R-029-204.1

3309

WASTE PIT 5 EXPOSED MATERIAL REMOVAL ACTION WORK PLAN MARCH 1992

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3309

Waste Pit 5
Exposed Material
Removal Action Work Plan

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio

WEMCO Subcontract No. 2-21487
March 1992
Revision No. 0

Operable Unit 1, Project Order 30

PARSONS

Fairfield Executive Center
6120 South Gilmore Road
Fairfield, Ohio 45014

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LIST OF ACRONYMS

AMS	Air Monitoring Stations
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	United States Department of Energy
EPDM	Ethylene Propylene Diene Monomer
FEMP	Fernald Environmental Management Project (formerly Feed Materials Production Center (FMPC))
FFA	Federal Facilities Agreement
MDA	Minimum Detectable Level
NAVFAC	Naval Facilities Engineering Command
NCP	National (Oil and Hazardous Substances) Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	Nuclear Regulatory Commission
OAC	Ohio Administrative Code
Ohio EPA	Ohio Environmental Protection Agency
RAWP	Removal Action Work Plan
REMP	Radiological Environmental Monitoring Program
RSE	Removal Site Evaluation
SCQ	Sitewide CERCLA Quality Assurance Project Plan
TBC	To-Be-Considered
US EPA	United States Environmental Protection Agency
WEMCO	Westinghouse Environmental Management Company of Ohio (formerly Westinghouse Materials Company of Ohio (WMCO))

SECTION 1

INTRODUCTION

This work plan describes a removal action to mitigate the threat of a release of airborne particulate radioactive emissions from the exposed material contained in Waste Pit 5 at the Fernald Environmental Management Project (FEMP). The removal action will redistribute the exposed material below the water line. The water cover will be periodically inspected and maintained to ensure that all of the waste material remains under water until final remediation under Operable Unit 1. This removal action work plan (RAWP) will be provided to the United States Environmental Protection Agency (US EPA) for approval in accordance with the requirements of the Amended CERCLA Consent Agreement (US EPA 1991). This removal action is identified as Removal Action 18 in the Amended CERCLA Consent Agreement. This RAWP will also be submitted to the Ohio Environmental Protection Agency (Ohio EPA).

1.1 Historical Background

Waste Pit 5 was constructed in 1968 and lined with a 60-mil-thick Royal Seal ethylene propylene diene monomer (EPDM) elastomeric membrane. Waste Pit 5, which is 30-feet deep, covers about 161,100 square feet and contains approximately 98,000 cubic yards of waste (DOE 1991). From 1968 until 1983, Waste Pit 5 was used as a surface impoundment which received high solids bearing (slurry) waste streams from the refinery and the recovery plant, including neutralized raffinate settled solids, slag leach slurry, sump slurry, and lime sludge. From 1983 to 1987, Waste Pit 5 received low solids-bearing wastewater from the general sump, filtrate from the recovery plant, and nonradioactive slurries (DOE 1990). Waste Pit 5 was taken out of service in February 1987; it remains uncovered (DOE 1991).

1.2 Physical and Topographic Conditions

Waste Pit 5 historically contained surface water ranging in depth from three feet in the west end to zero feet at the east end. The surface elevation of the water varied depending on precipitation and evaporation rates. Waste in the eastern third of the pit was not covered by water, and the exposed material was subject to dispersal from wind erosion. Currently, all of the water has been drained off the pit as part of the Waste Pit 5 liner repair activities. Figure 1-1 is an aerial topographic survey map of Waste Pit 5 from 1988. At the time the survey was performed, the western end of the pit contained standing water. The map indicates the water elevation to be approximately 587.5 feet. Also shown on the map are elevation contours and spot elevations of the berm and of the exposed waste surface. (Spot elevations are indicated by an "x" on the map). The crest of the berm varies in elevation from approximately 590.2 feet to 591.5 feet. The exposed waste surface elevation varies from approximately 587.5 feet at the western edge of the waste surface to 589.2 feet at the east end of the pit.

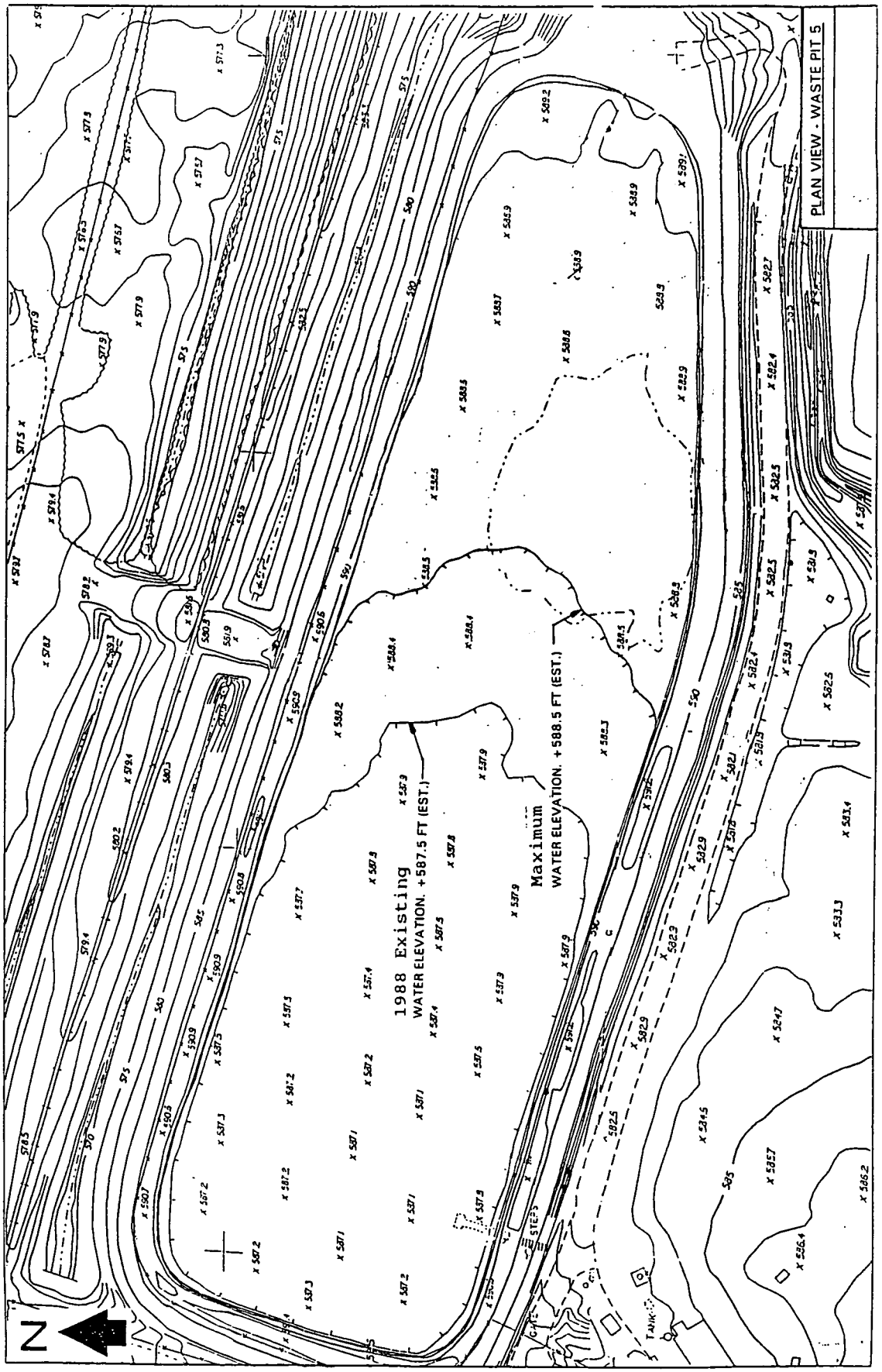

Figure 1-1 - Waste Pit 5 Aerial Topographic Survey Map

1.3 Radiological Conditions

Waste Pit 5 contains an estimated 111,700 pounds of uranium and 37,450 pounds of thorium. Table 1-1 shows concentrations of the radioactive materials found in Waste Pit 5 during the Characterization Investigation Study (WESTON 1987).

Table 1-1 - Radioactive Constituents in Waste Pit 5

Radionuclide	Activity (pCi/g)
Cs-137	2.0 - 76
Np-237	0.3 - 23
Pu-238	0.1 - 4.4
Pu-239/240	0.1 - 13
Ra-226	235 - 999
Ru-106	13 - 35
Sr-90	0.8 - 23
Tc-99	423 - 2,990
Th-228	41 - 191
Th-230	3,080 - 20,200
Th-232	21 - 90
U-234	310 - 1,250
U-235	14 - 79
U-238	387 - 1,230

SECTION 2

RELATED ACTIVITIES

2.1 Berm Investigation

A field investigation, soil sampling, laboratory analyses, and slope stability analyses were performed to facilitate in the preparation of a Removal Site Evaluation (RSE) of the structural integrity of the waste storage area dikes around Waste Pits 3 and 5, and the Clearwell (PARSONS 1992a). The field investigation consisted of advancing soil test borings to obtain subsurface soil samples (split-spoon samples and relatively undisturbed thin-walled tube samples) of the earthen materials below, within and near the waste storage area dikes. These soil samples were obtained for laboratory index property testing. Index property tests performed included natural moisture contents, Atterberg Limits, and grain size tests which were used to classify the soils according to their probable engineering behavior. During drilling, the soil samples were visually classified and logs of the bore holes prepared.

The geotechnical laboratory testing program was directed toward determining the classifications of the in situ soils and their engineering properties. The laboratory results were then utilized to classify the soils and categorize the different soil stratum within the waste storage area dikes according to their probable engineering behavior.

Slope stability analyses were conducted to investigate several potential failure surfaces for idealized cross sections of the waste storage area dikes. The idealized cross sections were developed from data resulting from the field and geotechnical laboratory activities. Total stress soil strength parameters were used in the slope stability analyses to account for the overconsolidated nature of the clay soils making up the dikes. Each cross section was analyzed for three general cases. The first case considered a low groundwater table which assumes seepage through the dike with a steep hydraulic gradient to a groundwater elevation near the top of the aquifer. The second case considered a high groundwater table in which seepage through the dike with a shallow hydraulic gradient to a groundwater elevation at the ground surface elevation at the toe of the slope was assumed. The third and final case considered a low groundwater table as in the first case with the addition of an earthquake loading of a 0.1 g horizontal acceleration applied to the dike. For each case analyzed, the stability of the Waste Pit 5 dike was greater than recommended minimum Factors of Safety published in the Naval Facilities Engineering Command (NAVFAC) design manual as referenced in DOE Order 6430.1A (NAVFAC 1986). These overall results of the slope stability evaluation indicate that there is no need to remove the contents of Waste Pit 5 based on the structural integrity of the earthen dikes.

2.2 Waste Pit 5 Liner Repair

In the winter of 1990, the need for a maintenance action to repair the Waste Pit 5 liner was identified when rips and tears were observed in the liner during a visual inspection. The water in the pit was drained to the Clearwell, vegetation was removed from liner seams, and the waste material in the pit was pushed back to expose the liner seams below the level of the sludge surface. Each seam was inspected to determine what size patch, if any, was needed. The following three basic sizes of patches were used:

1. Type A - 10" by 120" minor seam deterioration
2. Type B - 18" by 120" major seam deterioration
3. Type C - 48" by 120" major patch (old patch removed).

Repairs to the liner were made in accordance with the liner manufacturer's repair instructions. Each seam repaired was washed, cleaned, and left to dry. The adhesive was brushed on the area to be patched and left to dry (becoming tacky). The patch was installed over the repair area, smoothed out, and rolled out flat with a hand roller. After the patch was dry, a bead of caulking was installed around the entire perimeter of the patch. Each repair was visually inspected after installation. Approximately 95 seams were repaired. The Waste Pit 5 liner repair was completed on February 6, 1992; however, modifications need to be made to the effluent tower valves. Water will be returned to the pit as soon as the valves are modified.

2.3 Water Cover Management

Prior to Waste Pit 5 liner repair activities, water was maintained at an approximate elevation of 588.5 feet. The water varied in depth from three feet in the west end to zero feet in the eastern third of the pit. All of the surface water in the pit was drained off to repair the liner. Water will be returned to the pit once repairs are complete. The water level of Waste Pit 5 surface water is controlled by the effluent tower. Water drains through 12-inch diameter outlets to the Clearwell through a 12-inch diameter underground pipe. The inlet, as designed, maintains the maximum water elevation at 588.5 feet.

Water can be added to the pit at a rate of up to 25,000 gallons per hour. Historically, water has been pumped into the pit in a batch fashion. Periodic inspections of the water level will be conducted to determine if additional water needs to be added. The water level will be returned to its previous level (588.5 feet).

SECTION 3

EVALUATION OF POTENTIAL THREAT

A monitoring program was established for implementation during the pit liner repair activities to provide quantified results of airborne particulate radionuclide emissions during the liner repair activities. Three high volume air samplers were installed at the perimeter of the pit (Figure 3-1). Two air samplers (0086 and 0089) were positioned on the north side of the pit in the predominant wind direction. The third air sampler (0085) was positioned on the southeast perimeter of the pit to provide an air sampling point when the wind direction changes. Each air filter sample will be analyzed for total uranium, gross alpha and beta and specific radionuclides. Analytical results of gross alpha and gross beta radiation levels from the samples collected prior to January 8, 1992 have been received from the Westinghouse Environmental Management Company of Ohio (WEMCO) laboratories, and the results are presented in Table 3-1. The available air monitoring data permits only a conservative evaluation of the potential threat. This data appears to support the need to implement this removal action.

Waste Pit 5 is a potential contributor to risk from radon emissions. Waste Pit 5 has the highest level of radium-226 of any of the six waste pits. If the surface of the material in Waste Pit 5 were exposed and contained an average radium concentration of 555 pCi/g (RADIAN 1992), the average expected radon-222 flux would be 94 pCi/m^2-s (PARSONS 1992b). The normal average radon flux from Waste Pit 5 is expected to be less than this calculated flux because the residue in the western two-thirds of the pit is usually covered with water and the remainder of the pit is partially saturated. Increases in the saturation level result in a decrease in the radon flux.

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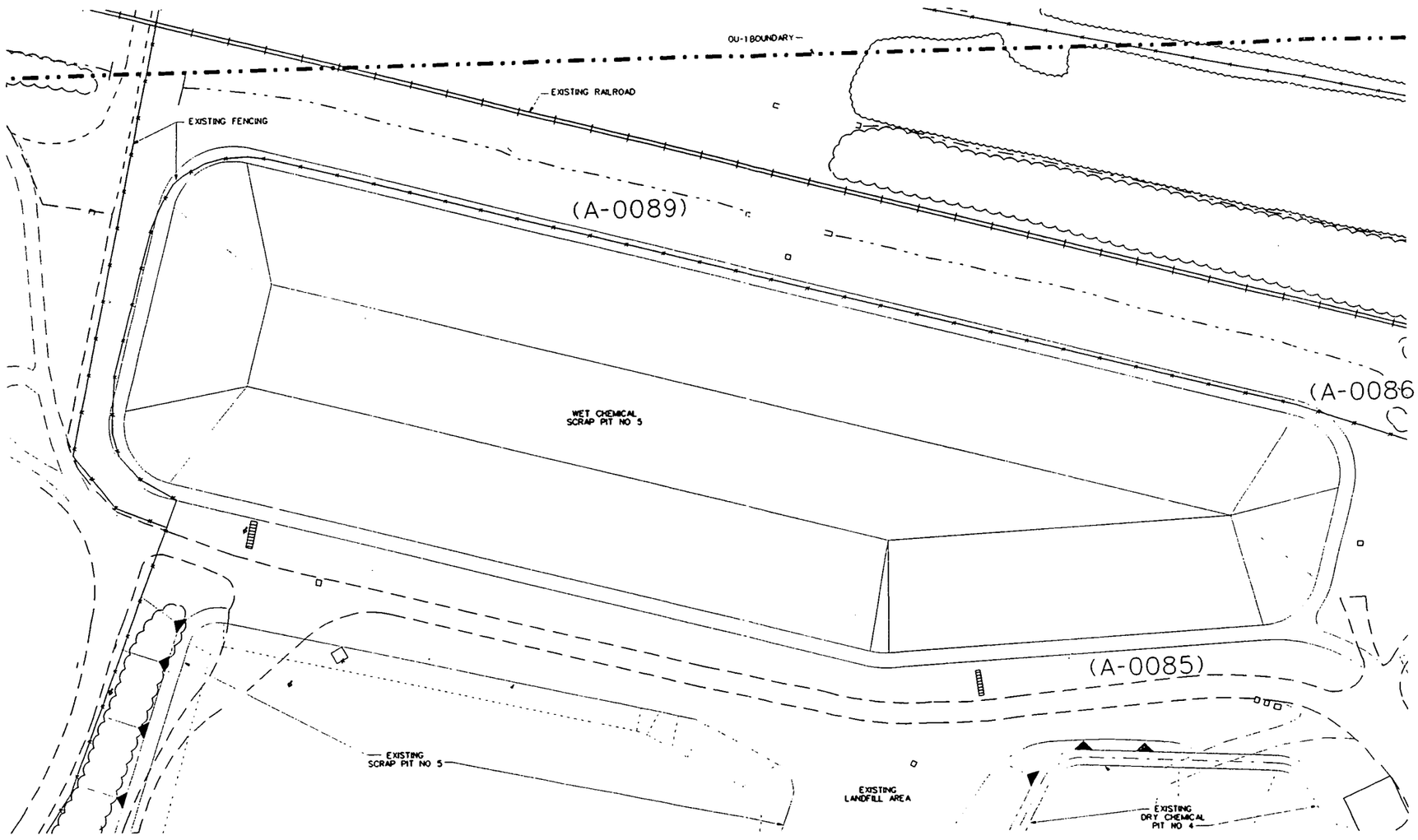


PIT #5 SITE PLAN
SCALE: 1" = 30'

NOTES

LEGEND
(A) HIGH VOLUME AIR SAMPLER

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	OPERATOR	DOE
			DETAILS AND DATE	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - CHAS. T. MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT TITLE
FEMP ERA
CONTROL OF EXPOSED PIT 5 MATERIAL OU1 / P030

DRAWING TITLE
ENVIRONMENTAL PLAN
FIGURE 3-1

DRAWN BY	DATE				
J.S.BROOKS	03-16-92				
PRELIMINARY		SCALE		1" = 30'	

BY D.O.E. LATER	WBS 00-90701	SK-X-00490	

brooks Mar. 23, 1992 13:47:53

Table 3-1 - Air Monitoring Data During Liner Repair

DATE	PUMP NO. 85		PUMP NO. 86		PUMP NO. 89	
	ALPHA (pCi/ml)	BETA (pCi/ml)	ALPHA (pCi/ml)	BETA (pCi/ml)	ALPHA (pCi/ml)	BETA (pCi/ml)
10-10-91	1.85E-07	1.23E-07	2.30E-08	2.20E-07	2.39E-08	1.96E-07
10-14-91	NA[1]	NA	NA	NA	3.57E-08	4.85E-07
10-16-91	3.62E-07	2.51E-07	2.71E-08	2.51E-07	2.41E-07	3.63E-07
10-17-91	9.39E-08	8.72E-08	3.29E-07	5.18E-07	8.59E-08	5.15E-07
10-18-91	3.86E-07	5.77E-07	1.71E-07	2.17E-07	8.88E-08	1.67E-07
10-21-91	<MDA[2]	1.25E-07	1.87E-07	5.33E-07	<MDA	3.84E-07
10-22-91	1.67E-07	2.32E-07	1.35E-07	6.13E-07	<MDA	1.86E-07
10-23-91	2.47E-07	7.08E-07	2.58E-07	5.15E-07	3.24E-08	3.72E-07
10-30-91	2.62E-07	1.18E-06	5.95E-08	1.42E-10	6.54E-07	1.16E-06
10-31-91	3.63E-09	2.65E-07	3.34E-07	4.16E-07	4.26E-08	1.49E-07
11-02-91	2.11E-08	2.22E-07	8.62E-08	4.01E-07	1.17E-07	2.64E-07
11-03-91	1.43E-07	8.58E-07	9.98E-08	4.48E-07	<MDA	1.58E-07
11-06-91	2.12E-07	1.04E-06	1.33E-07	1.13E-06	2.96E-07	1.05E-06
11-12-91	2.57E-07	4.63E-07	9.82E-09	2.23E-07	1.05E-07	5.13E-07
11-29-91	2.03E-08	2.31E-08	8.95E-08	2.22E-07	5.97E-08	4.70E-08
12-07-91	2.86E-07	1.44E-07	NA	NA	NA	NA
12-08-91	1.14E-07	1.69E-07	5.82E-07	1.17E-06	3.07E-07	<MDA
01-06-92	<MDA	1.18E-07	2.17E-08	5.66E-10	3.54E-07	6.86E-08
01-07-92	2.29E-07	3.17E-07	3.06E-08	7.99E-08	2.59E-07	2.29E-07

[1] NA - Not Available

[2] <MDA - Less Than Minimum Detectable Activity

SECTION 4

NEED FOR REMOVAL ACTION

Consistent with 40 CFR 300, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the United States Department of Energy (DOE) has determined the appropriateness of this removal action. Eight factors to be considered in this determination are listed in 40 CFR 300.415 (b)(2). The following apply specifically to Waste Pit 5:

1) 40 CFR 300.415 (b)(2)(i): Actual or potential exposure to nearby human populations, animals, or food chain from hazardous substances or pollutants or contaminants.

