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Our ref: HEM-10-26
Date: March 22, 2010

Subject: Additional Information Concerning License Amendment 52 (License No. SNM-00033, Docket No. 070-00036)

Reference: 1) Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-09-141, dated December 16, 2009, "Review of the Technical Basis for NRC Approval of Hematite License Amendment 52 for Building Demolition"

In Reference 1 Westinghouse Electric Company LLC submitted an evaluation of the current validity of NRC License Amendment 52 in light of the recent characterization surveys of the process buildings. That evaluation focused on the impact of a larger amount of Special Nuclear Material (SNM) than the NRC had previously evaluated for approval of the license amendment. In response to a request by NRC staff for evaluation of other potential impacts in light of the passage of time since June 2006 when Amendment 52 was approved, Westinghouse submits the attached additional information.

Attachment 1, *"Clarification of Amendment 52 Source Documents for Current Building Demolition,"* provides clarification of the changes which have evolved from the original assumptions in source documents the NRC used as a basis to justify Amendment 52 in June 2006 to present day planning for building demolition. Attachment 2, Technical Basis Document, HDP-TBD-HP-504, Rev. 0, *"Assessment of Conditions During Process Building Demolition,"* provides an update to the estimate of potential internal exposure from air emissions, and the current potential for external exposure. Attachment 2 also provides an explanation of engineering and administrative control measures to be used to mitigate potential adverse effects, and summarizes the monitoring plans for the building demolition effort.

Attachment 3, Technical Basis Document, HDP-TBD-WM-902, Rev. 0, *"Building Demolition Debris Volume and Weight Estimate,"* and Attachment 4, Technical Basis Document, HDP-TBD-WM-901, Rev. 0, *"Scaling Factors for Radioactive Waste Associated with the Process Buildings,"* are also attached. These documents provide the technical basis for certain

Attachment 2 input assumptions, including the physical and radiological characteristics of the buildings that were used as input to the exposure estimate.

If you have questions or comments regarding this submission, please contact Gerard Couture at (803) 647-2045.

Sincerely,

E. Kurt Hackmann
Director, Hematite Decommissioning Project

Attachments:
1) "Clarification of Amendment 52 Source Documents for Current Building Demolition"
2) Hematite Decommissioning Project, Technical Basis Document, HDP-TBD-HP-504, Revision 0, "Assessment of Conditions during Process Building Demolition"
3) HDP-TBD-WM-902, Revision 0, "Building Demolition Debris Volume and Weight Estimate"
4) HDP-TBD-WM-901, Revision 0, "Scaling Factors for Radioactive Waste Associated with the Process Buildings"

cc:
J. J. Hayes, NRC/FSME/DWMEP/DURLD
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G. F. Couture, Westinghouse

ATTACHMENT 1

Clarification of Amendment 52 Source Documents for Current Building Demolition

References:

1 Westinghouse (K. A. Craig) letter to NRC (A. Kouhestani), dated October 5, 2004, "Request for Amendment to Chapter 1 of SNM-33," ADAMS No. ML042860234
2 Westinghouse (E. K. Hackmann) letter to NRC (Document Control Desk), HEM-09-121, dated October 23, 2009, "Hematite Decommissioning Project Summary Report of the 2009 Process Building Characterization," ADAMS No. (not available)
3 Westinghouse (E. K. Hackmann) letter to NRC (Document Control Desk), HEM-09-141, dated December 16, 2009, "Review of the Technical Basis for NRC Approval of Hematite License Amendment 52 for Building Demolition," ADAMS No. (not available)
4 Westinghouse (K. A. Craig) letter to NRC (A. Kouhestani), HEM-04-342, dated December 22, 2004, "Submittal of Building Demolition Evaluation," ADAMS No. ML050250347
5 Westinghouse (T. D. Chance) to NRC (Document Control Desk), HEM-06-13, dated January 31, 2006, Response to NRC Request for Additional Information (TAC No. L52641)," ADAMS No. ML060330438
6 Westinghouse (T. D. Chance) letter to Document Control Desk (NRC), HEM-06-24, dated March 17, 2006, "Response to NRC Request for Additional Information for Review of the Hematite Former Fuel Cycle Facility – Building Demolition Amendment Request (TAC No. L52641)," ADAMS No. ML060800265
7 Westinghouse (E. K. Hackmann) letter to NRC (Document Control Desk), HEM-10-8, dated January 27, 2010, "Hematite Decommissioning Project, Process Buildings Activities Safety Reports," ADAMS No. (not available)
8 Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-09-140, dated December 3, 2009, "Hematite Decommissioning Project Criticality Alarm Exemption Request," ADAMS No. (not available)
9 NRC (L. W. Camper) letter to Westinghouse (E. K. Hackmann), dated March 17, 2010, "Exemption Request from the Requirements of 10 CFR 70.17(a) for a Criticality Monitoring System in Accordance With 10 CFR 70.24(a) at the Hematite Site," ADAMS No. (not available)

Introduction

In October 2004, Westinghouse submitted a license amendment request to the NRC for building demolition (Reference 1). Westinghouse also submitted several supporting documents over the ensuing months which were used as references in the NRC's Safety Evaluation Report (SER) and approval of the requested license amendment; i.e., Amendment 52, dated June 30, 2006.

In light of the 2009 radiological characterization of the Hematite process buildings (Reference 2), which more accurately estimated the residual Special Nuclear Material (SNM) in the buildings, and the long passage of time since the NRC's Amendment 52 approval to demolish the buildings, Westinghouse submitted a review of the basis for Amendment 52 (Reference 3) to evaluate the statements of the SER and its conclusions of almost four years ago. During review of the basis for Amendment 52, NRC staff has requested a more in-depth evaluation to clarify the current validity of the amendment's source documents, which is the purpose of this document.

The information supporting the original request for authorization of building demolition included an Environmental Report (Reference 1), a technical evaluation of building demolition activities (Reference 4), and answer to several questions the NRC had concerning environmental monitoring (Reference 5) and criticality safety (Reference 6). The current differences in the information provided in each of these references, including those resulting from the residual SNM from the 2009 radiological characterization of the process buildings, are clarified below. Inconsequential differences are not explicitly identified (e.g., while HDP policies and procedures which were referenced in the 2004 – 2006 source documents have been revised over the years, the revisions were approved in accordance with HDP's safety programs as required by the license, and the differences in the revisions from those referenced in the source documents are inconsequential for the present purpose).

Evaluation of Supporting Documents

A. Environmental Report

The letter that submitted the initial license amendment request for building demolition (Reference 1) also provided a corresponding Environmental Report. The following clarifies the current differences from the information provided in the Environmental Report, including those resulting from the residual SNM reported in the 2009 radiological characterization of the process buildings. Table 1 provides the results of our evaluation of the Environmental Report, by section.

- There has been significant progress in Hematite's dealings with the State of Missouri over the ensuing years. The need for NRC's authorization for the demolition of buildings is still valid.
- While HDP still requests authorization to demolish all the buildings, some of the buildings may not initially be demolished prior to Decommissioning and some may remain following license termination.
- The currently remaining equipment items to be removed from the process buildings prior to demolition are identified in Reference 7.
- Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
- The Environmental Report adequately described the affected environment associated with building demolition.
- There still are no definite future land use plans developed for the site.
- The transportation description for the facility area remains valid, with the exception of the railroad improvement at the Hematite site identified below.
- As noted in the Westinghouse review of the basis for Amendment 52 (Reference 3), installation of a railroad spur at the Hematite facility was completed in 2009 to provide an alternative means for transport of waste to an approved disposal facility. HDP is also

pursuing use of the U.S. Ecology's Idaho facility for an alternate waste disposal destination.

- The only transportation impact difference is the reduced impact in light of the railroad improvement which would reduce truck traffic.
- The current license restrictions continue to preclude subsurface excavation and slab removal, which are not a part of building demolition.
- Attachment 2 of the accompanying letter (Hematite Decommissioning Project, Technical Basis Document, HDP-TBD-HP-504, Revision 0, "Assessment of Conditions during Process Building Demolition,") provides a calculation of potential dose from air emissions in consideration of the recent characterization of current radionuclide inventory. The calculated dose does not alter the previous conclusions regarding air quality impacts from building demolition.
- Specific internal and external dose estimates have been calculated for the building demolition effort in light of the current radionuclide inventory. Attachment 2 of the accompanying letter provides the detailed calculations, which do not alter the previous conclusions regarding radiological impacts from building demolition.

B. Evaluation for Building Demolition

Reference 4 submitted an evaluation performed for building demolition in 2004. The following clarifies the current differences from the information provided in the 2004 evaluation for building demolition, including those resulting from the residual SNM reported in the 2009 radiological characterization of the process buildings. Table 2 provides the results of our evaluation of the 2004 Building Demolition Evaluation.

- While Westinghouse still requests authorization to demolish all the buildings, some of the buildings may not initially be demolished and some may remain following license termination.
- The currently remaining equipment items to be removed from the process buildings prior to demolition are identified in Reference 7.
- Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
- Subsequent to the 2004 evaluation for building demolition, Westinghouse submitted further information regarding environmental monitoring, as discussed herein.
- Specific internal and external dose estimates have been calculated for the building demolition, effort in light of the current radionuclide inventory. Attachment 2 of the accompanying letter (Hematite Decommissioning Project, Technical Basis Document, HDP-TBD-HP-504, Revision 0, "Assessment of Conditions during Process Building Demolition,") provides the detailed calculations, which do not alter the previous conclusions regarding radiological impacts from building demolition.
- Attachment 2 of the accompanying letter provides a calculation of potential dose from air emissions in consideration of the recent characterization of current radionuclide

inventory. The calculated dose does not alter the previous conclusions regarding air quality impacts from building demolition.

- Reference 8 thoroughly evaluated the criticality safety considerations for building demolition, including the difference in SNM inventory from that originally assumed in the SER. Reference 8 concluded that a criticality accident associated with the building demolition is not credible.

C. Environmental Monitoring and Control

In January 2006 Westinghouse submitted responses to NRC questions and a revised plan for environmental monitoring during building demolition (Reference 5). With the following exception, that document describes the environmental monitoring and control planned during building demolition:

- The amount of SNM in the process buildings is more accurately estimated in the 2009 radiological characterization of the process buildings. The additional amount of SNM over that assumed in the SER does not change the environmental monitoring and control conclusions of the SER.

D. Response to SNM Inventory Questions

In Reference 6, Westinghouse responded to an NRC request for additional information of March 2, 2006, concerning the amount of SNM in the process buildings. The NRC relied upon this information in Section 7 of the June 30, 2006, SER. Westinghouse's December 2009 review of the basis for Amendment 52 (Reference 3) thoroughly evaluated this section of the SER, and that evaluation is not reiterated here. In Reference 9 the NRC recently approved in part Westinghouse's December 2009 criticality monitoring system exemption request (Reference 8). The approval was limited to the current quiescent condition and D&D operations in the process buildings, but did not include building demolition and other site areas and activities. Therefore, Westinghouse reiterates its Reference 8 request for a criticality monitoring system exemption for building demolition and other site areas and activities.

Conclusion

Westinghouse concludes that the NRC License Amendment 52 authorization for building demolition continues to remain valid for the Hematite facility, even with the passage of time and the SNM as reported the Reference 2 radiological characterization of the process buildings. Westinghouse reiterates its Reference 8 request for a criticality monitoring system exemption for building demolition and other site areas and activities.

Table 1
Environmental Report (Reference 1) Evaluation

Sect. No.	Title	Clarification of Current Differences
1.0	Introduction	There has been significant progress in Hematite's dealings with the State of Missouri over the ensuing years. The need for NRC's authorization for the demolition of buildings is still valid.
1.1	Purpose and Need for the Proposed Action	None*
1.2	The Proposed Action	While HDP still requests authorization to demolish all the buildings, some of the buildings may not initially be demolished prior to Decommissioning and some may remain following license termination.
		The currently remaining equipment items to be removed from the process buildings prior to demolition are identified in Reference 7.
		Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
1.3	Applicable Regulatory Requirements, Permits, and Required Consultations	None
2.0	Alternative to the Proposed Action	None
3.0	Description of the Affected Environment	The Environmental Report adequately described the affected environment associated with building demolition.
3.1	Land Use	None
3.1.1	Regional Setting	None
3.2.1	Hematite Former Fuel Cycle Facility	None
3.1.3	Land Use Plans	There still are no definite future land use plans developed for the site.

* "None" indicates there are either no differences in current building demolition plans from those described in the source document, or the differences are inconsequential for the present purpose.

Sect. No.	Title	Clarification of Current Differences
3.2	Transportation	None
3.2.1	Hematite Facility Area	The transportation description for the facility area remains valid, with the exception of the railroad improvement at the Hematite site identified below.
3.2.2	Waste Transportation Routes	As noted in the Westinghouse review of the basis for Amendment 52 (Reference 3), installation of a railroad spur at the Hematite facility was completed in 2009 to provide an alternative means for transport of waste to an approved disposal facility. HDP is also pursuing use of the U.S. Ecology's Idaho facility for an alternate waste disposal destination.
3.3	Geology, Soils and Seismology	None
3.4	Water Resources	None
3.4.1	Surface Water Discharge	None
3.4.2	Groundwater	None
3.5	Ecological Resources	None
3.6	Metrology, Climatology, and Air Quality	None
3.6.1	Metrology and Climatology	None
3.6.2	Air Quality	None
3.7	Noise	None
3.8	Historic and Cultural Resources	None
3.8.1	regional History	None
3.8.2	Site History	None
3.9	Visual/Scenic Resources	None
3.10	Socioeconomics	None
3.11	Public and Occupational Health	None
3.12	Waste Management	None
3.12.1	Liquid Waste	None
3.12.1	Solid Waste	None
4.0	Environmental Impacts	None

Sect. No.	**Title**	**Clarification of Current Differences**
4.1	Land Use Impacts	None
4.2	Transportation Impacts	The only transportation impact difference is the reduced impact in light of the railroad improvement which would reduce truck traffic.
4.3	Geology and Soils Impacts	The current license restrictions continue to preclude subsurface excavation and slab removal, which are not a part of building demolition.
4.4	Water Resources Impacts	None
4.5	Ecological Resources Impacts	None
4.6	Air Quality Impacts	Attachment 2 of the accompanying letter (Hematite Decommissioning Project, Technical Basis Document, HDP-TBD-HP-504, Revision 0, "Assessment of Conditions during Process Building Demolition,") provides a calculation of potential dose from air emissions in consideration of the recent characterization of current radionuclide inventory. The calculated dose does not alter the previous conclusions regarding air quality impacts from building demolition.
4.6.1	Mitigation Measures	None
4.6.2	Monitoring	None
4.7	Noise Impacts	None
4.8	Historic and Cultural Resources Impacts	None
4.9	Visual/Scenic Resources Impacts	None
4.10	Socioeconomic Impacts	None
4.10.1	Environmental Justice	None
4.11	Public and Occupational Health Impacts	None
4.11.1	Radiological Impacts	Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
		Specific internal and external dose estimates have been calculated for the building demolition effort in light of the current radionuclide inventory. Attachment 2 of the

Sect. No.	**Title**	**Clarification of Current Differences**
		accompanying letter provides the detailed calculations, which do not alter the previous conclusions regarding radiological impacts from building demolition.
4.11.2	Non-radiological Impacts	None
4.11.3	Mitigation Measures	None
4.11.4	Summary of Proposed Action Impacts	None
4.12	Waste Management Impacts	None
4.12.1	Sanitary Waste	None
4.12.2	Clean Debris	None
4.12.3	Low Level Radioactive Waste ACM	None
4.12.4	Low Level Radioactive Waste Solids	None
4.12.5	LLRW Liquids	None
4.12.6	PCB Waste	None
4.12.7	Hazardous Waste	None
4.12.8	Mixed Waste	None
4.12.9	Investigative derived Waste (IDW)	None
4.12.10	Management of Hazardous Waste Containers	None
4.12.11	Management of Tanks	None
4.12.12	Waste Minimization	None
4.12.13	Waste Segregation	None
4.12.14	Requirements for Hazardous/Radioactive Waste Storage	None
5.0	Mitigation Measures	None

