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PROJECT SPECIFIC PLAN FOR FEMP TRAP RANGE INVESTIGATION JUNE 1993

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PROJECT SPECIFIC PLAN

for

FEMP TRAP RANGE INVESTIGATION

WBS No. 50.03.14

Draft Addendum to the
Remedial Investigation/Feasibility Study
Work Plan

Prepared by

Fernald Environmental Restoration Management Corporation

Prepared for

U.S. Department of Energy
Fernald Field Office

Under Contract DE-AC05-92OR21972

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1.0 INTRODUCTION

Past activities at the Fernald Environmental Management Project (FEMP) included operation of a Trap Range on site. The Trap Range is located along the south side of the Sewage Treatment Plant Access Road, southeast of the former production area (Figure 1-1). The Trap Range has been identified by Ohio Environmental Protection Agency (OEPA) as an area which requires further characterization. Potentially, there may be significant levels of lead contamination in the soil and both buildings associated with the Trap Range are contaminated with radionuclides; therefore, this Project Specific Plan (PSP) has been developed to characterize the Trap Range.

The purpose of this PSP is to characterize the nature and extent of contamination in the Trap Range area, supply data for the baseline risk assessment and support decision processes in the feasibility study. All data gathered will be included in the Operable Unit (OU) 5 Remedial Investigation (RI) and Feasibility Study (FS). This PSP will also provide sufficient data to determine if a removal action is warranted.

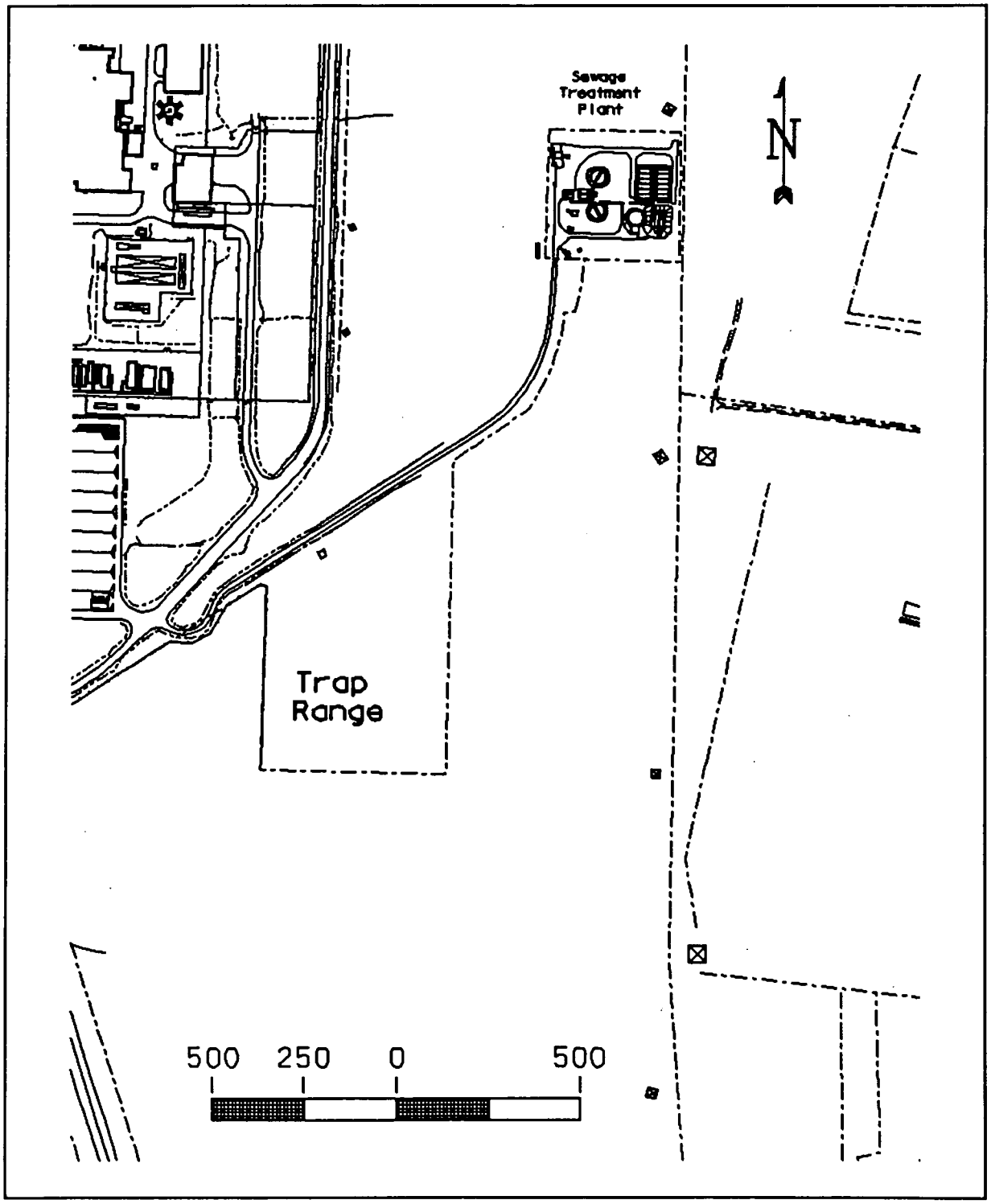
Lead-shot and trap fragments containing petroleum pitch are the main contaminants of concern. The contaminants, which are relatively immobile and insoluble, are assumed to be present within the Trap Range area and are not likely to have migrated from the area since deposition. Historical information and a metal detector survey will be used to delineate the major area of lead-shot contamination. There is also a potential that radionuclide contamination is present in the vicinity of the buildings and shooting platform. Therefore, a radiation walk-over survey will be conducted around each contaminated building.

Soil samples will be collected systematically from a square grid applied over the area delineated by the geophysical survey. The soil samples will be sieved to determine the lead-shot and trap fragment contents. Hot spot locations delineated by the walk-over survey will be sampled and analyzed for radiological parameters. Subsets of the soil samples will be analyzed for Hazardous Substance List (HSL) metals and semivolatile organic compounds (SVOCs). Standing surface water and flowing surface water, if present, will be analyzed for HSL metals, volatile organic compounds (VOCs) and SVOCs to determine if contaminants are being released to surface water.

2.0 SITE SETTING AND SITE BACKGROUND

No written background information is available for the Trap Range in the FEMP historical record. Some information is available about the location, the probable time of its operation and the extent of activities,

FIGURE 1-1
TRAP RANGE LOCATION MAP



from interviews with site employees who have personal knowledge about the area. In addition to this oral history, there are historic aerial photographs and Environmental Safety and Health (ES&H) records of radiological decontamination of the buildings located on the Trap Range.

2.1 TRAP RANGE OPERATIONS

The Trap Range was used for recreational purposes by site employees who organized a club in the mid-1950s and disbanded approximately in 1988. Figure 2-1 shows the layout of the range facilities. The members installed the shooting platform, trap house and a corrugated metal shed. The shooting platform is an arcuate feature consisting of five concrete spoke-like walkways approximately 27 feet in length, connected at both ends by curved walkways. The trap house is a 6-foot x 9-foot concrete-block structure which was constructed partially below grade. The trap house entrance is on the south side of the building and is covered with a plywood sheet hinged to the roof. The corrugated metal shed is 16 feet x 17 feet and rests on a concrete slab. Both the trap house and the shed are cordoned off as radiologically-controlled areas. The radioactive contamination will be discussed further in Section 2.8.