   The FEMP is located in a rural area approximately 18 miles northwest of Cincinnati, Ohio. The largest village near the FEMP is Ross which is located 2.5 miles northeast of the site, and has a population of approximately 2,200 people. Other smaller, nearby communities include Fernald and New Baltimore to the south, New Haven to the southwest, Shandon to the northwest, and Dunlap to the East (Figure 4-1). There are also produce farms and dairy farms located around the FEMP. Because there are radioactive materials in Waste Pit 5, there is a potential for exposure to nearby human populations, animals (cattle), and the food chain (produce farms).

2) 40 CFR 300.415 (b)(2)(v): Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

   Below normal amounts of precipitation and/or high rates of evaporation may cause the Waste Pit 5 exposed material to dry out. In such a condition, contaminants in the exposed material may migrate due to wind erosion.

3) 40 CFR 300.415 (b)(2)(vii): The availability of other appropriate federal or state response mechanisms to respond to the release.

   The DOE has committed to performing a removal action on the Waste Pit 5 Exposed Material by including it in Section IX of the Amended CERCLA Consent Agreement (US EPA 1991).

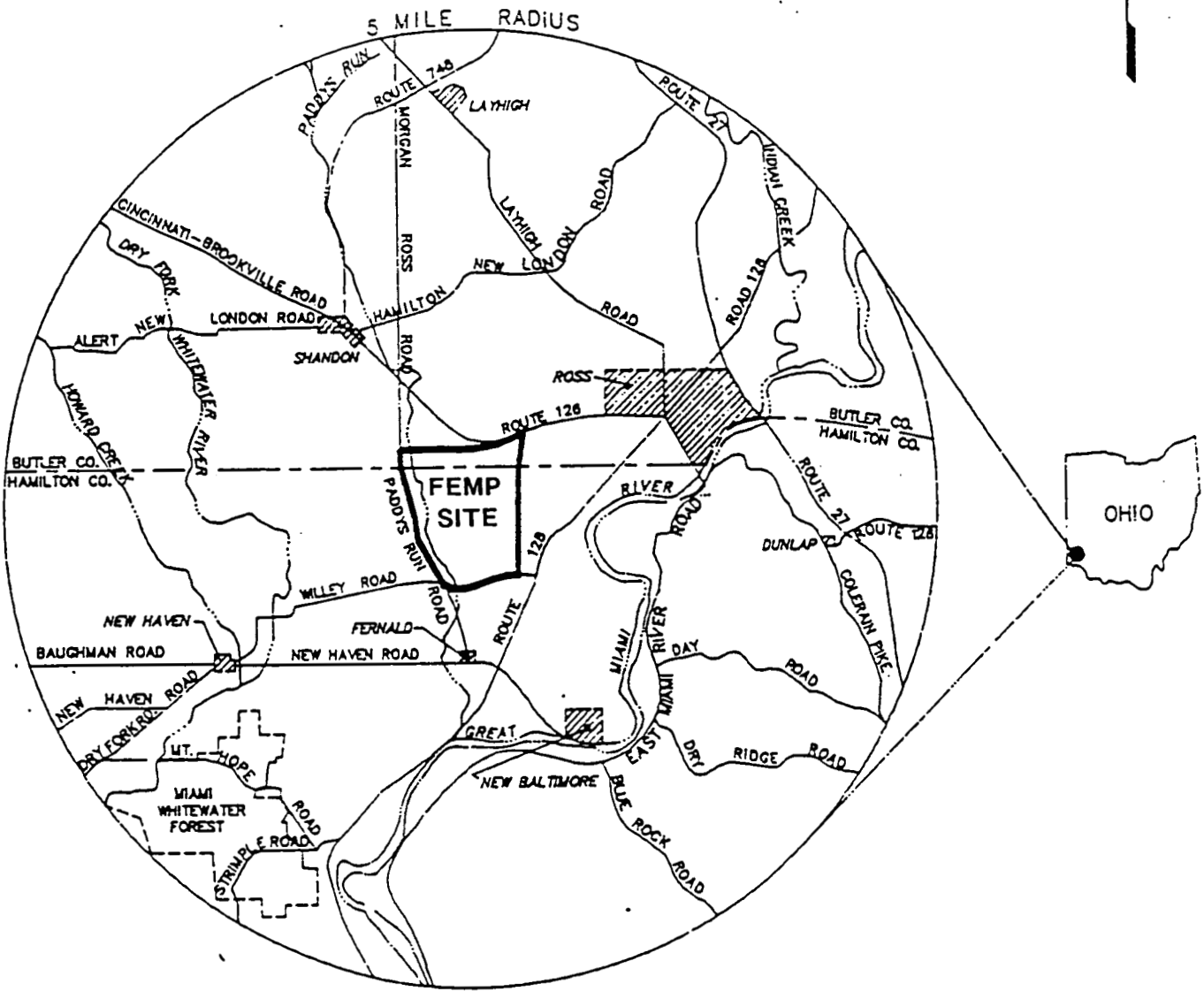


Figure 4-1 - Five-Mile Radius Map

SECTION 5

APPROPRIATENESS OF RESPONSE

DOE has determined that there is a threat of an airborne release of radioactive particulates from the exposed surface of Waste Pit 5. Further, DOE has committed to responding to this threat by including the Waste Pit 5 Exposed Material as removal action number 18 in Section IX of the Amended CERCLA Consent Agreement (US EPA 1991).

DOE has determined that the control of the exposed material in Waste Pit 5 is a time critical removal action. Since the planning period for this removal action is less than six months, DOE has issued an Action Memorandum. The Action Memorandum describes the selected response and provides supporting documentation for the decision.

SECTION 6

PROPOSED WASTE PIT 5 REMOVAL ACTION

The proposed removal action is to move the exposed material from the east end to the west end of the pit. Proposed methods will be further evaluated during detailed design. The US EPA and Ohio EPA will be notified of the redistribution method prior to the implementation of the removal action. The entire waste surface would then be covered with water at an elevation of 588.5 feet. The Ohio Administrative Code (OAC) regulation, OAC 3745-67-22, states that a surface impoundment must maintain a minimum of two feet of freeboard or a qualified engineer must certify that alternative design features or operating plans will prevent overtopping of the dike. The requirements of OAC 3745-67-22 would be met if the water level were maintained at an elevation of 588.5 feet. The water level will be inspected daily and additional water will be added as necessary to ensure the waste is continuously covered with water. The scope of the construction effort and the feasibility of the removal action depend on having a sufficient amount of volume capacity below the proposed water line in the west end of the pit. Rough order of magnitude calculations using the survey map from 1988 (Figure 1-1) were performed to estimate the feasibility of the removal action. The calculations show that approximately 20,700 cubic feet of material must be moved. After the removal action is complete, the waste will be covered with approximately 0.30 feet of water (PARSONS 1992c). The preliminary calculations based upon existing survey information indicate that a sufficient volume of space exists in the pit to redistribute the exposed waste and cover the entire waste surface with 0.30 feet of water. An increase in the water level by reducing the freeboard requirement of two feet would provide a greater depth of water cover over the waste material in the pit, and would increase the assurance that the full volume of waste can be covered.

SECTION 7

PROGRAM MANAGEMENT

7.1 Responsibilities

The DOE is the owner of the FEMP.

WEMCO is the site integrator at the FEMP and is contracted to the DOE. WEMCO operated the site from 1985 until production ceased in 1989 and now is tasked with managing the site during its restoration. WEMCO will be responsible for the implementation of this RAWP. WEMCO will prepare all reports associated with the removal action in a manner consistent with DOE and regulatory guidance. This removal action will be managed by the WEMCO/DOE Operable Unit 1 team to ensure compatibility with the final remedial action selected for Operable Unit 1.

RUST Engineering is a contractor to WEMCO and is in charge of supervising on-site construction. RUST Engineering will supervise field activities of this removal action.

PARSONS is the Architectural/Engineering firm contracted solely by WEMCO to provide Remedial Design to support the overall FEMP remediation. PARSONS will provide the engineering design for this removal action. This effort includes the evaluation of alternatives for the control of exposed material in Waste Pit 5 and preparation of this RAWP.

The Construction Contractor is the organization that will perform all field activities. This contractor will be selected through the standard DOE bid and award process.

The US EPA has approval authority for this RAWP.

The Ohio EPA may provide guidance and participate in the development and review of this RAWP.

7.2 Schedule

A proposed schedule has been developed and is as follows:

Activity	Duration
Design Effort	16 weeks
Field Activities	12 weeks

Design efforts for this removal action will begin within five days after work plan approval by the US EPA. Detailed design documents will be forwarded to the US EPA and Ohio EPA for informational purposes. Detailed design will be considered complete when the Certified for Construction documents are issued.

Implementation of field activities will commence within 180 days of when the Action Memorandum is issued. Field activities shall be considered complete when all exposed material has been placed below the water line. A final removal action report will be prepared and will be placed in the Administrative Record.

SECTION 8

REGULATORY AND CONSENT AGREEMENT REQUIREMENTS

8.1 Consent Agreement Requirements

As required under Section IX of the Amended CERCLA Consent Agreement, the US EPA is to approve the Work Plan prior to commencing the removal action. The basic components of the approval procedure for the Work Plan is as follows:

1) The DOE will submit a Work Plan to the US EPA which provides a concise description of the activities to be performed. The Work Plan shall contain a sampling and analysis plan, a quality assurance plan, and a schedule.

2) The US EPA will review the Work Plan and provide comments to the DOE within 30 days following receipt of the Work Plan. The US EPA will consult with Ohio EPA, as required.

3) The DOE will submit a revised Work Plan, addressing US EPA comments, to the US EPA within 30 days following receipt of US EPA's comments.

Within 5 days of US EPA's approval, the DOE shall commence implementation of the approved work plan. The removal action is to be implemented in accordance with the approved work plan and schedule.

The progress of the removal action shall be reported to the US EPA in the monthly progress report required by the Amended CERCLA Consent Agreement (US EPA 1991).

8.2 Regulatory Requirements

This removal action is being undertaken pursuant to Section IX of the Amended CERCLA Consent Agreement, and as such, this removal action shall comply with all Applicable or Relevant and Appropriate Requirements (ARARs) to the maximum extent practicable. In determining whether compliance with ARARs is practicable, the DOE may consider the urgency of the situation and the scope of the removal action to be conducted. In addition to the ARARs, other federal and state advisories, criteria, or guidance (known as To-Be-Considered (TBC)) may, as appropriate, be considered in formulating the removal action. The ARARs for this removal action are attached as Appendix A. Included with the ARARs (or TBCs) is the strategy for compliance.

SECTION 9

HEALTH AND SAFETY PLAN

This removal action will be performed consistent with the Health and Safety Plan which will be prepared for this removal action. The Health and Safety Plan will identify, evaluate, and outline control measures for all safety and health hazards. The plan will also identify training, monitoring, protective equipment, and work practices that will be used to reduce exposure to these hazards during the removal action. In addition, it identifies emergency response actions for hazardous operations. The plan will be consistent with 29 CFR 1910.120, OAC 3745-54-16(A), and the FEMP Site Health and Safety Plan. The task-specific Health and Safety Plan for this removal action will be completed prior to starting the start of field activities for this removal action.

SECTION 10

SAMPLING AND ANALYSIS PLAN

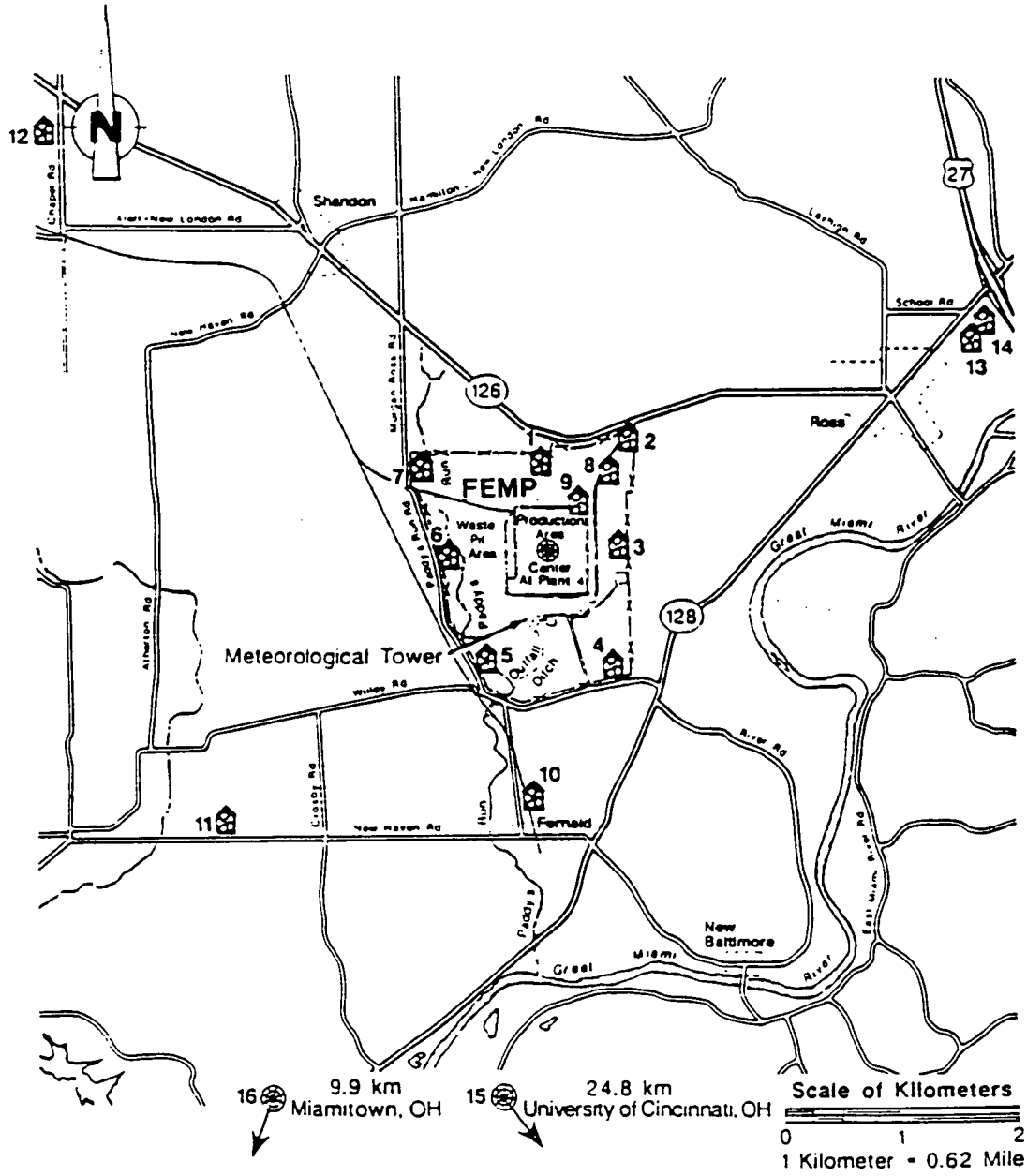
10.1 Air Monitoring

Air filter samples are collected as part of the Radiological Environmental Monitoring Program (REMP) sitewide air monitoring program to provide quantitative results of airborne radioactive particulate emissions to the surrounding area. There are currently 16 high-volume air monitoring stations (AMS) located around the FEMP (Figure 10-1). Four additional AMS are being installed near the waste pit area, and are being incorporated into the sitewide air monitoring program. The proposed locations of the four additional AMS are shown in Figure 10-2. The AMS are operating continuously, and each air filter is changed weekly according to the procedures established in the REMP Air Monitoring Procedure, EM-RM-001, which has been provided as Appendix B. All air filter samples will be handled according to the Environmental Monitoring Chain-of-Custody and Request for Analysis Procedure, EM-AD-008, which has been provided as Appendix C. The filters from the air monitoring stations will be analyzed for Total Uranium, Total Suspended Particulates, and Gross Beta according to the analytical methods presented in Appendix D (DOE 1992). Table 10-1 summarizes the air monitoring plan that will be followed during removal activities. All sampling activities will be performed in accordance with the *Sitewide CERCLA Quality Assurance Project Plan* (DOE 1992). The results of the REMP are summarized in the FEMP Annual Environmental Report which is submitted annually to the US EPA. The results of the air filter samples near the waste pits taken during removal action activities will be included in the final removal action report.

