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SAMPLING PLAN FOR THE WASTE RESIDUES OF THE BARIUM CHLORIDE WASTE SALT TREATMENT FACILITY - FEED MATERIALS PRODUCTIONS CENTER

03/18/88

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LETTER

6221-4

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

March 18, 1988
DOE 655-88

Dr. Richard Shank
Director
Ohio Environmental Protection Agency
1800 WaterMark Drive
Columbus, Ohio 43266-1049

Dear Sir:

SAMPLING PLAN FOR THE WASTE RESIDUES OF THE BARIUM CHLORIDE WASTE SALT TREATMENT FACILITY - FEED MATERIALS PRODUCTION CENTER

Reference is made to my letter to you dated February 19, 1988; subject, "Closure Plan for the Barium Chloride Waste Salt Treatment Facility - Feed Materials Production Center".

As indicated in the referenced letter, we are providing you our sampling plan for waste residues stored in the tanks of this facility. Please note that the sampling plan also contains a precautionary provision for sampling the treatment facility sump.

A sampling plan for rinseates which will be generated during closure, will be submitted by May 12, 1988.

If you have questions on the information provided or require further information, please let me know.

Sincerely,

Ray Hansen

for James A. Reafsnyder
Site Manager

P-84:Reafsnyder

Enclosures

cc: G. Mitchell, OEPA, Dayton
S. Shane, OEPA, Dayton
W. Muno, USEPA-5
C. McCord, USEPA-5
M. Travaglini, SE-31, DOE-ORO
M. Wilson, SE-31, DOE-ORO
J. Powell, DOE-FMPC
W. A. Weinreich, WMCO
R. A. Kispert, WMCO
C. R. Conner, WMCO

6221

bcc: S. Cheng, LWA

SAMPLING PLAN FOR THE BARIUM CHLORIDE WASTE SALT TREATMENT UNIT WASTE RESIDUES

UNITED STATES DEPARTMENT OF ENERGY

FEED MATERIALS PRODUCTION CENTER

FERNALD, OHIO

MARCH 1988

Prepared by:

Advanced Sciences, Inc.
IT Corporation

for

THE WESTINGHOUSE MATERIALS COMPANY OF OHIO

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PREFACE

This sampling plan was prepared for the Feed Materials Production Center (FMPC), Fernald, Ohio, as part of the Barium Chloride Waste Salt Treatment Unit Sampling Project. This facility is operated by Westinghouse Materials Company of Ohio (WMCO) for the U.S. Department of Energy (DOE). This sampling effort is not part of the Remedial Investigation/Feasibility Study (RI/FS) currently being conducted at the FMPC. However, existing RI/FS facilities and procedures (sampling plan, quality assurance project plan) are utilized as applicable. The sampling effort is part of closure of the Barium Chloride Waste Salt Treatment Unit being performed by WMCO.

1.0 INTRODUCTION

This sampling plan covers the sampling and analytical methodology for evaluation of the waste residue contained in three (3) tanks and a sump at the Feed Materials Production Center Barium Chloride Waste Salt Treatment Unit (Figure 1). This treatment unit was used to convert barium chloride waste salt, a Resource Conservation and Recovery Act (RCRA) hazardous waste, to barium sulfate, a nonhazardous waste. Barium sulfate is nonsoluble and will pass the extraction procedure (EP) toxicity test for barium, indicating it is safe for land disposal. Operation of the unit was suspended when corrosion problems developed in the unit equipment. The unit is now undergoing closure under the guidelines of 40 Code of Federal Regulations (CFR) 265.110 through 265.120. The closure is being performed by the Westinghouse Materials Company of Ohio.

There are four tanks associated with the treatment unit (Figure 2). A summary of the pertinent tank data is provided in Table 1. Three of these tanks will be sampled as part of this sampling plan. The fourth tank is included in the following discussion only to allow a clear understanding of the treatment process. Tank D-1, a 1,069-gallon tank, was used as a salt dissolution tank. In this tank, barium chloride waste salt was combined with water and agitated until the salt dissolved completely. Tank F13A-164, a 2,142-gallon tank, was used as a precipitating tank for converting barium chloride to barium sulfate. Tank F13A-164 will not be sampled as part of this effort. However, a hazard determination will be conducted for any residue collected from this tank during RCRA closure. Tank D-15, a 720-gallon tank, was used as a holding tank for storing barium sulfate filtrate. Tank W-10, a 2,200-gallon tank, was used for stripping ammonia from the barium sulfate filtrate.

