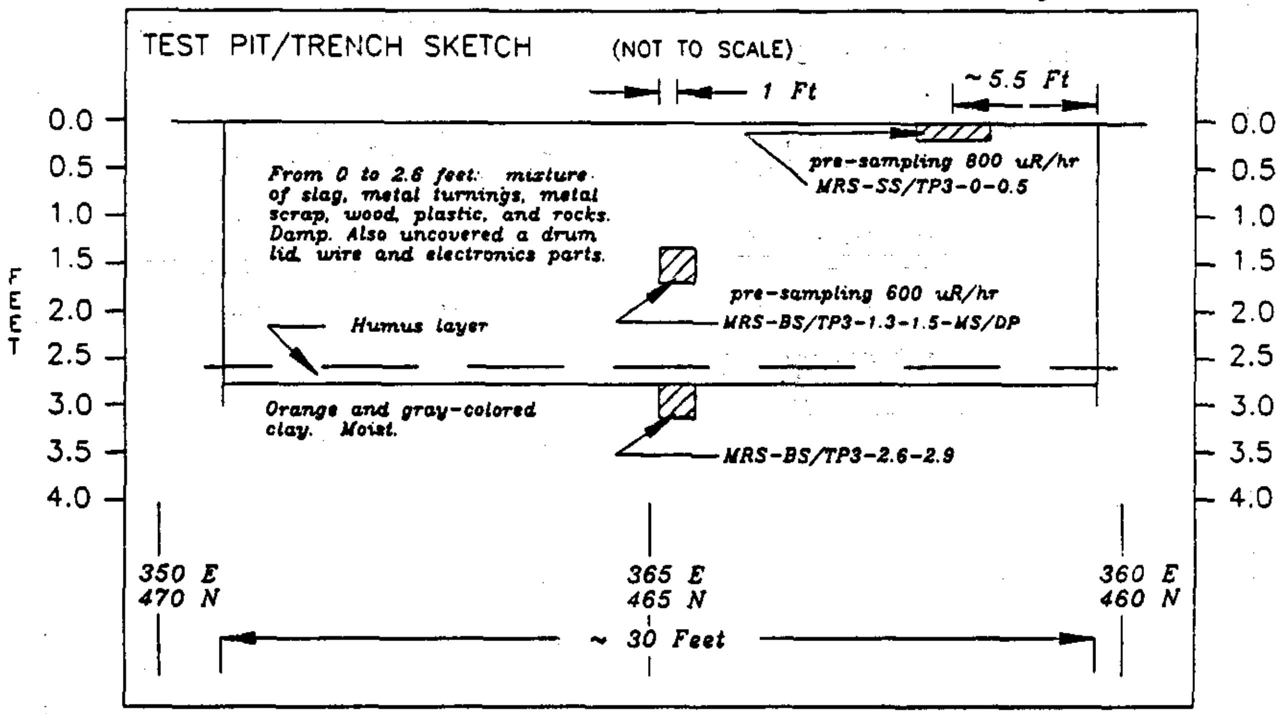
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 2 (REVISED)
TEST PIT/TRENCH SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
TEST PIT NO.: *3*	COLLECTOR'S NAME: *M. Howe*
DATE: *12-12-91*	LOG PAGE NUMBER *35* OF *53**

TEST PIT DESCRIPTION: *Located in area of slag fill and debris consisting of metal turnings, scrap metal, wood, plastic, and rock*

** Field Logbook No. 2*



SAMPLE ANALYSES: *Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL SCOOP AND MIXING BOWL*

NO. OF SAMPLES COLLECTED: *3*	CONTAINER SIZE: *8 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/TP3-0-0.5	*1140*	*0-0.5*	*Gravel, slag fines, metal turnings, metal scraps. 39 uR/hr*
MRS-BS/TP3-1.3-1.5-MS/DP	*1205*	*1.3-1.5*	*Slag fines, gravel, metal turnings, wood slivers. 110 uR/hr*
MRS-BS/TP3-2.6-2.9	*1150*	*2.6-2.9*	*Orange and gray-colored stiff mottled clay. Moist. 7 uR/hr*

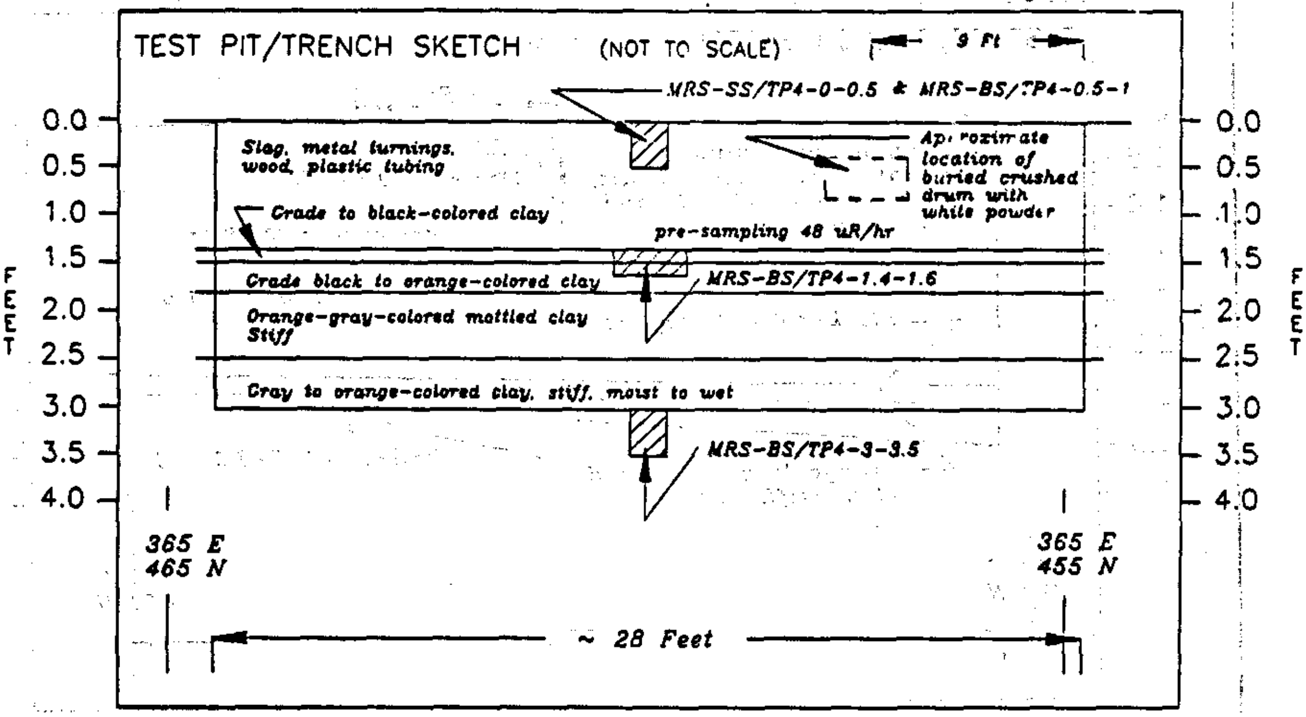
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 2 (REVISED)
TEST PIT/TRENCH SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
TEST PIT NO.: *4*	COLLECTOR'S NAME: *M. Howe*
DATE: *12-12-91*	LOG PAGE NUMBER *39* OF *53**

TEST PIT DESCRIPTION: *Located in an area of slag fill and debris consisting of metal turnings, scrap metal, wood, plastic, and rock.*

** Field Logbook No. 2*



SAMPLE ANALYSES: *Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL SCOOP AND MIXING BOWL*

NO. OF SAMPLES COLLECTED: *3*	CONTAINER SIZE: *8 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/TP4-0-0.5	*1315*	*0-0.5*	*Slag, metal turnings & slivers of wood.*
MRS-BS/TP4-0.5-1	*1325*	*0-0.5*	*Duplicate sample of MRS-SS/TP4-0-0.5*
MRS-BS/TP4-1.4-1.6	*1425*	*1.4-1.6*	*Black-colored stiff clay with some gravel. 10 uR/hr*
MRS-BS/TP4-3-3.5	*1415*	*3.0-3.5*	*Gray to orange-colored clay, stiff. Very moist.*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

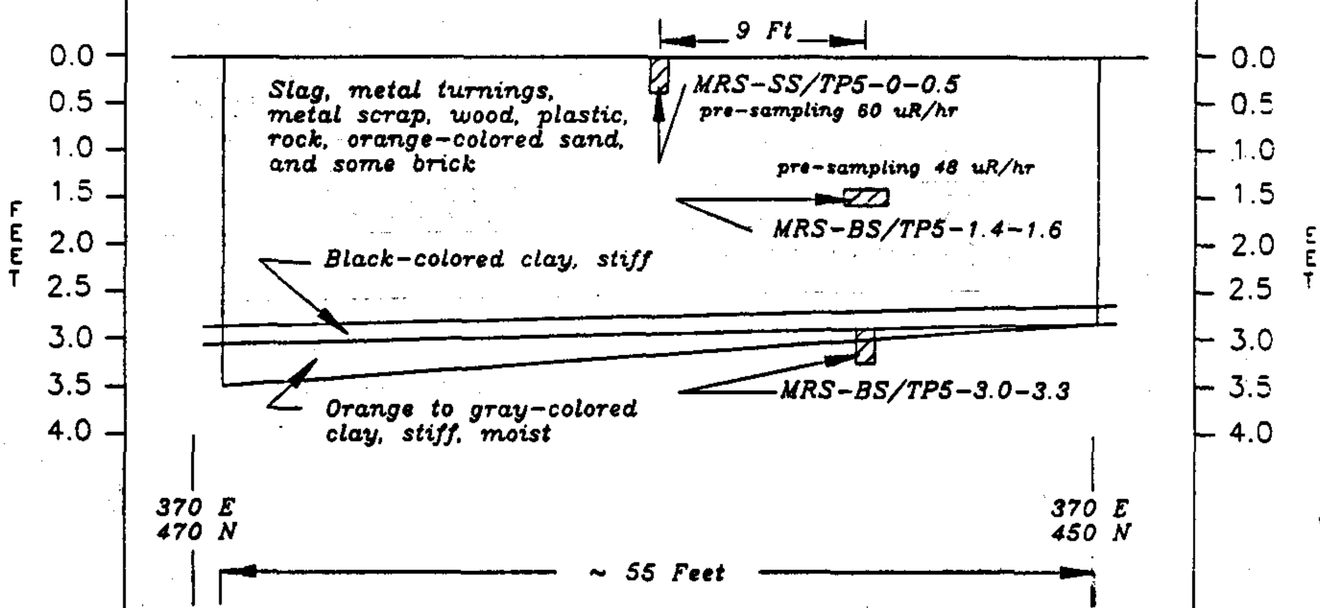
FIGURE 2 (REVISED)
TEST PIT/TRENCH SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
TEST PIT NO.: *5*	COLLECTOR'S NAME: *M. Howe*
DATE: *12-12-91*	LOG PAGE NUMBER *41* OF *53**

TEST PIT DESCRIPTION: *Located in area of slag fill and debris consisting of metal turnings, scrap metal, wood, plastic, and rock*

* *Field Logbook No. 2*

TEST PIT/TRENCH SKETCH (NOT TO SCALE)



SAMPLE ANALYSES: *Cd, Cu, Mo, Ni, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL SCOOP AND MIXING BOWL*

NO. OF SAMPLES COLLECTED: *3*	CONTAINER SIZE: *8 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/TP5-0-0.5	*1505*	*0-0.5*	*Orange-colored sand, slag, metal turnings. ~10 u/hr*
MRS-BS/TP5-1.4-1.6	*1555*	*1.4-1.6*	*Black-colored gravelly slag and white-colored slag, friable. 10 uR/hr*
MRS-BS/TP5-3.0-3.3	*1535*	*3.0-3.3*	*Orange to gray-colored mottled clay. Very stiff. Wet. 4-5 uR/hr*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

APPENDIX D

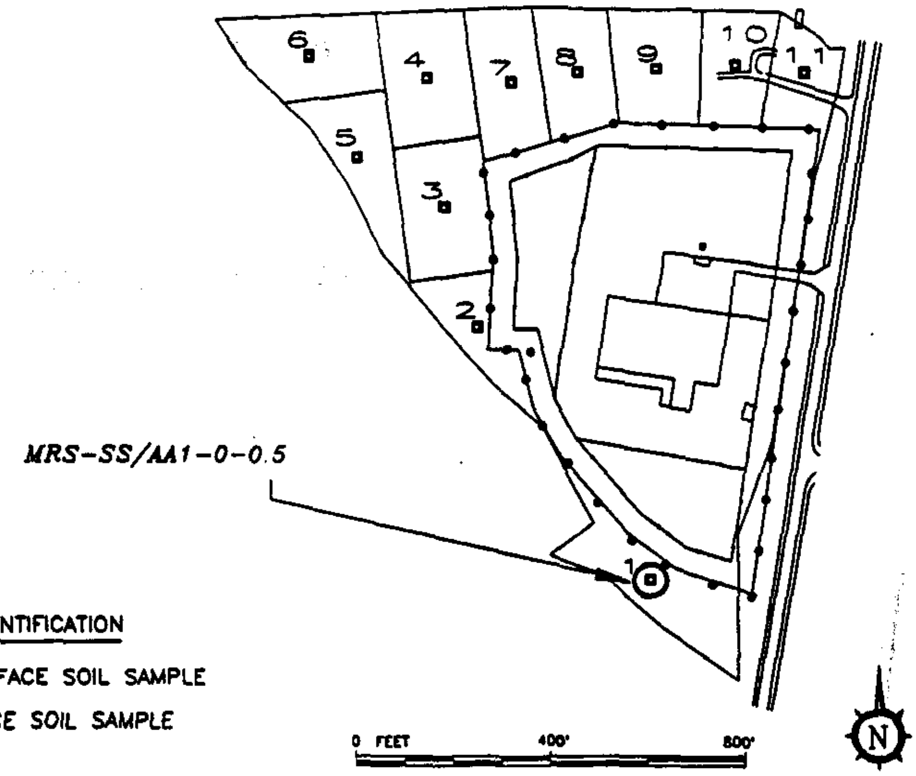
1-ACRE AREA SAMPLE LOGS

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *1* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

- ▣ 1 ACRE AREA SURFACE SOIL SAMPLE
- ● PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA1-0-0.5	*09:40*	*0-0.5*	*silty loam*

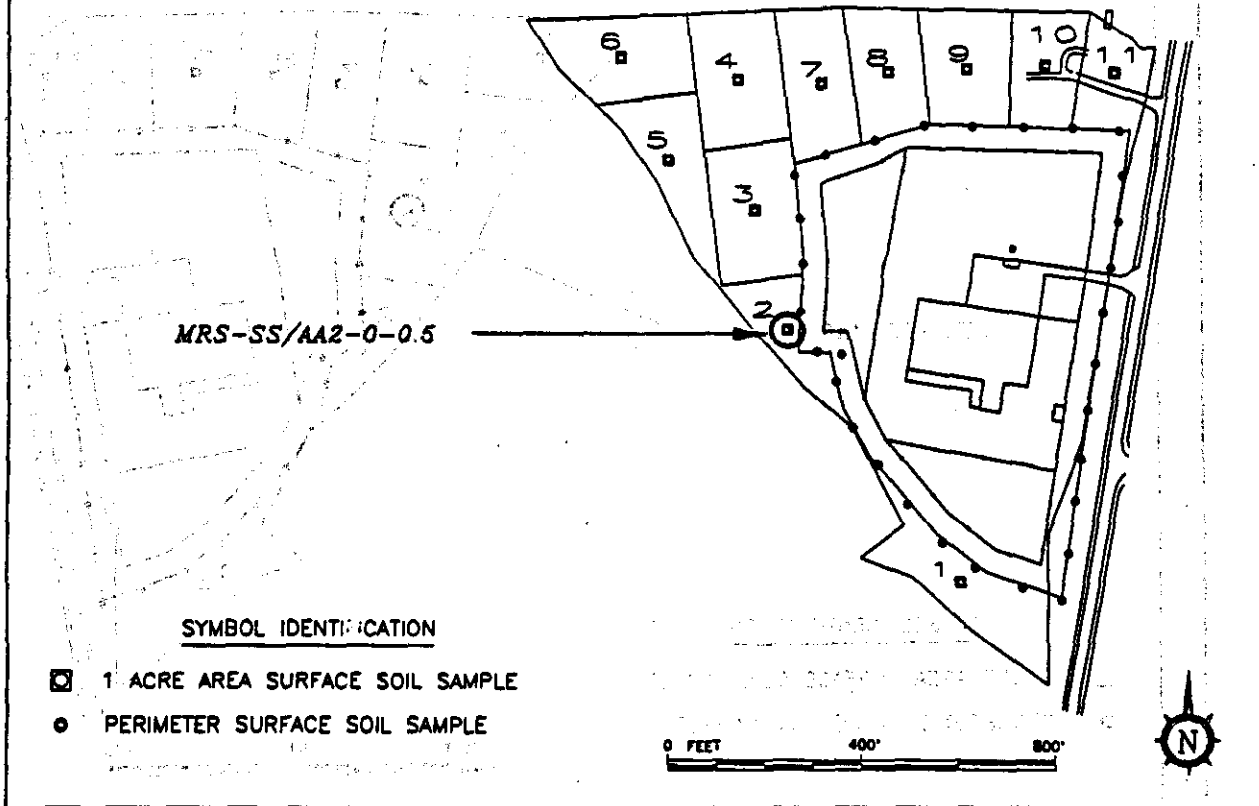
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *2* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA2-0-0.5	*10:00*	*0-0.5*	*silty clay loam*

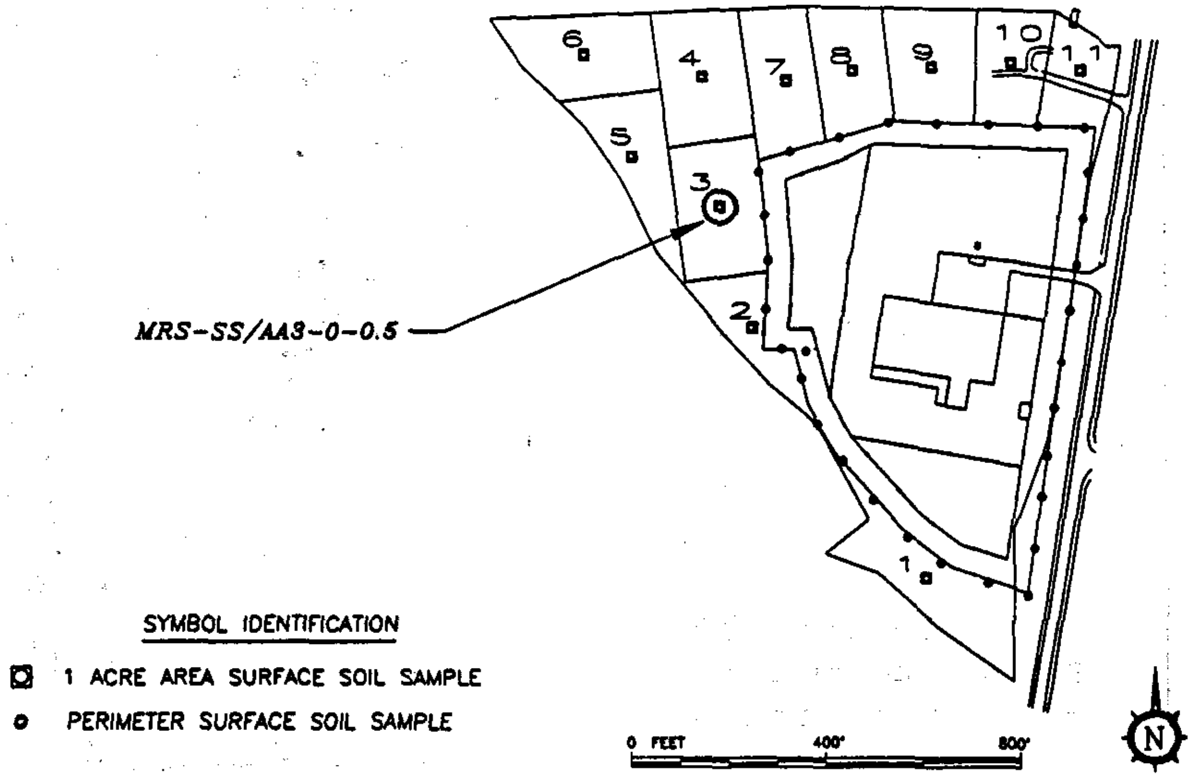
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *3* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA3-0-0.5	*10:40*	*0-0.5*	*silty clay loam*

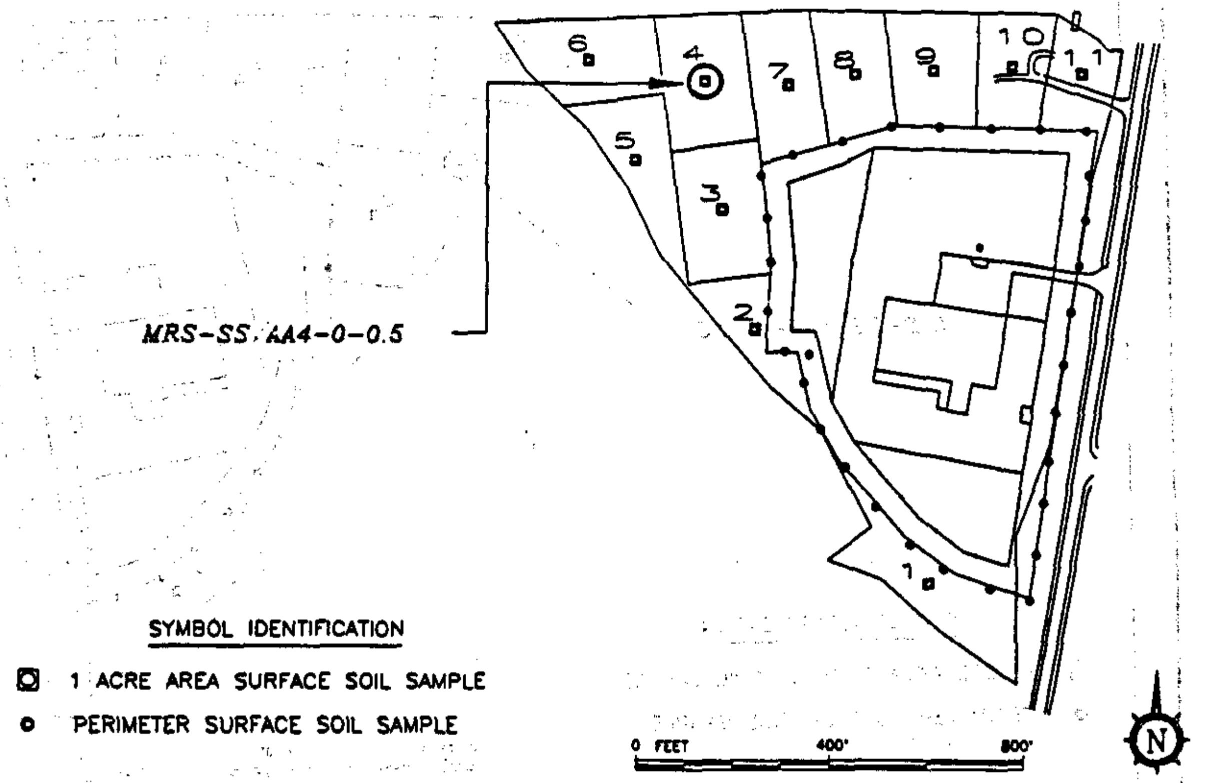
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *4* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA4-0-0.5	*10:50*	*0-0.5*	*silty clay loam*

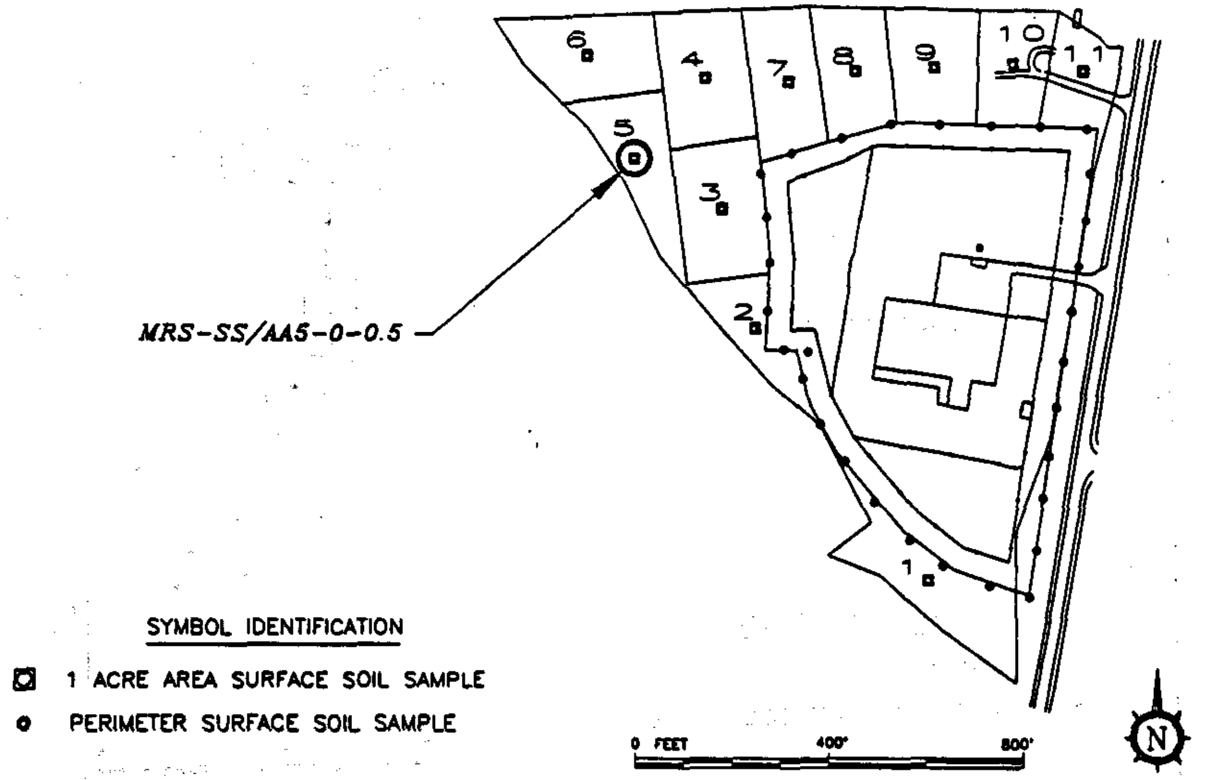
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *5* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA5-0-0.5	*11:10*	*0-0.5*	*silty clay loam*

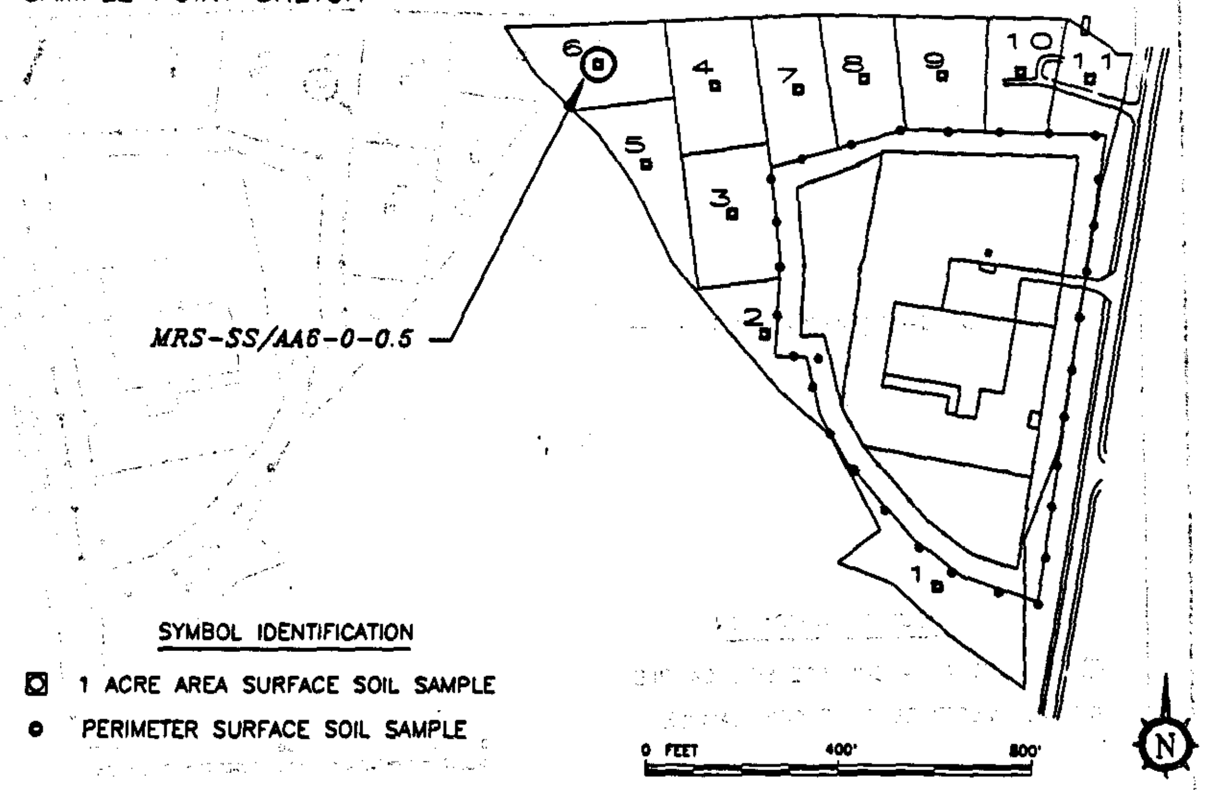
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *6* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area outside fence*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA6-0-0.5	*13:25*	*0-0.5*	*silty clay loam*

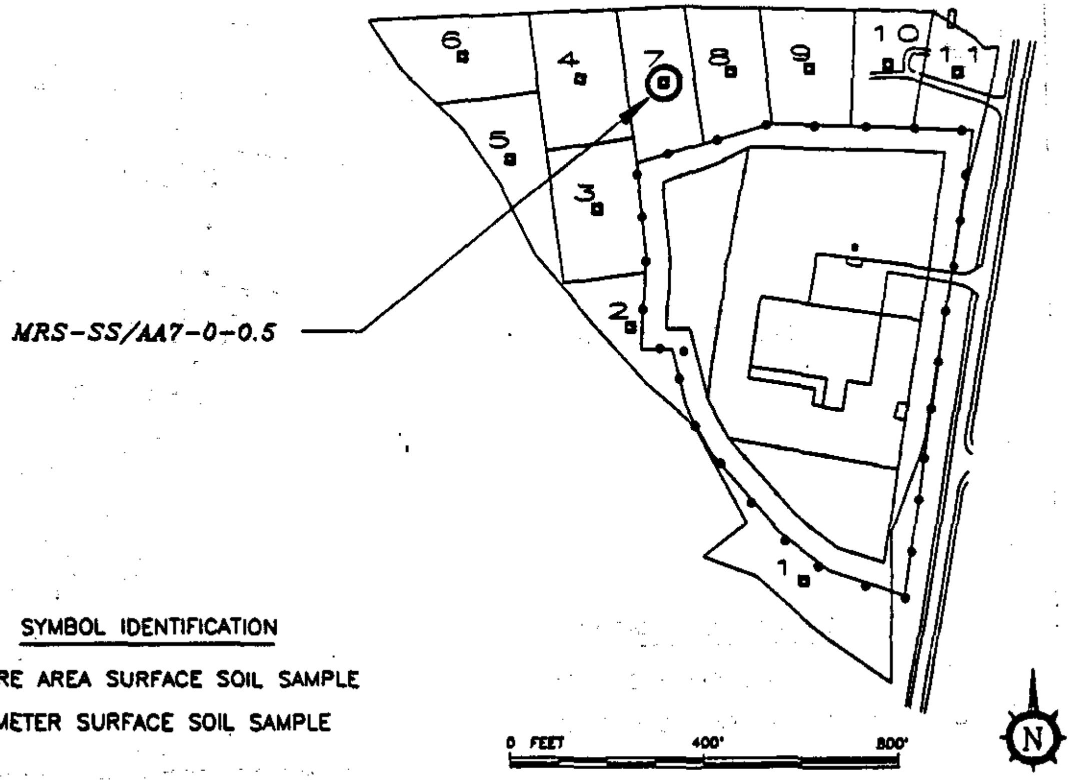
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *7* OF *41*

SAMPLE POINT DESCRIPTION: *Edge of wooded area outside fence*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

- ▣ 1 ACRE AREA SURFACE SOIL SAMPLE
- • PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA7-0-0.5	*11:45*	*0-0.5*	*clay loam*

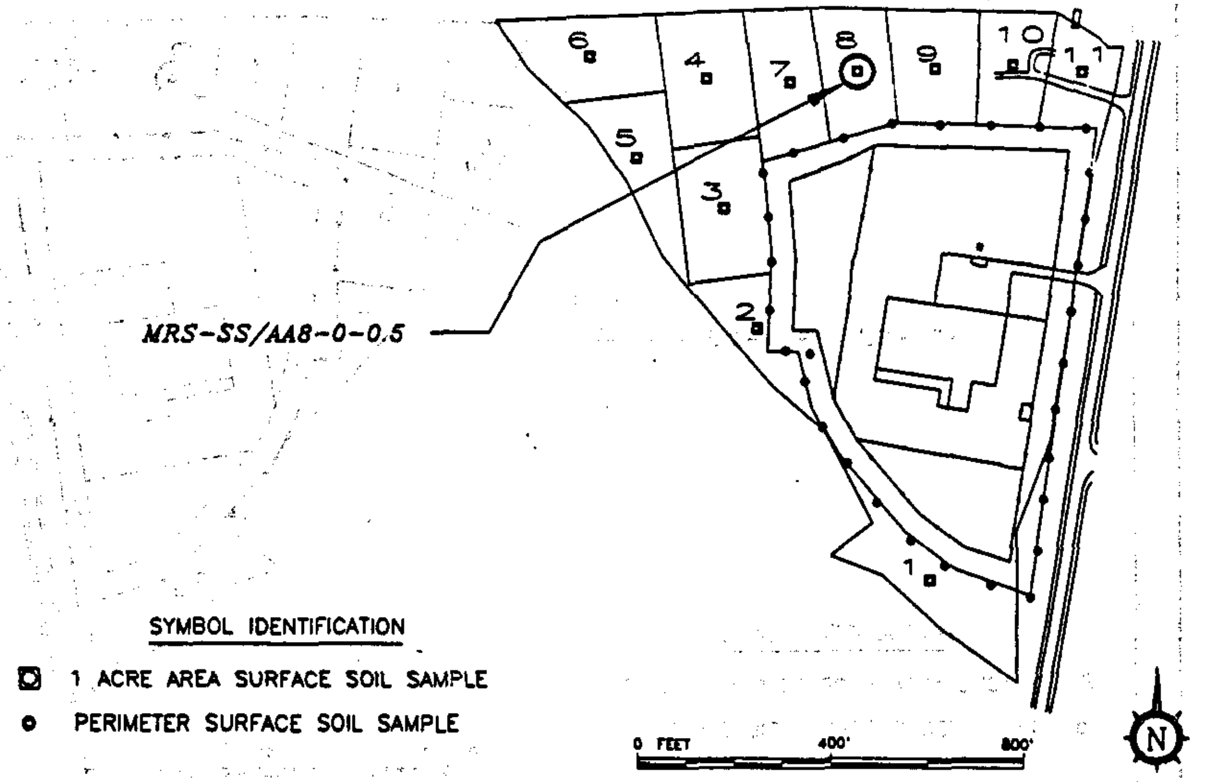
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *8* OF *41*

SAMPLE POINT DESCRIPTION: *Edge of wooded area outside fence at bottom of large soil pile*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA8-0-0.5	*13:51*	*0-0.5*	*clay, some silt*