Table 10-1 - Air Monitoring Plan

Total Number of Monitoring Locations Around the Waste Pit Area	Monitoring Frequency	Environmental Media	Laboratory Analyses
Four (4)	Continuous - Air Filters Changed Weekly	Air	1. Total Uranium 2. Total Suspended Particulates 3. Gross Beta

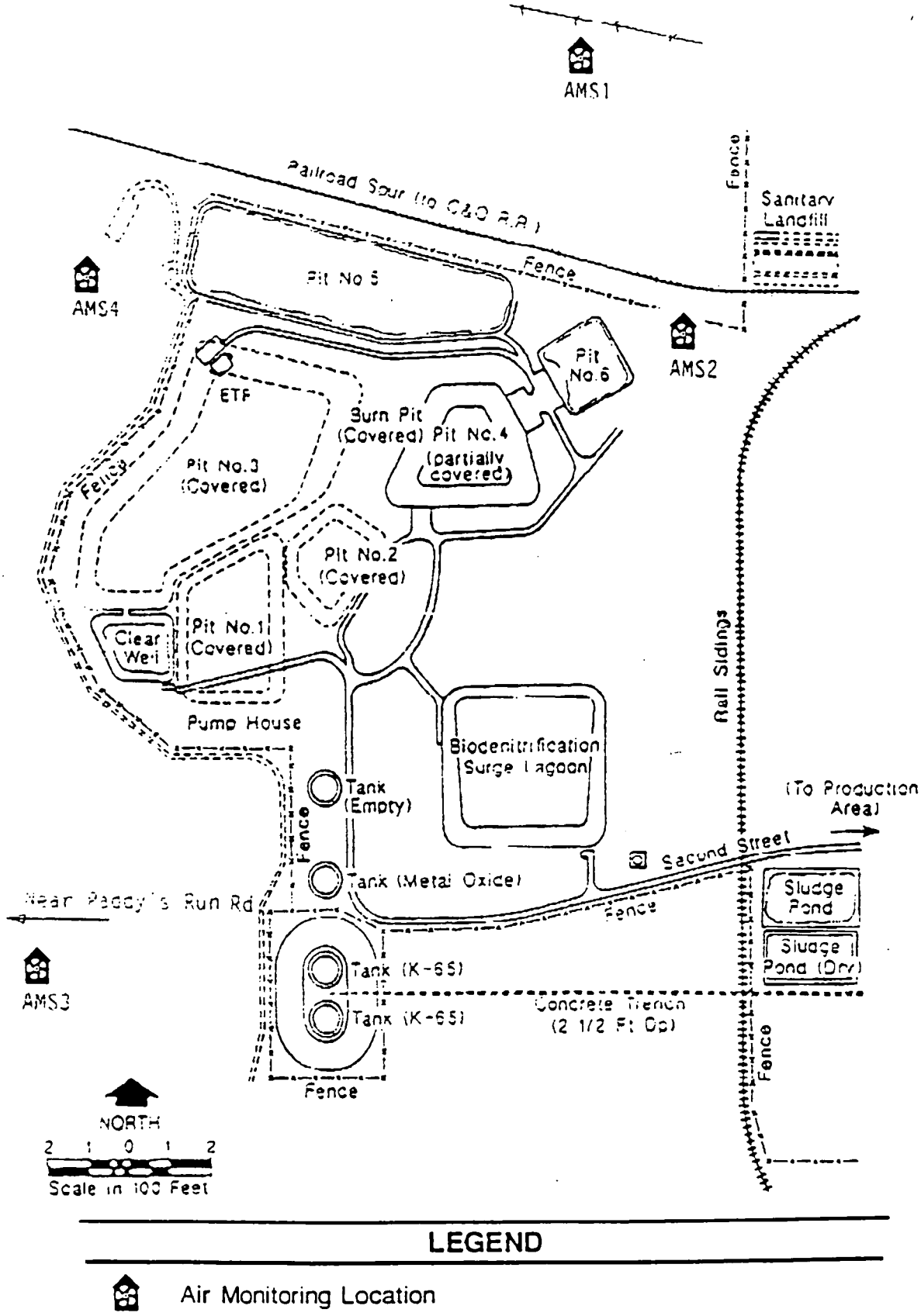
MAP OF AIR MONITORING STATIONS



LEGEND

Air Monitoring Location	Plant Perimeter
Distance from Center of Production Area to Sampling Locations off Map	Production Area Perimeter

Figure 10-1 - Location of Existing Air Monitoring Stations



LEGEND

Air Monitoring Location

Figure 10-2 - Proposed Locations of Additional Air Monitoring Stations

10.2 Radon Flux Measurements

National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61 Subpart Q regulations govern emissions of radon from storage or disposal facilities at DOE sites. These regulations specify a maximum flux (emission rate per unit area) of radon that can be emitted from each facility. As part of the Federal Facilities Agreement between the US EPA and the DOE, the DOE agreed to achieve compliance with the radon flux standards by implementing removal and final remedial actions. The DOE also committed to providing the US EPA with estimates of the radon flux from potential radon sources at the site (WMCO 1991). In accordance with 40 CFR 61, Appendix B, Method 115, Monitoring for Radon-222 Emissions, no radon flux measurements are required for water covered areas as the radon flux is assumed to be zero. Once this removal action has been implemented the entire waste surface will be covered with water and there will be no rationale or mechanism for performing direct radon flux measurements from Waste Pit 5.

SECTION 11

QUALITY ASSURANCE PLAN

This removal action will be performed in accordance with the overall quality assurance program at the FEMP as described in the *Sitewide CERCLA Quality Assurance Project Plan* (DOE 1992). The Sitewide CERCLA Quality Assurance Project Plan (SCQ) program was developed for FEMP environmental sampling and analysis. The SCQ is based on the criteria specified in US EPA Guideline QAMS-005/80, US EPA Guidance EPA/540/G-90-004, and DOE Order 5700.6. Detailed requirements are implemented by the WEMCO Site Policies and Procedures Manual (FMPC-2054), and WEMCO Departmental procedures and Topical Manuals. Specific quality assurance requirements will be incorporated into written and approved procedures, and into personnel training. The WEMCO Environmental Compliance and Quality Assurance Department will conduct surveillance and inspections and/or audits to verify compliance throughout the execution of this removal action.

SECTION 12

REFERENCES

(DOE 1990) United States Department of Energy, December 1990. *Remedial Investigation Report for Operable Unit 1 (Task 6)*, Fernald: U.S. DOE, FMPC (FMPC-0106-3).

(DOE 1991) -----, January 1991. *Initial Screening of Alternatives for Operable Unit 1 (Task 12), final*, Fernald: U.S. DOE, FMPC (FMPC-0112-6).

(DOE 1992) -----, March 1992. *Sitewide CERCLA Quality Assurance Project Plan*, draft, Fernald: U.S. DOE, FEMP.

(NAVFAC 1986) United States Department Of the Navy, 1986. *Foundations and Earth Structures - Design Manual 7.01*, Washington:SN 0525-LP-300-7071.

(PARSONS 1992a) PARSONS ERA Project, January 1992. *Waste Pit 3, 5 and the Clearwell Dike Stability Report*, Fairfield: PARSONS.

(PARSONS 1992b) -----, February 1992. "Radon-222 Flux from Waste Pit 5 Calculation," Fairfield: PARSONS.

(PARSONS 1992c) -----, February 1992. "Volume of Material and Available Volume in Waste Pit 5 Calculation," Fairfield: PARSONS.

(RADIAN 1992) Radian, February 1992. "Pit 5 CEM Preliminary Assessment and Action Memorandum," From: Thomas Tucker, Radian, To: Oba Vincent, DOE.

(US EPA 1991) United States Environmental Protection Agency, September 1991. *United States Environmental Protection Agency Region V.* Consent Agreement Under CERCLA Sections 120 and 106(a), Fernald: U.S. Department of Energy (OH6 890 008 976), Administrative Docket Number V-W-90-C-057.

(WMCO 1991) Westinghouse Materials Company of Ohio, 1991. *Feed Materials Production Center Annual Environmental Report for Calendar Year 1990,* Cincinnati: WMCO (FEMP-2245).

(WEMCO 1990) Westinghouse Environmental Management Company of Ohio, June 1990. *FEMP Sitewide Health and Safety Plan.* Cincinnati: WEMCO.

(WESTON 1987) Weston, Roy F., Inc., 1987. *Characterization Investigation Study,* West Chester, Pennsylvania: WESTON (FMPC/SUB-008, Vol. 2).

APPENDIX A

WASTE PIT 5 EXPOSED MATERIAL
TABLE OF ARAR/TBCs

CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Emergency Planning	All personnel must have immediate access to the following emergency equipment whenever hazardous waste is being handled: (1) an internal communications or alarm system (voice or signal), (2) telephone or two-way radio to summon emergency assistance, (3) portable fire extinguishers, spill control equipment, and decontamination equipment, and (4) water at adequate volume and pressure. All required emergency equipment must be tested and properly maintained. Arrangements must be made with the local authorities to ensure proper emergency planning procedures. Procedures need to be consistent with existing arrangements. 40 CFR 265 Subpart C {OAC 3745-65-30 to 37} [Applicable]	A site-wide internal communication/alarm system currently exists. Two-way radios will be provided as required. Portable fire extinguishers will be provided as required. The existing site-wide spill control and decontamination equipment will be available to respond to any incidents.
Emergency Planning	A Contingency Plan and Emergency Procedures are to be developed for the removal action in accordance with 40 CFR 265 Subpart D. The emergency procedures will include procedures for notifying off-site officials as required by 40 CFR 265.56(d) in the event of a situation which could threaten human health or the environment. 40 CFR 265 Subpart D {OAC 3745-65-50 to 56} [Applicable]	The existing Interim Status Contingency Plan and Emergency Procedures will be followed for any hazardous waste release associated with the removal action.
Public Health and Environment	The total effective dose equivalent to members of the public is limited to 100 mrem in a year, exclusive of the disposal for radioactive material into sanitary sewage in accordance with 10 CFR 20.2003. The dose in unrestricted areas is limited to 2 mrem in 1 hour. 10 CFR 20.1301 [Relevant and Appropriate] Operations must be in accordance with the requirements of DOE Order 5400.5 Chapter II involving DOE public dose limit for all exposure modes and all DOE sources of radiation. DOE Order 5400.5, Chapter II (1)(a) [To Be Considered]	This removal action will be implemented to minimize the potential release of radionuclides. Compliance will be demonstrated by site-wide environmental monitoring (including air, soil, and groundwater). Reports summarizing the site-wide monitoring results are submitted to the US EPA annually.

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CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Training	All personnel must be trained within six months from their date of hire or reassignment, and participate in annual reviews. The training requirements are to be specified in a Training Plan. Employees hired after April 15, 1981 are not to work unsupervised unless the requirements of 40 CFR 265.16(a) are fulfilled. 40 CFR 265 Subpart B {OAC 3745-65-16} [Applicable]	Employees who will be working on this removal action will receive training , including 29 CFR 1910.120, as required per the existing site-wide training program.
Worker Protection (Hazardous Substances)	Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. All occupational safety and health requirements of 29 CFR Parts 1910 and 1926 are to be followed. If there is a conflict or overlap, the most protective provision shall apply. 29 CFR 1910.120 [Relevant and Appropriate]	This removal action will be conducted in accordance with the provisions of the FEMP site-wide Health and Safety Plan (WEMCO 1990). As required by 29 CFR 1910.120(b)(4), a task-specific health and safety plan will be developed for this removal action.
Worker Protection (Radiation)	The occupational radiation doses specified in 10 CFR 20, Subpart C shall be followed. In addition to the dose limits, the radiation survey and monitoring requirements, the administrative controls for restricted areas, and other precautionary procedures identified in 10 CFR 20, Subparts D to J. Although the radiation protection standards promulgated under 10 CFR 20, are only applicable to NRC licensed facilities, these protection standards are deemed to be relevant and appropriate for individuals entering a radiologically controlled area at the FEMP. These standards are mandatory after January 1, 1993 with early compliance encouraged. 10 CFR 20, Subpart C to J [Relevant and Appropriate] At DOE facilities, the radiation protection standards contained in DOE Order 5480.11 for occupational workers, unborn children, minors, and on-site members of the public shall not be exceeded. DOE Order 5480.11 [To Be Considered]	The existing FEMP radiation protection program is being implemented under DOE Order 5480.11. This program is consistent with the requirements of 10 CFR 20. Occupational workers and on-site members of the public shall be required to wear dosimeters and personal protection equipment when entering a radiologically controlled area. Radiation monitoring shall also be required for all individuals exiting a radiologically controlled area. Details regarding the personal protection, radiation surveys and monitoring, and administrative controls will be identified in the task-specific health and safety plan developed for the Remedial Action Work Plan.

CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Security Fencing	A physical barrier (i.e., fence) or 24-hour surveillance system must be provided to control the unknowing or unauthorized entry of persons or livestock onto the active portion of the remediation facilities. Signs (legible from a distance of 25 feet) must be posted at each entrance to the active portion and at other locations as required by 40 CFR 265.14(c). 40 CFR 265 Subpart B {OAC 3745-65-14} [Applicable]	The fence currently surrounding the FEMP is adequate to restrict access to the waste pits. Warning signs (indicating the potential presence of hazardous waste) are posted at each entrance to the waste pit area.
Freeboard	A surface impoundment shall maintain enough freeboard to prevent any overtopping of the dike by overfilling, wind and wave action, or a storm. A freeboard level of at least 60 centimeters (2 feet) must be maintained unless the owner or operator obtains certification by a qualified engineer that alternative design features or operating plans will, to the best of his knowledge and opinion, prevent overtopping of the dike. The certification, along with a written identification of alternate design features of operating plans preventing overtopping, must be maintained at the facility. 40 CFR 265.222 {OAC 3745-67-22} [Applicable]	Upon completion of this removal action a minimum of two feet of freeboard will be maintained or a waiver will be sought.
Dike Stability	All earthen dikes must have a protective cover, such as grass, shale, or rock to minimize wind and water erosion and to preserve their structural integrity. 40 CFR 265.223 {OAC 3745-67-23} [Applicable]	The Waste Pit 5 dike is currently covered with vegetation to preserve the structural integrity of the dike.
Inspections	The owner or operator shall inspect the freeboard level at least once each operating day to ensure compliance with OAC 3745-67-22. The surface impoundment, including dikes and vegetation surrounding the dike, should be inspected at least once a week to detect any leaks, deterioration, or failures in the impoundment. 40 CFR 265.226 {OAC 3745-67-26} [Applicable]	A Maintenance Plan for Waste Pit 5 will be prepared by WEMCO.

CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Air Discharges - Nuisances & Fugitive Dust	The emission or escape into open air from any source whatsoever in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared a public nuisance and is prohibited. OAC 3745-15-07 [Applicable] The significant and avoidable deterioration of air quality shall be prohibited. OAC 3745-17-05 [Applicable] For those communities and areas identified in OAC 3745-17-08 Appendix A, the visible emissions of fugitive dust generated during grading, loading, or construction operations and other practices which emit fugitive dust are to be minimized or eliminated. The FEMP is not within a community or area identified in Appendix A; however, the remedial construction activities may generate fugitive dust. As such, this requirement is deemed to be relevant and appropriate due to potential fugitive dust generation during construction activities. OAC 3745-17-08 [Relevant and Appropriate]	Visible emissions will be mitigated during the removal action using standard construction practices such as water sprays.
Air Discharges - NAAQS	The National Ambient Air Quality Standards for lead and particulate matter will be followed according to 40 CFR 50.6 and 40 CFR 50.12. 40 CFR 50.6 and 50.12 {OAC 3745-71-02} [Relevant and Appropriate]	The potential for emissions will be controlled during the removal action by using standard construction practices such as water sprays. A program for monitoring particulate matter in the ambient air is already established for the FEMP.

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CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Air Discharges - Radionuclides	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem per year above background. This limit is based on an effective dose equivalent as calculated per the International Commission on Radiological Protection's Publication No. 26. Modelling and sampling procedures are specified in 40 CFR 61.93. An annual report must be submitted to US EPA headquarters and regional offices by June 30. This report includes the monitoring results as recorded in DOE's Effluent Information System and the effective dose equivalent calculations, as required by 40 CFR 61.93, for the previous year. Records as specified under 40 CFR 61.95 must be maintained for at least 5 years. 40 CFR 61 Subpart H {OAC 3745-54-94 & 95} [Applicable] DOE Order 5400.5 Chapter I [To Be Considered] The annual average radionuclide concentrations in air effluents are to be controlled so that the levels specified in Appendix B, Table II of 10 CFR 20 (Sections 20.1001 to 20.2401) are not exceeded. 10 CFR 20.1302(b) [Relevant and Applicable]	Ambient air monitoring will be conducted at the FEMP using the existing high-volume air monitoring stations which are part of the radiological environmental monitoring program. The results of this monitoring program are provided to the US EPA on an annual basis. The results from the four high-volume air monitoring stations which are located around the waste pit area will be incorporated into the Removal Action 18 Final Report, and will be placed in the Administrative Record.

CATEGORY	REGULATORY REQUIREMENTS	IMPLEMENTATION STRATEGY
Air Discharges - Radon	As required by 40 CFR 61.192, no more than 20 pCi/m^2-sec of radon-222 shall be emitted into the air from the facility, as an average for the entire source. 40 CFR 61 Subpart Q [Applicable] Radon-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed 100 pCi/l at any given point. Radon-222 concentrations in the atmosphere shall not exceed an annual average of 30 pCi/l over the facility or 3 pCi/l at locations outside the facility. Radon-222 flux rates shall not exceed 20 pCi/m^2-sec. DOE Order 5400.5 Chapter IV [To Be Considered]	DOE and US EPA have entered into a Federal Facilities Agreement (FFA) for the control and abatement of radon-222 emissions as required by the Amended CERCLA Consent Agreement, Executive Order 12088, and 40 CFR 61 Subpart Q. The FFA (dated 11/26/91) requires that the DOE provide the US EPA with radon flux estimates from potential radon sources. Once this removal action is complete, no radon flux measurements will be required since the entire pit will be covered with water and the radon flux will be assumed to be zero.

APPENDIX B

REMP AIR MONITORING PROCEDURE
EM-RM-001

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 1 OF 28
		REV NO. 2
TITLE: REMP AIR MONITORING	PROC. NO. EM-RM-001	DATE: Oct. 31, 1991

DOCUMENT APPROVAL

PROCEDURE SECTION: Radiological Environmental Monitoring

PROCEDURE TITLE: REMP Air Monitoring

PROCEDURE NO: EM-RM-001

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PREPARED BY: Patricia Kraps (AUTHOR) 09/17/91 (DATE)

APPROVED BY: Teresa L. Rogers (PROGRAM MANAGER) 10-18-91 (DATE)

AUTHORIZED BY: K. Farmer (MANAGER, ENVIRONMENTAL MONITORING) 10-18-91 (DATE)

1.0 PURPOSE

To assign responsibilities and establish the procedure for the collection of air samples in support of the Environmental Monitoring Program.

2.0 SCOPE

This procedure establishes guidelines for the method and frequency of the routine collection of environmental high volume air samples for analysis, data review and reporting, record keeping, and maintenance for General Metals and AMS-50 air monitoring pumps.

