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Our ref: HEM-10-135
Date: December 21, 2010

Subject: Waste Characterization for Alternate Disposal Request for Decommissioning Soils (License No. SNM-00033, Docket No. 070-00036)

References:

1) Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-09-52, dated May 21, 2009, "Request for Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste" (ADAMS Accession No. ML091480071)
2) Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-09-146, dated December 29, 2009, "Response to Request for Additional Information - Alternate Waste Disposal" (ADAMS Accession No. ML100320540)
3) Westinghouse (E. K. Hackmann) letter to NRC Document Control Desk, HEM-10-6, dated January 20, 2010, "Additional Information Concerning Alternate Waste Disposal"
4) Westinghouse (E. K. Hackmann) letter to NRC Document Control Desk, HEM-10-9, dated January 21, 2010, "Corrected Compact Disks Concerning Alternate Waste Disposal"
5) Westinghouse (E. K. Hackmann) letter to NRC Document Control Desk, HEM-10-38, dated March 31, 2010, "Additional Information for Alternate Waste Disposal Authorization and Exemption" (ADAMS Accession No. ML100950386)
6) Westinghouse (E. K. Hackmann) letter to NRC Document Control Desk, HEM-09-94 dated August 12, 2009, "Decommissioning Plan and Revision to License Application" (ADAMS Accession No. ML092330123)
7) Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-10-46, dated May 24, 2010, "Additional Information and Clarifications Concerning 10 CFR 20.2002 Alternate Waste Disposal Authorization and Exemption for Specific Hematite Decommissioning Project Waste"

Reference 1 provided the Westinghouse Electric Company LLC (Westinghouse) request for alternate waste disposal of decommissioning soils in accordance with 10 CFR 20.2002. That

request also included requests for exemptions from the regulations of 10 CFR 30.3 and §70.3 with respect to licensing requirements to allow the material disposal at the U.S. Ecology facility in Idaho. References 2 and 3 provided Westinghouse's responses to the associated NRC requests for additional information of NRC letter dated December 3, 2009. Reference 2 included two Compact Disks (CD) which were found to contain discrepancies; replacement CDs were provided via Reference 4 to replace those of Reference 2. Reference 5 submitted clarifications to several Reference 2 responses as a result of a telephone conversation between Westinghouse and NRC staff personnel on March 3, 2010.

Reference 6 had submitted several documents supporting the Hematite Decommissioning Plan; one of those documents, DO-08-008, "Derivation of Surrogates and Scaling Factors for Hard-To-Detect Radionuclides," Revision 0 (ADAMS Accession No. ML092870492), was referred to in the correspondence synopsis and clarifications of Reference 7.

Of the various communications between NRC and Westinghouse concerning the request for alternate waste disposal of decommissioning soils, this letter is meant to summarize those communications since submittal of Reference 7. Attachment 1 herein provides a description of the methods Westinghouse will implement to verify that the waste inventory, the disposal waste acceptance criteria, and the intruder dose scenario limits established in the 10 CFR 20.2002 request have been met prior to each shipment.

Please contact Mark Michelsen, Acting Licensing Manager of my staff at 314-810-3376 should you have questions or need any additional information.

Sincerely,

E. Kurt Hackmann
Director, Hematite Decommissioning Project

Attachment: 1) Technical Basis for Characterization of Decommissioning Soils Waste to be Sent to U. S. Ecology Idaho, Inc.

cc: J. J. Hayes, NRC/FSME/DWMEP/DURLD
J. W. Smetanka, Westinghouse, w/o attachment
J. E. Tapp, NRC Region III/DNMS/MCID, w/o attachment

ATTACHMENT 1

Technical Basis for Characterization of Decommissioning Soils Waste to be Sent to U. S. Ecology Idaho, Inc.

Westinghouse Electric Company LLC,
Hematite Decommissioning Project

Docket No. 070-00036

Table of Contents

1.0 Introduction

The following technical basis describes the method Westinghouse Electric Company LLC (Westinghouse) will implement to verify that the Tc-99 inventory, the U. S. Ecology Idaho, Inc. (USEI) waste acceptance criteria (WAC), and the intruder dose scenario limits (applicable to Ra-226 and Th-232) established in Westinghouse's 10 CFR 20.2002 request for authorization of alternate waste disposal of decommissioning soils have been met prior to each shipment. This document provides a review of characterization data variability, and the means Westinghouse will employ to ensure that all applicable limits are not exceeded. Details of field measurements and sampling frequencies to be utilized in the Hematite Decommissioning Project (HDP) excavation areas are included in the Waste Characterization Plan as Appendix A to this Technical Basis Document.

