Westinghouse Electric Company
Hematite Facility
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U.S.A.

January 31, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: SNM-33 (Docket 70-0036)
Letter from Amy M. Snyder, NRC Senior Project Manager to Henry A. Sepp, Westinghouse Site Manager; dated December 23, 2005

Attachment: WEC Hematite Environmental Monitoring Plan (PO-EM-001, Rev. 1)

Subject: Response to NRC Request for Additional Information (TAC No. L52641)

Westinghouse Electric Company LLC (WEC or Westinghouse) has received the NRC's request for additional information dated December 23, 2005. The purpose of this letter is to provide the Westinghouse responses to the NRC's questions and to transmit revision 1 of the Westinghouse Environmental Monitoring Plan (EMP). These responses to RAIs numbered 1 through 29 are intended to support the NRC's technical review of an amendment request allowing Westinghouse to dismantle and demolish buildings at the Hematite site. Responses for RAIs numbered 30 through 44 will be at a later date as described in the NRC's RAI letter. Comments or questions on this material should be addressed to Tracy Chance, RSO at 314-810-3329 or Hank Sepp, Decommissioning Director at 314-810-3368.

NRC RAIs regarding EMP Revision 0 and Westinghouse responses with references to EMP Revision 1 (attachment):

1. *Page1-1, 2nd paragraph: "The current environmental monitoring program is based on the program established when the facility was a fully operating commercial nuclear fuel fabrication facility." Clarify this statement. For building dismantlement and decommissioning activities, NRC expects the EMP to be based on decommissioning activities and appropriately modify the established program. Consider the following when responding to this question: the potential hazards of the materials released, considering both expected quantities and relative radiotoxicities; the extent to which the facility operations (decommissioning) are routine and unchanging; the need for supplementing and complementing effluent monitoring; the size and distribution of the exposed population; the cost-effectiveness of increments to the environmental monitoring program; and the availability of measurement techniques that will provide sufficiently sensitive comparisons with applicable standards and background measurements.*

Response
The EMP is a combination of the pre-existing program, which remains a condition of License SNM-33, and the requirements for monitoring the effects of decommissioning activities. Westinghouse has augmented the Environmental Monitoring Program that was in place when the Hematite facility was an operating Nuclear Fuel Cycle Facility to account for decommissioning activities, i.e., building demolition and soil remediation.

Westinghouse believes that appropriate consideration has been given to the list of recommendations in this RAI and has revised a major portion of the EMP for clarity, particularly paragraphs regarding the introduction, the purpose, and the radionuclides of concern.

The introduction has been changed to give a brief description of the Hematite site, an overview of the activities at the end of manufacturing operations, and a short synopsis of the EMP.

The purpose or objectives of the EMP has been clarified to state, the purpose of the EMP is 1) to provide the means for assessing the effects of Decontamination and Decommissioning (D&D) operations on public health and safety and on the environment; 2) demonstrate compliance with applicable standards; and 3) to evaluate the effectiveness of the operational controls so that effluent levels and public exposures are maintained as low as reasonably achievable (ALARA)."

The section "Regulatory Requirements" has been changed to "Radionuclides of Concern." This section describes the type and quantity of contamination expected, as determined by radiological surveys, during building demolition. Soil remediation radionuclides of concern are listed as determined from investigative studies and historical documentation.

Please refer to the EMP, Rev. 1, sections 1 and 4, for this RAI.

2. *Page 1-1, last sentence: Based on this sentence, It appears as if the scope of this monitoring plan only applies to soil remediation activities. Please clarify by describing other activities that are applicable.*

Response
This sentence has been rephrased in section 4. Please see the response to RAI #1.

3. *Page 1-2, 1st paragraph: Clarify the type of decontamination and decommissioning operations effects that are expected. Specifically, state what the potential radiological effects and potential non-radiological effects will be and why. For building dismantlement and demolition activities, estimate the expected nature and extent of residual contamination that is to be expected during this dismantlement and decommissioning activity and at the end of the activity.*

Response
Section 4 of the revised EMP explains that the only contaminant of concern for building dismantlement and demolition is Uranium Dioxide (UO_2). As described

in this section, WEC is expecting less than 5 kilograms UO_2 of surface contamination on approximately 285,000 square feet of surface area before fixatives are applied. After fixatives are applied, the expected quantity of loose surface contamination will be less than 250 grams UO_2, based on surfaces having less than 500 dpm/100cm^2 of Uranium contamination.

Using the COMPLY Code, the site passes the screening test using the first level of compliance based on the materials possessed.

Please refer to the EMP, Rev. 1, section 4.

4. *Page 1-2, 1st paragraph: State the purpose of Environmental Monitoring. Please clarify the objectives. Is the evaluation of the effectiveness of operational controls specific to effluent levels and as low as reasonably achievable (ALARA) the only objective? It appears that the Environmental Monitoring Program is being conducted for various reasons, namely - to verify and support compliance with applicable NRC requirements and other federal and state requirements, such as to: establish baselines (decommissioning) and to continue to characterize trends in the physical, chemical, and biological condition of effluent and environmental media; identify potential environmental problems during operations/decommissioning and evaluate the need for measures to mitigate the problem; detect, characterize, and report unplanned releases; or determine compliance with commitments made in licensing documents.*

Response
Please see the response to RAI #1.

5. *Page 3-4, last paragraph: Identify the type and location of Environmental Monitoring Program implementing procedures that exist and/or will be developed. For each major measurement parameter, does Westinghouse plan on documenting and approving the design of sampling methodology, equipment, and procedures? Clarify how Westinghouse's Hematite Site quality assurance/quality control program relates to environmental monitoring specifically in the areas of: inclusion of specific sampling procedures to be used, either by reference in the case of approved standard operating procedures or in entirety if the procedures are nonstandard; sampling design; field sampling operations; laboratory operations; custody records; calibration procedures; preventative maintenance of equipment used for collection and measurement of environmental data; and data evaluation.*

Response
EMP implementing procedures have been written, approved for use and are available for inspection. The procedures include, but are not limited to, Environmental Airborne Radiological Sampling, Surface Water Sampling, Groundwater Sampling, Soil Sampling, Sediment Sampling, Environmental Gamma Dose Monitoring, Vegetation Sampling, and Ambient Dust Monitoring These procedures, where applicable, include sampling techniques, QC blanks, QC replicates, sampling methods, limits, MDC levels and tracking and trending requirements. The Hematite Quality Assurance program requires custody records

and the use of laboratories approved for use after an extensive QA audit performed by Westinghouse QA representatives.

6. *Page 4-5: Identify the radionuclides of concern for the Hematite site and the reason for this conclusion. What is the basis for assuming that uranium is the only significant isotope? Identify whether or not transuranics isotopes may be present and how they will contribute to the total weighted release fraction. If transuranics are present, please provide the activity ratios of the transuranics to uranium.*

   In support of the Hematite Interference removal project, a report, "Analysis of the presence of the contaminants in the Enriched Uranium at the Westinghouse facility," showed that uranium, and progeny associated with separated Uranium, contributes 99.65% of the contamination inside the former process buildings.

   This paragraph has been revised for clarification using the above referenced sample data and the report has been listed as a reference.

7. *Page 4-5: Explain how the Hematite Environmental Monitoring Program will be used to demonstrate that the facility meets NRC dose limits to members of the public, particularly when all the effluent air point sources no longer exist and instead there are fugitive emissions from decommissioning operations. This question also applies to Page 8-34, Section 8.1.*

   Response
   WEC will demonstrate compliance through continued weekly review of the permanent environmental air samples and daily review of work control air samplers, which are described in sections 5.3 and 6.1 of the EMP.

8. *Page 4-6, Table 4-1: Airborne Effluent Limits. The 10 mrem/year air emission limit includes fugitive emissions. How does Westinghouse plan on demonstrating compliance with this limit when all the effluent air point sources no longer exist and instead there are fugitive emissions from decommissioning operations? Also, this RAI applies to page 5-9 and page 6-15.*

   Response
   WEC will be demonstrating compliance through the review of permanent and work control air samplers, which are described in sections 5.3 and 6.1 of the EMP. In addition, the EMP, and associated implementing procedures, contain administrative limits to ensure compliance with the 10CFR20.1101 ALARA limit.

9. *Page 4-6, Table 4.1: The effluent control limits for gross alpha are based on the 10 CFR Part 20 effluent concentrations of uranium and not based on the more conservative concentration of Thorium (Th)-232. What is the basis of the assumption that Th-232 may only exist in the burial pits? Please justify that only the burial pits contain Th-232. If not, provide the activity ratio of Th-232 to uranium.*

Response
Please see RAI #6 response. In addition, the 10 CFR Part 20 effluent concentration limit for thorium is 10% of the uranium limit. The EMP and associated procedures have limits and actions delineated to submit samples for isotopic analysis if the gross alpha concentration exceeds a control limit of 10% of the regulatory limit for uranium. In other words, should gross alpha analysis exceed the Th-232 effluent limit, isotopic analysis will be performed on the sample to determine the isotopes present and whether corrective actions are necessary.

Specific information on the soil concentrations of Th-232 and its ratio to U-238 is provided in table 4-4 of the Decommissioning Plan. A review of this data demonstrates that while Th-232 has been identified as a potential radionuclide of concern, the measured concentrations are consistent with natural background values.

10. *Page 5-7, Table 4-2: Clarify the unit of time for 25 mrem. Explain how compliance with other limits will ensure compliance with this limit.*

Response
This reference is from 40 CFR part 190, but is only applicable to fuel cycle operations. This limit has been deleted from the EMP due to the cessation of fuel cycle operations at the WEC Hematite site.

11. *Page 5-8: Clarify and identify which surface water runoff locations will be monitored during building demolition and other decommissioning activities.*

Response
This paragraph has been revised to remove the sentence "Collection of samples from these points will start by the quarter following the NPDES approval." The new sampling locations for outfalls #004, #005, and #006 will be sampled starting 1st quarter 2006. All surface water sampling locations and frequencies are listed in table 6-4 in the EMP revision 1.

12. *Page 5-9: Provide the basis that dust controlled at less than the average limit of 150 μ g/m3 level would lead to an airborne concentration of 1.5E-14 μ Ci/ml, which is 30% of the radiological effluent limit. Is the above conclusion based on the assumption of 100 pCi/g of the dust concentration? Please provide the uranium concentration profile of the dust and the basis for your assumption.*

Response
This section is guidance for future soil remediation operations and to show a method for compliance. Proper verification of radiological materials in dust would be necessary to use this method for compliance. In addition, section 4.12.2 of the Environmental Report submitted with the Decommissioning Plan provides a conservative dose assessment associated with soil remediation activities. This estimate is equally applicable to the building demolition activities as a conservative estimate. Due to the lower source terms and the application of fixatives to all contaminated building surfaces prior to building demolition

activities, the estimate in Section 4.12.2 is more conservative for building demolition activities. The Environmental Report estimate gives a dose rate of 0.15 mrem per month for the nearest resident. This conservative analysis was based on a dust concentration at the point of release of 3E-11 microCuries/ml or 2000 times higher than the more realistic assumptions given in section 5.3.2 of the Environmental Monitoring Plan, rev. 1. It is clear that the radiation exposure to the nearest resident will be a small fraction of the regulatory limit for exposure to the public even given the very conservative assumptions used without accounting for dust mitigation measures that will be taken.

As described in RAIs 7 and 8, WEC's primary compliance tool for dose received from airborne radioactivity will be the permanent and work control air samplers.

13. *Resolve the discrepancy between the July 22, 2005 RAI response and the Hematite EMP with regard to the number and physical placement of air samplers. For example, on Page 5-10, Table 5-1: The air particulate frequency is inconsistent with Environmental Report for Building Demolition that was submitted as part of the license amendment application.*

Response
Westinghouse does not feel that there is a discrepancy. The July 22, 2005 Building Demolition Work Plan RAI response discussed the use of six air samplers. The response did not go into more detail in which the six air samplers are a combination of samplers required by the Building Demolition Work Plan and the EMP. The EMP only mandates four permanent air samplers. The Building Demolition Work Plan, however, outlines the addition of two more ambient dust monitoring permanent stations. A procedure, in the Environmental Monitoring Program, has been written and approved for the collection and analysis of samples using the additional samplers. Even though the two additional samplers are primarily for ambient dust monitoring, the samples may also be used for radiological analysis.