3.0 DEFINITIONS

Custody Transfer Record - A form used to track each person responsible for the physical custody of each sample from the time of collection to the time of analysis.

4.0 RESPONSIBILITIES

4.1 Manager, Environmental Monitoring shall be responsible for the administration of the Air Monitoring Station (AMS) sample collection program as identified in this procedure.

4.2 EM Engineer/Technologist (E/T) shall coordinate the efforts of EM Technicians, notify the laboratory of desired analyses, review analytical results, and maintain program records.

4.3 EM Technicians shall be responsible for the collection of samples from the AMS per this procedure.

5.0 GENERAL

5.1 Training

Only sampling technicians trained in the requirements of this procedure and procedure EM-AD-008 Chain-of-Custody and Request for Analysis shall perform sampling activities.

5.2 Health and Safety

No items or articles of clothing which have been used in the production area shall be used for sampling outside the production area.

5.3 Quality Assurance

All sample collection activities shall be conducted in such a way as to ensure that the required level of quality is achieved and maintained.

5.4 Suggested Equipment/Materials

- A copy of EM-RM-001, REMP Air Monitoring
- 0-150 CFM rotameter
- Kurz Air Flow Calibration Unit
- Pre-loaded and/or bagged glass microfibre filters from the Lab
- Field Logbook
- Air Monitoring Station keys
- A previously tested and calibrated spare high volume air sampler pump
- A spare timer and chart recorder
- Replacement paper for circular chart recorders
- Air Monitoring Station Data Sheet (Attachment A)
- General Metals Air Monitoring Station Field Data Sheet (Attachment B, page 1 of 2)
- AMS-50 Air Monitoring Station Field Data Sheet (Attachment B, page 2 of 2)
- Custody Transfer Record (Attachment C)
- General Metals Operating Log (Attachment D)
- AMS-50 Operating Log (Attachment E)
- Spare pens for chart recorders
- Spare light bulbs
- Fluke DMM
- Extension cords
- Sealing tape

5.5 Sampling Frequency

Samples of particulate matter in the air are continuously collected at permanent sampling stations located on site and at several locations in the surrounding community (Attachment F).

- Each air monitoring station samples air at a rate of about 40-50 CFM (cubic feet per minute) through an 8 inch x 10 inch filter which is changed weekly.

6.0 PROCEDURE

6.1 Sample Collection Technique for General Metal Air Stations

Proceed to each of the air monitoring stations as shown on the maps (Attachment F) and perform filter exchange as described below.

6.1.1 Obtain the properly numbered AMS filter and other pertinent items.

6.1.2 Open the bottom compartment of the AMS housing.

* Attach rotameter rubber tubing to the fitting at the bottom of the pump.

* Read flowrate from the center of the silver metal ball (lower float) of the rotameter.

* Record the flowrate on the General Metal Air Monitoring Station Field Data Sheet in the column labeled "Air Flow (CFM) Ending."

* Record the date of collection on the General Metal Air Monitoring Field Data Sheet.

6.1.3 Turn the pump off by depressing the "STOP" toggle switch next to the timer.

* Record time unit stopped on the General Metal Air Monitoring Station Field Data Sheet.

* Record the reading from the elapsed timer on the General Metal Air Monitoring Station Field Data Sheet in the column labeled "Hours of Operation".

* Record the AMS #, date, and time on the back of a new chart.

* Remove the old chart from the Dickson recorder.

* Record the date and time on the back of the old chart.

* Place the new chart in the Dickson recorder.

* Align the chart pen at the proper day and time.

* Close Dickson door tightly.

6.1.4 Open the top of the AMS housing.

NOTE: If changing air monitoring station filters in the rain, avoid getting the filters wet. Keep the filter cover on the new filter as long as possible and exchange the filters under cover of the pump housing top.

* Unscrew the four wing nuts at the corners of the filter until loosened.

- Snap the filter cover off of the new filter.
- Place the filter cover on the old filter.
- Remove the old filter.
- Place the old filter in a clean plastic bag.
- Place new filter in housing.
- Tighten the four wing nuts at the corners of the filter until tightened.
- Close the top cover of the AMS housing.

6.1.5 Restart the pump by depressing the toggle switch for a couple of seconds until the pump starts and continues to run.

- Allow the pump to run for at least 1 minute prior to obtaining flowrate.
- Read the flowrate from the center of the silver metal ball (lower float) of the rotameter.
- Record the flowrate on the General Metal Air Monitoring Station Field Data Sheet in the column labeled, "Airflow (CFM) Start".
- Contact Health and Safety Instrumentation Lab (HSIL) for directions if the pump is not operating at 40-50 CFM.
- Make sure Dickson recorder is operating at the correct day and time.
- Ensure ink is flowing properly.

6.1.6 Close the lower door to the AMS housing, ensure the top cover and lower door are securely fastened and AMS fence locked.

6.1.7 Seal the bag closure containing the old filter.

6.1.8 Proceed to the next AMS station.

6.1.9 Repeat steps 6.1.1 through 6.1.8 until all filters have been exchanged.

6.1.10 Complete the Custody Transfer Record.

6.1.11 Submit the samples along with the Custody Transfer Record to the lab.

6.1.12 Transfer data from the General Metal Air Monitoring Station Field Data Sheet to the General Metal AMS Operating log.

- Transfer the "Air Flow (CFM) Ending" reading to the General Metal AMS Operating log in the column labeled "Ending Flowrate Rotameter."
- Transfer the actual flowrate in CFM from the corresponding calibration sheet for each air sampler pump to the General Metal AMS Operating log in the column labeled "End Flowrate (CFM)."
- * Record the number of hours the AMS operated.
- Transfer the "Hours of Operation" reading to the General Metal AMS Operating log in the column labeled "Timer Counter Reading."
- * Subtract the previous timer reading from the current to obtain the number of hours the AMS operated for the sampling period.
- * Record the operating hours in the General Metal AMS Operating log column labeled "Time Hours."
- Transfer the "Air Flow (CFM) Start" reading to the General Metal AMS Operating log column "Starting Flowrate Rotameter."
- * Transfer the actual flowrate in CFM from the corresponding calibration sheet to the General Metal AMS Operating log in the column labeled "Start Flowrate (CFM)."
- Record the date and time of collection in the General Metal AMS Operating log.
- * Initial the entry for collection.

6.2 Sample Collection Technique for AMS-50 Air Stations

Proceed to each of the air monitoring stations as shown on the maps (Attachment F) and perform filter exchange as described below.

6.2.1 Obtain the properly numbered AMS filter, spare chart paper and spare pens for chart recorders.

6.2.2 Prior to opening the door of the housing, observe the two lights on the door of the unit.

* The green light indicates power to the unit; light should be lit.

* The yellow light indicates low flow; light will automatically come on if the flow rate drops below 35 CFM or greater than 50 CFM.

6.2.3 Use the special key provided to open unit door.

* Observe the inside of the unit and note any abnormalities (i.e., small blower motor not operating, Sierra flow indicator not working, loose wires and connectors).

6.2.4 Record the Sierra flowrate on the AMS-50 Air Monitoring Field Data Sheet in the column labeled "Air Flow (CFM) Ending."

* Record the date of collection on the Field Data Sheet.

6.2.5 Turn the pump off.

* Record the time the unit was stopped on the AMS-50 Air Monitoring Station Field Data Sheet.

* Record the reading from the top elapsed timer on the AMS-50 Air Monitoring Station Field Data Sheet in the column labeled "Minutes of Operation."

* Record time to nearest whole minute.

* Reset top elapsed timer by depressing and releasing the red reset button (bottom timer cannot be reset).

* Record the AMS #, date and time on the back of a new chart.

* Remove the old chart from the recorder by loosening the swing arm and moving to the side.

* Lift the pen arm and pull the old chart off the hub.

* Record date and time removed on the back of the old chart paper.

* Place the new chart in the recorder.

* Align the paper to the correct day and time by lining up with the start mark on the chart controller box.

* Place the swing arm back in place and tighten.

* Close the chart recorder door and latch.

6.2.6 Lift the top of the AMS housing

Note: If changing air monitoring station filters in the rain, avoid getting the filters wet. Keep the filter cover on the new filter as long as possible and exchange the filters under cover of the pump housing top.

* Loosen the four screws on the filter holder and remove from the filter.

* If cassettes are not used with the filters, the filter should be handled by the edges, being careful not to touch the collection surface area.

* Remove the filter and fold in half so the dirty portions are on the inside facing each other.

* Place the folded filter in an envelope, bag, filter holder or other suitable holder.

* The filter holder shall be marked with the filter location.

* When collecting the filter, look for and record any signs of damage to the filters (holes, tears, changes in filter appearance color or texture).

* Check for signs of deteriorating gaskets, indicated by a blurring of the margins on the filter.

* Check Sierra flow by selecting toggle switch "Readout Select" to "Set"

* If flow is outside the ± 3 CFM of the 45 CFM set, then contact the REM instrument technician for direction.

* Place "Readout Select" switch to "Read" position.

6.2.7 Place new filter in the unit.

* Before replacing the filter, wipe any dirt particles from the support screen and faceplate.

* Carefully handle the new filter by the edges and hold it up to the light to check for damage.

* Place the new filter on the support screen, ensure the correct side is turned up (rough side up if using glass fiber filters or the serial number side up if using numbered filters)

* Carefully align the filter so it will be centered on the support screen.

* Place the filter holder over the filter and tighten.

* Avoid excessive tightening of the holder to prevent possible damage to the gasket.

* Close the top cover of the AMS housing.

* Ensure the low flow light is on prior to restarting the pump.

6.2.8 Restart the pump.

* Allow the pump to reach operating speed (about one minute) before recording flowrate.

* Record the Sierra flowrate on the AMS-50 Air Monitoring Station Field Data Sheet in the column labeled "Airflow (CFM) Start."

* Ensure chart recorder is operating at the correct day and time.

* Ensure ink is flowing properly.

* If pump is not operating at 40-50 CFM, contact REM instrument technician for direction.

* Ensure low flow light is deenergized.

6.2.9 If unit is out of operation, and/or any abnormalities are noted, contact the REM instrument technician for direction.

6.2.10 Close door to the AMS-50 unit and secure in place by using specialized key.

6.2.11 Lock the AMS fence upon leaving.

6.2.12 Seal the filter holder containing the old filter.

6.2.13 Proceed to the next AMS location.

6.2.14 Repeat steps 6.2.1 through 6.2.13 until all AMS-50 air filters have been exchanged.

6.2.15 Complete the Custody Transfer Record.

6.2.16 Submit the samples along with the Custody Transfer Record to the Bioassay Lab.

6.2.17 Transfer data from the AMS-50 Air Monitoring Station Field Data Sheet to the AMS-50 Operating log.

* Transfer the "Air Flow (CFM) Ending" reading to the AMS-50 Operating log column "Ending Flowrate Sierra."

* Record the number of minutes the AMS-50 operated from the AMS-50 Air Monitoring Station Field Data Sheet to the AMS-50 Operating log column "Time Counter Reading Minutes."

* Calculate the number of hours of operations by dividing the counter reading in minutes by 60.

* Record the hours in the AMS-50 Operating log column "Time Hours."

* Transfer the "Air Flow CFM Start" reading to the AMS-50 Operating log column "Starting Flowrate Sierra."

* Record the date and time of collection in the AMS-50 Operating log.

* Initial the entry for collection.

6.3 Fill out the Air Monitoring Station Data Sheet (AMSDS).

* Record the date of collection.

* Record the name of the sampling technician.

* Check the appropriate box for routine collection or special collection.

* Check the boxes for total U, total particulates (TSP), and gross beta.

* If there are special instructions for analysis, check the box marked other and write in the parameter to be analyzed.

* Record any comments or irregularities in the operation of the AMS.

* Transfer the hours of operation from the General Metals and AMS-50 Operating logbooks column labeled "Time Hours."

* Record the start and ending flow rates. Obtain the flow rate data for each station from the AMS Operating logbooks.

* Repeat the appropriate steps above for each AMS to complete the Air Monitoring Station Data Sheet.

* Submit the AMSDS along with the Chart Recorders to the Bioassay Lab.

6.4 AMS Parts Maintenance for General Metal Air Stations

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CAUTION

If electric plug is not disconnected from main outlet on the fence, the potential for electric shock exists.

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6.4.1 Disconnect electric plug from main outlet on the fence.

6.4.2 Remove a pump, timer, or Dickson recorder if the part is not running properly or not operating.

* Replace the defective part with a spare part.

* Take the defective part to the HSIL for repair.

* Report the problem to one of the HSIL technician on duty and note in the Field Logbook the name of the individual notified and the time and date of notification.

6.4.3 After a pump has been repaired and before the pump is put back into service:

* Run the pump for a minimum of five minutes to seat the brushes prior to calibration.

* Calibrate the pump using a Kurz Air Flow calibration unit and a 0-150 CFM rotameter.

* Record this information into the Field Logbook and on the calibration sheet for that pump.

6.5 AMS Parts Maintenance for AMS-50 High Volume Air Stations

6.5.1 AMS-50 units shall be calibrated once every twelve months.

6.5.2 Due to the unit construction, parts should not be removed and interchanged between units without the direction of REM instrument technician.

6.6 Data Review and Reporting

6.6.1 The results of the AMS sampling program will be evaluated by the E/T. Any unusual results will be investigated.

6.6.2 An annual notification of results letter should be sent to responsible parties at offsite monitor locations.

6.6.3 The results shall be incorporated into the site Annual Environmental Report.

6.7 Record Keeping

6.7.1 The E/T shall retain a copy of each Analytical Data Sheet and Custody Transfer Record in the EM files.

6.7.2 Field data sheets shall be maintained in the EM files.

6.7.3 The E/T shall retain the analytical results and the chart recorder in the EM files.

7.0 APPLICABLE DOCUMENTS

7.1 EM-AD-008, Chain-of-Custody and Request for Analysis

7.2 FMPC Site Health and Safety Plan

7.3 FMPC-718, Measuring and Test Equipment Calibration and Control

7.4 FMPC-2207, FMPC Restoration Quality Assurance Program Plan (RQAPP)

8.0 ATTACHMENTS

8.1 Attachment A, AIR MONITORING STATION DATA SHEET, FMPC-REST-2739

8.2 Attachment B, GENERAL METALS AIR MONITORING STATION FIELD DATA SHEET, page 1 of 2

8.3 Attachment B, AMS-50 AIR MONITORING STATION FIELD DATA SHEET, page 2 of 2

8.4 Attachment C, CUSTODY TRANSFER RECORD, FMPC-OS&H-2775

8.5 Attachment D, GENERAL METALS OPERATING LOG

8.6 Attachment E, AMS-50 OPERATING LOG

8.7 Attachment F, MAPS OF AIR MONITORING STATIONS

ATTACHMENT A
PAGE 1 OF 1

AIR MONITORING STATION DATA SHEET

FMPC
RESTORATION - ENVIRONMENTAL MONITORING
AIR MONITORING STATION DATA SHEET

COLLECTION DATE:

NAME:

SAMPLE TYPE:
- ☐ ROUTINE
- ☐ SPECIAL

ANALYZE FOR:
- ☐ TOTAL U
- ☐ TOTAL PARTICULATE (TSP)
- ☐ GROSS BETA
- ☐ OTHER

STATION NUMBER	COMMENTS	HOURS OF OPERATION	AIR FLOW (CFM)		TOTAL U (ug)	GROSS BETA (d/m)	TSP	OTHER
			START	ENDING				
AMS1								
AMS2								
AMS3								
AMS4								
AMS5								
AMS6								
AMS7								
AMS8								
AMS9								
A & W								
Crosby								
Morgan								
Elda								
Roof of Elda								
U.C.								
Miamitown								
Blank Filter								

NO.	DISTRIBUTION OF COPIES
1	Environmental Monitoring
2	Analytical Laboratories

FMPC-REST-278 (REV. 6/1/89)

ATTACHMENT B
PAGE 1 OF 2

AIR MONITORING STATION FIELD DATA SHEET
for GENERAL METAL MONITORS

FEMP

ENVIRONMENTAL MONITORING

AIR MONITORING STATION FIELD DATA SHEETS

FOR GENERAL METAL PUMPS

COLLECTION DATE		NAME OF ERMT			
STATION NUMBER	COMMENTS	HOURS OF OPERATION	AIR FLOW (CFM) START	AIR FLOW (CFM) END	TIME
AMS 1					
AMS 2					
AMS 3					
AMS 4					
AMS 5					
AMS 6					
AMS 7					
AMS 8					
AMS 9					
A & W					
CROSBY					
MORGAN					
ELDA					
ROOF OF ELDA					
U.C.					
MIAMITOWN					

ATTACHMENT B
PAGE 2 OF 2

AIR MONITORING STATION FIELD DATA SHEET
for AMS-50 MONITORS

FEMP

ENVIRONMENTAL MONITORING

AIR MONITORING STATION FIELD DATA SHEETS

FOR AMS-50 PUMPS

COLLECTION DATE		NAME OF ERMT			
STATION NUMBER	COMMENTS	MINUTES OF OPERATION	AIR FLOW (CFM) START	AIR FLOW (CFM) END	TIME
AMS 1					
AMS 2					
AMS 3					
AMS 4					
AMS 5					
AMS 6					
AMS 7					
AMS 8					
AMS 9					
A & W					
CROSBY					
MORGAN					
ELDA					
ROOF OF ELDA					
U.C.					
MIAMITOWN					

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 17 OF 28
		REV NO. 2
TITLE: REMP AIR MONITORING	PROC. NO. EM-RM-001	DATE: Oct. 31, 1991

ATTACHMENT C
PAGE 1 OF 1

CUSTODY TRANSFER RECORD

FMPC
OPERATIONS SAFETY & HEALTH - ENVIRONMENTAL MONITORING
CUSTODY TRANSFER RECORD

DATE	NAME OF SAMPLER(S)	REMARKS

SAMPLE IDENTIFICATION							COMMENTS
ITEM NUMBER	SAMPLE NO.	DESCRIPTION	MATRIX	DATE COLLECTED	CONTAINER	PRESERVATIVE	

MATRIX: A - AIR, M - MILK, SD - SEDIMENT, F - FERTILIZER, P - PRODUCE, W - WATER, G - GRASS, S - SOIL, X - OTHER (Specify)

CONTAINER: G - GLASS, P - PLASTIC

ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME	ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME

ATTACHMENT D
PAGE 1 OF 1

GENERAL METALS OPERATING LOG

BOUNDARY STATION

GENERAL METALS-OPERATING LOG

	STARTING FLOWRATE ROTOMETER	START FLOWRATE (CFM)	ENDING FLOWRATE ROTOMETER	END FLOWRATE (CFM)	TIME COUNTER READING	TIME HOURS	DATE & TIME	INIT.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 19 OF 28
		REV NO. 2
TITLE: REMP AIR MONITORING	PROC. NO. EM-RM-001	DATE: Oct. 31, 1991