2.2 ESTIMATED VOLUME OF LEAD EXPENDED

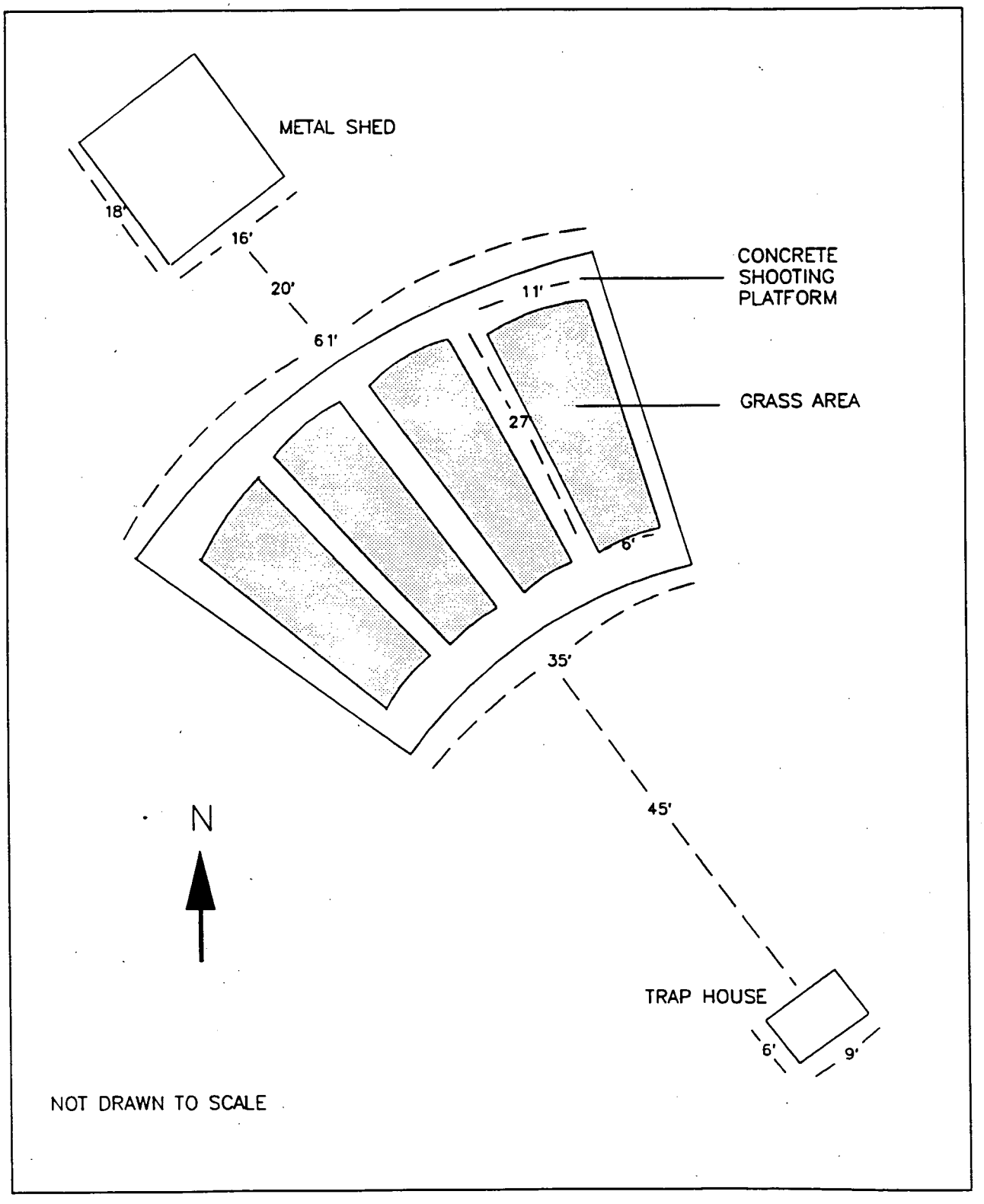
Interviews with former club members indicated that the Trap Club averaged approximately 30 members per year. Shooting was limited to the warm weather months and took place one day per week. The number of persons involved in the weekly shooting averaged about 10 per session. A day of shooting ended when each person had advanced and shot from each of the five shooting platforms and had expended 75 shotgun shells.

Each shotgun shell contained approximately 1.25 ounces of No. 7 lead-shot. Therefore, the estimated weight of lead-shot that fell over the Trap Range during its period of use is:

- 10 shooters expended in one session:
  - (10 people per session)(1.125 oz./shell)(75 shells) = 840 oz./session
- Annual lead-shot output assuming 4 sessions/month, 9 months/year:
  - (840 oz./session)(4 sessions/month)(9 months/year) = 30,240 oz./year
- Over 33 years of Trap Range operation, the total lead expended is 62,370 pounds

The calculations provide only a rough estimate of the amount of lead-shot that could be present at the Trap Range.

FIGURE 2-1
TRAP RANGE FACILITIES LAYOUT



2.3 CONTAMINATION FROM TRAP SHOOTING

The major contaminant of concern is believed to be lead from the lead-shot, heavy metal impurities in the lead-shot, particularly arsenic and antimony, or other compounds derived from the degradation of the lead-shot. Since lead-shot is relatively immobile and there were no other uses for the area, it is expected that virtually all of the lead-shot will be found in the upper one foot of soil. It is doubtful that this material poses a threat of contamination to either the underlying Great Miami Aquifer or perched water zone. However, to investigate the possibility that a fraction of the lead may have been solubilized and transported further into the subsurface, fine grain portions of soil will be analyzed for HSL metals after the lead-shot and trap fragments are removed.

A potential secondary source of contamination are the trap targets (clay targets or clay pigeons). These are typically composed predominantly of dolomitic limestone with petroleum pitch as a bonding agent. The targets are painted with a latex paint. Although it may not be possible to directly correlate the composition of present day trap with those used at the Trap Range, the Material Safety Data Sheet (MSDS), No. DU003852, for trap provides some information to support the assumption that trap targets should not be considered a major contributor to contamination at the Trap Range. The approximate percentage composition of petroleum pitch is 32%, dolomitic limestone is 67%, with latex paint comprising approximately 0.1%. The MSDs list the water solubility as "Low," the form as "Solid Disks" and the color as "Black with fluorescent orange or white painted top." The MSDs hazardous reactivity indicates the instability as "Stable," the incompatibility as "None reasonably foreseeable," decomposition as "Decomposition will not occur" and polymerization as "Polymerization will not occur."

Petroleum pitch is described as a mild skin irritant and also contains components which have carcinogenic properties. However, due to the insolubility and non-reactivity of the product, the trap would have to be crushed and swallowed or inhaled to cause adverse reactions to organisms.

There is a possibility that lead-based paint, which may have been used on the trap in the past, has contributed some inorganic contamination at the Trap Range. If this is true, the lead analysis of the soil samples should adequately characterize contamination contributed by the paint.

Dolomitic limestone, petroleum pitch and latex paint products or by-products from the trap are not considered hazardous. However, soil samples will be collected and analyzed for SVOC constituents.

2.4 AERIAL PHOTOGRAPH STUDY

Due to the lack of written information regarding the Trap Range, an assessment of historical aerial photographs was performed. The dates of aerial photographic coverage of the FEMP are shown in Table 2-1. The March 1957 photo is the earliest that shows the Trap Range. The April 1988 photograph shows the Trap Range after shutdown.

TABLE 2-1
AERIAL PHOTOGRAPH COVERAGE DATES AVAILABLE FOR THE FEMP TRAP RANGE INVESTIGATION

October 13, 1950	September 12, 1968
April 6, 1954	May 20, 1976
March 21, 1957	May 10, 1983
September 11, 1962	April 20, 1988
April 15, 1964	

2.4.1 Aerial Photograph of March 21, 1957

The 1957 aerial photo clearly shows the Trap Range. The most prominent feature is the concrete shooting platform located in the northwest portion of a fenced Trap Range area. In addition to the shooting platform, the trap house and shed are visible in the photograph. The fenced range area is approximately 350,000 square feet of regularly-mowed pasture. The dimensions of the mowed area are shown in Figure 1-1. This trapezoid-shaped area is clearly present on all later aerial photographs and is also shown on many maps of the FEMP. A row of trees is inside and parallel to the west boundary of the area. The eastern and southern boundary of the Trap Range is less definite, but is delineated by a pattern resulting from grass mowing in each of the available aerial photographs.