Tank D-1 contains approximately 900 gallons of what is assumed to be dissolved barium chloride waste salt material. Tank F13A-164 is empty and contains some scale at the bottom of the tank. Tank D-15 contains approximately a 1/2-inch thick layer of dried sludge. Tank W-10 contains approximately two inches of liquid, that is assumed to be mainly rainwater. Finally, the sump potentially contains residues of the approximately 450 gallons drained from Tank D-15.

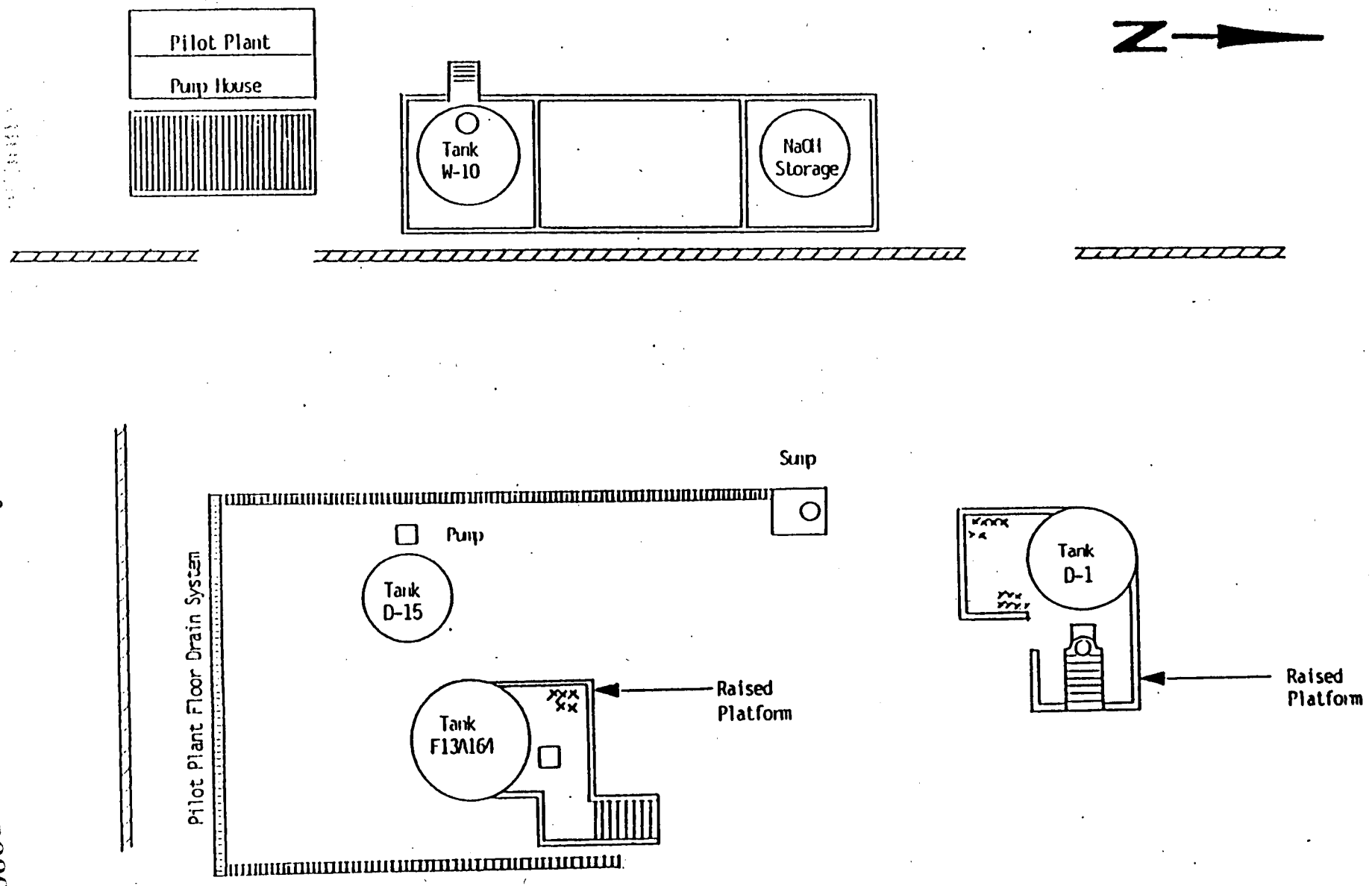