ATTACHMENT E
PAGE 1 OF 1

AMS-50 OPERATING LOG

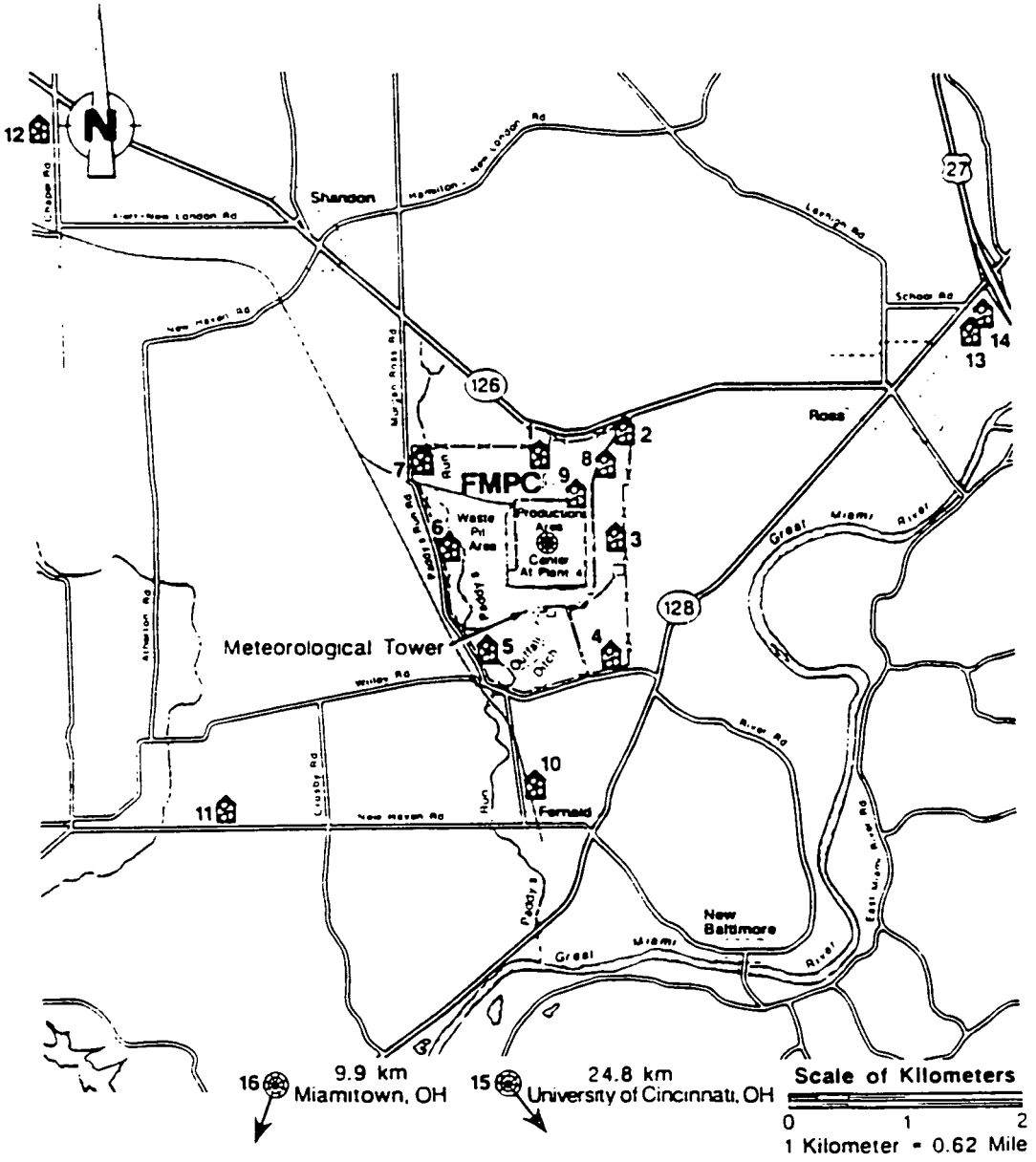
BOUNDARY STATION

AMS-50 OPERATING LOG

	STARTING FLOWRATE SIERRA (CFM)	ENDING FLOWRATE SIERRA (CFM)	TIME COUNTER READING	TIME HOURS	DATE & TIME	INITIALS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

ATTACHMENT F
PAGE 1 OF 9

MAP OF AIR MONITORING STATIONS



LEGEND

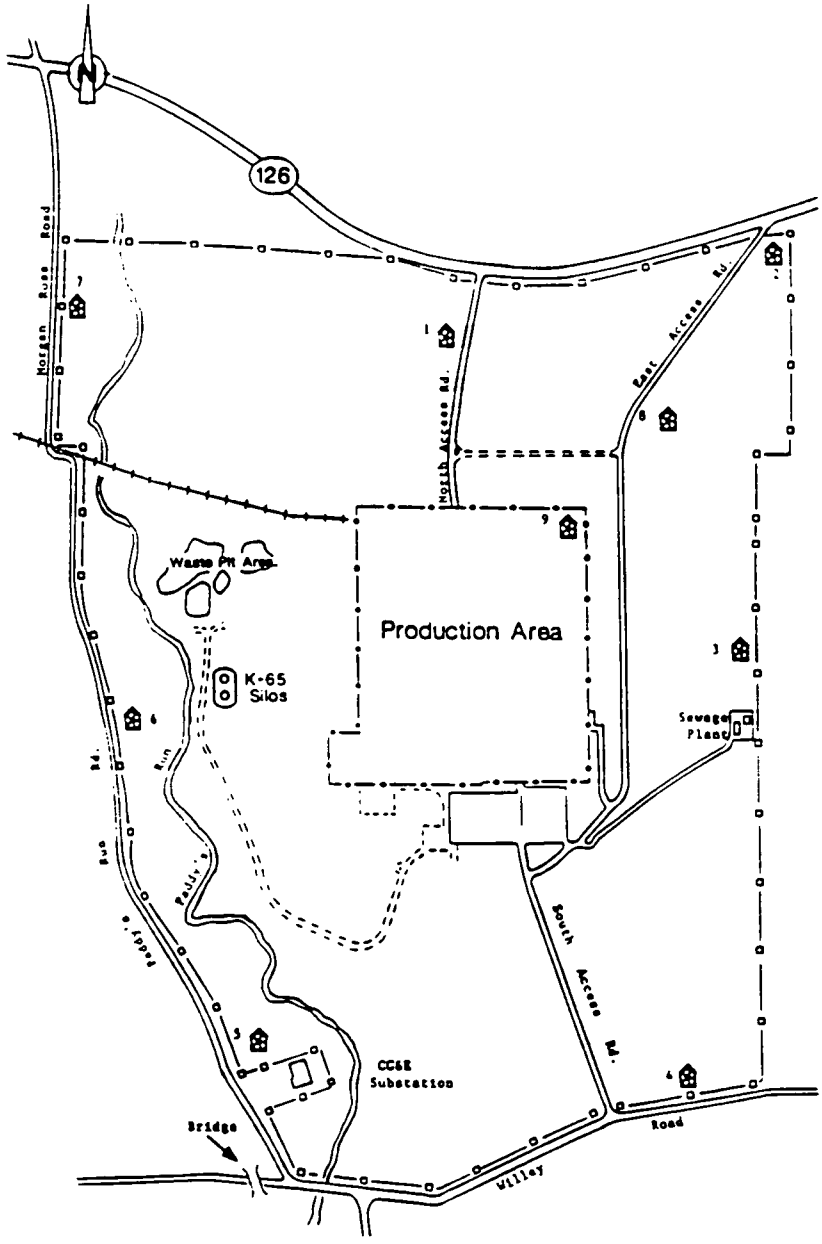
- Air Monitoring Location
- Distance from Center of Production Area to Sampling Locations off Map
- Plant Perimeter
- Production Area Perimeter

LIST OF AIR MONITORING STATIONS

AMS 1	On the old north Access Road.
AMS 2	Southwest of the east Access Road and state Route 126 intersection.
AMS 3	East of FMPC and 340 yards north of Sewage Treatment.
AMS 4	150 yards east of the south Access Road and Willey Road intersection.
AMS 5	On Paddy's Run Road at the CG&E substation.
AMS 6	On Paddy's Run Road due west of the K-65 Silos 1 & 2.
AMS 7	On Morgan-Ross Road northwest corner of FMPC site.
AMS 8	On the east Access Road northeast of the FMPC site.
AMS 9	Northeast corner of the process area northeast of production area.
AMS 10	Between Ruetgers - Nease Inc. and Albright and Wilson on Paddy's Run Road.
AMS 11	Crosby School on New Haven Road.
AMS 12	Southwest corner of Morgan School located on Chapel Road north of Shandon, Ohio.
AMS 13	Elda School in Ross, Ohio on State Route 128.
AMS 14	Roof of Elda School in Ross, Ohio on State Route 128.
AMS 15	University of Cincinnati campus on Martin Luther King Drive at the S.W.O.A.P.C.A. air monitoring station.
AMS 16	S.W.O.A.P.C.A. air monitoring station south of Harrison Avenue on Ripple Road next to Hamilton County Highway Maintenance facility.

ATTACHMENT F
PAGE 3 OF 9

AIR MONITORING STATION 1-9



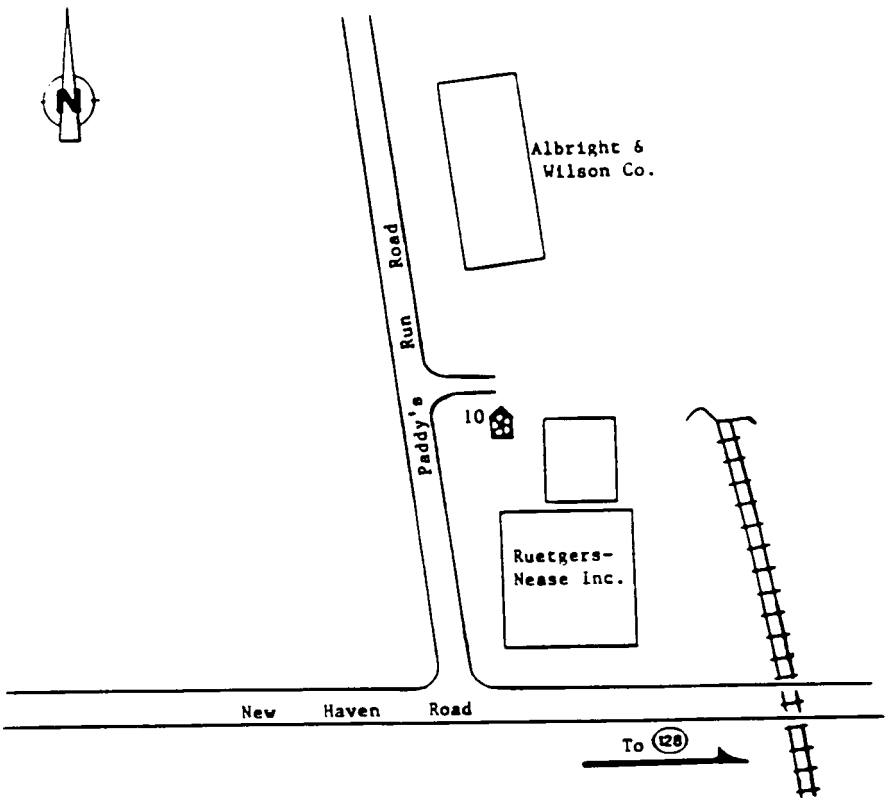
LEGEND

Air Monitoring Location

Plant Perimeter

Production Area Perimeter

AIR MONITORING STATION 10

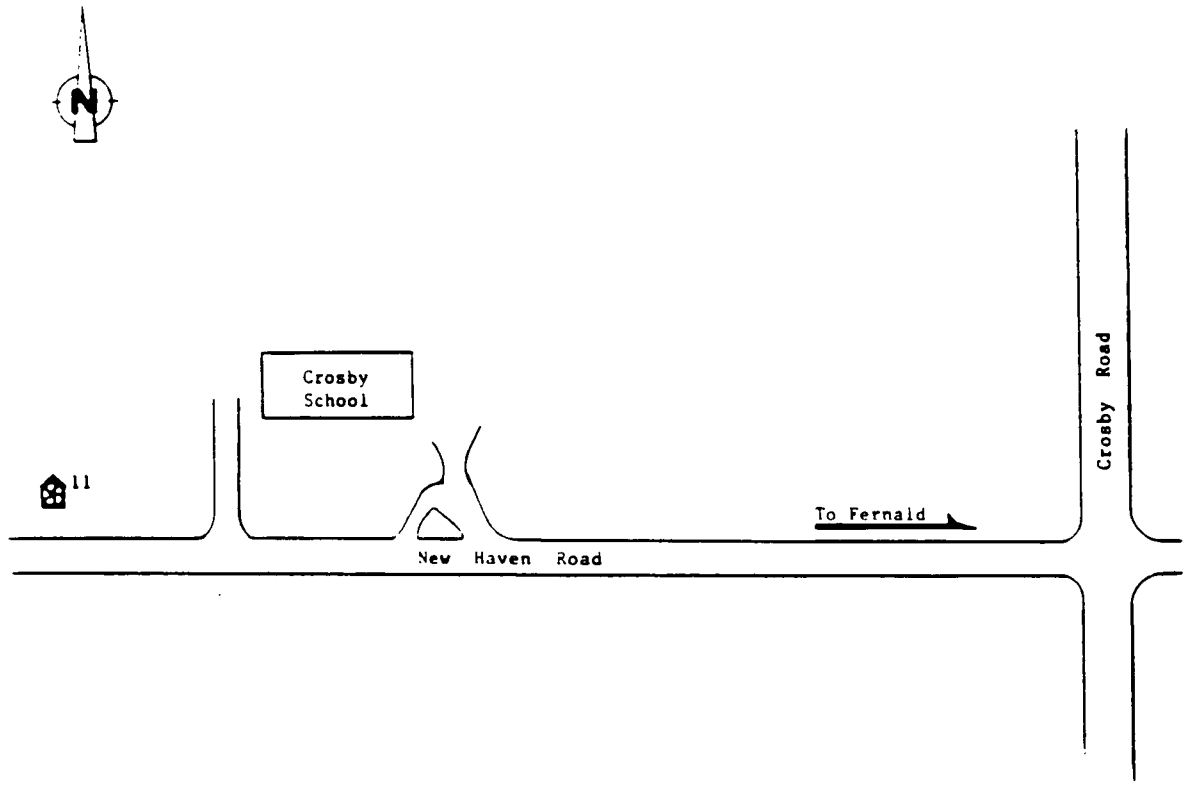


LEGEND

Air Monitoring Location

ATTACHMENT F
PAGE 5 OF 9

AIR MONITORING STATION 11



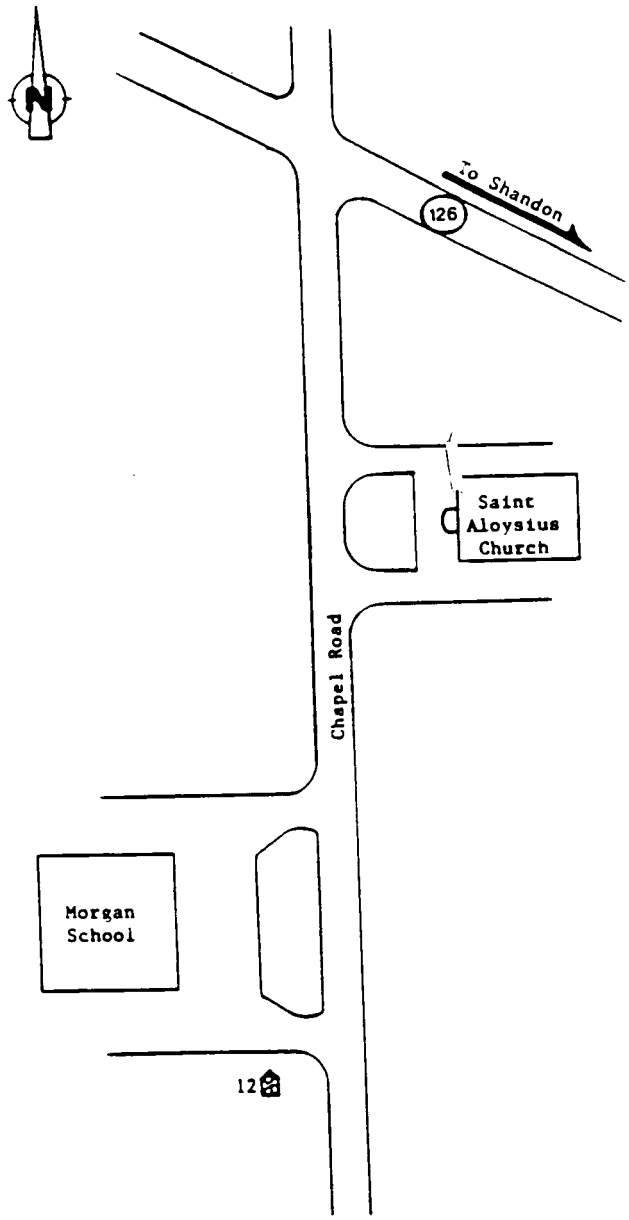
LEGEND

Air Monitoring Location

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 25 OF 28
		REV NO. 2
TITLE: REMP AIR MONITORING	PROC. NO. EM-RM-001	DATE: Oct. 31, 1991