Sect. No.	Title	Clarification of Current Differences
6.0	Environmental Measurements and Monitoring Programs	None
7.0	Cost Benefit Analysis	None
8.0	Summary of Environmental Consequences	None
8.1	Land Use Impacts	None
8.2	Transportation Impacts	None
8.3	Geology and Soils Impacts	None
8.4	Water Resources Impacts	None
8.5	Ecological Resources Impacts	None
8.6	Air Quality Impacts	None
8.7	Noise Impacts	None
8.8	Historic and Cultural Resources Impacts	None
8.9	Visual/Scenic Resources Impacts	None
8.10	Socioeconomic Impacts	None
8.11	Public and Occupational Health Impacts	None
8.12	Waste Management Impacts	None
9.0	List of References	None
10.0	List of Preparers	None

Table 2
Building Demolition (Reference 4) Evaluation

Sect. No.	Title	Clarification of Current Differences
1.0	Introduction	None
2.0	Description of Work to be Completed	While Westinghouse still requests authorization to demolish all the buildings, some of the buildings may not initially be demolished and some may remain following license termination.
		The currently remaining equipment items to be removed from the process buildings prior to demolition are identified in Reference 7.
		Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
	Permitting	None
	Environmental Monitoring	Subsequent to the 2004 evaluation for building demolition, Westinghouse submitted further information regarding environmental monitoring, as discussed herein.
3.0	Current Status	None
4.0	Is this Work Scope within previous work performed under the License?	None
5.0	Will the work involve radiation exposures to workers that are higher than encountered during operations?	Specific internal and external dose estimates have been calculated for the building demolition, effort in light of the current radionuclide inventory. Attachment 2 of the accompanying letter (Hematite Decommissioning Project, Technical Basis Document, HDP-TBD-HP-504, Revision 0, "Assessment of Conditions during Process Building Demolition,") provides the detailed calculations, which do not alter the previous conclusions regarding radiological impacts from building demolition.
		The currently remaining equipment items to be removed from the process buildings prior to demolition are identified in Reference 7.
		Waste characterization will be performed as appropriate for waste disposal purposes in accordance with approved procedures.
6.0	Will the work involve effluent releases higher than routine effluents during operations?	Attachment 2 of the accompanying letter provides a calculation of potential dose from air emissions in consideration of the recent characterization of current radionuclide inventory. The calculated dose does not alter the previous conclusions regarding air quality impacts from building demolition.
7.0	Does this work involve nuclear	Reference 8 thoroughly evaluated the criticality safety considerations for building demolition, including the difference in

Sect. No.	**Title**	**Clarification of Current Differences**
	criticality safety considerations?	SNM inventory from that originally assumed in the SER. Reference 8 concluded that a criticality accident associated with the building demolition is not credible.
8.0	Conclusions	None

ATTACHMENT 2

Assessment of Conditions During Process Building Demolition

HDP-TBD-HP-504, Revision 0

Westinghouse Non-Proprietary Class 3

Westinghouse

Hematite Decommissioning Project
Technical Basis Document

NUMBER: **HDP-TBD-HP-504**

TITLE: **ASSESSMENT OF CONDITIONS DURING PROCESS BUILDING DEMOLITION**

REVISION: **0**

Prepared By / Date: Joseph Guido / 3-11-10

Reviewed By / Date: Allison Wilding / 3-11-10

Approved By / Date: Gerald Rood / 3/11/10

REVISION LOG	
Revision #	**Change(s)**
0	Initial Issue

1.0 INTRODUCTION

This document provides a description of the current conditions that differ from those described in SNM-00033 License Amendment 52 that initially authorized demolition of the Process Buildings at the Hematite Fuel Fabrication Facility. In consideration of the differing conditions, an evaluation of the potential for airborne emissions during building demolition and handling of demolition debris, and the measures to be implemented that will mitigate adverse impact on decommissioning workers and members of the public are included in this document.

2.0 DIFFERING CONDITIONS

The most significant difference is the most recent estimate of the amount of uranium oxide (UO_2) that remains as residual contamination within the Process Buildings. The current estimate indicates that the amount of $_{235}U$ present on surfaces and within some of the remaining equipment is approximately 8.7 kg rather than approximately 0.25 kg as previously understood. Following the removal of additional equipment as described in the *NSA-TR-09-25, Nuclear Criticality Safety Assessment of Decontamination and Decommissioning Operations within the Former Process Buildings at the Hematite Site* (Reference 8.1), approximately 7.6 kg $_{235}U$ will remain distributed on surfaces and within equipment at the time of demolition.

A second condition is the current plan to remove certain components containing residual UO_2 prior to conducting demolition. The estimate of the amount of $_{235}U$ associated with these components is approximately 1.1 kg. In consideration of the conclusions of Reference 8.1 that showed no credible scenario for a nuclear criticality, the purposes for removing these components are to reduce the potential for the spread of radioactive contamination during demolition, and to segregate these components from the balance of the debris from the perspective of waste management.

A third condition is the presence of potentially more equipment within the Process Buildings at the time of demolition than had been previously understood. In consideration of the information obtained during the extensive radiological characterization that was conducted in 2009 (Reference 8.1), the presence of this additional equipment (less the equipment referenced above for removal) poses no significant adverse consequence from the perspectives of nuclear criticality safety, radiation protection, occupational safety or environmental protection.

3.0 EVALUATION OF POTENTIAL FOR AIR EMISSIONS

A prospective estimate of the amount of airborne radioactive particulate matter that may be released to air during building demolition has been prepared. This estimate is based on the most recent information regarding the amount of UO_2 that will remain within the buildings at the time of demolition and conservative assumptions regarding the amount of UO_2 that could be released to air. The following sections provide a summary of the methods used to prepare this estimate.

3.1 Inputs and Assumptions

3.1.1 The uranium inventory from Reference 8.1 was adjusted to account for material which will be removed prior to building demolition, as shown in Table 1.

Table 1, Process Building $_{235}$U Mass Inventory (grams)

	Area				
Location	**1**	**2**	**3**	**4**	**5**
(Equipment)	16	8	357	21	2
(Piping)	0	0	68	410	152
(Misc. Components / Items)	63	8	308	64	290
Subtotal:	79	16	733	495	444
(Walls and Ceilings Combined)	104	57	196	135	126
(Roof)	631	360	680	941	167
Subtotal:	735	417	876	1,076	293
Concrete Slabs Subtotal:	896	254	977	629	758
Current Total Inventory:	**1,710**	**687**	**2,586**	**2,200**	**1,495**
To be Removed Prior to Demolition:	**44**	**0**	**269**	**473**	**329**
Inventory At Demolition:	**1,666**	**687**	**2,317**	**1,727**	**1,166**

3.1.2 The mass of the process building structure and internal components (including roof) was calculated in *HDP-WM-TBD-902, Building Demolition Debris Volume and Weight Estimate*. (Reference 8.2) and is shown below in Table 2.

Table 2, Process Building Structure and Component Mass (grams)

Area	Total Weight
Area 1	7.52E+08
Area 2	5.49E+08
Area 3	1.21E+09
Area 4	6.32E+08
Area 5	3.37E+08
Total	**3.48E+09**

3.1.3 The derived air concentration (DAC) for occupational exposure and the acceptable air concentration for members of the public are those listed in 10 CFR 20, Appendix B, Tables 1 and 2, respectively.

Table 3, DAC and Air Effluent Limit Values Used in Exposure Assessment

Nuclide	DAC (μCi/ml)	Air Effluent Limit (μCi/ml)
Total U	2E-11	5E-14

3.1.4 The radionuclide concentration of the above-grade features that are planned for demolition were adjusted to also include the contribution from the radionuclide inventory associated with the building slabs (3.514 kg) as calculated in Reference 8.1. Although the building slabs will remain in place, some amount of surface abrasion may occur during building demolition, and therefore it was conservatively assumed that 100 percent of radionuclide inventory of the building slab will be released during demolition.

3.1.5 The interior surfaces of the Process Buildings and equipment have been coated with an encapsulant. Although the actual amount of removable surface contamination is very low as demonstrated by recent radiological surveys, the total amount of contained radioactivity has been assumed to be in a form that is readily dispersible.

3.1.6 The contributions to the total amount of radioactivity within the buildings from trace amounts of Tc-99, Sr-90, Np-237, Th-230, and Th-232 are based on HDP-WM-TBD-901, *Scaling Factors for Radioactive Waste Associated with the Process Buildings*. (Reference 8.3) These radionuclides were considered for inclusion, however it was determined that the combined contribution to dose would be less than 1 percent and therefore they were not included in calculations.

3.1.7 The use of water mist during demolition is assumed to reduce airborne particulate by a factor of ten (10). This factor was applied to the estimate of offsite airborne concentrations, but was not applied to estimated concentration for project workers. Note that building demolition activities are estimated to occur over a 2 month time frame.

3.1.8 Based on the method of demolition, it is assumed that gaseous emissions and elevated concentrations of radon gas will not be generated.

3.1.9 The airborne concentration in pCi/m^3 was calculated by multiplying the material concentration (pCi/g) by an airborne mass concentration (dust loading) of 5 mg/m^3, which is assumed to be a worst case condition for decommissioning workers within the demolition exclusion area.

3.2 Detailed Calculations

3.2.1 The mass values for $_{235}$U shown in Table 1 were converted to isotopic activities ($_{234}$U, $_{235}$U, and $_{238}$U) based on enrichment to 5 weight-percent $_{235}$U. The results of this calculation are shown in table 4, below.

Table 4, Process Building Structure/Components, Uranium Activity Inventory

Area	U-235	U-235	U-238	U-234	Total U
	grams	pCi	pCi	pCi	pCi
Area 1	7.70E+02	1.69E+09	5.00E+09	3.07E+10	3.74E+10
Area 2	4.33E+02	9.53E+08	2.81E+09	1.73E+10	2.10E+10
Area 3	1.34E+03	2.95E+09	8.69E+09	5.34E+10	6.50E+10
Area 4	1.10E+03	2.42E+09	7.13E+09	4.38E+10	5.33E+10
Area 5	4.08E+02	8.97E+08	2.65E+09	1.63E+10	1.98E+10

3.2.2 The weighted average radionuclide concentration in building materials and equipment above the concrete slab and foundations was calculated using the isotopic uranium activity calculated in step 3.2.1, above, and the building mass values from Table 2. The results of this calculation are shown in Table 5, below.

Table 5, Process Building Structure/Components, Average Uranium Concentration

Area	Total U	Total Weight	Average Specific Activity Total Uranium
	pCi	grams	pCi/g of waste
Area 1	3.74E+10	7.52E+08	50
Area 2	2.10E+10	5.49E+08	38
Area 3	6.50E+10	1.21E+09	54
Area 4	5.33E+10	6.32E+08	84
Area 5	1.98E+10	3.37E+08	59
		Weighted Average	**57**

3.2.3 The $_{235}$U mass value for the process building slab (3.514 kg) was converted to isotopic activities ($_{234}$U, $_{235}$U, and $_{238}$U) based on enrichment to 5 weight-percent $_{235}$U. The results of this calculation are shown in table 6, below.

Table 6, Process Building Slabs, Uranium Activity Inventory

U-235	U-235	U-234	U-238	Total U
grams	pCi	pCi	pCi	pCi
3.5E+03	7.7E+09	1.4E+11	2.3E+10	1.7E+11

3.2.4 The contribution to the process building radionuclide concentration from the radionuclide inventory in the slab was calculated by dividing the radionuclide inventory in Table 6 by the total mass of the process building mass (3.5 x 10^9 g). The results of this calculation are shown in Table 7, below.

Table 7, Process Building Slabs, Average Uranium Concentration

U-235	U-234	U-238	Total U
pCi/g	pCi/g	pCi/g	pCi/g
2.2E+00	4.0E+01	6.6E+00	4.9E+01

3.2.5 The total activity concentration assumed to be available for release was calculated as the sum of the quantities in Table 5 and 7 (57 pCi/g + 49 pCi/g) for a total of 106 pCi/g total Uranium.

3.2.6 Calculations of Air Concentration Within Demolition Work Area

The air concentration within the demolition work zone near the point of generation was calculated based on the assumption that the airborne dust level will be controlled in a manner wherein the levels will not exceed 5 mg/m^3 on average. This level is based on the OSHA limit for nuisance dust, the HDP commitment to MDNR, and expected capability to control fugitive dust. Applying a dust concentration of 5 mg/m^3, the effective air concentrations associated with the radionuclide concentration calculated in section 3.2.5 (106 pCi/g) is calculated as:

$$Air\ \text{Concentration} = 5\,(\frac{mg}{\text{m}^3}) \bullet 106\,(\frac{\text{pCi}}{\text{g}}) \bullet .001(\frac{g}{mg}) \bullet 1x10^{-12}\,(\frac{\mu Ci/ml}{pCi/m^3}) = 5E-13\mu Ci/ml$$

The DAC fraction associated with this air concentration is 0.026 (i.e., 5E-13/2E-11). This value is calculated based on the DAC values listed in section 3.1.3

3.2.7 Calculations of Air Concentration at Demolition Work Area Boundary

Calculations outlined in section 3.2.6 were repeated using a dust loading of 0.5 mg/m^3 in order to assess potential airborne radioactivity levels at the site perimeter. This dust level was selected since it represents the action level for particulate emissions discussed in section 6.1.2. Real time monitoring of particulate emissions (described in section 6.1.2) will allow WEC to measure and adjust engineering and administrative controls to maintain emissions below this level.

$$Air\text{ Concentration} = 0.5\,(\frac{mg}{m^3}) \bullet 106\,(\frac{\text{pCi}}{\text{g}}) \bullet .001(\frac{g}{mg}) \bullet 1x10^{-12}\,(\frac{\mu Ci/ml}{pCi/m^3}) = 5E-14\mu Ci/ml$$

The DAC fraction associated with this air concentration is 0.0026 (i.e., 5E-14/2E-11). This value is calculated based on the DAC values listed in section 3.1.3

3.2.8 Calculations of Peak Air Concentration Values

Air concentrations presented in sections 3.2.6, and 3.2.7 represent bounding emissions estimates under average conditions (i.e., assuming homogeneous mixing of handled materials). In order to establish an understanding of potential peak emissions, these calculations were repeated assuming that the source of dust emissions would be the building location with the highest source concentration (Process Building Room 255, Roof).

3.2.8.1 The mass value for $_{235}$U for Process Building Room 255, Roof (794 g) was converted to isotopic activities ($_{234}$U, $_{235}$U, and $_{238}$U) based on enrichment to 5 weight-percent $_{235}$U. The results of this calculation are shown in table 9, below.

Table 9, Process Building Room 255 Roof, Uranium Activity Inventory

U-235[1]	U-235	U-234	U-238	Total U
grams	pCi	pCi	pCi	pCi
7.9E+02	1.7E+09	3.2E+10	5.2E+09	3.9E+10

[1] 794 grams U-235 is associated with the building 255 roof (Reference 8.2)

3.2.8.2 The radionuclide concentration associated with the Building 255 roof was calculated by dividing the radionuclide inventory in Table 9 by the total mass of the Building 255 roof (1.8×10^8g). The results of this calculation are shown in Table 10, below.

Table 10, Process Building 255 Roof, Average Uranium Concentration

U-235	U-234	U-238	Total U
pCi/g	pCi/g	pCi/g	pCi/g
9.5.E+00	1.7.E+02	2.8.E+01	2.1.E+02

3.2.8.3 The Uranium 235 mass contribution from process building slab during demolition of the Process Building Room 255, Roof was assumed to be 23 percent of the total slab inventory (817 g). This quantity was converted to isotopic activities ($_{234}$U, $_{235}$U, and $_{238}$U) based on enrichment to 5 weight-percent $_{235}$U. The results of this calculation are shown in table 11, below.

Table 11, Process Building Slab Within Room 255, Uranium Activity Inventory

U-235	U-235	U-234	U-238	Total U
grams	pCi	pCi	pCi	pCi
8.2E+02	1.8E+09	3.3E+10	5.3E+09	4.0E+10

3.2.8.4 The contribution to the process building radionuclide concentration from the radionuclide inventory in the slab was calculated by dividing the radionuclide inventory in Table 11 by the total mass of the Building 255 roof (1.8×10^8 g). The results of this calculation are shown in Table 12, below.