FIGURE 1

MAP OF THE BARIUM CHLORIDE WASTE SALT TREATMENT UNIT

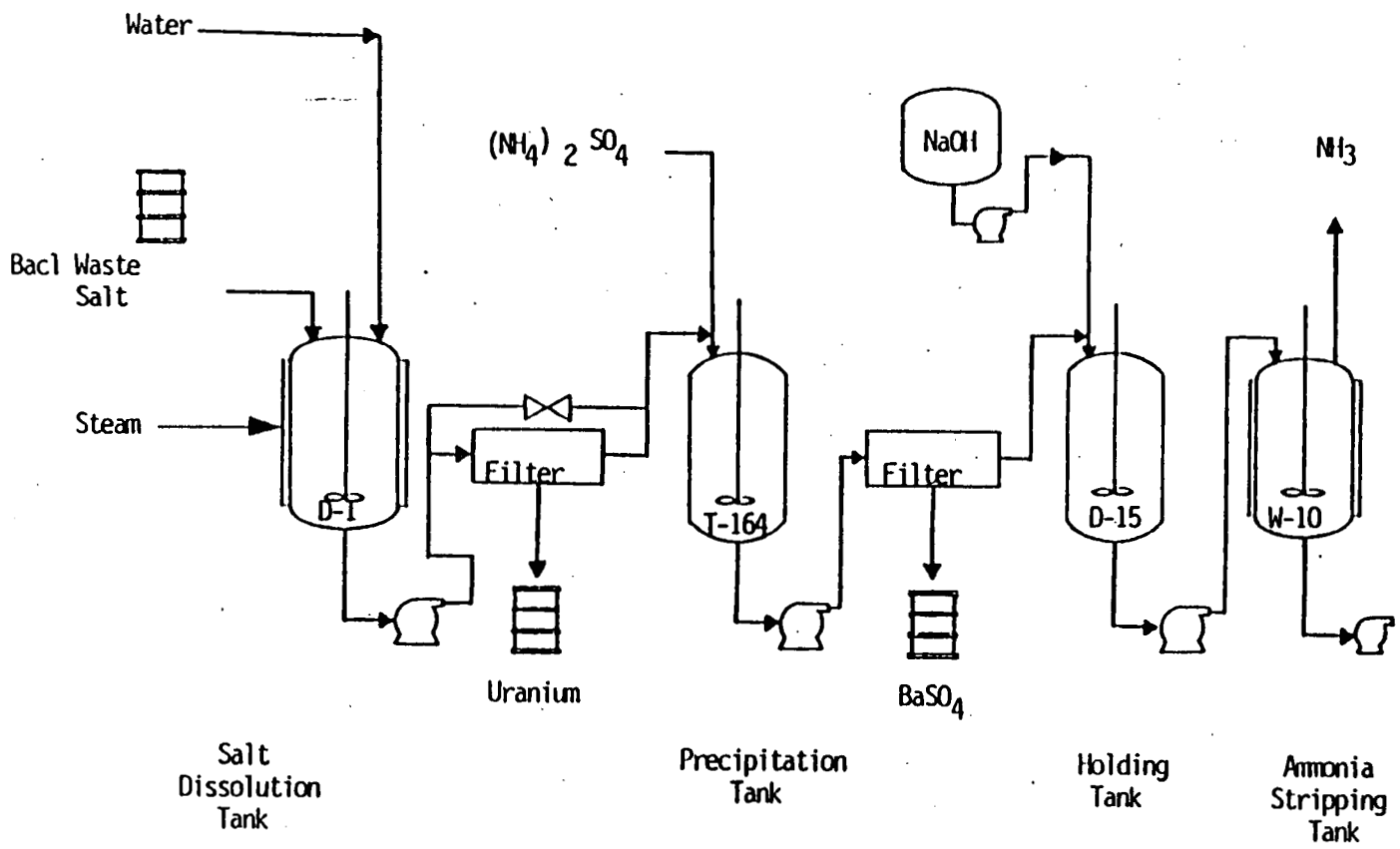

FIGURE 2

BARIUM STABILIZATION PROCESS FLOW DIAGRAM

TABLE 1

SUMMARY OF BARIUM CHLORIDE WASTE SALT TREATMENT UNIT TANKS

TANK	TANK CAPACITY (gal)	VOLUME of CONTENTS
D-1	1069	960 gal.
F13A-164[1]	2142	scale
D-15	720	dried sludge
W-10	2200	2 in. deep
Sump		undetermined

[1]Tank F13A-164 is not to be sampled as part of this sampling plan. RCRA determination of tank residue to be completed during closure.