14. *Page 5-10, Table 5-1: The radioactivity concentrations in soil, vegetation, and water are based on the gross alpha and gross beta. Specify the control limits or action levels for the concentrations of soil vegetation and water. For decommissioning activities, the control limits should be based on the allowable dose of 25 mrem per year to the general public. In order to determine the control limits, either modeling or isotopic analyses will be required. For activities covered under the Decommissioning Plan, the licensee is required to establish the control limits for the concentrations of soil vegetation and water based on the radioisotopes and their appropriate dose pathways.*

Response
The purpose of the EMP is to provide the means for assessing the effects of Decontamination and Decommissioning (D&D) operations, i.e. building demolition and soil remediation, on public health and safety and on the environment. The 25 mrem/year general public dose limit is for site release and is covered under the Decommissioning Plan. The EMP uses the 10 CFR 20 Appendix B table 2 limits for Uranium-234 which equate to 50 mrem/year from

water effluents and 50 mrem/year from air effluents. Surface water and air effluent control limits are currently set at 10% of the applicable limit, which would equate to a total control limit of 10 mrem/year.

15. *Page 6-11: Provide justification for placement of the Hematite site perimeter air samplers. An acceptable methodology would consider such factors as the site's prevailing wind direction, and the distance to local population centers.*

Response
The EMP references two sets of meteorological data that contradict each other. Due to the lack of on site data and the contradiction of the other data, section 5.3.1, EMP rev. 1, last sentence states, "Based on the directional variability, the sampling program has been designed to provide 360 degree coverage around the main plant areas." Four permanent samplers are set up at the site boundary. Two more perimeter samplers and additional temporary work control samplers will be used during building demolition and soil remediation. The location of these temporary work control samplers will change according to daily wind direction and operations. Significant changes in the wind direction during the day will also change the location of the temporary air samplers.

16. *Page 6-11 and page 6-12: Justify the applicability of regional meteorological data to the Hematite site with due consideration of local terrain effects, and then justify the correct placement of the perimeter air samplers.*

Response
Please see the response to RAI #15.

17. *Page 6-14: Clarify the purpose of using upwind and downwind air samplers in relationship to background.*

Response
The use of upwind and downwind samplers is different than background sampling. A background sampler would be placed away from the central tract. "Upwind and downwind" verbiage actually comes from the Building Demolition Work Plan and does not appear in the EMP. The "upwind" sampler may be used as a reference for the "downwind" samplers during building demolition.

18. *Page 6-12, last paragraph: Reference the source of the predominant wind direction. Explain why the words "should be" are used versus "will be."*

Response
This paragraph has been revised because the fourth air sampler has been established. Both sets of wind data in the EMP show that one of the more predominant wind directions is to the northwest.

19. *Page 6-14: Work control sampling. The licensee should establish the action level for the work control sampling to prevent the weekly effluent concentration exceeding the control limit.*

Response
The section describing work control sampling sets the action level equal to the site boundary limit due to possible radon interference and the abundance of non-working hours. This will ensure work activities are not arbitrarily inhibited and site boundary limits will not be breached.

20. *Page 6-15: Clarify when the stack samples will be collected. On page 6-15 it is stated that these samples will be collected daily; however this is inconsistent with the sampling frequency stated on page 6-30. Please resolve the discrepancy.*

Response
When the EMP was written, a typographical error stated daily. The collection frequency should have been stated as weekly. This section has been removed from EMP rev. 1 due to the completion of the equipment and ventilation removal project, IR-009, on 1/27/2006. Currently, zero stacks remain in operation at the facility and the building's interior walls and floor have been sprayed with a fixative.

21. *Pages 6-16, 6-17, 6-26, 6-27, and 8-33: Explain why Westinghouse is using the word "should" vs. "will be" (soil sampling, sediment, vegetation, monitoring wells, ALARA goals). Also, what does Westinghouse consider the "normal" concentration to be for each environmental sample matrix?*

Response
The "normal" concentration for a sample matrix would be the historical average. The wording has been changed to "will be" or equivalent. Please refer to the EMP, Rev. 1, sections 6.2, 6.3, 6.5, 6.6, and 7.0 for this RAI.

22. *Page 6-16, Table 6-2: The units of the historic soil sampling results are in pCi/g. Clarify this table in terms of the radionuclides of concern.*

Response
Historic soil samples were only analyzed for gross alpha and gross beta per SNM-33. Future soil samples, collected under the EMP, will be analyzed in the same manner unless special analyses are required due to adverse trends or if the need for additional information arises.

23. *Page 6-19: Identify which sampling points in Table 6-3 are used for dose compliance.*

Response
Surface water samples from locations WS-18, 19 and 20 are used for dose compliance. Table 6-3 has been revised to show that these sampling points are used for dose compliance.

24. *Page 6-32: Define the other "methods and formula" that "may also be used" or delete the sentence.*

Response
This sentence has been changed to state that one may use an equivalent formula.

25. *Page 6-32: Define, reference, or make a commitment that you will define the "constraint or limit" for each "analytical media" before it is analyzed in the laboratory.*

Response
Westinghouse has defined the limits for surface water and airborne samples in table 4-1 in section 4 of the EMP Rev. 1. An analytical medium that does not have regulatory limits, i.e. soil, sediment, vegetation, and groundwater, has a constraint based on its historical average.

26. *Page 8-33, Section 7: It is stated that "The data collected will be plotted to facilitate the assessment of trends and measure against the facility ALARA goals." Explain how your ALARA goal applies to building demolition activities.*

Response
For building demolition, Westinghouse will be using several industry accepted dust suppression techniques to minimize exposures to personnel, public and environment. The EMP and the implementing procedures have control limits typically set at 10% of the regulatory limit, where additional analyses and corrective actions occur.

27. *Page 6-21, Section 6.4.3: Weir Sampling. Please show in a separate figure, or sketch the relative locations of, the siphon tank, the small 30 V-notch weir feeding the siphon tank, the siphon tank and the site dam with its six (6) 120 V-notch weirs. The figure or sketch may start from an upstream point and end at a downstream point of the system. Also, please explain the function of the two 30-gallon composite collection drums and their relationships to the weirs and the siphon tank system. The water flow system information is not clear from the descriptions.*

Response
Westinghouse has included a diagram for the composite collection drums. The purpose of the drums is to collect a small fraction of the water in the siphon tank to make a composite sample over a one week period. Please refer to the EMP, Rev. 1, section 6.4.3, for this RAI.

28. *Page 6-23: The equation for the rate of water flow through the V-notch weir has a constant K. Please show the weir coefficients used and the calculations for obtaining the values of K=0.4369 and K=2.798 for the two weirs. The relationship Q Dam = (38.43) Q siphon is not clear. Please explain the purpose of this ratio in the flow system.*

Response
The equations and constants used to calculate flow over a weir are from ANSI guidance and from the "Handbook of Hydraulics" by King, Bradel, Lindell, and

Wei. Flow measurement, however, is required under the site's NPDES permit and is not directly applicable to radiological monitoring, therefore sections pertaining to flow measurement have been removed.

29. *Page 6-24: Please provide the method for arriving at the equation: Q = K (L - 0.2H) H1.5 (0.6463) and justify the use of K = 3.33. Also, please provide reference for K = 3.33. The constant in the beginning of the second line from the bottom of Page 6-24 should be 0.6463, not 0.06463. Please confirm this.*

Response
Please see the response to RAI # 28.

Sincerely,

Dwighty For T.D. CHANCE

Tracy D. Chance
RSO

Official Record Electronically Approved in EDMS 2000

cc: Mrs. Amy M. Snyder, NRC Headquarters
Regional Administrator, NRC Region III
Mr. Jamnes Cameron, NRC Region III
Mr. Henry A. Sepp, Westinghouse Electric Company
Mr. A. Joseph Nardi, Westinghouse Electric Company

Westinghouse

PO-EM-001

Hematite Former Fuel Cycle Facility Decommissioning

TITLE: **Environmental Monitoring Plan**

USERS: **All Hematite Decommissioning Staff**

REVISION: **1**

Owner : **Official Record Electronically Approved in EDMS 2000** Date: **See EDMS 2000**
Tracy D. Chance

Director: **Official Record Electronically Approved in EDMS 2000** Date: **See EDMS 2000**
Hank A. Sepp

Revision #	Change
0	Initial Issuance
1	***Global*** – All sections, except 2.0 and 3.0, have been revised for clarity and grammar. Sections have also been updated to coincide with current decommissioning activities. Tables and figures have been added and deleted as necessary. ***Section 1.0*** – Clarified introduction and purpose. ***Section 4.0*** – Clarified contaminants of concern. ***Table 4-2*** – Deleted 25mrem/year dose limit which is only applicable to functioning nuclear fuel cycle facilities. Defined time frame for 100 mrem dose limit. ***Section 5.2*** – Clarified sampling points. ***Section 6.1 Stack Air Sampling*** – Changed stack air sample collection and counting requirements to weekly to agree with SNM-33 requirements, clarified locations and reformatted section. ***Sections 6.2, 6.3, 6.5, 6.6.3, 7.0*** – Changed the word "should" to "will." ***Sections 6.2, 6.3, 6.4.2, 6.5, 6.6.3*** – Changed "normal concentration" to "historical average concentration." ***Table 5-1 & 6-3*** – Revised because WS-10, Plant Well, has been abandoned. ***Table 6-3*** – Identified sample locations used for 10CFR20 dose compliance. Noted that WS-10, Plant Well, has been abandoned. ***Section 6.4.3*** – Deleted NPDES flow measurement calculations. ***Section 6.5*** – Corrected number of samples historically collected to four. ***Section 6.8*** – Clarified that the MDA equation or equivalent shall be used. ***Section 8.1 Air Effluent Notifications*** – First paragraph corrected to coincide with SNM-33. ***Section 8.2 NPDES*** – Clarified that this section deals with the radiological portion of the NPDES permit. ***Section 8.3*** – Clarified section. ***Section 9.0 References*** – Added reference number 17. ***Appendix A*** – Deleted appendix, included wind rose data as reference 18.

Are quality records generated? YES or **NO** If yes, list below.

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Abbreviations/Acronyms

ALARA	as low as reasonably achievable
Am-241	americium-241
CAM	Continuous Air Monitor
CFM	cubic feet per minute
CFR	Code of Federal Regulations
cfs	cubic feet per second
cpm	counts per minute
DAC	derived air concentration
D&D	Decontamination and Decommissioning
EH&S	Environmental Health and Safety
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
gpm	gallons per minute
HP	health physics
kg/yr	kilogram per year
LPM	Liters per Minute
μCi/ml	microCuries per milliliter
MDA	minimum detectable activity
MDC	minimum detectable concentration
MDNR	Missouri Department of Natural Resources
mrem	millirem
mSv	milliSeivert
m/s	meter per second
Np-237	neptunium-237
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OSL	optically stimulated luminescence
OSHA	Occupational Health and Safety Administration
pCi/g	picoCuries per gram
Pu-239	Plutonium-239
RI/FS	Remedial Investigation/Feasibility Study
RSO	Radiation Safety Officer
SNM	special nuclear material
Tc-99	technetium-99
TEDE	total effective dose equivalent
Th-232	thorium-232
TRU	transuranic
TLD	thermo-luminescent dosimeter
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
UO_2	uranium dioxide
UF_6	uranium hexafluoride

1 Introduction/Purpose

INTRODUCTION

In 2001 the Hematite facility ended principle activities after approximately 35 years of operation and started the decommissioning process. The Hematite site comprises about 228 acres and is located in Jefferson County, Missouri, approximately 35 miles south of the City of St. Louis. Figure 1-1 illustrates an expanded section of the area within a 5-mile radius of the site and shows the location of small towns and settlements within this area. The plant is located on State Road P about 3/4 mile northeast of the unincorporated town of Hematite. During manufacturing operations, approximately 300,000 kilograms per year (kg/yr) of uranium hexafluoride (UF_6) was converted to uranium dioxide (UO_2) for subsequent manufacturing into finished nuclear fuel assemblies. Approximately 19 air effluent stacks discharged to the atmosphere from the facility. These stacks were filtered and continuously sampled for radioactivity when operating. Liquid effluents were discharged primarily through the sanitary sewer system and into the site creek. A storm water discharge system also drained to the site creek.

The facility continues to sample environmental media to monitor the effluents and dose resultant from the current decommissioning operations. The environmental monitoring program is based on the program established when the facility was a fully operating commercial nuclear fuel fabrication facility and augmented to account for decommissioning activities, i.e. building demolition and soil remediation.