Table 12, Process Building Slab Within Room 255, Average Uranium Concentration

U-235	U-234	U-238	Total U
pCi/g	pCi/g	pCi/g	pCi/g
9.8.E+00	1.8.E+02	2.9.E+01	2.2.E+02

3.2.8.5 The total activity assumed to be available for release was calculated as the sum of the quantities in Table 10 and 12 (i.e, 210 pCi/g + 216 pCi/g) for a total of 426 pCi/g total Uranium.

3.2.8.6 Table 13, below presents the calculated peak air concentration results based on potential emissions during demolition of the Process Building Room 255, Roof.

Table 13, Peak Radionuclide Air Concentrations Projected During Demolition

Location	Dust Concentration (mg/m3)	Total U (μCi/ml)
Within Demolition Area	5	2.1E-12
Within Perimeter Fence	0.5	2.1E-13

All above described scenarios are within the 10 CFR 20, Appendix B criteria of Table 1.

3.2.9 Calculation of Offsite Air Concentrations

Offsite impact from demolition of the process building was calculated using the source inventory presented in reference 8.1 and assuming a release fraction of 1E-04 which was based on recommendations contained in reference 8.5.

Component activities ($_{234}$U and $_{238}$U) associated with the process building $_{235}$U source term at the time of demolition (7,562 g) was first calculated based on an enrichment to 5 weight-percent $_{235}$U. This results in activity components as follows:

Table 14, Total Process Building Source Term

U-235	U-235	U-234	U-238	Total U
grams	pCi	pCi	pCi	pCi
7.6E+03	1.7E+10	3.0E+11	4.9E+10	3.7E+11

Based the stated release fraction (1E-04), demolition duration of 2 months (1.2E6 seconds), and a source term reduction factor assumed to be a factor of 10 for the application of high pressure water misting during demolition, the effective source release rate is 3.2 pCi/s. Using χ/Q values calculated with CAP88-PC using metrology data for St. Louis, MO, the air concentration was calculated at the site perimeter boundary closest the demolition site (State Road P); the nearest offsite resident (250 meters west of the site); and the nearest onsite resident (500 meters northeast of the site). The estimated air concentrations at these three locations are 1.4E-15 µCi/ml; 1.1E-16 µCi/ml; and 2.0E-17 µCi/ml, respectively. These values are equivalent to 0.03, 0.002, and 0.0004 times the 10 CFR 20, Appendix B, Table 2 criteria. Without consideration of the water mist, the air concentration could be a factor of 10 higher. Nonetheless, these values are well within the 10 CFR 20, Appendix B criteria of Table 2 (even without consideration of the water mist). Perimeter air sampling for particulate matter, and particulate sampling for subsequent radioactivity analysis will be performed to confirm the effectiveness in controlling air concentrations to levels that do not exceed the values in 10 CFR 20, Appendix B.

The CAP88-PC calculation for offsite air concentration described above was also benchmarked using Hotspot (version 2.07) operating in a general resuspension mode. The process building demolition area was modeled as a single diffuse source with an effective emission rate of 3.2 pCi/s. Based on a wind speed of 4 m/s (Reference 8.6) calculated centerline air concentration at a distance of 250 m is 6.4E-17 µCi/ml and 1.1E-16 µCi/ml for stability class B and C, respectively. These values compare favorably calculated for that output with the CAP88-PC program.

As a final assessment of potential short term emissions concentrations at the site boundary, the method of calculation used in section 3.2.6 and 3.2.7 was repeated using a dust loading of 0.15 mg/m^3. This dust level was selected since it represents the NAAQS for PM$_{10}$ as discussed in section 6.1.2 and, as such represents the dust level at which HDP must make measures to control emissions such as to reduce them below this level.

$$Air\ \text{Concentration} = 0.15(\frac{mg}{\text{m}^3}) \bullet 106(\frac{\text{pCi}}{\text{g}}) \bullet .001(\frac{g}{mg}) \bullet 1x10^{-12}(\frac{\mu Ci/ml}{pCi/m^3}) = 1.6E-14\ \mu Ci/ml$$

This value represents 0.32 times the 10 CFR 20, Appendix B, Table 2 criteria.

4.0 EVALUATION OF POTENTIAL FOR EXTERNAL EXPOSURE

An evaluation of the potential external dose to individuals handling demolition debris was conducted using the MicroShield model. Exposure rates at 1 foot from a gondola car containing material with source term as calculated in section 3.2.1 is 0.3 μR/hr. Based on two month duration for the demolition activity, the maximum external exposure that an individual could receive would be 0.1 millirem assuming exposure for 320 hrs at 1 foot from a loaded railcar.

5.0 MEASURES TO MITIGATE POTENTIAL ADVERSE AFFECTS

Controls include engineered and administrative measures to reduce the potential for air emissions. Engineered controls will be implemented by meeting prerequisites and by instructions to workers in the work package. Administrative controls such as the methods to measure concentrations in the workplace and at the site boundary will be implemented through instructions in the radiation work permit. The method to evaluate the results of sampling, and the appropriate actions in the event of concentrations that exceed the action level are implemented through procedures.

5.1 Engineered Controls

5.1.1 Lockdown Agent

The surfaces within the buildings, including the interior and exterior surface of the contained equipment were coated with a non-toxic chemical at the conclusion of the previous equipment removal work in 2006. The chemical agent served to bind radioactive contamination to the surface, and based on the results of recent radiological surveys, continues to be an effective method to control contamination in the current configuration. During demolition and material handling it is expected that dust will be generated, particularly during demolition work involving concrete block or reinforced concrete. Based on the method of demolition, it is reasonably assumed that the particulates generated in these activities will include a high fraction, by weight, of large particles (i.e., aerodynamic diameter greater than 10 microns). Except on during periods of high wind, the majority of the particulate matter would be expected to settle from the air within a short distance of the point of generation.

5.1.2 Water Application

Water sprays will be used to wet down concrete block and reinforced concrete walls immediately prior to demolition, during the actual demolition and when handling debris as needed during sizing, sorting, and loading operations.

Water will be applied by hoses using high-pressure nozzles or by entrainment at high pressure into the discharge flowpath of a large fan. Either method is capable for creating a fog or fine mist that coats the surfaces of particulates and removes them from air. These methods of application serve to minimize the volume of water that is required and thus minimize the amount of water that requires collection and processing. Water spraying will also be the primary method to control dust from unpaved on-site access and work roads, using either a water truck or hoses with high-pressure nozzles to wet down such roads, as required.

The objective is to apply sufficient water to control dust generation by achieving saturation or near-saturation conditions at the surface of porous materials but not in such excess quantities as to create appreciable surface water runoff or free liquids associated with the waste being loaded. Weather conditions (e.g., precipitation, wind speed, solar radiation, and temperature) as well the characteristics of the surfaces being wetted (e.g., painted versus unpainted materials, concrete block versus reinforced concrete) significantly affect water application rates. Water application procedures and effectiveness will heavily rely on the expertise and experience of the trained work force.

5.1.3 Other Engineered Controls

In addition to water application, other dust control measures will be employed. These measures include, but are not limited to the following:

- Covering stockpiled materials or laydown area with plastic sheeting or tarps during any extended periods of inactivity;
- Covering or closing transportation containers once they are loaded; Transporting materials off-site in enclosed or covered containers; and
- Restricting the on-site movement of over-the-road transportation vehicles to paved roadway and staging areas.

5.2 Administrate Controls to Mitigate Potential Adverse Affects

5.2.1 Work Practices

Demolition of the site buildings in a manner that minimizes and controls fugitive dust emissions will, in large part, rely on the development and implementation of effective, common sense work practices and then training the work force to understand and implement these practices.

Supervisory personnel will evaluate work activities on an ongoing basis and limit or modify work activities, as needed, based on weather conditions and other factors. For example, on dry days with strong winds or with winds blowing from the south across the site toward State Road P, operations with high dust potential (e.g., knocking down concrete block walls) may need to be modified or curtailed. In contrast, operations with higher dust-generation potential can be effectively carried out on days with light rain and/or light winds.

5.2.2 Action Levels Based on Air Concentration

Action levels are established to define the point at which work activities must be adjusted and measures taken to assure that air emissions are not exceeding regulatory requirements. For building demolition, action levels will be both qualitative and quantitative. If either the qualitative or quantitative action level is exceeded, efforts for dust control (e.g., watering) will be intensified, and additional dust control measures enacted (e.g., covering stockpiles). For fugitive dust, the qualitative action level is designed for compliance with the MDNR regulation regarding fugitive dust from demolition operation (10 CSR 10-6.170). If at any time visible emissions are observed leaving the work area and traveling downwind toward the property boundaries, supervisory personnel will modify or curtail work activities as needed until measures can be taken to ensure that fugitive dust emissions are not migrating beyond the premises of origin in quantities that: 1) the particulate matter may be found on surfaces beyond the property line of origin; or 2) the particulate matter emissions are visible in the ambient air beyond the property line.

The quantitative action level standard for airborne particulates is based on protecting ambient air quality and will be set at 500 micrograms per cubic meter ($\mu g/m^3$) over a 15-minute averaging time, as measured by real-time aerosol monitors located downwind of work areas between these work areas and the fence surrounding the Central Tract Area (Section 6.1.2). These real-time monitors will be used to determine the concentration of airborne particulate matter with an aerodynamic diameter of 10 microns (PM_{10}). A concentration of 500 $\mu g/m^3$ over a 15-minute averaging time is a conservative action level for compliance with the NAAQS for PM_{10}, which is set at 150 $\mu g/m^3$ averaged over 24 hours.

In addition to the stationary environmental monitoring locations, air monitoring data collected through breathing zone, general area, and additional downwind portable perimeter air monitoring stations will be used to provide a timely assessment of airborne radioactivity levels and to assess the adequacy of the engineering and process controls. This data will be used as the basis for adjustments to controls and work practices, as necessary, to ensure that radiation exposures are maintained ALARA.

6.0 MONITORING

6.1.1 Radiological Monitoring

Workplace air sampling shall be performed to comply with 10 CFR 20.1501 and to enable appropriate work controls so radiation exposure and radiological effluents are as low as reasonably achievable (ALARA). Sampling shall be performed as necessary to measure concentrations of airborne radioactivity in the work place, to estimate the corresponding internal exposure, to gauge the effectiveness of engineered controls to minimize airborne radioactivity, and to serve as a comparator to the regulatory limits and administrative action levels for concentrations in air effluents.

The extent of occupational exposure to airborne radioactivity shall be assessed using the Derived Air Concentration (DAC) values specified in 10 CFR 20 Appendix B, "Annual

Limits on Intake and Derived Air Concentrations of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage." The DAC may be based on the most conservative radionuclide present or on a calculation weighting the radionuclides. As Uranium (Class Y) is conservatively assumed to be the predominant radionuclide contributing to dose, the occupational DAC values most relevant to HDP are 2.0 E-11 μCi/ml.

Work place sampling shall be performed when airborne radioactivity concentrations are likely to exceed 2 percent of the occupational DAC values in general areas. Sampling that is representative of the concentrations within the breathing zone shall be performed when airborne radioactivity concentrations are likely to exceed 10 percent of the occupational DAC values in the breathing zone, or when airborne radioactivity concentrations are likely to exceed 2 percent of the occupational DAC values in the breathing zone of a declared pregnant female. Sampling shall also be performed when respirators are worn for the purpose of protecting individuals from exposure to airborne radioactivity.

6.1.1.1 External Dosimetry

Although monitoring for external exposure is not required by regulation, the HDP has conservatively elected to implement a program that includes provisions for monitoring occupational exposure to beta, gamma and neutron radiation for those personnel who routinely handle radioactive materials. Based on future decommissioning experience and additional information regarding the nature of the radioactive source term, the HDP may discontinue the external dosimetry program provided the actual conditions support that determination.

6.1.1.2 Personal Air Sampling

When monitoring is required for the purpose of determining occupational exposure, sampling is accomplished through the use of a personal air sampler (lapel pump), or a portable low volume air sampler. The personal air sampler is the preferred method because the filter cartridge can be easily located within approximately 12 inches of the worker's head during sample collection, increasing the probability of being representative of the concentration in the worker's breathing zone.

6.1.1.3 General Area Air Sampling

General area sampling is performed when work activities are likely to cause airborne concentrations in excess of 2 percent of an occupational DAC value. The samples are collected using a portable low volume air sampler, and the results of sampling are used to establish the requirements for posting and controls, for assessing the effectiveness of engineered controls, or for assessing the effectiveness of contamination controls. The sample data from GA air samples may be used for DAC-hour tracking if determined to be representative of the airborne concentrations breathed by the worker.

6.1.1.4 Perimeter Air Sampling

Perimeter air sampling is an element of the environmental monitoring program and is performed when work activities are likely to cause airborne concentrations at the work area boundary in excess of 10 percent of the air concentration values listed in 10 CFR 20, Appendix B, Table 2. The samples are collected using a portable low volume air sampler. The number and location(s) of the perimeter air sampler(s) shall be selected with consideration for the location and nature of the work activities, and environmental conditions such as wind direction.

6.1.1.5 Environmental Air Sampling

Westinghouse continues to conduct air sampling at four environmental area sampling stations located around the perimeter of the Central Tract as follows:

- AS-1: North of the site, north of State Road P at the electrical substation;
- AS-2: Southeast corner of the site near the Site Pond;
- AS-3: North-northeast of site near former Burial Pit area; and
- AS-4: North side of site adjacent to entrance at State Road P.

This sampling network provides radial symmetry around the facility taking into account the natural terrain features and building locations and maintains the continuity of the historical data. Station AS-4 is situated between the facility and nearest residence and is in one of the predominant downwind directions.

The environmental area sampling is conducted using moderate-volume pumps (i.e., 30 to 40 liters per minute) to draw samples through particulate filters. The filters are changed weekly and analyzed for gross alpha and gross beta activity. The Environmental Monitoring Plan (Reference 8.7) includes provisions for isotopic analysis if the results of the gross alpha and gross beta activity show elevated levels.

6.1.2 Particulate Monitoring

During demolition, particulate monitoring will be conducted using a combination of fixed and moveable real-time aerosol monitors. The use of a combination of sampling tools will provide data that allows comparisons to achieve the following:

- Demonstrate compliance with the MDNR regulation regarding fugitive dust from demolition operation (10 CSR 10-6.170);
- Confirm that site-related particulate emissions are not contributing to exceedences of NAAQS; and
- Support worker health and safety protection monitoring.

Four movable continuous aerosol monitors will be used to provide real-time data near the work area. These real-time aerosol monitors will be battery-powered and mounted on moveable tripods with the air intake at a height approximating the breathing zone. On a daily basis, prior to commencing site activities, these monitors will be positioned proximal to work areas, including buildings being actively dismantled, areas where demolition scrap and debris are being sorted and sized, and the area where transportation containers are being loaded. The locations of the monitors will be established each morning depending on the predominant wind direction at the start of the day's activities and that predicted for the day. If the wind direction shifts radically during the workday, the particulate meters will be relocated.

These meters use light scattering photometry sensing techniques to continuously determine the particulate concentration. The monitors will be outfitted with size-selective inlets for the determination PM_{10} concentrations and with audible and visual alarms that will activate if the PM_{10} concentration over a 15-minute averaging time exceeds 500 $\mu g/m^3$. Actions to be taken in the event of an alarm are described in Section 5.2.

In addition to the four movable aerosol monitors, two aerosol monitors will be installed at fixed locations at the site boundary. The selection of these fixed locations will be based on predominate wind direction and location of potential off-site receptors. These real-time monitors will be used to determine the concentration of airborne particulate matter with an aerodynamic diameter of 10 microns (PM_{10}) and ensure compliance with the NAAQS for PM_{10}, which is set at 150 $\mu g/m^3$ averaged over 24 hours at the site boundary.