2.0 OBJECTIVE

The objective of this sampling plan is to provide a plan for sampling and analysis of the waste residues contained in Tanks D-1, D-15, W-10 and the sump, for purposes of identifying whether the waste residues are hazardous or nonhazardous as defined by 40 CFR 261.

3.0 SAMPLING PLAN

The sampling plan includes the following information:

- Number of samples to be taken based on a statistical analysis and the U.S. EPA Test Methods for Evaluating Solid Wastes (U.S. EPA SW-846, Third Edition)
- Sampling procedures and equipment
- Chain-of-custody procedure
- Sample analysis requirements
- Statistical data evaluation procedure
- Health and safety program description
- Quality Assurance program summary

The intent of this evaluation of the FMPC Barium Chloride Waste Salt Treatment Unit is to determine whether the wastes remaining in the tanks and sump are to be classified as hazardous or nonhazardous using the EP toxicity procedure. The following sampling plan and statistical data evaluation procedure was developed to classify the wastes in Tanks D-1, D-15, W-10 and the sump with a specified degree of confidence in the classification.

In developing the sampling plan and data evaluation scheme that follows, it is assumed that after agitation, the wastes in Tanks D-1 and W-10 can be assumed to be homogeneous. The residue in Tank D-15 is not in liquid form. It does seem reasonable, however, to assume that the thin layer of precipitate residue is spatially homogeneous.

Agitation of the wastes in the sump is impractical due to equipment located in the sump that cannot be removed. In addition, limited access restricts available sampling locations. However, because of the nature of the barium chloride treatment process, and the fact that the wastes were recently drained from Tank D-15, it is expected that the wastes are homogeneous and the samples can be assumed to be representative of the entire sump.

3.1 STATISTICAL EVALUATION

The following subsections present statistical procedures to determine whether a waste is hazardous or nonhazardous with a specified degree of confidence, and to determine the quantity of samples required to support this confidence level. These procedures are those described in U.S. EPA SW-846.

3.1.1 Waste Classification

According to the EP toxicity procedure, if an extract of the sample (or the filtrate if the sample contains less than 0.5% filterable solids) contains any of the contaminants listed in 40 CFR 261.24 at levels equal to or greater than the regulatory threshold, then the waste is EP toxic and is a hazardous waste as defined by 40 CFR 261.3. A list of the EP toxicity thresholds for metals is provided in Table 2.

In addition to these criteria, according to 40 CFR 261.4(b)(6), wastes that fail the EP toxicity test only for chromium may be excluded as hazardous wastes if:

- The chromium in the waste is exclusively (or nearly exclusively) trivalent chromium; and
- The waste is generated from an industrial process that uses trivalent chromium exclusively (or nearly exclusively) and the process does not generate hexavalent chromium; and
- The waste is typically and frequently managed in non-oxidizing environments.

In any sampling effort, some indication of the degree of sampling precision and accuracy is required. Based on EPA Test Methods for Evaluating Solid Wastes (SW-846), it is recommended that a confidence interval (CI) of 95% be used for evaluating whether a waste is hazardous. For a given contaminant, the upper limit of the 95% confidence interval is compared to the regulatory threshold (RT) to determine the regulatory classification of the waste. If the upper limit of the 95% CI exceeds the regulatory threshold, the waste is classified as a hazardous waste. It is important to note that even if the upper limit of the 95% CI is only slightly less than the regulatory threshold, there is only a 2.5% (not 5%) chance of incorrectly classifying the waste as nonhazardous. This is due to the two-tailed characteristic of the CI curve. A 2.5% error is possible at the lower and upper limit of the CI curve for a total 5% possible error. Only the upper limit of the CI curve is near the regulatory threshold and so there is only a 2.5% chance of incorrect classification.

TABLE 2

REGULATORY THRESHOLD OF CONTAMINANTS
FOR CHARACTERIZATION OF EP TOXICITY[1]

CONTAMINANT	MAXIMUM CONCENTRATION (mg/l)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0

[1]From 40 CFR 261.24.