ATTACHMENT F
PAGE 6 OF 9

AIR MONITORING STATION 12

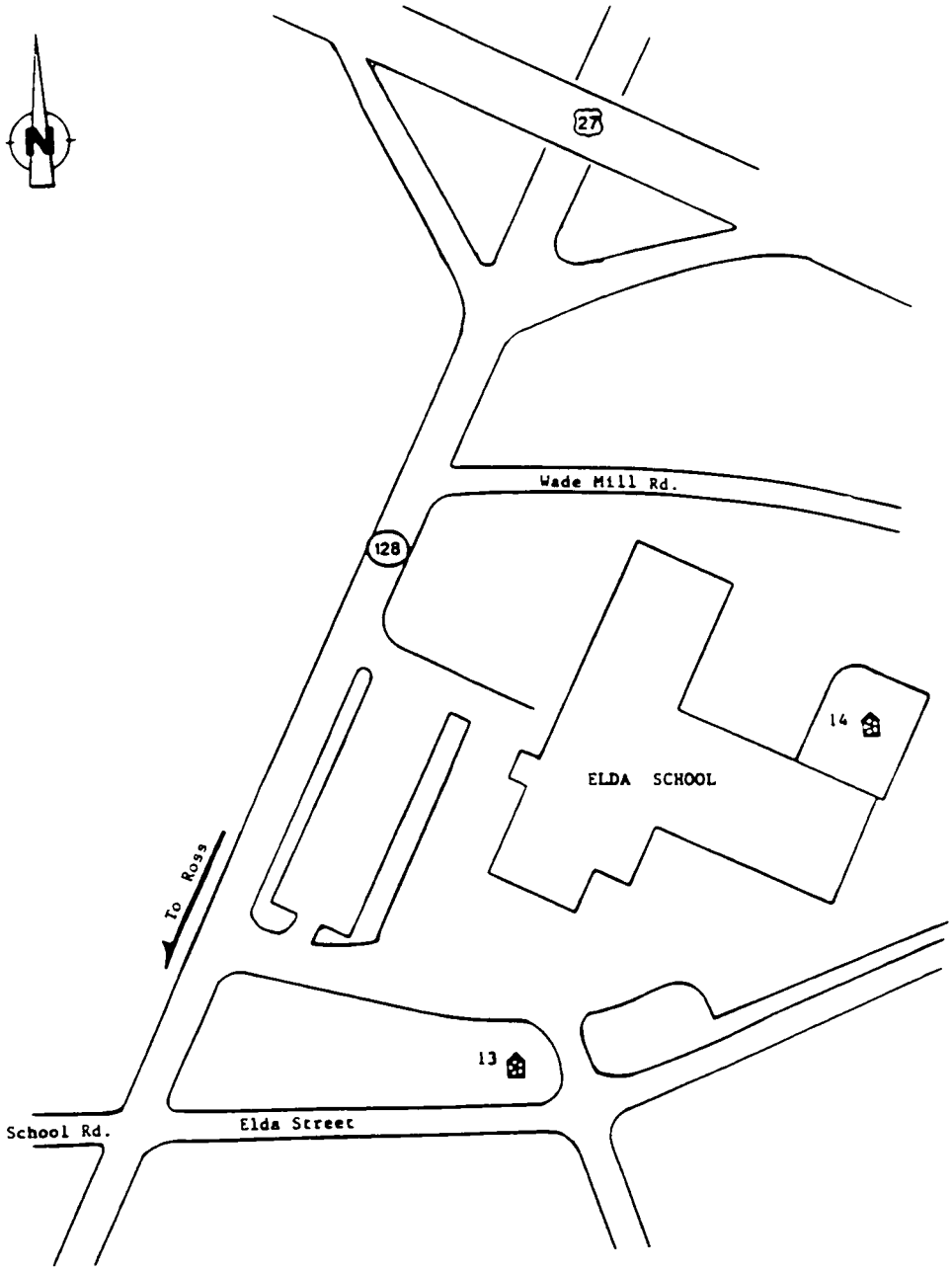


LEGEND

Air Monitoring Location

ATTACHMENT F
PAGE 7 OF 9

AIR MONITORING STATION 13-14



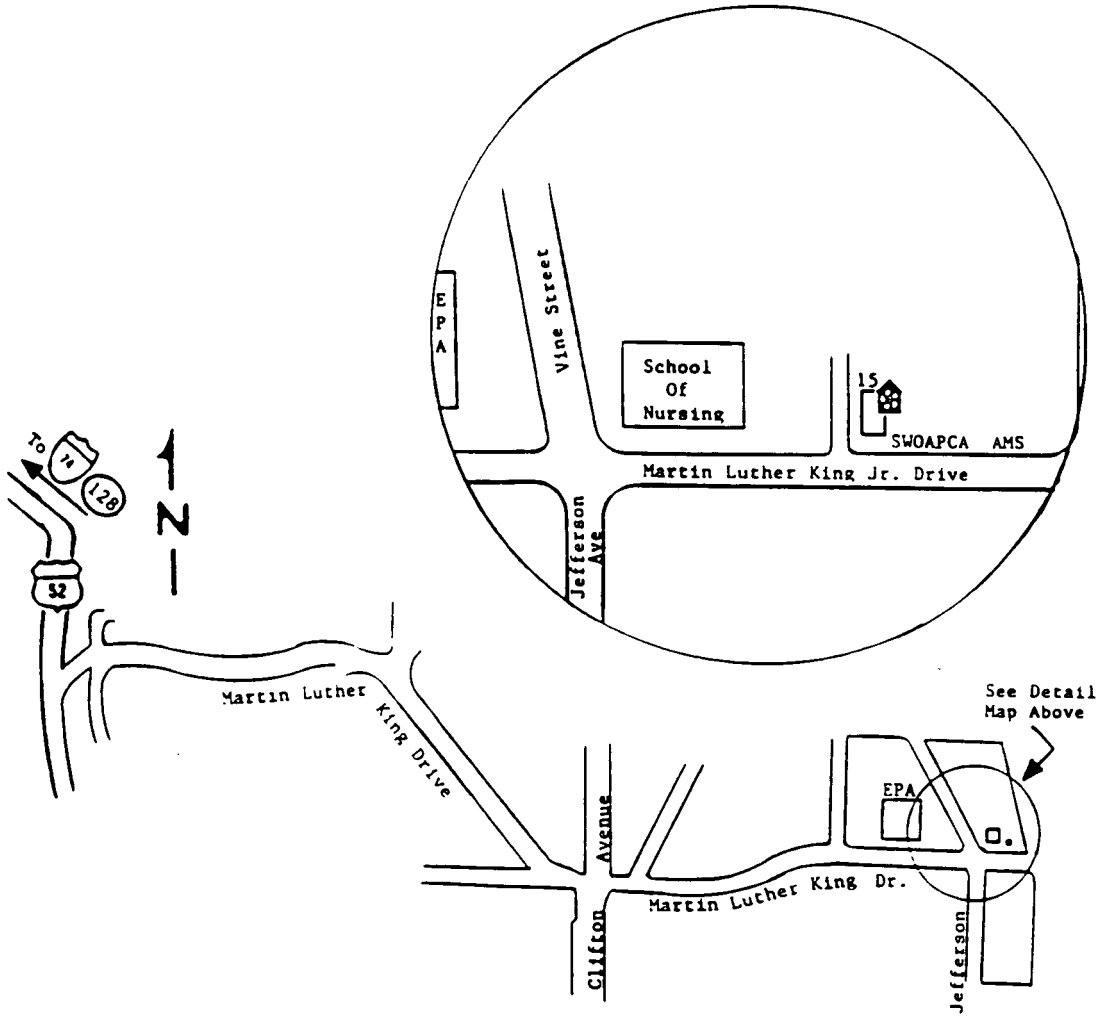
LEGEND

Air Monitoring Location

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 27 OF 28
		REV NO. 2
TITLE: REMP AIR MONITORING	PROC. NO. EM-RM-001	DATE: Oct. 31, 1991

ATTACHMENT F
PAGE 8 OF 9

AIR MONITORING STATION 15

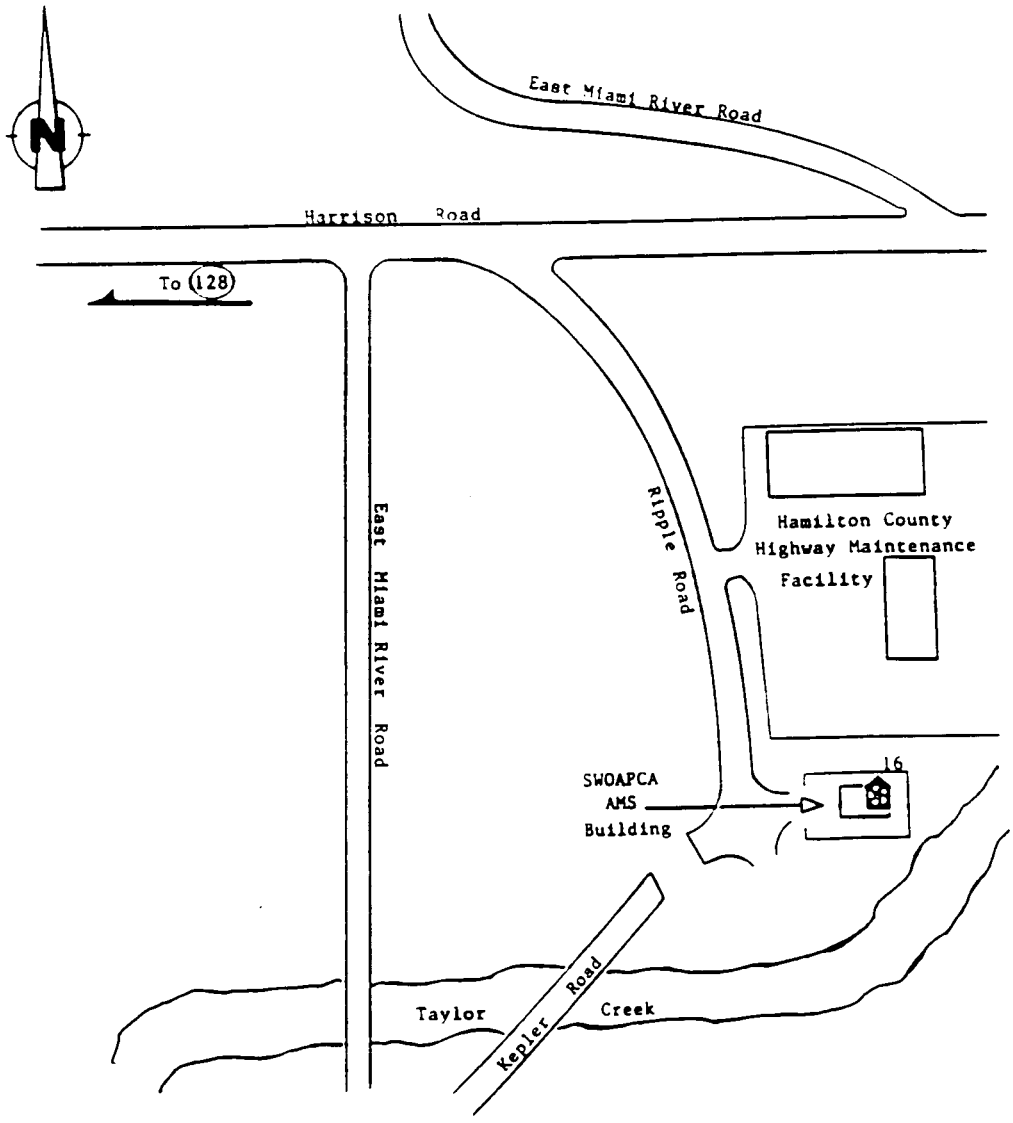


LEGEND

Air Monitoring Location

ATTACHMENT F
PAGE 9 OF 9

AIR MONITORING STATION 16



LEGEND

Air Monitoring Location

APPENDIX C

ENVIRONMENTAL MONITORING CHAIN-OF-CUSTODY AND REQUEST FOR ANALYSIS PROCEDURE EM-AD-008

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 1 OF 9
		REV NO. 1 *
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

COMPLETE REWRITE

RECEIVED
1992 MAR -9 AM 8:46

DOCUMENT APPROVAL

PROCEDURE SECTION: Administration

PROCEDURE TITLE: Chain-of-Custody and Request for Analysis

PROCEDURE NO: EM-AD-008

PREPARED BY: Mark Cornell (AUTHOR) 3/26/91 (DATE)

APPROVED BY: B D Woodruff (PROGRAM MANAGER) 5/2/91 (DATE)

AUTHORIZED BY: [signature] (MANAGER, ENVIRONMENTAL MONITORING) 5/3/91 (DATE)

*This revision contains the same information as the revision dated 3/29/91. This procedure is now being reissued to correct the revision number and to identify it as a "Complete Rewrite" from that dated 8/15/90. The correct revision number and "Complete Rewrite" were missing from the procedure dated 3/29/91.

1.0 PURPOSE

To assign responsibilities and establish the Chain-of-Custody and Request for Analysis procedure in support of the Environmental Monitoring Program.

2.0 SCOPE

This procedure identifies the Environmental Monitoring (EM) method for documenting the traceability of samples, and ensuring that samples are not altered, from initial collection through acceptance by the applicable laboratory.

3.0 DEFINITIONS

3.1 Custody - A sample is considered in custody and ensured its integrity if it is in an authorized person's physical possession, in view of the person after taking possession, secured by that person so that no one can tamper with it, or secured by that person in an area that is restricted to authorized personnel.

3.2 Transferring Custody - Giving physical control of or the responsibility for the samples to another person.

3.3 Final Field Custodian - The last person who has custody of the samples prior to transferring custody to the lab, a commercial carrier, or any persons who were not involved in the sampling effort.

4.0 RESPONSIBILITIES

4.1 The Manager, Environmental Monitoring shall be responsible for the administration of the Chain-of-Custody and Request for Analysis procedure.

4.2 The Program Manager(s) of personnel required to perform work per this procedure shall ensure that affected personnel are informed or trained to the extent necessary prior to initiation of that work.

4.3 The Engineer/Technologist (E/T) shall coordinate the efforts of the sampling technicians and retain completed chain-of-custody and request for analysis forms in the EM files.

4.4 The Sampling Technicians shall be responsible for completing chain-of-custody and request for analysis forms and delivering completed copies to the E/T for retention in EM files.

5.0 GENERAL

5.1 The chain-of-custody and request for analysis requirements are mandatory for all sampling conducted in support of EM programs.

5.2 The chain-of-custody and request for analysis forms must accompany samples until lab personnel sign the form accepting custody.

5.3 Each change of possession of a sample must be documented on the form under the headings "Relinquished By" and "Received By".

PCN-EM-AD-008-1-02

6.0 PROCEDURE

6.1 Sampling Technique

6.1.1 Obtain samples per applicable sampling procedure.

6.1.2 Record all required information in the field logbook.

6.1.2.1 Review information prior to leaving sampling location to ensure accuracy.

6.1.2.2 Note conditions which are considered abnormal for the specific sampling being performed.

6.1.3 Verify that the correct chain-of-custody and request for analysis forms are in use.

* Radiological Environmental Monitoring personnel shall use the Custody Transfer Record form (Attachment A).
* Groundwater Monitoring personnel shall use the Chain-of-Custody Record form (Attachment B). PCN-EM-AD-008-1-01
* Environmental Characterization & Surveillance personnel shall use the Analysis Request/Custody Record form (Attachment C).

6.1.4 Complete the appropriate form by entering the applicable information. At a minimum, the following items shall be completed on all forms:

* Date and time of collection
* Name of person performing sampling
* Sample ID number
* Matrix (type of sample)
* Type of container used
* Preservatives used (if applicable)
* Description (sample location)
* Remarks/Comments

Westinghouse Environmental Management Company of Ohio	PROCEDURE CHANGE NOTICE	*ENVIRONMENTAL MONITORING SECTION PROCEDURE*
PCN NO: PCN-EM-AD-008-1-02	PROCEDURE TITLE: Chain of Custody and Request for Analysis	EFFECTIVE DATE: 12/31/91
AUTHORIZED BY: (MANAGER, ENVIRONMENTAL MONITORING Mark Cheney 12-23-91		PAGE 1 OF 1

PREVIOUS REQUIREMENTS:

None

NEW REQUIREMENTS:

5.4 Appropriate sample holding time(s) will be documented on either the sampling schedule or sampling plan.

Westinghouse Materials Company of Ohio	PROCEDURE CHANGE NOTICE	ENVIRONMENTAL MONITORING SECTION PROCEDURE
PCN NO.: PCN-EM-AD-008-1-01	PROCEDURE TITLE: Chain of Custody and Request for Analysis	EFFECTIVE DATE: 9-13-91
AUTHORIZED BY: (MANAGER, ENVIRONMENTAL MONITORING)		PAGE 1 OF 1

PREVIOUS REQUIREMENTS:

6.1.3 * Groundwater Monitoring personnel shall use the Chain-of-Custody Record form (Attachment B).

8.2 Attachment B, Chain-of-Custody Record

NEW REQUIREMENTS:

6.1.3 * Groundwater Monitoring personnel shall use the Chain-of-Custody Record form and Request-for-Analysis form (Attachment B).

8.2 Attachment B, Page 1 of 2, Chain-of-Custody Record
" Page 2 of 2, Request-for-Analysis Form

FMPC-EM-3278 (10/31/90)

6.1.5 Ensure that all analyses required for each specific sample are identified on the form, if necessary.

6.1.6 If several samples are grouped for transport to the lab, then a common chain-of-custody and request for analysis form may be used for the entire group.

6.2 Transferring custody of samples

The chain-of-custody form shall be signed by both the person relinquishing custody and the person receiving custody each time physical control of the sample is transferred.

6.2.1 If the person who collected the sample does not transport the sample to the lab, the first "Relinquished By' and "Received By" spaces shall be completed.

6.2.2 Complete subsequent "Relinquished By" and "Received By" spaces each time custody changes prior to delivery to lab.

* If all spaces for custody transfer become full prior to delivery to the lab, then transfer all information to a new form and continue custody transfer on the second form. All sheets shall be attached to complete the chain-of-custody record for the sample.

6.2.3 The person who relinquishes the samples to the lab shall retain one copy of the chain-of-custody form.

* Final field custodian shall sign the next "Relinquished By" space.

* Lab personnel shall sign the next "Received By" space.

6.2.4 Forward the completed copy of the form to the E/T for placement in the EM files.

7.0 REFERENCES

U.S. EPA SW-846 EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

8.0 ATTACHMENTS

8.1 Attachment A, CUSTODY TRANSFER RECORD, FMPC-OS&H-2775

8.2 Attachment B, CHAIN-OF-CUSTODY RECORD

8.3 Attachment C, ANALYSIS REQUEST/CUSTODY RECORD

PCN-EM-AD-008-1-0

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 5 OF 9 REV NO. 1
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

ATTACHMENT A
PAGE 1 OF 1

CUSTODY TRANSFER RECORD

EXAMPLE - BLANK

FMPC
OPERATIONS SAFETY & HEALTH - ENVIRONMENTAL MONITORING
CUSTODY TRANSFER RECORD

DATE	NAME OF SAMPLER(S)	SIGNATURE

SAMPLE IDENTIFICATION							COMMENTS
ITEM NUMBER	SAMPLE NO.	DESCRIPTION	MATRIX	DATE COLLECTED	CONTAINER	PRESERVATIVE	

MATRIX: A - AIR, M - MILK, SD - SEDIMENT, F - FERTILIZER, P - PRODUCE, W - WATER, G - GRASS, S - SOIL, X - OTHER (Specify)

CONTAINER: G - GLASS, P - PLASTIC

ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME	ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME

FMPC-REST-3226 (11/13/90)

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 6 OF 9
		REV NO. 1
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

ATTACHMENT B
PAGE 1 OF 2

CHAIN-OF-CUSTODY RECORD

PCN-EM-AD-008
1-01

FMPC
CHAIN-OF-CUSTODY RECORD

R/A Control No
C/C Control No 10622

Project Name/Number
Sample Team Members
Lab Destination
Carrier/Waybill No

SAMPLE NUMBER	SAMPLE LOCATION AND DESCRIPTION	DATE AND TIME COLLECTED	SAMPLE TYPE	CONTAINER TYPE	CONDITION ON RECEIPT (NAME AND DATE)	DISPOSAL RECORD NO.