7.0 SUMMARY

A summary of the conditions that differ from those described in License Amendment 52 has been presented. Based on the most significant difference, (i.e., a greater inventory of UO^2), a conservative prospective estimate of airborne emissions from demolition of the Process Building has been presented. The estimate was based on the assumption that primary route of exposure would be from the resuspension and transport of contaminated dust. Onsite air concentrations were calculated based on the assumption that airborne dust would be present at 5 mg/m^3, and 0.5 mg/m^3 inside the demolition work area and at the demolition work area boundary, respectively. Additionally, offsite concentrations were calculated using the CAP-88PC program at the site boundary, and the locations of the nearest on and offsite resident (100m , 250m and 500m).

Results of these calculations are summarized in Tables 15 and 16. As indicated in these tables, the estimate of offsite air concentrations are well below the 10 CFR 20, Appendix B, Air Effluent Limit (AEL) values. Based on an exposure duration of 320 hrs (8 hr/day, 5 day/wk for 8 weeks), the dose to the maximally exposed individual (located 250 m NW) would be 0.006 mrem. The exposure duration is limited to 40 hrs a week to coincide with the anticipated duration of site activities. The estimate based on continuous exposure (24 hr/day, 7 days/wk for 8 weeks) would be 0.024 mrem. The exposure to an individual at the site boundary (road) would be 0.0002 mrem/hr.[1] All of these estimates are below the 10 mrem/yr constraint on air emissions to the individual member of the public likely to receive the highest dose set at 10 CFR 20.1101(d).

The estimates of onsite air concentrations are within an acceptable range considering the nature of the work being performed and radiological controls being implemented. In all cases, it should be noted that the calculations performed represent a conservative approximation of potential emissions, and do not necessary reflect expected conditions.

[1] All projected dose values would be a factor of 10 higher without credit for the use of water mist for dust suppression during demolition. The dose to the maximally exposed individual (250 meters east of the site) would not exceed 2.4% of the 10 CFR 20.1101(d) constraint on air emissions (10 mrem) even if this factor was not included.

Table 15, Projected Onsite Total Uranium Air Concentration During Demolition

Location	Scenario	Air Concentration (μCi/ml)	DAC Fraction[3]
Within Demolition Work Area[1]	Average	5.3E-13	0.026
	Peak	2.1E-12	0.11
At Demolition Work Area Boundary[2]	Average	5.3E-14	0.0026
	Peak	2.1E-13	0.011

[1] Based on Dust Loading of 5 mg/m^3
[2] Based on Dust Loading of 0.5 mg/m^3
[3] 10CFR20, Appendix B, Derived Air Concentration (DAC) values

Table 16, Projected Offsite Total Uranium Air Concentration During Demolition

Location	Air Concentration (μCi/ml)[1]	AEL Fraction[1,2]
Site Boundary (State Road P)[3]	1.4 E -15	0.03
Offsite Resident (250 m NW)	1.1 E -16	0.002
Onsite Resident (500 m NE)	2.1 E -17	0.0004

[1] Projected concentrations would be a factor of 10 higher without credit for the use of water mist for dust suppression during demolition.
[2] 10CFR20, Appendix B, Air Effluent Limit (AEL) value.
[3] The calculated short term concentration based on a Dust Loading of 0.15 mg/m^3 is 1.6 E -14 μCi/ml (0.32 times the 10CFR20, Appendix B, Air Effluent Limit (AEL) value). (See section 3.2.9)

8.0 REFERENCES

8.1 NSA-TR-09-25, Nuclear Criticality Safety Assessment of Decontamination and Decommissioning Operations within the Former Process Buildings at the Hematite Site

8.2 HDP-WM-TBD-902, Building Demolition Debris Volume and Weight Estimate

8.3 HDP-WM-TBD-901, Scaling Factors for Radioactive Waste Associated with the Process Buildings

8.4 Federal Guidance Report 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion

8.5 DOE HDBK-3010-94, Airborne Release Fractions / Rates and Respirable Fractions for Non Reactor Nuclear Facilities, Volume 1, Analysis of Experimental Data.

8.6 National Climatic Data Center, Climatic Wind Data for the United States, November 1998 (St Louis, MO).

8.7 PO-EM-001, *Environmental Monitoring Plan, Rev. 1*

ATTACHMENT 3

Building Demolition Debris Volume and Weight Estimate

HDP-TBD-WM-902, Revision 0

Westinghouse

Hematite Decommissioning Project

Technical Basis Document

NUMBER: HDP-TBD-WM-902

TITLE: BUILDING DEMOLITION DEBRIS VOLUME AND WEIGHT ESTIMATE

REVISION: 0

Prepared by/Date 3-11-10

Reviewed by/Date 3/11/10 Joseph Guido

Approved by/Date Gerald J Rood 3/11/10

REVISION LOG	
Revision #	**Change(s)**
0	This is a new technical basis document.

1.0 PURPOSE

The purpose of this Technical Basis Document (TBD) is to document the basis for the volume and weight of the buildings to be demolished during the Hematite Decommissioning Project.

2.0 APPLICABILITY

This document is applicable to the buildings to be demolished during the Hematite Decommissioning Project. The specific buildings include:

- 115, Fire/Diesel Pump House
- 235, West Vault
- 245, Pump house
- 252, South Vault
- 101, Tile Barn
- 120, Wood Barn
- Sewage Treatment Shed
- 240, Process Building
- 253, Process Building
- 254, Process Building
- 255, Process Building
- 256, Process Building
- 260, Process Building, and
- Limestone Building

3.0 REFERENCES

None

4.0 VOLUME ESTIMATES

The volume of materials as installed associated with the process the process buildings at the Hematite Decommissioning project have been evaluated at least twice. One evaluation was conducted by Westinghouse and a second evaluation was conducted by Energy Solutions. The specific buildings evaluated included buildings 240, 253, 254, 255, 256, 260 and the Limestone Building. The overall installed volume of material estimated by both groups had a good correlation and was within approximately 1000 cubic feet of each other. A spread sheet summarizing the material volume was developed and is shown as Appendix A. The estimates appeared to have been made by visual inspection and physical measurement of walls, equipment and areas in the various buildings. Energy Solutions take off notes are provided in Appendix B.

Waste volume estimates associated with Buildings 101, 115, 120, 235, 245, 252 and the Sewage Treatment Shed were made and are based on visual inspection and physical measurement of the buildings. The estimated installed volume of material associated with these buildings is shown in Appendix C.

6.0 WEIGHT ESTIMATES

Weight estimates for the Process Buildings were made based on the following assumptions.

Concrete block has an installed density of 65 pounds per cubic foot.
Poured concrete has an installed density of 150 pounds per cubic foot.
The roof of Building 252 which is a light weight concrete and built up material has an installed density of 100 pounds per cubic foot.
The Sewage Treatment Shed has an installed density of 20 pounds per cubic foot.
All other materials have an installed density of 50 pounds per cubic foot.

The basic formula for calculating weight is

Weight = Installed Volume X Installed Density

Based on these assumptions, the weight and volume of material associated with the buildings to be demolished is summarized in Appendix C for the non-process buildings and Appendix D for the process buildings. The volume of the material associated with the process buildings is higher than identified in Appendix A since it includes equipment and components that were not removed.

7.0 APPENDICES

Appendix A, Volume Estimates for Various Buildings
Appendix B, Hematite Building Take Off Information
Appendix C, Volume and Weight Estimate Summary for Non-Process Buildings
Appendix D, Weight and Volume Estimate Summary for Process Buildings

Appendix A
Volume Estimates for Process Buildings

240 HP, Lab, Cafeteria, Laundry	**Height**	**Width**	**Length**	**Volume**
Exterior	13	0.66	286.00	2454
Offices	11	0.66	90.00	653
Interior Partitions	13	0.66	220.00	1888
Red Room				
Exterior	13	0.66	203.00	1742
Green Room				
Exterior	13	0.66	163.00	1399
Maintenance				
Exterior	13	0.66	163.00	1399
Lab Annex	**Height**	**Width**	**Length**	**Volume**
All walls	13	0.66	80.00	686
Vestibule	8	0.66	18.00	95
Parapet Walls	2	0.66	166.00	219
Roof Deck	0.5	83	215.00	8923
Structural Steel E-W	0.833	0.33	1079.00	297
Structural Steel N-W	0.833	0.33	1200.00	330
Columns	0.833	0.33	845.00	232
Lab Annex Roof	13	0.5	40.00	260
3" Cap on Entire Floor (concrete)	0.25	83	215.00	4461
Exterior Lights (All Buildings)				
A/C Units (All Buildings)				5060
Equipment Room (Ventilation)				0
Exterior	13	0.66	98.00	841
Roof	24	0.5	50.00	600
				0
Building 253	**Height**	**Width**	**Length**	**Volume**
Exterior High	28	0.66	154.00	2846
Interior High	11	0.66	77.00	559
Exterior Low	17	0.66	154.00	1728
Offices 1st floor	11	0.66	68.00	494
Offices 2nd floor	9	0.45	227.00	919
Interior Partitions	17	0.66	80.00	898
Pump Room Wall	13	0.66	25.00	215
Pump Room Wall	11	0.66	52.00	378
Pump Room Wall	11	0.66	20.00	145
Roof	130	0.5	77.00	5005
Pump Room Roof	25	0.5	25.00	313
Structural Steel E-W (Lower)	304	1	0.88	266
Structural Steel N-W (Lower)	90	1.33	0.50	60
Columns (Lower)	136	1	0.88	119
Roof	77	0.66	130.00	6607
Structural Steel E-W (Upper)	304	0.5	1.88	285
Structural Steel N-W (Upper)	152	0.5	1.88	143
Columns (Upper)	120	1	1.00	120

Appendix A
Volume Estimates for Process Buildings

Building 254	**Height**	**Width**	**Length**	**Volume**
Exterior	19	0.66	488.00	6120
Upper Levels of Mezzanine	16	0.66	206.00	2175
Interior wall South Side	19	0.66	83.00	1041
Grating Mezz North	20	0.0833	166.00	277
Grating Mezz Middle	15	0.0833	83.00	104
Concrete floor North	10	0.5	83.00	415
Long Runs Grating	4	0.0833	302.00	101
Sound Proof Walls 2 N & 2 S	11	0.33	80.00	290
Women's Locker Room	14	0.66	70.00	647
Women's Utility Room	14	0.66	30.00	277
Roof	161	0.66	83.00	8820
Locker Roof Women's	15	0.5	83.00	623
Structural Steel E-W	644	0.5	1.33	13704
Structural Steel N-W	0	0	0.00	0
Columns	19	1	1.00	608
Building 255	**Height**	**Width**	**Length**	**Volume**
Exterior	16	0.66	327.00	3453
Offices and Interior Partitions	7	0.66	305.00	1409
Interior Partitions	16	0.4	70.00	448
Grating	83	0.25	25.00	519
South Floor	15	0.166	70.00	174
Men's Locker Room	14	0.66	95.00	878
Roof	83	0.5	161.00	6682
Men's Locker Room Roof	83	0.5	15.00	623
Structural Steel E-W	483	1.66	0.50	401
Structural Steel N-W	2241	1	0.50	1121
Columns	16	1	1.00	512
HVAC Rooms	**Height**	**Width**	**Length**	**Volume**
All Walls	16	0.66	180.00	1901
Roof	15	0.5	105.00	788
Structural Steel E-W	1	0.5	255.00	128
Structural Steel N-W	1	0.5	105.00	53
Columns	1	0.5	16.00	48
Building 256	**Height**	**Width**	**Length**	**Volume**
Exterior	17.5	0.66	242.00	2795
Interior Partitions	17.5	0.66	46.00	531
Roof	46	0.66	146.00	4433
Structural Steel E-W	0	0	0.00	0
Structural Steel N-W	438	1.5	0.50	329
Columns	17.5	0.66	0.50	173

Appendix A
Volume Estimates for Process Buildings

Building 260	**Height**	**Width**	**Length**	**Volume**
Exterior Oxide	50	0.25	134.00	1675
Exterior Oxide Dock	24	0.25	141.00	846
Structural Steel E-W	1.33	0.5	279.00	186
Structural Steel N-W	1.33	0.5	432.00	287
Crane Rails Oxide	72	0.5	1.66	60
Crane Rails Oxide Dock	72	0.5	1.66	60
Perlings Oxide Dock	1210	0.25	0.50	151
Roof	91	0.5	31.00	1411
Columns	1.33	0.5	50.00	399
Roof Beams N-S	2	0.5	144.00	1728
Roof Beams E-W	0.66	0.25	217.00	430
Floor 2nd	25	0.4	36.00	360
Floor 3rds	25	0.4	36.00	360
Floor 4th	25	0.4	36.00	360
LimeStone Storage	**Height**	**Width**	**Length**	**Volume**
All Walls Concrete	4	0.66	116.00	306
All Walls Steel Siding	20	0.25	116.00	580
Roof	40	0.5	24.00	480
Small Room Roof	12	0.5	15.00	90
Structural Steel E-W	24	0.5	0.33	36
Structural Steel N-W	24	0.5	1.66	60
Columns	1	0.5	24.00	72
Perlings	256	0.166	0.33	84
Total Building Structure				**128502**

Appendix B
Hematite Building Take Off Information

Hematite Building Take Off Information

General Notes:

1. Dimensions are in inches unless noted other wise.
2. Roof steel girders are in varying sizes. Due to lighting conditions and height, unable to determine a lot of roof girder sizes. Sizes will have to be assumed unless the dimensions are noted on takeoff.
3. Majority of the rooms contain process and water piping. Piping ranges from .5 inch to 6 inch diameter.
4. Ventilation ducting primarily constructed of thin gauge sheet metal.
5. Ducting on HEPA units and roof stacks constructed of steel. Assume 1/16".
6. Diamond decking approximately 1/16" thick.
7. Unknown as to type and size of reinforcement used for poured concrete walls and ceiling.
8. Wood roof joists 2"X8". Roof under lament for areas with wood roof joists is either plywood or OSB. Thickness unknown, probably 5/8".
9. All rooms/areas contain electrical conduit and ceiling light fixtures. Primarily fluorescent lighting. Mercury vapor lighting being removed by client.
10. HEPA filter banks 8' X 8' X 4'
11. Steel roof trusses run with the width of the room, unless noted otherwise.
12. Steel box columns are hollow.
13. HEPA exhaust ducting approximately 24" dia.
14. Handrails on catwalks and stairs constructed of 2" steel pipe.

Building 240:

Lunch Room:

1. (24) 2" X 8"X 155" wood roof trusses
2. (3) 2" X 8" X 208" wood roof trusses
3. (2) 2" X 12" X 122" metal door supports
4. (7) 12" X 6" steel I-Beam roof girders
5. Approximately 20 feet of 4" dia. cast iron drain pipe with lead joint sealant.
6. Ceiling: Mixed between steel corrugated and plywood/OSB.

Laundry Room:

1. (6) 6" X 6" X 144" steel I-Beam columns (.25" thick)
2. (6) 6" X 12" steel I-Beam roof girders
3. Ceiling: corrugated metal

Offices:

1. 2" X 8" ceiling joists with plywood/OSB under lament
2. Sheet metal ventilation ducting

Appendix B
Hematite Building Take Off Information

Laboratory:

1. (4) 6" X 6" X 168" steel I-Beam columns
2. (12) steel I-Beam roof girders
3. (32) fluorescent ceiling light fixtures
4. Ceiling: corrugated metal

Storage Room within Laboratory:

1. Sheet metal ventilation ducting.
2. Ceiling mounted HVAC unit.
3. (10) fluorescent lights
4. Ceiling: corrugated metal

Ingress/Egress Area:

1. (1) 6" X 6" steel I-Beam column
2. (2) steel I-Beam roof girders
3. Cast iron drain pipe with lead joint sealant.