This document is intended to summarize Westinghouse's waste characterization approach, and to address waste characterization issues raised by NRC during discussions with Westinghouse regarding the application for alternate disposal of waste material at USEI. Most notably, NRC provided a list of concerns during the September 15, 2010 conference call that were subsequently addressed by Westinghouse during the October 29, 2010 conference call. The key items discussed with NRC on October 29, 2010 are listed below and addressed in the subsequent sections of this document:

- Westinghouse will not assume normal distribution for Tc-99 data. Non-parametric statistics will be used for the final compliance calculation and the inventory check calculations during shipping.
- To address variability, the Visual Sampling Plan (VSP) was used to determine the number of samples required to ensure that the final inventory compliance calculation is made with sufficient confidence.
- Westinghouse acknowledges that the surrogate ratios for $^{99}Tc/^{235}U$ vary substantially across the site. Consequently, only laboratory analyses for ^{99}Tc will be used to calculate ^{99}Tc inventories.
- To ensure control of rail shipments prior to dispatch, Westinghouse will perform a number of in-process data checks to ensure all applicable inventory and disposal site WAC limits are met prior to shipment.
- A comprehensive QA/QC program will be in place as described in Section 8 below.
- Westinghouse will have contingency plans in place that are tied to specific action levels to ensure that unexpected conditions are identified (Section 10 below).

2.0 Objectives of Sampling Approach

The objective of the waste characterization plan for material destined for USEI is to provide inventory data to ensure compliance with the limitations on the estimated radiological dose submitted in the 10 CFR 20.2002 request for alternate waste disposal authorization. The primary radionuclide of concern from the long-term perspective of exposure to the public is Tc-99, for which a total inventory limit of 1 Curie (Ci) has been established. Although not limiting from

the long-term perspective of dose, Ra-226 and Th-232 were determined to be limiting based on the intruder dose scenario, and as such individual railcars are subject to a mean concentration-based limit of 13 and 16 pCi/g for Ra-226 and Th-232, respectively.

3.0 Summary of Characterization Data

Data collected during site characterization efforts were used to identify areas which would require remediation and to develop a series of contour maps to estimate the volume of material to be excavated. The characterization data falling inside these contour areas (i.e., areas identified as requiring excavation) were used as the basis for the characterization of the material to be submitted under the USEI Alternate Disposal Request submittal (Westinghouse (E. K. Hackmann) letter to Document Control Desk (NRC), HEM-09-52, dated May 21, 2009, "Request for Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste").

Westinghouse has identified discrepancies in a small number of Tc-99 results that were used in the initial application for alternate disposal. The revisions to the dataset were transmitted to the NRC in the response to a June 21, 2010 telephone call with the NRC (Mark A. Michelsen email to John Hayes, et al, dated June 25, 2010 at 3:28PM CDT, "Additional Info for Hematite USEI Alternate Disposal Request for Soils"), as well as in a more recent transmittal submitted on November 2, 2010 (Mark A. Michelsen email to John Hayes, dated November 2, 2010 at 3:11PM CST, "Alternate Disposal Request for Soils - Data Correction").

The resultant dataset for the material within the excavation is tabulated in Tables 1 and 2, below. Please note that the overall mean and median values were weighted by the volume of material from each tabulated area. The median values are presented in addition to the mean to provide a more realistic indication of the radionuclide concentration in the waste material as it is less impacted by the presence of high outlier values. The high outlier values are given equal weighting in the calculated mean and median concentrations. The median concentration values were used in the Alternate Disposal Request performance assessment as an *a-priori* estimate of the concentration in the material that will be shipped to USEI. Please note however that the compliance calculations described in this document will be based on the mean concentration of radionculides in the actual material shipped.

Table 1
Weighted Mean Radionuclide Concentrations

Location	Volume	Ra-226	Tc-99	Th-232	U-234	U-235	U-238
	m^3	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
0-1.0 CSM	3,334	1	370.0	1.1	1075.0	47.3	67.7
1.0-5.0 CSM	4,067	1	41.5	1.0	192.3	7.7	9.0
> 5.0 CSM	873	1	4.24	1.16	1622	82.7	570.8
Th-232 Area	108	1	0.9	686.8	4489.4	170.7	440.0
Ra-226 Area	328	38.1	0.3	1.3	45.0	2.5	10.1
Weighted Mean		2.4	161.5	9.6	721.0	32.2	93.1