Special Instructions
Possible Sample Hazards

SIGNATURES:

RELINQUISHED BY:	RECEIVED BY	RELINQUISHED BY:	RECEIVED BY:
NAME/COMPANY	NAME/COMPANY	NAME/COMPANY	NAME/COMPANY
DATE	DATE	DATE	DATE
TIME	TIME	TIME	TIME

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
NAME/COMPANY	NAME/COMPANY	NAME/COMPANY	NAME/COMPANY
DATE	DATE	DATE	DATE
TIME	TIME	TIME	TIME

DISTRIBUTION OF COPIES	
White	Original to Accompany Samples
Yellow	Field Copy

FMPC-REST-3226 (11/13/90)

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 7 OF 9
		REV NO. 1
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

ATTACHMENT B
PAGE 2 OF 2

PCN-EM-AD-008
1-01

REQUEST FOR ANALYSIS

FMPC
REQUEST FOR ANALYSIS

R/A Control No
C/C Control No 20623

Project Name
Project Number
Project Manager
Bill To
Purchase Order No

Date Samples Shipped
Lab Destination
Laboratory Contact
Send Lab Report To

Date Report Required
Project Contact
Project Contact Phone No

SAMPLE NO	SAMPLE TYPE	SAMPLE VOLUME	PRESERVATIVE	REQUESTED TESTING PROGRAM	SPECIAL INSTRUCTIONS

TURNAROUND TIME REQUIRED (Rush must be approved by the Project Manager)
☒ Normal - 4 Weeks
☐ Rush - (Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION (Please indicate if samples are hazardous materials and/or suspected to contain high levels of hazardous substances)
☐ Nonhazard ☐ Flammable ☐ Skin Irritant ☐ Highly Toxic ☒ Low-Level Radionuclides ☐ Other

SAMPLE DISPOSAL (Please indicate disposition of sample following analysis. Lab will have for packing, shipping and disposal)
☐ Return to Client ☒ Dispose by Lab

FOR LAB USE ONLY
Received By
Date/Time

DISTRIBUTION OF COPIES	
White	Original to Accompany Samples
Yellow	Field Copy

FMPC Form 3226 (11/13/90)

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 8 OF 9
		REV NO. 1
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

ATTACHMENT C
PAGE 1 OF 2

ANALYSIS REQUEST/CHAIN-OF-CUSTODY

EXAMPLE - BLANK (FRONT)

WESTINGHOUSE MATERIALS COMPANY OF OHIO

P.O. BOX 39704, CINCINNATI, OHIO 45239-0704

Control #: _____ ANALYSIS REQUEST / CUSTODY RECORD Pg _ of _

PROJECT:	CLIENT:	TECHNICIAN/EXT.:
PROJECT #:	CLIENT CONTACT:	CHARGE #: -
PE/PM:	PHONE:	LOT MARK CODE:

SAMPLE IDENTIFICATION							ANALYSIS REQUESTED (USE NUMBERS FOR PARAMETERS)					
SAMPLE NUMBER	CUSTOMER NUMBER	DESCRIPTION	MATRIX	DATE/TIME COLLECTED	CONTAINER/ PRESERVATIVE	# CONT/ VOLUME	TABLE 1	2	3	4	5	6

Copy to:

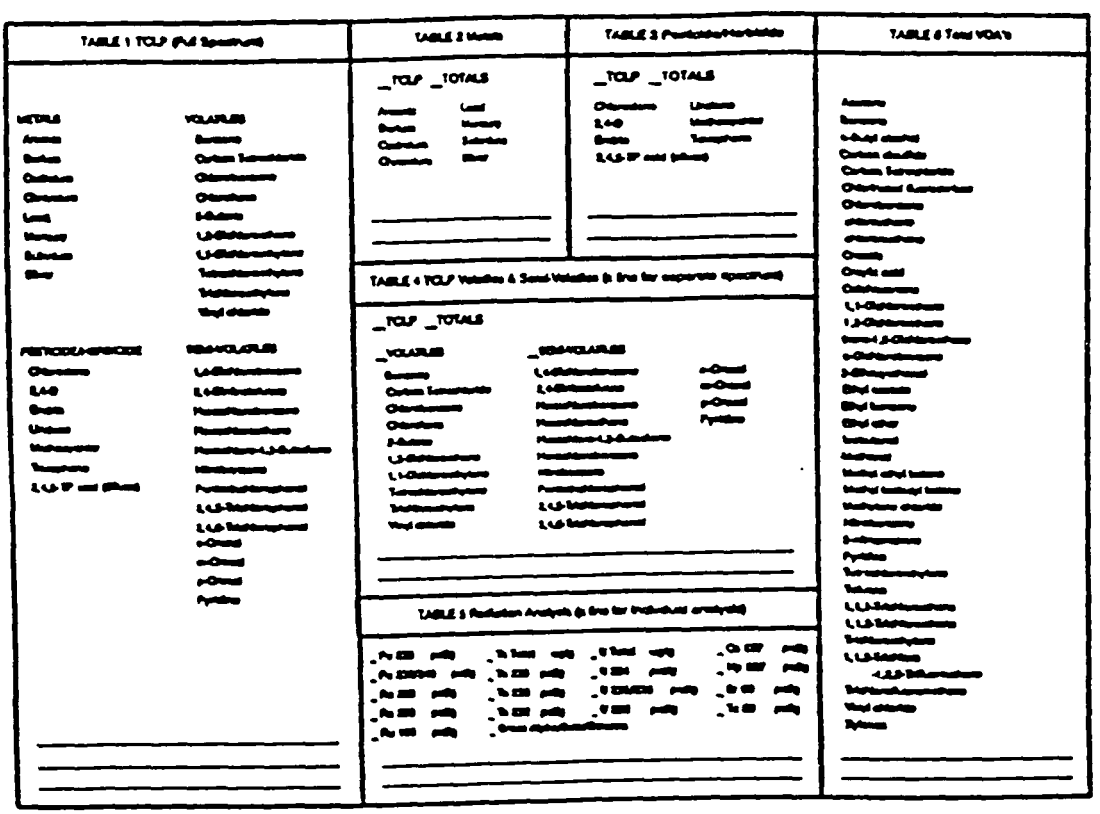
ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME	ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME

Westinghouse Materials Company of Ohio	ENVIRONMENTAL MONITORING SECTION PROCEDURES	PAGE 9 OF 9
		REV NO. 1
TITLE: CHAIN OF CUSTODY AND REQUEST FOR ANALYSIS	PROC. NO. EM-AD-008	DATE: 5-6-91

ATTACHMENT C
PAGE 2 OF 2

ANALYSIS REQUEST/CHAIN-OF-CUSTODY (cont'd.)

EXAMPLE - BLANK (REAR)



APPENDIX D

FERNALD LABORATORY ANALYTICAL METHODS FROM THE SITEWIDE CERCLA QUALITY ASSURANCE PROJECT PLAN

Uranium in Water, Soil/Sediment, and Air Filters by Pulsed-Laser Phosphorimetry

Working Linear Range:	Greater than 50 ng/L, infinite with dilution
Reporting Limit:	50 ng/L Water; TBD for other matricies
Reporting Units:	Water, mg/L; Solids, mg/g; Air filters, mg/air filter
Matricies:	Water, soil/sediment, air filters

1.0 Scope and Application

1.1 The method covers the determination of uranium in water, soil/sediment, and air filters in the range of 50 ng/L or greater. Samples with uranium levels above the laser phosphorimeter dynamic range may be diluted to bring the concentration to a measurable level. The minimum detectable concentration is approximately 50 ng U/L of water. The nominal sensitivity that may be obtained by this exact method for the other media requires additional performance data.

1.2 The method applies to Analytical Support Levels C and D.

2.0 Method Summary

2.1 The method is based on the use of commercially available laser phosphorimeters to analyze uranium in the sample media.

2.2 The method is useful for the analysis of water either directly, following dilution, or following wet-ashing as required by the sample media.

3.0 Interferences

3.1 Possible interference modes in uranium assays with consist of four types:

3.1.1 Absorption (Inner Filter Effect): Absorption of ultraviolet excitation light (337 nm) is more severe than visible excitation because many prevalent compounds have pi-bonding and absorb strongly in that region. Ferric iron and oxy-anions such as nitrate and organic acids are examples. Visible excitation (425 nm) may be absorbed by yellow solutions; e.g., chromate. Interferences may cause reduced signals and low results.

3.1.2 Lumiphors: Many organic substances, such as humic acids and organic degradation products from incomplete ashing, emit luminescence of varying lifetimes after excitation. Such effects are handled according to the manufacturer's instructions.

3.1.3 Quenching: Shortened triplet-state lifetime and reduced phosphorescence intensities of the excited uranyl complex result when quenching occurs. Reliable results can not be obtained when quenching exceeds 80 to 90%. Reducing agents, such as alcohols, halides except fluoride, and metals with electronic energy levels overlapping those of uranyl ion, are strong quenching agents. Examples are silver, lead, iron (II), manganese (II), and thallium. Results from single time-gated instruments are particularly sensitive to even mild quenching agents such as Al (III), Mg (II), Ca (II), and Sr (II). See the manufacturer's literature for more specific information.

3.1.4 Competing Reactions: For the method to perform well, the uranyl ion must be protected from various intermolecular mechanisms that rapidly quench the uranyl luminescence. Complexation fulfills this need, and examples of effective agents are phosphoric acid, polyphosphates (Fluran), and Uraplex (Chemchek Instruments). The use of polyphosphates for uranium analysis is patented by Scintrex, Ltd.; they are very acid sensitive. Nitric acid as low as one molar concentration suppresses complexation of uranyl ion with phosphoric acid, which permits increased quenching effects. Uraplex is a stronger complexing agent and is effective in samples containing up to two molar nitric acid.

4.0 Safety Precautions

4.1 The analyst must practice standard laboratory safety procedures as outlined in the laboratory-specific hygiene plan as specified by OSHA regulation 29 CFR Part 1910.1450. Any hazardous waste generated during the procedure, or samples determined to be hazardous, will be disposed of in accordance with applicable federal, state, and local regulations.

4.2 Because hazardous chemicals are used during the method, procedures for handling low level radioactive materials, acids, and/or solvents must be practiced. Personal protective equipment must include goggles for eye protection, gloves for skin protection, and a lab coat or apron for clothing protection.

5.0 Sample Collection and Handling

Sample size, container, and preservative requirements are detailed in Section 6.7 and Appendix K of the FEMP QAPjP.

6.0 Apparatus

6.1 Laser phosphorimeter, meeting the following criteria:

6.1.1 Detection limit: The detectable level for uranium must be 50 ng/L or less.

6.1.2 Dynamic range: The phosphorimeter must handle an analytical range from 50 to 20,000 ng/L. Samples with higher concentrations may be diluted.

6.1.3 Instrumental precision: The precision of repetitive measurements must be within 15% R.S.D.

6.2 Beakers, pipettes, funnels, and volumetric flasks. Class A volumetric glassware is used for standard preparation unless otherwise specified. If samples containing less than 100 ng/L uranium are to be analyzed, digestion vessels (both Teflon and glassware) if used, should be leached in hot, dilute nitric acid to reduce sample contamination from leachable uranium. Liquid scintillation vials, for example, should be hot-acid leached for at least 3 days before use in digestions.

6.3 Ceramic or Vycor containers (casseroles).

6.4 Scissors: Reserved for cutting only air filters.

6.5 Teflon beakers and stirring rod.

6.6 Platinum dish: 125-mL.

6.7 Drying oven: Gravity convection type is recommended, having thermostatic controls to maintain desired temperature and able to reach at least 125°C and able to maintain temperatures within ± 5°C.

6.8 Ash-free filter paper: Whatman No. 42, or equivalent.

6.9 Muffle furnace: Able to reach at least 500°C and able to maintain temperatures within ± 15°C.

6.10 Analytical balance: Scale readability of ± 0.1 mg.

6.11 Sieves: 2-mm and 15 mesh.

6.12 Grinder or Ball mill: Sufficient to reduce sample to pass 15 mesh sieve.

6.13 Electric hot plate/magnetic stirrer: Apparatus should have built in stirrer and stepless temperature controls that can be changed as heating requirements demand.

7.0 Routine Preventive Maintenance

7.1 Perform routine preventive maintenance for the laser phosphorimeter according to the manufacturer's directions.

7.2 All instrument maintenance must be documented in the instrument-specific maintenance logbook, as specified in Section 13 of the Sitewide QAPjP.

7.3 Examine Class A glassware before each use for scratches and cracks, and replace as necessary.

8.0 Reagents

8.1 Chemicals must be reagent grade, meeting American Chemical Society (ACS) specifications. In all cases, acids or bases are added to water.

8.2 Water: All references to water, unless otherwise specified, assume the use of ASTM Type II water.

8.3 Nitric acid (HNO_3): Concentrated.

8.4 Nitric acid (HNO_3), 1 M: Dilute 60 mL of concentrated HNO_3 to 1 L with water.

8.5 Nitric acid (HNO_3), 3 M: Dilute 189.5 mL of concentrated HNO_3 to 1 L with water.

8.6 Hydrofluoric acid (HF): Concentrated (48% solution).

8.7 Uranium complexant: The source of phosphoric acid, if used, must be selected with care because it has varying levels of uranium impurity. Reagents supplied by

laser phosphorimeter manufacturers are recommended because of lower uranium background. Use of URAPLEX can produce better precision and lower detection limits because of the longer phosphorescence lifetimes of the uranyl complex as well as stronger complexes for resistance to quenching.

8.8 Uranium standard: From NIST, or NIST-traceable, or from another nationally recognized agency.

8.9 Hydrogen peroxide (H_2O_2), 30%: Reagent.

8.10 Perchloric acid ($HClO_4$), 12 M: Concentrated, reagent.

9.0 Calibration Procedures

Follow the manufacturer's instructions to calibrate the laser phosphorimeter.

10.0 Sample Preparation

10.1 Samples may be analyzed with any of three levels of pretreatment. The choice depends on desired detection limit, what is known about the sample source, and the content of quenchers and lumiphors. General guidelines below are followed by specific sample media preparation steps.

10.1.1 Direct: Clear water from municipal supplies or streams can usually be analyzed without dilution. Follow the instructions provided by the phosphorimeter manufacturer.

10.1.2 Dilution: If the desired lower level of determination permits a large dilution, this may be the only sample treatment necessary. Both quenching agents and lumiphors can be diluted to levels of negligible effect. Analyze the dilution according to the instructions provided by the phosphorimeter manufacturer.

10.1.3 Ashing: Most quenching agents are either volatilized or oxidized, and luminescing substances can be decomposed.

10.2 Water: If sample cannot be analyzed directly or by dilution, wet ash the sample as follows.

10.2.1 Transfer desired aliquot of sample to a beaker and add at least 10% by volume of nitric acid. Record volume of sample used.

10.2.2 Record comment if presence of any undissolved material is noted.

10.2.3 Carefully evaporate the sample solution to dryness. **Caution:** Rapid boiling will cause spattering and poor precision.

Note: Substantial organic material will require addition of a second oxidant, either hydrogen peroxide or perchloric acid. The nitric acid/oxidant may need to be replenished to complete the ashing.

10.2.4 Dissolve residue with dilute (e.g., 1 M) nitric acid and warm; transfer to volumetric flask and dilute to the desired final volume using dilute nitric acid. Record final volume.

10.3 Glass Fiber Filters

10.3.1 Remove filter from shipping envelope or bag and hold filter over a 125-mL platinum dish while cutting it into pieces about 1″ by 2″ with a cleaned pair of scissors. Transfer any material remaining inside bag to platinum dish.

10.3.2 Place dish with sample in muffle furnace. Ash sample for about 16 hours at 500°C ± 15°C.

10.3.3 Remove dish and allow to cool.

10.3.4 Completely dampen the sample with a minimum amount but no more than 10 mL of concentrated HNO_3.

10.3.5 Add 15 mL of concentrated HF in 5-mL portions. Evaporate on hot plate until moist residue remains. Remove dish and allow to cool.

10.3.6 Add 10 mL of concentrated HF and evaporate until residue is almost completely dry. Remove dish and allow to cool.

10.3.7 Add 10 mL of concentrated HNO_3 and evaporate until sample is lightly fuming and just moist. Remove dish and allow to cool.

10.3.8 Repeat above step (step 10.3.7).

10.3.9 Moisten residue on sides and bottom of dish with 3 M HNO_3. Scrape residue from sides and bottom of dish, and break it up with a Teflon rod. Wash down sides of dish and Teflon rod thoroughly using 3 M HNO_3.

10.3.10 Return dish to hot plate and evaporate until about 5 mL of solution remains. Remove dish and allow to cool.

10.3.11 Filter sample using a funnel and Whatman No. 42 filter paper into 50-mL volumetric flask.

10.3.12 Wash out dish using three small portions (less than 5 mL each) of 3 M HNO_3.

10.3.13 Wash down filter and residue with three small portions (less than 5 mL each) of 3 M HNO_3.

10.3.14 Make up contents of volumetric flask to 50 mL with 3 M HNO_3, stopper, and mix thoroughly.

10.3.15 Continue with Sample Analysis, Section 11.0.

10.4 Soil/Sediment

10.4.1 Dry sample at 100°C ± 5°C for about 12 hours. Pass sample (typically 100 g) through 2-mm sieve to remove roots, stones, etc. Grind, mill, or pulverize to reduce sample to pass 15 mesh screen. Blend unitl thoroughly mixed.

Note: Use FEMP procedure FM-CON-0190 to determine percent moisture (soils) or percent solids (sediment), if requested.

10.4.2 Weigh an appropriate amount of 15 mesh soil/sediment sample to meet the required sensitivity and transfer to casserole. Record exact (dry) weight used.

10.4.3 Heat casserole containing sample in muffle furnace. Increase temperature at 1-hour intervals to 300°, 400°, and 550°C. Muffle for 2 or 3 hours at 550°C ± 15°C or until only a brown powdery ash remains. Remove and cool.

10.4.4 Transfer sample to 250-mL Teflon beaker, rinsing casserole with 10-mL portions of 16 M HNO_3, to a final volume of 60 mL of nitric acid.

10.4.5 Carefully add 30 mL of 48% HF, cover with Teflon watch glass, and heat on hot plate with frequent stirring for about 1 hour. Remove from hot plate and cool. (**Caution:** Hydrofluoric acid is extremely hazardous. Wear rubber gloves, safety glasses or goggles and a laboratory coat. Clean up all spills and wash thoroughly after using HF. Perform operations in a hood and avoid breathing any HF fumes.)

10.4.6 Carefully add 30 mL each of 16 M HNO_3 and 48% HF, and digest on a hot plate with some stirring for an additional hour.

10.4.7 Remove from hot plate and cool to room temperature. Slowly add 20 mL of 16 M HNO_3, and heat on hot plate with some stirring until solution has evaporated to liquid volume of approximately 10 mL.

10.4.8 Add 50 mL of water, and digest on hot plate with stirring for 10 minutes to dissolve soluble salts.

10.4.9 Cool and filter sample using Whatman No. 42 filter paper into 100-mL volumetric flask with minimum of 3 M HNO_3. Wash residue with 3 M HNO_3.