HEPA Room:

1. (4) steel I-Beam columns (dimensions unk.)
2. (10) steel I-Beam roof girders
3. (2) HEPA filter banks (8' X 8' X 4')
4. (1) complete HEPA filter unit (consists of filter bank, fan, motor and exhaust ducting).
5. Ceiling: corrugated metal

Dry Recovery (Red Room):

1. (8) steel columns
2. (12) steel roof trusses
3. Small overhead mounted HVAC unit (more than likely a chiller)
4. Ceiling: corrugated metal

Wet Recovery (Green Room):

1. (8) steel columns
2. (11) steel roof trusses
3. Small overhead mounted HVAC unit (more than likely a chiller)
4. Ceiling: corrugated metal

Appendix B
Hematite Building Take Off Information

Maintenance Shop (includes offices):

1. (6) steel columns
2. (19) steel roof trusses
3. Ceiling: corrugated metal

Health Physics Office:

1. (4) steel I-Beam roof girders
2. (1) 6" X 6" X 156" steel I-Beam column
3. (9) 2" X 8" X 144" wood roof trusses
4. Small ceiling mounted HVAC unit
5. Ceiling: corrugated metal
6. Ceiling in small office: plywood/OSB

Building 253:

Tank Room:

1. 3" to 4" dia. process piping with valving
2. Ceiling: Pre-cast reinforced concrete with cast concrete roof girders (type of reinforcement unknown

Main Area (U02 Powder Storage):

1. (8) 10" X 10" steel box columns
2. (8) 12" X 12" steel box columns
3. (4) 21.5" X 12" steel roof girders (.5" thick)
4. (7) 6" X 24" steel roof girders
5. (23) steel roof trusses
6. (2) complete HEPA units (consists of filter bank, fan, motor and exhaust ducting).
7. (1) ceiling mounted HVAC unit
8. Ceiling: corrugated metal
9. Floor of upstairs offices constructed of corrugated metal with app. 4" of poured concrete. Type of concrete reinforcement unknown.

Decon Room:

1. (6) 10" X 10" steel box columns
2. (3) steel I-Beam roof girders
3. (6) steel roof trusses
4. Ceiling: corrugated metal

Appendix B
Hematite Building Take Off Information

HP Ingress/Egress Area (Floor Level):

1. (4) 10" X 10" X 124" steel box columns
2. (2) 24" X 12.5" X 192" steel I-Beam girders
3. (1) 12" X 7" X 192" steel I-Beam girder
4. (1) 13.5" X 6" X 279" steel I-Beam girder
5. (1) 13.5" X 6" X 276" steel I-Beam girder
6. (1) 13.5" X 6" X 168" steel I-Beam girder
7. (8) 47' steel roof trusses
8. Ceiling: corrugated metal

Upper Level above HP Ingress/Egress Area:

1. (14) 12" X 12' X 144" steel box beams
2. (4) 24" X 8" X 540" steel I-Beam roof girders
3. (2) 14" X 6" 720" steel I-Beam roof girders
4. (2) 14" X 6" X 132" steel I-Beam roof girders
5. (1) 14" X 5" X 264" steel I-Beam roof girders
6. (9) 77' long steel roof trusses
7. Floor: poured concrete over corrugated metal (concrete ~ 4" thick)
8. Ceiling: corrugated metal

<u>Building 254:</u>

3rd Floor Mezzanine:

1. (11) steel I-Beam roof girders
2. (15) steel roof trusses
3. (2) complete HEPA units (consists of filter bank, fan, motor and exhaust ducting)
4. 60" X 24" X 384" sheet metal ventilation ducting
5. Floor: diamond decking
6. Ceiling corrugated metal

2nd Floor Mezzanine:

1. (10) I-Beam roof girders
2. (6) large electrical cabinets
3. Floor: diamond decking

Center Mezzanine and Catwalk:

1. (2) complete HEPA units (consists of filter bank, fan, motor and exhaust ducting)
2. Floor: diamond decking
3. Handrails constructed of 2"pipe

Appendix B
Hematite Building Take Off Information

HVAC Room:

1. (4) complete HEPA units (consists of filter bank, fan, motor and exhaust ducting)
2. Ceiling: corrugated metal

Ventilation Ducting Room:

1. (7) steel I-Beam roof girders
2. (18) steel roof trusses
3. (1) complete HEPA unit (consists of filter bank, fan, motor and exhaust ducting)
4. Area contains a lot of sheet metal ventilation duct work
5. Floor: diamond decking
6. Ceiling: corrugated metal

Main Floor Area:

1. (13) 10" X 10" X 252" steel box columns
2. (8) 12" X 12" X 252" steel box columns
3. (34) steel roof trusses
4. (60) steel I-Beam and channel roof girders and floor supports (includes girders for mezzanine)
5. (153) mezzanine steel floor trusses (approximately 12' to 24' in length)
6. (9) 12" X 12" X 408" steel box columns
7. (16) 8" X 5" X 144" steel support columns
8. Area contains a lot of sheet metal ventilation duct work
9. Ceiling: corrugated metal

Building 256-1:

1. (8) steel roof trusses
2. (5) 8" X 8" X 240" steel box columns
3. (1) 6" X 6" X 144" steel I-Beam support column
4. (8) steel I-Beam roof girders
5. (9) steel roof trusses (99" long each)
6. (1) complete HEPA unit (consists of filter bank, fan, motor and exhaust ducting)
7. Area contains a lot of sheet metal ventilation duct work
8. Ceiling: corrugated metal

Building 256-2:

1. (8) 8' X 8" X 216" steel box columns
2. (2) 6" X 6" X 144" steel I-Beam support columns
3. (1) steel I-Beam girder (app. 50" long)
4. (17) steel roof trusses
5. App. 138' of 4" water piping
6. App. 300' of 3-3" water piping

Appendix B
Hematite Building Take Off Information

7. Area contains a lot of water and process piping
8. Ceiling: corrugated metal

Building 255:

Area A-1 (see map):

1. (2) steel I-Beam roof girders running length of room
2. (1) steel I-Beam roof girder running width of room
3. (6) 8" X 8" X 144" steel box columns
4. (~16) steel roof trusses
5. ~ 50' of sheet metal ventilation duct work
6. (1) 6" X 6" X 144" steel I-Beam support column
7. Ceiling: corrugated metal

Area A-2 (see map):

1. (11) 4" X 4" X 84" steel box columns
2. (14) 3" X 3" X 84" steel box columns
3. (23) 3" X 6" X 120" steel roof girders
4. (6) 3" X 6" X 144" steel roof girders
5. (5) 4" X 6" X 189" steel roof girders
6. (6) 3" X 6' X 144" steel roof girders
7. Ceiling: 75% diamond decking, 25% corrugated metal

Area A-3 (see map):

1. (4) complete HEPA units (consists of filter bank, fan, motor and exhaust ducting)
2. (13) steel roof I-Beam girders running length of room
3. (3) steel roof I-Beam girders running width of room
4. (6) 8" X 8" X 180" steel I-Beam columns
5. (7) 4" X 4" X 89" steel columns supporting mezzanine
6. (11) 6" X 4" steel girders supporting mezzanine overhang
7. Mezzanine Floor: diamond deck
8. Ceiling corrugated metal

Area A-4 (see map):

1. (7) steel I-Beam roof girders
2. (3) small HVAC units in overhead
3. Ceiling: corrugated metal

Area A-5 (see map):

1. (5) steel I-Beam roof girders
2. Ceiling: corrugated metal

Appendix B
Hematite Building Take Off Information

Area A-6 (see map):

1. (2) 8" X 8" X 180" steel I-Beam columns
2. (12) steel roof I-Beam girders running length of room.
3. Mezzanine Floor: diamond decking
4. Area contains a lot of process piping
5. Ceiling: corrugated metal

Area A-7 (see map):

1. (2) steel I-Beam roof girders running length of room
2. (1) steel I-Beam roof girder running width of room
3. (1) bank of electrical cabinets (15.5" X 82" X 188")
4. Area contains a lot of process piping
5. Ceiling: corrugated metal

Area A-8 (see map)

1. (6) steel roof trusses
2. (1) steel I-Beam roof girder running width of room
3. Ceiling: corrugated metal

Area A-8-1 (see map):

1. (1) steel I-Beam roof girder running length of room
2. Ceiling: corrugated metal

Area A-8-2 HVAC Area (see map):

1. (20) 2" X 10" X 156" light gauge metal roof joists
2. (1) 4" X 8" X 144" steel I-Beam columns
3. (1) 12" X 8" X 294" steel I-Beam roof girder
4. (1) 12" X 12" X 144" steel I-Beam roof girder
5. (1) complete HVAC unit
6. Ceiling: corrugated metal

Building 260 (Oxide):

1st Floor:

1. (4) 14" X 7" X 456" steel I-Beam roof girders
2. (11) 8" X 13" X 600" steel I-Beam columns (columns run from 1st floor to roof)

2nd Floor:

1. (2) 10" X 6" X 456" steel I-Beam girders

Appendix B
Hematite Building Take Off Information

2. (2) 14" X 7" X 456" steel I-Beam girders
3. (2) 14" X 7" X 396" steel I-Beam girders
4. (1) electrical cabinet (175" X 13" X 91.5")
5. Floor: diamond plate

3rd Floor:

1. (2) 16" X 8" X 456" steel I-Beam girders
2. Floor: diamond plate

4th Floor

1. (2) 36" X 10" X 456" steel I-Beam girders
2. (1) HEPA filter bank
3. 30" dia. steel duct running from 4th floor to 1st floor
4. Floor: diamond plate
5. Ceiling: corrugated metal

Building 260 (Limestone):

1. (4) 9.75" X 8" X 264" steel I-Beam columns
2. (2) 9.75" X 8" X 240" steel I-Beam columns
3. (9) ~ 10" X 4" X 444" steel J-girders
4. (3) 14" X 6" 152" steel I-Beam roof girders
5. Ceiling: corrugated metal

Roofs:

1. Building roofs contain several carbon and SS ventilation stacks. Height ranges from ~ 14' to 16'
2. Roof is made up of reinforced rubber matting over ½" fiber board and Styrofoam insulation. Thickness for rubber matting to sub roof is ~ 5.75".

South Vault:

1. (1) steel I-Beam girder
2. (12) steel roof trusses
3. Poured reinforced concrete walls and partisans
4. Building contains 4 – 10" thick concrete partisans and 1 – 10" thick room divider wall from floor to ceiling
5. 20" brick cap around 3 sides of building roof.
6. Ceiling: corrugated metal

APPENDIX C

Volume and Weight Estimate Summary for Non Process Buildings

Building	Concrete/ Block Volume ft3	Concrete Weight lbs	Other Material Volume ft3	Other Material Weight lbs	Total Volume ft^3	Total Weight lbs.
Sewage Treatment Shed	0	0	896	17,920	896	17,920
Building 101-Tile Barn	2,908	254,917	1,856	92,188	4,764	347,105
Building 115-Diesel/Fire Pump	1,077	70,013	400	20,000	1,477	90,013
Building 120-Wood Barn	0	0	1,110	55,520	1,110	55,520
Building 235-West Vault	1,227	79,751	370	18,500	1,597	98,251
Building 245-Well Water Pump	116	7,516	32	1,600	148	9,116
Building 252-South Vault	2,227	334,080	1,025	102,500	3,252	436,580
Total	7,555	746,277	5,689	308,229	13,244	1,054,505

Sewage Treatment Shed Item	Qty	Length ft	Width ft	Thickness ft	Concrete/ Block Volume ft^3	Concrete/ Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
Walls	2	16	12	0.5	0	0	192	3,840
Walls	2	22	12	0.5	0	0	264	5,280
Roof	1	22	40	0.5	0	0	440	8,800
				Total	0	0	896	17,920

APPENDIX C

Volume and Weight Estimate Summary for Non Process Buildings

Building 101-Tile Barn Item	Qty	Length inches	Width inches	Thickness inches	Tile Block Volume ft^3	Tile Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
2x6x6	65	72	6	2	0	0	33	1,625
2x6x12	390	144	6	2	0	0	390	19,500
2x6x16	130	192	6	2	0	0	173	8,667
2x10x12	217	144	10	2	0	0	362	18,083
2x4x16	240	192	4	2	0	0	213	10,667
Beams	2	1536	8	8	0	0	114	5,689
Columns	26	96	8	8	0	0	92	4,622
Gable End Framing	22	288	4	2	0	0	29	1,467
Gable End Framing	16	84	6	2	0	0	9	467
Gable End Framing	34	156	6	2	0	0	37	1,842
Siding Gable Ends	2	120	84	1	0	0	12	583
Siding Gable Ends	2	156	288	1	0	0	52	2,600
Block Wall	1	120	3840	8	2,133	138,667	0	0
Roof	2	192	1536	0.5	0	0	171	8,192
Roof	2	144	1536	0.5	0	0	128	6,144
Silos- Walls	2	186	450	8	775	116,250	0	0
Silos-Roof Framing	48	120	2	6	0	0	40	2,000
Silos-Roof Tin	2	186	4	1	0	0	1	41
				Total	2,908	254,917	1,856	92,188

APPENDIX C
Volume and Weight Estimate Summary for Non Process Buildings

Building 115 Diesel And Fire Pump Building Item	Qty	Length ft	Width ft	Thickness ft	Block Volume ft^3	Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
Walls	2	20	12	0.66	317	20,592	0	0
Wall	1	16	12	0.66	127	8,237	0	0
Walls	2	40	12	0.66	634	41,184	0	0
Roof	1	20	40	0.5	0	0	400	20,000
				Total	1,077	70,013	400	20,000

Building 120-Wood Barn Item	Qty	Length inches	Width inches	Thickness inches	Block Volume ft^3	Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
1x4x16 walls	98	192	4	1	0	0	44	2,178
2x6x18 walls	70	216	6	2	0	0	105	5,250
2x6x18 roof	82	216	6	2	0	0	123	6,150
2x4x12 roof	82	144	4	2	0	0	55	2,733
Beams	1	960	8	8	0	0	36	1,778
Columns	10	96	11	5	0	0	31	1,528
Gable End Framing	14	120	6	2	0	0	12	583
Gable End Framing	8	156	4	1	0	0	3	144
Siding Gable Ends	2	156	120	1	0	0	22	1,083
Floor	1	960	360	1	0	0	200	10,000
Roof	2	960	216	0.5	0	0	120	6,000
Siding	1	2640	216	1	0	0	330	16,500
Floor Framing	172	16	10	2	0	0	32	1,593
				Total	0	0	1,110	55,520

APPENDIX C
Volume and Weight Estimate Summary for Non Process Buildings

Building 235-West Vault Item	Qty	Length ft	Width ft	Thickness ft	Block Volume ft^3	Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
Walls	2	20	13	0.66	343	22,308	0	0
Wall	1	37	13	0.66	317	20,635	0	0
Walls	2	33	13	0.66	566	36,808	0	0
Roof	1	20	37	0.5	0	0	370	18,500
				Total	1,227	79,751	370	18,500

Building 245-Well Pump House Item	Qty	Length ft	Width ft	Thickness ft	Block Volume ft^3	Block Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
Walls	3	8	7.3	0.66	116	7,516	0	0
Roof	1	8	8	0.5	0	0	32	1,600
				Total	116	7,516	32	1,600

Building 252-South Vault Item	Qty	Height ft	Thickness ft	Width ft	Concrete Volume ft^3	Concrete Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.
All Walls		12	0.8	232.00	2,227	334,080	0	0
Roof		41	0.5	50.00	0	0	1,025	102,500
				Total	2,227	334,080	1,025	102,500

APPENDIX D
Volume and Weight Estimate Summary for Process Buildings

Building	Area	Concrete Volume ft^3	Concrete Weight lbs.	Other Material Volume ft^3	Other Material Weight lbs.	Total Volume ft^3	Total Weight lbs.
Process Bldg. 240	1	11,375	739,382	18,359	1,193,311	29,734	1,932,693
Process Bldg. 253	2	6,524	424,067	15,720	1,021,792	22,244	1,445,859
Process Bldg. 254 & 1/2 of 256	3	13,630	921,237	34,771	2,260,134	48,401	3,181,371
Process Bldg. 255 & 1/2 of 256	4	10,642	691,756	14,005	910,299	24,647	1,602,055
Process Bldg. 260 & Limestone Bldg	5	306	19,906	14,430	937,965	14,736	957,870
Total		**42,478**	**2,796,346**	**97,285**	**6,323,501**	**139,763**	**9,119,847**

ATTACHMENT 4

Scaling Factors for Radioactive Waste Associated with the Process Buildings

HDP-TBD-WM-901, Revision 0

Westinghouse

Hematite Decommissioning Project

Technical Basis Document

NUMBER: **HDP-TBD-WM-901**

TITLE: **SCALING FACTORS FOR RADIOACTIVE WASTE ASSOCIATED WITH THE PROCESS BUILDINGS**

REVISION: **0**

DATE: ~~**Enter date approved in EDMS**~~ DC 4-15-09

Author: 3-5-09
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Owner: ~~3/13/09~~ 4/13/09
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REVISION LOG	
Revision #	**Change(s)**
0	This is a new technical basis document.