2.4.2 Aerial Photograph of April 20, 1988

Analysis of the 1988 photograph indicates that the land use in the area is unchanged from the conditions in the 1957 photograph. The trapezoid-shaped area, fence row vegetation, shooting platform, trap house and shed are all visible. The vegetation pattern has not been altered and there is no evidence of any new construction or any other activities in the area.

2.5 FEMP SOIL BACKGROUND LEVELS

Background concentrations naturally occurring in the FEMP soils and subsoils are presented in Table 2-2. This information was gathered during 1992 as part of an investigation of background concentrations of radiological and inorganic constituents which occur naturally in the vicinity of the FEMP (DOE, 1993). Background sampling locations were all northwest of the FEMP in the vicinity of Shandon, Ohio. Note that lead occurs at a higher concentration in the surface soil. This is a regional phenomena possibly due to atmospheric pollution, such as automobile exhaust.

TABLE 2-2
BACKGROUND CONCENTRATIONS - MEAN AND RANGE

Depth (inches)	Mean (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)
ANTIMONY			
0-6	Not detected in any sample collected for the background study. The average sample quantitation limit was 6.7 mg/kg.		
36-42			
48-54			
ARSENIC			
0-6	5.18	3.40	9.20
36-42	5.33	2.70	14.50
48-54	4.32	1.60	8.40
LEAD			
0-6	17.22	11.0	36.4
36-42	9.06	5.2	18.4
48-54	7.34	3.0	13.0

2.6 CURRENT SITE CONDITIONS

The area was inspected in the summer of 1992 and all reported features were as they had appeared on the aerial photographs. Due to the deep thatch developed in the pasture, no evidence of trap fragments or lead-shot was observed. The area was again inspected for the preparation of this PSP on April 16, 1993, and several significant changes were noted as a result of the construction activities for Removal Action No. 3. The shooting platform is still present; however, it is difficult to find because heavy equipment has been repeatedly driven over the area between the shed and the trap house churning mud over the concrete and leaving deep ruts in the soft soil. Equipment with large tires has also been repeatedly driven across the area extending from the trap house to approximately 100 feet south of the

trap house. The equipment has matted the grass, and trap fragments can be seen scattered throughout the area.

2.7 RADIOLOGICAL CONTAMINATION

As indicated in Section 2.1, the FEMP employees constructed the trap house and shooting platform. The materials used for this construction were apparently brought from the former production area. Interview records are not clear about the origin of the shed; however, there is reason to believe that it was originally a part of Plant 7 and was brought to the Trap Range without proper decontamination.

The water main for Removal Action No. 3 was installed immediately north of the corrugated metal shed in the winter of 1992. During construction, a buried 440-volt electrical line was discovered leading to the corrugated shed. Since this line was not on any plant drawings, suspicions were aroused as to the construction of the building which lead to an ES&H inspection. The building contained significant levels of contamination as did the lumber and rope inside the building. Between June and September 1992, the shed was decontaminated to bring it within FEMP standards for the Production Area.

The ES&H documents refer to the metal shed as the "trap house." Therefore, it is unclear as to whether or not the actual trap house has been decontaminated. In either case, it is clear that loose contamination was present in the shed and the trap house. The area immediately around each structure is roped off as a radiologically contaminated area. Consequently, it is quite possible that there could have been radiological surface contamination in the area of the shooting platform between these two structures as a result of foot traffic from the contaminated buildings across the shooting platform.

3.0 SAMPLING PROGRAMS

The investigation will consist of three main activities:

- A metal detector geophysical survey to delineate the area where lead-shot is in greatest abundance;
- A walk-over radiological survey to delineate the area where surface radiological contamination is greatest; and
- Soil sampling at depths of 0.0 to 4.0 and 4.0 to 8.0-inch intervals for sieve, chemical and radiological analyses.

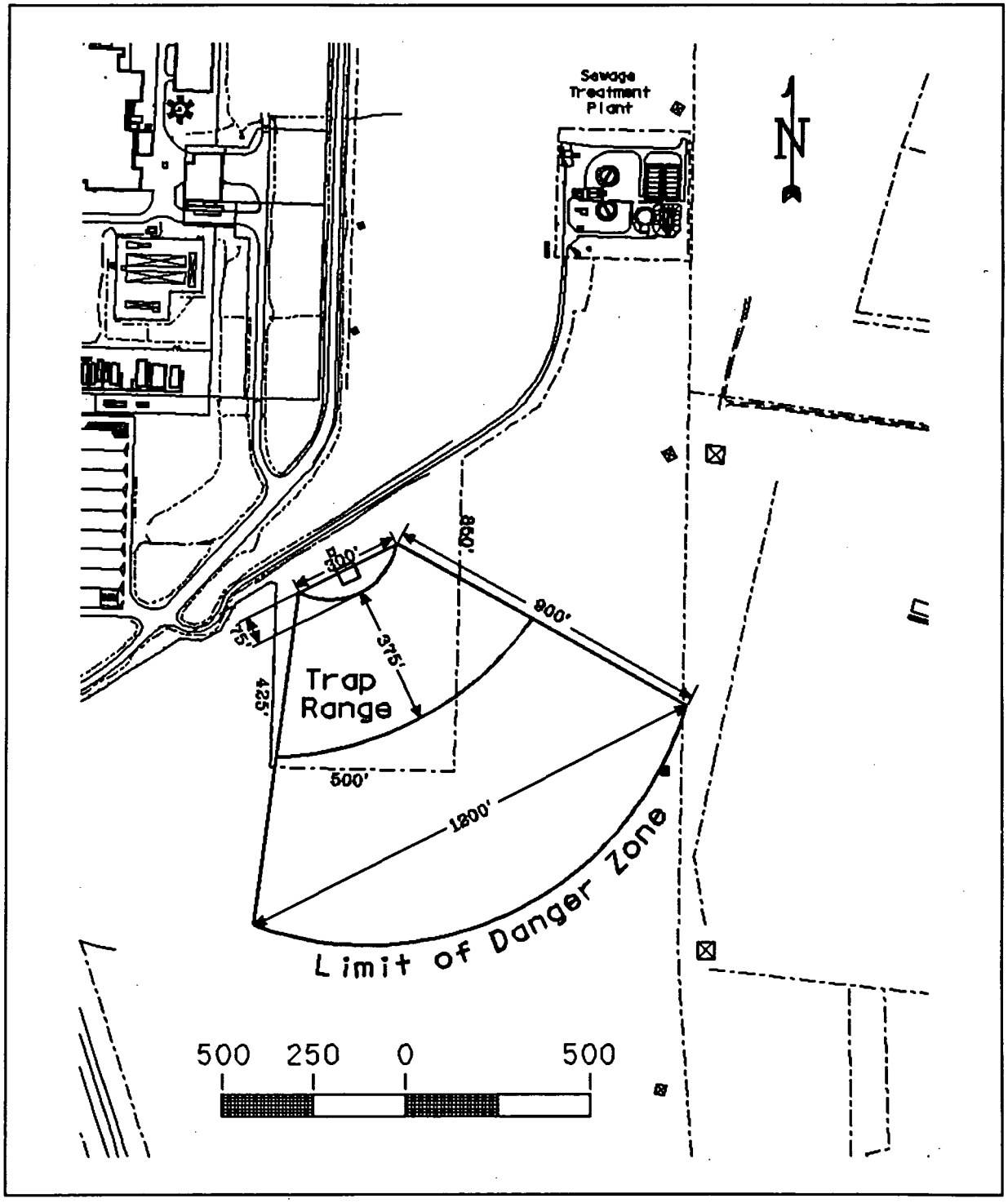
A geophysical survey discussed in Section 3.1 will be used to delineate the area of concern for lead-shot contamination. The metal detector will locate the areas where the greatest abundance of lead-shot is on or near the surface. Although the metal detector values are not quantifiable in terms of metal content, they will provide a delineation of the area where soil samples will be collected to quantify the contamination. Similarly, the radiation walk-over survey discussed in Section 3.2 will be used to delineate areas where surface contamination is present. A soil sampling program, discussed in Section 3.3, will be conducted to determine the distribution of lead-shot and trap fragments in the subsurface soil, the level of HSL metals leaching from lead-shot in the soil, the levels of HSL SVOC in soil leaching from trap fragments and the levels of radionuclides in soil. In addition to the soil sampling, surface water samples will be collected to determine if metals, radionuclides or organics are leaching into surface water.