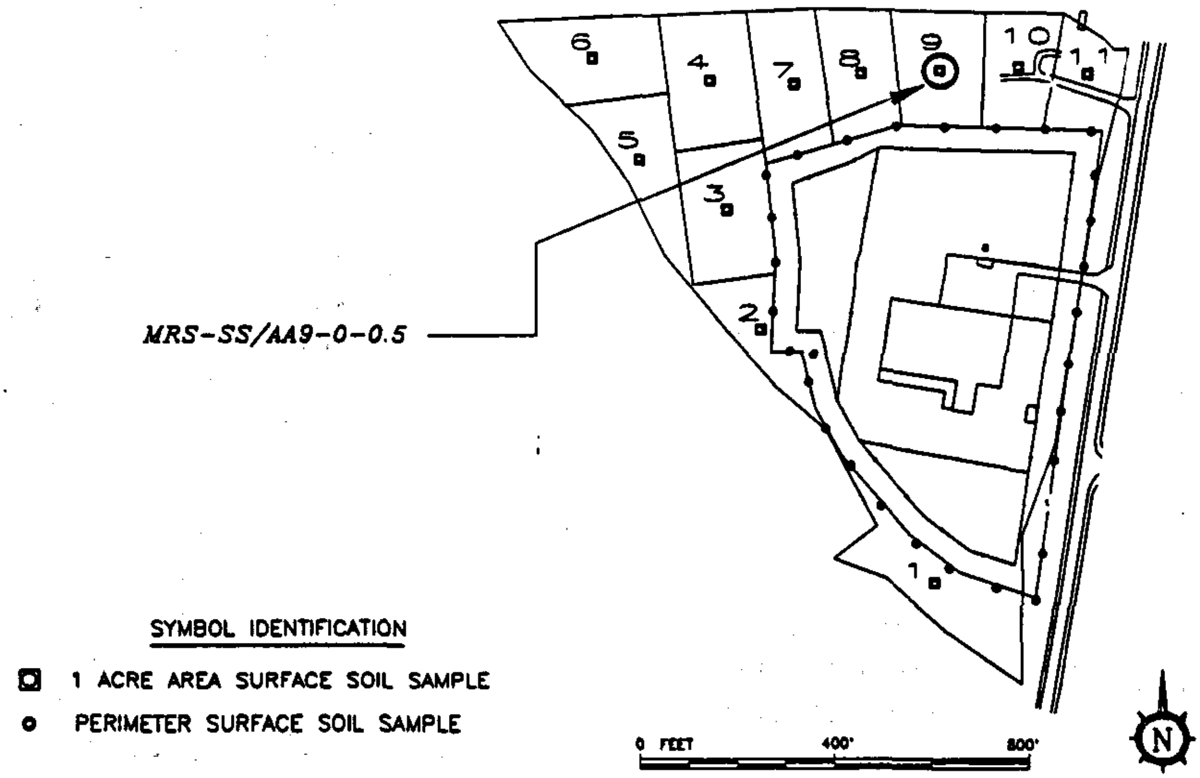
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *9* OF *41*

SAMPLE POINT DESCRIPTION: *Edge of wooded area outside fence at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA9-0-0.5	*14:05*	*0-0.5*	*clay, some silt*

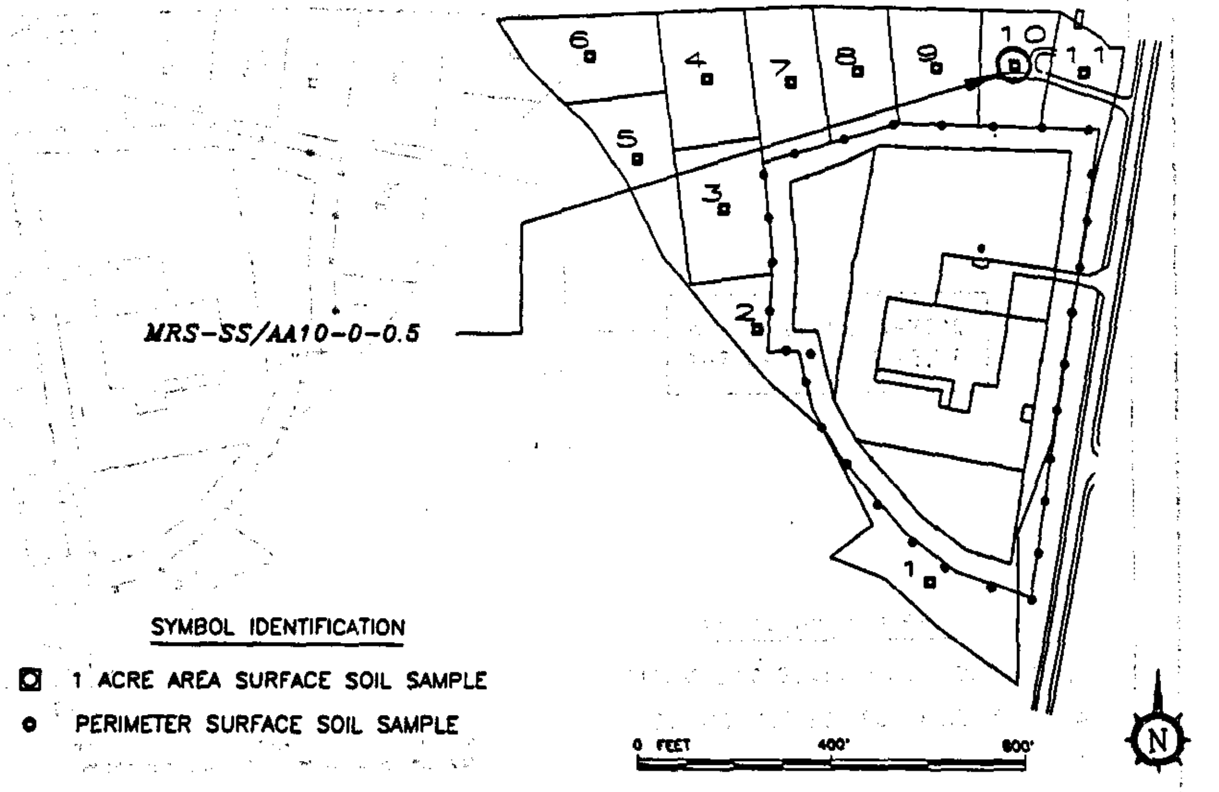
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *10* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared field area outside fence at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA10-0-0.5	*14:32*	*0-0.5*	*silty clay loam*

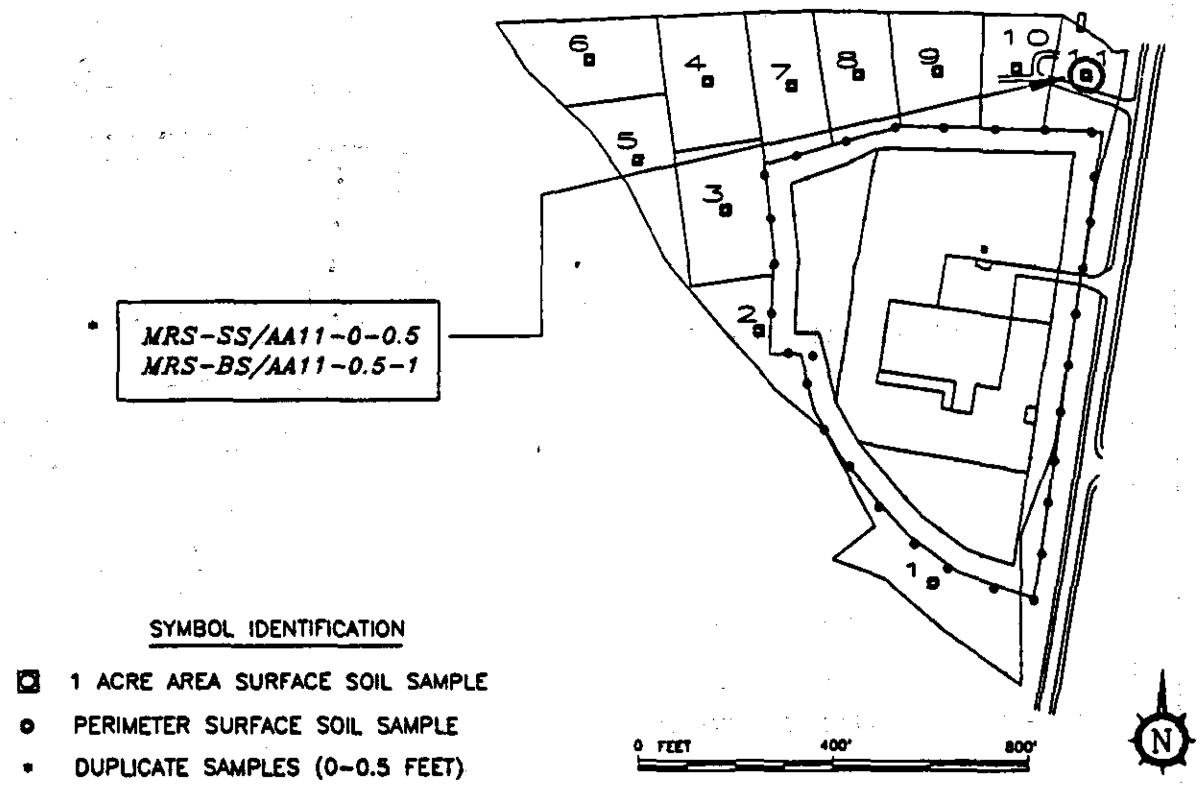
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *1-Acre Area*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-11-91*	LOG PAGE NUMBER *11* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared field area outside fence at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *2*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/AA10-0-0.5	*14:55*	*0-0.5*	*silt loam*
MRS-BS/AA11-0.5-1		*0-0.5*	*silt loam - blind duplicate*
			of MRS-SS/AA11-0-0.5

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

APPENDIX E

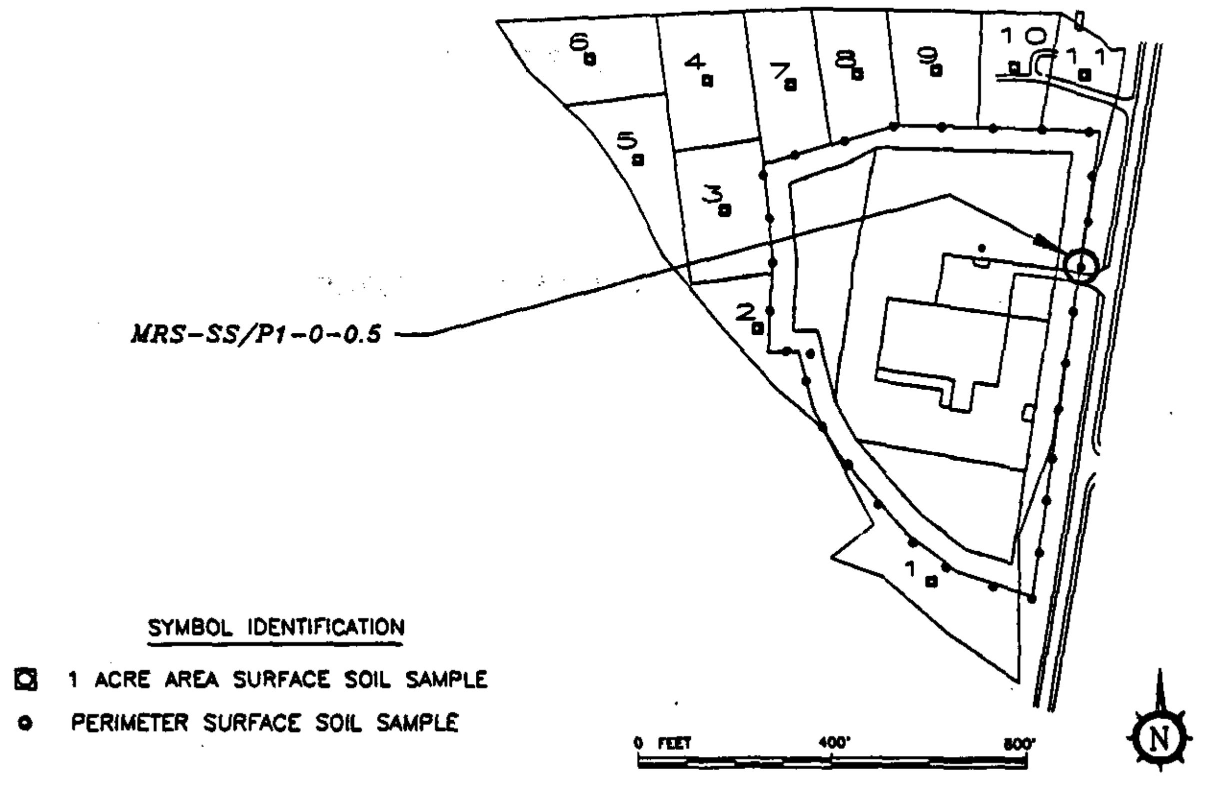
PERIMETER SAMPLE LOGS

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *12* OF *41*

SAMPLE POINT DESCRIPTION: *Grass field between fence and State Route 551, next to entrance driveway*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P1-0-0.5	*11:25*	*0 - 0.5*	*silt loam*

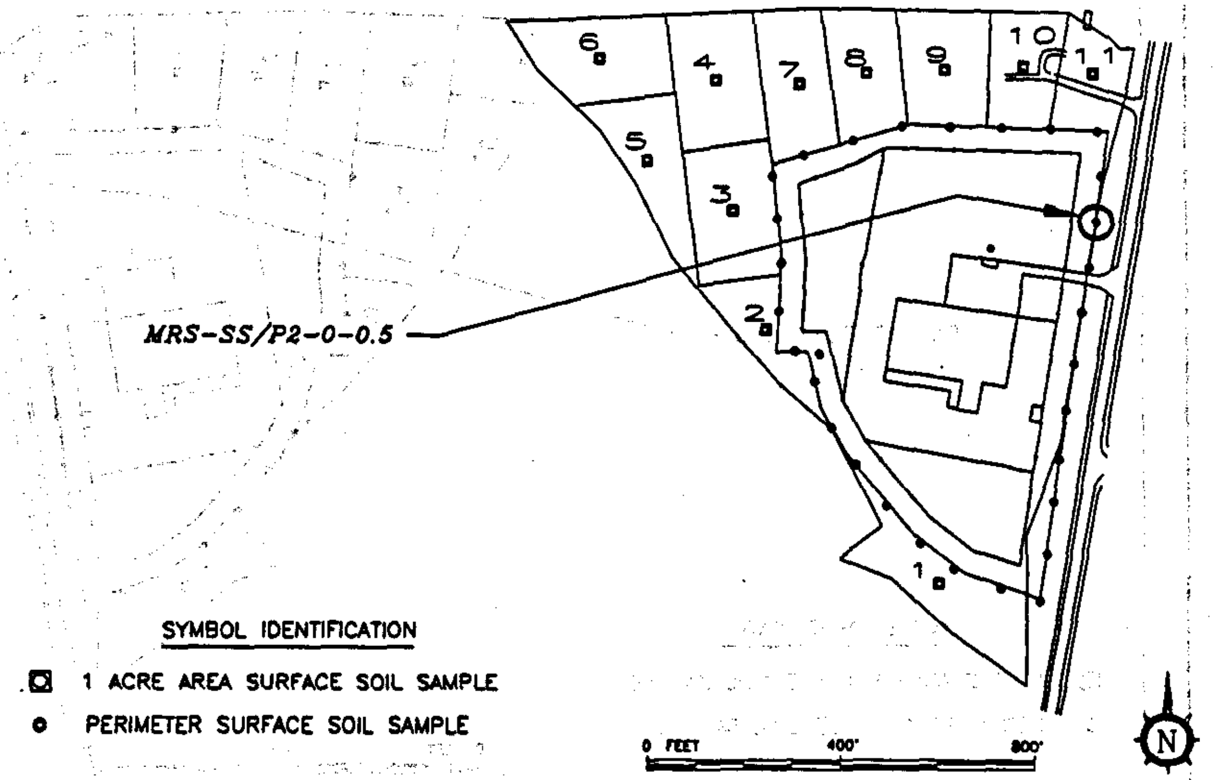
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *13* OF *41*

SAMPLE POINT DESCRIPTION: *Grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P2-0-0.5	*11:33*	*0 - 0.5*	*silty clay loam*

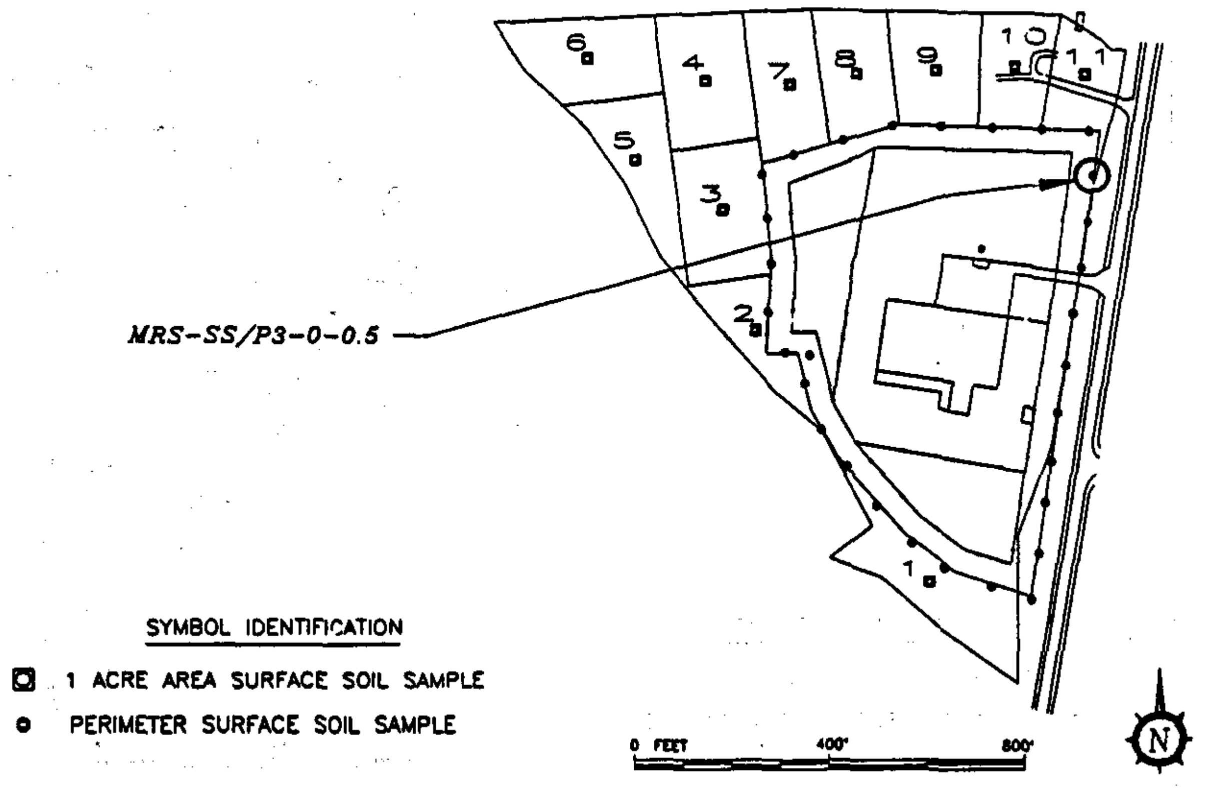
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *14* OF *41*

SAMPLE POINT DESCRIPTION: *Grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P3-0-0.5	*11:42*	*0 - 0.5*	*silty clay loam*

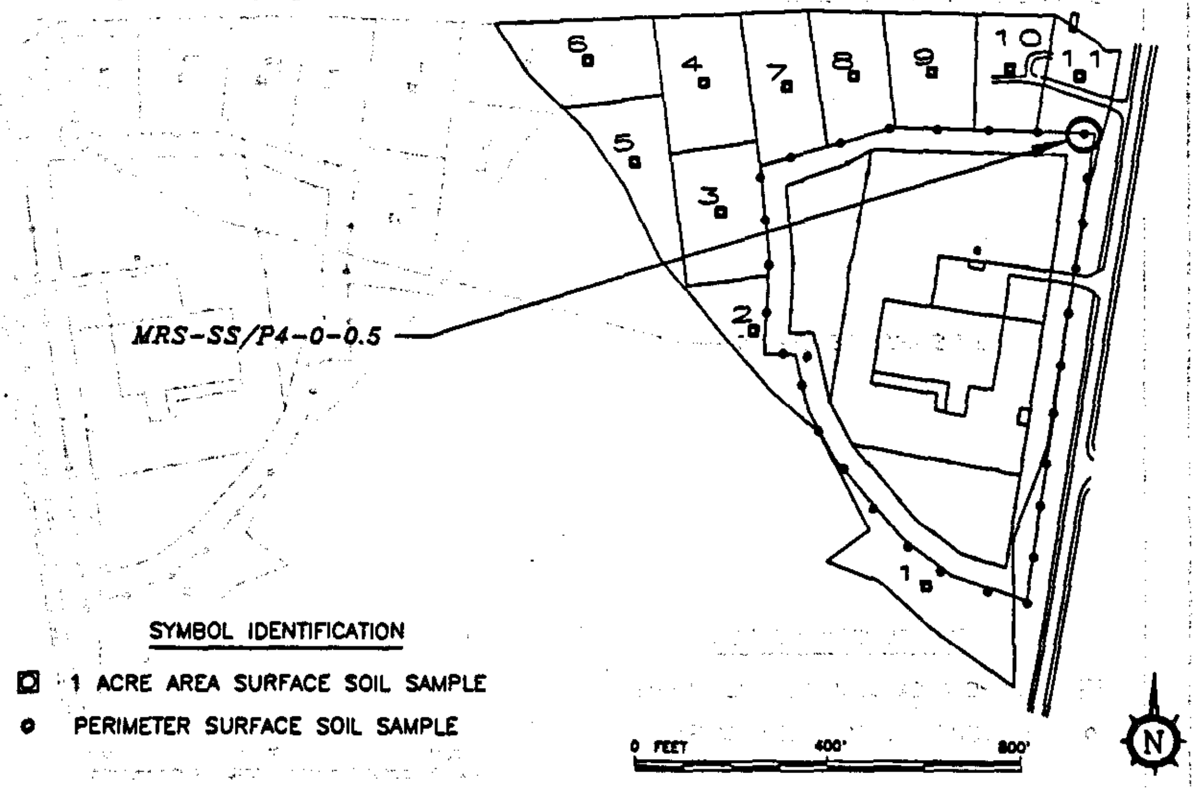
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER: *15* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P4-0-0.5	*11:47*	*0 - 0.5*	*silty clay loam*

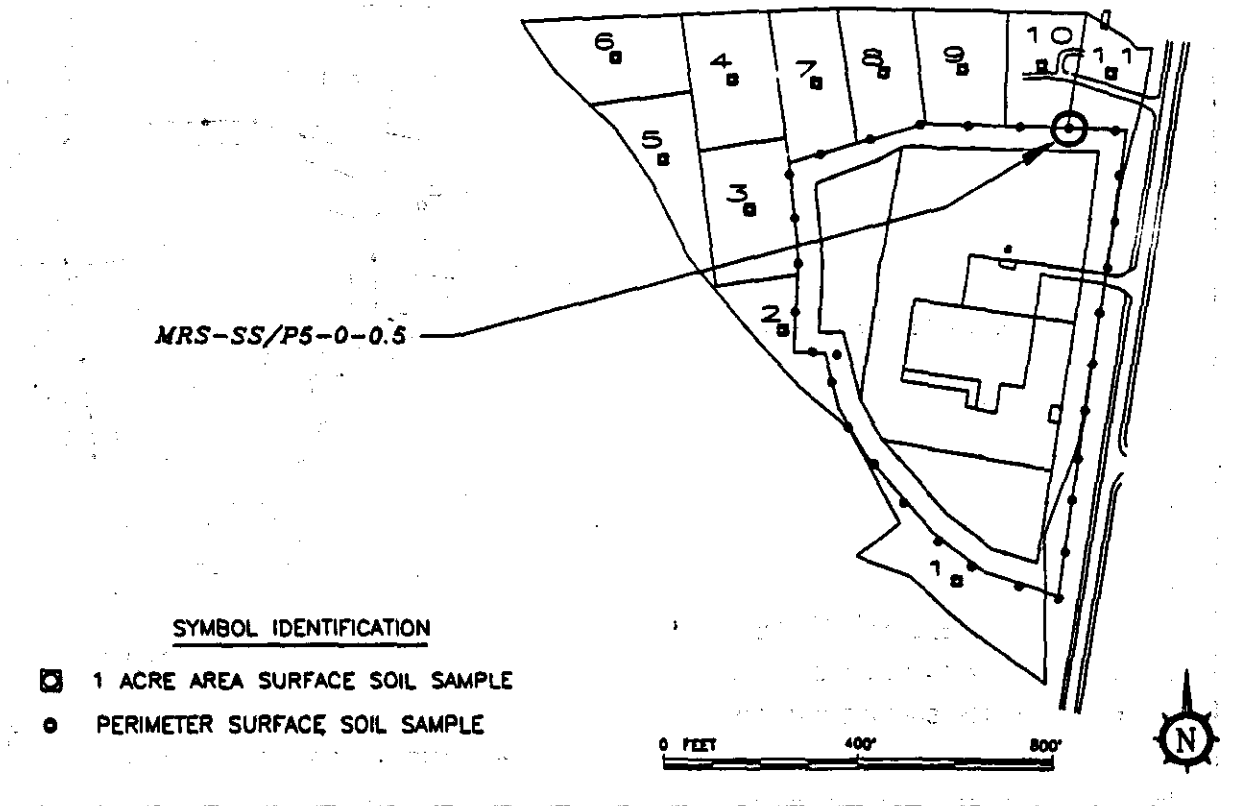
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: 9105-449	PROJECT: METCOA RESTART SITE
SAMPLE IDENTIFICATION: Perimeter	COLLECTOR'S NAME: R. Heath
DATE: 12-12-91	LOG PAGE NUMBER 16 OF 41

SAMPLE POINT DESCRIPTION: Cleared grass field at northern end of site

SAMPLE POINT SKETCH



SAMPLE ANALYSES: Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM

EQUIPMENT USED: STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS

NO. OF SAMPLES COLLECTED: 1	CONTAINER SIZE: 16 OZ. WIDE MOUTH

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P5-0-0.5	11:54	0 - 0.5	sandy silt loam

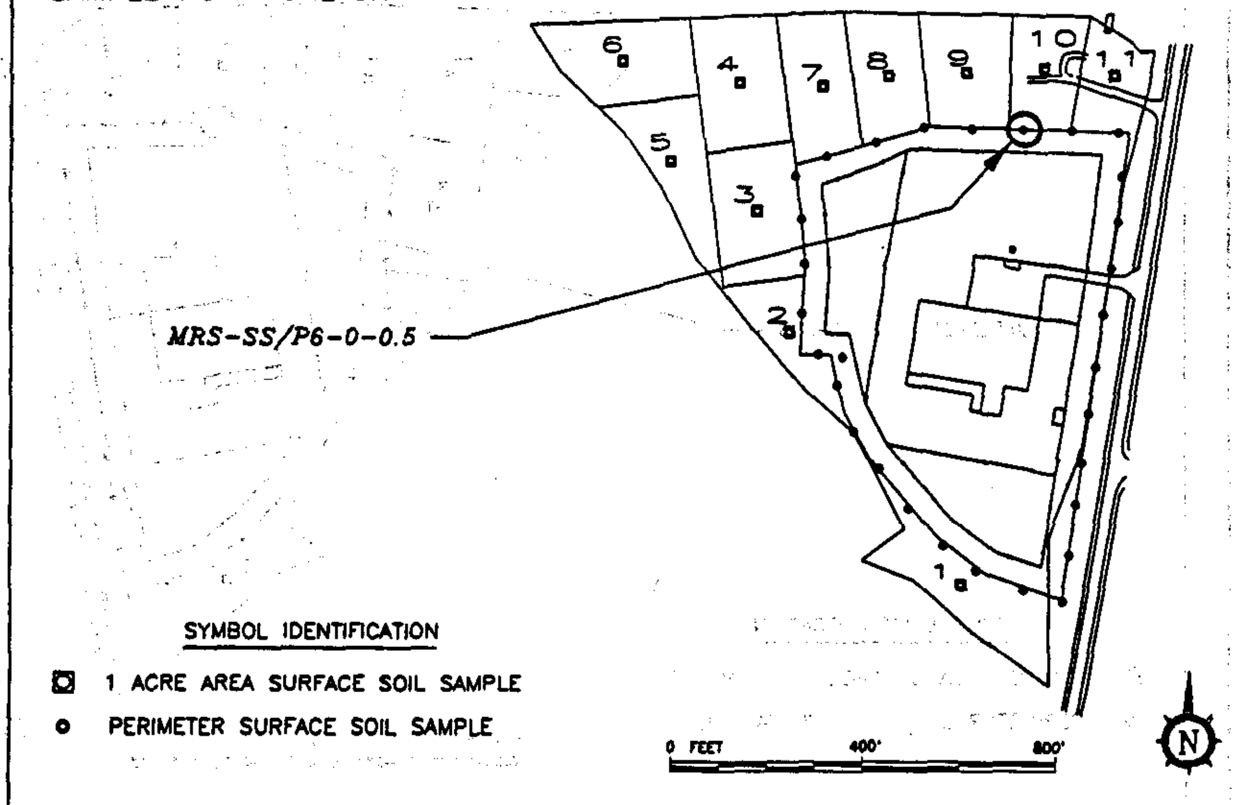
ANALYTICAL SERVICE: CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *17* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P6-0-0.5	*12:02*	*0 - 0.5*	*silt clay loam*

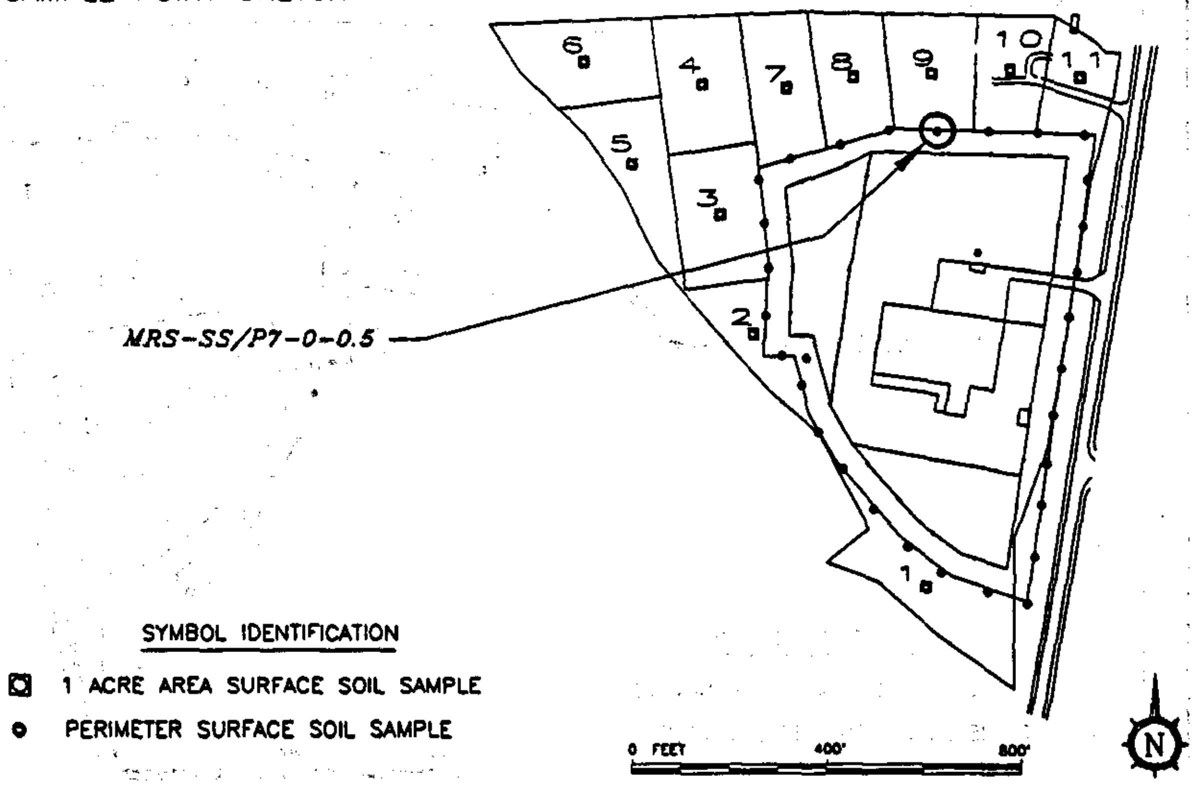
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *18* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P7-0-0.5	*12:55*	*0 - 0.5*	*silt clay loam*

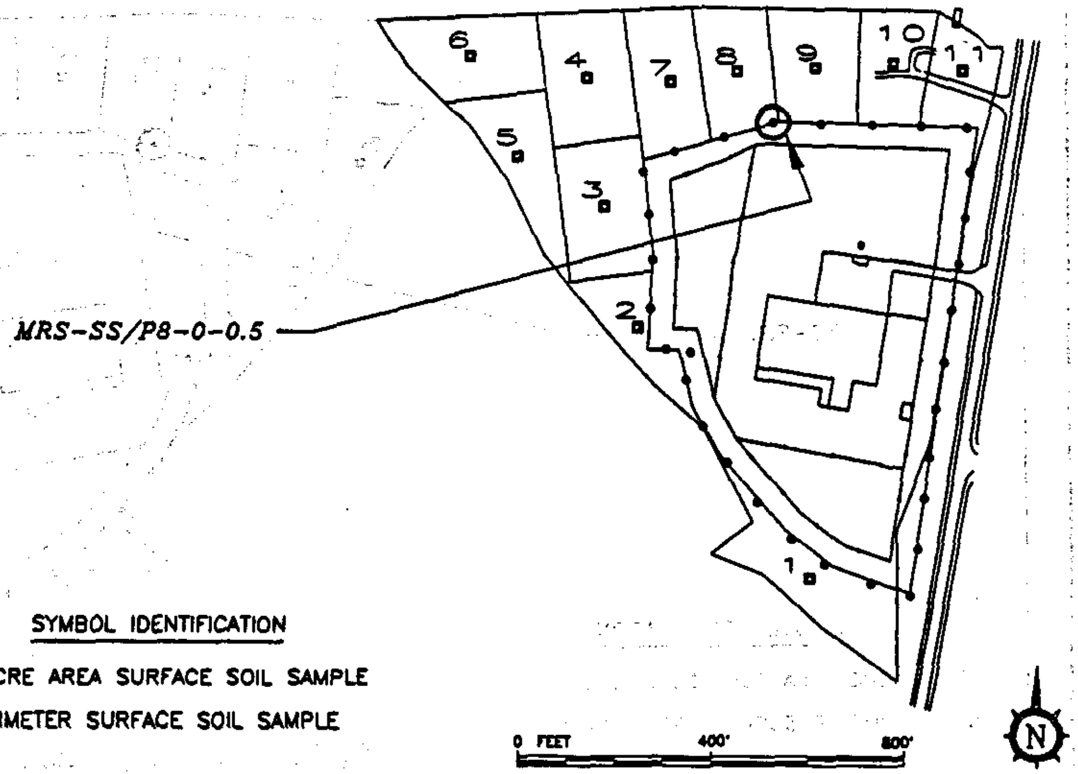
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *19* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field at northern end of sit*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

- ▣ 1 ACRE AREA SURFACE SOIL SAMPLE
- ● PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P8-0-0.5	*13:00*	*0 – 0.5*	*silty clay with some gravel*

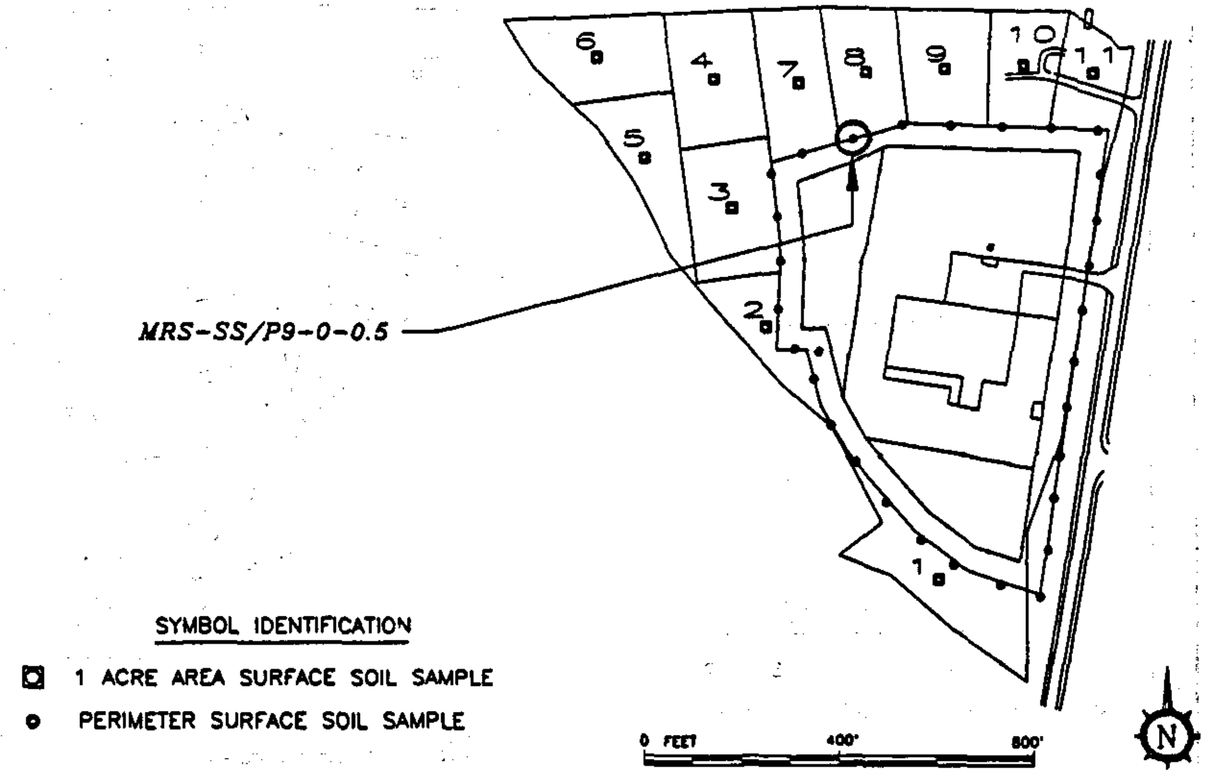
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *20* OF *41*