1.0 PURPOSE

The purpose of this Technical Basis Document is to evaluate results obtained from samples taken in the process buildings and to establish scaling factors for hard to detect isotopes based on those results. Samples had been previously obtained from the various process building areas on 10/22/04 and were analyzed by Severn Trent Laboratories (since the time of analysis, this company has a new name, TestAmerica). Sample results need not be decay corrected as part of the scaling factor calculation due to the relatively long half lives of the parent isotopes of concern compared to the elapsed time since sampling. Short half life daughter products will have established equilibrium with the parent isotopes.

2.0 APPLICABILITY

The scaling factors will be used to calculate activities of hard to detect isotopes in waste that originates from the process buildings including the process buildings.

3.0 DEFINITIONS/ACRONYMS

3.1. Definitions

3.1.1 Scaling factor is a unitless number that is the ratio of a hard to detect isotope to an easily detected isotope.

4.0 REFERENCES

4.1. USNRC Low-Level Licensing Branch, Technical Position on Radioactive Waste Classification

4.2. DO-08-005, Historical Site Assessment

5.0 DATA AND DATA EVALUATION

5.1. RAW Data

5.1.1. Sample results for samples W-102204-1 (Building 240 Red Room), W-102204-2 (Building 240 Green Room), W-102204-3 (Building Maintenance and Decon Room), W-102204-4 (Building 253), W-102204-5 (Building 254), W-102204-6 (Building 256), W-102204-7 (Building 255) and, W-102204-8 (Building 260) are provided in attachments 1 through 8. Laboratory QC test results are provided in attachment 9. A subsequent assessment of the laboratory analysis by Test America is provided in attachment 10.

5.2. Isotopes Eliminated from Inclusion in Waste Stream

5.2.1. The following isotopes were not detected in any sample and are not considered to be present for waste management purposes.

- Cesium 137 (Cs-137)
- Iron 55 (Fe-55)
- Nickel 59 (Ni-59)
- Nickel 63 (Ni-63)
- Plutonium 238 (Pu-238)
- Americium 241 (Am-241)
- Curium 243/244 (Cm-243/244)

5.2.2. The following isotopes were detected in at least 1 sample, but were eliminated due to inconsistency in results as noted.

- Plutonium 239/240 (Pu-239/240) was detected in 1 sample but the detection was within the uncertainty of the measurement and MDC.
- Plutonium 241 (Pu-241) was detected in 1 sample at elevated activity, but no corresponding Am-241 was detected. Am-241 as a daughter of Pu-241 should be present. Additionally the detected value was within the uncertainty of the measurement and MDC. See attachment 10 evaluation of the result.
- Curium 242 (Cm-242) was reported as detected in one sample, but the statistics had zero reported for the MDC which is inconsistent as an MDC value. Based on attachment 10, the reported value and the MDC values were switched. The sample was actually less than MDC.

5.2.3. The following isotopes were detected in the samples, but are the short lived daughters in equilibrium parent isotopes which will be reported as identified in 49 CFR 173.433(c)(2).

- Thorium 228 daughter of Thorium 232
- Thorium 231 daughter of Uranium 235
- Thorium 234 daughter of Uranium 238
- Protactinium 234m daughter of Uranium 238

5.2.4. Strontium 89 (Sr-89) was eliminated as an isotope of concern due its short half life of 52.7 days and that a means of production of additional Sr-89 is not available on site.

5.3. Isotopes of Concern

5.3.1. The following isotopes and their associated half lives were detected in a sufficient number of samples and with an activity to justify their use as nuclides of concern.

Isotope	Half Life
Strontium 90 (Sr-90)	27.7 years
Technetium 99 (Tc-99)	2.12E+05 years
Uranium 234 (U-234)	2.47E+05 years
Uranium 235 (U-235)	7.1E+08 years
Uranium 238 (U-238)	4.51E+09 years
Thorium 230 (Th-230)	8.0E+04 years
Thorium 232 (Th-232)	1.41 E+10 years
Neptunium 237 (Np-237)	2.14E+06 years

6.0 ASSUMPTIONS

6.1. If an isotope sample result was reported at less than MDC, then the MDC value was reported as a positive result in the calculation.

6.2. All isotopes of concern were scaled to Uranium 235. This leads to consistent results for relatively insoluble isotopes of concern. For soluble isotopes of concern such as Sr-90 and Tc-99, the selection of U-235 for scaling will result in underestimation or overestimation of activity for any particular sample. On average the reported activity is expected to be within a factor of 10 of the true activity as required by reference 2.1. Based on very low concentrations, Sr-90 and Tc-99 will not be disposal limiting isotopes of concern for Hematite waste streams.

6.3. To achieve an average scaling factor for the process buildings, an average activity for each isotope of concern will be calculated and an average scaling factor calculated. This averaging process will result in an accurate assessment of activity.

7.0 CALCULATIONS

7.1. Attachment 11 is a spread sheet that has imbedded formulas for the calculation of scaling factors relative to U-235, mass enrichment and evaluation of soluble isotope scaling factors. The general formulas for each are as follows:

Scaling factor

Scaling Factor (SF) = Activity of Isotope/ Activity of U-235

Enrichment

Activity of U-234/Specific Activity U-234= grams U-234
Activity of U-235/Specific Activity U-235= grams U-235
Activity of U-238/Specific Activity U-238= grams U-238

$$\text{Enrichment \%} = \frac{\text{Grams U-235 X 100\%}}{\text{(Grams U-234+Grams U-235+Grams U-238)}}$$

Soluble Isotope Scaling Factor Adequacy

Sample SF/Average SF is within a factor of 10 of the Average SF

Attachment 1

LVI Environmental Services, Inc.

Client Sample ID: W-102204-01

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F4J290245-001
Work Order: GVT3P
Matrix: SOLID

Date Collected: 10/22/04 1200
Date Received: 10/29/04 0900

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	19400		1500	50	11/02/04	11/10/04	4308437	99
Uranium 235	860		160	30	11/02/04	11/10/04	4308437	99
Uranium 238	2810		310	30	11/02/04	11/10/04	4308437	99
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	3.4		1.7	1.7	11/02/04	11/06/04	4308435	75
Thorium 230	5.6		1.9	1.3	11/02/04	11/06/04	4308435	75
Thorium 232	0.33	U	0.48	0.66	11/02/04	11/06/04	4308435	75
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	392		43	14	11/04/04	11/09/04	4309246	100
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	-0.9	U	2.8	5.3	11/04/04	11/04/04	4309327	
Protactinium 234M	630	U	360	780	11/04/04	11/04/04	4309327	
Thorium 234	300		45	25	11/04/04	11/04/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	108		25	21	11/04/04	11/04/04	4309327	
Uranium 235	98		37	39	11/04/04	11/04/04	4309327	
Uranium 238	300		38	25	11/04/04	11/04/04	4309327	
Iron-55 by Liquid Scint. Spectrometry				pCi/sample	STL-RC-0055			
Iron 55	-29	U	44	35	11/04/04	11/08/04	4309372	90
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	23400		2400	10	11/03/04	11/05/04	4310287	
Gross Beta	6090		620	10	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	23	11/04/04	11/08/04	4309373	90
Nickel 63	17	U	13	21	11/04/04	11/08/04	4309373	90
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	3.9	U	4.4	7.1	11/05/04	11/15/04	4310368	69
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	2.8	U	4.1	6.8	11/05/04	11/15/04	4310367	65
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	500	U	460	940	11/02/04	11/15/04	4308438	87

LVI Environmental Services, Inc.

Client Sample ID: W-102204-01

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-001	Date Collected:	10/22/04 1200
Work Order:	GVT3P	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R			
Plutonium 238	0.0	U	0.0	0.8	11/11/04	11/12/04	4316228	87
Plutonium 239/40	0.33	J	0.44	0.30	11/11/04	11/12/04	4316228	87
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Americium 241	0.0	U	0.0	2.8	11/11/04	11/12/04	4316226	17
Curium 243/244	0.0	U	0.0	5.6	11/11/04	11/12/04	4316226	17
Curium 242	2.4 U		0.0	0.0 2.4	11/11/04	11/12/04	4316226	17
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	1.80		0.87	0.56	11/08/04	11/10/04	4313294	116

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.
U Result is less than the sample detection limit.

LVI Environmental Services, Inc.

Client Sample ID: W-102204-01 DUP

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-001X	Date Collected:	10/22/04	1200
Work Order:	GVT3P	Date Received:	10/29/04	0900
Matrix:	SOLID			

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				**pCi/sample**	**GA-01-R MOD**			
Cesium 137	0.2	U	1.9	3.7	11/04/04	11/05/04	4309327	
Protactinium 234M	360	U	330	700	11/04/04	11/05/04	4309327	
Thorium 234	**324**		**47**	**29**	**11/04/04**	**11/05/04**	**4309327**	
--- Other Detected Radionuclides ---								
Thorium 231	**97**		**26**	**23**	**11/04/04**	**11/05/04**	**4309327**	
Uranium 235	**80**		**34**	**38**	**11/04/04**	**11/05/04**	**4309327**	
Uranium 238	**324**		**39**	**29**	**11/04/04**	**11/05/04**	**4309327**	

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

U   Result is less than the sample detection limit.

Attachment 2

LVI Environmental Services, Inc.

Client Sample ID: W-102204-02

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F4J290245-002
Work Order: GVT31
Matrix: SOLID

Date Collected: 10/22/04 1200
Date Received: 10/29/04 0900

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	43500		3400	70	11/02/04	11/10/04	4308437	97
Uranium 235	1910		350	80	11/02/04	11/10/04	4308437	97
Uranium 238	5890		660	70	11/02/04	11/10/04	4308437	97
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	2.3		1.1	0.7	11/02/04	11/06/04	4308435	92
Thorium 230	6.8		1.9	0.7	11/02/04	11/06/04	4308435	92
Thorium 232	0.66	J	0.57	0.51	11/02/04	11/06/04	4308435	92
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	0.66	J	0.53	0.25	11/02/04	11/05/04	4308430	108
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	44		11	14	11/04/04	11/09/04	4309246	100
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	1.6	U	2.2	4.7	11/04/04	11/04/04	4309327	
Protactinium 234M	660	U	450	950	11/04/04	11/04/04	4309327	
Thorium 234	651		83	37	11/04/04	11/04/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	172		38	33	11/04/04	11/04/04	4309327	
Uranium 235	201		63	44	11/04/04	11/04/04	4309327	
Uranium 238	651		66	37	11/04/04	11/04/04	4309327	
Iron-55 by Liquid Scint. Spectrometry				pCi/sample	STL-RC-0055			
Iron 55	-40	U	180	50	11/04/04	11/08/04	4309372	57
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	53900		5500	30	11/03/04	11/05/04	4310287	
Gross Beta	12600		1300	20	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	21	11/04/04	11/08/04	4309373	88
Nickel 63	2	U	11	20	11/04/04	11/08/04	4309373	88
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	9.8		5.0	7.6	11/05/04	11/15/04	4310368	67
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	-5.9	U	5.5	9.7	11/05/04	11/15/04	4310367	59

LVI Environmental Services, Inc.

Client Sample ID: W-102204-02

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-002	Date Collected:	10/22/04 1200
Work Order:	GVT31	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	2900		1800	2400	11/02/04	11/15/04	4308438	85
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R			
Plutonium 238	0.13	U	0.48	0.84	11/11/04	11/12/04	4316228	85
Plutonium 239/40	0.11	U	0.31	0.30	11/11/04	11/12/04	4316228	85
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Americium 241	0.0	U	0.0	1.7	11/11/04	11/12/04	4316226	39
Curium 243/244	0.0	U	0.0	2.4	11/11/04	11/12/04	4316226	39
Curium 242	0.0	U	0.0	1.2	11/11/04	11/12/04	4316226	39

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.
U Result is less than the sample detection limit.

Attachment 3

LVI Environmental Services, Inc.

Client Sample ID: W-102204-03

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-003	Date Collected:	10/22/04 1200
Work Order:	GVT33	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	36700		2900	100	11/02/04	11/10/04	4308437	107
Uranium 235	1590		310	70	11/02/04	11/10/04	4308437	107
Uranium 238	4830		570	80	11/02/04	11/10/04	4308437	107
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	5.1		2.2	1.9	11/02/04	11/06/04	4308435	66
Thorium 230	7.5		2.3	1.1	11/02/04	11/06/04	4308435	66
Thorium 232	0.39	U	0.69	1.0	11/02/04	11/06/04	4308435	66
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	0.69	J	0.56	0.27	11/02/04	11/05/04	4308430	99
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	29.7		9.9	14	11/04/04	11/09/04	4309246	96
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	-2.7	U	2.2	3.3	11/04/04	11/04/04	4309327	
Protactinium 234M	470	U	380	790	11/04/04	11/04/04	4309327	
Thorium 234	537		69	32	11/04/04	11/04/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	136		30	24	11/04/04	11/04/04	4309327	
Uranium 235	135		47	44	11/04/04	11/04/04	4309327	
Uranium 238	537		55	32	11/04/04	11/04/04	4309327	
Iron-55 by Liquid Scint. Spectrometry				pCi/sample	STL-RC-0055			
Iron 55	-30	U	180	40	11/04/04	11/08/04	4309372	67
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	38800		4000	20	11/03/04	11/05/04	4310287	
Gross Beta	10700		1100	20	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	18	11/04/04	11/08/04	4309373	91
Nickel 63	-4	U	14	20	11/04/04	11/08/04	4309373	91
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	5.2	U	1.5	8.4	11/05/04	11/15/04	4310368	63
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	10.5		5.2	7.9	11/05/04	11/15/04	4310367	58

LVI Environmental Services, Inc.

Client Sample ID: W-102204-03

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-003	Date Collected:	10/22/04 1200
Work Order:	GVT33	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Plutonium-241 by Liquid Scintillation				**pCi/sample**	**STL-RC-0245**			
Plutonium 241	1300	U	1100	2000	11/02/04	11/15/04	4308438	82
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R**			
Plutonium 238	0.1	U	0.40	0.74	11/11/04	11/12/04	4316228	82
Plutonium 239/40	0.29	U	0.42	0.58	11/11/04	11/12/04	4316228	82
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.3	U	1.3	2.8	11/11/04	11/12/04	4316226	17
Curium 243/244	1.3	U	2.5	3.9	11/11/04	11/12/04	4316226	17
Curium 242	0.0	U	0.0	1.4	11/11/04	11/12/04	4316226	17

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.
U Result is less than the sample detection limit.

Attachment 4

LVI Environmental Services, Inc.

Client Sample ID: W-102204-04

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-004	Date Collected:	10/22/04 1200
Work Order:	GVT34	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	10700		910	40	11/02/04	11/10/04	4308437	96
Uranium 235	420		110	40	11/02/04	11/10/04	4308437	96
Uranium 238	1420		200	30	11/02/04	11/10/04	4308437	96
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	0.0	U	0.0	2.1	11/02/04	11/06/04	4308435	54
Thorium 230	16.4		3.9	1.5	11/02/04	11/06/04	4308435	54
Thorium 232	0.0	U	0.0	0.9	11/02/04	11/06/04	4308435	54
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	0.0	U	0.0	0.3	11/02/04	11/05/04	4308430	103
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	43		11	14	11/04/04	11/09/04	4309246	99
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	1.2	U	2.3	4.4	11/04/04	11/04/04	4309327	
Protactinium 234M	190	U	310	620	11/04/04	11/04/04	4309327	
Thorium 234	178		39	25	11/04/04	11/04/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	42		18	21	11/04/04	11/04/04	4309327	
Uranium 235	54		29	33	11/04/04	11/04/04	4309327	
Uranium 238	178		37	25	11/04/04	11/04/04	4309327	
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	11700		1200	10	11/03/04	11/05/04	4310287	
Gross Beta	3400		350	10	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	23	11/04/04	11/08/04	4309373	87
Nickel 63	0.2	U	9.2	21	11/04/04	11/08/04	4309373	87
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	16.8		3.4	7.2	11/05/04	11/15/04	4310368	69
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	9.3		4.9	7.5	11/05/04	11/15/04	4310367	60
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	700	U	1300	1300	11/02/04	11/15/04	4308438	85

LVI Environmental Services, Inc.