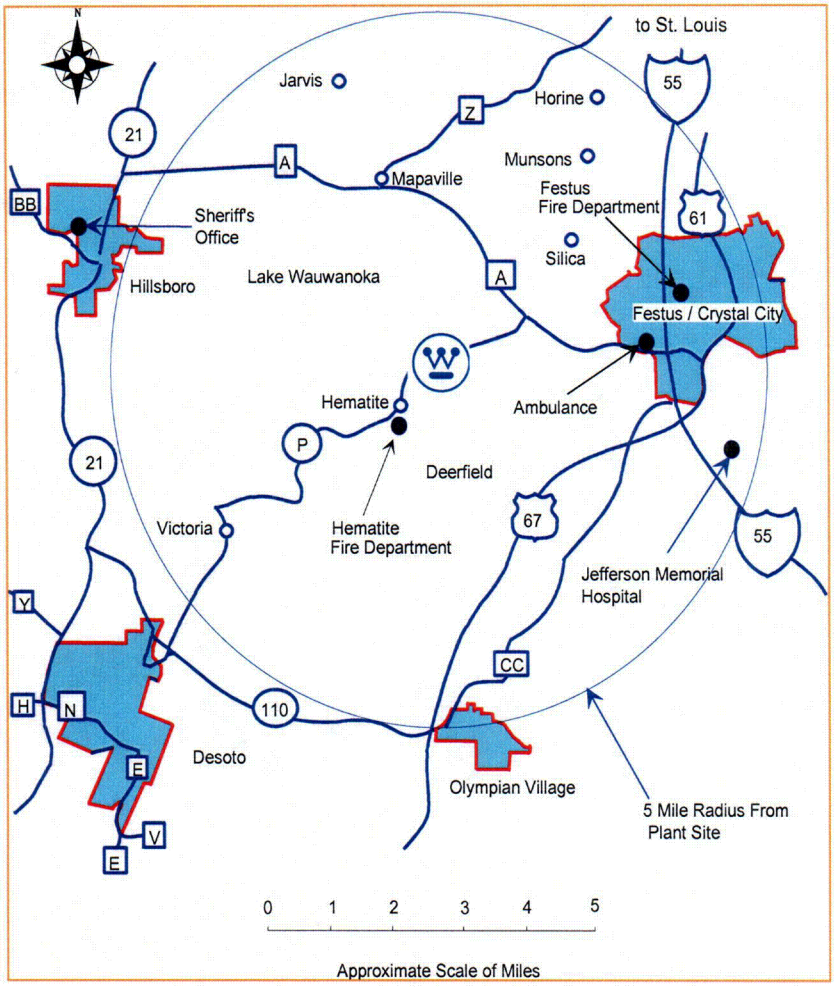
In addition to the ongoing monitoring program a number of investigative studies have been undertaken over the years to characterize the nature and extent of residual contamination on the site. Input from these studies was used for selecting some of the sample points. Based on these studies it can be concluded that the radiological impact due to historic operations is limited to the immediate operations area.

Since the cessation of operations, a significant decrease in radioactivity in facility effluents has been observed in the environmental samples. The sampling of flora and fauna was considered and determined to be of limited or no value to an effective program. The vegetation sampling described in this plan is included only because it is currently required by the SNM-33 license. Future sampling of flora and fauna would potentially be performed as part of a human health or ecological risk assessment and not a part of this routine monitoring program.

This plan meets the SNM-33 commitment that states "Location of air particulate, soil, vegetation, well water, surface water and liquid effluent sampling stations shall be established and documented." The license provides some flexibility in the selection of monitoring locations, which may be changed if a documented evaluation demonstrates that a new location provides data that are as representative (or more representative) of conditions likely to impact on the general public, as was the data from the original location.

This plan addresses the radiological monitoring regime and does not include the non radiological environmental data collected under the National Pollutant Discharge Elimination System (NPDES) permit.

Figure 1-1 Facility Location



PURPOSE

The purpose of the EMP is to provide the means for assessing the effects of Decontamination and Decommissioning (D&D) operations, i.e. building demolition and soil remediation, on public health and safety and on the environment. The basic objective of environmental monitoring is to evaluate the effectiveness of the operational controls so that effluent levels are maintained as low as reasonably achievable (ALARA) and within applicable standards. This EMP provides a basis for monitoring the long term environmental trends to achieve the EMP's basic objective. The plan also provides a basis for the compliance based, work control sampling associated with the remedial action tasks planned over the duration of the decommissioning. Work control samplers, whose locations may vary daily depending on wind direction, are the primary method for detecting unplanned releases, for detecting fugitive emissions, and for demonstrating compliance with applicable regulations, including dose compliance. The plan provides sample locations, required analyses, regulatory limits, administrative limits, minimum detection levels, tracking/trending requirements, and required notifications.

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2 Applicability

This EMP is applicable to the Westinghouse Electric Company Hematite Decommissioning Project.

3 Responsibilities

The Radiation Safety Officer (RSO) is responsible for technical oversight, administration and implementation of this program, including oversight of health physics (HP) technician activities relative to effective implementation of procedures in support of the program.

The RSO may delegate specific responsibilities for implementation of this program to qualified personnel; however, in such cases, the RSO shall retain responsibility for administration and ensuring proper implementation.

4 Radionuclides of Concern

The only radionuclide of concern for building demolition is uranium as determined by radiological isotopic analyses. Although some trace quantities of transuranics (TRU), such as Plutonium-239 (^{239}Pu), Americium-241 (^{241}Am) and Neptunium-137 (^{137}Np), etc., have been detected in the process buildings, they do not contribute significantly (collectively less than 3.1%) to the total weighted release fraction and are therefore not included in the routine monitoring program. (Ref. 17) In terms of dose, the TRU quantities in the former process building are less than 0.5% of the total dose contribution.

For building dismantlement and demolition, it is expected that the residual surface contamination on the approximate 285,000 ft^2 of building surfaces, i.e. floors, walls and ceilings, will be less than 5 kilograms of UO_2. Building surfaces will be coated with a fixative to minimize fugitive airborne emissions during demolition. Additional sampling points for air, water, soil and sediment have been established in this plan.

During remediation activities for soil and burial pits, low enriched uranium, high enriched uranium, and technetium will be and thorium may be encountered based on historical documentation and results from previous investigative studies. Additional isotopes may be encountered in the soils as more investigative studies, decommissioning operations and surveys are conducted.

If effluents exceed 10% of the effluent limits shown in Table 4-1 for greater then one month, then consideration will be given to compositing the samples and analyzing for specific radioisotopes.

Table 4-1 Air and Liquid Effluent Regulatory and Control Limits

	Effluent Limits	Commitment Source	Notes
Airborne Effluent Limits	**150** μCi per quarter from stacks	SNM-33	Limit imposed by the NRC in the 1980s for compliance with 40CFR190
	5E-14 μCi/ml gross α stacks (conservatively assumes that activity is due to ^{234}U and class Y ^{99}**Tc 9E-10**μCi /ml ^{232}**Th 4E-15**μCi /ml	SNM-33, 10 CFR20 appendix B, Table 2	Control limit averaged over 2 weeks at the accessible unrestricted area. Analyzing for gross beta activity ensures that the ^{99}Tc concentration is met
	10 mrem (0.01mSv) dose from air emission such that the individual member of the public likely to receive the highest dose will not be expected to receive a TEDE in excess of 10 mrem (0.1 mSv) per year from these emissions.	10CFR 20.1101(d) To implement the ALARA requirements of 10 CFR 20.1101 (b)	NRC's implementation of radionuclide NESHAPS constraint on air emissions of radioactive material to the environment
Liquid Effluents	The control limits for alpha and beta activity in liquid effluents: **Alpha - 3.0 x 10^{-7}** μCi/ml average **Beta - 5.0 x 10^{-6}** μCi/ml average	SNM-33	These control limits for alpha and beta apply at the site boundary and are average values for the year. Transients exceeding these values do not imply that the limit has been exceeded
	3.0 x 10^{-7} μCi/ml uranium-234 **6.0 x 10^{-5}** μCi/ml technetium-99 **3.0 x 10^{-8}**μCi/ml thorium-232	10 CFR 20 Appendix B table 2	Since the limit for ^{99}Tc is 200 times greater then Uranium no additional analysis is proposed for ^{99}Tc. Complying with the beta constraint for uranium ensure that the ^{99}Tc constraint is met.

Table 4-2 Dose and Dose Rate Limits for Members of the Public

Dose Limits	Commitment Source	Notes
100 mrem/yr (1mSv/yr)	10 CFR 20.1301	Member of the public total effective dose equivalent (TEDE)
2 mrem/h (0.02 mSv/h)	10 CFR 20.1301	Dose rate in unrestricted area

5 Environmental Pathways

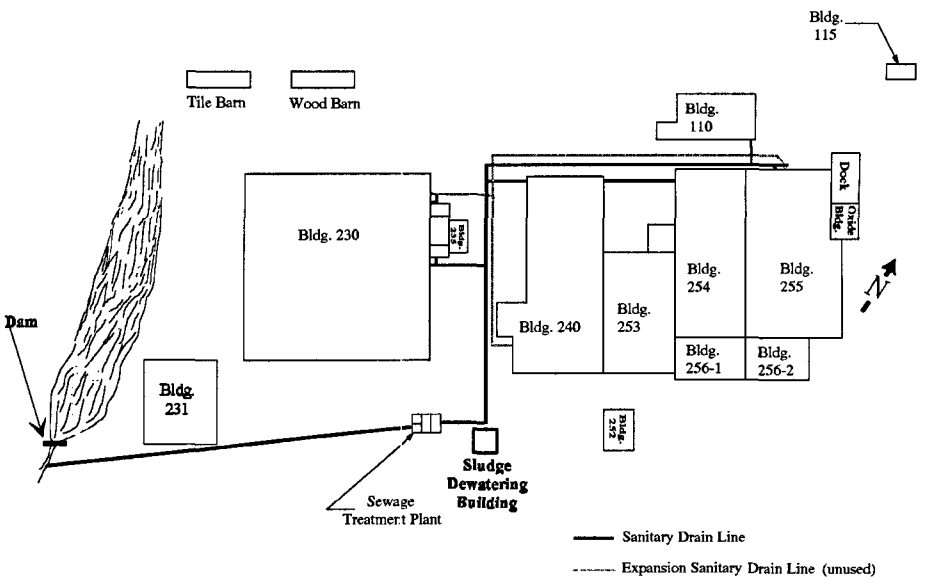
The primary pathways available to potential transfer radioactive material from the facility are discussed below. Table 5-1, at the end of the section, provides an overview of sample types and frequencies.

5.1 Sanitary Waste

Sanitary waste waters flow to the site sanitary system from sinks, toilets, showers and drinking fountains. This system used to receive laundry water (after the water was filtered and held for sampling) and waste water from the process water demineralizer system and laboratory sinks.

The routing of the sanitary system drains is shown in Figure 5-1. The system includes an extended aeration sewage treatment plant in which sanitary sewer effluents are discharged to a chlorine contact tank where they are treated (only from April 1 to October 31) with dry chlorine tablets and finally treated with sodium sulfite for dechlorination before discharge into the site creek immediately below the site pond dam. Design capacity of the treatment plant is 8,000 gallons per day. The effluent is sampled and analyzed weekly for gross alpha and beta activity by taking a grab sample. Discharge from the treatment plant is authorized under a NPDES Permit to discharge issued by the Missouri Department of Natural Resources (MDNR). During the decommissioning the use of the sanitary sewer will diminish as the site population decreases.

Figure 5-1 Sanitary Discharge System Outfall #001



5.2 Storm Water

Rain and storm water have the potential to transport surface contamination from decommissioning areas to the intermittent streams and site creek through several pathways.

5.2.1 Climatology and Meteorology

General climatological characteristics of the site area can be approximated by those of St. Louis, about 35 miles NNE of the site and the location of the nearest U. S. Weather Bureau recording station. Both are located near the Mississippi River and the geographical center of the United States. The region experiences a modified continental climate without prolonged periods of extreme cold or extreme heat. To the south is the warm, moist air of the Gulf of Mexico, and to the north, Canada, is a source of cold air masses. The alternate invasion of the region by air masses from these sources produces a variety of weather conditions, none of which is likely to persist for any length of time.

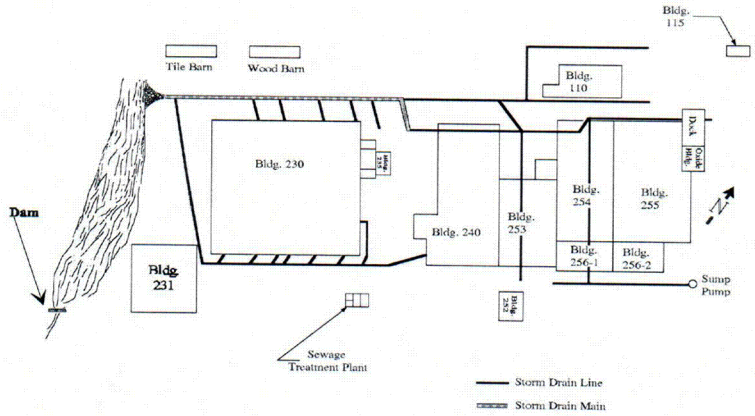
The following information is based on the 30 year normals from St. Louis, Missouri obtained from the Department of Commerce. Winters are brisk but seldom severe. Snowfall has averaged 19.5 inches per year. The average number of days per year with a minimum temperature $\leq 32°$ F is 98. The average number of days per year with a minimum temperature $\leq 0°$ F is 4. The average number of days per year with a maximum temperature $\geq 90°$ F is 41. The average annual precipitation (water equivalent) for the St. Louis area is 38 inches. The average number of thunderstorms per year is 47. During any year there are usually a few of these that can be classified as severe storms with hail and damaging winds.