SAMPLE POINT DESCRIPTION: *Top of soil pile at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P9-0-0.5	*13:05*	*0 - 0.5*	*silt clay loam*

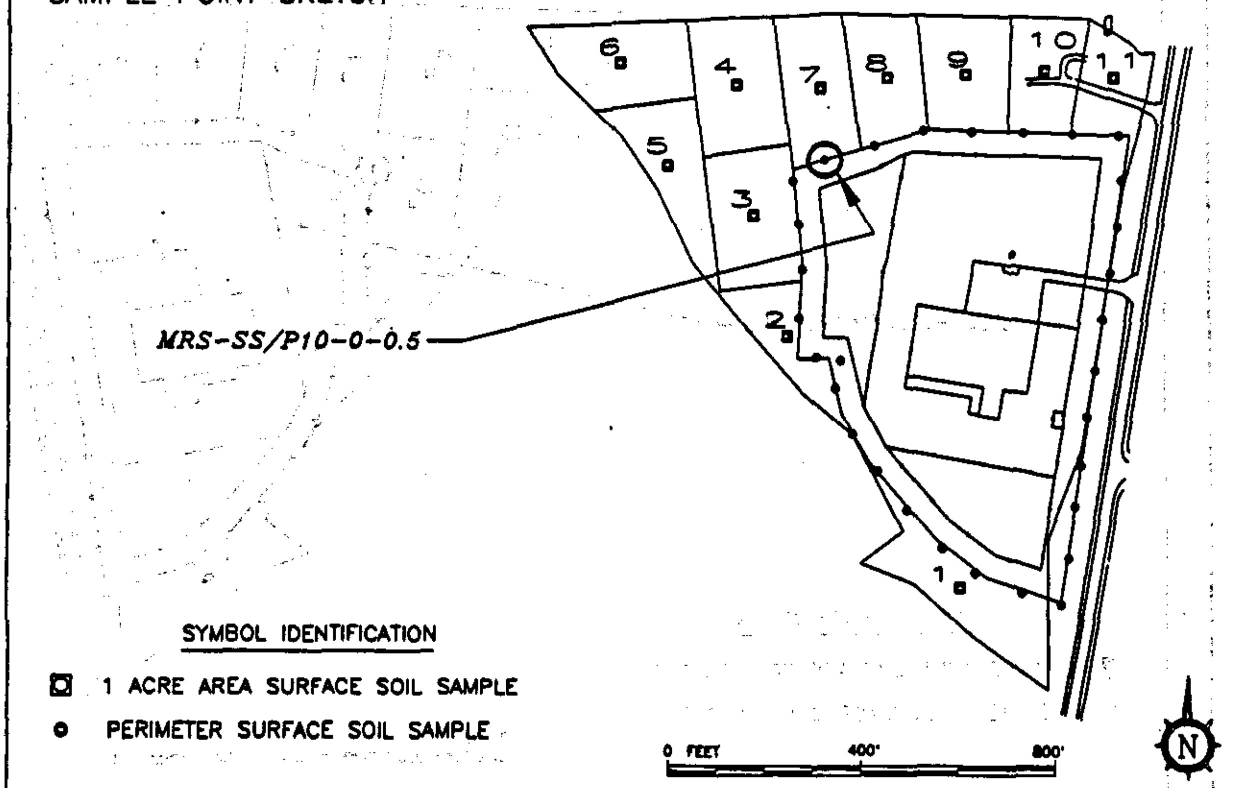
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *21* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared brush and field area at northern end of site*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P10-0-0.5	*13:10*	*0 - 0.5*	*silt clay loam*

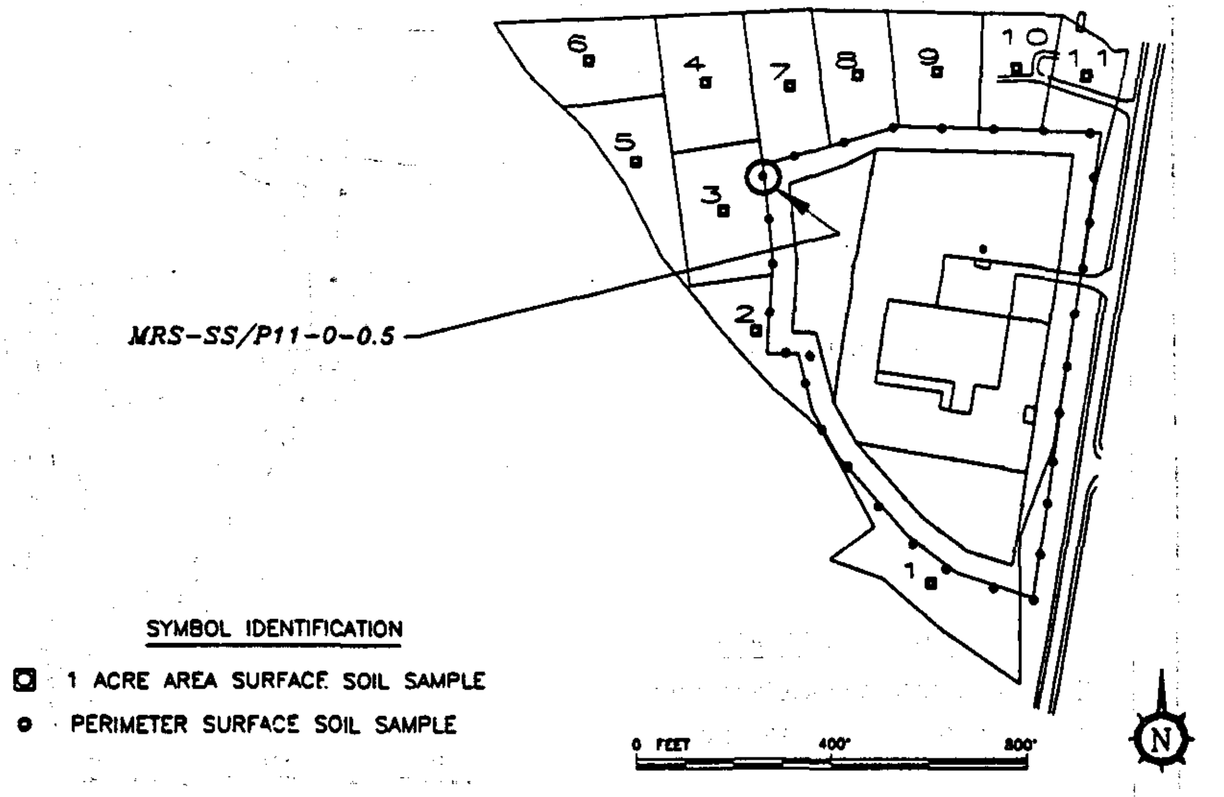
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *22* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUCER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P11-0-0.5	*13:15*	*0 - 0.5*	*clay*

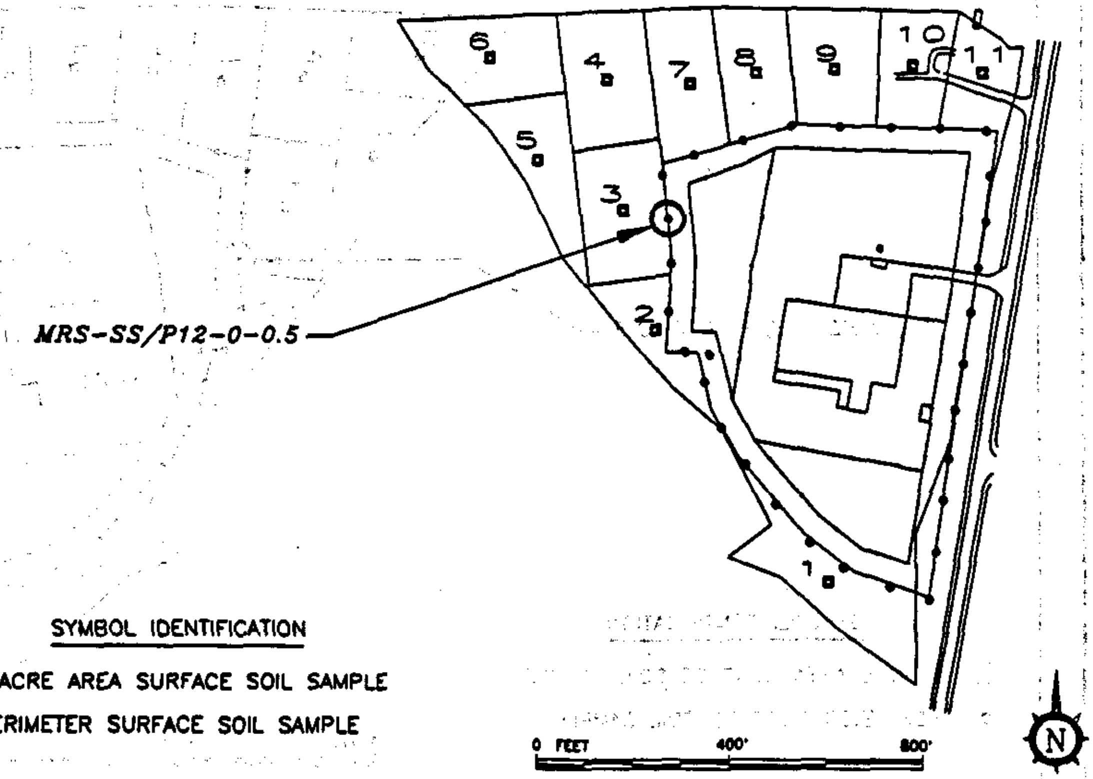
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *23* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

▣ 1 ACRE AREA SURFACE SOIL SAMPLE

● PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P12-0-0.5	*13:20*	*0 - 0.5*	*silt clay loam*

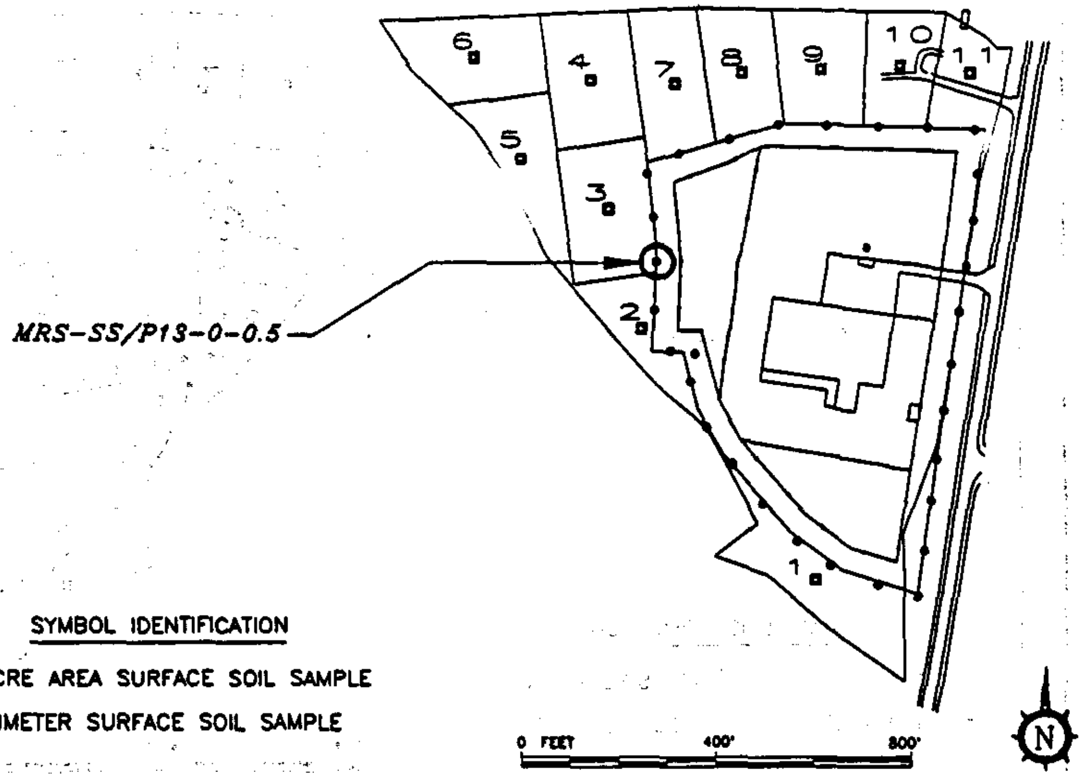
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *24* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

- ▣ 1 ACRE AREA SURFACE SOIL SAMPLE
- ● PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P13-0-0.5	*14:10*	*0 - 0.5*	*clay loam*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

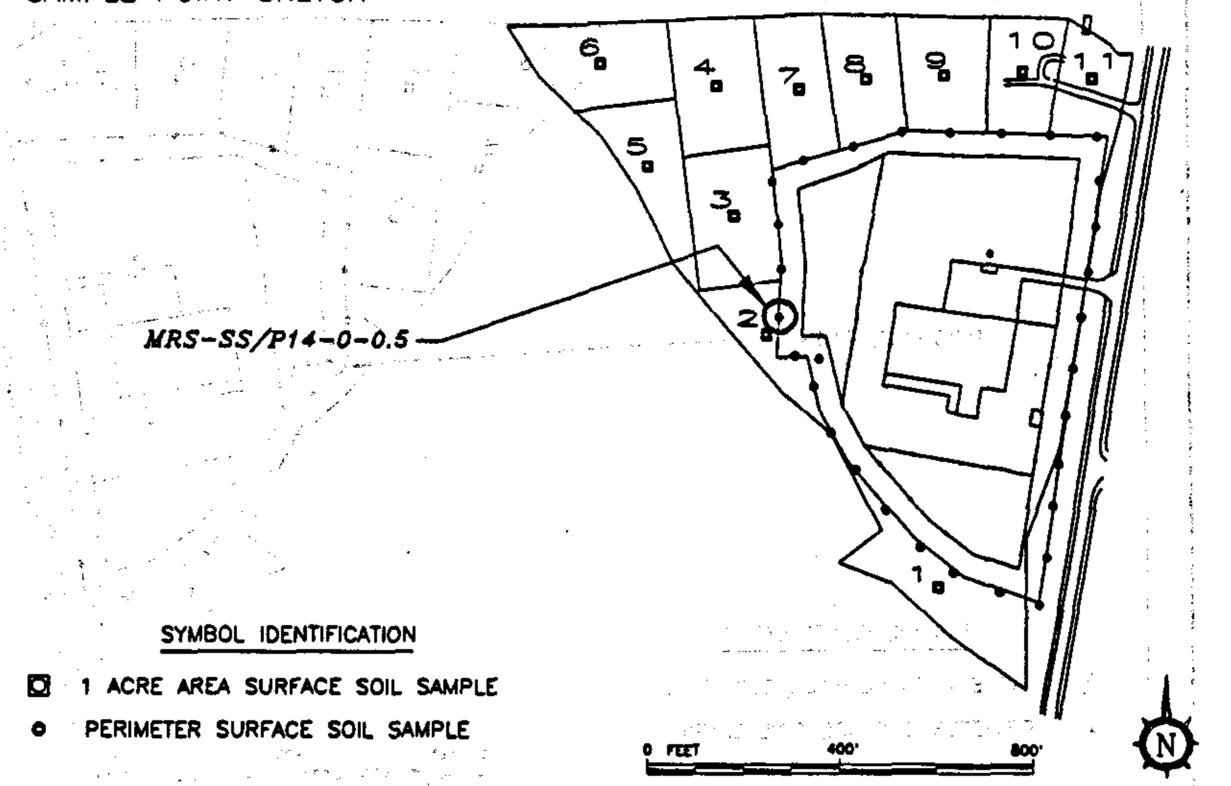
1

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *25* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P14-0-0.5	*14:15*	*0 - 0.5*	*sandy silt loam*

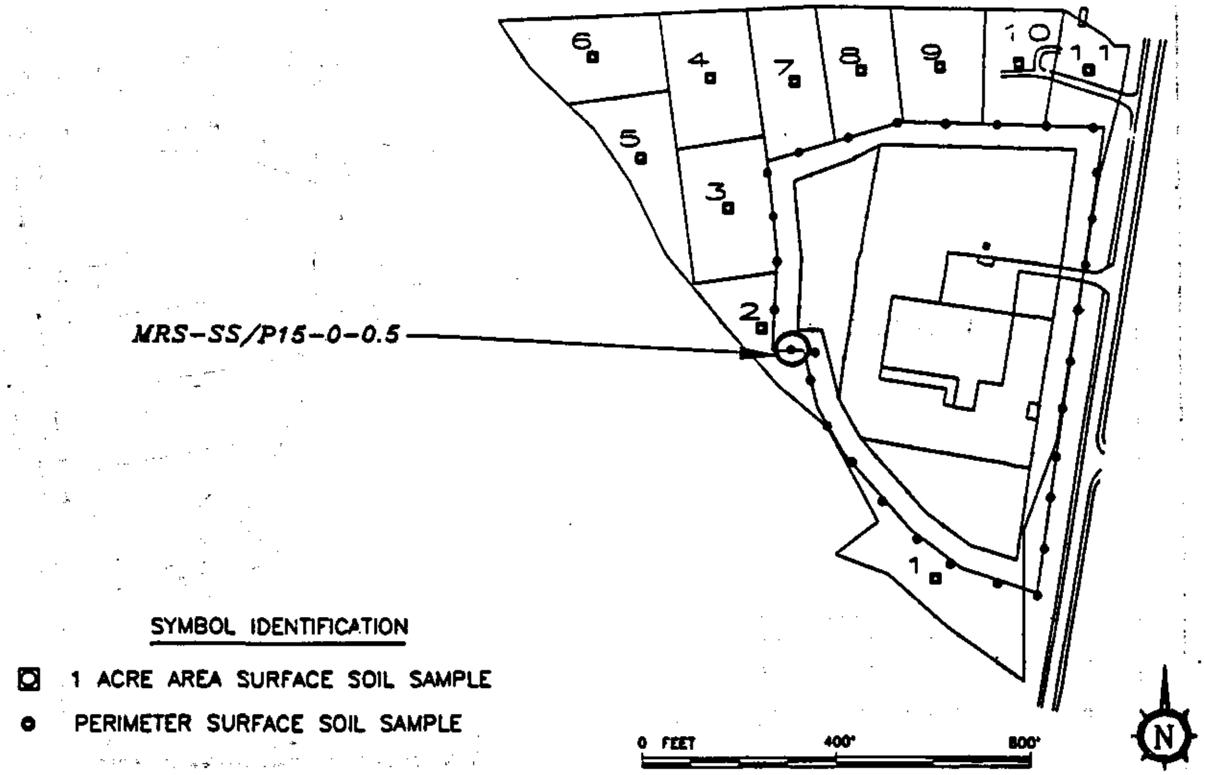
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *26* OF *41*

SAMPLE POINT DESCRIPTION: *East bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P15-0-0.5	*14:19*	*0 - 0.5*	*sand*

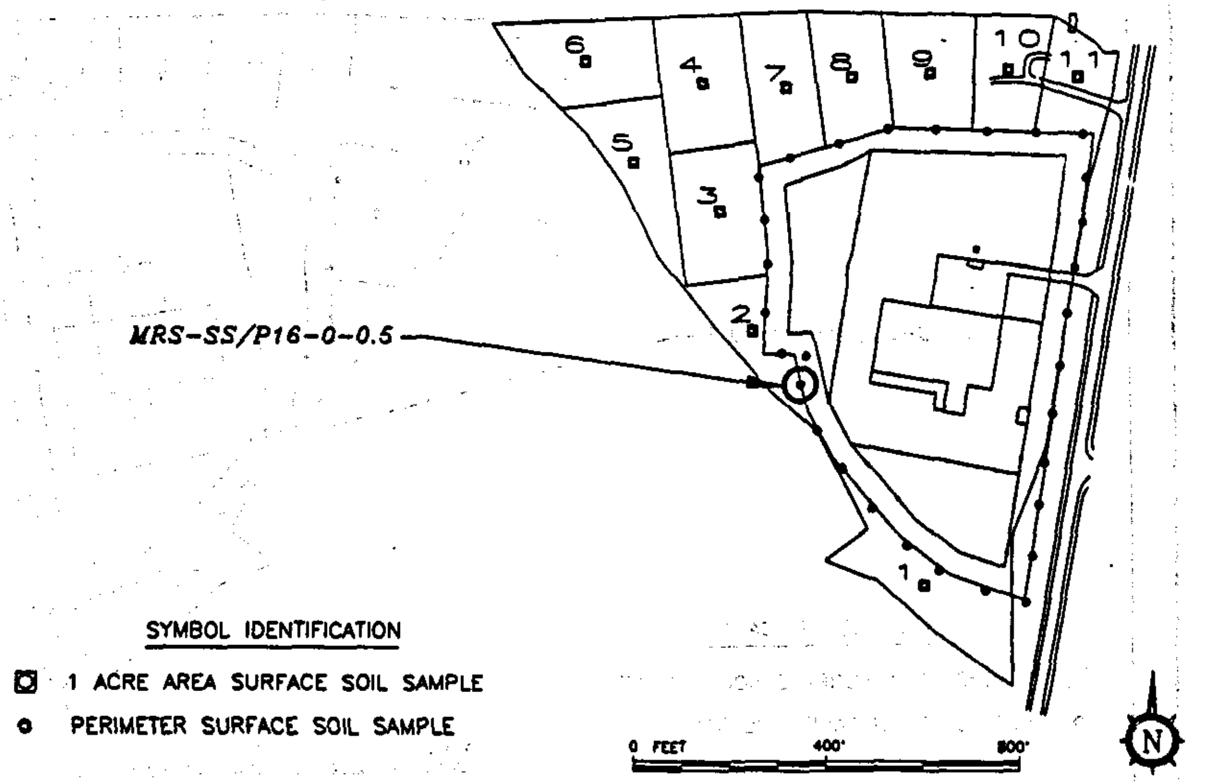
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *27* OF *41*

SAMPLE POINT DESCRIPTION: *Near east bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P16-0-0.5	*14:24*	*0 - 0.5*	*sand*

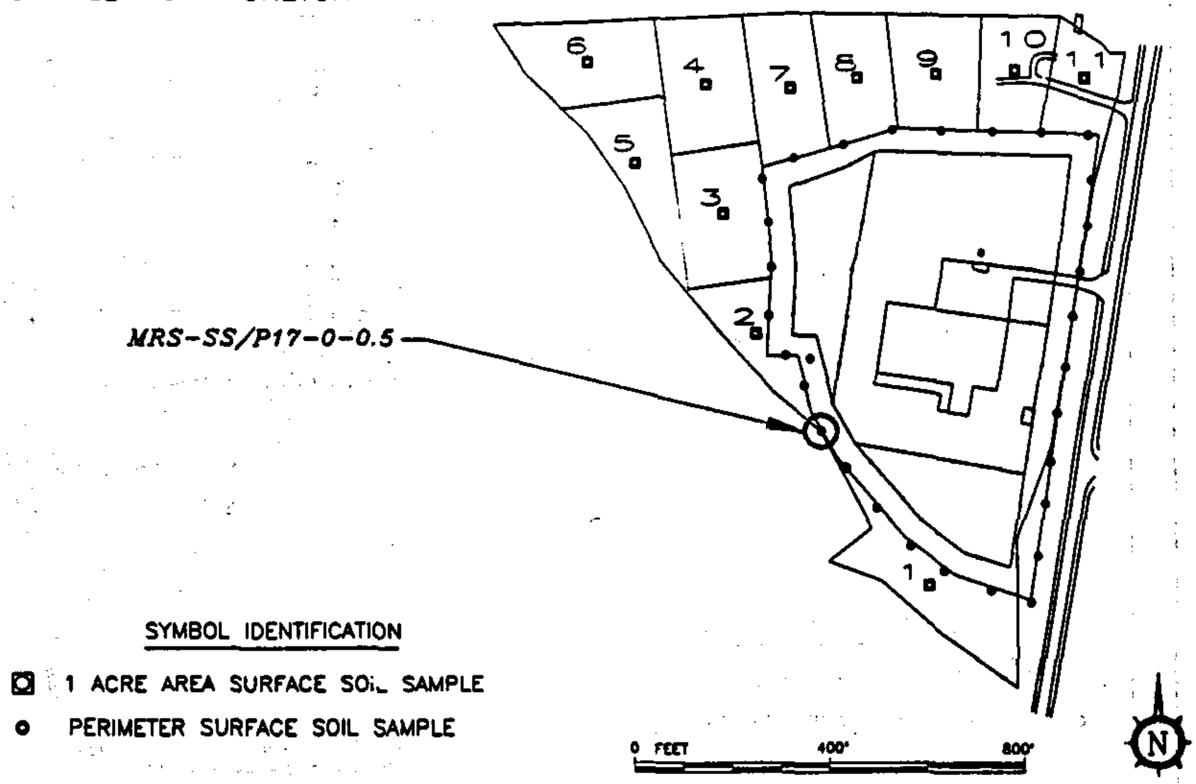
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *28* OF *41*

SAMPLE POINT DESCRIPTION: *Near east bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P17-0-0.5	*14:30*	*0 - 0.5*	*silty clay loam*

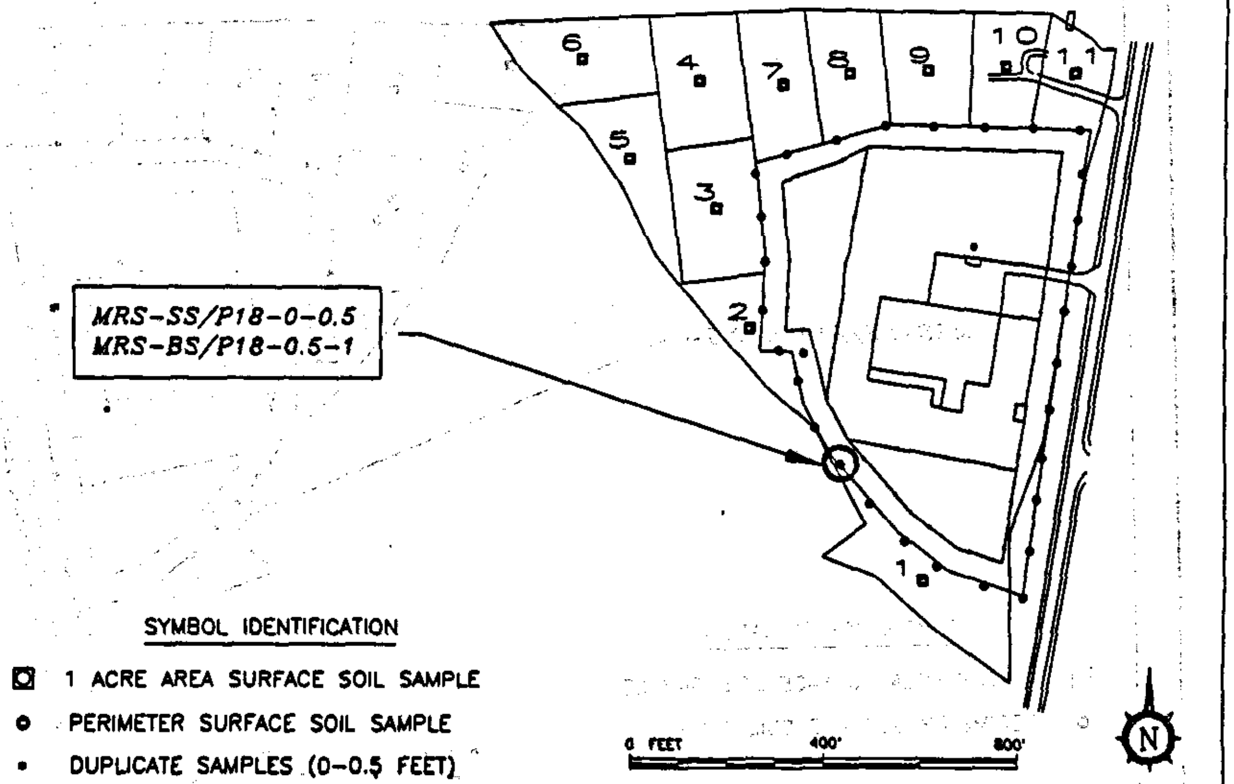
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *29* OF *41*

SAMPLE POINT DESCRIPTION: *West bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *2*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P18-0-0.5	*15:09*	*0 - 0.5*	*sand and gravel*
MRS-BS/P18-0.5-1		*0 - 0.5*	*blind duplicate of MRS-SS/P18-0-0.5*

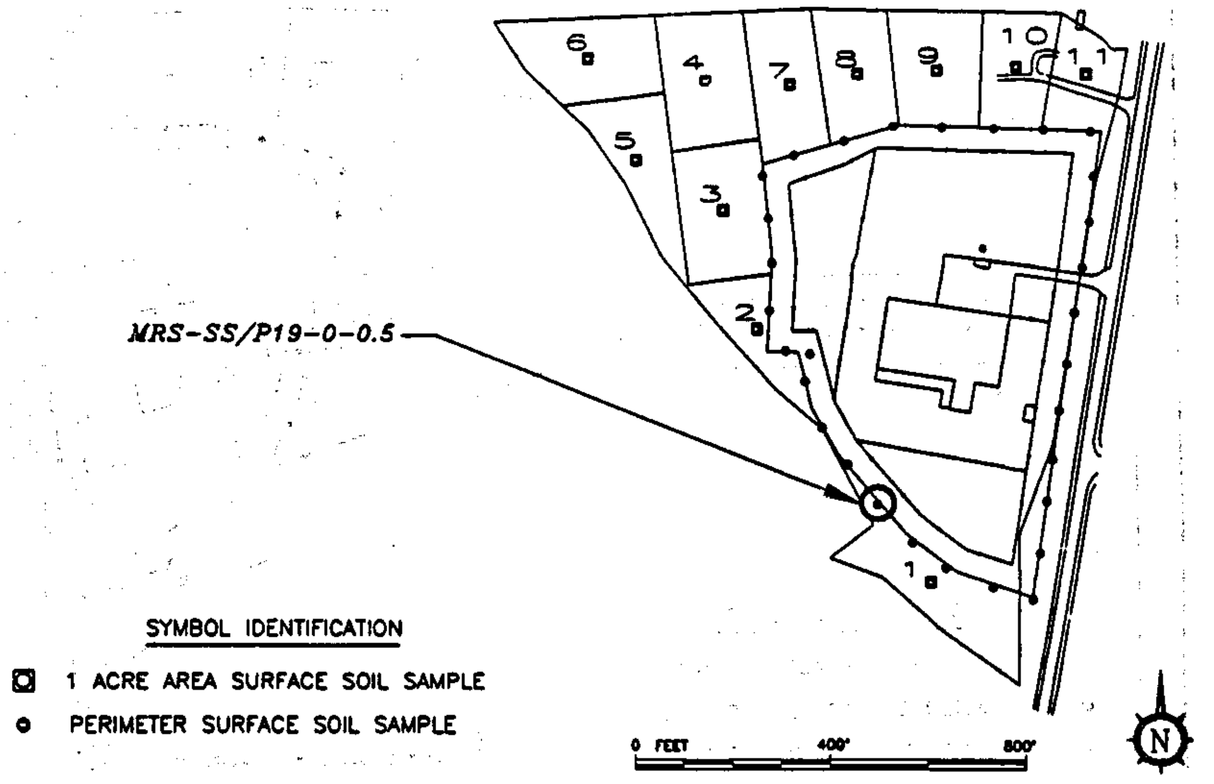
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *30* OF *41*

SAMPLE POINT DESCRIPTION: *East bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P19-0-0.5	*15:12*	*0 - 0.5*	*silty sand*

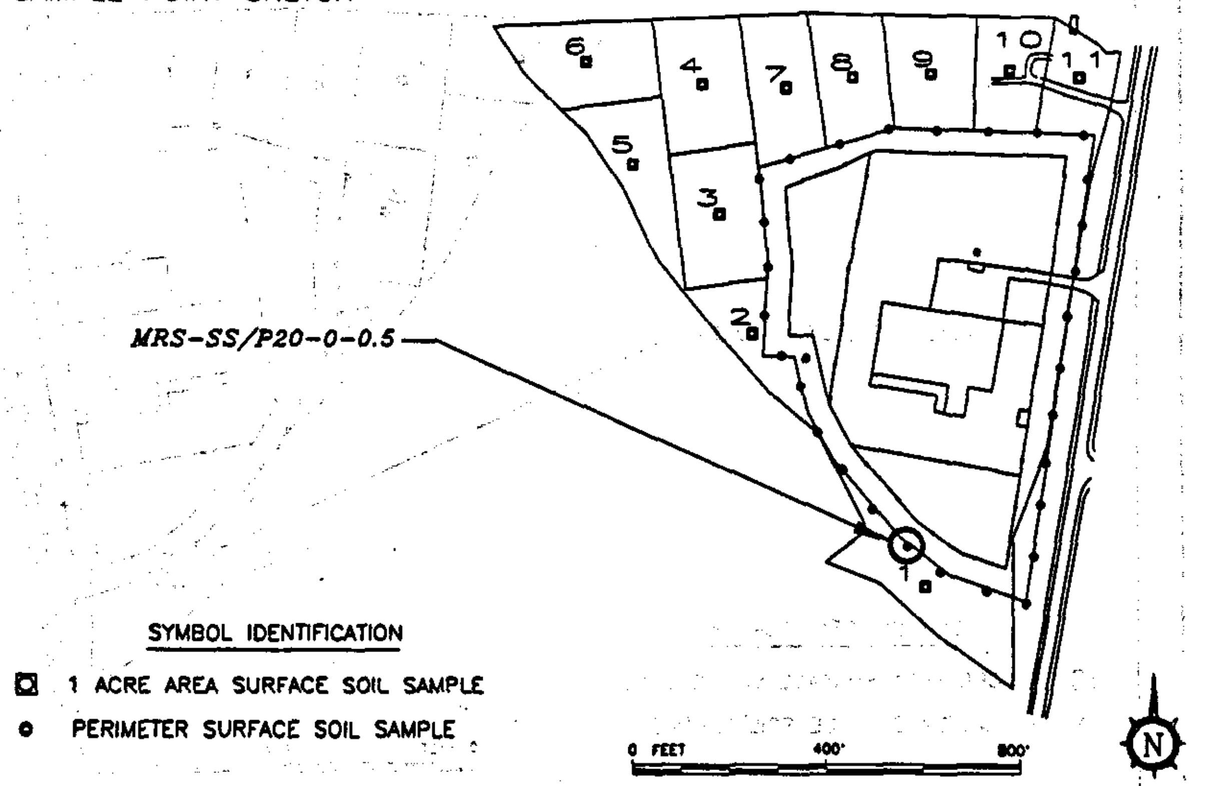
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *31* OF *41*

SAMPLE POINT DESCRIPTION: *Near east bank of Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P20-0-0.5	*15:14*	*0 - 0.5*	*sandy silt loam*

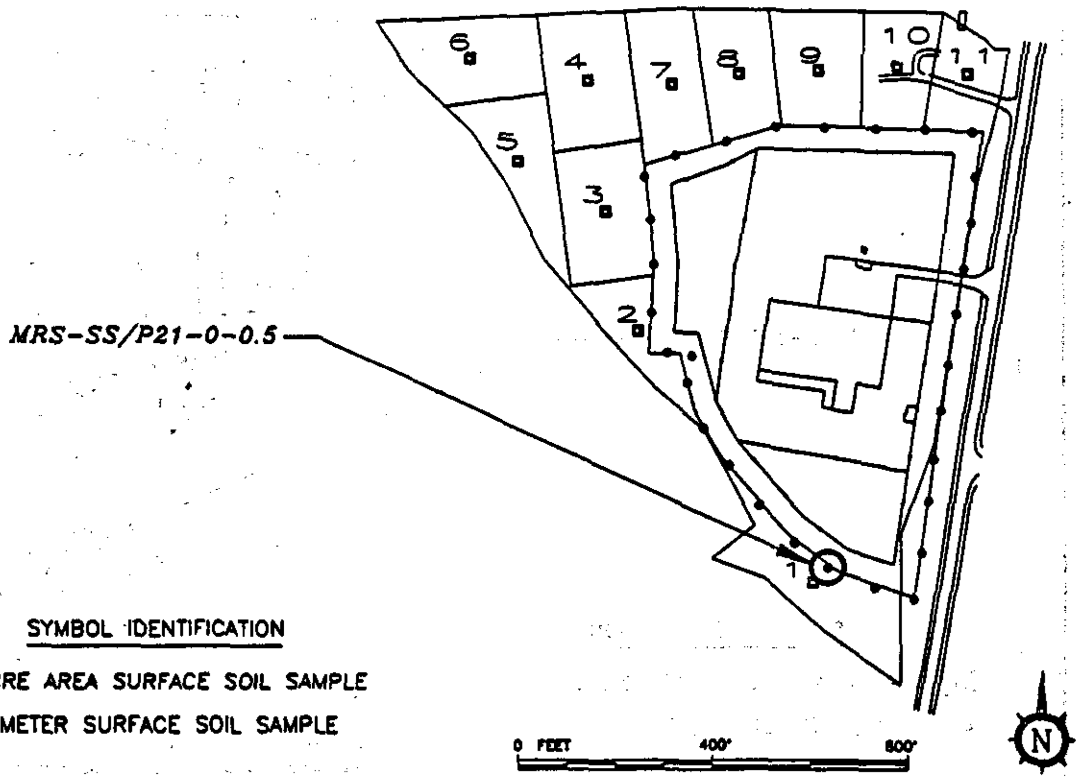
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *32* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area, near Buchanan Run*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P21-0-0.5	*15:20*	*0 - 0.5*	*silt loam*