Client Sample ID: W-102204-04

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-004	Date Collected:	10/22/04 1200
Work Order:	GVT34	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R**			
Plutonium 238	0.0	U	0.0	0.8	11/11/04	11/12/04	4316228	85
Plutonium 239/40	0.0	U	0.0	0.3	11/11/04	11/12/04	4316228	85
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.07	U	0.59	1.3	11/11/04	11/12/04	4316226	39
Curium 243/244	0.0	U	0.0	2.1	11/11/04	11/12/04	4316226	39
Curium 242	0.0	U	0.0	1	11/11/04	11/12/04	4316226	39
Iron-55 by Liquid Scint. Spectrometry				**pCi/sample**	**STL-RC-0055**			
Iron 55	30	U	29	80	11/09/04	11/10/04	4314427	82

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

U Result is less than the sample detection limit.

Attachment 5

LVI Environmental Services, Inc.

Client Sample ID: W-102204-05

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-005	Date Collected:	10/22/04 1200
Work Order:	GVT37	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	32300		2600	100	11/02/04	11/10/04	4308437	91
Uranium 235	1360		290	80	11/02/04	11/10/04	4308437	91
Uranium 238	4330		530	70	11/02/04	11/10/04	4308437	91
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	2.9		1.5	1.5	11/02/04	11/06/04	4308435	98
Thorium 230	3.6		1.4	0.8	11/02/04	11/06/04	4308435	98
Thorium 232	0.0	U	0.0	0.7	11/02/04	11/06/04	4308435	98
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	12.1	U	8.6	14	11/04/04	11/09/04	4309246	100
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	-1.7	U	2.7	5.0	11/04/04	11/05/04	4309327	
Protactinium 234M	440	U	330	530	11/04/04	11/05/04	4309327	
Thorium 234	484		64	27	11/04/04	11/05/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	135		27	23	11/04/04	11/05/04	4309327	
Uranium 235	143		47	38	11/04/04	11/05/04	4309327	
Uranium 238	484		52	27	11/04/04	11/05/04	4309327	
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	37700		3800	20	11/03/04	11/05/04	4310287	
Gross Beta	9470		980	20	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	29	11/04/04	11/08/04	4309373	91
Nickel 63	0.09	U	0.86	21	11/04/04	11/08/04	4309373	91
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	40.9		5.3	7.5	11/05/04	11/15/04	4310368	64
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	33.6		7.7	9.8	11/05/04	11/15/04	4310367	60
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	20	U	70	1800	11/02/04	11/15/04	4308438	90
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R			
Plutonium 238	0.17	U	0.44	0.72	11/11/04	11/12/04	4316228	90
Plutonium 239/40	0.0	U	0.0	0.5	11/11/04	11/12/04	4316228	90

LVI Environmental Services, Inc.

Client Sample ID: W-102204-05

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-005	Date Collected:	10/22/04 1200
Work Order:	GVT37	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.0	U	0.0	1.4	11/11/04	11/12/04	4316226	76
Curium 243/244	0.0	U	0.0	1.9	11/11/04	11/12/04	4316226	76
Curium 242	0.0	U	0.0	1.3	11/11/04	11/12/04	4316226	76
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Neptunium 237	**1.69**		0.83	0.50	11/08/04	11/10/04	4313294	114
Iron-55 by Liquid Scint. Spectrometry				**pCi/sample**	**STL-RC-0055**			
Iron 55	-3.6	U	2.0	78	11/09/04	11/10/04	4314427	83

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

U Result is less than the sample detection limit.

Attachment 6

LVI Environmental Services, Inc.

Client Sample ID: W-102204-06

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F4J290245-006
Work Order: GVT38
Matrix: SOLID

Date Collected: 10/22/04 1200
Date Received: 10/29/04 0900

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	13900		1200	40	11/02/04	11/10/04	4308437	87
Uranium 235	620		150	20	11/02/04	11/10/04	4308437	87
Uranium 238	2160		280	30	11/02/04	11/10/04	4308437	87
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	0.9	U	1.1	1.5	11/02/04	11/06/04	4308435	83
Thorium 230	2.5		1.1	0.7	11/02/04	11/06/04	4308435	83
Thorium 232	0.09	U	0.25	0.49	11/02/04	11/06/04	4308435	83
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	0.46	U	0.51	0.62	11/02/04	11/05/04	4308430	106
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	4.0	U	8.2	14	11/04/04	11/09/04	4309246	100
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	-1.4	U	2.3	3.9	11/04/04	11/05/04	4309327	
Protactinium 234M	230	U	370	740	11/04/04	11/05/04	4309327	
Thorium 234	200		43	33	11/04/04	11/05/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	56		29	26	11/04/04	11/05/04	4309327	
Uranium 235	55		28	39	11/04/04	11/05/04	4309327	
Uranium 238	200		41	33	11/04/04	11/05/04	4309327	
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	12500		1300	10	11/03/04	11/05/04	4310287	
Gross Beta	3730		380	10	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	23	11/04/04	11/08/04	4309373	85
Nickel 63	-0.9	U	14	22	11/04/04	11/08/04	4309373	85
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	14.6		5.1	7.1	11/05/04	11/15/04	4310368	64
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	3.6	U	4.7	7.7	11/05/04	11/15/04	4310367	61
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	-300	U	1300	1000	11/02/04	11/15/04	4308438	80

LVI Environmental Services, Inc.

Client Sample ID: W-102204-06

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-006	Date Collected:	10/22/04 1200
Work Order:	GVT38	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R**			
Plutonium 238	0.04	U	0.30	0.67	11/11/04	11/12/04	4316228	81
Plutonium 239/40	0.0	U	0.0	0.3	11/11/04	11/12/04	4316228	81
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.0	U	0.0	1.7	11/11/04	11/12/04	4316226	45
Curium 243/244	0.0	U	0.0	2.9	11/11/04	11/12/04	4316226	45
Curium 242	0.0	U	0.0	1.4	11/11/04	11/12/04	4316226	45
Iron-55 by Liquid Scint. Spectrometry				**pCi/sample**	**STL-RC-0055**			
Iron 55	11.5	U	8.6	68	11/09/04	11/10/04	4314427	91

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

U Result is less than the sample detection limit.

Attachment 7

LVI Environmental Services, Inc.

Client Sample ID: W-102204-07

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F4J290245-007 Date Collected: 10/22/04 1200
Work Order: GVT39 Date Received: 10/29/04 0900
Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	21800		1700	50	11/02/04	11/10/04	4308437	96
Uranium 235	1020		180	30	11/02/04	11/10/04	4308437	96
Uranium 238	3040		330	40	11/02/04	11/10/04	4308437	96
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	2.5		1.4	1.4	11/02/04	11/06/04	4308435	85
Thorium 230	3.8		1.4	0.7	11/02/04	11/06/04	4308435	85
Thorium 232	0.24	U	0.45	0.70	11/02/04	11/06/04	4308435	85
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	1.6	U	8.4	14	11/04/04	11/09/04	4309246	98
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	0.5	U	2.3	4.3	11/04/04	11/05/04	4309327	
Protactinium 234M	770		370	440	11/04/04	11/05/04	4309327	
Thorium 234	341		48	27	11/04/04	11/05/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	77		20	22	11/04/04	11/05/04	4309327	
Uranium 235	106		43	35	11/04/04	11/05/04	4309327	
Uranium 238	341		40	27	11/04/04	11/05/04	4309327	
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	23700		2400	20	11/03/04	11/05/04	4310287	
Gross Beta	6810		700	20	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	18	11/04/04	11/08/04	4309373	82
Nickel 63	9	U	11	21	11/04/04	11/08/04	4309373	82
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	-5.89	U	0.90	7.3	11/05/04	11/15/04	4310368	66
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	40.9		7.2	7.4	11/05/04	11/15/04	4310367	60
Plutonium-241 by Liquid Scintillation				pCi/sample	STL-RC-0245			
Plutonium 241	-510	U	660	910	11/02/04	11/15/04	4308438	90
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R			
Plutonium 238	0.02	U	0.42	0.81	11/11/04	11/12/04	4316228	90
Plutonium 239/40	0.0	U	0.0	0.3	11/11/04	11/12/04	4316228	90

LVI Environmental Services, Inc.

Client Sample ID: W-102204-07

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F4J290245-007
Work Order: GVT39
Matrix: SOLID

Date Collected: 10/22/04 1200
Date Received: 10/29/04 0900

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.5	U	1.2	1.8	11/11/04	11/12/04	4316226	68
Curium 243/244	0.0	U	0.0	2.8	11/11/04	11/12/04	4316226	68
Curium 242	0.63	U	0.81	1.1	11/11/04	11/12/04	4316226	68
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Neptunium 237	**0.85**	J	**0.60**	**0.26**	**11/08/04**	**11/10/04**	**4313294**	**118**
Iron-55 by Liquid Scint. Spectrometry				**pCi/sample**	**STL-RC-0055**			
Iron 55	8.9	U	6.2	73	11/09/04	11/10/04	4314427	85

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.
U Result is less than the sample detection limit.

Attachment 8

LVI Environmental Services, Inc.

Client Sample ID: W-102204-08

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-008	Date Collected:	10/22/04 1200
Work Order:	GVT4A	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Iso URANIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Uranium 234	31400		2700	100	11/02/04	11/10/04	4308437	82
Uranium 235	1750		350	80	11/02/04	11/10/04	4308437	82
Uranium 238	4420		570	50	11/02/04	11/10/04	4308437	82
Iso THORIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Thorium 228	2.2		1.1	0.9	11/02/04	11/06/04	4308435	99
Thorium 230	2.01		0.95	0.47	11/02/04	11/06/04	4308435	99
Thorium 232	0.0	U	0.0	0.5	11/02/04	11/06/04	4308435	99
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			
Neptunium 237	0.82	J	0.61	0.56	11/02/04	11/06/04	4308430	108
TC-99 by LSC by DOE TC-02-RC Mod.				pCi/sample	TC-02-RC MOD			
Technetium 99	214		26	14	11/04/04	11/09/04	4309246	99
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				pCi/sample	GA-01-R MOD			
Cesium 137	-0.003	U	2.3	4.2	11/04/04	11/05/04	4309327	
Protactinium 234M	520	U	340	760	11/04/04	11/05/04	4309327	
Thorium 234	436		58	33	11/04/04	11/05/04	4309327	
--- Other Detected Radionuclides ---								
Thorium 231	102		33	28	11/04/04	11/05/04	4309327	
Uranium 235	90		40	34	11/04/04	11/05/04	4309327	
Uranium 238	436		48	33	11/04/04	11/05/04	4309327	
Iron-55 by Liquid Scint. Spectrometry				pCi/sample	STL-RC-0055			
Iron 55	-47	U	76	47	11/04/04	11/08/04	4309372	61
GROSS A/B BY GFPC SW846 9310 MOD				pCi/sample	9310 MOD			
Gross Alpha	34300		3500	20	11/03/04	11/05/04	4310287	
Gross Beta	8580		880	20	11/03/04	11/05/04	4310287	
Ni-59 & Ni-63 by Liquid Scint. Spec.				pCi/sample	STL-RC-0055			
Nickel 59	0.0	U	0.0	14	11/04/04	11/08/04	4309373	91
Nickel 63	-2	U	12	19	11/04/04	11/08/04	4309373	91
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			
Strontium 89	2.35	U	0.44	7.9	11/05/04	11/15/04	4310368	65
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/sample	SR-03-RC MOD			
Strontium 90	24.9		5.9	7.5	11/05/04	11/15/04	4310367	64

LVI Environmental Services, Inc.

Client Sample ID: W-102204-08

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F4J290245-008	Date Collected:	10/22/04 1200
Work Order:	GVT4A	Date Received:	10/29/04 0900
Matrix:	SOLID		

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Plutonium-241 by Liquid Scintillation				**pCi/sample**	**STL-RC-0245**			
Plutonium 241	110	U	320	1900	11/02/04	11/15/04	4308438	86
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R**			
Plutonium 238	0.09	U	0.38	0.71	11/11/04	11/12/04	4316228	86
Plutonium 239/40	0.0	U	0.0	0.6	11/11/04	11/12/04	4316228	86
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				**pCi/sample**	**A-01-R MOD**			
Americium 241	0.0	U	0.0	2.6	11/11/04	11/12/04	4316226	45
Curium 243/244	0.0	U	0.0	3.2	11/11/04	11/12/04	4316226	45
Curium 242	0.0	U	0.0	1.4	11/11/04	11/12/04	4316226	45

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.
Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.
U Result is less than the sample detection limit.

Attachment 9

METHOD BLANK REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (2 σ+/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD			pCi/sample	A-01-R MOD		Lab Sample ID: F4K030000-430B		
Neptunium 237	0.025	U	0.037	0.051	11/02/04	11/06/04	4308430	97
Iso THORIUM (SHORT CT) DOE A-01-R MOD			pCi/sample	A-01-R MOD		Lab Sample ID: F4K030000-435B		
Thorium 228	0.0	U	0.0	0.2	11/02/04	11/06/04	4308435	85
Thorium 230	0.0	U	0.0	0.1	11/02/04	11/06/04	4308435	85
Thorium 232	0.004	U	0.030	0.067	11/02/04	11/06/04	4308435	85
Iso URANIUM (SHORT CT) DOE A-01-R MOD			pCi/sample	A-01-R MOD		Lab Sample ID: F4K030000-437B		
Uranium 234	0.0	U	0.0	0.07	11/02/04	11/10/04	4308437	107
Uranium 235	0.0	U	0.0	0.06	11/02/04	11/10/04	4308437	107
Uranium 238	0.007	U	0.037	0.070	11/02/04	11/10/04	4308437	107
Plutonium-241 by Liquid Scintillation			pCi/g	STL-RC-0245		Lab Sample ID: F4K030000-438B		
Plutonium 241	0.60	U	0.68	1.7	11/02/04	11/15/04	4308438	92
TC-99 by LSC by DOE TC-02-RC Mod.			pCi/sample	TC-02-RC MOD		Lab Sample ID: F4K040000-246B		
Technetium 99	-15.9	U	7.9	14	11/04/04	11/09/04	4309246	96
Gamma Cs-137 & Hits by DOE GA-01-R MOD.			pCi/g	GA-01-R MOD		Lab Sample ID: F4K040000-327B		
Cesium 137	-0.3	U	2.8	5.4	11/04/04	11/05/04	4309327	
Protactinium 234M	100	U	250	510	11/04/04	11/05/04	4309327	
Thorium 234	-8	U	14	26	11/04/04	11/05/04	4309327	
Iron-55 by Liquid Scint. Spectrometry			pCi/sample	STL-RC-0055		Lab Sample ID: F4K040000-372B		
Iron 55	-7	U	21	5	11/04/04	11/08/04	4309372	42
Ni-59 & Ni-63 by Liquid Scint. Spec.			pCi/sample	STL-RC-0055		Lab Sample ID: F4K040000-373B		
Nickel 59	0.0	U	0.0	26	11/04/04	11/08/04	4309373	89
Nickel 63	-2.5	U	9.5	21	11/04/04	11/08/04	4309373	89
GROSS A/B BY GFPC SW846 9310 MOD			pCi/sample	9310 MOD		Lab Sample ID: F4K050000-287B		
Gross Alpha	4.9	J	1.6	1.5	11/03/04	11/05/04	4310287	
Gross Beta	1.3	U	2.0	3.3	11/03/04	11/05/04	4310287	
SR-90 BY GFPC DOE SR-03-RC MOD			pCi/sample	SR-03-RC MOD		Lab Sample ID: F4K050000-367B		
Strontium 90	-0.27	U	0.51	0.89	11/05/04	11/15/04	4310367	54

METHOD BLANK REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (2 σ+/-)		MDC	Prep Date	Analysis Date	Lab Sample ID Batch #	Yld %
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/sample	SR-01-RC MOD			F4K050000-368B	
Strontium 89	0.28	U	0.45		0.75	11/05/04	11/15/04	4310368	62
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			F4K080000-294B	
Neptunium 237	0.0	U	0.0		0.05	11/08/04	11/10/04	4313294	98
Iron-55 by Liquid Scint. Spectrometry				pCi/sample	STL-RC-0055			F4K090000-427B	
Iron 55	33	U	28		84	11/09/04	11/09/04	4314427	87
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R MOD			F4K110000-226B	
Americium 241	0.083	U	0.082		0.10	11/11/04	11/12/04	4316226	81
Curium 243/244	0.015	U	0.092		0.15	11/11/04	11/12/04	4316226	81
Curium 242	0.0	U	0.0		0.07	11/11/04	11/12/04	4316226	81
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/sample	A-01-R			F4K110000-228B	
Plutonium 238	0.0	U	0.0		0.07	11/11/04	11/12/04	4316228	92
Plutonium 239/40	0.003	U	0.026		0.058	11/11/04	11/12/04	4316228	92

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined using instrument performance only

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

Laboratory Control Sample Report

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Parameter	Spike Amount	Result	Total Uncert. (2 σ+/-)	MDC	% Yld	% Rec	Lab Sample ID QC Control Limits
Gamma Cs-137 & Hits by DOE GA-01-R MOD.			pCi/g	GA-01-R MOD			F4K040000-327C
Americium 241	2640	2650	190	20		100	(90 - 115)
Cesium 137	1110	1140	88	12		103	(90 - 115)
Cobalt 60	1600	1520	110	10		95	(90 - 111)
	Batch #:	4309327		Analysis Date:	11/05/04		

NOTE(S)

MDC is determined by instrument performance only
Calculations are performed before rounding to avoid round-off error in calculated results

a Spiked analyte outside of stated QC limits.