5.2.2 Pathways

Water from building roof areas and ground surface drains flows to the site pond above the dam via the storm water system. During facility operation this system also received condensed steam from the UF_6 vaporizer steam jackets, and cooling water from heat exchangers. The routing of the storm drain is shown in Figure 5-2. Discharges are authorized under a NPDES permit issued by the MDNR. The overflow at the site dam is continuously proportionately sampled and then collected weekly to be analyzed for gross alpha and beta activity.

Surface water as the result of rain that does not discharge to the storm water system may flow toward the Joachim creek via several tributaries. To address these potential release points, three additional surface water pathways have been added. These storm water outfalls are sampled for gross alpha/beta activity as well as some non radiological parameters quarterly. These outfalls designated as #004, #005 and #006 in the NPDES permit and are shown in Figure 6-1 and Figure 6-5. Consistent with the site nomenclature for water samples these sample points have been designated WS50, WS51 and WS52 respectively.

Figure 5-2 Storm Water Drainage System

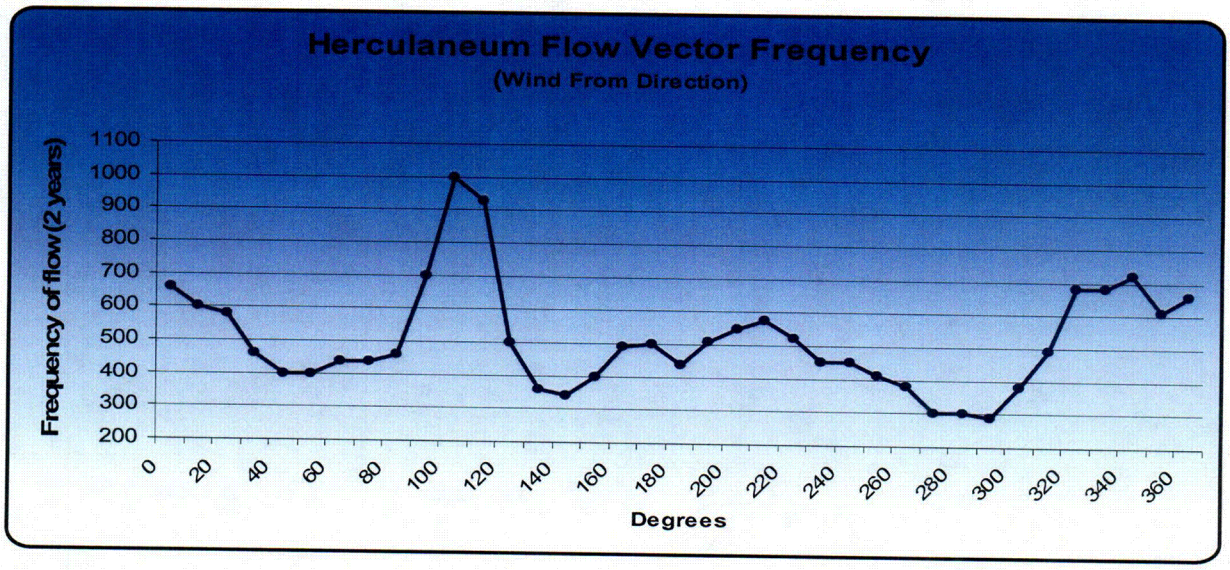


5.3 *Airborne Release*

5.3.1 Wind Flow Direction

Figure 5-3 depicts the wind frequency distribution measured at the Doe Run facility in Herculaneum, Missouri. This figure shows that the predominant direction of flow is approximately 120 degrees from the north to the northwest (the wind comes from the SE and blows to the NW). The average wind speed for the period was 2.37meters per second (m/s). The data was compiled over a 2 year period from on-site meteorological data collected at the facility. The Doe Run facility is located approximately 7 miles NE of the Hematite facility.

Figure 5-3 Air Flow Direction Vector Histogram



In addition to the above data, a review of wind rose diagrams (ref. 18) plotted for the St. Louis area over the period from 1961 through 1990 was conducted. The average wind speed from the wind rose diagrams is presented by month. A total average over the 12 months reported (for a 30 year period) was 4.63 m/s. Although the wind blows predominately from the SE and NW it is variable by season and year and location. Based on the directional

C02

variability the sampling program has been designed to provide 360 degree coverage around the main plant areas.

5.3.2 Airborne Sources

Plant ventilation systems discharge air from the contamination control areas of the buildings after High Efficiency Particulate Air (HEPA) filtration. This air is sampled directly at the discharge point (stack) and serves as the basis for showing compliance with the airborne effluent limits. During remediation activities contaminated soil, sediment and dust from building demolition could also become airborne. Sampling for these types of releases is described as part of the work control sampling regime and is primarily comprised of temporary air samplers set up for the specific task taking into account the direction of the wind. The use of temporary or spot ventilation if used and discharged directly to the environment will be sampled at the discharge point to show compliance with the effluent control values.

Visual dust control is typically a good method for controlling uranium concentration from excavations and demolition. Dust controlled to the Occupational Safety and Administration (OSHA) nuisance dust level of 5 mg/m^3 at 100pCi/g would lead to an airborne concentration of 5E-13 μCi/ml which is about 2.5% of the occupational derived air concentration (DAC) and 10 times the effluent control limit. Gravitational settling and atmospheric dispersion rapidly diminish the concentration with distance from the source of generation.

$5mg/m^3$ x 100pCi/g x 1E-$6m^3$/ml x 1g/1,000mg x 1E-6μCi/pCi = 5E-13μCi/ml

Dust controlled at less than the average limit of 150$\mu g/m^3$ level would lead to an airborne concentration of 1.5E-14μCi/ml which is 30% of the radiological effluent limit.

Table 5-1 Sample Types and Frequency

Sampling Type	Sampling Sites	Collection Frequency	Analysis Type
Ground Water	Four down gradient wells (Figure 6-11, Figure 6-10)	Quarterly	Gross Alpha/Beta[1]
Soil	Four strategically located (Figure 6-11, Figure 6-3)	Quarterly	Gross Alpha/Beta
Vegetation	Four strategically located (Figure 6-11, Figure 6-3)	Quarterly	Gross Alpha/Beta
Sediment	One One (Figure 6-11, Figure 6-5)	Annual Quarterly	Gross Alpha/Beta
Gamma External (TLD)	4 along highway P from the site creek to East Creek 2 along west side (Figure 6-11, Figure 6-3)	Quarterly	mrem
Drinking Water	Post Office (Figure 6-11)	Quarterly	Gross Alpha/Beta
Airborne Particulates	4 permanent (Figure 6-11, Figure 6-3)	Weekly	Gross Alpha/Beta (composite and perform spectroscopy if quarterly average exceeds 10% of the effluent control limit)
	Variable number of work control samplers	Daily for work control samplers	Gross Alpha/Beta
Surface Water	Two Three (Figure 6-11, Figure 6-5)	Weekly Quarterly	Gross Alpha/Beta

[1] If the beta to alpha activity ratio is greater then 10, consideration should be given to performing ^{99}Tc analysis.

6 Environmental Sampling Program

Environmental sampling will be conducted for air and liquid effluents, sediment, surface water, ground water, site soils and Vegetation. In addition to discrete sampling, this section describes the environmental radiation measurements to be performed.

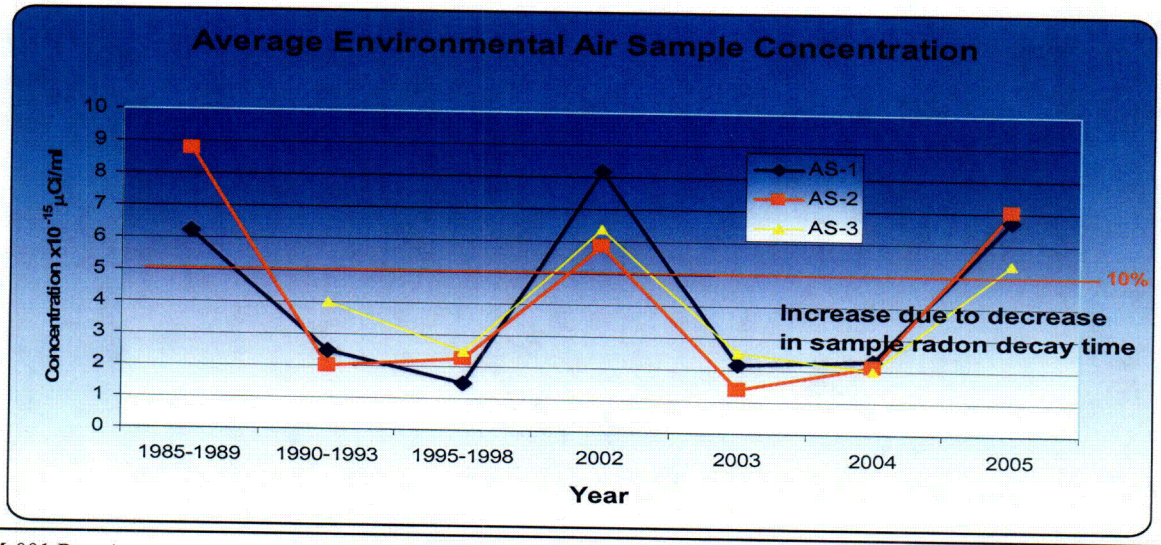
6.1 Air Sampling

Four air samplers (AS-1 AS-4) are strategically placed around the facility as shown in Figure 6-3. The air sampler locations are maintained from the operating facility program to ensure a continuity of historical trending data. Air sampling during building dismantlement, soil and burial pit remediation will be performed using additional temporary air samplers positioned based on the daily activity and meteorological conditions. Air samplers have been designated as either environmental or work control samplers as described below. Additionally, effluent air sampling will continue to be performed while work in the contamination control areas of the buildings is performed and environmentally exhausted ventilation is used. Table 6-1 provides a historic perspective of sample analysis results for the three historic environmental air samplers.

Table 6-1 Average Air Sample Result x10^{-15}µCi/ml

Years	Air Sampler		
	AS-1	AS-2	AS-3
1985-1989	6.2	8.8	Not installed
1990-1993	2.5	2	4
1995-1998	1.5	2.3	2.5
2002	8.2	5.9	6.4
2003	2.2	1.4	2.5
2004	2.3	2.1	2.0
2005	6.7	7.0	5.4

Figure 6-1 Environmental Air Sample Trends



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6.1.1 Environmental Air Sampling

Figure 6-11 and Figure 6-3 show the location of the four environmental air samplers. Three of the locations, AS-1, 2, and 3, were originally selected to provide radial symmetry around the facility taking into account the natural terrain features and building locations. These samplers will continue to be used because of their relative symmetry around the facility and to maintain the continuity of the historical data. A fourth air sampler has been established in the vicinity of the front parking lot, plant north from building 110 as noted in Figure 6-3. This new sampler essentially intercepts the facility and nearest resident and is in the direction of one of the predominant wind patterns. In order to meet the MDC goals, long sample collection times are required to draw a large volume of air through the filter. Sample collection times should be collected for one week at a flow rate of 30 - 40 liters per minute (lpm). Samples will be analyzed for gross alpha/beta activity after a minimum 36 hour decay period for the radon progeny to decay. Consistency in decay times is important for evaluating long term trends. Samples that average greater than 10% of the effluent value for more than a month will be composited and isotopically analyzed. Once the individual isotopes are quantified the compositing of samples can be stopped unless the remediation activities substantially change so that there is the potential for encountering other radioisotopes not previously quantified.

6.1.2 Work Control Sampling

Work control sampling should be performed when the potential exists to disperse radioactive material at non-discrete locations into the air at greater than an average of 10% of the effluent control values. The number of samplers and location should be established based on the work being performed and the relative meteorological conditions. Because of the short sample duration (limits volume of air collected) it is difficult to meet the MDC goals discussed above. Sample count times, background count times and counter background need to be adjusted to reduce the MDC for work control sampling. The goal for work control sampling is to meet the effluent control values during air sampling period. The air concentration during the periods of non activity will tend to be lower, ensuring that the overall long term average is less than the control values.

Continuous Air Monitors (CAMS) may be useful for work control sampling however the MDC may not be satisfactory.

Work control samples should be counted more than once. The first count is used to qualitatively assess the radiological controls in place for the outdoor work activity. The second count will be performed after at least 36 hours to allow the decay of radon progeny.