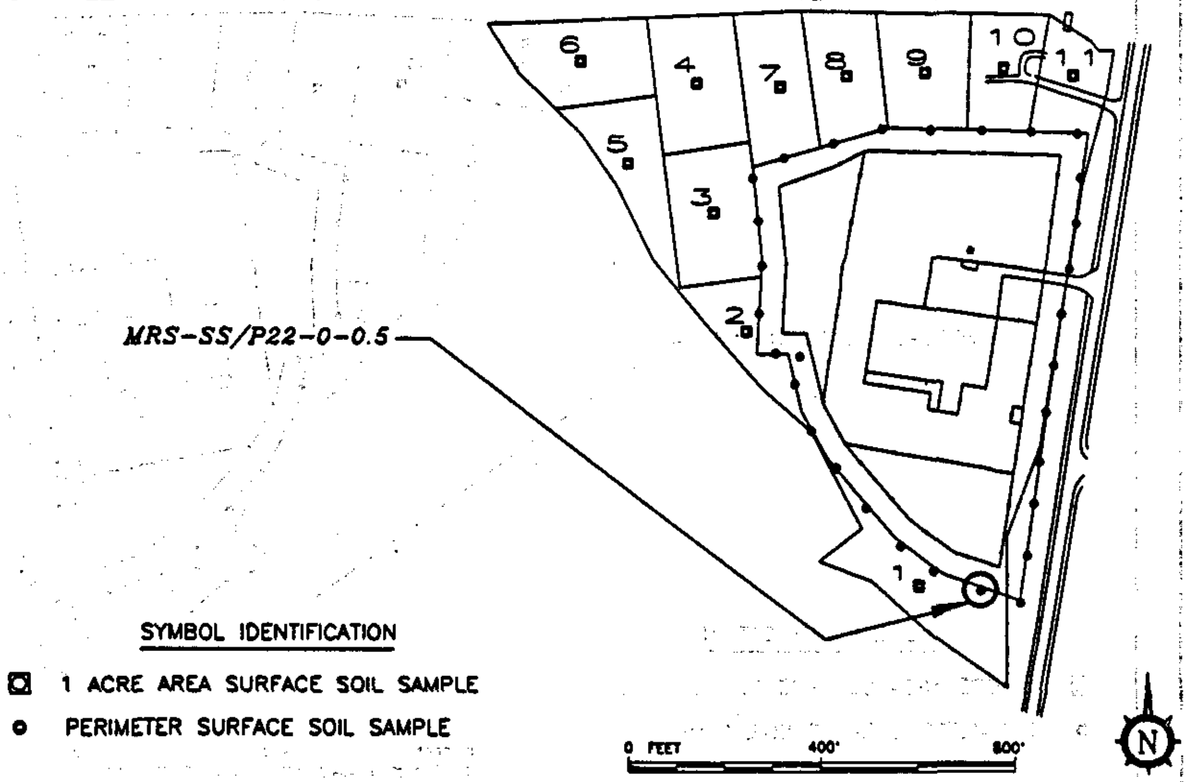
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *33* OF *41*

SAMPLE POINT DESCRIPTION: *Wooded area*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P22-0-0.5	*15:26*	*0 - 0.5*	*silt loam*

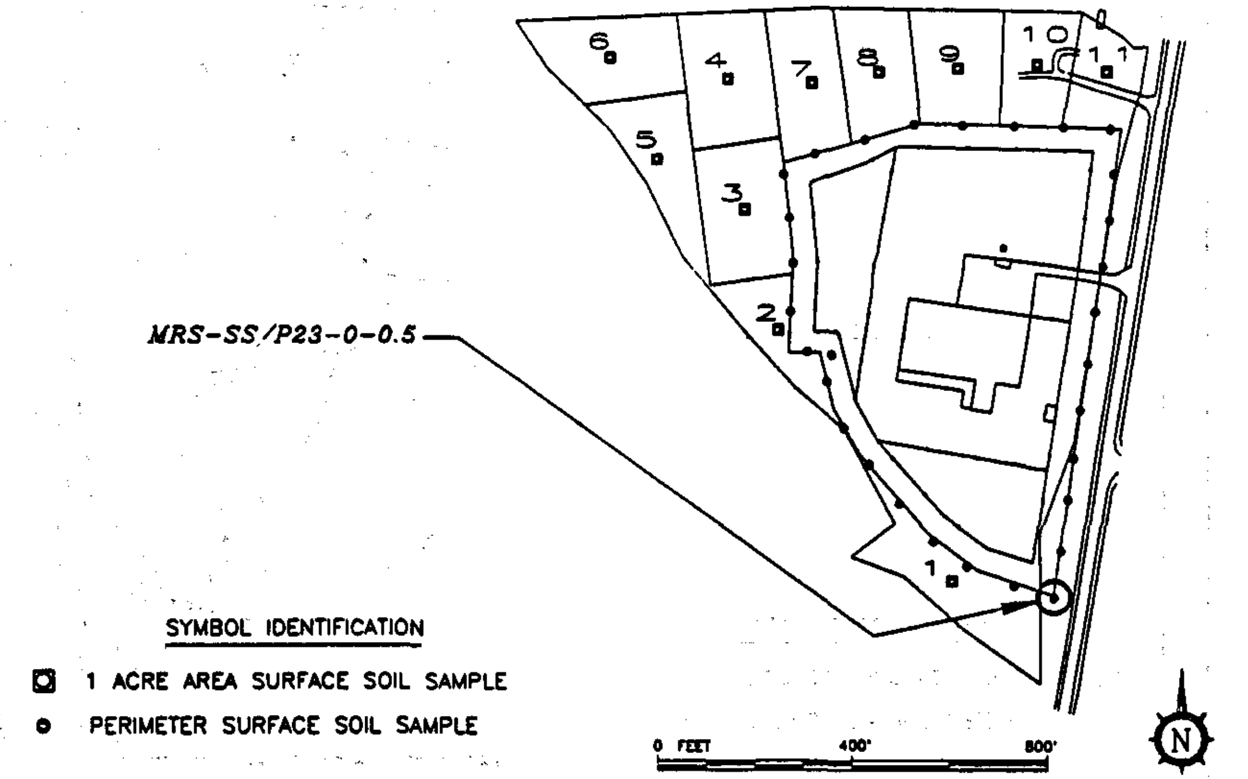
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *34* OF *41*

SAMPLE POINT DESCRIPTION: *Brush and thickett covered area at edge of wooded area*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P23-0-0.5	*16:16*	*0 - 0.5*	*silt clay loam*

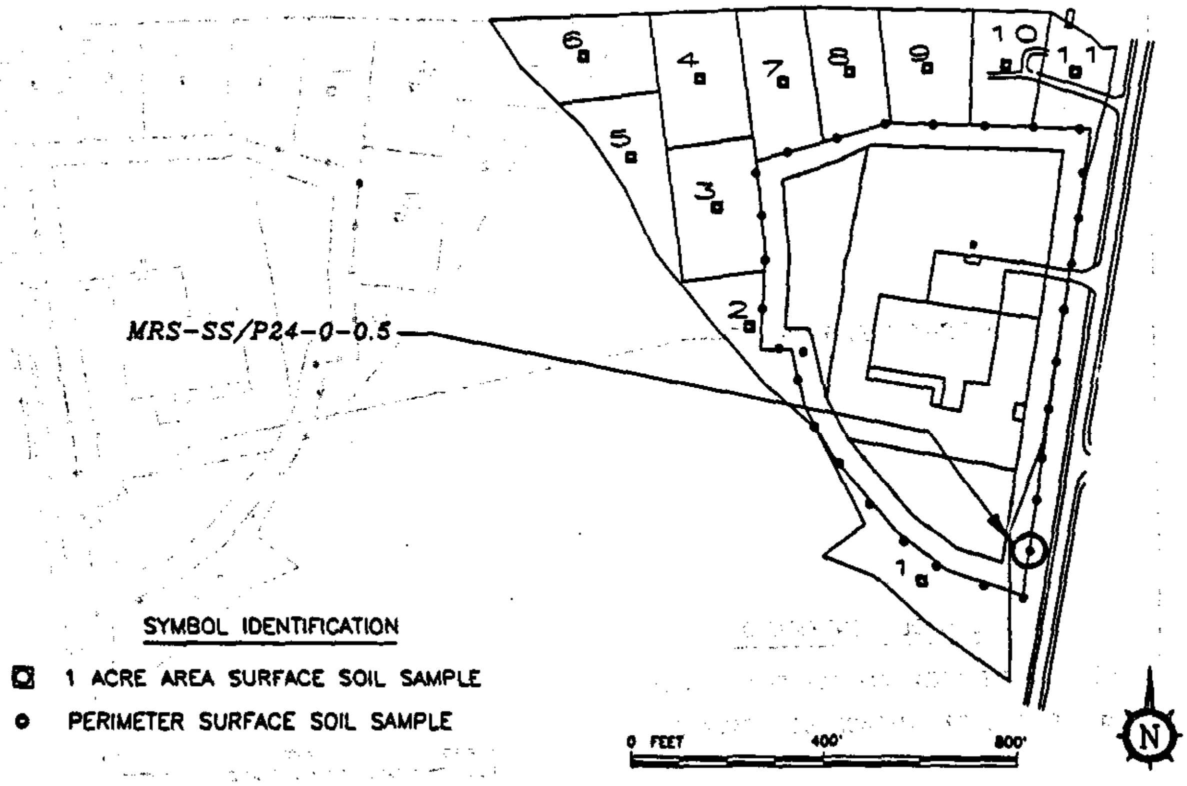
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *35* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P24-0-0.5	*16:27*	*0 - 0.5*	*silt clay loam*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

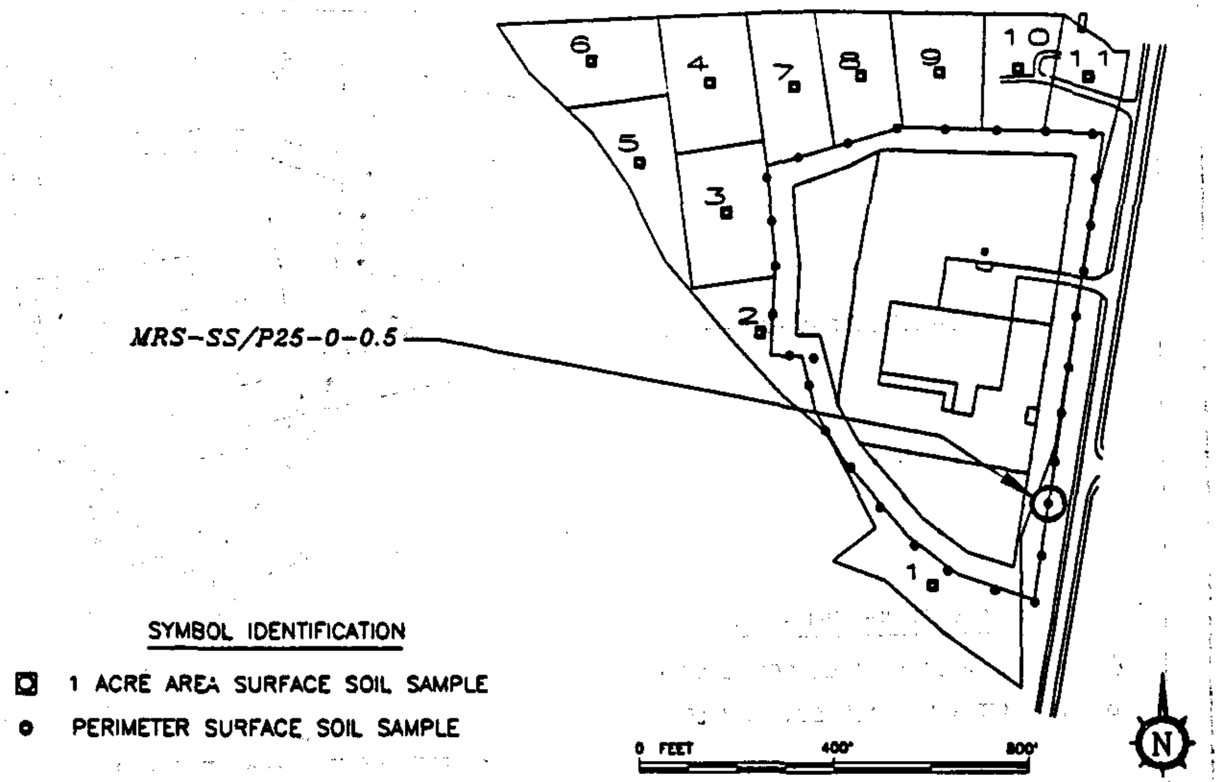
APPENDIX E METCOA RESTART SITE, WORKPLAN NO. 2 SURFACE SOIL SAMPLE LOG	Environmental Standards, Inc.

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *36* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P25-0-0.5	*16:36*	*0 - 0.5*	*silt clay loam with stones*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

APPENDIX E METCOA RESTART SITE, WORKPLAN NO. 2 SURFACE SOIL SAMPLE LOG	Environmental Standards, Inc.

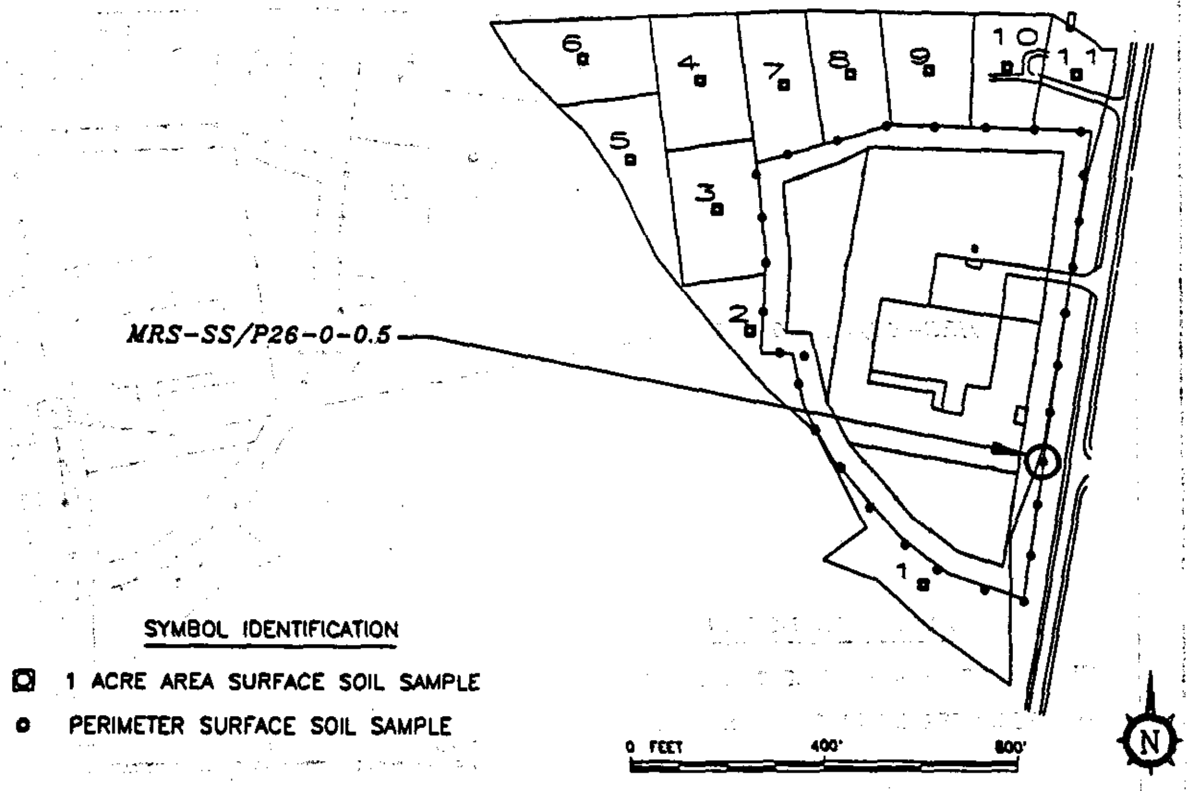
AR102679

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *37* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P26-0-0.5	*16:44*	*0 - 0.5*	*silt clay loam*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

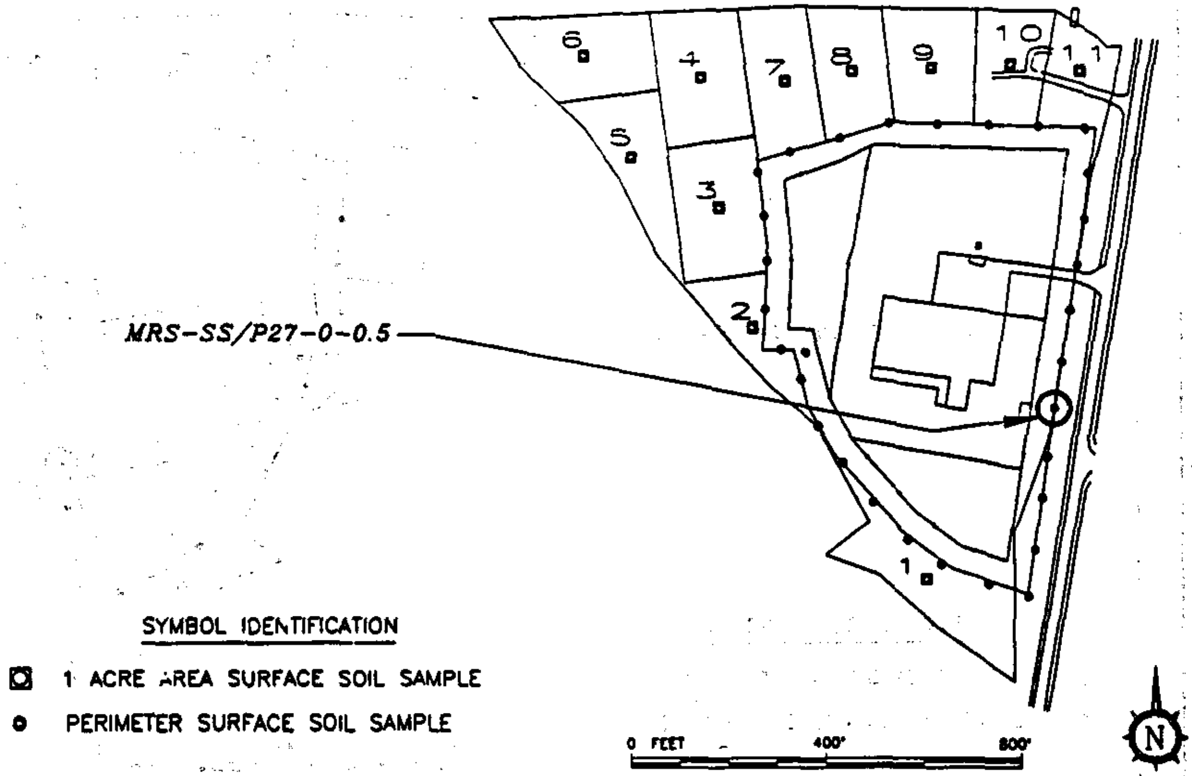
PROJECT NO.: *9105-449* | PROJECT: *METCOA RESTART SITE*

SAMPLE IDENTIFICATION: *Perimeter* | COLLECTOR'S NAME: *R. Heath*

DATE: *12-12-91* | LOG PAGE NUMBER *38* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1* | CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P27-0-0.5	*16:52*	*0 - 0.5*	*silt clay loam*

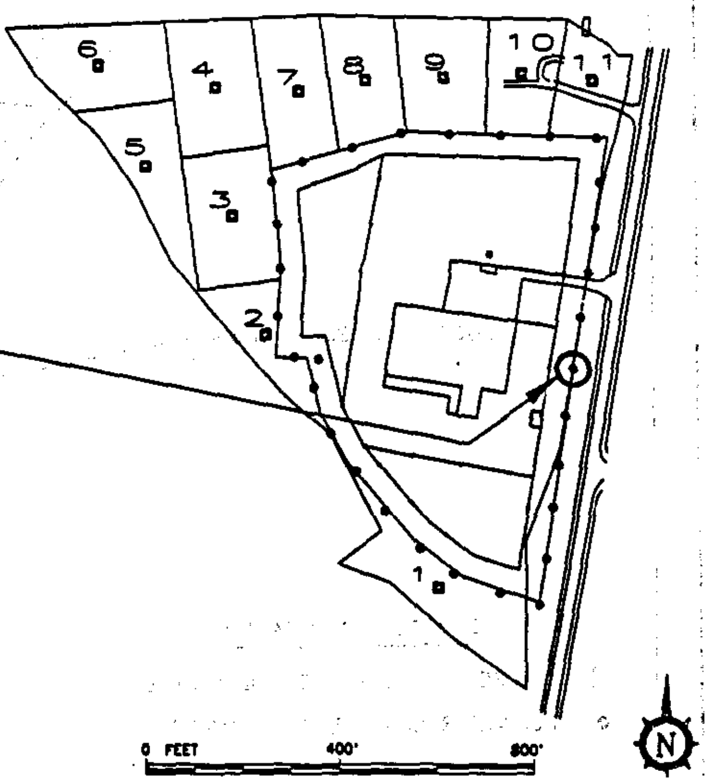
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *39* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SYMBOL IDENTIFICATION

- ◘ 1 ACRE AREA SURFACE SOIL SAMPLE
- • PERIMETER SURFACE SOIL SAMPLE

SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P28-0-0.5	*16:58*	*0 - 0.5*	*silt clay loam*

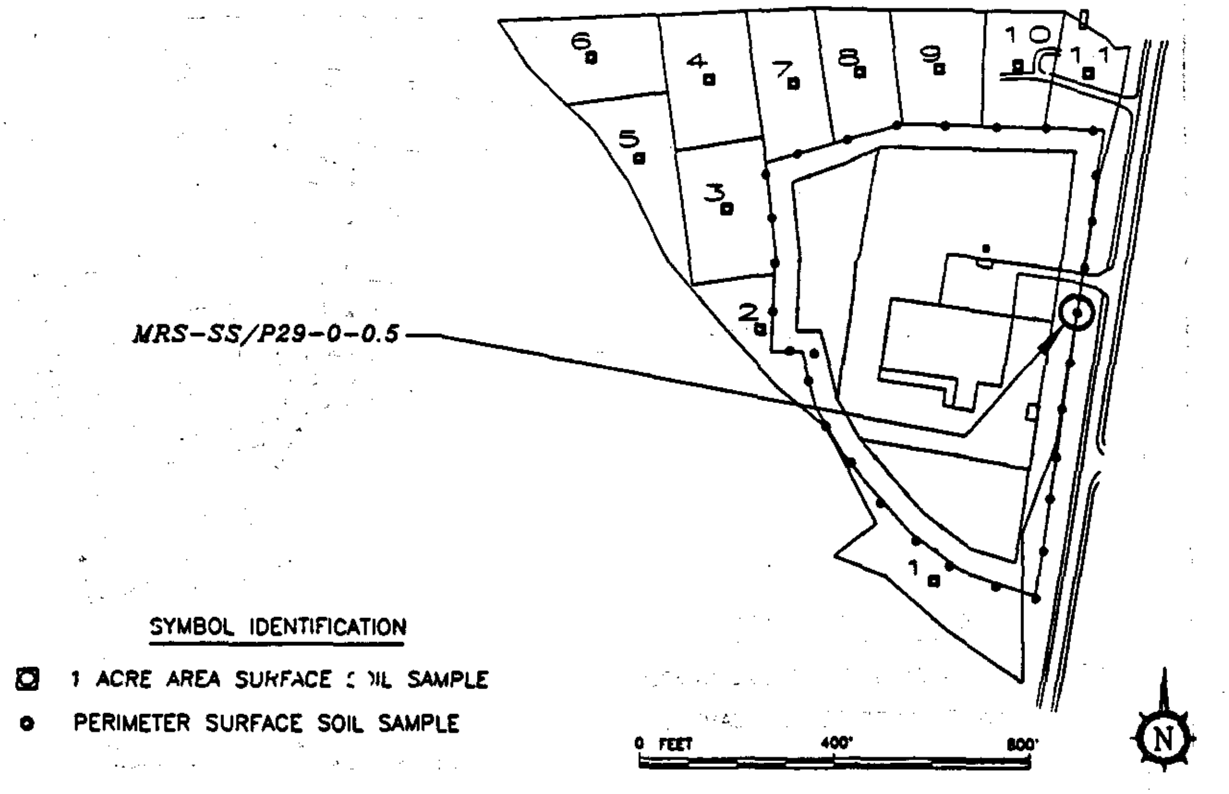
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *R. Heath*
DATE: *12-12-91*	LOG PAGE NUMBER *40* OF *41*

SAMPLE POINT DESCRIPTION: *Cleared grass field between fence and State Route 551*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *1*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P29-0-0.5	*17:05*	*0 - 0.5*	*silt clay loam*

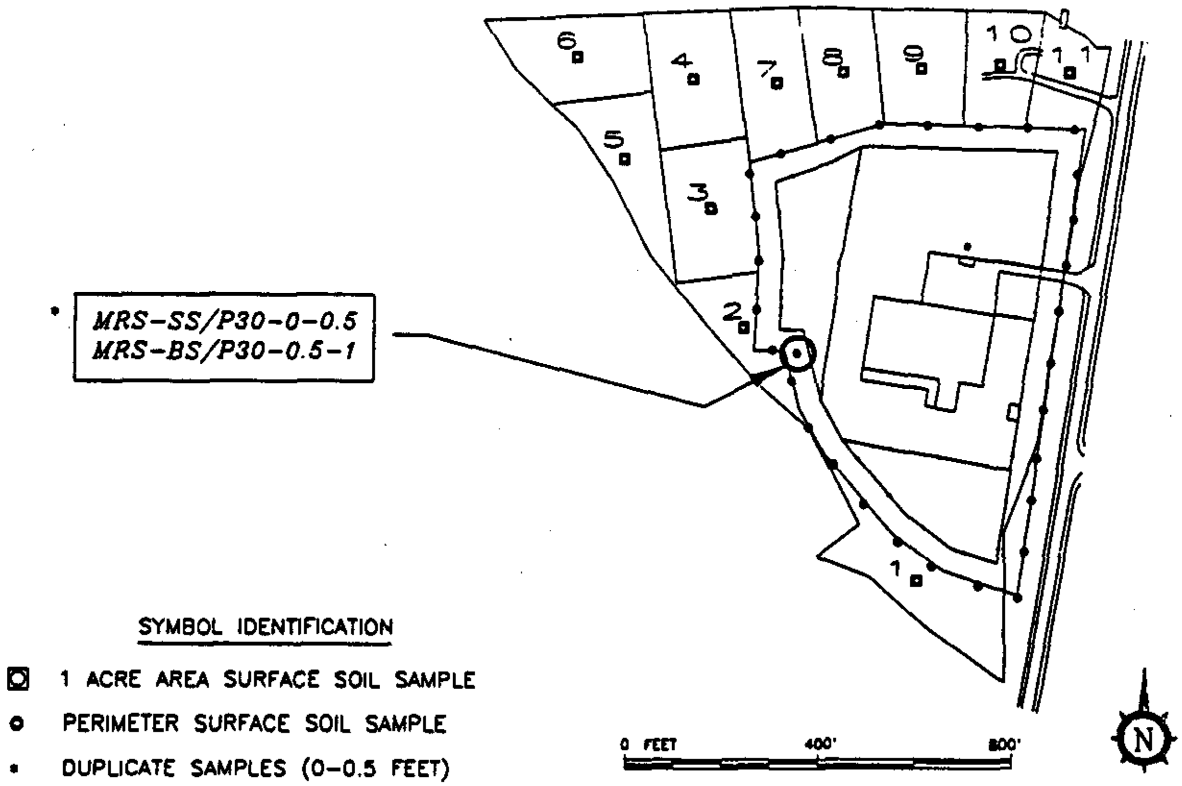
ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

FIGURE 1 (REVISED)
SURFACE SOIL SAMPLE LOG

PROJECT NO.: *9105-449*	PROJECT: *METCOA RESTART SITE*
SAMPLE IDENTIFICATION: *Perimeter*	COLLECTOR'S NAME: *D. Cernansky*
DATE: *12-16-91*	LOG PAGE NUMBER *41* OF *41*

SAMPLE POINT DESCRIPTION: *Bottom of drainage ditch near outfall of drainage culvert*

SAMPLE POINT SKETCH



SAMPLE ANALYSES: *Cd, Cu, Ni, Mo, Pb, W AND RADIOANALYSIS FOR THORIUM*

EQUIPMENT USED: *STAINLESS STEEL HAND AUGER, SCOOPS AND MIXING BOWLS*

NO. OF SAMPLES COLLECTED: *2*	CONTAINER SIZE: *16 OZ. WIDE MOUTH*

SAMPLE NO.	TIME	DEPTH (FEET BELOW GROUND)	DESCRIPTION OF MATERIAL
MRS-SS/P30-0-0.5	*09:30*	*0 - 0.5*	*sandy soil and gravel w/ some cinders*
MRS-BS/P30-0.5-1	*09:35*	*0 - 0.5*	*blind duplicate of MRS-SS/P30-0-0.5*

ANALYTICAL SERVICE: *CONTROLS FOR ENVIRONMENTAL POLLUTION, SANTA FE, NM*

APPENDIX F

NUCLEAR REGULATORY COMMISSION'S BRANCH TECHNICAL POSITION OCTOBER 23, 1981

The Assistant Secretary finds that good cause exists for not publishing the supplement to the Puerto Rico State Plan as a proposed change and making the Regional Administrator's approval effective upon publication for the following reasons:

1. The standards are identical to the Federal standards which were promulgated in accordance with Federal law meeting requirements for public participation.

2. The standards were adopted in accordance with the procedural requirement of State Law and further participation would be unnecessary.

The decision is effective October 23, 1981.

(Sec. 18 Pub. L. 91–596, 84 Stat. 1608 (29 U.S.C. 667))

Signed at New York City, New York, this 15th day of June 1981.

Roger A. Clark,

Regional Administrator.

[FR Doc. 81–30745 Filed 10-22-81; 8:45 am]

BILLING CODE 4510-26-M

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards, Subcommittee on Callaway Plant; Location Change

The ACRS Subcommittee on Callaway Plant will hold a meeting on November 4 and 5, 1981, at the HOLIDAY INN–WEST, 1900 I–70 Drive Southwest, Columbia, MO instead of the Hilton Inn.

Notice of this meeting was published in the Federal Register on October 19, 1981 (46 FR 51329), and all other items remain the same except for the location change as indicated above.

Dated: October 19, 1981.

John C. Hoyle,

Advisory Committee, Management Officer.

[FR Doc. 81–30733 Filed 10-22-81; 8:45 am]

BILLING CODE 7590-01-M

Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations

AGENCY: Nuclear Regulatory Commission (NRC).

ACTION: Discussion of options for NRC approval of applications for disposal or onsite storage of thorium or uranium wastes; interim use and public comment.

SUMMARY: This notice discusses five options for NRC approval of disposal or onsite storage or thorium or uranium wastes from past nuclear operations. The options are contained in a Branch Technical Position for administration by the Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

DATES: Comments on the options for disposal or onsite storage of thorium or uranium are encouraged. Such comments will be considered in any subsequent revision of the Branch Technical Position. Comments are due December 22, 1981.

Note.—Comments received after the expiration date will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments filed on or before that date.

FOR FURTHER INFORMATION CONTACT: Ralph G. Page, Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, Washington, D.C. 20555, telephone 301–427–4309.

SUPPLEMENTARY INFORMATION:

I. Introduction

Some of the sites formerly used for processing thorium and uranium are known today to be contaminated with residual radioactive materials. Some are currently covered by NRC licenses. Others were once licensed, but the licenses to possess and use material have expired. In many cases, the total amount of contaminated soil is large, but the activity concentrations of radioactive materials are believed sufficiently low to justify their disposal on privately owned lands or storage onsite rather than their transport to a licensed radioactive materials disposal (commercial) site. In many instances packaging and transporting these wastes to a licensed disposal site would be too costly and not justified from the standpoints of risk to the public health or cost-benefit. Furthermore, because of the total volume of these wastes, limited commercial waste disposal capacity, and restrictions placed on receipt of long-lived wastes at commercial sites, it is not presently feasible to dispose of these wastes at commercial low-level waste disposal sites.

Effective January 28, 1981, NRC regulations in 10 CFR 20, "Standards for Protection Against Radiation", were amended (45 FR 71761–71762) to delete § 20.304 which provided general authority for disposal of radioactive materials by burial in soil. Under the amended regulations, licensees must apply for and obtain specific NRC approval to dispose of radioactive materials in this manner under the provisions of 10 CFR 20.302. A case-by-case review was believed needed to assure that burial of radioactive wastes would not present an unreasonable health hazard at some future date.

The deleted provisions of § 20.30[4] previously permitted burial of up [to 100] millicuries of thorium or natural u[ranium] at any one time, with a yearly limitation of 12 burials for each type of material at each site. The only disposal standards specified were (1) burial at a minimum depth of four feet, and (2) successive burials separated by at least six feet. Thus a total of 1.2 curies of these materials were permitted to be disposed of each year by burial in a 12 foot by 18 foot or larger plot of ground.

Under the amended regulations, it is incumbent on an applicant who wants to bury radioactive wastes to demonstrate that local land burial is preferable to other disposal alternatives. The evaluation of the application takes into account the following information:

- Types and quantities of material to be buried
- Packaging of waste
- Burial location
- Characteristics of burial site
- Depth of burial
- Access restrictions to disposal site
- Radiation safety procedures during disposal operations
- Recordkeeping
- Local burial restrictions, if any

For applications involving dispo[sal of] soils contaminated with low level concentrations of thorium and uranium (other than concentrations not exceeding EPA cleanup standards), the matters of principal importance are:

- Concentrations of thorium and uranium (either in secular equilibrium with their daughters or without daughters present)
- Volume of contaminated soil
- Costs for offsite and onsite disposal
- Availability of offsite burial space
- Disposal site characteristics
- Depth of burial and accessibility of buried wastes
- State and local government views

II. Branch Technical Position

There are five acceptable options for disposal or onsite storage of thorium and uranium contaminated wastes. Applications for disposal or storage will be approved if the guidelines discussed under any option are met. Applications for other methods of disposal may be submitted and these will be evaluated on their own merits.

1. Disposal of acceptably low concentrations (which meet EPA cleanup standards) of natural thor[ium] with daughters in secular equilibri[um,] depleted or enriched uranium, and

uranium ores with daughters in secular equilibrium with no restriction on burial method.

Under this option, the concentrations of natural thorium and depleted or enriched uranium wastes are set sufficiently low that no member of the public is expected to receive a radiation dose commitment from the disposed materials in excess of 1 millirad per year to the lung or 3 millirads per year to the bone from inhalation and ingestion, under any foreseeable use of the material or property. These radiation dose guidelines were recommened by the Environmental Protection Agency (EPA) for protection against transuranium elements present in the environment as a result of unplanned contamination (42 FR 60956–60959). In addition, the concentrations are sufficiently low so that no individual may receive an external dose in excess of 10 microroentgens per hour above background. This is compatible with guidelines EPA proposed as cleanup standards for inactive uranium processing sites (46 FR 2556–2563).

For natural uranium ores having daughters in equilibrium, the concentration limit is equal to that set by the EPA (46 FR 2556–2563) for radium-226 (i.e., 5 pCi/gm, including background) and its decay products.

The concentrations specified below are believed appropriate to apply. It is expected, however, that currently licensed operations will be conducted in such a manner as to minimize the possibility of soil contamination and when such occurs the contamination will be reduced to levels as low as reasonably achievable.

Kind of material	Concentration (pCi/gm)
Natural thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium	10
Depleted Uranium	35
Enriched Uranium	30
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium	10

The analysis upon which the Branch Technical Position is based is available for inspection at the Commission's Public Document Room at 1717 H St., N.W., Washington, D.C.

The concentrations specified under this option may be compared with naturally occurring thorium and uranium ore concentrations of 1.3 pCi/gm in igneous rock and uranium concentrations of 120 pCi/gm in Florida phosphate rock and 50–80 pCi/gm in Tennessee bituminous shale. Concentration limits for natural thorium and natural uranium ore wastes containing daughters not at secular equilibrium can be calculated on a case-by-case basis using the applicable isotopic activities data.

2. Disposal of certain low concentrations of natural thorium with daughters in secular equilibrium and depleted or enriched uranium with no daughters present when buried under prescribed conditions with no subsequent land use restrictions and no continuing NRC licensing of the material.

Under this option the concentrations of natural thorium and uranium are set sufficiently low so that no member of the public will receive a radiation dose exceeding those discussed under option 1 when the wastes are buried in an approved manner absent intrusion into the burial grounds. This option will require establishing prescribed conditions for disposal in the license, such as depth and distribution of material, to minimize the likelihood of intrusion. Burial will be permitted only if it can be demonstrated that the buried materials will be stabilized in place and not be transported away from the site.