The confidence interval (CI) is calculated as follows:

$$CI = x \pm t_{.05}\, s_x$$

where:

CI = confidence interval,

x = mean concentration,

$t_{.05}$ = Student's 't' value for 95% (two tailed) confidence interval

s_x = Standard error of the mean.

The standard error of the mean is computed as follows:

$$s_x = s/n$$

$$s = \sqrt{\frac{\sum x_i^2 - (\sum x_i)^2/n}{n-1}}$$

where:

s = Standard deviation of the sample,

x_i = individual concentration measurements,

n = number of samples.

Table 3 presents a list of students 't' values for 80% and 95% confidence intervals.

TABLE 3

STUDENT'S 't' VALUE
FOR STATISTICAL EVALUATION[1]

NUMBER OF SAMPLES (n)	't' VALUE (95% CI)
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262

[1]Two-tailed Student's 't' data.

3.1.2 Number of Samples

The appropriate number of samples (n) to be collected, is calculated as follows:

$$n = \frac{(t_{.05})^2 \; s^2}{(RT - x)^2}$$

where:

n = appropriate number of samples,

x = mean concentration,

$t_{.05}$ = Student's 't' value for 95 % (two-tailed) confidence interval,

RT = regulatory threshold,

s = standard deviation of the sample.

Use of this procedure requires a preliminary estimate of the mean (x) and the standard deviation (s). Since this preliminary data is unavailable, a determination has been made to collect a total of 36 samples; 4 from each tank and sump for laboratory analysis, 1 from each tank and sump for use by WMCO, and 4 additional from each tank and sump for subsequent confirmatory analysis. The selection of four samples is considered reasonable due to the nature of the materials in the tanks and sump. For example, if the results from a given tank indicate that all samples exceed the regulatory threshold, it can be conclusively established that the material is hazardous. Likewise, if the mean and confidence interval of all samples from a tank are less than the threshold, a non-hazardous designation can be considered reliable. Situations in the middle ground, where the mean concentration is less than the threshold value but the confidence interval is not, are less clear and will likely require the analysis of the additional four confirmatory samples to achieve better statistical confidence. Since the standard deviation will not be significantly reduced if more samples are analyzed over and above the proposed eight samples, it is not considered necessary to exceed this number of samples to satisfy the objectives of this task.

3.2 SAMPLING PROCEDURES

Sampling methods to be implemented for collection of samples from the mentioned tanks are those outlined in U.S. EPA SW-846.

Liquid wastes in the tanks may be stratified, necessitating the agitation of the wastes before collection in order to obtain representative samples. Mixing will be accomplished using an air

sparger. The tanks and sump will be sampled for liquid wastes using one of four devices:

- A containerized liquid waste sampler (COLIWASA),
- A bailer,
- A weighted bottle, or
- A pump.

A field inspection of the tanks will be made by the Task Manager prior to sampling to determine the appropriate sampling device. The COLIWASA consists of a plastic tube which is equipped with a stopper that can be opened and closed while submerged. The sample is collected by carefully lowering the COLIWASA into the tank. When the sampler reaches the tank bottom, the T-handle on the COLIWASA is closed to seal the sample collection tube. Because of the depth of the tanks (8 to 15 feet), specially constructed, long-handled COLIWASA's will be required.

An alternate procedure would use a bailer instead of a COLIWASA. The bailer consists of a length of plastic pipe, with a check valve in the base. The bailer is lowered into the tank using a retrieval line. Liquid enters the bailer through the bottom. As the bailer is lifted, the check valve closes, collecting the sample. The bailer is simpler to use and less expensive than the COLIWASA, and is the preferred sampling device for this situation.

A weighted bottle sampler consists of a weighted plastic bottle attached to a retrieval line. A clean bottle would be used for each sample, avoiding sampler decontamination problems between samples. Samples collected using a bailer, COLIWASA or weighted bottle will be withdrawn and transferred into a 500-ml wide-mouth plastic sample bottle.

One of the tanks, W-10, is reported to contain approximately two (2) inches of liquid. Use of the COLIWASA or bailer to sample this tank would require multiple lifts (approximately 10) to collect a 500 ml sample. Prior to sampling this tank, the liquid level will be determined using a dipstick. If the tank contains less than five (5) inches of liquid, the samples may be collected using a peristaltic or suction pump. Clean tubing (weighted at one end) would be lowered into the tank and the sample pumped directly into sample bottles.