6.1.3 Background Air Samplers

The use of background air samplers was considered and may provide useful data regarding ambient radioactivity concentrations in air. An air sampler set up at PW-19 may be used as operations warrant collecting background air samples. In addition to the background air sampler the long history of low concentration environmental air sample results shown in Figure 6-1 serves as a good historic base level.

6.1.4 Discrete point effluents

Ventilated enclosures or point source ventilation, i.e., negative air machines that discharge air to the environment from contaminated areas shall be sampled for gross alpha activity. Sampler flow rates should be established so that the velocity of the air intake of the sample tube is equal to the linear velocity of the air in the duct being sampled. Periodic measurements of the duct velocity should be made to ensure that air is being sampled and the volumetric flow rate is consistent with the tables used to calculate total effluents. As long as stacks are operating the samples should be collected and counted weekly after allowance for radon decay.

6.2 *Soil Sampling*

The SNM-33 license requires that a minimum of four grab soil samples be collected quarterly and analyzed for gross alpha/beta activity. Figure 6-11 and Figure 6-3 show the collection location for these samples. The number of soil samples has been decreased from the current practice of collecting seven samples to reflect the very limited effluents from the facility and the cessation of the S-121 stack. The S-121 stack was a 21,000 cubic feet per minute (CFM) stack that lofted material into the atmosphere creating the potential for dispersion from the immediate confines of the facility. The purpose of these samples is to spot adverse trends indicative of a release, there are no regulatory limits associated with soil sample analysis. An adverse trend will be determined by reviewing a line graph or similar and visually interpreting the plotted or tabular data. Sample results that are 3 times the historical average concentration will be evaluated to determine the cause and corrective action taken if needed.

Table 6-2 Historic Soil Sample Results pCi/g

Year	SS-12		SS-13		SS-14		SS-15	
	α	β	α	β	α	β	α	β
1988-1989	11	33	13	28	14	38	19	48
1991-1995	20	61	18	61	22	69	26	72
1995-1998	12	29	8	33	12	29	13	39
1Q 2003	13	37	16	38	15	46	13	47
2Q 2003	16	38	16	46	15	38	13	47
3Q 2003	11	39	5.6	31	7.1	42	6.0	34
4Q 2003	12	38	7.1	30	10	40	10	44
1Q 2004	2.7	36	4.7	25	3.1	35	0.77	41
2Q 2004	9.8	30	6.9	28	9.6	37	12	42
3Q 2004	1.1	12	0.43	12	0.61	10	1.0	14
4Q 2004	0.74	9.9	0.81	14	0.68	9.7	0.59	4.4

Figure 6-2 Soil Sample Results

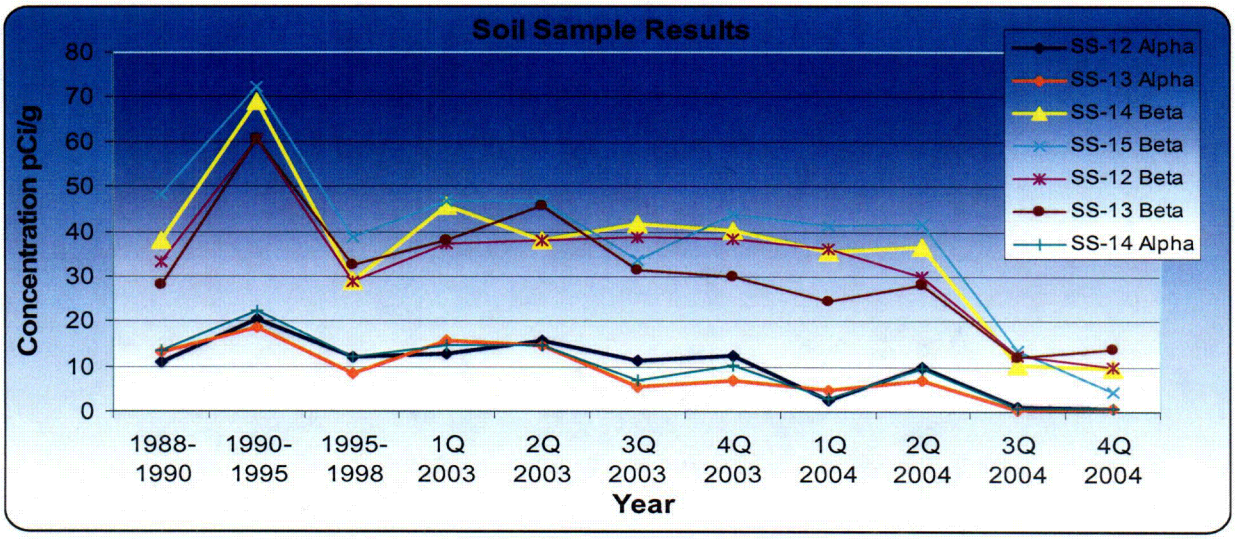
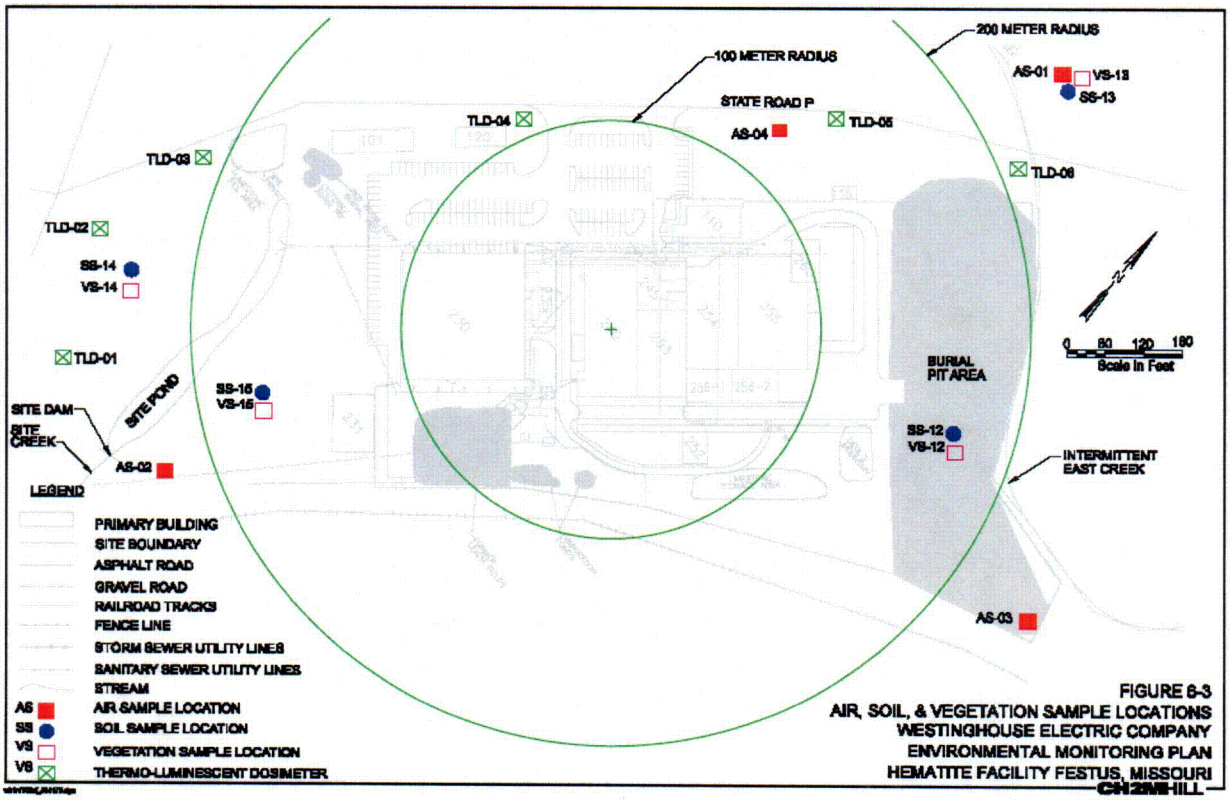


Figure 6-3 Air and Soil and Vegetation Sample Locations



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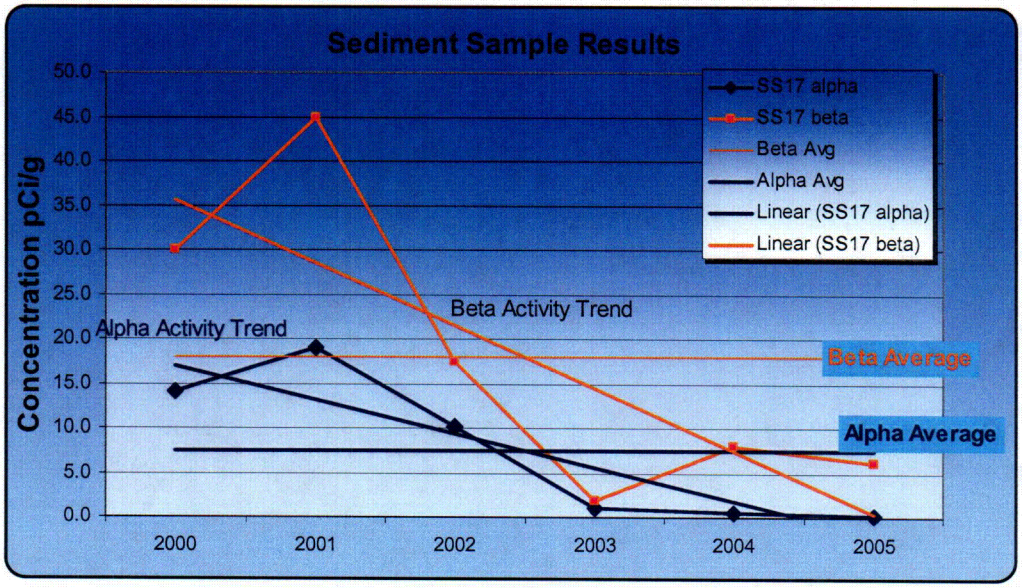
6.3 Sediment Sampling

The SNM-33 license requires that an annual grab sediment sample be collected at the confluence of the site creek and Joachim Creek and analyzed for gross alpha/beta activity. Figure 6-11 and Figure 6-5 show the collection location for this sample. One additional sediment sample has been added based on the revised outfall samples of the NPDES permit under review. These samples are shown in Figure 6-11 and Figure 6-5 and are collected quarterly. The purpose of these samples is to spot adverse trends indicative of a release or migration of contaminated sediment from the site creek to the Joachim Creek, there are no regulatory limits associated with sediment sample analysis. An adverse trend will be determined by reviewing a line graph or similar and visually interpreting the plotted or tabular data. Sample results that are 3 times the historical average concentration will be evaluated to determine the cause and corrective action taken if determined. Other sediment samples have been collected as part of the site wide characterization and do not show an adverse accumulation. This location provides a good baseline for evaluation since data has been collected since 1994.

Other sediments on site will be addressed as part of the decommissioning and do not warrant routine sampling.

Figure 6-4 Sediment Sample Trend



6.4 Surface Water

6.4.1 Surface Water Characteristics

The Hematite facility includes approximately 228 acres of land of which only a small fraction was used for operations. The following surface waters are the waters that may have been influenced by the former site operations and may be impacted as a result of decommissioning. Other site surface water features are being sampled according to the remedial investigation (RI) and are not considered for routine sampling as part of this EMP.

C05

Joachim Creek is the largest stream on the site and is permanently flowing. The Joachim Creek is perennial and based on flow gauge information from the U.S. Geological Survey, the annual mean flow is approximately 132 cubic feet per second (cfs). The seasonal mean flows are: 330 cfs (spring), 12 cfs (summer), 16 cfs (fall), and 169 cfs (winter). Joachim Creek flows into the Mississippi River near Herculaneum, Missouri. A number of intermittent streams flow into Joachim Creek. Tributaries to Joachim Creek and other surface water features on the site include the following:

Site Spring – the site spring flows continuously at an estimated 1 to 10 gallons per minute (gpm) most of the year. The spring is likely a result of fracture flow in the Jefferson City-Cotter Dolomite, which receives its source water from the hills northwest of the Hematite site.

Site Pond - the Site Pond is a small concrete dam impoundment southwest of the central site tract. It receives flow from the Site Spring and the storm water runoff from the area of the Hematite facility (see Figure 6-11 for the outfall location). Flow is measured at the Site Pond dam and reported quarterly to the MDNR..

Site Creek - the Site Creek is the effluent from below the dam of the Site Pond. It also receives discharge from the Hematite facility's sanitary water system (see Figure 6-11 for the outfall location). It flows through a culvert beneath the railroad track and joins the effluent from the Lake Virginia drainage basin.

Northeast Site Creek - the Northeast Site Creek flows intermittently southeast, then east to its confluence with the effluent of East Lake tributary, and then to Joachim Creek.