3.1 GEOPHYSICAL SURVEY

A metal detector survey will provide data on lead-shot distribution and define the area of concern for lead-shot and trap fragment contamination. A current Trap Range design has also been used to estimate the area of concern. Figure 3-1 shows a current trap range design superimposed on the FEMP Trap Range. As depicted in Figure 3-1, the design "danger zone," using a current trap range design, extends well beyond the fence that defined the FEMP Trap Range. Interviews with commercial trap range operators indicate that lead-shot generally has a maximum range of 700 to 900 feet. Also, companies that mine lead-shot on commercial ranges do the majority of their work in the zone 75 to 375 feet in front of the trap house. Figure 3-1 shows two arcs that define these distances. The FEMP Trap Range boundary generally resides within this 375-foot radius.

It is assumed in planning this investigation, that lead-shot and trap fragments will be concentrated along the center line of the range and within the danger zone as shown in Figure 3-1. It is further expected that the majority of the contamination from trap shooting will be within the 375-foot radius from the trap house. The majority of lead-shot and trap fragments will likely have fallen along the center line and their concentrations should decrease laterally from the center line and with distance downrange. Lead-shot and trap fragments should be confined to the upper four inches of soil. Due to the differing launch velocities of lead-shot and traps, the locus of the highest concentration of trap fragments may be closer to the trap house than the highest concentration of lead-shot.

FIGURE 3-1
CURRENT DESIGN OVERLAY ON FEMP TRAP RANGE



The RI/FS requires information on the spatial distribution of contaminants. Data from a square grid are the best input for estimating spatial distributions by methods such as trend surface analysis or weighted moving averages (Gilbert, 1987). Trends are strongly suspected to occur over distances greater than 50 feet; therefore, a square 50-foot grid will be adequate for a metal detector survey.

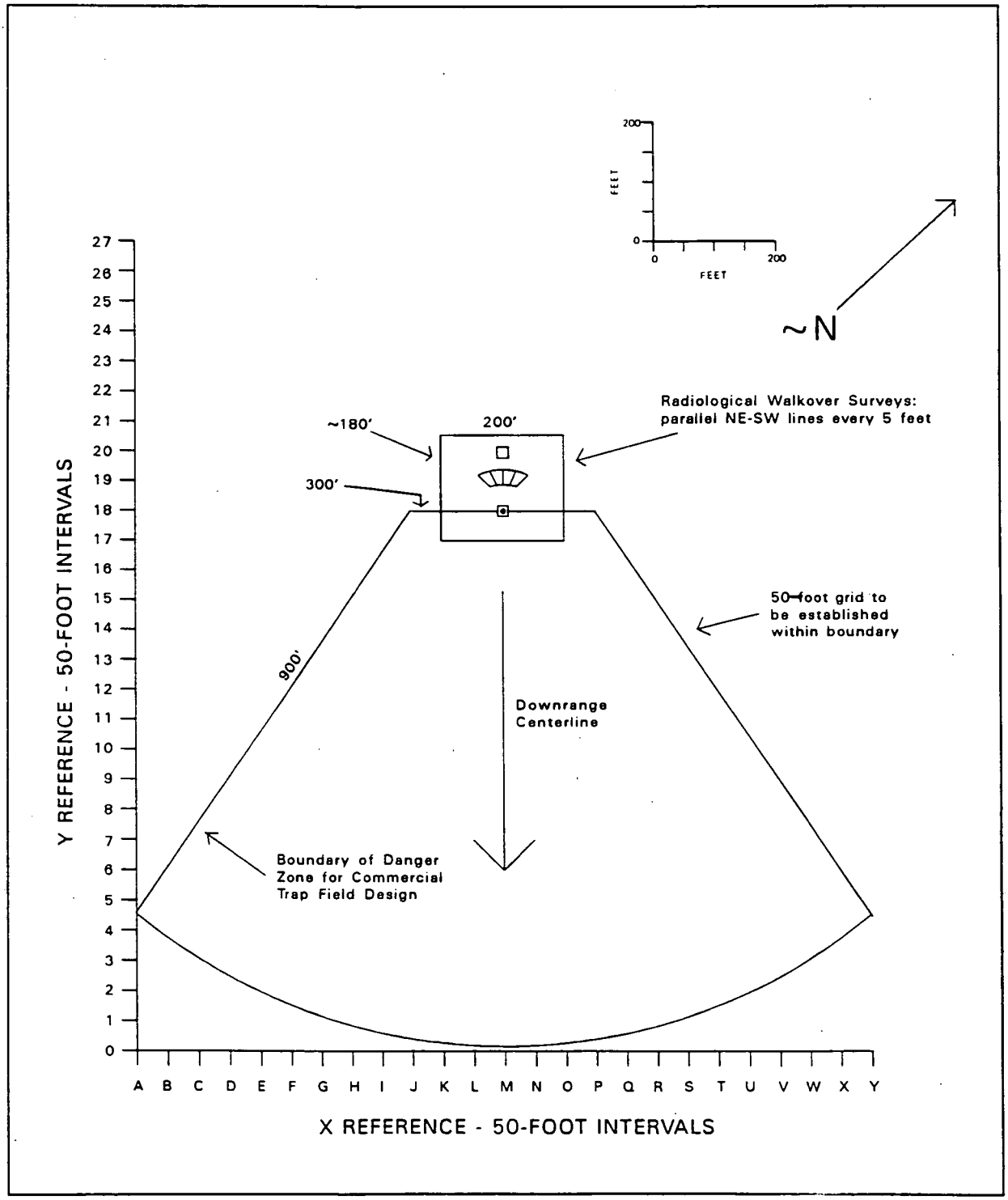
Figure 3-2 shows the survey grid for the metal detector geophysical survey. A FERMCO employee used his metal detector to test the theory that such a device will find dispersed lead-shot in soil. Although this test cannot be considered a true calibration, such a tool was sufficiently responsive to low concentrations of lead-shot and, therefore, should provide the required screening to determine the location of soil samples. The detailed procedures for conducting the geophysical survey are provided in Section 7.1.

Test scanning with known quantities of lead-shot has shown that a FISHER MODEL 95 metal detector has the capability of delineating lead-shot in the concentrations expected at the Trap Range. Thus, it is possible to delineate areas of lead-shot contamination using a sensitive metal detector with an analog or digital scale, such as the FISHER MODEL 95. All readings will be collected by holding the detector at a standard height according to the manufacturer's recommendations.

In summary, the survey will be conducted by establishing an instrument reading at the highest sensitivity-instrument configuration at a shot-free location and using this as a base station. Readings will be collected at 50-foot intervals along the center line of the Trap Range beginning at the trap house. The survey will continue downrange until background readings are found at two consecutive survey locations. The survey will continue on either side of the center line to complete the definition of the area where lead-shot is on the surface. The boundary of the lead-shot area will be defined by finding two consecutive background readings in a row after leaving an area where elevated reading occurs. Once the northern and southern boundaries are defined, the lateral boundaries will be established by surveying from areas of elevated readings outward.