Acceptability of the site for disposal will depend on topographical, geological, hydrological and meteorological characteristics of the site. At a minimum, burial depth will be at least four feet below the surface. In the event that there is an intrusion into the burial ground, no member of the public will likely receive a dose in excess fo 170 millirems to a critical organ. An average dose not exceeding 170 millirems to the whole body for all members of a general population is recommended by international and national radiation expert bodies to limit population doses. With respect to limiting doses to individual body organs, the concentrations are sufficiently low that no individual will receive a dose in excess of 170 millirems to any organ from exposure to natural thorium, depleted uranium or enriched uranium.

The average activity concentration of radioactive material that may be buried under this option in the case of natural thorium (Th-232 plus Th-228) is 50 pCi/gm, if all daughters are present and in equilibrium; for enriched uranium it is 100 pCi/gm if the uranium is soluble and 250 pCi/gm if insoluble; for depleted uranium it is 100 pCi/gm if the uranium is soluble and 300 pCi/gm if insoluble. Natural uranium ores containing radium 226 and its daughters are not included under this option, because of possible radon 222 emanations and resultant higher than acceptable exposure of individuals in private residences if houses were built over buried materials.

3. Disposal of low concentrations of natural uranium ores, with all daughters in equilibrium, when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the specified land contains buried radioactive materials and are conditioned in a manner acceptable under state law to impose a covenant running with the land that the specified land may not be used for residential building. (There is no continuing NRC licensing of the material.)

Disposal will be approved if the burial criteria outlined in option 2 (including burial at a minimum of 4 feet) are met. Depending upon local soil characteristics, burials at depths greater than 4 feet may be required. In order to assure protection against radon 222 releases (daughter in decay chain of uranium 238 and uranium 234), it is necessary that the recorded title documents be amended to state in the permanent land records that no residential building should be permitted over specified areas of land where natural uranium ore residues (U-238 plus U-234) in concentrations exceeding 10 pCi/gm has been buried. Industrial building is acceptable so long as the concentration of buried material does not exceed 40 pCi/gm of uranium (i.e., Ra-226 shall not exceed 20 pCi/gm).

4. Disposal of land-use-limited concentrations of natural thorium or natural uranium with daughters in secular equilibrium and depleted or enriched uranium without daughters present when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents ar amended to state that the land contains buried radioactive material and are conditioned in a manner acceptable under state law to impose a covenant running with land that the land (1) may not be excavated below stated depths in specified areas of land unless cleared by appropriate health authorities, (2) may not be used for residential or industrial structures over specified areas where radioactive materials in concentrations higher than specified in options 2 and 3 are buried, and (3) may not be used for agricultural purposes in the specified areas. (There is no continuing NRC licensing of the disposal site.)

Under this option, conditions of buria will be such that no member of the public will receive radiation doses in excess of those discussed under option absent intrusion into the burial ground. Criteria for disposal under these conditions is predicated upon the assumption that intentional intrusion is less likely to occur if a warning is giver in land documents of record not to excavate below burial depths in specified areas of land without clearance by health authorities; not to construct residential or industrial building on the site; and not to use specified areas of land for agricultural purposes. Because of this, we believe it appropriate to apply a maximum critical organ exposure limit of 500 millirems per year to thorium and uranium buried under this restriction instead of 170 millirems as used in options 2 and 3. In addition, any exposure to such materials is likely to be more transient than assumed (essentially continual exposure) under those options. These two factors combine to increase the activity concentration limits calculated under option 2 by about 10. Thus, the average concentration that may be buried under this option for thorium (Th-232 plus Th-228) is 500 pCi/gm if all daughters are present and in equilibrium; for enriched uranium it is 1000 pCi/gm if the uranium is soluble and 2500 pCi/gm if insoluble; and for depleted uranium it is 1000 pCi/gm if the uranium is soluble and 3000 pCi/gm if insoluble.

With respect to natural uranium with daughters present and in equilibrium, the concentration that may be buried under this option is 200 pCi/gm of U-238 plus U-234, i.e., 100 pCi/gm Ra-226. This concentration is based on a limited exposure of 2.4 hours per day to limit the radon dose to less than 0.5 working level month (WLM) which is equivalent to continuous exposure to 0.02 working level (WL). Depending upon local soil characteristics, burials at depths greater than 4 feet may be required.

SUMMARY OF MAXIMUM CONCENTRATIONS PERMITTED UNDER DISPOSAL OPTIONS

Kind of Material	Disposal Options			
	1[1]	2[2]	3[3]	4[4]
Natural Thorium (Th-232+Th-228) with daughters present and in equilibrium	10	50		500
Natural Uranium (U-238+U-234) with daughters present and in equilibrium	10		40	200
Depleted Uranium:				
*Soluble	35	100		1,000
*Insoluble	35	300		3,000
Enriched Uranium:				
*Soluble	30	100		1,000
*Insoluble	30	250		2,500

[1] Based on EPA cleanup standards.
[2] Concentrations based on limiting individual doses to 170 mrem/yr.
[3] Concentration based on limiting equivalent exposure to 0.02 working level or less.
[4] Concentrations based on limiting individual doses to 500 mrem/yr and, in case of natural uranium, limiting exposure to 0.02 working level or less.

5. Storage of licensed concentrations of thorium and uranium onsite pending the availability of an appropriate disposal site.

When concentrations exceed those specified in option 4, long term disposal other than at a licensed disposal site will not normally be a viable option under the provisions of 10 CFR 20.302. In such cases, the thorium and uranium may be permitted to be stored onsite under an NRC license until a suitable method of disposal is found. License conditions will require that radiation doses not exceed those specified in 10 CFR Part 20 and be maintained as low as reasonably achievable.

Before approving an application to dispose of thorium or uranium under options 2, 3, or 4, NRC will solicit the view of appropriate State health officials within the State in which the disposal would be made.

Dated at Silver Spring, Maryland this 19th day of October, 1981.

Richard E. Cunningham,

Director, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

[FR Doc. 81-30808 Filed 10-22-81; 8:45 am]

BILLING CODE 7590-01-M

OFFICE OF PERSONNEL MANAGEMENT

Postponement of Application Deadline for Fund-Raising Privileges Among Federal Employees by Private Voluntary Organizations

Section 5.43 of the "Manual on Fund-Raising Within the Federal Service for Voluntary Health and Welfare Agencies" sets December 1 of each year as the deadline by which national voluntary agencies must submit applications for participation in the Combined Federal Campaign (CFC) to be conducted in the fall of the following year. This year's deadline is being postponed from December 1, 1981, to February 1, 1982. In June 1981, the U.S. Office of Personnel Management (OPM) announced that the eligibility criteria for participation in the 1982-83 CFC are being reviewed. The deadline date is being postponed to avoid national voluntary agencies having to revise their applications to meet eligibility criteria which may be changed.

Donald J. Devine,

Director.

[FR Doc. 81-30730 Filed 10-22-81; 8:45 am]

BILLING CODE 6325-01-M

OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE

Resolution of Complaint of Price-Undercutting of Subsidized Chee[se] Imports

On October 1, 1981, the United St[ates] Trade Representative received a letter from the Secretary of Agriculture informing him of the Secretary's finding that imported Grade A Swiss type cheese produced in Finland has been offered for sale in the United States at duty-paid wholesale prices which are five cents per pound less than the domestic wholesale market price of similar cheese produced in the United States.

In accordance with Section 702(c)(2) of the Trade Agreements Act of 1979 (the Act) (19 U.S.C. 1202 note), the Office of the United States Trade Representative notified Finland of the price undercutting determination made by the Secretary of Agriculture, requested that corrective action be taken, and asked for appropriate assurances concerning the commitments made in the Arrangement Between the United States and Finland Concerning Cheese.

On October 14, 1981, Finland notified the United States Trade Representative that measures have been taken to ensure that the duty-paid whole[sale] price of imported Grade A Swiss cheese produced in Finland will [not be] less than the domestic wholesale market price of similar cheese produced in the United States. In addition, Finland gave assurance that it will respect the price commitments in the Arrangement. Since the above notification by Finland has occurred within the 15-day period provided in Section 702(c)(3) of the Act, the United States Trade Representative has notified the Secretary of Agriculture of his belief that no further action is required.

William E. Brock,

United States Trade Representative.

[FR Doc. 81-30694 Filed 10-22-81; 8:45 am]

BILLING CODE 3190-01-M

SECURITIES AND EXCHANGE COMMISSION

[Release No. 22238; 70-6650]

Arkansas Power & Light Co.; Proposed Issuance and Sale of First Mortgage Bonds

October 19, 1981.

Arkansas Power & Light Com[pany]

AR102688

APPENDIX G

RISK-BASED RESPONSE LEVEL DEVELOPMENT SUPPORTING MATERIALS

Table 1
Cadmium Data Plot and Frequency Histogram for Surface Soil Data from the Site and Perimeter (all concentrations are in 10^3 mg/kg)
METCOA Restart Site, Pulaski, PA

$i := 0..87$
$N := 16$
$j := 0..N$
$k := 0..N - .1$

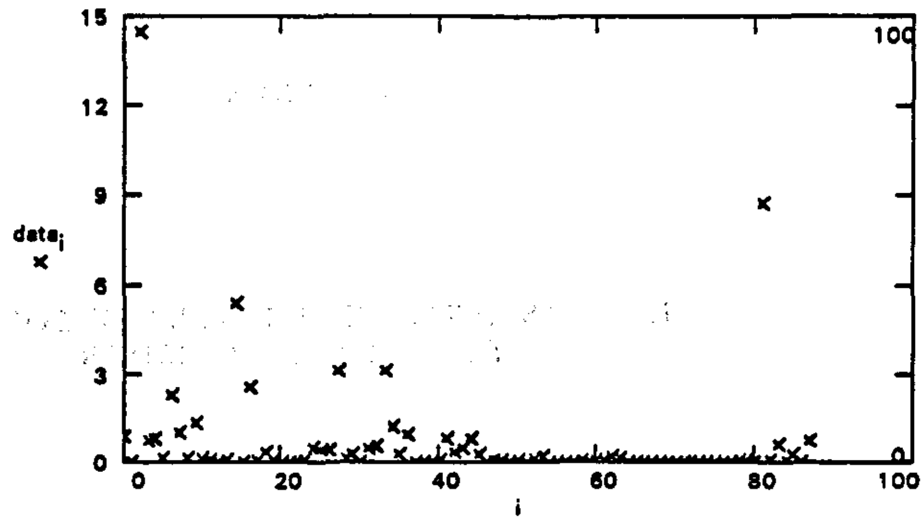
$data := READPRN(CRAW)$

$intervals_j := 0.00001 + \frac{j}{1}$

$f := hist(intervals, data)$

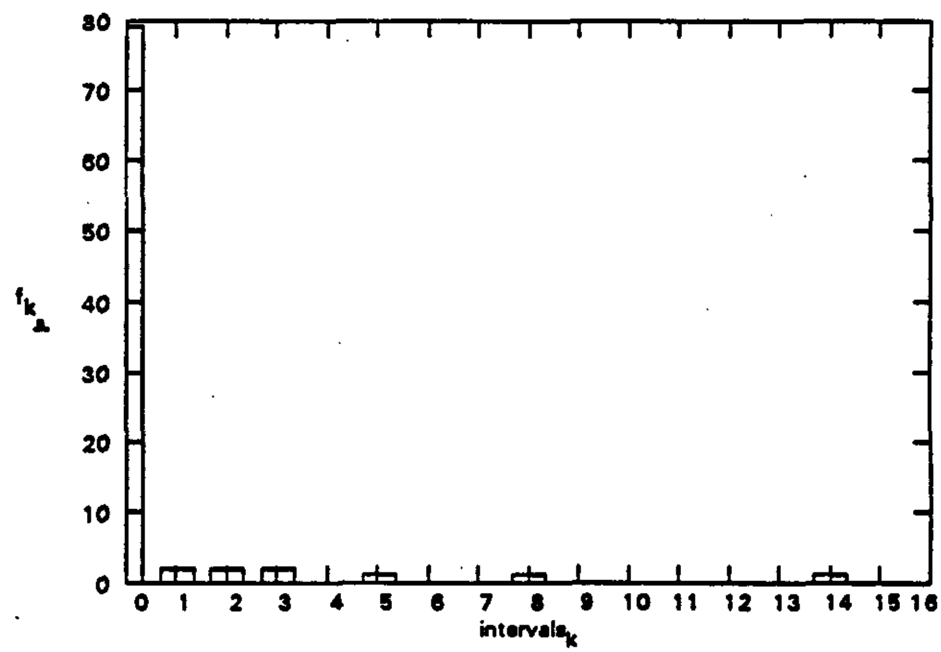
$min(data) = 1.7 \cdot 10^{-4}$
$max(data) = 14.45$
$mean(data) = 0.64$
$stdev(data) = 1.905$

The graph at right shows the data points



The graph at right shows the frequency histogram of the data above

Frequency



Values are 10^3 mg/kg

Table 2
Nickel Data Plot and Frequency Histogram for Surface Soil Data from the Site and Perimeter (all concentrations are in 10^3 mg/kg)
METCOA Restart Site, Pulaski, PA

$i := 0..87$
$N := 80$
$j := 0..N$
$k := 0..N - 1$

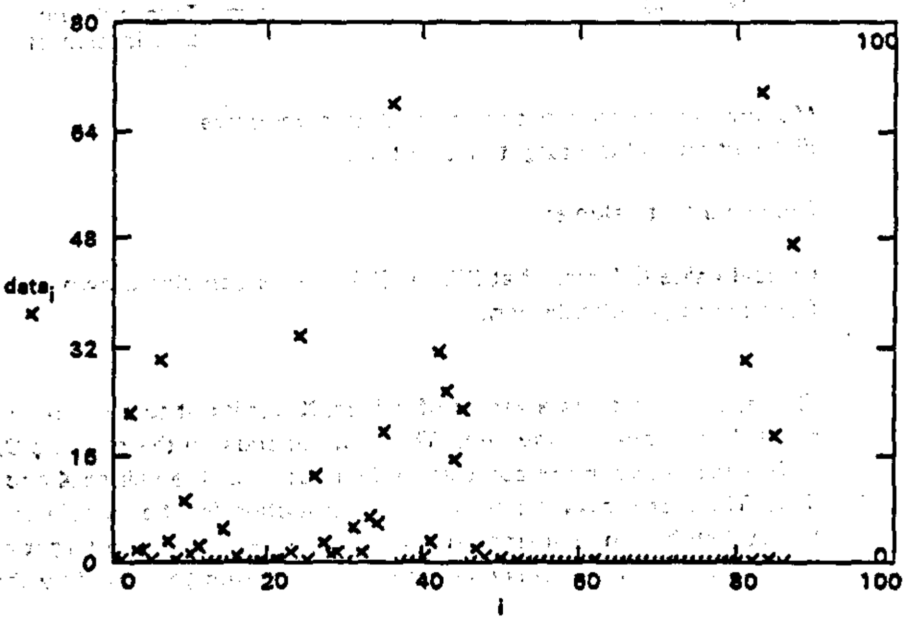
data := READPRN(NRAW)

$intervals_j := 0.00001 + \frac{j}{1}$

f := hist(intervals, data)

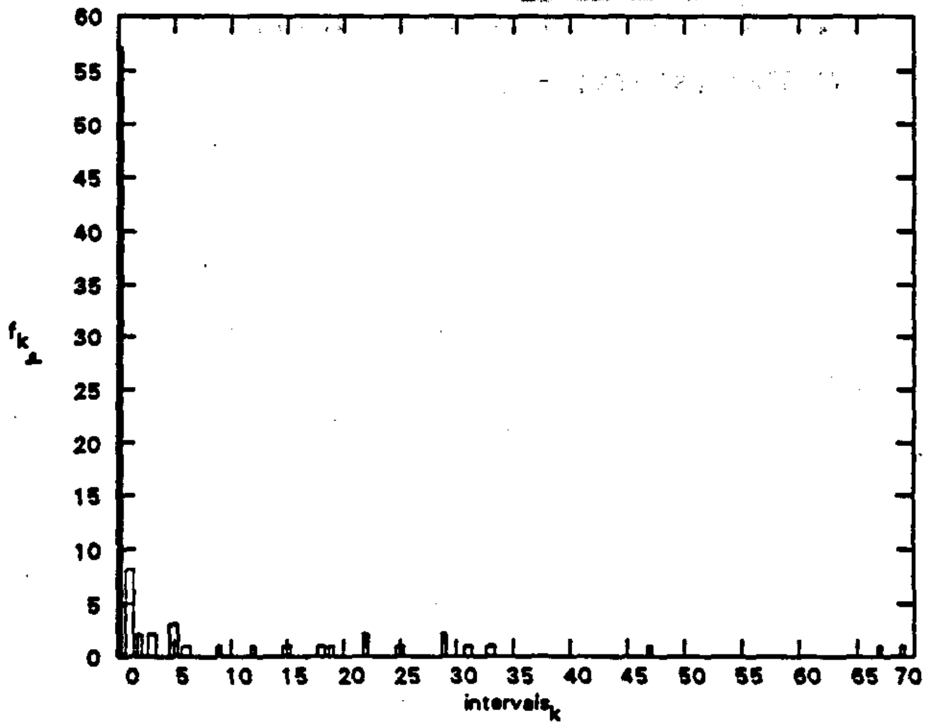
min(data) = $8.5 \cdot 10^{-4}$
max(data) = 69.8
mean(data) = 5.802
stdev(data) = 13.347

The graph at right shows the data points



The graph at right shows the frequency histogram of the data above

Frequency



Values are 10^3 mg/kg

Table 3
Natural Log Values for Cadmium Concentrations in Surface Soil

KOLMOGOROV-SMIRNOV TEST

METCOA Restart Site, Pulaski, PA

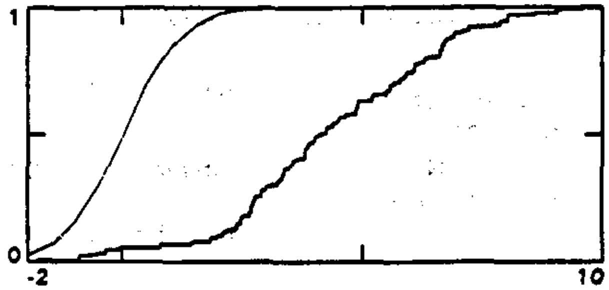
Data vector: X ≡ READPRN(kscad)

Target distribution:

dist(t) ≡ cnorm(t)

Number of data values:

N = 88



Maximum difference between the data cumulative distribution and the target distribution: D = 0.886

Choose a test value a: a ≡ .05

Critical value CV such that P(D > CV) = a for samples drawn from the target distribution: CV = 0.145

This application tests a vector of values, X, for its fit to a given distribution, dist(t), by using the Kolmogorov-Smirnov test. This test depends on the statistic D, the maximum absolute difference between the cumulative distribution of the values X and the target distribution dist. The plot shows the cumulative distribution for the sample as a step function, and the target distribution as a smooth curve. In this example, the target distribution is normal (0,1), and the vector X contains random normal deviates generated by the Box-Muller method.

s := 0 .. 29

$d_s := \sqrt{-2 \cdot \ln(\text{rnd}(1))} \cdot \cos(2 \cdot p \cdot \text{rnd}(1))$

WRITEPRN(KDATA) := d

<u>Equations</u> for the Kolmogorov-Smirnov test

The first equations sort the data X into the array C and extend C at each end. Y, the cumulative distribution function of X, increases by 1/N at each of the sorted values in C.

$N := \text{length}(X)$ $\quad j := 0 .. N - 1$ $\quad n := 0 .. N + 1$ $\quad count_j := j$

$f(a, b, c, d) := (c < d) + (c = d) \cdot (a < b)$

$R_j := 1 + \sum \overrightarrow{f(count, j, X, X_j)}$

$C_{R_j} := X_j$ $\quad C_0 := \text{floor}(C_1)$ $\quad C_{N+1} := \text{ceil}(C_N)$

$Y_n := \frac{n}{N}$ $\quad Y_{N+1} := 1$

$t := C_0, C_0 + .5 .. C_{N+1}$

These equations calculate D, the maximum distance between the cumulative distribution Y and the target cumulative distribution dist.

$height := \overrightarrow{(\text{dist}(C))}$ $\quad height_0 := -\frac{1}{N}$

$mminus := \max\left(height - Y + \frac{1}{N}\right)$ $\quad mplus := \max(Y - height)$

$D := \text{if}(mplus - mminus > 0, mplus, mminus)$

The function Q gives the tail of the distribution of $D \cdot \sqrt{N}$

$k := 1 .. 10$ $\quad Q(l) := 2 \cdot \sum_k (-1)^{k-1} \cdot e^{-2 \cdot (k \cdot l)^2}$

To calculate the critical value for a:

$x := 1.5$

$CV := \frac{1}{\sqrt{N}} \cdot \text{root}(Q(x) - a, x)$

These critical values will be correct to two decimal places for N > 25 and a between .1 and .01.

Table 4

Natural Log Values for Nickel Concentrations in the Surface Soil

KOLMOGOROV-SMIRNOV TEST

METCOA Restart Site, Pulaski, PA

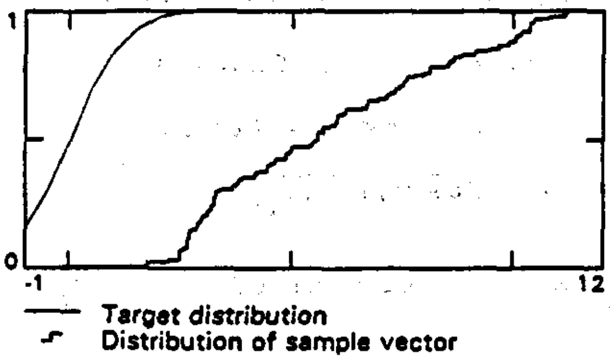
Data vector: X ≡ READPRN(ksnick)

Target distribution:

dist(t) ≡ cnorm(t)

Number of data values:

N = 88



Maximum difference between the data cumulative distribution and the target distribution: D = 0.966

Choose a test value a: a ≡ .05

Critical value CV such that P(D > CV) = a for samples drawn from the target distribution: CV = 0.145

This application tests a vector of values, X, for its fit to a given distribution, dist(t), by using the Kolmogorov-Smirnov test. This test depends on the statistic D, the maximum absolute difference between the cumulative distribution of the values X and the target distribution dist. The plot shows the cumulative distribution for the sample as a step function, and the target distribution as a smooth curve. In this example, the target distribution is normal (0,1), and the vector X contains random normal deviates generated by the Box-Muller method.

$s := 0 .. 29$

$d_s := \sqrt{-2\cdot \ln(\mathrm{rnd}(1))}\cdot \cos(2\cdot p\cdot \mathrm{rnd}(1))$

WRITEPRN(KDATA) := d

Equations for the Kolmogorov-Smirnov test

The first equations sort the data X into the array C and extend C at each end. Y, the cumulative distribution function of X, increases by 1/N at each of the sorted values in C.

$N \equiv \text{length}(X) \qquad j \equiv 0..N-1 \qquad n \equiv 0..N+1 \qquad count_j \equiv j$

$f(a,b,c,d) \equiv (c<d) + (c=d)\cdot(a<b)$

$R_j \equiv 1 + \sum \overrightarrow{f(count, j, X, X_j)}$

$C_{R_j} \equiv X_j \qquad C_0 \equiv \text{floor}(C_1) \qquad C_{N+1} \equiv \text{ceil}(C_N)$

$Y_n \equiv \frac{n}{N} \qquad Y_{N+1} \equiv 1$

$t \equiv C_0, C_0 + .5 .. C_{N+1}$

These equations calculate D, the maximum distance between the cumulative distribution Y and the target cumulative distribution dist.

$height \equiv \overrightarrow{(\text{dist}(C))} \qquad height_0 \equiv -\frac{1}{N}$

$mminus \equiv \max\left(height - Y + \frac{1}{N}\right) \qquad mplus \equiv \max(Y - height)$

$D \equiv \text{if}(mplus - mminus > 0, mplus, mminus)$

The function Q gives the tail of the distribution of$D\cdot\sqrt{N}$

$k \equiv 1..10 \qquad Q(l) \equiv 2\cdot\sum_k (-1)^{k-1}\cdot e^{-2\cdot(k\cdot l)^2}$

To calculate the critical value for a:

$x \equiv 1.5$

$CV \equiv \frac{1}{\sqrt{N}}\cdot\text{root}(Q(x) - a, x)$

These critical values will be correct to two decimal places for N > 25 and a between .1 and .01.

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations Locations	Initial Soil Concentrations (mg/ kg) Cadmium	Nickel	Concentrations after Response Action to the Cleanup Action Level (mg/ kg) Cadmium	Nickel
Perimeter and Fenced in Soil				
Upper 95% Surface Soil	3773	27758	1282	18288
Average Surface Soil	640	5802	340	4336
Standard Deviation Surface Soil	1905	13347	573	8481
Variance Surface Soil	3628188	178141824	328110	71933706
Max Value Surface Soil	14450	69800	3050	33500
Min Value Surface Soil	0.17	0.85	0.17	0.85
Number of Sampling Locations	88	88	88	88
Upper 95% all Soil Layers	2118	12108	870	9827
Average all Layers	322	2538	166	2049
Standard Deviation all Layers	1091	5818	306	4728
Variance all Layers	1191253	33851220	93695	22356179
Max Value all Layers	8710	30000	1888	30000
Min Value all Layers	0.23	0.85	0.23	0.85
Number of Sampling Locations	88	88	88	88
CAL (Cleanup Action Level)	1307	18554		
TL (Threshold Limit based on average)	3773	27758		
TL' (Threshold Limit based on CAL)	5040	44714		
Fenced in Soil				
Upper 95% all Soil Layers	1542	12993	752	9580
Average all Layers	319	3308	210	2567
Standard Deviation all Layers	744	5888	329	4264
Variance all Layers	553007	34664916	108451	18179743
Max Value all Layers	5052	23695	1888	21376
Min Value all Layers	0.23	8.75	0.23	8.75
Number of Sampling Locations	58	58	58	58
Perimeter Soil				
Upper 95% Surface Soil	2974	10183	477	10183
Average Surface Soil	328	1048	81	1048
Standard Deviation Surface Soil	1557	5377	233	5377
Variance Surface Soil	2425142	28909741	54239	28909741
Max Value Surface Soil	8710	30000	1307	30000
Min Value Surface Soil	0.39	0.85	0.39	0.85
Number of Sampling Locations	30	30	30	30

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations	Initial Soil Concentrations (mg/ kg)		Concentrations after Response Action to the Cleanup Action Level (mg/ kg)	
Locations	Cadmium	Nickel	Cadmium	Nickel
Surface 0 - 0.5 feet				
DP1	865	500	865	500
DP2	27.1	224	27.1	224
DP3	14450	22110	1307	22110
DP4	735	1890	735	1890
DP5	826	1790	826	1790
A1	133	402	133	402
A2	2250	30000	2250	30000
A3	993	3360	993	3360
A4	133	297	133	297
A5	1350	9210	1350	9210
A6	128	1220	128	1220
A7	88.1	2240	88.1	2240
A8	0.17	15.3	0.17	15.3
A9	46.8	103	46.8	103
B1	5370	5070	1307	5070
C1	28.1	47.6	28.1	47.6
C2	2570	766	2570	766
C3	34	41.8	34	41.8
C4	354	66.4	354	66.4
D1	90.5	417	90.5	417
D2A	25.4	43.1	25.4	43.1
D3	28.5	255	28.5	255
D4	15	397	15	397
D5	81.7	1610	81.7	1610
TP1	440	33500	440	33500
TP2	434	262	434	262

Bold faced numbers indicate locations for response action

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations Locations	Initial Soil Concentrations (mg/ kg) Cadmium	Initial Soil Concentrations (mg/ kg) Nickel	Concentrations after Response Action to the Cleanup Action Level (mg/ kg) Cadmium	Concentrations after Response Action to the Cleanup Action Level (mg/ kg) Nickel
E1	375	12800	375	12800
E2	3050	2805	3050	2805
E3	135	1037	135	1037
E4	247	1370	247	1370
E5	0.57	25.3	0.57	25.3
E6	449	5170	449	5170
E7	550	1470	550	1470
E8	3100	6760	1307	6760
E9	1220	5880	1220	5880
DE1	266	19400	266	19400
DE2	917	67800	917	18554
F1	10.3	90.2	10.3	90.2
F2	4.2	14.7	4.2	14.7
F3	26.3	64.2	26.3	64.2
F4	62.6	818	62.6	818
F5	775	3310	775	3310
F6	337	31300	337	31300
TP3	477	25200	477	25200
TP4	792	15400	792	15400
TP5	262	22700	262	22700
G1	18.3	147	18.3	147
G2	69.6	1990	69.6	1990
G3	37.7	798	37.7	798
G4	17.9	84.2	17.9	84.2
G5	51.2	465	51.2	465
G6	2.2	25	2.2	25
Phase 1 location 1	54.1	340	54.1	340
location 2	576	69800	576	18554
location 3	56.6	262	56.6	262
location 4	289	18900	289	18900
location 5	8.1	14.3	8.1	14.3
location 6	749	47100	749	18554

Bold faced numbers indicate locations for response action
Phase 1 samples were collected for the Interim Data Investigation

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations Locations	Initial Soil Concentrations (mg/ kg) Cadmium	Nickel	Concentrations after Response Action to the Cleanup Action Level (mg/ kg) Cadmium	Nickel
Perimeter Surface Soil 0 - 0.5 feet				
P1	131	297	131	297
P2	182	83	182	83
P3	11.5	17	11.5	17
P4	13.9	23.2	13.9	23.2
P5	19.9	17.6	19.9	17.6
P6	33	26.4	33	26.4
P7	44.3	126	44.3	126
P8	14.7	0.85	14.7	0.85
P9	44	37.5	44	37.5
P10	71.9	126	71.9	126
P11	192	237	192	237
P12	106	142	106	142
P13	15.6	20.4	15.6	20.4
P14	10.9	24.1	10.9	24.1
P15	0.92	14.2	0.92	14.2
P16	7.1	21.5	7.1	21.5
P17	0.69	12.2	0.69	12.2
P18	0.39	5.7	0.39	5.7
P19	15.1	11.8	15.1	11.8
P20	12.1	26.2	12.1	26.2
P21	14.3	19.4	14.3	19.4
P22	15.5	24.9	15.5	24.9
P23	6.2	12.2	6.2	12.2
P24	8.5	9.7	8.5	9.7
P25	11.9	28.8	11.9	28.8
P26	22.4	15.1	22.4	15.1
P27	44	15	44	15
P28	47.7	13.4	47.7	13.4
P29	30.9	17.9	30.9	17.9
P30	6710	30000	1307	30000

Bold faced numbers indicate locations for response action

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations	Initial Soil Concentrations (mg/ kg)		Concentrations after Response Action to the Cleanup Action Level (mg/ kg)	
Locations	Cadmium	Nickel	Cadmium	Nickel
Sub-Surface				
DP1 1-3 feet	11.6	7	11.6	7
DP2	0.16	6.5	0.16	6.5
DP3	46	13.7	46	13.7
DP4	8.5	30.2	8.5	30.2
DP5	7.8	11.2	7.8	11.2
DP1 3-5 feet	0.43	6.8	0.43	6.8
DP2	0.97	13.4	0.97	13.4
DP3	659	177	659	177
DP4	32.6	37.5	32.6	37.5
DP5	22.4	80.2	22.4	80.2
A1 1-3 feet	1.1	9.2	1.1	9.2
A2	6.6	26.5	6.6	26.5
A3	134	74.5	134	74.5
A4	44.4	13.4	44.4	13.4
A5	29	56.5	29	56.5
A6	0.37	6.5	0.37	6.5
A7	0.16	6.1	0.16	6.1
A8	0.37	10.3	0.37	10.3
A9	0.18	16.4	0.18	16.4
A1 3-5 feet	3.6	13.5	3.6	13.5
A2	20.7	22.4	20.7	22.4
A3	26.3	35.3	26.3	35.3
A4	3.4	9.2	3.4	9.2
A5	9.9	15.6	9.9	15.6
A6	3.5	9.8	3.5	9.8
A7	0.16	13.2	0.16	13.2
A8	0.16	0.64	0.16	0.64
A9	0.16	20.9	0.16	20.9

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations Locations	Initial Soil Concentrations (mg/kg) Cadmium	Nickel	Concentrations after Response Action to the Cleanup Action Level (mg/kg) Cadmium	Nickel
B1 1-3 feet	42.1	45.6	42.1	45.6
C1	1.4	13.2	1.4	13.2
C2	32.8	14.1	32.8	14.1
C3	61.6	47.5	61.6	47.5
C4	3.3	11.9	3.3	11.9
B1 3-5 feet	140	74.5	140	74.5
C1	1.3	14.9	1.3	14.9
C2	21.7	20	21.7	20
C3	17.2	31.7	17.2	31.7
C4	1.9	17.7	1.9	17.7
D1 1-3 feet	60.2	542	60.2	542
D2A	4.2	16.2	4.2	16.2
D3	0.6	7.6	0.6	7.6
D4	0.18	65.5	0.18	65.5
D5	0.42	16.4	0.42	16.4
TP1	2.3	135	2.3	135
TP2	7.2	82.4	7.2	82.4
D1 3-5 feet	4.8	69	4.8	69
D2A	4.8	2.4	4.8	2.4
D3	0.17	7.4	0.17	7.4
D4	0.25	9.7	0.25	9.7
D5	0.17	9.1	0.17	9.1
TP1	0.18	6.7	0.18	6.7
TP2	0.17	25	0.17	25

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations	Initial Soil Concentrations (mg/ kg)		Concentrations after Response Action to the Cleanup Action Level (mg/ kg)	
Locations	Cadmium	Nickel	Cadmium	Nickel
E1 1-3 feet	2.6	60	2.6	60
E2	514	346	514	346
E3	4.2	11.1	4.2	11.1
E4	6.7	59.4	6.7	59.4
E5	0.41	6.7	0.41	6.7
E6	1.6	25.3	1.6	25.3
E7	4.7	27.6	4.7	27.6
E8	2.7	25.4	2.7	25.4
E9	1.1	7.5	1.1	7.5
DE1	7.2	847	7.2	847
DE2	10	193	10	193
E1 3-5 feet	128	10200	128	10200
E2	0.21	7	0.21	7
E3	0.51	6.9	0.51	6.9
E4	2.1	47	2.1	47
E5	0.33	12.7	0.33	12.7
E6	1.1	20.4	1.1	20.4
E7	3.7	17.6	3.7	17.6
E8	19.1	119	19.1	119
E9	2.3	13	2.3	13
DE1	322	9760	322	9760
DE2	0.16	49.9	0.16	49.9
F1 1-3 feet	0.17	7.5	0.17	7.5
F2	0.8	18.4	0.8	18.4
F3	0.18	4.8	0.18	4.8
F4	3.8	79.6	3.8	79.6
F5	1040	4460	1040	4460
F6	0.8	15.7	0.8	15.7
TP3	114	9900	114	9900
TP4	4870	12800	4870	12800
TP5	65.3	41400	65.3	41400
F1 3-5 feet	0.45	7.2	0.45	7.2
F2	0.7	6.8	0.7	6.8
F3	0.31	11.8	0.31	11.8
F4	0.4	6.2	0.4	6.2
F5	13.9	132	13.9	132
F6	0.8	11.7	0.8	11.7
TP3	0.18	57.6	0.18	57.6
TP4	1.2	13.6	1.2	13.6
TP5	0.19	29.1	0.19	29.1

Table 5
Sampling Locations and Soil Concentrations
METCOA Restart Site, Pulaski, PA

Initial Soil Concentrations Locations	Initial Soil Concentrations (mg/ kg) Cadmium	Nickel	Concentrations after Response Action to the Cleanup Action Level (mg/ kg) Cadmium	Nickel
G1 1-3 feet	0.16	10.5	0.16	10.5
G2	0.16	7.7	0.16	7.7
G3	1.1	20.2	1.1	20.2
G4	2.3	43.1	2.3	43.1
G5	1.5	15.5	1.5	15.5
G6	2.6	14.7	2.6	14.7
G1 3-5 feet	0.17	7.2	0.17	7.2
G2	1	37.2	1	37.2
G3	0.78	40.1	0.78	40.1
G4	0.83	15.2	0.83	15.2
G5	0.17	7.2	0.17	7.2
G6	0.17	6.4	0.17	6.4
Phase 2 location 1 1-3 feet	7.535	20.75	7.535	20.75
location 2	35.5	1100	35.5	1100
location 3	22.7	113.4	22.7	113.4
location 4	17.9	96.4	17.9	96.4
location 5	216.45	589.7	216.45	589.7
location 6	41	1162.5	41	1162.5
Phase 2 location 1 3-5 feet	0.17	12.1	0.17	12.1
location 2	51.4	184	51.4	184
location 3	0.35	7.1	0.35	7.1
location 4	4.9	18.3	4.9	18.3
location 5	4	12.5	4	12.5
location 6	3.6	53.3	3.6	53.3

Phase 2 samples were collected adjacent to the Phase 1 sampling locations
(Phase 1 samples were collected for the Interim Data investigation)

Table 6
Upper 95% Confidence Limit of the Mean Concentration of Analytes in Soil
Used in Exposure Pathway Calculations for Children
METCOA Restart Site, Pulaski, PA