Figure 6-5 Surface Water Sample Locations

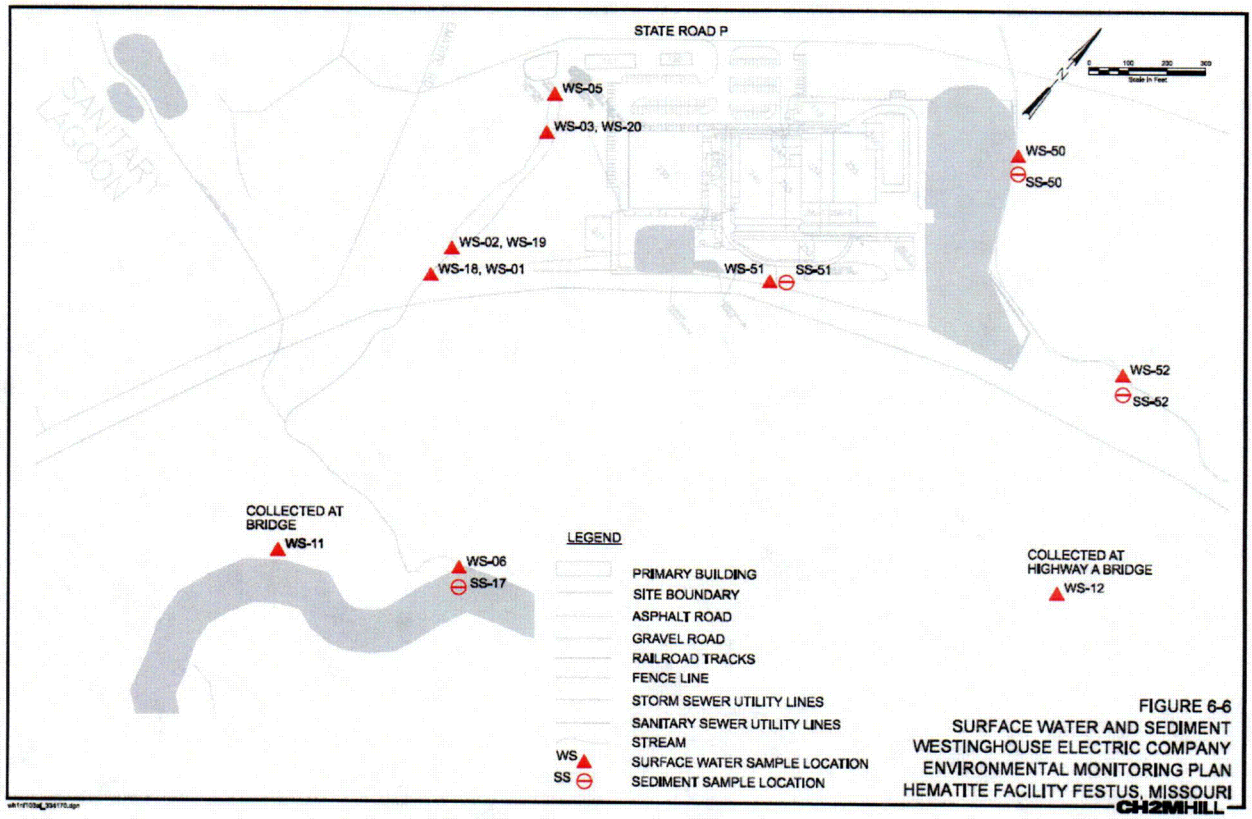


Table 6-3 Water Sample Cross Reference Table

Sample Point	Alias	Location	Sample Frequency	Notes
WS-1	Outfall #001	Sanitary Sewer outfall	Not associated with radiological sampling.	
WS-2	Outfall #002	Site Dam	Quarterly	Also WS-19 weekly sample
WS-3	Outfall #003	Storm Drain	Monthly	Also WS-20 weekly sample
WS-4	Hematite Residence Well Offsite Well (Hematite)	Well located at the Post Office	Quarterly	Formerly collected at Hematite Residence house.
WS-5	Spring	West Creek Spring	Quarterly	Collected for background but not required by SNM-33 or NPDES.
WS-6	Joachim Creek and Site Creek confluence	West Creek Confluence with Joachim Creek	Quarterly	

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Sample Point	Alias	Location	Sample Frequency	Notes
WS-7	North Sample Well (Evaporation Ponds) Retention Pond North	Down gradient from evaporation (depth = 22.5 feet).	Quarterly	
WS-8	Southeast Sample Well (Evaporation Ponds) Retention Pond South-East	Down gradient from plant across the railroad tracks (depth = 17.7 feet).	Quarterly	
WS-9	Southwest Sample Well (Evaporation Ponds) Retention Pond South-West	Down gradient from plant across the railroad tracks (well depth = 25.3 feet).	Quarterly	
WS-10		Plant Well	N/A	Well has been abandoned.
WS-11		Joachim Creek Upstream	Monthly	
WS-12		Joachim Creek Downstream	Monthly	
WS-13	South Vault Sample Well	South vault well, down gradient from former ring storage area	Quarterly	In area of high 99Tc (In addition to minimum #)
WS-14	Burial Well #2	Located within burial pit area.	Quarterly	Sampling discontinued ~ 1999 because of high TCE and mixed waste concerns
WS-15	Burial Ground Monitoring Well # 1	Located within burial pit area.	Quarterly	
WS-16	Burial Ground Monitoring Well #3	Located within burial pit area.	Quarterly	
WS-17b	Burial Ground Monitoring Well WS-17 was also Burial monitoring Well #4	Located within burial pit area.	Quarterly	WS-17 was abandoned because of questionable construction and replace with WS-17b
WS-18	Outfall #001	Sewage Treatment Outfall	Weekly	Used for 10CFR20 dose compliance
WS-19	Outfall #002	Site Pond Dam	Weekly	Used for 10CFR20 dose compliance
WS-20	Outfall #003	Storm Drain	Weekly	Used for 10CFR20 dose compliance

Sample Point	Alias	Location	Sample Frequency	Notes
WS-21	Weekly East Creek	East Creek	No longer sampled, was weekly not sampled since ~ 2000	License commitment removed ~2000 because creek seldom flows. Will be new points under revised NPDES (Outfall #006) sampled Quarterly as WS-52
WS-29,30,31		Well cluster representing OB and JC, located at east-southeastern edge of burial pit area.	Quarterly	Installed for burial pit characterization
WS-50	New point	Discharge from the east culvert	Quarterly	Pending NPDES renewal
WS-51	New point	Discharge from the south culvert	Quarterly	Pending NPDES renewal
WS-52	New point similar to former sample point WS-21	Intermittent stream east of the central site tract that collects runoff from the east culvert	Quarterly	Pending NPDES renewal

6.4.2 Outfalls

Six outfalls have been identified for sampling under NPDES permit number MO-0000761. Outfalls 001 - 003 are long term sampling points and Outfalls 004 - 006 are recently proposed sample points. In addition to the NPDES sampling requirements the SNM-33 license requires weekly samples from Outfall #001 and #002 and analyzed for uranium typically using gross alpha/beta activity. Figure 6-11 and Figure 6-5 shows the location of each of the Outfalls and provides the frequency and sample type. The following Outfalls are described in the NPDES permit.

Outfall 001 – Discharge from the site sanitary wastewater treatment plant to the unnamed tributary downstream of the Site Pond

Outfall 002 – Discharge from the Site Pond to the site creek

Outfall 003 – Discharge to the Site Pond from site storm drains

Outfall 004 – Discharge from the east culvert, which collects runoff from paved and unpaved areas east of Building 260 and conveys it to the unnamed, intermittent stream located to the east of the central site tract

Outfall 005 – Discharge from the south culvert, which collects runoff from paved and unpaved areas southwest of Building 252 and conveys it to the low-lying area north of the Union Pacific railroad tracks

Outfall 006 – Intermittent stream east of the central site tract that collects runoff from the east culvert (proposed Outfall 004) and non-point-source runoff from paved and unpaved areas on the eastern side of the central site tract

In conjunction with the discharges to and from the Site Pond, these additional outfalls include the locations from which point-source discharges of site runoff could occur during site decommissioning.

The purpose of these samples is to spot adverse trends indicative of a release and monitor compliance. An adverse trend will be determined by reviewing a line graph or similar and visually interpreting the plotted or tabular data. Sample results that are 3 times the historical average concentration or single sample greater than the control limit in Table 4-1 should be evaluated to determine the cause and corrective action taken if needed.

6.4.3 Weir Sampling

Site Dam and Composite Sampler

Water at the Site Dam (Outfall #002) continuously feeds an adjacent siphon tank through a small V-notch weir Figure. Inside the siphon tank is a Miller automatic sewer siphon that drains the siphon tank when the tank fills to the within a couple inches of the top. When the water approaches the top of the tank it begins to gravity feed a small fraction of the water to the two 30 gallon composite collection drums until the tank flushes. On a weekly basis a radiological sample is obtained from the composite collection drums and the drums are drained. A secondary function for the siphon tank is to provide a method for estimating the total flow of water over the dam for the site NPDES permit.

Figure 6-6 Site Dam and Composite Collection System

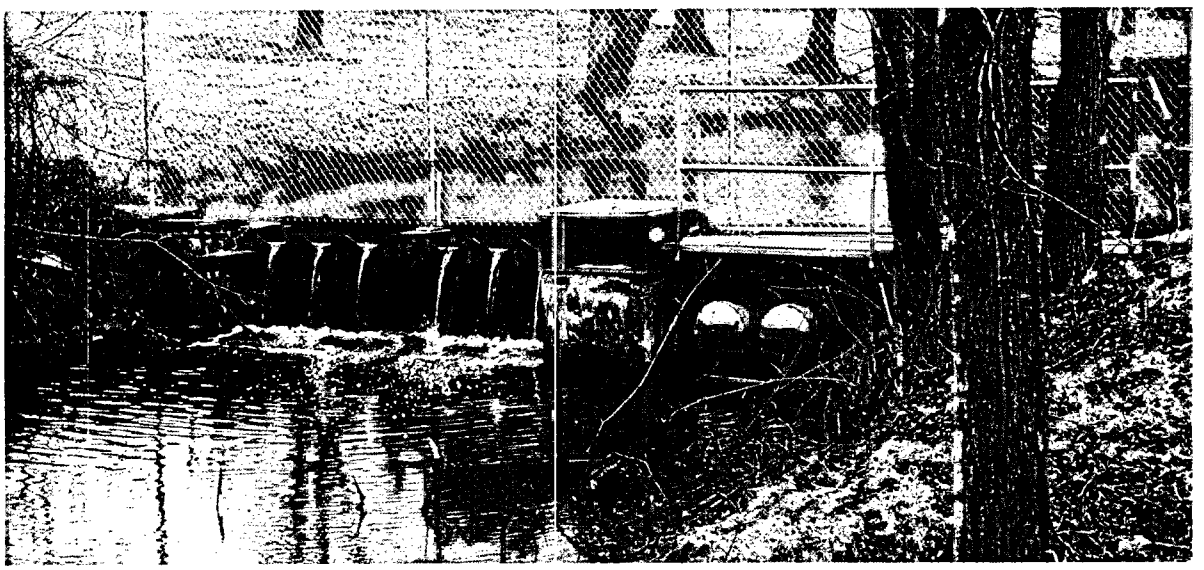
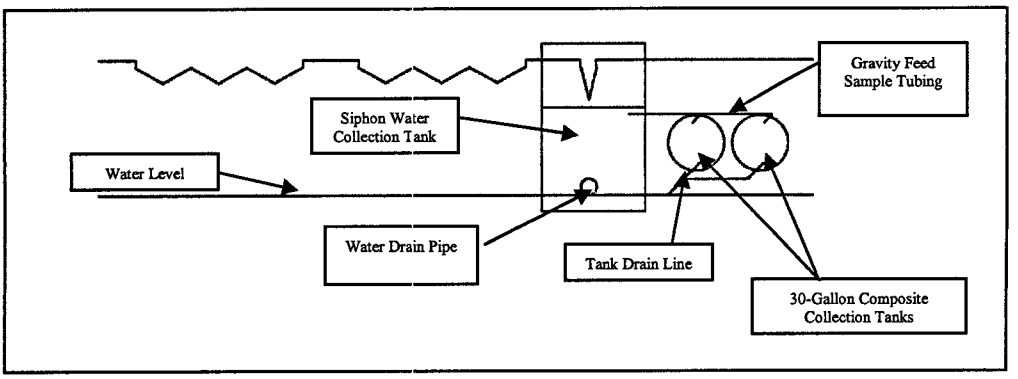