The maximum reading from the metal detector will be recorded on a map and contoured to establish the metal anomaly resulting from the presence of lead-shot. Soil samples will be collected, as discussed in Section 3.3.1, at each of the grid locations within the area delineated by the metal detector and at the first grid point outside the area delineated by the metal detector.

FIGURE 3-2
GRID FOR THE GEOPHYSICAL AND RADIOLOGICAL SURVEYS



The background will be established for the metal detector in either of two ways: 1) If the instrument does not register a response on its scale in background soil, then any instrument response is assumed to be an above-background value; or 2) If the instrument registers readings on its scale in all areas, then a "background" value will be established by collecting readings at a discrete number of clean locations. In the latter case, the "background" mean and standard deviation will be established by collecting 30 readings in clean areas adjacent to the Trap Range, 10 readings east of the range, 10 readings west of the range and 10 readings south of the range.

The metal detector will be calibrated at the start of each day and checked every three hours thereafter, or more frequently, if recommended in the instrument operating instructions. A calibration area will be established in a clean area east of the "danger zone" shown in Figure 3-1 and marked with a nonmetallic stake. The particular method for establishing background values will be determined by the CRU5 Project Manager after the specific metal detector is purchased.

At each staked 50-foot survey location, the operator will sweep 360 degrees with the instrument held at a uniform height above the ground surface and a uniform distance from his/her body following the procedure in Section 7.1 of this PSP. All readings will be collected in a consistent and repeatable manner to ensure comparability of data. The highest instrument reading will be recorded and plotted on a map. Five percent of the survey points will be repeated at the end of the day for quality control.

3.2 RADIOLOGICAL INVESTIGATION

As discussed in Section 2.8, the shed and trap house are roped off as radiologically-contaminated areas. While the structures have been decontaminated, there are no data to indicate the soil around these buildings was tested. Potentially, soil contamination may be locally present within the vicinity of the structures and between structures where foot traffic would have spread the loose contamination in the buildings. To determine if soils adjacent to the structures are contaminated, a radiation walk-over survey will be conducted with a shielded SPA-3 probe. If areas of elevated readings "hot spots" are identified during the survey, they will be marked with flags and the readings will be recorded and mapped. Confirmatory soil samples will be collected to determine the level of radionuclides at the locations where the five highest "hot spot" readings occur. If the survey identifies extensive areas with above-background activities, the five samples will be collected at evenly-spaced intervals over the area.

The radiation walk-over survey will be conducted in a series of parallel paths spaced at five-foot intervals across the area as shown in Figure 3-2. The survey technician will traverse each path while surveying the ground in a serpentine-search pattern holding the detector at a uniform height to yield a viewing window of approximately 16 inches in diameter. All hot spots will be marked with flags as the walk-over survey progresses. Hot spots will then be scanned in detail to determine the area affected and that area will be marked with flagging. The location and approximate size of the hot spots will be recorded on the walk-over survey forms and maps of the grid area. At the conclusion of the survey, the survey technician will complete a sketch map to portray the walk-over survey lines and the location of the hot spots.

3.3 SOIL AND SURFACE WATER SAMPLING

Soil samples will be collected on the basis of the results from the metal detector survey. After an initial sieve analysis, sub-samples will be selected for HSL metals and SVOC analysis. A separate set of soil samples will be collected for radiological analysis. In order to determine if there is any migration of either metals from the lead-shot or organics from the trap fragments, two surface water samples will also be collected.

3.3.1 Metals and HSL Semivolatiles Soil Samples

Surface soil samples will be collected from the 50-foot grid within the area of the metal anomaly identified during the metal detector survey. The 0.0 to 4.0-inch samples will undergo a grain size analysis (TAL 50.03.14 E, Appendix A) to separate and determine the weight percent lead-shot and trap fragments in each sample. The soil portion of the four samples with the greatest weight percent lead-shot will be analyzed for HSL metals (TAL 50.03.14 A) after the lead-shot and trap fragments have been removed. Also, the soil from three soil samples where lead-shot was not found will be analyzed for HSL metals. The analysis of these seven samples will determine the HSL metal content that may be present in soil as fine fragments or mobilized metal that has accumulated in soil grains and the ambient metals content of the soil in the area. The 4.0 to 8.0-inch samples will be archived and available for analysis if elevated metals values are present in the 0.0 to 4.0-inch samples.

The four samples with the greatest weight percent trap fragments will determine where additional samples will be collected for HSL SVOC analysis (TAL 50.03.14 B, Appendix A). Because the sieve analysis

will destroy the validity of the sample for HSL SVOC analysis, a new sample from each grid point where the greatest concentration of trap fragments exists will have to be collected for shipment to an off-site laboratory. In addition, three samples from grid points where no trap fragments were found will be sampled and analyzed for HSL SVOCs to determine ambient conditions.

Soil samples will be collected at seven locations for full radiological analysis and HSL metals (TAL 50.03.14 C). Samples will be collected from the surface to a depth of four inches and from four inches to eight inches. The surface sample will be sent to an off-site laboratory for full radiological analysis and HSL metals while the deeper sample will be archived. The deeper sample will be analyzed if elevated levels of radionuclides are detected in the surface sample. If the walk-over survey identifies hot spots, then the three locations with the highest SPA-3 readings northwest of the mid-point of the shooting platform, and the three locations with the highest SPA-3 readings southeast of the mid-point of the shooting platform, will be sampled. One sample will be collected in an area where the walk-over survey indicates that ambient conditions exist.

If hot spots are not identified during the walk-over survey, then soil samples will be collected at a point four feet out from mid-point of each of the walls of both the shed and the trap house.

3.3.2 Surface Water Samples

Surface water samples will be analyzed to determine if contaminants are leaving the Trap Range via the surface water pathway. Surface water samples will be collected from two locations and analyzed for HSL metals, VOCs, SVOCs and full radiological parameters (TAL 50.03.14 D).

One sample will be collected from standing water within or immediately downgradient of the most heavily contaminated area identified by the metal detector survey. The field team will collect a sample of standing water immediately after a period of rain.

The second sample will be collected from surface water draining from the Trap Range to the ditch on the east side of the Sewage Treatment Plant Access Road. If flowing water that meets the above criteria cannot be found, a second sample of standing surface water will be collected from a location within the metal detector anomaly on the Trap Range.

3.4 ANALYTICAL PROGRAM

The required radiological and non-radiological analytical tests to be conducted for this characterization are listed in the Target Analyte Lists in Appendix A. The majority of the samples will undergo a sieve analysis at the FERMCO laboratory.

3.5 SUMMARY OBJECTIVES

Table 3-1 presents a summary of the objectives of this investigation. The table is a summary of the activities to be undertaken in this PSP. Table 3-2 summarizes the samples to be collected and the TAL to be used with each sample.

4.0 ORGANIZATION AND RESPONSIBILITIES

This PSP has been developed by CRU5 to fulfill data needs for the FEMP site characterization to be reported in the OU 5 RI. The CRU5 RI/FS Project Manager has full responsibility and authority for the content and specifications in this PSP. Any changes to the activities specified in this PSP must have the approval of the CRU5 RI/FS Project Manager prior to implementation.

4.1 FIELD ACTIVITIES

Field activities are to be conducted by the FEMP Site Characterization Group using SCQ-approved work procedures and sampling procedures described above. The Site Characterization staff have the responsibility for adhering to the SCQ and to the procedures in this PSP. The Site Characterization staff will assign unique sample numbers for all samples collected. Field activities include: sample collections, sample handling, preservation, shipment and notification of laboratories and management of subcontracted services.