Chemical	Soil Concentration (mg/kg)
Cadmium	2.97E+03
Copper	8.79E+03
Lead	3.06E+02
Molybdenum	1.88E+02
Nickel	1.02E+04
Tungsten	3.38E+01

Table 7
Ingestion of Perimeter Soil by Children
METCOA Restart Site, Pulaski, PA

Intake (mg/kg/day) = $\frac{Cs*IR*EF*ED*CF}{BW*AT*365}$

Cs = Concentration in soil	= chemical specific		
IR = Ingestion rate	mg/day	100
EF = Exposure frequency	days/year	15
ED = Exposure duration	years	9
CF = Conversion factor (1 kg/1,000,000 mg)	kg/mg	1.00E-06
BW = Body weight	kg	51.8
AT = Averaging time for noncarcinogenic effects	years	9
and for carcinogenic effects	years	75

Chemical	Upper 95% of Confidence Interval of the of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Oral RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	2.97E+03	2.35E-04	1.00E-03	2.35E-01	2.82E-05	0.00E+00	0.00E+00
Copper	8.79E+03	6.95E-04	3.70E-02	1.88E-02	0.00E+00	0.00E+00	0.00E+00
Lead	3.06E+02	2.42E-05	2.80E-03	8.64E-03	2.90E-06	0.00E+00	0.00E+00
Molybdenum	1.88E+02	1.49E-05	4.00E-03	3.73E-03	0.00E+00	0.00E+00	0.00E+00
Nickel	1.02E+04	8.06E-04	2.00E-02	4.03E-02	9.67E-05	0.00E+00	0.00E+00
Tungsten	3.38E+01	2.67E-06	2.00E-02	1.34E-04	0.00E+00	0.00E+00	0.00E+00
			Total Hazard Index =	3.07E-01			0

Table 8
Dermal Exposure to Perimeter Soil by Children
METCOA Restart Site, Pulaski, PA

Dermal Absorbed Dose (mg/kg/day) = Cs*SA*AF*ABS*EF*ED*CF / BW*AT*365

Cs = Concentration in soil	= chemical specific		
SA = 31.3% of a child's (age 6-15 yrs) surface area is available for exposure	cm^2		14700
AF = Absorption factor	mg/cm^2		0.51
ABS for inorganics = (0.0001/hr)*(10 hr)			0.001
EF = Exposure frequency	days/year		15
ED = Exposure duration	years		9
CF = Conversion factor (1 kg/1,000,000 mg)	kg/mg		1.00E-06
BW = Body weight	kg		51.8
AT = Averaging time for noncarcinogenic effects	years		9
and for carcinogenic effects	years		75

Chemical	Upper 95% of Confidence Interval of the of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Dermal RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	2.97E+03	5.51E-06	1.00E-03	5.51E-03	6.61E-07	0	0
Copper	8.79E+03	1.63E-05	6.17E-02	2.64E-04	1.96E-06	0	0
Lead	3.06E+02	5.67E-07	1.87E-02	3.04E-05	6.81E-08	0	0
Molybdenum	1.88E+02	3.49E-07	4.00E-03	8.72E-05	4.18E-08	0	0
Nickel	1.02E+04	1.89E-05	4.65E-01	4.07E-05	2.27E-06	0	0
Tungsten	3.38E+01	6.27E-08	2.00E-02	3.13E-06	7.52E-09	0	0
		Total Hazard Index =		5.93E-03			0

Table 9
Upper 95% Confidence Limit of the Mean Concentration of Analytes in Soil
Used in Exposure Pathway Calculations for Construction Workers
METCOA Restart Site, Pulaski, PA

Chemical	Soil Concentration (mg/kg)
Cadmium	1.54E+03
Copper	5.88E+03
Lead	4.70E+02
Molybdenum	4.61E+02
Nickel	1.30E+04
Tungsten	6.05E+01

Table 10
Ingestion of Soil by Construction Workers
METCOA Restart Site, Pulaski, PA

Intake (mg/kg/day) = $\frac{Cs*IR*EF*ED*CF}{BW*AT*365}$

Cs = Concentration in soil	= chemical specific		
IR = Ingestion rate	mg/day	50
EF = Exposure frequency	days/year	125
ED = Exposure duration	year	1
CF = Conversion factor (1 kg/1,000,000 mg)	kg/mg	1.00E-06
BW = Body weight	kg	70
AT = Averaging time for noncarcinogenic effects	year	1
and for carcinogenic effects	years	75

Chemical	Upper 95% of Confidence Interval of the of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Oral RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	1.54E+03	3.77E-04	2.30E-03	1.64E-01	5.02E-06	0.00E+00	0.00E+00
Copper	5.88E+03	1.44E-03	3.70E-02	3.89E-02	0.00E+00	0.00E+00	0.00E+00
Lead	4.70E+02	1.15E-04	2.80E-03	4.11E-02	1.53E-06	0.00E+00	0.00E+00
Molybdenum	4.61E+02	1.13E-04	4.00E-03	2.83E-02	0.00E+00	0.00E+00	0.00E+00
Nickel	1.30E+04	3.18E-03	2.00E-02	1.59E-01	4.24E-05	0.00E+00	0.00E+00
Tungsten	6.05E+01	1.48E-05	2.00E-01	7.40E-05	0.00E+00	0.00E+00	0.00E+00
			Total Hazard Index =	4.31E-01			0

Table 11
Dermal Exposure to Soil by Construction Workers
METCOA Restart Site, Pulaski, PA

Dermal Absorbed Dose (mg/kg/day) = $\frac{Cs*SA*AF*ABS*EF*ED*CF}{BW*AT*365}$

Cs = Concentration in soil	= chemical specific	
SA = 10% of an adult's surface area is available for exposure	cm^2	20000
AF = Absorption factor	mg/cm^2	0.51
ABS for inorganics = (0.0001/hr)*(10 hr)		0.001
EF = Exposure frequency	days/year	125
ED = Exposure duration	year	1
CF = Conversion factor (1 kg/1,000,000 mg)	kg/mg	1.00E-06
BW = Body weight	kg	70
AT = Averaging time for noncarcinogenic effects	year	1
and for carcinogenic effects	years	75

Chemical	Upper 95% Confidence Interval of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Sub-Chronic Dermal RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	1.54E+03	7.68E-06	2.30E-03	3.34E-03	1.02E-07	0	0
Copper	5.88E+03	2.93E-05	6.17E-02	4.76E-04	3.91E-07	0	0
Lead	4.70E+02	2.35E-06	1.87E-02	1.26E-04	3.13E-08	0	0
Molybdenum	4.61E+02	2.30E-06	4.00E-03	5.75E-04	3.07E-08	0	0
Nickel	1.30E+04	6.49E-05	4.65E-01	1.39E-04	8.65E-07	0	0
Tungsten	6.05E+01	3.02E-07	2.00E-01	1.51E-06	4.03E-09	0	0
		Total Hazard Index =		4.66E-03			0

Table 12
Hazards and Risks Posed to Construction Workers During Excavation via Inhalation of Dust from Soil
METCOA Restart Site, Pulaski, PA

Parameters for calculation of average ambient air concentrations:

Downwind Ht =	meters	10.91
Width =	meters	167.00
Wind speed =	m/s	4.34
Length =	meters	167.00
Roughness Ht. =	meters	0.20
z:		167
Inhalation Rate =	cu.m/shift	20
Exposure Frequency =	days/year	125
Exposure Duration =	year	1

Chemical	Upper 95% of 5 feet of Soil Conc. (mg/kg)	Particle Emission Rate (mg/sec)	Contaminant Emission Rate (mg/sac)	Modelled Air Conc. (mg/m3)	Chron. Daily Intake * (mg/kg/day)	Inhalation RfD (mg/kg/day)	Cancer Potency Factor	Hazard Index (dim)	Carcin. Risk (dim)
Cadmium	1540	75.6	1.16E-01	1.47E-05	1.44E-06	5.80E-04	6.10E+00	2.48E-03	1.17E-07
Copper	5880	75.6	4.45E-01	5.62E-05	5.50E-06	1.00E-02		5.50E-04	
Lead	470	75.6	3.55E-02	4.49E-06	4.40E-07	4.29E-04		1.02E-03	
Molybdenum	461	75.6	3.49E-02	4.41E-06	4.31E-07	1.00E-01		4.31E-06	
Nickel	13000	75.6	9.83E-01	1.24E-04	1.22E-05	1.70E-04	8.40E-01	7.15E-02	1.36E-07
Tungsten	60.5	75.6	4.57E-03	5.78E-07	5.66E-08	5.10E-02		1.11E-06	
							Totals:	7.56E-02	2.53E-07

* Breathing Rate is 20 cubic meters per workshift (US. EPA HHEM 1991)

Table 13
Hazards and Risks Posed to Construction Workers from Vehicular Movement
via Inhalation of Dust from Soil
METCOA Restart Site, Pulaski, PA

Parameters for calculation of average ambient air concentrations:

Parameter	Units	Value
Downwind Ht =	meters	12.90
Width =	meters	211.00
Wind speed =	m/s	4.34
Length =	meters	211.00
Roughness Ht. =	meters	0.20
z:		211
Inhalation Rate =	cu.m/shift	20
Exposure Frequency =	days/year	125
Exposure Duration =	year	1

Chemical	Upper 95% of 5 feet of Soil Conc. (mg/kg)	Particle Emission Rate (mg/sec)	Contaminant Emission Rate (mg/sec)	Modelled Air Conc. (mg/m3)	Chron. Daily Intake * (mg/kg/day)	Inhalation RfD (mg/kg/day)	Cancer Potency Factor	Hazard Index (dim)	Carcin. Risk (dim)
Cadmium	3.77E+03	150	5.66E-01	4.79E-05	4.68E-06	5.80E-04	6.10E+00	8.08E-03	3.81E-07
Copper	1.43E+04	150	2.15E+00	1.82E-04	1.78E-05	1.00E-02		1.78E-03	
Lead	9.70E+02	150	1.46E-01	1.23E-05	1.21E-06	4.29E-04		2.81E-03	
Molybdenum	9.06E+02	150	1.36E-01	1.15E-05	1.13E-06	1.00E-01		1.13E-05	
Nickel	2.78E+04	150	4.17E+00	3.53E-04	3.45E-05	1.70E-04	8.40E-01	2.03E-01	3.87E-07
Tungsten	8.68E+01	150	1.30E-02	1.10E-06	1.08E-07	5.10E-02		2.11E-06	
							Totals:	1.27E-02	3.81E-07

* Breathing Rate is 20 cubic meters per workshift (US. EPA HHEM 1991)

Table 14
Upper 95% Confidence Limit of the Mean Concentration of Analytes in Soil Used in Exposure Pathway Calculations for Future Employees
METCOA Restart Site, Pulaski, PA

Chemical	Soil Concentration (mg/kg)
Cadmium	3.77E+03
Copper	1.43E+04
Lead	9.71E+02
Molybdenum	9.06E+02
Nickel	2.78E+04
Tungsten	8.68E+01

Table 15
Ingestion of Soil by Future Employees
METCOA Restart Site, Pulaski, PA

Intake (mg/kg/day) = Cs*IR*EF*ED*CF / BW*AT*365

Cs = Concentration in soil	= chemical specific		
IR = Ingestion rate		mg/day	50
EF = Exposure frequency		days/year	250
ED = Exposure duration		years	25
CF = Conversion factor (1 kg/1,000,000 mg)		kg/mg	1.00E-06
BW = Body weight		kg	70
AT = Averaging time for noncarcinogenic effects		years	25
and for carcinogenic effects		years	75

Chemical	Upper 95% of Confidence Interval of the of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Oral RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	3.77E+03	1.84E-03	1.00E-03	1.84E+00	6.15E-04	0.00E+00	0.00E+00
Copper	1.43E+04	7.00E-03	3.70E-02	1.89E-01	0.00E+00	0.00E+00	0.00E+00
Lead	9.71E+02	4.75E-04	2.80E-03	1.70E-01	1.58E-04	0.00E+00	0.00E+00
Molybdenum	9.06E+02	4.43E-04	4.00E-03	1.11E-01	0.00E+00	0.00E+00	0.00E+00
Nickel	2.78E+04	1.36E-02	2.00E-02	6.80E-01	4.53E-03	0.00E+00	0.00E+00
Tungsten	8.68E+01	4.25E-05	2.00E-02	2.13E-03	0.00E+00	0.00E+00	0.00E+00
			Total Hazard Index =	2.99E+00			0

Table 16
Dermal Exposure to Soil by Future Employees
METCOA Restart Site, Pulaski, PA

Dermal Absorbed Dose (mg/kg/day) = $\frac{Cs*SA*AF*ABS*EF*ED*CF}{BW*AT*365}$

Cs = Concentration in soil	= chemical specific	
SA = 10% of an adult's surface area is available for exposure	cm^2	20000
AF = Absorption factor	mg/cm^2	0.51
ABS for inorganics = (0.0001/hr)*(10 hr)		0.001
EF = Exposure frequency	days/year	250
ED = Exposure duration	years	25
CF = Conversion factor (1 kg/1,000,000 mg)	kg/mg	1.00E-06
BW = Body weight	kg	70
AT = Averaging time for noncarcinogenic effects	years	25
and for carcinogenic effects	years	75

Chemical	Upper 95% Confidence Interval of the Mean Concentration (mg/kg)	Average Daily Intake (non-cancer) (mg/kg/day)	Dermal RfD (mg/kg/day)	Hazard Quotient	Average Lifetime Daily Intake (cancer) (mg/kg/day)	Oral Cancer Potency Factor (risk units per mg/kg/day)	Upper Bound Cancer Risk
Cadmium	3.77E+03	3.76E-05	1.00E-03	3.76E-02	1.25E-05	0	0
Copper	1.43E+04	1.43E-04	6.17E-02	2.31E-03	4.76E-05	0	0
Lead	9.71E+02	9.69E-06	1.87E-02	5.19E-04	3.23E-06	0	0
Molybdenum	9.06E+02	9.04E-06	4.00E-03	2.26E-03	3.01E-06	0	0
Nickel	2.78E+04	2.77E-04	4.65E-01	5.97E-04	9.25E-05	0	0
Tungsten	8.68E+01	8.66E-07	2.00E-02	4.33E-05	2.89E-07	0	0
			Total Hazard Index =	4.34E-02			0

Table 17
Summary of Risk Calculations
METCOA Restart Site, Pulaski, PA

Scenario/Pathways	Potential Exposed Populations		Total Hazard Index	Total Cancer Risks
Incidental Ingestion of soil	Future employees		3	0
Dermal Absorption from soil	Future employees		0.04	0
		Subtotal	3	0
Incidental Ingestion of soil	Construction workers		0.4	0
Dermal Absorption from soil	Construction workers		0.005	0
Inhalation of fugitive dust from vehicular movement	Construction workers		0.01	4E-07
Inhalation of fugitive dust during excavation	Construction workers		0.08	2E-07
		Subtotal	0.5	6E-07
Incidental Ingestion of soil	Trespassing children		0.3	0
Dermal Absorption from soil	Trespassing children		0.006	0
		Subtotal	0.3	0

Table 18

Calculation of Relative Hazard and Average Concentrations Corresponding to Individual Hazard Quotients of 1.0 for Site Chemicals through Ingestion and Inhalation of Surface Soil by Future Workers Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equations for Non-Carcinogenic Effects METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = $\frac{Cs*10^{-6}*EF*ED*IngR}{(RfDo*BW*AT*365)} + \frac{Cs*EF*ED*InhR*(1/PEF)}{(RfDi*BW*AT*365)}$

Target Concentration in Soil = $\frac{THI*BW*AT*365}{ED*EF*[((1/RfDo)*10^{-6}*IngR) + ((1/RfDi)*InhR*(1/PEF))]}$

Cs = Concentration in soil

EF = Exposure Frequency	days/year =	250
ED = Exposure Duration	years =	25
IngR = Ingestion Rate	mg/day =	50
InhR = Inhalation Rate	cu. m/day =	20
PEF = Particulate Emission Factor	cu. m/kg	4.63E+09

RfDo = chemical specific oral chronic RfD mg/kg/day

RfDi = chemical specific inhalation chronic RfD mg/kg/day

BW = Body Weight	kg =	70
AT = Averaging Time	years =	25
365	days/year =	365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	RfD Oral (mg/kg/day)	RfD Inhalation (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index	Relative Hazard	Target Average Soil Concentration Corresponding to Individual Hazard Quotient of 1 (mg/kg)
Cadmium	3.77E+03	1.00E-03	5.80E-05	1.84E+00	2.75E-03	2	60.2%	2041
Copper	1.43E+04	3.70E-02	1.00E-02	1.89E-01	6.04E-05	0.2	6.16%	75604
Lead	9.71E+02	2.80E-03	4.29E-04	1.70E-01	9.57E-05	0.2	5.53%	5720
Molybdenum	9.06E+02	4.00E-03	1.00E-01	1.11E-01	3.83E-07	0.1	3.61%	8176
Nickel	2.78E+04	2.00E-02	1.70E-05	6.80E-01	6.91E-02	0.7	24.42%	37108
Tungsten	8.68E+01	2.00E-02	5.00E-02	2.12E-0[illegible]	7.34E-08	0.002	0.07%	40879
					Totals :	3	100.%	

Table 19

Calculation of Preliminary Target Soil Concentrations Using Relative Hazard for Site Chemicals through Ingestion and Inhalation of Surface Soil by Future Workers According to the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects Under Conditions of Industrial/Commercial Soil Exposure and Using Renal-Specific RfDs

METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = $\frac{Cs*10^{-6}*EF*ED*IngR}{(RfDo*BW*AT*365)} + \frac{Cs*EF*ED*InhR*(1/PEF)}{(RfDi*BW*AT*365)}$

Target Conc. in Soil = $\frac{THI*BW*AT*365}{ED*EF*[((1/RfDo)*10^{-6}*IngR) + ((1/RfDi)*InhR*(1/PEF))]}$

Cs = Concentration in soil

EF = Exposure Frequency days/year = 250

ED = Exposure Duration years = 25

IngR = Ingestion Rate mg/day = 50

InhR = Inhalation Rate cu. m/day = 20

PEF = Particulate Emission Factor cu. m/kg 4.63E+09

RfDo = chemical specific oral chronic RfD mg/kg/day

RfDi = chemical specific inhalation chronic RfD mg/kg/day

BW = Body Weight kg = 70

AT = Averaging Time years = 25

365 days/year = 365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	Renal-Specific RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Relative Contribution to Hazard	Preliminary Target Soil Concentration Corresponding to Combined Total Hazard Index of 1 (mg/kg)
Cadmium	3.77E+03	1.00E-03	5.80E-05	0.602	1229
Copper	1.43E+04	1.14E+00	1.00E-02	0.062	
Lead	9.71E+02	5.00E-03	4.29E-04	0.055	
Molybdenum	9.06E+02	1.40E-02	1.00E-01	0.036	
Nickel	2.78E+04	5.00E-02	1.70E-05	0.244	19898
Tungsten	8.68E+01	2.00E-02	5.00E-02	0.001	
			Total Hazard Index:	1.0	

Table 20a
Calculations of Target Response Cleanup Levels for Nickel
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects due to Industrial/Commercial Soil Exposure and Using Renal-Specific RfD Values
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs =	Concentration in soil		
EF =	Exposure Frequency	days/year =	250
ED =	Exposure Duration	years =	25
IngR =	Ingestion Rate	mg/day =	50
InhR =	Inhalation Rate	cu. m/day =	20
PEF =	Particulate Emission Factor	m^3/kg	4.63E+09
RfDo =	chemical specific oral chronic RfD mg/kg/day		
RfDi =	chemical specific inhalation chronic RfD mg/kg/day		
BW =	Body Weight	kg =	70
AT =	Averaging Time	years =	25
	365	days/year =	365

Back Calculation for Nickel Acceptable Upper 95% Confidence Interval Concentration

Conc in Soil = THI*BW*AT*365 / ED*EF*(((1/RfDo)*10^-6*IngR) + ((1/RfDi)*InhR*(1/PEF))

Chemical	RfDoral (mg/kg/day)	Inhalation RfD (mg/kg/day)	THI	Upper 95% Confidence of Conc in Soil
Nickel	2.00E-02	1.70E-05	5.00E-01	18554

Hazard Index Forward Calculation of Site Chemicals

Chemical	Conc. Soil (mg/kg)	Renal-Specific RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	See part b					
Copper	1.43E+04	1.14E+00	1.00E-02	6.14E-03	6.04E-05	6.20E-03
Lead	9.71E+02	5.00E-03	4.29E-04	9.50E-02	9.57E-05	9.51E-02
Molybdenum	9.06E+02	1.40E-02	1.00E-01	3.17E-02	3.83E-07	3.17E-02
Nickel	1.83E+04	2.00E-02	1.70E-05	4.47E-01	4.55E-02	4.93E-01
Tungsten	8.68E+01	2.00E-02	5.00E-02	2.12E-03	7.34E-08	2.12E-03
					total:	6E-01

Table 20b
Calculations of Target Response Cleanup Levels for Cadmium
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects due to Industrial/Commercial Soil Exposure and Using Renal-Specific RfD Values
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs = Concentration in soil		
EF = Exposure Frequency	days/year =	250
ED = Exposure Duration	years =	25
IngR = Ingestion Rate	mg/day =	50
InhR = Inhalation Rate	cu. m/day =	20
PEF = Particulate Emission Factor	m^3/kg	4.63E+09
RfDo = chemical specific oral chronic RfD mg/kg/day		
RfDi = chemical specific inhalation chronic RfD mg/kg/day		
BW = Body Weight	kg =	70
AT = Averaging Time	years =	25
365	days/year =	365

Hazard Index Forward Calculations for "Other" Chemicals

Chemical	Conc. Soil (mg/kg)	Renal-Specific RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Copper	1.43E+04	1.14E+00	1.00E-02	6.14E-03	6.04E-05	6.20E-03
Lead	9.71E+02	5.00E-03	4.29E-04	9.50E-02	9.57E-05	9.51E-02
Molybdenum	9.06E+02	1.40E-02	1.00E-01	3.17E-02	3.83E-07	3.17E-02
Nickel	1.83E+04	5.00E-02	1.70E-05	1.79E-01	4.55E-02	2.24E-01
Tungsten	8.68E+01	2.00E-02	5.00E-02	2.12E-03	7.34E-08	2.12E-03
					total:	3.59E-01
					1-total THI	6.41E-01
					Target Hazard Index for Cadmium =	6.41E-01

Back Calculation for Cadmium and Nickel Acceptable Upper 95% Confidence Interval Concentration

Conc in Soil = THI*BW*AT*365 / ED*EF*[((1/RfDo)*10^-6*IngR) + ((1/RfDi)*InhR*(1/PEF))]

Chemical	RfDoral (mg/kg/day)	Inhalation RfD (mg/kg/day)	THI	Upper 95% Confidence of Conc in Soil
[redacted]		5.80E-05	6.41E-01	1307

Hazard Index Forward Calculation of Site Chemicals

Chemical	Conc. Soil (mg/kg)	Renal-Specific RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	1.28E+03	1.00E-03	5.80E-05	6.27E-01	9.34E-04	6.28E-01
Copper	1.43E+04	1.14E+00	1.00E-02	6.14E-03	6.04E-05	6.20E-03
Lead	9.71E+02	5.00E-03	4.29E-04	9.50E-02	9.57E-05	9.51E-02
Molybdenum	9.06E+02	1.40E-02	1.00E-01	3.17E-02	3.83E-07	3.17E-02
Nickel	1.83E+04	5.00E-02	1.70E-05	1.79E-01	4.55E-02	2.24E-01
Tungsten	8.68E+01	2.00E-02	5.00E-02	2.12E-03	7.34E-08	2.12E-03
					total:	1E+00

Table 21
Calculations of Cancer Risk through Ingestion and Inhalation of Surface Soil by Future Workers
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Cancer Risk
Under Conditions of Industrial/Commercial Soil Exposure
METCOA Restart Site, Pulaski, PA

$$\text{TR = Target Excess Individual Lifetime Cancer Risk} = \frac{SFo*C*10^{-6}*EF*ED*IRs}{BW*AT*365} + \frac{SFi*C*EF*ED*IRs*(1/PEF)}{BW*AT*365}$$

$$\text{Risked Based Concentration} = \frac{TR*BW*AT*365}{EF*ED((SFo*10\text{-}6*IRs) + (SFi*IRs*(1/PEF)))}$$

Concentration in Soil (mg/kg) = chemical specific
Slope Factor Oral (1/mg/kg/day) = chemical specific
Slope Factor inh (1/mg/kg/day) = chemical specific
Ingestion Rate (mg/day) = 50
Inhalation Rate (cu m./day) = 20
Particulate Emission Factor (cu. m/kg) = 4.63E+09

Target Excess Individual Lifetime Cancer Risk (unitless) = 1.00E-06
Exposure Frequency (days/year) = 250
Exposure Duration (years) = 25
Body Weight (kg) = 70
Averaging Time (years) = 70
365 days/year = 365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration	Slope Factor Oral (1/mg/kg/day)	Slope Factor Inhalation (1/mg/kg/day)	Cancer Risk Oral	Cancer Risk Inhalation	Total Cancer Risk
Cadmium	3.77E+03	0	6.10E+00	0	1.74E-08	1.74E-08
Copper	1.43E+04	0	0	0	0	0
Lead	9.71E+02	0	0	0	0	0
Molybdenum	9.06E+02	0	0	0	0	0
Nickel	2.78E+04	0	8.40E-01	0	1.76E-08	1.76E-08
Tungsten	8.68E+01	0	0	0	0	0

Total Cancer Risk = 3E-08

Table 22
Calculations of Hazard Index through Ingestion and Inhalation of Surface Soil by Future Workers Using the U.S. EPA RAGS 1991 Parts B & C Default Industrial/Commercial Equation Values for Non-Carcinogenic Effects due to Exposure to Soil Contaminants
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs = Concentration in soil		
EF = Exposure Frequency	days/year =	250
ED = Exposure Duration	years =	25
IngR = Ingestion Rate	mg/day =	50
InhR = Inhalation Rate	cu. m/day =	20
PEF = Particulate Emission Factor	m^3/kg	4.63E+09
RfDo = chemical specific oral chronic RfD mg/kg/day		
RfDi = chemical specific inhalation chronic RfD mg/kg/day		
BW = Body Weight	kg =	70
AT = Averaging Time	years =	25
365	days/year =	365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	RfDoral (mg/kg/day)	RfD Inhalation (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	3.77E+03	1.00E-03	5.80E-05	1.84E+00	2.75E-03	1.85E+00
Copper	1.43E+04	3.70E-02	1.00E-02	1.89E-01	6.04E-05	1.89E-01
Lead	9.71E+02	2.80E-03	4.29E-04	1.70E-01	9.57E-05	1.70E-01
Molybdenum	9.06E+02	4.00E-03	1.00E-01	1.11E-01	3.83E-07	1.11E-01
Nickel	2.78E+04	2.00E-02	1.70E-05	6.80E-01	6.91E-02	7.49E-01
Tungsten	8.68E+01	2.00E-02	5.00E-02	2.12E-03	7.34E-08	2.12E-03
					Total Hazard Index =	3E+00

Table 23
Calculations of Cancer Risk through Ingestion and Inhalation of
Surface and Sub-Surface Soil by Future Workers
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Cancer Risk
Under Conditions of Industrial/Commercial Soil Exposure
METCOA Restart Site, Pulaski, PA

TR = Target Excess Individual Lifetime Cancer Risk = $\frac{SFo*C*10^{-6}*EF*ED*IRs}{BW*AT*365} + \frac{SFi*C*EF*ED*IRa*(1/PEF)}{BW*AT*365}$

Risked Based Concentration = $\frac{TR*BW*AT*365}{EF*ED((SFo*10\text{-}6*IRs) + (SFi*IRa*(1/PEF)))}$

Target Excess Individual Lifetime Cancer Risk (unitless) = 1.00E-06
Exposure Frequency (days/year) = 250
Exposure Duration (years) = 25
Body Weight (kg) = 70
Averaging Time (years) = 70
365 days/year = 365

Concentration in Soil (mg/kg) = chemical specific
Slope Factor Oral (1/mg/kg/day) = chemical specific
Slope Factor inh (1/mg/kg/day) = chemical specific
Ingestion Rate (mg/day) = 50
Inhalation Rate (cu m./day) = 20
Particulate Emission Factor (cu. m/kg) = 4.63E+09

Chemical	Upper 95% of Confidence Interval of the Mean Concentration	Slope Factor Oral (1/mg/kg/day)	Slope Factor Inhalation (1/mg/kg/day)	Cancer Risk Oral	Cancer Risk Inhalation	Total Cancer Risk
Cadmium	2.21E+03	0	6.10E+00	0	1.02E-08	1.02E-08
Copper	6.96E+03	0	0	0	0	0
Lead	4.19E+02	0	0	0	0	0
Molybdenum	3.90E+02	0	0	0	0	0
Nickel	1.21E+04	0	8.40E-01	0	7.67E-09	7.67E-09
Tungsten	5.30E+01	0	0	0	0	0

Total Cancer Risk = 2E-08

Table 24
Calculations of Hazard Index from Ingestion and Inhalation of
Surface and Sub-Surface Soil by Future Workers
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation Under Conditions of
Industrial/Commercial Soil Exposure for Non-Carcinogenic Effects
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs = Concentration in soil			
EF = Exposure Frequency	days/year =	250	
ED = Exposure Duration	years =	25	
IngR = Ingestion Rate	mg/day =	50	
InhR = Inhalation Rate	cu. m/day =	20	
PEF = Particulate Emission Factor	m^3/kg	4.63E+09	
RfDo = chemical specific oral chronic RfD mg/kg/day			
RfDi = chemical specific inhalation chronic RfD mg/kg/day			
BW = Body Weight	kg =	70	
AT = Averaging Time	years =	25	
365	days/year =	365	

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	RfDoral (mg/kg/day)	RfD Inhalation (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	2.21E+03	1.00E-03	5.80E-05	1.08E+00	1.61E-03	1.08E+00
Copper	6.96E+03	3.70E-02	1.00E-02	9.20E-02	2.94E-05	9.21E-02
Lead	4.19E+02	2.80E-03	4.29E-04	7.32E-02	4.13E-05	7.33E-02
Molybdenum	3.90E+02	4.00E-03	1.00E-01	4.77E-02	1.65E-07	4.77E-02
Nickel	1.21E+04	2.00E-02	1.70E-05	2.96E-01	3.01E-02	3.26E-01
Tungsten	5.30E+01	2.00E-02	5.00E-02	1.30E-03	4.48E-08	1.30E-03
				Total Hazard Index =		1.6E+00

Table 25
Calculations of Hazard Index through Ingestion and Inhalation of
Surface and Sub-Surface Soil by Future Workers
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects due to Industrial/Commercial Soil Exposure and Using Renal-Specific RfD Values
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs = Concentration in soil		
EF = Exposure Frequency	days/year =	250
ED = Exposure Duration	years =	25
IngR = Ingestion Rate	mg/day =	50
InhR = Inhalation Rate	cu. m/day =	20
PEF = Particulate Emission Factor	m^3/kg	4.63E+09
RfDo = chemical specific oral chronic RfD mg/kg/day		
RfDi = chemical specific inhalation chronic RfD mg/kg/day		
BW = Body Weight	kg =	70
AT = Averaging Time	years =	25
365	days/year =	365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	RfDoral (mg/kg/day)	RfD Inhalation (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	2.12E+03	1.00E-03	5.80E-05	1.04E+00	1.54E-03	1.04E+00
Copper	6.96E+03	1.14E+00	1.00E-02	2.99E-03	2.94E-05	3.02E-03
Lead	4.19E+00	5.00E-03	4.29E-04	4.10E-04	4.13E-07	4.10E-04
Molybdenum	3.90E+02	1.40E-02	1.00E-01	1.36E-02	1.65E-07	1.36E-02
Nickel	1.21E+04	5.00E-02	1.70E-05	1.18E-01	3.01E-02	1.48E-01
Tungsten	5.30E+01	2.00E-02	5.00E-02	1.30E-03	4.48E-08	1.30E-03
					Total Hazard Index =	1E+00

Table 26

Calculations of Hazard Index through Ingestion and Inhalation of Sub-Surface and Remediated Surface Soil by Future Workers
Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects due to Industrial/Commercial Soil Exposure
METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = Cs*10^-6*EF*ED*IngR / (RfDo*BW*AT*365) + Cs*EF*ED*InhR*(1/PEF) / (RfDi*BW*AT*365)

Cs	= Concentration in soil		
EF	= Exposure Frequency	days/year =	250
ED	= Exposure Duration	years =	25
IngR	= Ingestion Rate	mg/day =	50
InhR	= Inhalation Rate	cu. m/day =	20
PEF	= Particulate Emission Factor	m^3/kg	4.63E+09
RfDo	= chemical specific oral chronic RfD mg/kg/day		
RfDi	= chemical specific inhalation chronic RfD mg/kg/day		
BW	= Body Weight	kg =	70
AT	= Averaging Time	years =	25
	365	days/year =	365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	6.70E+02	1.00E-03	5.80E-05	3.28E-01	4.88E-04	3.28E-01
Copper	6.96E+03	3.70E-02	1.00E-02	9.20E-02	2.94E-05	9.21E-02
Lead	4.19E+02	2.80E-03	4.29E-04	7.32E-02	4.13E-05	7.33E-02
Molybdenum	3.90E+02	4.00E-03	1.00E-01	4.77E-02	1.85E-07	4.77E-02
Nickel	9.83E+03	2.00E-02	1.70E-05	2.40E-01	2.44E-02	2.65E-01
Tungsten	5.30E+01	2.00E-02	5.00E-02	1.30E-03	4.48E-08	1.30E-03
				Total Hazard Index =		8E-01

Table 27
Calculations of Hazard Index through Ingestion and Inhalation of Sub-Surface and Remediated Surface Soil by Future Workers Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation for Non-Carcinogenic Effects due to Industrial/Commercial Soil Exposure and Using Renal-Specific RfD Values METCOA Restart Site, Pulaski, PA

Target Hazard Index (THI) = $\frac{Cs*10^{-6}*EF*ED*IngR}{(RfDo*BW*AT*365)} + \frac{Cs*EF*ED*InhR*(1/PEF)}{(RfDi*BW*AT*365)}$

Cs =	Concentration in soil		
EF =	Exposure Frequency	days/year =	250
ED =	Exposure Duration	years =	25
IngR =	Ingestion Rate	mg/day =	50
InhR =	Inhalation Rate	cu. m/day =	20
PEF =	Particulate Emission Factor	m^3/kg	4.63E+09
RfDo =	chemical specific oral chronic RfD mg/kg/day		
RfDi =	chemical specific inhalation chronic RfD mg/kg/day		
BW =	Body Weight	kg =	70
AT =	Averaging Time	years =	25
	365	days/year =	365

Chemical	Upper 95% of Confidence Interval of the Mean Concentration (mg/kg)	Renal-Specific RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Ingestion Hazard Index	Inhalation Hazard Index	Total Hazard Index
Cadmium	6.70E+02	1.00E-03	5.80E-05	3.28E-01	4.88E-04	3.28E-01
Copper	6.96E+03	1.14E+00	1.00E-02	2.99E-03	2.94E-05	3.02E-03
Lead	4.19E+02	5.00E-03	4.29E-04	4.10E-02	4.13E-05	4.10E-02
Molybdenum	3.90E+02	1.40E-02	1.00E-01	1.36E-02	1.65E-07	1.36E-02
Nickel	9.83E+03	5.00E-02	1.70E-05	9.62E-02	2.44E-02	1.21E-01
Tungsten	5.30E+01	2.00E-02	5.00E-02	1.30E-03	4.48E-08	1.30E-03

Total Hazard Index = 5E-01

Table 28
Calculations of Cancer Risk through Ingestion and Inhalation of Sub-Surface and Remediated Surface Soil by Future Workers Using the U.S. EPA RAGS 1991 Parts B & C Default Risk Equation Under Conditions of Industrial/Commercial Soil Exposure for Carcinogenic Effects METCOA Restart Site, Pulaski, PA

TR = Target Excess Individual Lifetime Cancer Risk =

$$\frac{SFo*C*10^{-6}*EF*ED*IRs}{BW*AT*365} + \frac{SFi*C*EF*ED*IRa*(1/PEF)}{BW*AT*365}$$

Risked Based Concentration =

$$\frac{TR*BW*AT*365}{EF*ED((SFo*10\text{-}6*IRs) + (SFi*IRa*(1/PEF)))}$$

Target Excess Individual Lifetime Cancer Risk (unitless) = 1.00E-06

Concentration in Soil (mg/kg) =	chemical specific	Exposure Frequency (days/year) =	250
Slope Factor Oral (1/mg/kg/day) =	chemical specific	Exposure Duration (years) =	25
Slope Factor inh (1/mg/kg/day) =	chemical specific	Body Weight (kg) =	70
Ingestion Rate (mg/day) =	50	Averaging Time (years) =	70
Inhalation Rate (cu m./day) =	20	365 days/year =	365
Particulate Emission Factor (cu. m/kg) =	4.63E+09		

Chemical	Upper 95% of Confidence Interval of the Mean Concentration	Slope Factor Oral (1/mg/kg/day)	Slope Factor Inhalation (1/mg/kg/day)	Cancer Risk Oral	Cancer Risk Inhalation	Total Cancer Risk
Cadmium	6.70E+02	0	6.10E+00	0	3.08E-09	3.08E-09
Copper	6.96E+03	0	0	0	0	0
Lead	4.19E+02	0	0	0	0	0
Molybdenum	3.90E+02	0	0	0	0	0
Nickel	9.83E+03	0	8.40E-01	0	6.23E-09	6.23E-09
Tungsten	5.30E+01	0	0	0	0	0

Total Cancer Risk = 9E-09

TOXICITY PROFILE FOR TUNGSTEN

Tungsten is found worldwide in various tungstate minerals. It is one of the rarer metals comprising about 1.5 ppm of the earth's crust. It is used to increase the hardness, toughness, elasticity and tensile strength of steel. Other uses include alloys, especially for high-strength alloys, incandescent lamp filaments, and compounds used as pigments, catalysts and analytical reagents. Traces of tungsten have been found in seawater and small concentrations, usually less than 1.5 ng/m^3, have been detected in air. One study estimated dietary intake of tungsten to range from 8 to 13 μg/day (HSDB, 1991; Carson et al., 1986).