Figure 6-7 Site Dam and Composite Collection System Diagram



Storm Water Outfall #003

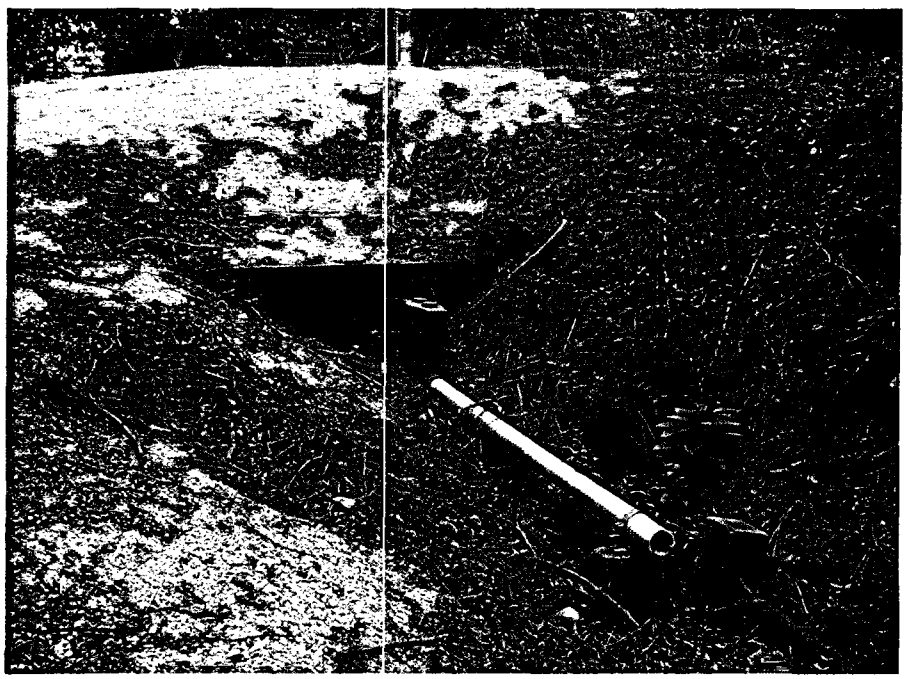
Storm water runoff from the parking lot and building rooftops is funneled to the storm water outfall at the north end of the site pond. See figure 6-8 for a diagram. The storm water outfall flows over a contracted rectangular notch weir to obtain NPDES required flow measurements. The weir also provides a sampling point for the weekly radiological grab sample.

Figure 6-8 Storm Water Outfall #001 Weir System

Sanitary Sewer Outfall #001

The sanitary sewer outfall discharges to the site creek just below the site dam as shown in Figure 6-9. Flow rate measurements are collected automatically using a Sigma 970 flow meter. Flow is calculated automatically by the flow meter using the same principle of weir flow described above for the other two weirs. The measurement system uses an ultrasonic level detector that electronically measures the height of water above the discharge tank weir and converts this input into a flow rate. Flow rates are obtained for NPDES purposes. A weekly radiological grab sample is obtained from the end of the discharge pipe.

Figure 6-9 Sanitary Outfall #001



6.5 Vegetation Sampling

Vegetation sampling and analysis has been historically performed on four samples collected quarterly. Vegetation samples can provide data regarding atmospheric deposition and to a lesser extent biological uptake from the soil and water. The rational for vegetation samples was largely based on the large effluent load during the operating years primarily from the

conversion process. Continued sampling will be performed to measure potential deposition from remedial activities. The four sample locations are shown in Figure 6-3. The quarterly samples are analyzed for gross alpha/beta activity. There are no limits associated with vegetation samples and evaluation of results is performed as part of the tracking and trending process discussed in section 7. An adverse trend will be determined by reviewing a line graph or similar and visually interpreting the plotted or tabular data. Sample results that are 3 times the historical average concentration will be evaluated to determine the cause and corrective action taken if needed.

6.6 Ground Water Sampling

This section of the EMP provides a brief description of groundwater characteristics at the site, an overview of historical sampling events and analytical results, and the sample locations for the Hematite site.

6.6.1 Groundwater Characteristics

The major components of the hydrogeologic system near the Hematite site include the following:

- Overburden—unconsolidated clays, sands, and gravels that overlie bedrock in the floodplain of Joachim Creek
- Jefferson City-Cotter Formation—dolomite with some sandstone interbeds and cherty intervals
- Roubidoux Formation—dolomite and sandy dolomite with some sandstone interbeds and cherty intervals

In the unconsolidated terrace/alluvial flood plain sediments (herein referred to as the overburden), groundwater flow is chiefly confined to the basal, coarse-grain unit and is in a southeastward direction from the Hematite Facility toward Joachim Creek where it discharges. A groundwater mound is associated with the northeast corner of the Hematite Facility and has a significant impact on the potentiometric surface. Groundwater flow in the upper Jefferson City-Cotter Dolomite appears to be affected by the mounding, and components of flow radiate from the Hematite Facility toward the northeast (along bedding planes) and toward the southeast (in a transmissive zone) within this bedrock unit. Below the Jefferson City-Cotter Dolomite, the current direction of groundwater flow appears to reflect a northeasterly direction, which is consistent with the regional groundwater flow direction in the Roubidoux Formation.

Groundwater flow velocity is estimated to range between approximately 20 and 300 ft/year in the overburden, and from 2 to >300 ft/year in bedrock.

6.6.2 Previous Groundwater Sampling Results

Numerous monitoring wells have been installed at the Hematite site over the years. The most recent RI effort included the installation of over 100 monitoring wells at varying depths across the site. A total of 118 groundwater samples were collected during the RI. Analytical results from the RI indicate that only ^{99}Tc has entered the groundwater at numerous locations. Uranium contamination may also be present, but the extent is limited

(preliminary conclusions from the Draft RI Report). In general, radiological contamination with uranium, and somewhat more, although still localized, contamination with ^{99}Tc is localized to the site and located in the overburden.

In 1983 a series of sample wells were installed by the Radiation Management Corporation (RMC) under contract to the Nuclear Regulatory Commission (NRC). Samples from these overburden wells have been routinely sampled as part of the NRC approved SNM-33 environmental sampling program. The majority of these wells have been sampled historically and the data provides a good baseline for long term trends.

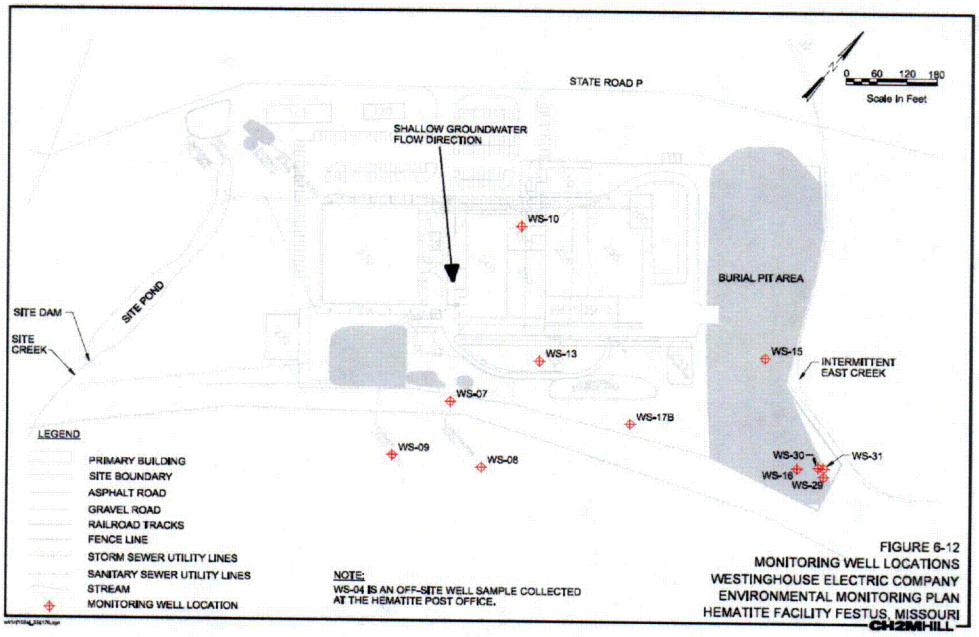
Currently, Westinghouse implements a sentry well monitoring program based primarily on Volatile Organic Compounds (VOC) in which monitoring wells BR1-RB, BR2-RB, BR3-RB, BR4-RB and BR4-JC are sampled and analyzed for gross alpha, gross beta, and ^{99}Tc. The sentry well monitoring program is completed on a quarterly basis and the groundwater from these wells is analyzed for gross alpha, gross beta and volatile organic compound. These sentry wells are typically located (screened) in the deeper aquifer and are located at the further property boundaries.

6.6.3 Groundwater Monitoring Wells for Sampling

The monitoring wells for environmental radioactivity sampling include WS-4, WS-07, WS-08, WS-09, WS-10, WS-13, WS-15, WS-16, and WS-17B. The locations of these wells are shown in Figure 6-10. The overall purpose for monitoring at these locations is to represent potential contaminant levels along the front edge of the contaminant plume over time.

The purpose of these samples is to spot adverse trends indicative of a migration or release. An adverse trend will be determined by reviewing a line graph or similar and visually interpreting the plotted or tabular data. Sample results that are 3 times the historical average concentration will be evaluated to determine the cause and corrective action taken if needed.

Figure 6-10 Ground Water Samples



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Well ID	Description	Rationale
WS-4	Well located at the Post Office.	Required by SNM-33 and provides data for North West drinking water quality.
WS-07	Down gradient from evaporation (depth = 22.5 feet).	Monitor levels of radiological constituents immediately down gradient from ponds.
WS-08	Down gradient from plant across the railroad tracks (depth = 17.7 feet).	Monitor levels of radiological constituents further down gradient from ponds, (anticipated edge of contamination).
WS-09	Down gradient from plant across the railroad tracks (well depth = 25.3 feet).	Monitor levels of radiological constituents further down gradient from ponds, (anticipated edge of contamination).
WS-10	Plant Well	Water supply for the site. Once the plant is hooked up to public water supply, this well will not require sampling.
WS-13	South vault well, down gradient from former ring storage area.	Monitor levels of radiological constituents down gradient from former ring storage area.
WS-15	Located within burial pit area.	Monitor levels of radiological constituents in the burial pit area. This well will be removed upon remediation efforts.
WS-16	Located within burial pit area.	Monitor levels of radiological constituents in the burial pit area. This well will be removed upon remediation efforts.
WS-17B	Located within burial pit area.	Monitor levels of radiological constituents in the burial pit area. This well will be removed upon remediation efforts.

Overall Environmental Sampling Program Map and Matrix

Figure 6-1 provides a map of the environmental sampling points discussed in this section. Table 6-4 provides a comprehensive matrix of the environmental samples collected or measured under this program. The table includes the source of the requirement to ensure changes to the program are coordinated with license or NPDES permit modifications.

Figure 6-11 Sample Locations

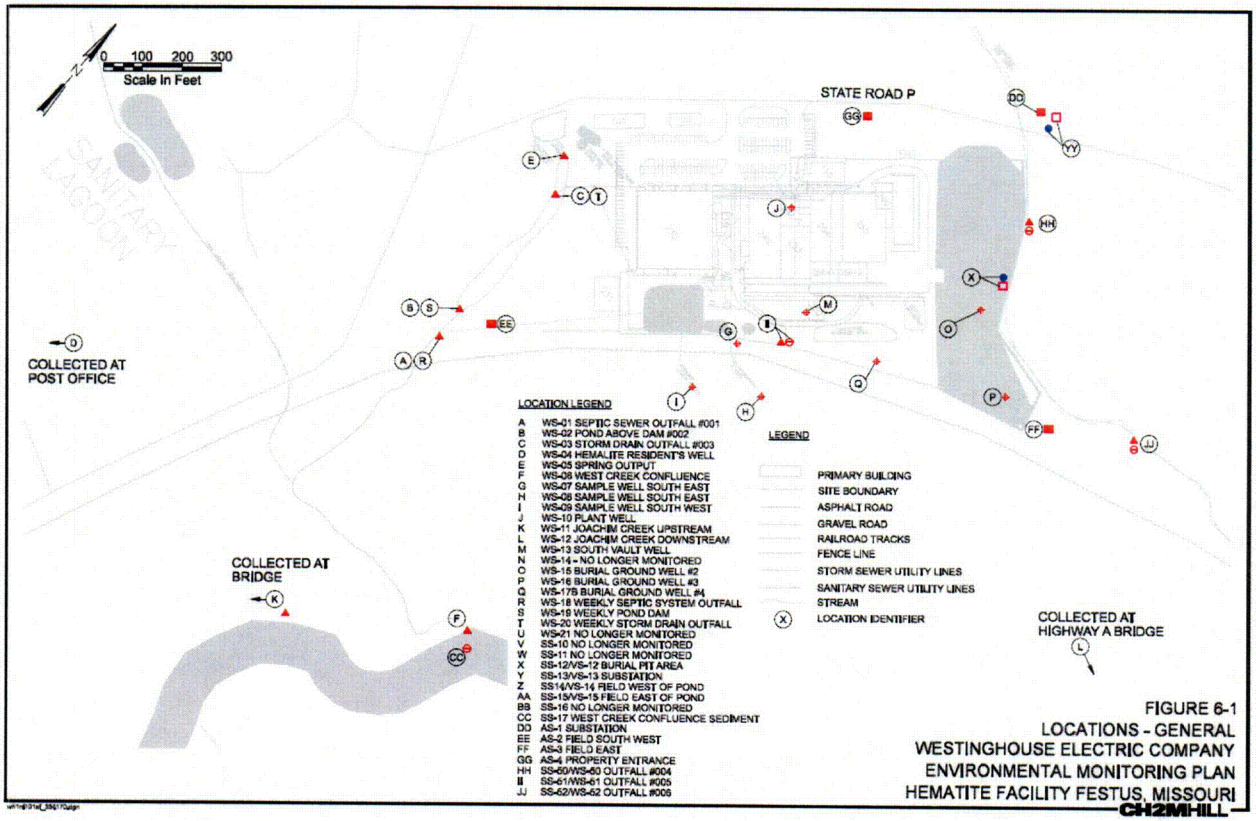

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Table 6-4 Environmental Sample Matrix