At the completion of field activities associated with each of the three tasks above (Sections 3.1, 3.2 and 3.3), a task completion report will be prepared by the Site Characterization/Data Management (SC/DM) Department and submitted to the CRU5 Project Manager, which includes copies of all field forms, data sheets and activity logs, as well as a written summary of the field activities noting any variances from either this PSP or the SCQ procedures. Appropriate SCQ forms (D-1 through D-13), Appendix B of the SCQ, must also be completed for data validation and submitted to the FEMP laboratory as part of the field activity.

TABLE 3-1
SUMMARY OBJECTIVES FOR TRAP RANGE INVESTIGATION

Activities	Conduct a systematic metal detector survey of the Trap Range. Collect soil samples for analysis of weight percent lead-shot and trap fragment. Collect surface water samples. Conduct a radiation walk-over survey of soils adjacent to contaminated structures. Analyze soil for HSL metals and SVOCs. Analyze soil samples for full radiological list and HSL metals. Analyze local surface water for HSL metals, VOCs and SVOCs and full radiological list.
Objectives	Achieve definition of suspect area in order to establish the area for soil sampling. Determine weight percent lead-shot and trap fragments in soil. Determine HSL metal and HSL SVOC content in soil. Determine if contaminants in soil are present in surface water runoff. Determine if radiological soil contamination is present and the constituents.
Prioritized data uses	Evaluate the site for a possible removal action. Data for nature-and-extent discussion and fate-and-transport input to baseline risk assessment in the OU 5 RI. Data for evaluation of alternatives in FS.
Appropriate analytical level	Radiation walkover and metal detector survey ASL A; Sieve analysis and full radiological ASL E; HSL metals, VOCs and SVOCs ASL D; Ten percent of the ASL D data packages will be validated at ASL D and 90 percent at ASL C.
Constituents of concern	HSL metals and SVOCs in soil (TAL 50.03.14 A and B, Appendix A). Full radiological and HSL metals in soil (TAL 50.03.14 C). HSL metals, VOCs, SVOCs and full radiological in surface water (TAL 50.03.14 D).
Required detection limits	Detection levels are specified in Section 9 of the SCQ and by preliminary remediation goals for radionuclides.
Critical samples	No individual sample is considered critical; however, acquiring 90 percent of proposed data is essential to success in later data analysis.

TABLE 3-2
SUMMARY LIST OF SAMPLES

Sample	Number
Soils[a]	75[b]
Metals Area[c]	7
Organics Area[d]	7
Radiological Area[e]	8
Surface Water[f]	2
Rinsate[g]	10[b]
Duplicate[g]	3
Trip Blank[h]	1
Field Blank[i]	2

[a] TAL 50.03.14 E
[b] Will depend on the geophysical survey results
[c] TAL 50.03.14 A
[d] TAL 50.03.14 B
[e] TAL 50.03.14 C
[f] TAL 50.03.14 D
[g] Same TAL as the samples collected
[h] TAL 50.03.14 F
[i] TAL 50.03.14 A and B

4.2 QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

The FERMCO QA department will assure that the contents of this PSP conform to the requirements of the SCQ. The FERMCO QC department will monitor field activities to assure that all work conducted in the execution of this PSP conforms to the appropriate standards specified in the SCQ and this PSP.

5.0 HEALTH AND SAFETY CONSIDERATIONS

Effective health and safety programs for any activity are based on an effective training program. All involved personnel will receive adequate training prior to implementation of the field work. This training will make all employees aware of the physical, radiological and chemical hazards which may be encountered during the execution of this project.

All FEMP employees and subcontractor personnel who will be performing field work during this project are required to have completed all Occupational Safety and Health Administration (OSHA)-mandated

1910.120 Hazardous Waste Site Worker training. In addition, all applicable annual refresher training will have been taken by the individuals. The Department of Energy (DOE) regulations at the FEMP require a series of site specific training courses related to the site. These courses are designed to augment OSHA-required training and provide additional training specific to the hazards which exist at the FEMP. For health and safety considerations, field personnel participating in the performance of this project will be trained according to the FEMP SCQ and this PSP. In summary, employee awareness and clearly delineated lines of authority and responsibility have been designed to provide for effective health- and safety-related knowledge specific to each activity.

5.1 TASK SPECIFIC PLANS

All aspects of this PSP will be performed in accordance with all existing applicable DOE, United States Environmental Protection Agency (U.S. EPA), OSHA and State of Ohio Health and Safety regulations. Additionally, all practices will be managed in accordance with commonly-accepted practices used in the hazardous waste industry.

Each field activity must have a separate task specific health and safety plan. Task specific health and safety plans have been prepared in accordance with the FEMP Site Health and Safety Plan. For each project task and sub-task, health and safety technician coverage is provided by the assignment of a technician to monitor the field crew's activities.

Task specific health and safety plans provide for the hazards typically encountered by personnel when performing the specified field work. Proper equipment to be used for health and safety monitoring and personnel protection are specified. Criteria for the selection of monitoring equipment and protective clothing are detailed. Each member of the field crews is required to participate in a health and safety training session, which is specific to each field project, prior to performance of the field work.

5.2 RADIOLOGICAL MONITORING AND CONTROLS

Radiological monitoring for this PSP will be achieved using existing institutional controls commonly utilized at the FEMP. For those areas of the FEMP which are under existing institutional radiological controls, any employee who will be entering such areas is required to possess and wear a Thermal Luminescent Detector (TLD) to monitor for exposure to radiological contamination. In addition, each

employee is required to participate in a regularly-scheduled urine analysis program which is designed to monitor for radiological exposure.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, Radiation Worker Permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological technician will be assigned to each field crew performing any activities in an area which could be expected to result in site workers being exposed to levels of radiological contamination exceeding DOE limitations.

Ingress and egress of personnel, equipment and vehicles to and from radiologically-controlled areas will be monitored with "real time" radiation detection instrumentation. Monitoring results which exceed FEMP-determined exposure guidelines will be further evaluated as to the possible source(s). Measures necessary to remediate radiological contamination sources will be implemented. Such measures may include, but are not limited to, personnel training, decontamination, employee exposure monitoring, increased personnel monitoring, Personnel Protective Equipment (PPE) and sampling of suspect materials encountered.

If the responsible radiological technician assigned to the field activities being performed identifies a real or potential condition which could or will result in an unsafe condition, then that person has the responsibility to cease field operations until such time as the unsafe condition has been corrected.

5.3 NONRADIOLOGICAL MONITORING AND CONTROLS

Monitoring of potential health and safety problems associated with nonradiological hazards is performed by a health and safety technician. Also, all field crews are responsible for hazard awareness and recognition. Task specific training is designed to enhance the performance of all field work using good and safe work practices.

Evaluating the potential for personnel exposure to organic contaminants will be achieved mainly through the use of an HNu P-101 Photoionization Detector or equivalent instrument. Other equipment which could potentially be used include: Drager Tubes, oxygen meters and combustible gas indicators.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The primary objectives of the QA and QC sections of this plan relate to the collection of field information and data which are sufficient to accurately characterize soil and surface water contamination. Specific objectives of this field sampling effort will be designed, organized and implemented in a manner which will optimize the collection of information which meets predetermined data quality objectives. To ensure that information is gathered in such a manner that data quality objectives are met, quality control measures will be used to determine conformance with overall OU 5 RI/FS program objectives.

6.1 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field quality control samples will be taken to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in project analytical results. Four types of QC samples will be collected: sampling equipment rinsates, field blanks, duplicate samples and trip blanks. During soil sampling, rinsate samples will be collected at a rate of one in 20 washings and analyzed for parameters in TAL 50.03.14 A. Rinsates will also be collected at a rate of one in 20 washings from the sieves used in the sieve analysis. Trip blanks for HSL VOCs (TAL 50.03.14 F) will be shipped in each container with HSL VOC samples. One certified blank sample for soil matrices will be shipped with the soils analyzed for HSL metals and one for soils to be analyzed for SVOC. Duplicate radiological and SVOC samples will be collected as adjacent samples at surface locations.