Table 2
Weighted Median Radionuclide Concentrations

Location	Volume	Ra-226	Tc-99	Th-232	U-234	U-235	U-238
	m^3	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
0-1.0 CSM	3,334	1	32.5	1.0	111.8	6.2	16.7
1.0-5.0 CSM	4,067	1	17.3	1.1	12.4	0.6	2.9
> 5.0 CSM	873	1	0.42	1.2	619.2	28.5	100.0
Th-232 Area	108	1	0.1	18.5	144.9	2.8	2.7
Ra-226 Area	328	1.6	0.2	1.0	6.4	0.4	2.7
Weighted Median		1.0	20.6	1.2	112.6	5.5	17.9

The total volume of material within the contour areas (8710 m^3) is smaller than the estimated total volume which is expected to be shipped to USEI (22,809 m^3). The difference between the volume inside the contours and the larger volume represents the additional material that may be identified as requiring disposal, and the additional volume that may be generated as a result of inadvertent mixing of surrounding materials during the excavation process.

4.0 Variability in Data Set

Due to the importance of Tc-99 concentration (and inventory) with respect to long-term dose, the variability of the Tc-99 concentration within the material to be disposed must be known to ensure compliance with sufficient confidence. The variability in the sample dataset from all areas within the excavation contours is an upper bound on the variability that may be seen in the material after it is excavated and stockpiled for disposal. When all of the data within the excavation contours is pooled, the standard deviation for the Tc-99 measurements is 1447 pCi/g.

This variability is largely driven by two samples (EP-08-00-SL and EP-10-00-SL) from the area around the evaporation pond that showed concentrations of 3,420 and 17,100 pCi/g, respectively. Excavating and evaluating the material associated with these two samples near the evaporation pond independently from the balance of the material results in a calculated standard deviation of 225 pCi/g for the remainder of the site with all samples from the evaporation pond area removed, and 200 pCi/g with only EP-08-00-SL and EP-10-00-SL removed. Additionally, correcting for the discrepancies in the dataset (i.e., in identified the aforementioned June 22, 2010 and November 2, 2010 eMails) results in a standard deviation of 123 pCi/g for the pooled dataset with all the samples in the evaporation pond area removed, and 116 pCi/g with only EP-08-00-SL and EP-10-00-SL removed.

5.0 Basis for Sampling Approach

The application for alternate disposal of waste materials at USEI proposed to use the median Tc-99 concentration defined by the existing site characterization data, (i.e., 27 pCi/g) as the best estimate of the concentration in the source term as input to the USEI post-closure dose assessment. The assessment concluded that the post-closure dose to a member of the public resulting from a concentration of 27 pCi/g Tc-99 within a 22,809 m^3 volume of waste would be approximately 2 mrem/yr, which is within NRC's guideline of a few mrem/yr. Based on that estimate of volume and concentration, the total inventory of Tc-99 that HDP will be allowed to

dispose of at USEI will be limited to 1 Ci.

To address the NRC concern regarding the high variability in the Tc-99 characterization data, and to ensure that the total inventory of Tc-99 actually shipped to USEI is known with sufficient confidence, HDP has taken the following steps:

1) Developed a statistically based sample plan for the material to be disposed that will include the collection of an adequate population of samples to define the upper limit of the mean concentration (and associated total inventory) at the 95% confidence level.

2) To reduce variability within the entire site wide dataset, the area showing elevated outlier concentrations of Tc-99 within the vicinity of the Evaporation Ponds will be characterized independently prior to being included with the balance of the material shipped to USEI. Material from the immediate vicinity of EP-08-00-SL and EP-10-00-SL (approximately 5 m^3) will be held prior to being shipped to USEI; further characterization of this material will be performed to determine its ultimate disposition. Other materials in this area (outside the immediate vicinity of EP-08-00-SL and EP-10-00-SL) will be intentionally mixed within the excavation during the excavation process and subsequently sampled at a rate of one composite sample (composed of four aliquots) per 15 – 20 yd^3 consistent with the material from the balance of the site.

3) The statistically based sample plan will demonstrate that the volumetrically averaged mean concentration of Tc-99 in waste material disposed during the duration of the project is well known. It will also ensure that a sufficient number of samples are collected to demonstrate that the $UCL_{(0.95)}$ for the total inventory would not result in a post-closure dose estimate in excess of 3 mrem/yr. Demonstrating compliance with the limit of approximately 2 mrem/yr as indicated by the post-closure dose assessment by limiting the $UCL_{(0.95)}$ to 3.0 mrem/yr is a reasonably prudent approach, and consistent with the NRC guideline that the dose from a 10 CFR 20.2002 disposal should be on the order of a few mrem per year. To show compliance with this criterion, HDP will set a limit of 1.6 Ci for the $UCL_{(0.95)}$ to be used in conjunction with the 1 Ci limitation on the mean activity. HDP will conduct operations in a manner as to ensure that neither of these limits are exceeded.