Samples will be acidified to a pH less than 2 with nitric acid. Prior to acidification, a pH determination for each sample will be made using a portable pH meter. A custody seal will be placed over the lid of all samples. The samples will immediately be placed in a cooler and cooled to 4°C with blue ice.

The dried sludge in Tank D-15 will be sampled using a dipper. The dipper consists of a plastic beaker clamped to the end of an appropriate length handle. Approximately 100 g of sludge is required for the analyses. The samples will be transferred into a 200-ml wide mouth plastic bottle. No preservative is required.

3.3 CHAIN-OF-CUSTODY

A formal chain-of-custody procedure will be implemented for all samples collected. A sample is defined as being "in custody" when:

- It is in the physical possession of the designated responsible party,
- It is in the view of the designated responsible party,
- It is placed in a secure area by the designated responsible party, or
- It is in a secure area restricted to access by authorized personnel only.

The chain-of-custody documentation provides the ability to trace the possession and handling of the samples from time of collection through analysis and final disposition. Chain-of-custody is required for all regulatory sampling. A sample Chain-of-Custody Form is shown in Figure 3.

Each sample will be assigned a unique sample number. Samples will be identified using a three (3) character project identifier (BCT for Barium Chloride Tanks), a three (3) character tank identifier (D01, D15, W10, SMP), and a two (2) digit unique, consecutive number. For example, at Tank D1, the first sample collected would be BCT-D01-01. Each sample will be labeled using a sample label as shown in Figure 4.

A field log book will be maintained containing the following minimum information for each sample collected:

- Date and time of sample collection
- Initials of field technicians
- Sample location

FERNALD RI/FS

CHAIN-OF-CUSTODY RECORD

R/A Control No. _____

C/C Control No.

PROJECT NAME/NUMBER _____ LAB DESTINATION _____

SAMPLE TEAM MEMBERS _____ 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: (Name, Company, Date and Time)

1. Relinquished By: _____

   Received By: _____

2. Relinquished By: _____

   Received By: _____

3. Relinquished By: _____

   Received by: _____

4. Relinquished By: _____

   Received By: _____

WHITE - To accompany samples
YELLOW - Field copy

FIGURE 3

FERNALD RI/FS 23-8-85

Project Name _____ Project No. _____

Sample Location _____ Number _____

Boring/Well No. _____ Date _____

Collector's Name _____ Time _____

Sample Type: ____ Ground Water ____ Surface Water

____ Soil ____ Sludge/Waste

Parameters _____ Preservative _____

Bottle _____ of _____ ____ Filtered ____ Nonfiltered

FIGURE 4

- Sample number
- Sample preservatives
- Site specific observations
- pH of sample prior to acidification

The on-site RI/FS sample coordinator will serve as the sample custodian to receive the samples after collection, maintain the samples in a secured refrigerated environment, and ship the samples to the laboratory. Existing FMPC RI/FS sample packaging and shipping procedures shall be followed.

In order to assure proper handling, the following information will accompany each sample:

- Request for Analysis form
- Purchase order information
- Hazard identification
- Name and address of person to receive report.

A sample Request For Analysis Form is shown in Figure 5.

Unused sample portions and archived samples will be maintained by the laboratory in unrefrigerated storage until notified in writing to return the samples to the site for disposal.

The archived samples and unused sample portions will be returned to the FMPC Plant 1 Supervisor. If notification to return the samples is not received by January 1, 1992, the contracting officer will be notified of the need to extend this storage period and to renegotiate storage terms.

3.4 SAMPLE ANALYSIS

The tank samples will be analyzed for RCRA metals including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Table 4 lists the specific EPA test methods from SW-846 to be used for analyzing the samples, the detection limits of those methods, and the allowable sample holding times.

FERNALD RI/FS

REQUEST FOR ANALYSIS

R/A Control No.
C/C Control No. _____

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 _____ Rush _____ (Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Nonhazard _____ Flammable _____ Skin Irritant _____ Highly Toxic _____ Other _____ (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, and disposal.)