10.4.10 If any residue remains, repeat steps 10.4.3 through 10.4.9, combining filtrates in the 100-mL volumetric flask.

10.4.11 Make volume up to 100 mL with 3 M HNO_3. Proceed to Sample Analysis Section 11.0. Sample may require additional dilution before analysis.

11.0 Sample Analysis

Analyze the solution according to the instructions provided by the laser phosphorimeter manufacturer.

12.0 Calculations

12.1 Refer to the laser phosphorimeter manual for appropriate calculation, which varies depending on the instrument model and brand.

12.2 Final results are automatically calculated by computerized instruments. Sample volume for air filter is fraction of total.

13.0 Data Package Deliverables

Data package deliverables are determined by the Analytical Support Level and are outlined in the FEMP QAPjP or specified in the project specific Sampling and Analysis Plan or the analytical laboratory services contract.

14.0 Quality Control Requirements

Quality control requirements are determined by the Analytical Support Level and the project specific QAPjP. A specific discussion of each type of QC sample is presented in the QAPjP.

Analytical Support Levels C and D

Requirement	Frequency*	Acceptance Range	Corrective Action
Reagent Blank-	1/20	To be determined	Qualify data
LCS	1/20	To be determined	Qualify data
Duplicate-	1/20	To be determined	Qualify data

* or per batch or fraction thereof
\- per matrix

15.0 References

Standard Test Method for Trace Uranium in Water by Pulsed-Laser Phosphorimetry, (Draft) ASTM Standard D19.04.005R0. 1992.

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Gross Alpha and Gross Beta Radioactivity in Water and Gross Beta Radioactivity in Air Filters by Proportional Counting

Working Linear Range:	Infinite with dilution
Reporting Limit:	To be determined.
Reporting Units:	Water, pCi/L; Air filter, pCi/air filter
Matricies:	Water, air filters

1.0 Scope and Application

1.1 The method establishes a procedure for monitoring water for gross alpha and gross beta activity and air filters for gross beta activity. The method can measure alpha particles with energies above 3.9 million-electron-volts (MeV) and beta particles with maximum energies above 0.1 MeV.

1.2 The minimum detectable concentration for the method depends on sample size, counting system characteristics, background, and counting time. For water with extremely high solids content (>500 mg/L), EPA Method 900.1 is recommended.

1.3 This analytical method applies to Analytical Support Levels C and D.

2.0 Method Summary

2.1 An aliquot of a dissolved air filter or water sample is evaporated to a small volume and transferred quantitatively to a tared 2-inch stainless steel counting planchet. The sample residue is dried to constant weight and counted for alpha and/or beta radioactivity.

2.2 Counting efficiencies for both alpha and beta particle activities are selected from graphs (or best fit equations) of counting efficiency versus sample weight.

2.3 The radioactive constituents of the sample are not separated from the solids of the sample; therefore, the solids concentration is a limiting factor in the sensitivity of the method for any given (water) sample. For samples with very low radioactivity, it is essential to analyze as large a sample aliquot as possible to give reasonable counting times in meeting the required sensitivity (minimum detectable concentration).

2.4 The largest sample aliquot to be counted for gross alpha activity is the volume that gives a solids density thickness of 5 mg/cm^2 in the counting planchet. For a 2-inch-diameter counting planchet (20 cm^2), an aliquot containing 100 mg of solids is the maximum sample size to be evaporated and counted for gross alpha activity.

2.5 Sample density thickness on the planchet shall not be more than 5 mg/cm^2 for gross alpha and not more than 10 mg/cm^2 for gross beta.

2.6 The concentration of total dissolved solids is not as limiting for determining gross beta activity because beta particles are not stopped in solids as easily as alpha particles. Very often a single sample aliquot is evaporated and counted for both gross alpha and gross beta activity. In that case, the sample aliquot size would be dictated by the solids limitation for alpha particles. For beta counting only, the solids on the planchet shall be limited to 200 mg (for 2" planchet).

2.7 Radionuclides that are volatile under the sample preparation conditions of the method will not be measured. The sample is evaporated after nitric acid is added, and the nitrated solids that form will not remain at a constant weight after being dried and if exposed to high atmospheric humidity. Therefore, the samples need to be heated to a dull red glow for a few minutes to convert the nitrate salts to oxides. Sample weights are then usually stable enough to give consistent counting rates, and a correct counting efficiency can then be determined.

3.0 Interferences

3.1 Moisture absorbed by the sample solids on the counting planchet alters counting and self-absorption characteristics.

3.2 Nonuniformity of sample residue in the counting planchet interferes with the accuracy and precision of the method.

3.3 When counting alpha and beta particles by a gas flow proportional counting system, counting at the alpha plateau discriminates against beta particles, whereas, counting at the beta plateau is sensitive to alpha particle activity present in the sample. This latter effect should be determined and compensated for during the calibration of the specific instrument being used.

3.4 Inaccuracies in the analyses of samples are mainly due to beta emitters with energies different than the calibration standards or collected matter flaking off of air filters.

4.0 Safety Precautions

4.1 The analyst must practice standard laboratory safety procedures as outlined in the laboratory-specific hygiene plan as specified by OSHA Regulation 29 CFR Part 1910.1450. Any hazardous waste generated during the procedure, or samples determined to be hazardous, will be disposed of in accordance with applicable federal, state, and local regulations.

4.2 Because hazardous materials are used during the method, procedures for handling low level radioactive materials, acids and/or solvents must be practiced. Personal protective equipment must include goggles for eye protection, gloves for skin protection, and a lab coat or apron for clothing protection.

5.0 Sample Collection and Handling

Sample size, container, and preservative requirements are detailed in Section 6.7 and Appendix K of the FEMP QAPjP.

6.0 Apparatus

6.1 Beakers, pipettes, funnels, volumetric flasks. Class A volumetric glassware is used for standard preparation, unless otherwise specified. Unless otherwise noted, all glassware shall be nitric acid washed before use.

6.2 Stainless steel counting planchets: Planchets shall be fabricated from uniform density stainless steel and be capable of withstanding nitric acid and heat treatment. Planchets shall be ringed and have a raised wall to contain the sample being evaporated. Their size is dictated by the inside dimensions of the detector chamber. Planchets shall be nitric acid washed and flamed to a dull red glow prior to use.

6.3 Magnetic stirrer/electric hot plate: The apparatus should have a built-in stirrer and stepless temperature controls that can be changed as heating requirements demand.

6.4 Analytical balance: scale readability $\pm$ 0.1 mg.

6.5 Desiccator: Large enough to hold dried planchets until ready for counting.

6.6 Scissors, reserved for cutting only air filters.

6.7 Platinum dishes, 125 mL.

6.8 Muffle furnace, able to reach at least 500°C and able to maintain temperatures within ± 15°C.

6.9 Teflon stirring rods.

6.10 Ash free filter paper, Whatman No. 42, or equivalent.

6.11 Gas-flow proportional counting system: Tennelec low background (LB5100 Model II or III) gas-flow proportional counting system, or equivalent. The detector must be a "thin window" type, e.g., 100 $\mu g/cm^2$ or less. The detector must have a rigid sample positioning device that has accurate and reproducible geometry.

7.0 Routine Preventive Maintenance

7.1 Routine preventive maintenance for the instruments is performed according to the manufacturer's directions.

7.2 All instrument maintenance will be documented in the instrument specific maintenance logbook as specified in Section 13 of the FEMP QAPjP.

7.3 Examine class A glassware before each use for scratches and cracks and replace as necessary.

8.0 Reagents

8.1 Chemicals are reagent grade, meeting American Chemical Society (ACS) specifications. All radionuclide standards must be corrected for decay. In all cases, acids or bases are added to water.

8.2 Water: All references to water, unless otherwise specified, assume the use of ASTM Type II water.

8.3 Nitric acid (HNO_3), 3 M: dilute 187.5 mL of 16 M HNO_3 to 1 L with water.

8.4 Nitric acid (HNO_3), 16 M: concentrated, reagent.

8.5 NIST, or NIST traceable, or another nationally recognized agency, standard sources or solutions of ^{239}Pu and $^{90}Sr/^{90}Y$ for detector efficiency calibrations.

8.6 Hydrofluoric acid (HF), 29 M: concentrated, reagent.

9.0 Calibration Procedure

9.1 The counting system is calibrated (e.g., plateau determination, operating voltages) according to the manufacturer's instructions at least annually and after every significant change to the detector system.

9.2 Plateau checks are made after every gas bottle change by counting a check source at the operating voltage. The results must be within the established limits, e.g., $\pm$ 3 sigma before commencing analyses.

9.3 Detectors are calibrated annually to obtain the ratio of count rate to disintegration rate, i.e., efficiency. Plutonium-239 is used for alpha activity calibration of the method. (^{239}Pu has a higher alpha particle energy (5.16 MeV) than those emitted by naturally occurring uranium and ^{226}Ra radionuclides but is close to the energy of the alpha particles emitted by naturally occurring ^{228}Th and ^{224}Ra.) It is, therefore, the prescribed radionuclide for gross alpha calibration. Standards are prepared in the standard geometry for the weight ranges to be encountered in analyses.

9.4 Strontium-90 in equilibrium with its daughter ^{90}Y is the prescribed radionuclide for gross beta efficiency calibrations. The beta efficiency calibration is also performed annually and after significant changes in the detector system.

9.5 For each counting instrument to be used, the analyst shall prepare separate alpha and beta particle self-absorption graphs showing water sample residue weight (mg) versus efficiency factor (cpm/dpm) using standard alpha and beta emitter solutions and water. Activity is added to varying size aliquots of water so that aliquot residue weight is varied between 0 to 100 mg for alpha and 0 to 200 mg for beta (for a 2-inch counting planchet). The self-absorption curve shall have at least 5 points evenly spaced over the range of weights. Alternatively, $Ca(NO_3)_2$ may be substituted for water solids to achieve sufficient residue weights on the planchets.

9.6 Varying size water aliquots with a constant amount of added ^{239}Pu or ^{90}Sr standard must be acidified with a few milliliters of 16 M HNO_3, then evaporated to a small volume in a beaker on a hot plate, transferred quantitatively in small portions to a flamed and tared counting planchet, evaporated to dryness, and then carefully flamed to a red glow. Cool and weigh, and record weight. Sample weight stability is essential to gross alpha and gross beta measurements to ensure the accuracy of the self-absorption counting efficiency factor to be used for samples. Weight-stable aliquot residues must then be alpha or beta counted to achieve less than or equal to 3% uncertainty at the 1 sigma level. A single set of reference standards prepared in this way can be used for each counting instrument for separate graph preparations and can be stored for reverification whenever needed.

9.7 When counting beta particles in the presence of alpha radioactivity by gas-flow proportional counting systems, alpha particles are also counted. Since alpha particles are more readily absorbed by the sample than beta particles, the alpha/beta count ratios vary with increasing sample thickness. Therefore, it is necessary to prepare an amplification factor curve by counting several ^{239}Pu standards that have varying density thickness of solids on the alpha plateau and then on the beta plateau, plotting the ratios of the two counts versus density thickness. The alpha amplification factor (E) from that curve is used to correct the alpha count on the beta plateau.

9.8 A background count of sufficient length to meet the required uncertainty and lower limit of detection is performed weekly. The results must be within the established limits, e.g., $\pm$ 3 sigma before commencing analyses.

9.9 Daily, or before use, a check source is counted to verify detector efficiency. The results must be within the established limits, e.g., $\pm$ 3 sigma before commencing analyses.

10.0 Sample Preparation

10.1 Water

10.1.1 Transfer to a beaker an appropriate volume of a water sample that will result in a solids content of 100 mg or less (for alpha only or alpha/beta determination) or 200 mg or less (for beta only). Record volume of sample transfered.

10.1.2 Evaporate aliquot to near dryness on a hot plate. Add 5 mL of 16 M HNO_3 to the sample residue and evaporate to near dryness. Repeat.

10.1.3 Add 10 mL 3 M HNO_3 to beaker and swirl to dissolve residue.

10.1.4 Quantitatively transfer aliquot concentrate in small portions (not more than a few mL at a time to avoid overflowing) to a new, washed, flamed, and tared planchet. Being careful to avoid spattering, evaporate each portion to near dryness. After adding the last portion, evaporate to dryness.

10.1.5 Carefully flame samples to a dull red glow for a few minutes to convert nitrate salts to oxides, cool in desiccator, and weigh. Record weight and divide net weight by the area of planchet to determine the density thickness. Store sample residue in desiccator until ready for counting.

10.1.6 Continue with Sample Analysis, Section 11.0.

10.2 Glass Fiber Filters

10.2.1 Remove the filter from the shipping envelope or bag and hold the filter over a 125-ml platinum dish while cutting it into pieces about 1" by 2" with a cleaned pair of scissors. Transfer any material remaining inside the bag to the platinum dish.

10.2.2 Place the dish with sample in a muffle furnace. Ash the sample for about 16 hours at 500°C ± 15°C.

10.2.3 Remove the dish and allow to cool.

10.2.4 Completely dampen the sample with a minimum amount but no more than 10 mL of concentrated HNO_3.

10.2.5 Add 15 mL of concentrated HF in 5 mL portions. Evaporate on a hot plate until a moist residue remains. Remove the dish and allow to cool. (**Caution:** Hydrofluoric acid is extremely hazardous. Wear rubber gloves, safety glasses or goggles and a laboratory coat. Clean up all spills and wash thoroughly after using HF. Perform operations in a hood and avoid breathing any HF fumes.)

10.2.6 Add 10 mL of concentrated HF and evaporate until the residue is almost completely dry. Remove the dish and allow to cool.

10.2.7 Add 10 mL of concentrated HNO_3 and evaporate until the sample is lightly fuming and just moist. Remove the dish and allow to cool.

10.2.8 Repeat above step (Step 10.2.7).

10.2.9 Moisten the residue on the sides and bottom of the dish with 3 M HNO_3. Scrape the residue from the sides and bottom of the dish and break it up with a Teflon rod. Wash down the sides of the dish and the Teflon rod thoroughly using 3 M HNO_3.

10.2.10 Return the dish to the hot plate and evaporate until about 5 mL of solution remains. Remove the dish and allow to cool.

10.2.11 Filter the sample using a funnel and Whatman No. 42 filter paper into a 50-mL volumetric flask.

10.2.12 Wash out the dish using 3 small portions (less than 5 mL each) of 3 M HNO_3.

10.2.13 Wash down the filter and residue with 3 small portions (less than 5 mL each) of 3 M HNO_3.

10.2.14 Make up the contents of the volumetric flask to 50 mL with 3 M HNO_3, stopper, and mix thoroughly.

10.2.15 Using a volumetric pipette transfer an appropriate volume of sample to a new, washed, flamed, and tared planchet and evaporate to dryness.

10.2.16 Carefully flame samples to a dull red glow for a few minutes to convert nitrate salts to oxides, cool in desiccator, weigh, and count. Record weight and divide net weight by the area of the planchet to determine the density thickness. Store sample residue in desiccator until ready for counting.

10.2.17 Continue with Sample Analysis, Section 11.0 (beta count only).

11.0 Sample Analysis

Count for alpha and beta activity. If sample is to be recounted for verification, store it in a desiccator.

Note: As long as counting chambers are capable of handling the same size planchet, alpha and beta activity can be determined at their respective operating voltages in the designated counting instruments. Samples may be counted for beta activity immediately after drying, but alpha counting should be delayed at least 72 hours to allow decay of short half-life radon progeny. If the gas-flow internal proportional counter does not discriminate for higher energy alpha pulses at the beta plateau, alpha activity must be subtracted from the beta plus alpha activity. This is particularly important for samples with high alpha activity.

12.0 Calculations

12.1 All radionuclide standards must be corrected for decay from time of standardization to time of sample count using the following equation:

$$A = A_o e^{-\lambda t}$$

where

A = activity at mid-point of counting interval, in dpm, or pCi as appropriate,

A_o = activity at time of standardization in same units as A,

λ = decay constant of radionuclide of interest ($\ln 2/T_{1/2}$), in same time units as t,

t = time elapsed from standardization to mid-point of counting interval.

12.2 Calculate alpha radioactivity in pCi/L using the equation:

$$\text{alpha} = \frac{R}{(2.22)\ (C)\ (V)}$$

Where:

R = net alpha count rate (gross alpha count rate minus background count rate) at alpha operating voltage

C = alpha efficiency factor from graph (or best fit equation) of efficiency versus weight of solids in planchet (cpm/dpm)

V = volume of sample aliquot (L)

2.22 = dpm per pCi

Note: pCi may be converted to Bq by using the following multiplicative factor: 3.667E-02 Bq/pCi. Final sample results shall be corrected for reagent blank contribution.

12.3 The beta activity of the sample can be determined by counting the sample at the beta operating voltage and using the following equation:

$$\text{beta} = \frac{B - (R)(E)}{(2.22)\ (D)\ (V)} \quad \text{pCi/L (or per air filter)}$$

Where:

B = net beta count rate (gross count rate minus background count rate at beta operating voltage)

D = beta efficiency factor from graph (or best fit equation) of efficiency versus weight of solids in planchet (cpm/dpm)

R = net alpha count rate (gross alpha count rate minus background count rate)

E = alpha amplification factor from the graph (or best fit equation) of the ratio of alpha counted at the beta voltage/alpha counted at the alpha voltage versus sample density thickness

V = volume of sample aliquot (L) (V for air filter is fraction of total filter)

2.22 = dpm per pCi

12.4 The total propagated uncertainty is determined using the same parameters as the activity concentration calculation. Specific equations are contained in the analytical service contact(s). The minimum detectable concentration (MDC) in pCi/L (or air filter) shall be calculated *a posteriori* as specified in the analytical laboratory service contract(s).

13.0 Data Package Deliverables

Data package deliverables are determined by the Analytical Support Level and are outlined in the FEMP QAPjP or specified in the project specific Sampling Analysis Plan, or the analytical laboratory services contract.

14.0 Quality Control Requirements

Quality control requirements are determined by the Analytical Support Level and the project specific QAPjP. A specific discussion of each type of QC sample is presented in the QAPjP.

Analytical Support Levels C and D

Requirement	Frequency	Acceptance Range	Corrective Action
Reagent Blank[−]	1/20[*]	To Be Determined	Qualify Data
LCS	1/20[*]	To Be Determined	Qualify Data
Duplicate[−]	1/20[*]	To Be Determined	Qualify Data

[*] or per batch or fraction thereof
[−] per matrix

15.0 References

15.1 *Prescribed Procedures for Measurement of Radioactivity on Drinking Water.* U.S. EPA Environmental Monitoring and Support Laboratory. Cincinnati, OH, EPA-600/4-80-032. 1980.

15.2 *Detector Calibration and Analysis of Radionuclides.* ASTM E181-82. 1982.

15.3 U.S. Environmental Protection Agency. Method 9310: Gross Alpha and Gross Beta. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.* SW-846, Office of Solid Waste, Washington DC. 1986.

15.4 *Radiochemical Analytical Procedures for Analysis of Environmental Samples.* U.S. EPA Environmental Monitoring and Support Laboratory. Las Vegas, NV, EMSL-LV-0539-17. 1979.