Industrial experience has indicated no pneumoconiosis to develop among workers exposed solely to tungsten when air concentrations were about 5 mg/m^3. There is no evidence of acute toxicity of tungsten and its compounds in humans. Lethal and near-lethal doses produce nervous prostration, diarrhea, coma and death due to respiratory paralysis. Repeated doses not immediately fatal cause anorexia, colic, uncoordinated movements, trembling and weight loss (HSDB, 1991; Carson et al., 1986).

Oral Exposure

The U.S. EPA has not published oral risk reference dose (RfD) values for subchronic or chronic exposure to tungsten. No adverse effects were observed in patients given 25 to 80 g of powdered tungsten metal by mouth as a substitute for barium in radiological examinations. Tungsten metal powder given to weanling rats for 70 days at levels of 2, 5 and 10% of their diet, resulted in no effect on growth rate of male rats but a 15% decrease in weight gain in females when compared to controls. No oral dose-response data were available to derive an RfD (HSDB, 1991).

An LD_{50} of 2 g/kg for rats is listed in RTECS (1991). Where long-term dose-response or dose effect data are nonexistent, it is useful to rely on whatever toxicity information is available. Layton *et al.* (1987) compared oral LD_{50} values with acceptable daily intake (ADI) values derived from classical long-term no-observable-effect levels (NOELs) for a large number of chemicals and demonstrated that the lower-bound estimate of a ratio of chronic NOELs to oral LD_{50} values was from 5×10^{-4} to 1×10^{-3} day^{-1}. Applying an additional safety factor of 100 to conservatively derive ADIs, these authors revealed that a ratio of 1×10^{-5} day^{-1} applied to an LD_{50} would provide a high probability (>95%) of the ADI being below a human toxic intake level. That is, if the ADI could be computed from a NOEL determined in a well-conducted, chronic toxicity study, it would nearly always be higher than the value determined from the LD_{50}. A provisional chronic oral RfD is derived as follows:

$$pRfD_{c\text{-}o} = 2000 \text{ mg/kg} \times 1 \times 10^{-5} \text{ day}^{-1} = 2 \times 10^{-2} \text{ mg/kg/day}$$

The subchronic provisional value is determined by multiplying the interim chronic value by a factor of 5 to 10 (Layton et al., 1987).

$$pRfD_{s-o} = 2 \times 10^{-1} \text{ mg/kg/day}$$

Inhalation Exposure

There are no published risk reference concentrations (RfCs) for tungsten in the most recent Health Effects Assessment Summary Tables (HEAST, 1991) or Integrated Risk Information System (IRIS, 1991). Tungsten dust introduced into the trachea of rats at 50 mg resulted in proliferation of the intra-alveolar septa, especially in those areas where dust had visibly accumulated. The TLV for tungsten insoluble compounds is 5 mg/m^3. Utilizing this TLV, in the absence of adequate inhalation dose-effect data, and assuming a 70-kg worker inhales 10 m^3 of air per workday, applying an uncertainty factor of 10 to account for sensitive human subpopulations and correcting for 7-day exposure instead of 5-day exposure, provisional values are derived as follows:

$$pRfD_{c-i} = \frac{5 \text{ mg/m}^3}{10} \times \frac{5 \text{ days}}{7 \text{ days}} \times \frac{10 \text{ m}^3\text{/day}}{70 \text{ kg}} = 5.1 \times 10^{-2} \text{ mg/kg/day (administered dose)}$$

$$pRfD_{s-i} = 5.1 \times 10^{-2} \text{ mg/kg/day (administered dose)}$$

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TOXICITY PROFILE FOR CADMIUM

Cadmium is a naturally occurring metal used in electroplating, nickel-cadmium batteries, paint, and pigments (U.S. EPA, 1985). Data collected by EPA shows mean levels of cadmium in air to typically range from 0.0005-0.01 $\mu g/m^3$. Using 0.01 $\mu g/m^3$ as typical high value and 20 m^3/day as the ventilation rate, the respiratory intake for the adult male would be up to 0.20 μg/day (U.S. EPA, 1985).

Acute and chronic exposure to cadmium in animals and humans results in renal dysfunction, hypertension, anemia and altered liver microsomal activity. The kidney is considered to be the critical target organ in humans chronically exposed to cadmium by ingestion. The early clinical signs of renal injury include proteinuria, glucosuria and aminoaciduria (U.S. EPA, 1985).

Cadmium and cadmium compounds have been shown to induce sarcomas at injection sites in animals when administered parenterally, and cadmium chloride given by aerosol for 18 months can produce lung tumors in rats (U.S. EPA, 1985). Cadmium is classified by EPA as a Group B1 carcinogen (probable human carcinogen) via inhalation exposure. ACGIH set a TLV of 0.05 mg/m^3 for cadmium dust, fume, salts, and cadmium oxide. The PEL for cadmium fume is 0.1 mg/m^3 and 0.2 mg/m^3 for cadmium dust.

<u>Oral Exposure</u>

The U.S. EPA has derived two separate chronic oral RfD values for cadmium: one for cadmium in drinking water and another for cadmium in food. (U.S. EPA, HEAST, 3rd Q, 1990), presumably to reflect the lower bioavailability of cadmium in food, soils, *etc.*

verified $RfD_{o\text{-}o}$ (water) = 5×10^{-4} (applies to oral intake)

verified $RfD_{o\text{-}o}$ (food) = 1×10^{-3} (applies to oral intake)

Because of background dietary exposure, a subchronic oral RfD value was not estimated by EPA. No inhalation RfDs are listed in EPA's IRIS data base or the most recent HEAST (1991). There is inadequate evidence for the carcinogenicity of cadmium by the oral route of exposure.

Friberg *et al.* (1974) employed toxicokinetic data on typical cadmium absorption (4.5%) and excretion (0.01% of the total body burden per day) to calculate that intake of 0.35 mg/day (0.005 mg/kg/day) would approach the critical (threshold) concentration in kidney after 50 years of exposure. This indirectly calculated value is in good agreement with direct estimates of the average daily dietary intake (about 0.6 mg/day) in patients suffering from cadmium-induced toxicity in Japan (Yemagata and Shigematsu, 1970).

Because the typical total daily intake (dietary and inhalation) for the adult male is estimated to be about 0.028 mg/day, additional oral intake of about 0.32 mg of cadmium per day over a period of 50 years is believed to put an average individual at risk of latent renal dysfunction. For purposes of defining a subchronic provisional oral RfD (14 days to 7 years), this calculated near-lifetime benchmark provides a realistic basis for incorporating an added margin of safety for a subchronic exposure duration. By applying an additional modifying factor of 2 to account for variability, a provisional subchronic oral RfD may be derived as follows:

$$pRfD_{s\text{-}o} = \frac{0.32\ mg/day}{2} \div 70\ kg = 2.3 \times 10^{-3}\ mg/kg/day$$

(applies to oral intake: no correction for absorption needed)

<u>Inhalation Exposure</u>

The human NOAEL for cadmium is lower than animal NOAEL values for any organ systems studied (ATSDR, 1987), and human data are preferred over animal data whenever good dose-response information is available. The lowest estimated acute lethal air concentration of cadmium oxide in humans is 2500 mg - min/m^3 (Barrett *et al.*, 1947; Beton *et al.*, 1966). This corresponds to a concentration of about 250 mg/m^3 for a 10-minute exposure, or about 5 mg/m^3 for an eight-hour exposure (Friberg *et al.*, 1974). Friberg reports 1 mg/m^3 for 8 hours as the IDLH (immediately dangerous to life and health) level. Bernard and Lauwerys (1986) report that acute exposure to 0.2 to 0.5 mg/m^3 may cause mild and reversible symptoms similar to metal fume fever. The WHO (1980) identified 0.5 mg/m^3 as the threshold for respiratory effects in humans following an 8-hour exposure.

At lower levels of chronic exposure, the principal target organs are the lungs and kidneys (chronic obstructive lung disease such as fibrosis and emphysema, and microglobinuria for renal injury). At low levels, inhalation exposure effects are most prominent on the kidney without marked lung injury.

Epidemiological data taken together from a variety of studies reveal a time- and dose-dependency for cadmium-induced renal injury, with a value of about 500 (μg/m^3)-years being associated with proteinuria in some exposed workers (ATSDR, 1987). Based on a review of a number of studies (mostly in occupationally exposed groups), the World Health Organization (WHO, 1980) concluded that the 8-hour time-weighted average concentration over a 20-year period should not exceed 0.02 mg/m^3 [400 (μg/m^3)-years].

ATSDR (1987) defines this as a human NOAEL. Correcting for lifetime exposure and applying a UF of 10, a provisional, chronic inhalation RfD is derived assuming a 70-kg adult male worker breathes on average 10 m^3 per 8-hr workshift, as follows:

$$pRfD_{c\text{-}i} = \frac{0.02\ mg/m^3}{10} \times \frac{5\ days}{7\ days} \times \frac{20\ years}{70\ years} \times \frac{10\ m^3}{70\ kg} =$$

$$= 5.8 \times 10^{-5}\ mg/kg/day$$ (this value applies to inhaled dose)

For subchronic exposures, EPA recommends a maximum duration of 7 years. Accordingly, a subchronic provisional inhalation RfD value is derived as follows:

$$pRfD_{s\text{-}i} = \frac{0.02\ mg/m^3}{10} \times \frac{5\ days}{7\ days} \times \frac{20\ years}{7\ years} \times \frac{10\ m^3}{70\ kg}$$

$$= 5.8 \times 10^{-4}\ mg/kg/day$$ (administered dose)

With regard to carcinogenic risk from inhalation of cadmium dusts or compounds, the U.S. EPA (HEAST, 1991) lists an upper-bound slope factor (cancer potency factor) of 6.1 risk units per mg/kg/day of daily lifetime exposure. "Cd compounds have not been observed to cause significant health effects when exposure is by the dermal route" (ATSDR, 1987).

Small quantities of Cd may be absorbed through the skin (Wahlberg, 1965), but dermal absorption is not normally a significant fraction of total Cd absorption (Faulkes, 1986).

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TOXICITY PROFILE FOR COPPER

Copper is ubiquitous in the earth's crust, occurring commonly as sulfides and oxides and occasionally as metallic copper. Copper is regarded as an essential element in mammalian nutrition because it is required in many enzymatic reactions (U.S. EPA, 1985).

A daily copper intake of 2 mg is considered to be adequate for health and normal copper metabolism. The normal daily adult intake of copper from food in the U.S. is reported to range from 2.0 to 4.0 mg per day (U.S. EPA, 1985).

Copper has toxic effects at high dose levels and is an essential element at lower levels (U.S. EPA, 1985). In individuals with a normal copper metabolism and normal levels of glucose-6-phosphate dehydrogenase, there seems to be a wide separation between required levels and toxic levels (U.S. EPA, 1984). Toxic effects resulting from acute exposure to copper in laboratory animals and humans include gastrointestinal disturbances, hemolytic anemia, renal damage, liver damage and glucose-6-phosphate dehydrogenase inhibition. Limited data are available on the chronic toxicity of copper. Efficient homeostatic mechanisms generally protect mammals from the adverse effects of dietary copper excess (U.S. EPA, 1985).
EPA classifies copper as a Group D carcinogen (not classifiable as to human carcinogenicity).

Copper fume has a TLV and PEL of 0.1 mg/m^3 and copper dusts and mists have a TLV and PEL of 1.0 mg/m^3.

Oral Exposure

The U.S. EPA (HEAST, 3rd Q, 1990; IRIS, 1990; U.S. EPA, 1987) has concluded that the toxicity data were inadequate for calculation of an RfD for copper. The IRIS database and most recent HEAST list a value of 1.3 mg/L in drinking water as the chronic and subchronic oral RfD values. This concentration is equivalent to the proposed MCL and MCLG (Safe Drinking Water Act) for copper in public water supplies (U.S. EPA, 1988).

Assuming a water consumption of 2 liters/day by a 70-kg adult, a corresponding RfD is derived as follows:

$$RfD_{c\text{-}o,\ s\text{-}o} = 1.3\ mg/L \times \frac{2\ L/day}{70\ kg} = 3.7 \times 10^{-2}\ mg/kg/day$$

An equivalent value is suggested for subchronic as EPA has indicated equivalent values in its IRIS and HEAST criteria.

For purposes of perspective it may be noted that a concentration of 15 ppm in pig feed is Generally Recognized As Safe (GRAS, NAS, 1977). The Recommended Daily Allowance (RDA) for copper in man is 2 to 5 mg (NAS, 1980).

Inhalation Exposure

No satisfactory toxicity data have been located regarding effects of subchronic or chronic inhalation of copper and its compounds. In its Health Effects Assessment of Copper (U.S. EPA, 1984), EPA published an inhalation AIC (Acceptable Intake for Chronic exposure) based upon the TLV.

> "Since these TLVs were based on extensive experience with industrial exposure, and since no animal toxicity studies were available, it was deemed prudent to use the TLVs as a starting point to derive a maximum tolerated chronic inhalation dose."

Assuming a 70-kg worker inhales 10 m^3 of air in a workday and works 5 days per week, the dose of copper vapor expected to be inhaled is estimated to be 1.4 mg Cu/day. Similarly, starting with a TLV of 1.0 mg copper dust or mist/m^3 of air, the dose is equivalent to 7.14 mg Cu/day. A UF of 10 is introduced to provide an additional safety factor for highly sensitive subpopulations. Dividing the average dose per day by the body weight and the uncertainty factor of 10 results in an AIC for chronic inhalation exposure of 2×10^{-3} mg copper vapors/kg/day and a 1.0×10^{-2} mg copper mists or dusts/day (U.S. EPA, 1984). Because welding or very high temperatures are not likely scenarios at sites where environmental media are contaminated by copper, the provisional inhalation RfDs are most appropriately based on copper dusts (*i.e.*, formation of copper vapor is a highly unlikely event). In accordance with the HEA, a provisional chronic inhalation value is derived as follows, based on the TLV for copper dusts:

$$pRfD_{c\text{-}i} = \frac{1.0\ mg/m^3}{10} \times \frac{10\ m^3}{70\ kg} \times \frac{5\ days}{7\ days} = 1.0 \times 10^{-2}\ mg/kg/day$$

(no correction for pulmonary absorption needed)

A similar value is recommended for subchronic inhalation exposure:

$$pRfD_{s\text{-}i} = 1 \times 10^{-2}\ mg/kg/day$$

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TOXICITY PROFILE FOR LEAD

Lead (Pb) is a relatively rare metal in the earth's crust. About 65 percent of the lead produced is used for the manufacture of storage batteries.

In rural areas, Americans not occupationally exposed to lead are estimated to consume 40-60 μg Pb/day. This level of exposure is referred to as the baseline exposure for the American population because it is unavoidable except by drastic change in lifestyle or by unrealistic regulation of lead in foods or ambient air (U.S. EPA, 1985).

Children represent a sensitive subpopulation with regard to lead toxicity. The most serious effects associated with markedly elevated blood lead (PbB) levels are severe neurotoxic effects that include irreversible brain damage, as indexed by the occurrence of acute or chronic encephalopathic symptoms; for most adults such damage typically does not occur until PbB levels exceed 100-120 μg/dl. Effective blood levels for producing encephalopathy or death in children are lower than for adults, starting at approximately 80-100 μg/dl. Much lower PbB levels may be associated with neurological and behavioral deficits in young children.

Experimental evidence exists for carcinogenic activity (renal tumors) associated with oral ingestion of high doses of lead in at least one mammalian species (*i.e.*, the rat) and some cases of renal tumors in long-exposed human lead workers. Lead has been classified in EPA's Group B2, according to EPA's Proposed Guidelines for Carcinogen Risk Assessment based upon evidence of kidney tumors in rats by the oral route, but no potency factors have been published to date by EPA. The TLV for lead is 0.15 mg/m³.

<u>Inhalation exposure</u>

For inhalation, it is recommended that air emissions of lead in entrained dusts be compared with the National Ambient Air Quality Standard for Pb of 1.5 $\mu g/m^3$. This should supersede the need for deriving provisional inhalation RfD values, however, for the purpose of consistency in units, the values in terms of mg/kg/day may be derived as follows:

$$RfD_{s\text{-}i} = \frac{1.5\ \mu g/m^3}{70\ kg} \times \frac{1\ mg}{1000\ \mu g} \times 20\ m^3/day = 4.29 \times 10^{-4}\ mg/kg/day$$

$$RfD_{s\text{-}i} = 4.29 \times 10^{-4}\ mg/kg/day$$

Oral exposure

In deriving the proposed MCLG of 20 μg/L in drinking water in 1985, EPA assumed that 15 μg/dl was the blood level of concern for infants and that infants receive 100% of their lead exposure from tap water used in reconstituting formula. EPA used a factor of 0.16 μg/dl per μg/L lead to correlate tap water lead levels to blood-lead levels. For infants with a body weight of 4.5 kg (or 10 lb) this translates to a provisional ADI of 4.44×10^{-3} mg/kg/day. Adults are much less sensitive to the toxic effects of lead than are developing infants, which have a less patent blood-brain barrier during a time of rapid and susceptible neurological development and maturation. Adults also absorb only about 20% as much of a given dose of lead from the GI tract as young children (U.S. EPA, 1986). In reassessing the MCL for lead, EPA reviewed the recent toxicological data and concluded that 10-15 μg/dl blood-lead constitutes an appropriate range of concern for health effects that warrant avoidance (U.S. EPA, 1988). Assuming that 80% of lead intake is contributed by sources other than the site, and targeting a tolerable blood-lead level of 10 μg/dl in infants, a conservative, provisional ADI for chronic exposure of workers to lead-contaminated soil, dust or other material can be estimated.

To achieve a tolerable blood-lead level of 10 μg/dl a daily intake in a newborn infant of 62.5 μg of lead is suggested by the conversion factor of 6.25 to convert from blood-lead to lead in drinking water (Ryu et. al. 1983; U.S. EPA, 1986). For a 4.5-kg newborn infant this translates to a total dose of 62.5 μg/day. Conservatively assuming 80% of the infant's tolerable lead intake is derived from other sources, an intake of 12.5 μg/day or 2.8×10^{-3} mg/kg/day should not result in excessive blood-lead levels. Accordingly:

$$pRfD_{c\text{-}o} = 2.8 \times 10^{-3} \text{ mg/kg/day}$$

This provisional oral RfD is derived to be protective of newborns, the most sensitive and susceptible population at risk, and it is anticipated to be more than amply protective of adults and older children.

For subchronic exposure, it is conservatively assumed that the $pRfD_{s\text{-}o}$ and $pRfD_{c\text{-}o}$ are equivalent for purposes of risk assessment.

$$pRfD_{s\text{-}o} = 2.8 \times 10^{-3} \text{ mg/kg/day}$$

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TOXICITY PROFILE FOR MOLYBDENUM

Molybdenum is an essential metal as a cofactor for the enzymes xanthine oxidase and aldehyde oxidase. In plants, it is necessary for the fixing of atmospheric nitrogen by bacteria at the start of protein synthesis. Because of these functions, it is ubiquitous in food. The primary use of molybdenum is as a steel alloy. As such, it is used in the arms industry, in aeronautical engineering and in the automobile industry. Exposure to molybdenum occurs chiefly through the ingestion of meats, grains and legumes. Daily intake is estimated at 100 to 500 μg. Ambient air in urban areas contained molybdenum at levels from 0.01 to 0.03 $\mu g/m^3$ while non-urban areas have reported concentrations between 0.001 and 0.0032 $\mu g/m^3$. The world mean soil concentration of molybdenum is 2 mg/kg (HSDB, 1991; Carson *et al.*, 1986).

Pastures containing 20 to 100 ppm molybdenum may produce a disease referred to as "teart" in cattle and sheep. It is characterized by anemia, poor growth rate and diarrhea. Copper or sulfate in the diet prevents the disease, and removal of the animals from pastures containing high levels of molybdenum facilitates their rapid recovery. Prolonged exposure has led to deformities of the joints. Experimental studies have revealed differences in toxicity of molybdenum salts. Molybdenum sulfide was well tolerated in rats at 500 mg/kg/day and was not injurious to guinea pigs at 28 mg/m^3. Hexavalent compounds were more toxic. In rats, molybdenum trioxide at a dose of 100 mg/kg/day, by inhalation, was irritating to the eyes and mucous membranes and subsequently lethal. After repeated oral administration at sufficient levels, fatty degeneration of the liver and kidney was induced. In comparison with chromium and tungsten salts, sodium molybdate by intraperitoneal injection was less toxic in mice (Goyer, 1986).

Oral Exposure

The U.S. EPA has published subchronic and chronic oral risk reference dose (RfD) values for molybdenum (HEAST, 1991). The RfDs were based on a study in humans exposed to 50 μg/day of molybdenum via their drinking water (Chappell *et al.*, 1979). The authors identified a NOAEL for biochemical indices of 0.004 mg/kg/day. Utilizing an uncertainty factor of 1, EPA derived the following oral RfD values:

$$RfD_{c\text{-}o} = 4 \times 10^{-3} \text{ mg/kg/day}$$

$$RfD_{s\text{-}o} = 4 \times 10^{-3} \text{ mg/kg/day}$$

Inhalation Exposure

There are no published inhalation risk reference concentrations (RfCs) for molybdenum in the most current HEAST (1991) or IRIS (1991). Rabbits given a suspension of powdered molybdenum intratracheally in doses of 70 to 80 mg/kg developed diffused pneumoconiosis with interstitial pneumonia. Fumes from arcing molybdenum metal causes kidney and liver damage in animals. Inhalation of molybdenum compounds in high concentrations may be irritating to the upper respiratory tract. The TLV for insoluble molybdenum compounds is 10 mg/m^3. Since no inhalation dose-response data are available, the TLV will be used to derive RfCs.

The RfCs are derived assuming a 70-kg worker inhales 10 m^3 of air/workday and is continuously exposed (7 days instead of 5 days). An additional safety factor of 10 is applied to account for sensitive human populations.

$$pRfD_{s\text{-}i} = \frac{10\ \text{mg/m}^3}{10} \times \frac{5\ \text{days}}{7\ \text{days}} \times \frac{10\ \text{m}^3/\text{day}}{70\ \text{kg}} = 1 \times 10^{-1}\ \text{mg/kg/day (administered dose)}$$

$$pRfD_{s\text{-}i} = 1 \times 10^{-1}\ \text{mg/kg/day (administered dose)}$$

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TOXICITY PROFILE FOR NICKEL

Elemental nickel is not commonly found in nature as the pure metal, but occurs as sulfides, arsenides, antimonides and oxides or silicates. Nickel is common in a wide variety of foods. Reported dietary levels of nickel for U.S. consumers range from 165 to 900 μg/day. Average values range form 400 to 500 μg/day (U.S. EPA, 1985).

The absorption of dietary nickel from the gastrointestinal tract appears to be quite low, with the majority of nickel excreted in the feces. Laboratory studies have demonstrated depressed body weight gain, alterations in hematology parameters, cytochrome oxidase activity and iron contents of organs following high dose oral exposure (U.S. EPA, 1985).

The chemical form and route of exposure are important factors in determining the carcinogenic potential of nickel. Metallic nickel, nickel subsulfide and nickel carbonyl, which are insoluble nickel compounds, have been shown to produce tumors through inhalation exposure in animals. Intravenous injection of nickel carbonyl has also been shown to result in liver and kidney sarcomas in animals. In humans, it has been demonstrated that the incidence of respiratory tract cancers in nickel refinery workers is significantly elevated. However, nickel has not been shown to be carcinogenic through oral exposure. The results of several studies suggest that 5 mg/L nickel in drinking water is not carcinogenic in rats and mice. Data are not available concerning the potential carcinogenic effects of ingested nickel compounds in humans (U.S. EPA, 1985).

Nickel has been classified in EPA's Group A, according to EPA's Proposed Guidelines for Carcinogen Risk Assessment. The TLV for nickel metal, insoluble and soluble compounds, is 0.05 mg/m^3.

Oral Exposure

The U.S. EPA (HEAST, 3rd Q, 1990) has derived oral RfD values for nickel based upon long-term studies in rats given 100 ppm nickel sulfate (5 mg/kg/day) in the diet. The oral RfD is under review by EPA's RfD Workgroup.

$$RfD_{c\text{-}o} = 2 \times 10^{-2} \text{ mg/kg/day}$$

$$RfD_{s\text{-}o} = 2 \times 10^{-2} \text{ mg/kg/day}$$

Inhalation Exposure

No inhalation RfD values are listed in EPA's IRIS database or the most current HEAST. The lung is the target organ of nickel toxicity in humans, but specific dose-response information for respiratory effects in humans is not available (ATSDR, 1987). A LOAEL for short-term exposure in rats was provided in a study by Bingham *et al.* (1972) in which exposure to nickel chloride or nickel oxide at 0.109 mg Ni/m³ for 12 hours/day, 6 days/week for 2 weeks resulted in hyperplasia of the bronchial epithelium and mucous secretion. A study of Ni dust, rather than NiO or $NiCl_2$, of greater duration (up to 8 months; 6 hrs/day, 5 days/week) at the comparable air concentration of 0.13 mg/m³ resulted in no structural changes, but did produce increased phospholipids and phosphatidylcholines (Curstedt *et al.*, 1983), indicating an effect on type II cells without an interference on cellular mechanisms for alveolar clearance. The ATSDR (1987) considers the Curstedt *et al.* study of Ni dust at 0.13 mg/m³ as a subchronic NOAEL. On this basis, a provisional chronic and subchronic inhalation RfD value may be derived, utilizing a UF of 1000 (10 for species extrapolation, 10 for less-than-lifetime evidence, and 10 for human variability). Assuming a rat weighs 0.35 kg and breathes 0.26 m³ of air:

$$pRfD_{c\text{-}i} = \frac{0.13 \text{ mg/m}^3}{1000} \times \frac{0.26 \text{ m}^3}{0.35 \text{ kg}} \times \frac{6 \text{ hrs}}{24 \text{ hrs}} \times \frac{5 \text{ days}}{7 \text{ days}} = 1.7 \times 10^{-5} \text{ mg/kg/day}$$

$$pRfD_{s\text{-}i} = \frac{0.13 \text{ mg/m}^3}{1000} \times \frac{0.26 \text{ m}^3}{0.35 \text{ kg}} \times \frac{6 \text{ hrs}}{24 \text{ hrs}} \times \frac{5 \text{ days}}{7 \text{ days}} = 1.7 \times 10^{-4} \text{ mg/kg/day}$$

For purposes of comparison, it may be noted that if the $pRfD_{c\text{-}i}$ were derived from the TLV of 0.05 mg/m³ (as Ni), the provisional inhalation value would derive to 5.1×10^{-4}, which is in fairly good agreement with the values derived from animal data.

Nickel refinery dusts have been associated with occupational cancer. The U.S. EPA has classified nickel as a Group A carcinogen. An inhalation potency slope factor of 8.4×10^{-1} risk units per mg/kg/day of lifetime exposure has been published by EPA (Iris, 1990; HEAST, 1990). No evidence is available to indicate that nickel may be carcinogenic via the oral route of exposure.

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APPENDIX H

RESPONSE ACTION ALTERNATIVE COST ESTIMATES

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
INSTITUTIONAL CONTROLS/SITE SECURITY ALTERNATIVE

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Mobilization and Demobilization	$15,000	to	$25,000
(2) Repair and Replacement Materials for Building Openings	$25,000	to	$50,000
(3) Repairs to Building Roof Structure	$15,000	to	$60,000
(4) Temporary Site Services (ie. Labor, Electricity, Etc.)	$10,000	to	$40,000
(5) Legal Costs (Deed Restrictions)	$10,000	to	$15,000
Subtotal	$75,000		$190,000
Administration and Engineering @ 15%	$11,250	to	$28,500
Subtotal	$86,250	to	$218,500
Contingency @ 25%	$21,563	to	$54,625
Subtotal	$107,813	to	$273,125
Present Worth of Long–Term Security @ 8% for 10 years	$33,550	to	$50,325
TOTAL ESTIMATED RANGE OF COSTS	$141,363	to	$323,450

Notes: – Long–Term Security is projected to consist of a weekly exterior perimeter fence inspection with a bi–annual interior building inspection. Annual cost isestimated at $5,000 to $7,500.
– The Limited Action Alternative cost estimate is identical to the cost estimate for the Radioactive/ Non–Radioactive Material On–Site Storage Option

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
RADIOACTIVE MATERIAL – PHYSICAL SEPARATION

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Mobilization and Demobilization	$20,000	to	$40,000
(2) Excavation, Screening and Grinding of Materials	$100,000	to	$200,000
(3) Equipment, Materials and Components	$160,000	to	$200,000
(4) Temporary Site Services	$50,000	to	$75,000
(5) Start–up Operations (Pilot Testing)	$20,000	to	$40,000
(6) Operational Costs (Electric, Labor, ect.)	$150,000	to	$300,000
(7) Post Treatment Sampling and Characterization	$10,000	to	$15,000
(8) Removal and Off–Site Disposal of Radioactive Material	$200,000	to	$400,000
Subtotal	$710,000	to	$1,270,000
Administration and Engineering @ 15%	$106,500	to	$190,500
Subtotal	$816,500	to	$1,460,500
Contingency @ 25%	$204,125	to	$365,125
TOTAL ESTIMATED RANGE OF COSTS	$1,020,625	to	$1,825,625

Notes: – Maintenance for this period is included in operation costs.
– Assumes treatment of between 2,000 and 4,500 cubic yards.
– Removal and Off–Site Disposal assumes approximately 2% of excavated material remains radioactive after separation.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
RADIOACTIVE MATERIAL–CHEMICAL EXTRACTION

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Mobilization and Demobilization	$30,000	to	$50,000
(2) Excavation and Screening of Materials	$25,000	to	$50,000
(3) Grinding and Soil Washing of Radioactive Slag Materials	$800,000	to	$900,000
(4) Treatment Equipment, Components, and Operation	$700,000	to	$900,000
(5) Temporary Site Services	$50,000	to	$75,000
(6) Start–up Operations (Bench and Pilot Testing)	$70,000	to	$100,000
(7) Operational Costs (Electricity, Chemicals, Labor, etc.)	Incl. in (4)	to	Incl. in (4)
(8) Post Treatment Sampling and Characterization	$20,000	to	$30,000
(9) Removal and Off–Site Disposal of Radioactive Materials	$200,000	to	$400,000
Subtotal	$1,895,000	to	$2,505,000
Administration and Engineering @ 15%	$284,250	to	$375,750
Subtotal	$2,179,250	to	$2,880,750
Contingency @ 25%	$544,813	to	$720,188
TOTAL ESTIMATED RANGE OF COSTS	$2,724,063	to	$3,600,938

Notes: – Maintenance for this period in included in operation costs.
– Assumes treatment of between 2,000 and 4,500 cubic yards.
– Removal and disposal costs assume 2% radioactive material content of total volume processed.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
NON–RADIOACTIVE MATERIAL–CONTAINMENT/CAPPING

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Mobilization and Demobilization	$15,000	to	$30,000
(2) Equipment	$30,000	to	$60,000
(3) Materials – Fill	$45,000	to	$120,000
(4) Temporary Site Services	$30,000	to	$70,000
(5) Operational Costs (Electric, Labor, ect.)	$65,000	to	$15,000
(6) Testing	$20,000	to	$40,000
(7) Legal Costs (Deed Restrictions)	$10,000	to	$15,000
Subtotal	$215,000	to	$350,000
Administration and Engineering @ 15%	$32,250	to	$52,500
Subtotal	$247,250	to	$402,500
Contingency @ 25%	$61,813	to	$100,625
Subtotal	$309,063	to	$503,125
Present worth of Cap Maintenance @ 8% for 30 Years	$112,578	to	$168,867
TOTAL ESTIMATED RANGE OF COSTS	$421,640	to	$671,992

Notes: – Maintenance for this period is assumed to range from $10,000 to $15,000 per year.
– Assumes capping an area of approximately 100,000 square feet.
– Removal of radioactive materials from the areas in question is assumed to have taken place prior to capping activities.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
NON–RADIOACTIVE MATERIAL – EX–SITU FIXATION/STABILIZATION

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Sampling of Material for Bench Scale Testing	$2,500	to	$5,000
(2) Bench Scale Testing	$10,000	to	$15,000
(3) Mobilization and Demobilization	$35,000	to	$50,000
(4) Excavation, Screening, and Grinding of Materials	$20,000	to	$40,000
(5) Temporary Site Services	$30,000	to	$70,000
(6) Start–up (Pilot Testing)	$20,000	to	$40,000
(7) Operational Costs (Electricity, Chemicals, Labor, etc.)	$100,000	to	$200,000
(8) Post Treatment Sampling	$10,000	to	$20,000
(9) Material Replacement, Cover, and Revegetation	$15,000	to	$30,000
Subtotal	$242,500	to	$470,000
Administration and Engineering @ 15%	$36,375	to	$70,500
Subtotal	$278,875	to	$540,500
Contingency @ 25%	$69,719	to	$135,125
TOTAL ESTIMATED RANGE OF COSTS	$348,594	to	$675,625

Notes:
- Excavation, screening, and grinding of material prior to processing only for those areas not previously excavated for radioactive material response.
- Assumes treatment of between 500 and 1,500 cubic yards.
- Cover and revegetation of treated material following placement to stabilize surface and prevent erosion.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
NON–RADIOACTIVE MATERIAL – EX–SITU
SOIL WASHING/CHEMICAL EXTRACTION

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Sampling of Material for Bench Scale Testing	$2,500	to	$5,000
(2) Bench Scale Testing	$20,000	to	$30,000
(3) Mobilization and Demobilization	$35,000	to	$50,000
(4) Excavation, Screening and Grinding of Material	$20,000	to	$40,000
(5) Equipment, Material and Components	$200,000	to	$350,000
(6) Start–up (Pilot Testing)	$30,000	to	$60,000
(7) Operational Costs (Electricity, Chemicals, Labor, etc.)	$150,000	to	$300,000
(8) Post Treatment Sampling	$15,000	to	$30,000
(9) Material Replacement, Cover, Revegetation	$15,000	to	$30,000
(10) Off–Site Disposal of Concentrated Material	$20,000	to	$50,000
Subtotal	$507,500	to	$945,000
Administration and Engineering @ 15%	$76,125	to	$141,750
Subtotal	$583,625	to	$1,086,750
Contingency @ 25%	$145,906	to	$271,688
TOTAL ESTIMATED RANGE OF COSTS	$729,531	to	$1,358,438

Notes: – Excavation, Screening, and Grinding of material prior to processing only for those areas not previously excavated for radioactive material response.
– Assumes treatment of between 500 and 1500 cubic yards.
– Cover and revegetation of treated material following placement to stabilize surface and prevent erosion.
– Off–Site Disposal of concentrated material following treatment assumes between 50 and 125 tons of characteristic waste.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
NON-RADIOACTIVE MATERIAL - REMOVAL
EXCAVATION AND TREATMENT/DISPOSAL OFF-SITE

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Sampling of Material/Characterization	$15,000	to	$30,000
(2) Mobilization and Demobilization	$15,000	to	$30,000
(3) Excavation and Loading of Material	$30,000	to	$60,000
(4) Transportation and Disposal	$360,000	to	$1,080,000
(5) Regrade, Clean Fill, and Vegetation	$40,000	to	$70,000
(6) Temporary Site Services	$20,000	to	$50,000
Subtotal	$480,000	to	$1,320,000
Administration and Engineering @ 15%	$72,000	to	$198,000
Subtotal	$552,000	to	$1,518,000
Contingency @ 25%	$138,000	to	$379,500
TOTAL ESTIMATED RANGE OF COSTS	$690,000	to	$1,897,500

Notes: - Excavation of material only for those areas not previously excavated for radioactive material response.
- Assumes disposal of between 500 and 1,500 cubic yards or 750 to 2,250 tons.
- Cover and revegetation of excavated area following removal to stabilize surface and prevent erosion.