SAMPLING FREQUENCY	SAMPLE LOCATION	LOCATION ACRONYM	ANALYSIS PARAMETERS
Weekly	Sewage Treatment Outfall Outfall #001	WS18	Flow[1], Gross α and β (SNM-33)[2]
	Site Pond Dam Outfall #002	WS19	Flow[1], Gross α and β (weekly composite) (SNM-33)[2]
	Storm Drain Outfall #003	WS20	Flow[1], Gross α and β (Weekly not required by NPDES or SNM-33)
	Air Stations AS1-AS4	AS1, AS2, AS3, AS4	Gross α Continuous sampling (SNM-33)[2]
Monthly	Storm Drain Outfall #003	WS3	BOD, TSS, pH, Oil & Grease, Temperature, Fluoride[3] (NPDES)
	Plant Well	WS10	Gross α and β (SNM-33)
	Joachim Creek Upstream	WS11	Gross α and β (SNM-33)
	Joachim Creek Downstream	WS12	Gross α and β (SNM-33)
	Site Pond Dam Outfall #002	WS19	Flow[1], Gross α and β (NPDES) The weekly SNM-33 required samples satisfy this obligation and no additional sampling is required
	Septic System (Sanitary Sewer) Outfall #001	WS18	Flow[1], Gross α and β (NPDES) The weekly SNM-33 required samples satisfy this obligation and no additional sampling is required monthly

[1] Flow required monthly by NPDES however it is collected with the weekly measurements for gross alpha and beta
[2] SNM-33 allows the analysis for uranium by a number of methods. The facility currently analyzes sample by using both gross alpha and gross beta activity. "Samples shall be analyzed for uranium by using any of the following methods: alpha activity measurements, uranium fluorimetry, kinetic phosphorescence analysis, mass spectroscopy, beta measurements, gamma spectroscopy, or neutron activation analysis."
[3] Requested that fluoride be removed from NPDES permit since fluoride process is decommissioned

SAMPLING FREQUENCY	SAMPLE LOCATION	LOCATION ACRONYM	ANALYSIS PARAMETERS
Quarterly	North Sample Well (Evaporation Ponds)	WS7	Gross α and β (SNM-33)
	Site Pond Dam Outfall #002 **Collect during February, May, August, November**	WS2	Fluoride, TSS, pH, Oil & Grease (NPDES)
	Southeast Sample Well (Evaporation Ponds)	WS8	Gross α and β (SNM-33)
	Southwest Sample Well (Evaporation Ponds)	WS9	Gross α and β (SNM-33)
	South Vault Sample Well	WS13	Gross α and β (SNM-33)
	Burial Ground Sample Wells 2-4	WS15, WS17B, WS-16	Gross α and β (SNM-33)
	Offsite Well (Hematite) Water	WS4	Gross α and β (SNM-33)
	West Creek Spring	WS5	Gross α and β (No requirement provides background for Site Creek)
	West Creek Confluence with Joachim Creek	WS6	Gross α and β (SNM-33)
	Soil (4 locations)	SS10-SS16	Gross α and β (SNM-33)
	Vegetation (4 locations)	VS12-VS15	Gross α and β (SNM-33)
	East Culvert Outfall #004	WS50	TSS, pH, TCE, PCE, Gross α and β
	South Culvert Outfall #005	WS26	TSS, pH, TCE, PCE, Gross α and β
	Intermittent Stream Outfall #006	WS27	TSS, pH, TCE, PCE, Gross α and β
	West and North along Highway P	TLD-1 – TLD-6	mrem
Annual	West Creek Confluence with Joachim Creek	SS-17 Sediment	Gross α and β (SNM-33)

6.7 Dose

The monitoring of penetrating radiation will be performed using standard environmental dosimeters that are placed at various locations around the perimeter of the restricted remediation area. Note that if dosimeters placed close to the tile barn, they will show elevated results due to the high background radiation of the materials of construction. Dosimeters will be collected and analyzed quarterly to measure the integrated gamma dose for each location. Results of the dose monitoring will compared to the annual limit of 100 mrem from all sources (airborne and direct dose). For the purpose of showing compliance to the annual total effective dose equivalent (TEDE) limit for a member of the public an arbitrary external dose limit of 10 mrem per quarter has been established. 10 mrem was derived by allocating 50 % of the allowable 100 mrem dose to effluent and 50% to direct dose and then taking 80% of this value. If doses exceed this control value the use of stay times should be used. A stay time is the reasonable amount of time a member of the public could be exposed at the point of interest.

A minimum of six environmental dosimeters are recommended for the facility. Two dosimeters should be placed along the Hematite side of the facility adjacent to the road and 4 more along the front of the facility close to the road and evenly distributed. **Figure** 6-3 shows the approximate locations of the environmental thermo-luminescent dosimeters (TLDs).

6.8 Minimum Detectable Activity (MDA) Calculations

In general the minimum detectable activity (MDA) for each analytical media should be <5% of the constraint or limit. The MDA at the 95% confidence level can be expressed by using the equations below, or equivalent.

MDA if the sample count time and background count time are different:

$$MDA = \frac{2.71/T_s + 3.29\left(\frac{R_b}{T_b} + \frac{R_b}{T_s}\right)^{1/2}}{E}$$

MDA if the sample count time and background count time are the same

$$MDA = \frac{2.71/T + 4.65\left(\frac{R_b}{T_b}\right)^{1/2}}{E}$$

MDA	Minimum Detectable Activity (DPM)
E	Counting efficiency in disintegration per count
R_b	Background Count Rate (CPM)
T	Count Time (Minutes)
T_b	Background Count Time (Minutes)
T_s	Sample Count Time (Minutes)

The Minimum Detectable Concentration (MDC) is the MDA divided by the sample volume and any other modifying factors such as recovery yield.

Example: Determine the MDC for an air sample collected over one week

E	0.25
R_b	1 CPM
T	10 Minutes
V =	R x T = 30 lpm x 7 days
	30 l/min x 1,000ml/l x 7days x 24h/day x 60 min/hr
	3.02E8 ml

$$\text{MDA} = MDA = \frac{2.71/T + 4.65\left(\frac{R_b}{T_b}\right)^{1/2}}{E} = MDA = \frac{2.71/10 + 4.65\left(\frac{1}{10}\right)^{1/2}}{0.25} = 6.97 \text{ DPM}$$

= 6.97DPM x 1μCi/2.22E6DPM = 3.14E-6 μCi

MDC = 3.14E-6 μCi/3.02E8 ml = 1.04E-14 μCi/ml

7 ALARA

The Hematite ALARA program provides for establishing realistic and challenging ALARA goals for project tasks. The ALARA goal for effluent control during all decommissioning activities is to maintain effluent concentrations at or below 10% of the respective values in 10 Code of Federal Regulations (CFR) part 20, Appendix B as presented in Table 4-1. The ALARA goal for dose to the individual member of the public likely to receive the highest dose is 1 millirem (mrem) which is 10% of the constraint requiring reporting under 10 CFR 20.1101(d) and 10 CFR 20.2203.

The data collected will be plotted to facilitate the assessment of trends and measure performance against the facility ALARA goals. The use of control and warning limits on the graphs aids in quickly identifying when a goal or limit has been exceeded or a trend that may intercept the control limit if uncorrected.

The RSO will report the results to management, along with recommendations for changes in procedures that are necessary to achieve ALARA goals.

8 Reports and Notifications

This section highlights the reporting and notification requirements of the license and applicable NRC regulations regarding effluents and dose limits to the public.

8.1 NRC Notifications

The Nuclear Regulatory Commission has several reporting thresholds regarding effluent and dose to members of the public. Specific reports and timing of these reports can be found in the applicable regulation.

Air Effluent

SNM-33 requires that if the average airborne stack effluent concentration, averaged over a two-week period, exceeds the control limit in Table 4-1, an investigation shall be conducted and corrective action(s) taken.

If the 10 mrem ALARA constraints for air emissions established under 20.1101(d) is exceeded it shall be reported as provided in 10CFR20.2203 and take prompt appropriate corrective action to ensure against recurrence.

10 CFR 20.2202(a)(2) requires immediate reporting if "The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures)".

10 CFR20.2202(b)(2) requires 24 hour reporting if, "The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures"

In addition to the notification required by 10CFR20.2202, a written report is required within 30 days after learning of any of the following occurrences:

(1) Any incident for which notification is required by 10CFR 20.2202; or

(2) Doses in excess of any of the following:

The limits for an individual member of the public in 10CFR 20.1301; or

Any applicable limit in the license; or

The ALARA constraints for air emissions established under 10CFR 20.1101(d); or

Levels of radiation or concentrations of radioactive material in

A restricted area in excess of any applicable limit in the license; or

An unrestricted area in excess of 10 times any applicable limit set forth in this part or in the license (whether or not involving exposure of any individual in excess of the limits in § 20.1301); or

For licensees subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR part 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

8.2 NPDES

Semi annual radiological effluent reports shall be prepared according to the NPDES permit requirements.

8.3 Internal Reporting and Corrective Actions

Should a significant continuous upward trend be noted in any of the sampling data, corrective actions will be taken to investigate the cause and remedial actions will be taken as appropriate to bring the effluent back within the control parameters. This is typically tracked using the (CAP) system.

If an unacceptable increase in sample activity is noted in any media or quarterly dose rates as noted in the sample analysis section 6, consideration of appropriate dose pathways will be made.

Air and liquid effluent samples whose result exceeds 10% of the regulatory limit in Table 4-1 will be analyzed isotopically to establish the individual radionuclides.

If the Table 4-1 liquid effluent limits are exceeded, averaged over a calendar quarter, an investigation shall be conducted and corrective action taken.

9 References

1) Missouri Nation Pollution Discharge Elimination System (NPDES) Permit MO-0000761
2) PR-HP-011 "Environmental Sampling", revision 1.1
3) NRC Regulatory Guide 4.5, "Measurements of Radionuclides in the Environment - Sampling and Analysis of Plutonium in Soil."
4) NRC Regulatory Guide 4.15, "Quality Assurance for Radionuclide Monitoring Programs(Normal Operations) - Effluent Streams and the Environment."
5) NRC Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants."
6) NRC Regulatory Guide 4.20, "Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other than Power Reactors."
7) NRC Regulatory Guide 8.37, "ALARA Levels for Effluents from Materials Facilities."
8) NRC Information Notice 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage Under the Revised 10 CFR Part 20," January 28, 1994.
9) ANSI N13.1-1982, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities."
10) ANSI N42.18-1980, "Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactive Effluents."
11) NCRP Report No. 123, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground," January 1996.
12) U.S. Environmental Protection Agency, "Limiting Values of Radionuclide Intake And Air Concentration and Dose Conversion Factors For Inhalation, Submersion And Ingestion," Federal Guidance Report No. 11, September 1988.
13) U.S. NRC License No. SNM-33 (Docket No. 70-36).
14) Westinghouse Electric Company, "Remedial Investigation/Feasibility Study Work Plan," Rev. 0, May 9, 2003.
15) Westinghouse Electric Company, "Hematite Decommissioning Plan," Rev. 2, August, 2005.
16) 1998 NRC submittal to SNM-33 with the biennial update to part 2 of the license Westinghouse Electric Company, ENVIRONMENTAL REPORT FOR HEMATITE SITE DECOMMISSIONING, DO-05-001, Rev. 0, August 2005
17) Westinghouse Electric Company, "Analysis of the presence of contaminants in the Enriched Uranium at the Westinghouse Hematite Facility," Rev. 1, February 21, 2005.
18) West, Sara, USDA-ARS, "St. Louis/Lambert International Airport, MO Wind Rose Plot: 1961-1990," October 29, 2002.