Return to Client _____ Disposal by Lab _____

FOR LAB USE ONLY

Received By _____ Date/Time _____

WHITE - Original, to accompany samples
YELLOW - Field copy

FIGURE 5

TABLE 4

TEST METHODS FOR ANALYZING

FOR EP TOXICITY METALS

PARAMETER/ ITEM	METHOD[1]	DETECTION LIMIT (ug/l)	HOLDING TIME
EP toxicity (for solid residue only)	1310	--	--
Acid digestion (for solid residue only)	3010	--	--
Arsenic	6010	200	6 mo.
Barium	6010	2	6 mo.
Cadmium	6010	2	6 mo.
Total chromium	6010	20	6 mo.
Hexavalent chromium	7196	200	24 hrs.
Lead	6010	50	6 mo.
Mercury	7470	0.2	28 days
Selenium	6010	200	6 mo.
Silver	6010	10	6 mo.

[1]Alternate test methods may be identified if interferences occur with the specified method.

The samples will be submitted to the IT Radiological Sciences Laboratory, at the following address:

IT Radiological Sciences Laboratory
ATTN: Jim Harvey
1550 Bear Creek Road
Oak Ridge, TN 37830

Sample analysis results are to be returned to:

Advanced Sciences, Incorporated
ATTN: L. Murphy
10845 S.R. 128
P.O. Box 475
Ross, Ohio 45061

3.5 DECONTAMINATION PROCEDURES

The sampling devices and air sparger, will be decontaminated before use and between samples. The sampling devices will be cleaned with a nonphosphate detergent and rinsed successively with tap water and deionized water. A single rinsate sample will be collected and archived from the final deionized water rinse to verify decontamination. If the weighted bottle sampler is used, a clean sample bottle will be used to collect each sample.

If tank W-10 is sampled by pumping, new tubing will be used for each sample and decontamination is not required.

3.6 WASTE MANAGEMENT

Waste materials generated by the sampling activities will be disposed according to the existing WMCO and RI/FS procedures. This waste may include, but is not limited to, plastic ground cloths, disposable protective clothing, retrieval lines, disposable toweling, and plastic tubing. Unless preliminary radiological information to be supplied by WMCO indicates the tanks to be sampled are not uncontaminated, all waste generated during sampling will be assumed contaminated, and will be disposed of in yellow radiological waste trash bags. WMCO plant personnel will be contacted for disposal of the trash bags.

Waste decontamination fluids will be containerized in 55-gallon drums and disposed according to existing RI/FS procedures.

3.7 SAMPLING EQUIPMENT

The following sampling equipment is required:

NAME		QUANTITY
Bailers		3
Weighted bottle samplers (optional)		1
COLIWASA (optional)		3
Portable pump (if required for Tank W-10)		1
Tygon tubing (if required for Tank W-10)		25 LF
500 ml polyethylene sample bottles (wide mouth)		27
Nitric acid w/dispenser		100 ml
Nonphosphate detergent	approx.	50 g
Deionized water		5 gal.
Sample bottles		27
Plastic ground cloths		3
Sample labels		27
Retrieval line		75 LF

3.8 REPORT OF FINDINGS

A report of findings, including the laboratory analysis data and the assessment of contaminant levels, will be prepared and submitted to WMCO. This report will include the following information:

- The total number of samples taken
- The location of each sample taken
- The date and time each sample was obtained
- The type of analysis performed on each sample
- The concentration of each metal in each sample

- The results of statistical analysis for data evaluation and identification of waste residues which must be handled as hazardous waste, or recommendations for further testing before a hazardous designation can be made.

3.9 HEALTH AND SAFETY

The sampling of the barium chloride tanks will be performed under the provisions of the RI/FS Health and Safety Plan of March 3, 1988 (Revision 3), including the Health and Safety Addendum. Based on information available at this time, the following protective equipment will be used for tank sampling:

- Cotton coveralls (WMCO issue)
- Safety boots (WMCO issue)
- Nitrile gloves
- Safety glasses.
- Boot Covers
- Saranex coveralls

Modifications to the protective equipment for sampling will depend on information supplied by WMCO and on-site evaluation and assessment of risk.

In addition, radioactivity levels to be supplied by WMCO will be used to determine if the samples can be analyzed at IT's Mixed Waste Laboratory. Additional screening may be required on the samples before shipment to the laboratory and at the laboratory to further categorize the samples according to the level of hazard.

3.10 QUALITY ASSURANCE AND QUALITY CONTROL

Quality Assurance (QA) and Quality Control (QC) procedures from the RI/FS shall be implemented during this sampling program. These procedures are defined in the "Quality Assurance Project Plan for the Remedial Investigation and Feasibility Study" (Revision 3, dated March 3, 1988).