METCOA RESTART SITE
RESPONSE ACTION COST ESTIMATE
RADIOACTIVE/NON–RADIOACTIVE MATERIAL
OFF–SITE STORAGE/TREATMENT OPTION

RESPONSE ACTION ITEMS	ESTIMATED COST RANGE		
(1) Packaging, Labeling, Transportation Off–Site	$40,000	to	$60,000
(2) Repackaging, Transportation, and Disposal of Empty Drums	$45,000	to	$60,000
(3) Sampling, Analysis, and Classification (Metals Only)	$35,000	to	$45,000
(4) Storage for Drums (One Year)	$125,560	to	$373,760
(5) Treatment of Material	$45,000	to	$128,000
(6) Off–Site Disposal at Low–Level Radioactive Dipsosal Site	$56,911	to	$169,409
Subtotal	$347,471	to	$836,169
Administration and Engineering @ 15%	$52,121	to	$125,425
Subtotal	$399,592	to	$961,594
Contingency @ 25%	$99,898	to	$240,399
TOTAL ESTIMATED RANGE OF COSTS	$499,490	to	$1,201,993

Notes:
- Empty drums will be crushed and disposed of at a licensed/permitted facility.
- Storage, treatment, and disposal costs range for quantities between 43 and 128 drums based on potential volume reduction and additional characterization activities.
- Costs not included for potential return of non–treatable waste streams following a one (1) year storage limitation at the off–site facility.

APPENDIX I

AIR MONITORING REPORTS (RADIOLOGICAL AND NON-RADIOLOGICAL)

RADIOLOGICAL AIR MONITORING REPORT

The following formulas were used to calculate the true concentration of long lived nuclides collected on the high volume air samples;

$$C = \frac{C2 - C1e^{-\lambda \Delta t}}{1 - e^{-\lambda \Delta t}}$$

Where: $C2$ = 24 hour count (t2)
$C1$ = 4 hour count (t1)
Δt = time t2-t1

If measurements are made exactly at 4 hours and 24 hours then;

$t = 20$ and $e^{-\lambda \Delta t} = 0.271$

Therefore:

$$C = \frac{C2 - 0.271\ C1}{0.729}$$

$$\text{Concentration} = \frac{C}{E\ m\ R}$$

Where: Concentration = disintegrations per minute/meter^3
c = counts/minute
m = # of minutes of sampling
R = sampling rate in meter^3/minute
E = efficiency of counter

or:

$$\text{Concentration} = \frac{C \times 10^{-12}}{2.22\ E\ m\ R}$$

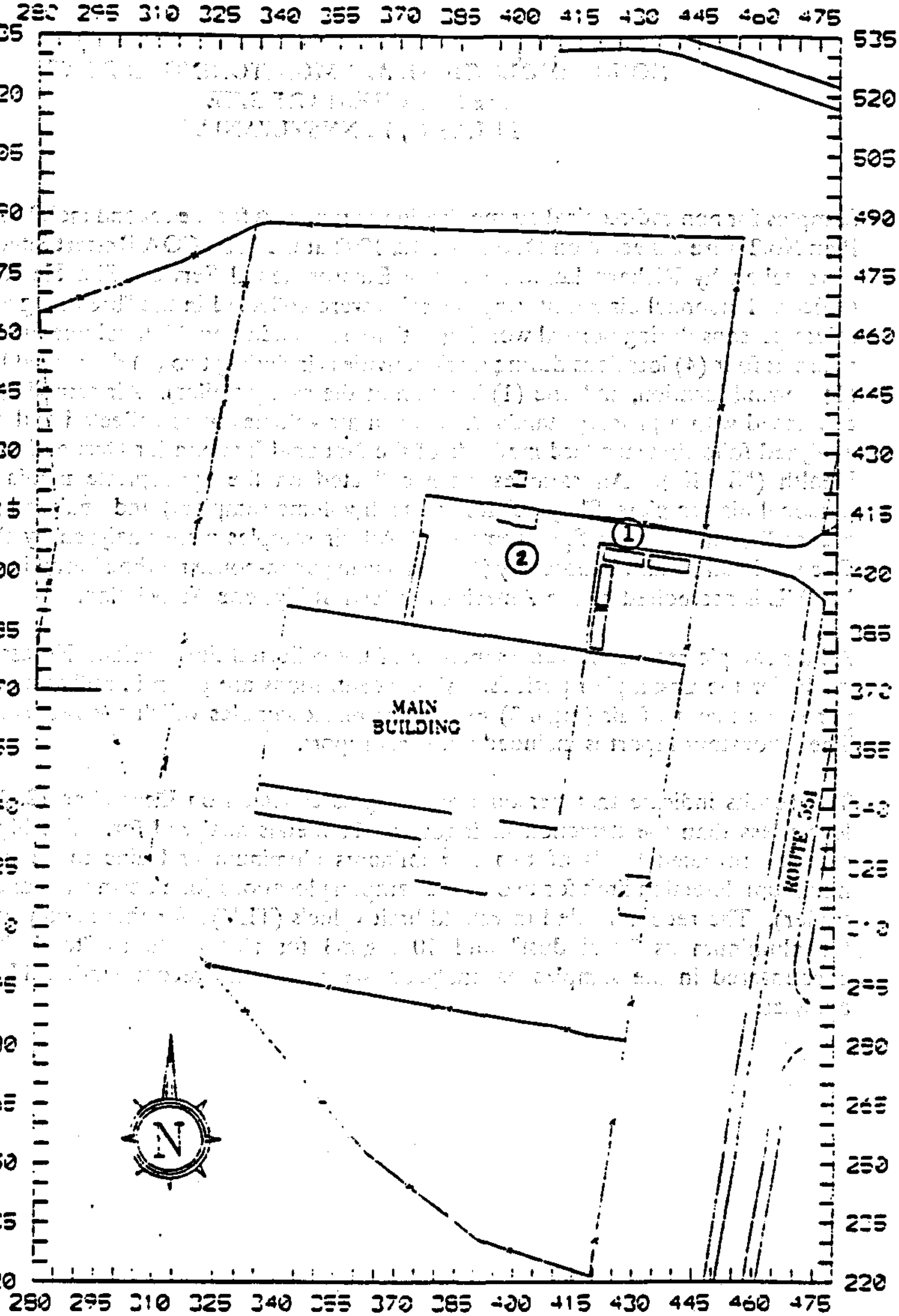
Where Concentration = microCuries/centimeter^3

RADIOLOGICAL AIR MONITORING RESULTS

SUMMARY TABLE

SAMPLE	DATE 1991	TIME	CFM	SAMPLE TIME MINUTES	COUNT t0	COUNTt1	COUNTt2	E	DPM	CONCENTI µCi/cm
1	12/06	420	25	10	394	2	0	.329	0	0
2	12/08	1310	25	10	536	6	0	.347	0	0
3	12/09	1030	25	10	658	1	0	.315	0	0
4	12/12	1100	25	10	1361	42	0	.368	0	0

SAMPLE #	LOCATION	MAP LOCATION
1	DECON AREA (DECONNING DRILL BITS)	2
2	DECON AREA (WHILE DRILLING)	2
3	SAFETY TRAILER (DRILLING)	1
4	DECON AREA (DRILLING)	2



METCOA WORK PLAN 2 AIR SAMPLING MAP

100'

AR102760

NON-RADIOLOGICAL AIR MONITORING REPORT
METCOA RESTART SITE
PULASKI, PENNSYLVANIA

Samples for non-radiological air monitoring parameters for the second mobilization of Work Plan No.2 were collected on December 12, 1992 at the METCOA Restart Site. Air samples were taken by Richard Lenius, Laidlaw Environmental Services Site Health and Safety Officer. Personnel air monitoring samples were collected in the "breathing zone" (BZ) of select persons during normal working activities. In addition, high volume air samples were taken at four (4) locations during work activities (including two (2) downwind locations, one (1) upwind location, and one (1) location at the safety trailer). Air sampling pumps were calibrated with a primary standard. Known air volumes were collected and samples were analyzed following standard methods of the National Institute for Occupational Safety and Health (NIOSH). Air samples were collected on the appropriate media (37 mm for personal air samplers, 8" by 10" for the high volume samplers) and analyzed for metals by a Jarrell Ash Emission Spectrometer. All air samples were analyzed by the Wisconsin Occupational Health Laboratory (WOHL) using an in-house method based in NIOSH 7300. WOHL is accredited by the American Industrial Hygiene Association.

All air sample results are representative of the collected time period. No assumptions are made for the unsampled periods. All concentrations are given in milligrams of substance per cubic meter of air (mg/m3) except for blank samples which are reported in ug/filter. The laboratory report is included with this report.

The results indicate that personal air samples collected on December 12, 1991 revealed levels less than the detection limit for the 11 metals analyzed for. The high volume air samples revealed levels of two contaminants aluminum and zinc to be present at the minimum detection limit for two of the sampling locations (one down wind and at the safety trailer). The recommended threshold limit value's (TLV)'s for these analytes is 15 mg/m3 for aluminum as "total dust" and 10 mg/m3 for zinc oxide as "total dust". Values encountered in the samples as analyzed are below the recommended TLV's for these analytes.

STATE LABORATORY OF HYGIENE
UNIVERSITY OF WISCONSIN
CENTER FOR HEALTH SCIENCES

In Reply Please Refer to:
Wisconsin Occupational Health Laboratory
979 Jonathon Drive
Madison, WI 53713
(608) 263-6550
FAX (608) 263-6551

December 17, 1991

Mr. David Spencer
Laidlaw Environmental
1123 Lumpkin Rd
PO Box 19529
Houston, TX 77224

RE: Project #23 Metcoa Restart Site

Dear Mr. Spencer:

Below are results for samples we received on December 13, 1991 for analysis:

Sample#	MET 1212-01 DW	02 DW	03 ST	04 UW	B1	P-000 1	2	3	4	B1
	Samples reported out in mg/m3 except blanks - ug/filter									
Substance										
Aluminum	<.001	.001	.001	<.001	49	<.01	<.01	<.01	<.01	<5
Beryllium	<.0001	<.0001	<.0001	<.0001	<.05	<.0001	<.0001	<.0001	<.0001	<.
Cadmium	<.001	<.001	<.001	<.001	<.5	<.001	<.001	<.001	<.001	<.
Cobalt	<.001	<.001	<.001	<.001	<.5	<.001	<.001	<.001	<.001	<.
Chromium	<.001	<.001	<.001	<.001	1.1	<.001	<.001	<.001	<.001	<.
Copper	<.001	<.001	<.001	<.001	6.1	<.001	<.001	<.001	<.001	<.
Manganese	<.001	<.001	<.001	<.001	2.2	<.001	<.001	<.001	<.001	<.
Nickel	<.001	<.001	<.001	<.001	2.3	<.001	<.001	<.001	<.001	<.
Lead	<.001	<.001	<.001	<.001	5.1	<.001	<.001	<.001	<.001	.6
Antimony	<.001	<.001	<.001	<.001	1.7	<.002	<.002	<.002	<.002	<1
Zinc	<.001	.001	.001	<.001	12	<.002	<.002	<.002	<.002	<1

If you have any questions regarding these results, please feel to contact me.

Sincerely,

Lyle Reichmann, CIH, Chemist Supervisor

LR/ms

AR102762

GSX

INDUSTRIAL HYGIENE GROUP

CHAIN OF CUSTODY RECORD

GSX Services, Inc.—EASTERN REGION
P.O. Box 14964 1415 Woodsi
Greensboro, NC 27415-4964
(919) 272-0185

PROJECT NAME: Metcoa Restart Site #189 — PROJ. #: 23

PROJECT LOCATION: Hwy 551 North Pulaski Pa 16143

DS 9901

STA. NO.	DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	NIOSH 7300 (Scan)	NIOSH 7300	REMARKS
01	12/12	1230		✓	MET-1212-01-DW 137710	1	✓		240X 40 cfm = 9600 CFM
02	12/12	1230		✓	MET-1212-02-DW 137711	1	✓		240X 40 ... = 9600 cfm
03	12/12	1230		✓	Met 1212-03-ST 137712	1	✓		240X 40 = 9600 cfm
04	12/12	1230		✓	Met 1212-04-UW 137713	1	✓		240X 40 = 9600 CFM
00	12/12	1330		✓	BLANK 137714	1	●		
									[redacted] RW
05	12/12	1330			MET-1212-P-0001 137715			✓	240X 2 l/m = 480 L
06	12/12	1330			MET-1212-P-0002 137716			✓	240X 2 l/m = 480 L
07	12/12	1330			MET-1212-A-0003-U 137717			✓	240X 2 l/m = 480 L
08	12/12	1330			MET-1212-A-0004-D 137718			✓	240X 2 l/m = 480 L
09	12/12	1330			BLANK 137719	1		✓	

RUSH

SAMPLED BY AND TITLE (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature] SSO	12/12 12:30	Fed Ex	|	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)
	|	[illegible signature]	DEC 13 1991	|	

REMARKS: Send Reports to Project. Send Bill to David Spencer

SAMPLE SHIPPED VIA: ☐ UPS ☐ BUS ☒ FEDERAL EXPRESS

DESIGNATED LABORATORY: Wisconsin Health Lab

YELLOW – [illegible] ... FIELD SUPPORT OFFICE

909-7562 (11-90)

AR102076

APPENDIX I

AIR MONITORING REPORTS (RADIOLOGICAL AND NON-RADIOLOGICAL)

AR101764

RADIOLOGICAL AIR MONITORING REPORT

The following formulas were used to calculate the true concentration of long lived nuclides collected on the high volume air samples;

$$C = \frac{C2 - C1e^{-\lambda \Delta t}}{1 - e^{-\lambda \Delta t}}$$

Where:

$C2$ = 24 hour count (t2)
$C1$ = 4 hour count (t1)
Δt = time t2-t1

If measurements are made exactly at 4 hours and 24 hours then;

$t = 20$ and $e^{-\lambda \Delta t} = 0.271$

Therefore:

$$C = \frac{C2 - 0.271\,C1}{0.729}$$

$$\text{Concentration} = \frac{C}{E\,m\,R}$$

Where:

Concentration = disintegrations per minute/meter^3
c = counts/minute
m = # of minutes of sampling
R = sampling rate in meter^3/minute
E = efficiency of counter

or:

$$\text{Concentration} = \frac{C \times 10^{-12}}{2.22\,E\,m\,R}$$

Where Concentration = microCuries/centimeter^3

RADIOLOGICAL AIR MONITORING RESULTS

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SAMPLE #	LOCATION	MAP LOCATION
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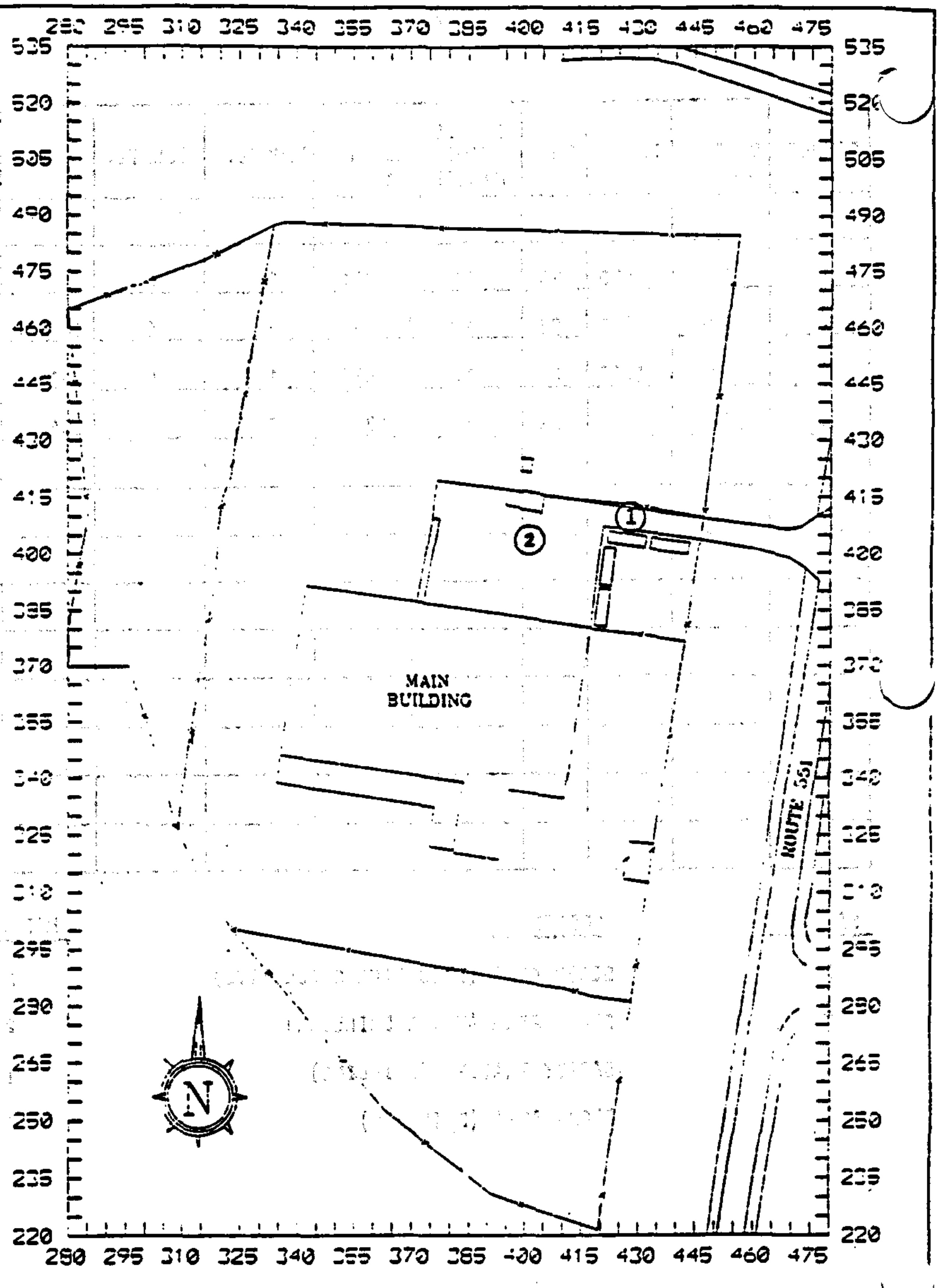
4	DECON AREA (DRILLING)	2



METCOA WORK PLAN 2 AIR SAMPLING MAP

100'

AR102767

NON-RADIOLOGICAL AIR MONITORING REPORT
METCOA RESTART SITE
PULASKI, PENNSYLVANIA

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All air sample results are representative of the collected time period. No assumptions are made for the unsampled periods. All concentrations are given in milligrams of substance per cubic meter of air (mg/m3) except for blank samples which are reported in ug/filter. The laboratory report is included with this report.

The results indicate that personal air samples collected on December 12, 1991 revealed levels less than the detection limit for the 11 metals analyzed for. The high volume air samples revealed levels of two contaminants aluminum and zinc to be present at the minimum detection limit for two of the sampling locations (one down wind and at the safety trailer). The recommended threshold limit value's (TLV)'s for these analytes is 15 mg/m3 for aluminum as "total dust" and 10 mg/m3 for zinc oxide as "total dust". Values encountered in the samples as analyzed are below the recommended TLV's for these analytes.

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	Samples reported out in mg/m3 except blanks - ug/filter									
Substance										
Aluminum	<.001	.001	.001	<.001	49	<.01	<.01	<.01	<.01	<
Beryllium	<.0001	<.0001	<.0001	<.0001	<.05	<.0001	<.0001	<.0001	<.0001	<
Cadmium	<.001	<.001	<.001	<.001	<.5	<.001	<.001	<.001	<.00	
)balt	<.001	<.001	<.001	<.001	<.5	<.001	<.001	<.001	<.001	
Chromium	<.001	<.001	<.001	<.001	1.1	<.001	<.001	<.001	<.001	<
Copper	<.001	<.001	<.001	<.001	6.1	<.001	<.001	<.001	<.001	<
Manganese	<.001	<.001	<.001	<.001	2.2	<.001	<.001	<.001	<.001	<
Nickel	<.001	<.001	<.001	<.001	2.3	<.001	<.001	<.001	<.001	<
Lead	<.001	<.001	<.001	<.001	5.1	<.001	<.001	<.001	<.001	.6
Antimony	<.001	<.001	<.001	<.001	1.7	<.002	<.002	<.002	<.002	<1
Zinc	<.001	.001	.001	<.001	12	<.002	<.002	<.002	<.002	<1

If you have any questions regarding these results, please feel to contact me.

Sincerely,

Lyle Reichmann, CIH, Chemist Supervisor

LR/ms

AR102769

GSX INDUSTRIAL HYGIENE GROUP

CHAIN OF CUSTODY RECORD

GSX Services, Inc.—EAS REGION
P.O. Box 14964 1415 Wood
Greensboro, NC 27415-4964
(919) 272-0185

PROJECT NAME: Metcoa Restord Site #189

PROJ. #: 23

PROJECT LOCATION: Hwy 551 North Pulaski Pa 16143

DS 9901

STA. NO.	DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	Niosh 7300 (Scan)	NIOSH 7300	REMARKS
01	12/12	1230		✓	MET-1212-01-DW 137710	1	✓		240X 40cfm = 9600 CFM
02	12/12	1230		✓	MET-1212-02-DW 137711	1	✓		240X40 = 9600 cfm
03	12/12	1230		✓	Met 1212-03-ST 137712	1	✓		240X40 = 9600 cfm
04	12/12	1230		✓	Met 1212-04-UW 137713	1	✓		240X40 = 9600 CFM
00	12/12	1330		✓	BLANK 137714	1	●		
									[redacted]
05	12/12	1330			MET-1212-P-0001 137715			✓	240X 2l/m = 480L
06	12/12	1330			MET-1212-P-0002 137716			✓	240X 2l/m = 480L
07	12/12	1330			MET-1212-A-0003-U 137717			✓	240X 2l/m = 480L
08	12/12	1330			MET-1212-A-0004-D 137718			✓	240X 2l/m = 480L
09	12/12	1330			BLANK 137719	1		✓	

RUSH

ARI 270.

SAMPLED BY AND TITLE (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature] SSO	12/12 1200	Fed Ex		

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)
		Alle Ann McHarg	DEC 13 1991		

REMARKS: Send Reports to Project. Send Bill to David Spencer

SAMPLE SHIPPED VIA: ☐ UPS ☐ BUS ☒ FEDERAL EXPRESS

DESIGNATED LABORATORY: Wisconsin Occ Health Lab

APPENDIX J

MEDICAL SURVEILLANCE PROGRAM RESULTS

T.L.D. BADGES ISSUED FOR 3rd QUATER 1991

#	Date	NAME	SOCIAL SECURITY	BIRTH DATE	WORK FOR COMPANY NAME	[illegible]
102	7/1	David Spencer	391-64-6686	3-15-65	Laidlaw	7/
103	7/1	Marco Diaz	453-81-8837	11-24-68	Laidlaw	7/
104	7/1	William Fisher			Keystone Security	7/
105	7/1	Scott Rice	211-60-8855	2-15-68	TAT	7/
106	7/1	Clint Tillis	453-33-9725	12-16-61	G.S.X. Laidlaw	7/
			Red Badges			
40	7/1	Joe Scelsi	172-46-1929	8-29-61	KEA INC. --	7/
41	7/1	Greg Grimes	428-47-8329	10-9-67	G.S.X. Laidlaw	7/
42		Did Not Receive				
43	7/1	Mark Travers	331-50-5111	11-23-56	de maximis	8/
44	7/1	Carol Manning	261-81-6218	8-19-63	E.P.A.	
45	7/1	Clarence Helton	189-34-5223	4-21-45	J K V I S	8/
46	7/1	Benny Banipal	151-77-4379	10-20-58	EPA / TAT	8/
47	7/1	Richard Lee	211-46-5406	10-6-55	Quantum Geophsis	8/
48	7/1	Did Not Receive				
49	7/1	Jeffery R. Winters	192-44-5396	8-10-68	Keystone Security	8/
50		Did Not Receive				
51	7/1	David C. Stimmell	203-58-6585	2-27-71	Keystone Security	7/
52	7/1	Richard Allen	239-27-3303	9-2-67	Laidlaw	9/
53						
54						
55						
56						

AR102772

NAME	SS#	BIRTH DATE	COMPANY	DATE ISSUED	DOSE (mRem)		URINE ANALYSIS (pCi/l)	
					SKIN	WHOLE BODY	TH-228	TH-232
[illegible]EXANDER, CLARK	422-92-2594	07/29/63	ROBBIE D. WOOD	07/16/91	0	0	*	*
ALLEN, RICHARD	239-27-3303	09/02/67	LAIDLAW	09/14/91	33	33	*	*
ALLENDER, KAREN	211-36-2467	04/09/47	KEYSTONE	07/02/91	0	0	*	*
BANIPAL, BENNY	151-77-4379	10/20/58	EPA/TAT	08/12/91	22	22	0.00	0.00
BARTO, WAYNE	062-48-0478	10/13/53	DE MAXIMIS	07/08/91	0	0	0.00	0.00
BEECHER, SHIRLEY	172-52-7246	08/19/64	KEYSTONE	07/02/91	0	0	*	*
BISWAS, MRINAL	066-66-6177	12/20/44	TAT	07/18/91	0	0	*	*
BRADY, VALLEREA	464-81-0107	01/07/71	GSX	07/18/91	0	0	*	*
BRANCH, ERIC	569-65-4457	06/16/66	ROBBIE D. WOOD	07/16/91	0	0	0.00	0.00
CERNANSKY, DON	185-48-1573	10/25/59	ESI	07/23/91	0	0	0.00	0.00
COATS, SCAN	281-50-8479	09/04/53	LAIDLAW	07/16/91	0	0	*	*
DAWSON, TIMOTHY	168-38-6706	08/01/60	KEYSTONE	07/02/91	0	0	*	*
[illegible]COTT	428-04-7044	06/22/63	G.S.X. SERVICES	07/15/91	0	0	0.00	0.00
DIAZ,MARCO	453-81-8837	11/24/68	LAIDLAW	07/27/91	0	0	0.00	0.00
DILLON, FRANK	273-30-9265	01/20/38	KEYSTONE	07/02/91	0	0	*	*
FISHER, WILLIAM	N/A	N/A	KEYSTONE	07/27/91	0	0	*	*
GALLAGHER, CHARLIE	056-38-0418	09/14/49	NSSI	07/16/91	0	0	0.00	0.00
GREEN, JOHN	436-37-4657	11/14/65	GSX	07/22/91	0	0	0.00	0.00
GRIMES, GREG	428-47-8329	10/09/67	GSX-LAIDLAW	07/29/91	22	22	0.00	0.00
HOLTON, CLARENCE	189-34-5223	04/21/45	JK VIC	08/06/91	17	17	*	*
HOWE, MARTIN	198-46-7292	05/02/57	ENVIR. STANDARDS	07/08/91	0	0	*	*
LADY, RICHARD L.	415-86-3192	01/17/51	DE MAXIMIS	07/08/91	0	0	0.00	0.00
LEE, RICHARD	211-46-5406	10/06/55	QUENTUM GEOPHYSICS	08/12/91	14	14	0.00	0.00
LENIUS, RICHARD	455-47-1701	12/30/67	GSX SERVICES	07/16/91	0	0	0.00	0.00
[illegible]NG, CAROL	261-81-6218	08/19/63	EPA	08/01/91	23	23	0.00	0.00

* IN ANALYSIS COLUMN INDICATES NO SAMPLE SUBMITTED IN THIS PERIOD
MAXIMUM PERMISSIBLE QUARTERLY DOSE: SKIN 7500 MREM: WHOLE BODY 1250 MREM.
MAXIMUM PERMISSIBLE THORIUM IN URINE IN PICOCURIES/LITER:
TH-228 1.1 TH-232 1.36

METCOA RESTART RADIATION EXPOSURE REPORT
3RD QTR 1991

NAME	SS#	BIRTH DATE	COMPANY	DATE ISSUED	DOSE (mRem)		URINE ANALYSIS (pCi/l)	
					SKIN	WHOLE BODY	TH-228	TH-
URPHY, WETZEL	171-12-0639	02-24-20	KEYSTONE	07/02/91	0	0	*	*
PEAK, WILBERT	187-34-6886	03/27/44	KEYSTONE	07/02/91	0	0	*	*
RICE, SCOTT	211-60-8855	02/15/68	TAT	07/29/91	0	0	*	*
SCELSI, JOE	172-46-1929	08/29/61	KEA, INC.	07/29/91	11	11	*	*
SHULER, BOB	202-38-1363	02/12/64	KEYSTONE	07/12/91	0	0	*	*
SIKDAR, NIRONMOY	188-64-6273	11/28/47	TAT	07/22/91	0	0	*	*
SPENCER, DAVID	391-64-6686	03/15/65	LAIDLAW	07/24/91	0	0	*	*
STIMMEL, DASVID C.	239-27-3303	02/27/71	KEYSTONE	09/09/91	13	13	*	*
TILLIS, CLINT	453-33-9725	12/16/61	GSX-LAIDLAW	07/29/91	0	0	0.00	0.00
TRAVERS, MARK	331-50-5111	11/23/56	DE MAXIMIS	08/01/91	27	27	*	*
VANGORDER, BOB	198-58-9729	06/15/66	EPA/TAT	07/15/91	0	0	*	*
WILER, GARY	176-60-9092	06/14/67	EPA-TAT	07/08/91	0	0	*	
W[illegible]RS, JEFFERY R.	192-44-5396	08/10/68	KEYSTONE	08/13/91	24	24	*	*

* IN ANALYSIS COLUMN INDICATES NO SAMPLE SUBMITTED IN THIS PERIOD
MAXIMUM PERMISSIBLE QUARTERLY DOSE: SKIN 7500 MREM; WHOLE BODY 1250 MREM.
MAXIMUM PERMISSIBLE THORIUM IN URINE IN PICOCURIES/LITER:
TH-228 1.1 TH-232 1.36

AR102774

NAME	SS#	BIRTH DATE	COMPANY	DATE ISSUED	DOSE (mRem)		URINE ANALYSIS (pCi/l)	
					SKIN	WHOLE BODY	TH-228	TH-232
[illegible]NDER, KAREN	211-36-2467	04-09-47	KEYSTONE	10/05/91	0	0	*	*
ALLRON, BILL	191-20-1253	07/18/28	KEYSTONE	12/27/91	0	0	*	*
BARTO, WAYNE	062-48-0478	10/13/53	DE MAMIMIS	12/12/91	0	0	0.05	0.02
BEECHER, KENNETH	545-23-6220	11/15/67	KEYSTONE	11/04/91	0	0	*	*
BEECHER, SHIRLEY	172-52-7246	08/19/64	KEYSTONE	10/05/91	0	0	*	*
BRANCH, ERIC	569-65-4457	06/16/66	GSX	12/08/91	0	0	0.00	0.00
BRUCEWOOD, F.	184-44-1268	07/14/53	ELDREDGE	12/18/91	0	0	*	*
CARTER, JOE	233-92-1045	09/12/62	EPA/TAT	12/03/91	0	0	0.00	0.00
CERNANSKY, DON	185-48-1573	10/25/59	ESI	12/05/91	0	0	0.00	0.00
DAWSON, TIMOTHY	168-38-6706	08/01/60	KEYSTONE	10/05/91	0	0	*	*
DAY, SCOTT	428-04-7044	06/22/63	GSX	12/03/91	0	0	0.00	0.00
DILLON, FRANK	273-30-9265	01/30/38	KEYSTONE	10/05/91	0	0	*	*
[illegible] JOHNNY III	436-37-4657	11/14/65	GSX	15/05/91	0	0	0.00	0.00
HEATH, RICHARD	217-92-2174	09/28/62	ESI	12/11/91	0	0	*	*
HOWE, MARTIN R.	198-46-7292	05/02/57	ENVIRON STANDARDS	12/12/91	0	0	0.00	0.00
LADY, RICHARD	415-86-3192	01/17/51	DEMAXIMIS	12/03/91	0	0	0.00	0.00
LEDNEY, MIKE	173-32-8483	03/25/40	KEYSTONE	12/20/91	0	0	*	*
LEMIUS, RICHARD	455-47-1701	09/12/67	GSX	12/03/91	0	0	0.00	0.00
MURPHY, WETZEL	171-12-0639	03/24/20	KEYSTONE	10/05/91	0	0	*	*
PEAK, WILBERT	187-34-6886	03/27/44	KEYSTONE	10/05/91	0	0	*	*
STIMMELL, DAVID C.	203-58-6588	02/27/71	KEYSTONE	10/05/91	0	0	*	*
TUCKER, TOM	168-40-4977	04/14/50	KEYSTONE	12/15/91	0	0	*	*
VANGORDER, ROBERT	198-58-9729	06/15/66	EPA/TAT	12/03/91	0	0	0.00	0.00
WADDELL, CURT	195-58-3956	09/04/65	PA DRILLING	12/04/91	0	0	0.00	0.00
[illegible]TRAL, MARTY	187-64-0057	01/03/71	PA DRILLING	12/04/91	0	0	0.00	0.00

* IN ANALYSIS COLUMN INDICATES NO SAMPLE SUBMITTED IN THIS PERIOD
MAXIMUM PERMISSIBLE QUARTERLY DOSE: SKIN 7500 MREM; WHOLE BODY 1250 MREM.
MAXIMUM PERMISSIBLE THORIUM IN URINE IN PICOCURIES/LITER:
TH-228 1.1 TH-232 1.36

METCOA RESTART RADIATION EXPOSURE REPORT
4TH QTR 1991

NAME	SS#	BIRTH DATE	COMPANY	DATE ISSUED	DOSE (mRem)		URINE ANALYSIS (pCi/l)	
					SKIN	WHOLE BODY	TH-228	TH-
WILER, GARY	176-60-9092	06/14/67	TAT	12/09/91	0	0	*	*

* IN ANALYSIS COLUMN INDICATES NO SAMPLE SUBMITTED IN THIS PERIOD
MAXIMUM PERMISSIBLE QUARTERLY DOSE: SKIN 7500 MREM: WHOLE BODY 1250 MREM.
MAXIMUM PERMISSIBLE THORIUM IN URINE IN PICOCURIES/LITER:
TH-228 1.1 TH-232 1.36

NAME	SS#	BIRTH DATE	COMPANY	DATE ISSUED	DOSE (mRem)		URINE ANALYSIS (pCi/l)	
					SKIN	WHOLE BODY	TH-228	TH-232
[illegible]LEN, WILLIAM	191-20-1253	07/18/28	KEYSTONE	01/01/92	0	0	*	*
ALLENDER, KAREN	211-36-2467	04/09/47	KEYSTONE	01/01/92	0	0	*	*
DAWSON, TIM	168-38-6706	08/01/60	KEYSTONE	01/01/92	0	0	*	*
DAY, SCOTT	428-04-7044	06/22/63	GSX	01/26/92	12	12	0.00	0.00
DILLION, FRANK	273-30-9265	01/20/38	KEYSTONE	01/01/92	0	0	*	*
HEDNEY, MIKE	173-32-8483	03/25/40	KEYSTONE	01/01/92	0	0	*	*
KROESEN, DICK	204-26-2998	08/19/31	KEYSTONE	01/01/92	0	0	*	*
LADY, RICHARD	415-86-3192	01/17/51	DE MAXIMIS	01/26/92	0	0	0.00	0.00
MURPHY, WETZEL	171-12-0639	03/34/20	KEYSTONE	01/01/92	0	0	*	*
PEAK, WILBERT	187-34-6886	03/27/44	KEYSTONE	01/01/92	0	0	*	*
STIMMEL, DAVID C.	203-58-6588	02/27/71	KEYSTONE	01/01/92	0	0	*	*
THOMPSON, BRUCE	174-42-3940	01/19/63	DE MAXIMIS	01/26/92	0	0	0.00	0.00

* [illegible]NALYSIS COLUMN INDICATES NO SAMPLE SUBMITTED IN THIS PERIOD
MAXIMUM PERMISSIBLE QUARTERLY DOSE: SKIN 7500 MREM; WHOLE BODY 1250 MREM.
MAXIMUM PERMISSIBLE THORIUM IN URINE IN PICOCURIES/LITER:
TH-228 1.1 TH-232 1.36

NSSI / SOURCES & SERVICES, INC.
P.O. BOX 34042 HOUSTON, TEXAS 77234 AREA CODE 713/641-
FAX 713/641-6153 TLX 160810 NSSI MUT

April 10, 1992

Laidlaw Environmental Services
2039 Willow Springs Lane
Burlington, NC 27215

Attn: Stan Coates

Dear Stan:

On the third quarter of 1991 personnel dosimeter report, it was noticed that ten individuals are recorded as having received (although 50 to 100 times less than the allowable limit) an exposure.

After reviewing these individuals' activities on-site at that time, it was determined that the exposures must be in error because some of the individuals never entered the restricted zone.

A review of the badge assignment log indicated that all ten of the individuals were issued badges from a particular batch that was sent on an overnight delivery by Federal Express in response to a request by the site that they were running lower on spare badges.

Since Federal Express frequently transports radioactive material packages, it would be a safe assumption to make in this case, that this shipment of badges probably came in close proximity to a radioactive shipment along the way.

In the future, I would recommend that all shipments of personnel dosimeters be shipped using the U.S. Postal Service since they by regulation limit any radioactive shipments not to exceed 0.5 mR/Hr. on the surface of the packaging.

If you need further clarification, please contact me.

Sincerely,

Charles T. Gallagher
Technical Services Manager

CTG/vw
Ref. #92303

AR102778