Five percent of the radiation walk-over survey and metal detector survey stations will be repeated to verify results as specified in the SCQ, Section 5.3.2, for surface geophysical surveys.

6.2 QUALITY ASSURANCE AUDITS

To verify compliance with the SCQ and project-specific requirements, the FEMP CRU5 Project Manager and designated FEMP QA personnel will conduct audits and surveillances. The U.S. EPA may obtain audit results of activities covered by the SCQ upon written request to the Department of Energy, Fernald

Field Office (DOE-FN). They may also conduct external audits of FEMP activities covered by the 1991 Amended Consent Agreement as required.

As a minimum, audits and surveillances shall consist of evaluation of the QA program and procedures, effectiveness of the implementation, and review of associated project documentation and final reports. Audits and surveillances shall be performed in accordance with DOE guidelines and the SCQ.

6.3 QUALITY CONTROL SURVEILLANCES

Surveillances shall consist of monitoring/observing on-going project activity and work areas to verify item and activity conformance to specified requirements. Project surveillance activities will be scheduled, planned and documented as specified in Section 12 of the SCQ.

7.0 FIELD ACTIVITY GUIDELINES

This section presents a generalized description of the field activities and procedures to be implemented in order to provide the additional contaminant (nature and extent) information necessary for the RI/FS. All procedures for this PSP will be performed in accordance with directives established in the SCQ, with the addition of specific procedures presented in this PSP. Standard procedures are listed in Table 7-1 and are supplemented by project specific procedures presented in Sections 7.1 through 7.3.

7.1 GEOPHYSICAL PROCEDURE

Objectives of the geophysical survey will be accomplished in the following steps:

1. Establish a northwest-southeast downrange centerline through the middle of the shooting platform. The line will be based on the layout of the existing structures and the arrangement of structures observed in aerial photos.

2. Establish a survey grid with 50-foot by 50-foot spacing. The coordinate system of the grid will be parallel to the downrange center line (Figure 3-2), and individual survey locations will be referenced by their grid intersection, e.g., 1A, 2B and 5K. A licensed surveyor will establish the grid and produce a map that sample technicians will use to plot data while in the field. The grid will be marked in the field using labeled nonmetallic stakes.

3. Establish background values (mean and standard deviation) for the metal detector. Establish a base station where the metal detector will be calibrated at regular intervals.

4. Perform a metal detector geophysical survey along the downrange centerline to initially establish the northwest-southeast extent of the metal anomaly.

TABLE 7-1 PROCEDURES	
Administrative Procedures	**Reference document**
Chain of Custody	SCQ Volume I, Section 7.1
Corrective Action	SCQ Volume I, Section 15.2
Daily Logs	Section 5.1, Appendix J, Subsection J.4.1
Variances	Section 15.4
Field Procedures	
Subsurface Soil Sampling	SCQ, Appendix K, Subsection K.5.3
Surface water sampling	SCQ, Section 6, Appendix K
Field Screening of Samples for Radioactive Contamination	SCQ, Appendix K, Subsection K.5.3.2
Decontamination	SCQ, Appendix K, Subsection K.11
Field Storage and Shipment of Samples	SCQ, Appendix K, Subsection K.10
Sample Handling Procedures	
Classification, Preservation, Transportation, and Shipment of FEMP RI/FS Samples	SCQ, Appendix A, Table 6.1

5. The geophysical reading will be taken at each grid while the operator is stationary at the point. The metal detector will be held at a constant height above the ground and slowly swung in an arc from the left rear, to the front, and around to the right rear of the operator. The highest reading on the metal detector meter will be recorded. The operator will then face in the opposite direction at the same point and repeat the reading. Both values will be recorded and the highest value will be used to define the metal anomaly.

6. Perform the survey and mark the edge of the metal anomaly with flags. The survey will progress by making traverses along the northwest-southeast grid lines. Lateral boundaries will be determined by conducting the geophysical survey along lines parallel to the center line. The survey will be complete when there are two data points at background beyond all sides of the metal anomaly.

7. A field map with the information gathered in Step 6 will be prepared as the survey progresses, which shows the high reading at each grid point. This map will be used by the CRU5 Project Manager to determine when the geophysical survey is complete.

8. Soil sampling may begin as soon as areas with elevated geophysical readings are identified. The final limits of the soil sampling will be determined by the anomaly boundaries established on the map developed in Step 7 and approved by the CRU5 Project Manager.

7.2 SOIL SAMPLING PROCEDURES

Equipment decontamination and sample handling procedures are presented in Section 6.3 and Appendix K of the SCQ. The following are additional procedures to cover the unique sampling requirements of this PSP. All soil samples collected at the surface for sieve analysis will follow these procedures. These samples will consist of the composite of soil from two points near each of the grid points. Since the lead-shot and trap fragments are on the surface or incorporated into the thatch on the surface, it is important to include grass roots and thatch in the samples. Therefore, the following procedures will be used when collecting the 0.0 to 4.0-inch samples for the sieve analysis:

- Mark two points for sampling at each grid point. One point will be two feet south and one point two feet north of the grid point.
- Use shears to remove grass from above the soil. Cut as close to the root as possible without removing the roots.
- Collect a four-inch diameter sample to a depth of four inches at each of the sampling points. Place the soil thatch and grass roots from both points in a heavy gauge polyethylene bag.
- Repeat the process by collecting the four to eight-inch sample set from the same points and placing the soil in a second polyethylene bag.
- Seal each bag with tape, custody tape and label with the grid location and a unique sample number.

The 4.0 to 8.0-inch samples will be collected using the normal sampling procedures for soil samples except that they will be a composite of material from the two sample points on each side of the grid stake.

7.3 SIEVE ANALYSIS PROCEDURES

Sieve analysis for soil samples will follow the standard sieve analysis protocol with the following additional steps:

1. Dry the sample but leave the grass roots and thatch in the sample for sieve analysis.

2. Inspect each sieve for lead-shot and trap fragments.

3. Remove all lead-shot and trap fragments before weighing the soil fraction in the sieve.

4. Weigh all the lead-shot and provide a weight percent value for lead-shot for the sample.

5. Weigh all the trap fragments and provide a weight percent value for trap fragments for the sample.

6. Combine all sieve fractions of soil into a sample bottle for possible HSL metals analysis.

7.4 WASTE DISPOSITION

The following wastes will be generated during characterization activities:

- Contact wastes
- Equipment decontamination solutions

The following subsections provide the proposed disposition methodology for each type of waste generated.

7.4.1 Contact Wastes

Contact wastes, such as PPE and rags or wipes (paper towels, Chemwipes, etc.), will be placed in plastic bags or 55-gallon drums and transported to the FEMP for appropriate disposition. Contact waste handling and disposition is discussed in the SCQ, Appendix K.

7.4.2 Decontamination Solutions

Equipment decontamination solutions will be transferred to U.S. Department of Transportation (DOT)-approved bung-type, 55-gallon drums, labeled as "Decontamination Solutions." The drums will be placed on wooden pallets, underlaid by diked Herculite sheeting to prevent contaminant migration resulting from spills or leaks. Upon completion of field activities, the drummed decontamination solutions will be transported to the FEMP for storage and appropriate disposal.

8.0 FIELD SAMPLING SCHEME

Sampling for this project will be performed by the SC/DM Department of the FERMCO Environmental Management Division. Due to the nature, objectives and programmatic requirements of this project,

actual sampling locations and parameter selection is designated by FERMCO personnel of CRU5, specifically for RI/FS Project Manager.

8.1 SAMPLE TEAM ORGANIZATION

Crews will be directly supervised by the SC/DM Field Operations Manager. Sampling will be accomplished by two-person field crews, consisting of a geologist/engineer and a sampling technician. The Sample Management Office staff will be utilized to provide an interface between the sampling crews and the FEMP or contract laboratory to be used for sample analysis.