Laboratory Control Sample/LCS Duplicate Report

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Parameter		Spike Amount	Result		Total Uncert. (2 σ+/-)	% Yld	% Rec		QC Control Limits	Lab Sample ID Precision	
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD			pCi/samp		A-01-R MOD					F4K030000-430C	
Neptunium 237		13.3	13.1		0.72	108	99		(70 - 130)		
	Spk 2	13.3	12.5		0.71	119	94		(70 - 130)	4	%RPD
		Batch #:	4308430			Analysis Date:	11/06/04				
Iso THORIUM (SHORT CT) DOE A-01-R MOD			pCi/samp		A-01-R MOD					F4K030000-435C	
Thorium 228		5.06	5.86	a	0.71	87	116	a	(0.0 - 0.0		
	Spk 2	5.06	5.77	a	0.71	88	114	a	(0.0 - 0.0	2	%RPD
Thorium 230		4.10	3.87		0.53	87	94		(75 - 130)		
	Spk 2	4.10	3.04	a	0.45	88	74	a	(75 - 130)	24	%RPD
Thorium 232		5.07	5.19	a	0.65	87	102	a	(0.0 - 0.0		
	Spk 2	5.07	5.42	a	0.67	88	107	a	(0.0 - 0.0	4	%RPD
		Batch #:	4308435			Analysis Date:	11/06/04				
Iso URANIUM (SHORT CT) DOE A-01-R MOD			pCi/samp		A-01-R MOD					F4K030000-437C	
Uranium 234		5.37	5.10		0.61	83	95		(70 - 130)		
	Spk 2	5.37	5.37		0.77	58	100		(70 - 130)	5	%RPD
Uranium 238		5.37	4.89		0.59	83	91		(70 - 130)		
	Spk 2	5.37	5.50		0.78	58	102		(70 - 130)	12	%RPD
		Batch #:	4308437			Analysis Date:	11/10/04				
Plutonium-241 by Liquid Scintillation			pCi/g		STL-RC-0245					F4K030000-438C	
Plutonium 241		20.2	18.7		2.9	92	93		(70 - 130)		
	Spk 2	20.2	21.1		3.6	89	104		(70 - 130)	12	%RPD
		Batch #:	4308438			Analysis Date:	11/15/04				
TC-99 by LSC by DOE TC-02-RC Mod.			pCi/samp		TC-02-RC MOD					F4K040000-246C	
Technetium 99		2150	2110		210	98	98		(70 - 130)		
	Spk 2	2150	2060		210	99	96		(70 - 130)	2	%RPD
		Batch #:	4309246			Analysis Date:	11/09/04				
Iron-55 by Liquid Scint. Spectrometry			pCi/samp		STL-RC-0055					F4K040000-372C	
Iron 55		148	175		20	42	119		(70 - 130)		
	Spk 2	148	179		20	44	121		(70 - 130)	2	%RPD
		Batch #:	4309372			Analysis Date:	11/08/04				
Ni-59 & Ni-63 by Liquid Scint. Spec.			pCi/samp		STL-RC-0055					F4K040000-373C	
Nickel 59		2050	2110		220	86	103		(70 - 130)		
	Spk 2	2050	1860		190	85	91		(70 - 130)	13	%RPD
Nickel 63		1930	1930		200	86	100		(70 - 130)		
	Spk 2	1930	2060		220	85	107		(70 - 130)	7	%RPD
		Batch #:	4309373			Analysis Date:	11/08/04				
GROSS A/B BY GFPC SW846 9310 MOD			pCi/samp		9310 MOD					F4K050000-287C	
Gross Beta		209	187		20		90		(70 - 127)		
	Spk 2	209	194		20		93		(70 - 127)	3	%RPD
		Batch #:	4310287			Analysis Date:	11/05/04				
GROSS A/B BY GFPC SW846 9310 MOD			pCi/samp		9310 MOD					F4K050000-287C	
Gross Alpha		103	86		12		83		(70 - 130)		
	Spk 2	103	86		12		84		(70 - 130)	0.8	%RPD
		Batch #:	4310287			Analysis Date:	11/05/04				

Laboratory Control Sample/LCS Duplicate Report

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Parameter		Spike Amount	Result		Total Uncert. (2 σ+/-)	% Yld	% Rec		QC Control Limits	Lab Sample ID Precision	
SR-90 BY GFPC DOE SR-03-RC MOD				pCi/samp	SR-03-RC MOD					F4K050000-367C	
Strontium 90		9.65	10.5		1.3	68	108		(53 - 138)		
	Spk 2	9.65	12.9		1.5	59	134		(53 - 138)	21	%RPD
	Batch #:		4310367		Analysis Date:		11/15/04				
SR-89 BY GFPC DOE SR-01-RC MOD				pCi/samp	SR-01-RC MOD					F4K050000-368C	
Strontium 89		53.5	47.3		4.9	81	88		(60 - 150)		
	Spk 2	0.0535	49.0	a	5.1	65	9150	a	(60 - 150)	3	%RPD
	Batch #:		4310368		Analysis Date:		11/15/04				
ISO NEPTUNIUM (SHORT CT) DOE A-01-R MOD				pCi/samp	A-01-R MOD					F4K080000-294C	
Neptunium 237		13.3	12.5		0.71	123	94		(70 - 130)		
	Spk 2	13.3	12.6		0.71	113	95		(70 - 130)	1	%RPD
	Batch #:		4313294		Analysis Date:		11/10/04				
Iron-55 by Liquid Scint. Spectrometry				pCi/samp	STL-RC-0055					F4K090000-427C	
Iron 55		2950	3080		340	86	104		(70 - 130)		
	Spk 2	2950	3100		340	88	105		(70 - 130)	0.7	%RPD
	Batch #:		4314427		Analysis Date:		11/09/04				
Am241, Cm243/244 (SHORT CT) DOE A-01-R MOD				pCi/samp	A-01-R MOD					F4K110000-226C	
Americium 241		7.71	5.96		0.77	88	77		(70 - 124)		
	Spk 2	7.71	6.59		0.78	95	86		(70 - 124)	10	%RPD
	Batch #:		4316226		Analysis Date:		11/12/04				
Iso PLUTONIUM (SHORT CT) DOE A-01-R MOD				pCi/samp	A-01-R					F4K110000-228C	
Plutonium 238		2.98	2.81		0.40	86	94		(70 - 111)		
	Spk 2	2.98	3.00		0.41	96	101		(70 - 111)	7	%RPD
Plutonium 239/40		2.88	3.25		0.44	86	113		(77 - 125)		
	Spk 2	2.88	2.96		0.40	96	103		(77 - 125)	9	%RPD
	Batch #:		4316228		Analysis Date:		11/12/04				

NOTE(S)

Calculations are performed before rounding to avoid round-off error in calculated results

a Spiked analyte outside of stated QC limits.

DUPLICATE EVALUATION REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F4J290245
Matrix: SOLID

Date Sampled: 10/22/04
Date Received: 10/29/04

Parameter	SAMPLE Result		Total Uncert. (2σ+/-)	% Yld	DUPLICATE Result		Total Uncert. (2 σ+/-)	% Yld	QC Sample ID Precision	
Gamma Cs-137 & Hits by DOE GA-01-R MOD.				**pCi/samp**	**GA-01-R MOD**				**F4J290245-001**	
Cesium 137	-0.9	U	2.8		0.2	U	1.9		-285	%RPD
Protactinium 234M	630	U	360		360	U	330		55	%RPD
Thorium 234	300		45		324		47		8	%RPD
---Other Dedected Radionuclides---										
Thorium 231	108		25		97		26		11	%RPD
Uranium 235	98		37		80		34		20	%RPD
Uranium 238	300		38		324		39		8	%RPD
	Batch #:		4309327	(Sample)	4309327	(Duplicate)				

NOTE(S)

Data are incomplete without the case narrative.
Calculations are performed before rounding to avoid round-off error in calculated results

U **Result is less than the sample detection limit.**

From: Rood, Gerald J.
Sent: Tuesday, April 07, 2009 7:53 AM
To: Cummin, Chris C.
Subject: RE: Energy Solutions Questions

Thanks. We can accept their explanation that the data are likely anomalous. We should retain a copy of their explanation with the project record for the data.

Gerald J. Rood CHP
Project Radiation Safety Officer
Westinghouse Electric Company
Hematite Decommissioning Project
Office: (314) 810-3382
Cellular: (636) 544-9299
Email: roodgj@westinghouse.com
Home Page: www.westinghousenuclear.com

From: Cummin, Chris C.
Sent: Friday, April 03, 2009 3:34 PM
To: Rood, Gerald J.
Subject: FW: Energy Solutions Questions

Gerry
This is what I got from the lab. I intend to attach to the TBD for waste characterization for the MM&A material.
Chris

From: Everett, Jerry [mailto:Jerry.Everett@testamericainc.com]
Sent: Friday, April 03, 2009 1:30 PM
To: Cummin, Chris C.
Subject: FW: Energy Solutions Questions

Chris,

Please see comment below from Terry Romanko.

JERRY A EVERETT
Project Manager

TestAmerica
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Earth City, MO 63045-1205
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www.testamericainc.com www.stl-inc.com
-----Original Message-----
From: Romanko, Terry
Sent: Friday, April 03, 2009 1:19 PM
To: Everett, Jerry
Subject: Energy Solutions Questions

Jerry,

Attachment 10 pg 2 of 2

Following are some comments regarding the questions regarding Lot F4J290245. As this lot was analyzed quite some time ago (more than four years ago), it is hard to be definitive, especially as we have no way to go back to recount, reanalyze, or otherwise look at the samples.

- It appears on sample -001 that the Result and MDC fields were switched for Cm-242.
- For sample -002, the client made a comment regarding the "positive" Pu-241 results without the presence of Am-241. Note that the aliquot volume used for the Iso-Pu analysis (including Pu-241) was very small. This in turn drove the MDC and Total Uncertainty for Pu-241 up quite high. It is possible the elevated result for Pu-241 is an anomaly (statistical or otherwise). Again, we have no way to confirm this result or investigate the issue further. I considered the idea that, given the high activity of Uranium in the samples we may have some interference/false positive due to incomplete separation. I checked out the Iso-Pu spectra in the raw data, and this does not appear to be the case.
- According to the client inquiry, for samples -005, -007, and -008 the Sr-90 and/or Sr-89 result seems to be elevated. For -005, the Sr-89 result is well above the MDC although Sr-89 would not be expected to be seen in the sample (should probably be decayed out). I do not have an explanation for the elevated Sr-89 anomaly. It is possible, given the elevated activity of Uranium in the samples that we may have some Uranium tagging along with the Sr precipitate. However, I don't expect this to be the case, as there are several cleanup and re-precipitation steps along the way. Again, we have no way to recount or reprepared the samples to verify this.

If you need other information, please let me know.

Thanks,

TERRY ROMANKO
Technical Director

TestAmerica
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Earth City, MO 63045
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Attachment 11
Process Building Scaling Factors

					pCi/sample				
Location	**Sample #**	**U-234**	**U-235**	**U-238**	**Th-230**	**Th-232**	**Tc-99**	**Np-237**	**Sr-90**
Bldg 240 Red R	W-102204-01	19400	860	2810	5.6	0.66	392	1.8	6.8
Bldg 240 Green R	W-102204-02	43500	1910	5890	6.8	0.66	44	0.66	9.7
Maint/Decon	W-102204-03	36700	1590	4830	7.5	1	29.7	0.69	10.5
Bldg 253	W-102204-04	10700	420	1420	16.4	0.9	43	0.3	9.3
Bldg 254	W-102204-05	32300	1360	4330	3.6	0.7	14	1.69	33.6
Bldg 256	W-102204-06	13900	620	2160	2.5	0.49	14	0.62	7.7
Bldg 255	W-102204-07	21800	1020	3040	3.8	0.7	14	0.85	40.9
Bldg 260	W-102204-08	31400	1750	4420	2.01	0.5	214	0.82	24.9
	Total	209700	9530	28900	48.21	5.61	764.7	7.43	143.4
	Average	2.62E+04	1.19E+03	3.61E+03	6.03E+00	7.01E-01	9.56E+01	9.29E-01	1.79E+01
Scaling Factor	Isotope/U-235	2.20E+01	1	3.03E+00	5.06E-03	5.89E-04	8.02E-02	7.80E-04	1.50E-02
Percentages	total pCi/sample	%	SA	Grams	% Enrich				
U-234	209700	84.18%	6.20E+09	3.38E-05					
U-235	9530	3.83%	2.20E+06	4.33E-03	4.85%				
U-238	28900	11.60%	3.40E+05	8.50E-02					
Th-230	48.21	0.02%							
Th-232	5.61	0.00%							
Tc-99	764.7	0.31%							
Np-237	7.43	0.00%							
Sr-90	143.4	0.06%							
Total	249099.35	100.00%							

Attachment 11
Process Building Scaling Factors

Location	**Tc-99to U_235**		**Sr-90 to U-235**	
Bldg 240 Red R	0.455814	5.680537	0.007907	0.525478
Bldg 240 Green R	0.023037	0.287092	0.005079	0.337506
Maint/Decon	0.018679	0.232788	0.006604	0.43887
Bldg 253	0.102381	1.275913	0.022143	1.471558
Bldg 254	0.010294	0.128289	0.024706	1.64189
Bldg 256	0.022581	0.281409	0.012419	0.825359
Bldg 255	0.013725	0.171053	0.040098	2.664814
Bldg 260	0.122286	1.523974	0.014229	0.945595
	0.080241	1	0.015047	1
	0.080241	1	0.015047	1
Scaling Factor				
Percentages				
U-234				
U-235				
U-238				
Th-230				
Th-232				
Tc-99				
Np-237				
Sr-90				
Total				