8.2 RESPONSIBILITIES OF TEAM MEMBERS

The Field Operations Manager is responsible for the coordination and effective use of all personnel on site and for proper maintenance of the record of all field activities. In addition, the Field Operations Manager is responsible for field quality control including issuance and tracking of measurement and test equipment.

Field sampling personnel are responsible for the collection of the samples in accordance with the approved PSP. All activities associated with the execution of sampling are to be documented on the appropriate Field Activity Daily Logs (FADLs) which are to be completed by the sampling technicians for each location. These technicians are also responsible for ensuring that the proper sampling equipment is available, in serviceable condition and properly decontaminated between each sampling point. Field sampling personnel are responsible for sample labelling, handling and completion of a Chain of Custody/Request for Analysis (CC/RFA) form prior to submittal of the samples to the Sample Management Office.

The Sample Management Office staff will interface with the FEMP or contract laboratory and are responsible for ensuring that proper sampling containers, preservatives and sampling coolers are available and in serviceable condition. They are also responsible for logging in all collected samples, delivering the samples to the FEMP laboratory or sending the samples, with accompanying paperwork, to the appropriate contract laboratory.

8.3 SAMPLING SCHEDULE

In general, sampling will be performed concurrent with other investigative activities; however, it is imperative that sample results be available for validation by August 1, 1993.

The survey grids will be staked and the radiological and metal surveys (Sections 3.1 and 3.2) may run concurrently. Sampling will begin after the surveys are finished and the field data have been analyzed. The choice of sampling locations is dependent on the conclusions reached from the survey data and will be made by the CRU5 RI/FS Project Manager.

9.0 REFERENCES

The United States Department of Energy, 1993, CERCLA/RCRA Background Soil Study, Fernald Environmental Management Project, Fernald, Ohio.

Gilbert, R. O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrund Reinhold, New York, NY.

APPENDIX A

TARGET ANALYTE LISTS

FEMP TRAP SHOOTING RANGE INVESTIGATION

SOIL SAMPLES AND RINSATES

TAL 50.03.14 A

FEMP RI/FS – LIMITED HSL (METALS) – ANALYTICAL PARAMETERS

	INORGANICS	Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Iron	
12	Lead	
13	Magnesium	
14	Manganese	
15	Mercury	
16	Molybdenum	
17	Nickel	
18	Potassium	
19	Selenium	
20	Silicon	
21	Silver	
22	Sodium	
23	Thallium	
24	Vanadium	
25	Zinc	

FEMP TRAP SHOOTING RANGE INVESTIGATION

SOIL SAMPLES AND RINSATES

TAL 50.03.14 B

FEMP RI/FS – LIMITED HSL (SVOC) – ANALYTICAL PARAMETERS

	SEMIVOLATILE ORGANICS	Pay Item
1	1,2-Dichlorobenzene	52
2	1,2,4-Trichlorobenzene	
3	1,3-Dichlorobenzene	
4	1,4-Dichlorobenzene	
5	2-Chloronaphthalene	
6	2-Chlorophenol	
7	2-Methylnaphthalene	
8	2-Methylphenol	
9	2-Nitroaniline	
10	2-Nitrophenol	
11	2,4-Dichlorophenol	
12	2,4-Dimethylphenol	
13	2,4-Dinitrophenol	
14	2,4-Dinitrotoluene	
15	2,4,5-Trichlorophenol	
16	2,4,6-Trichlorophenol	
17	2,6-Dinitrotoluene	
18	3-Nitroaniline	
19	3,3'-Dichlorobenzidine	
20	4-Bromophenyl phenylether	
21	4-Chloro-3-methylphenol	
22	4-Chloroaniline	
23	4-Chlorophenyl-phenyl ether	
24	4-Methylphenol	
25	4-Nitroaniline	
26	4-Nitrophenol	
27	4,6-Dinitro-2-methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2-Chloroethoxy)methane	
39	bis(2-Chloroethyl)ether	
40	bis(2-Chloroisopropyl) ether	
41	bis(2-Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di-n-butyl phthalate	
50	Di-n-octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3-cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N-Nitroso-di-n-propylamine	
62	N-Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

FEMP TRAP SHOOTING RANGE INVESTIGATION

SOIL SAMPLES

TAL 50.03.14 C

FEMP RI/FS – LIMITED HSL (METALS) – ANALYTICAL PARAMETERS

	INORGANICS	Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

	RADIOLOGICAL	Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

	MISC. RADIOLOGICAL	
1	Gross alpha	19
2	Gross beta	

FEMP TRAP SHOOTING RANGE INVESTIGATION

WATER SAMPLES

TAL 50.03.14 D

FEMP RI/FS – HSL – ANALYTICAL PARAMETERS

INORGANICS

		Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS

1	1,1–Dichloroethane	47
2	1,1–Dichloroethene	
3	1,1,1–Trichloroethane	
4	1,1,2–Trichloroethane	
5	1,1,2,2–Tetrachloroethane	
6	1,2–Dichloroethane	
7	1,2–Dichloroethene (total)	
8	1,2–Dichloroethylene	
9	1,2–Dichloropropane	
10	2–Butanone	
11	2–Hexanone	
12	4–Methyl–2–pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis–1,3–Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans–1,3–Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

SEMIVOLATILE ORGANICS

		Pay Item
1	1,2–Dichlorobenzene	52
2	1,2,4–Trichlorobenzene	
3	1,3–Dichlorobenzene	
4	1,4–Dichlorobenzene	
5	2–Chloronaphthalene	
6	2–Chlorophenol	
7	2–Methylnaphthalene	
8	2–Methylphenol	
9	2–Nitroaniline	
10	2–Nitrophenol	
11	2,4–Dichlorophenol	
12	2,4–Dimethylphenol	
13	2,4–Dinitrophenol	
14	2,4–Dinitrotoluene	
15	2,4,5–Trichlorophenol	
16	2,4,6–Trichlorophenol	
17	2,6–Dinitrotoluene	
18	3–Nitroaniline	
19	3,3'–Dichlorobenzidine	
20	4–Bromophenyl phenylether	
21	7	
22	4–Chloroaniline	
23	4–Chlorophenyl–phenyl ether	
24	4–Methylphenol	
25	4–Nitroaniline	
26	4–Nitrophenol	
27	4,6–Dinitro–2–methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2–Chloroethoxy)methane	
39	bis(2–Chloroethyl)ether	
40	bis(2–Chloroisopropyl) ether	
41	bis(2–Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di–n–butyl phthalate	
50	Di–n–octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3–cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N–Nitroso–di–n–propylamine	
62	N–Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL

		Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

MISC. RADIOLOGICAL

1	Gross alpha	19
2	Gross beta	

FEMP TRAP SHOOTING RANGE INVESTIGATION

GEOTECHNICAL SAMPLES TO FERMCO GEOTECHNICAL LAB

TAL 50.03.14 E

FEMP RI/FS – GEOTECHNICAL – ANALYTICAL PARAMETERS

1	Modified Geotechnical Test

FEMP TRAP SHOOTING RANGE INVESTIGATION

TRIP BLANKS

TAL 50.03.14 F

FEMP RI/FS – LIMITED HSL (VOCs) – ANALYTICAL PARAMETERS

	VOLATILE ORGANICS	Pay Item
1	1,1–Dichloroethane	47
2	1,1–Dichloroethene	
3	1,1,1–Trichloroethane	
4	1,1,2–Trichloroethane	
5	1,1,2,2–Tetrachloroethane	
6	1,2–Dichloroethane	
7	1,2–Dichloroethene (total)	
8	1,2–Dichloroethylene	
9	1,2–Dichloropropane	
10	2–Butanone	
11	2–Hexanone	
12	4–Methyl–2–pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis–1,3–Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans–1,3–Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	