6.0 Sampling Approach

The sampling plan that will be implemented by Westinghouse is based on the Visual Sampling Plan (VSP) module for Calculating a One-Sided Confidence Interval for the Population Mean Using Simple Random Sampling. Data quality objectives for the survey design are shown in Figure 2. VSP was used to estimate the sample size necessary to meet the data quality objectives using a standard deviation of 225 pCi/g and a confidence interval width of 14 pCi/g (equivalent to 1 mrem). Using 14 pCi/g as the interval width is the most conservative assumption, and results in the largest sample size, because it applies to the most limiting case where the mean is 27 pCi/g and the corresponding 3 mrem $UCL_{(0.95)}$ would then be 41 pCi/g. As the mean decreases, the interval width could increase and still satisfy the 3 mrem/yr upper $UCL_{(0.95)}$ limit. The resultant sample size is 704.

An important observation regarding the selection of standard deviation for determining sample size is that, if the standard deviation of the excavated waste samples is significantly larger than

estimated in the VSP sample size calculation, the requirement that the $UCL_{(0.95)}$ be less than 3 mrem from Tc-99 would limit the volume of material that can be disposed. Prior to each shipment, the running mean and $UCL_{(0.95)}$ of the inventory will be calculated as Tc-99 analysis results are reported. If the mean for the pending shipment exceeds 1 Ci, or the $UCL_{(0.95)}$ exceeds 1.6 Ci, the shipment will not be made.

A total of 704 samples would be required to meet the data quality objectives for the sampling approach outlined above. Based on the volume of material projected to be shipped (22,809 m^3), this sampling frequency would correspond to one sample for every 42 yd^3 of waste material. In practice, one composite sample will be collected from multiple locations within each 15 – 20 yd^3 of waste material. This sample will be submitted for Tc-99 analysis by an offsite laboratory. This sampling approach (one composite sample for each 15 – 20 yd^3 of waste) will result in an abundance of samples which will allow for a significant number of contingency samples.

As indicated previously, material in the area around the evaporation pond area will be handled separately due to the relatively high levels of Tc-99 found in that area. Material from the immediate vicinity of the two areas with known high Tc-99 concentrations (EP-08-00-SL and EP-10-00-SL) will be excavated separately and not be considered as candidate material for shipment to USEI until it has undergone more detailed sampling. Material from the remainder of the evaporation pond area will be intentionally mixed within the excavation process and subsequently sampled at a rate of one composite sample (composed of 4 aliquots) per 15 – 20 yd^3.

7.0 Material Handling Summary

The HDP material handling process, including the multiple material handling decision points and shipping limit-based decision points, is shown in the Figure 1 Waste Handling Flowchart.

For material originating from areas requiring nuclear critically safety (NCS) controls, two independent surveys using *in-situ* gamma measurement instruments will be conducted prior to material excavation as described in Section 2 of Appendix A herein. Survey results that indicate soil/waste materials exceed criticality screening levels are sent to the Waste Evaluation Area (WEA) for detailed surveys, isotopic analysis and segregation, if appropriate. Soil/waste materials that pass criticality screening are excavated in a predetermined cut depth and removed to the Waste Consolidation Area (WCA). See Figure 3 for an illustration of the locations of the WEA and WCA.

Material originating from areas not requiring NCS controls will not be scanned *in-situ*, however scanning will occur at the time of unloading at the Waste Holding Area (WHA) as described in Appendix A, Section 3. Discrete sources of elevated activity or other items that cannot be adequately characterized by radiological scanning due to physical characteristics (e.g., self-shielding) will be removed from the material stream and taken to the WEA for detailed characterization. See Figure 3 for an illustration of the location of the WHA.

Once received at the WHA, each truckload of approximately 17 cubic meters will have one composite sample from four locations taken after dumping. Each rail car will typically hold 4 truckloads of material, and therefore have 4 composite samples associated with it. Truckloads will be added to the WHA pile until enough material has been accumulated for 5 rail cars (approximately 20 truckloads) resulting in 20 composite samples. The samples will be analyzed

for radionuclides of concern, including Tc-99, and the resulting data added to the data set. A new mean and $UCL_{(0.95)}$ will be calculated prior to shipment and compared to the mean and confidence interval limits to ensure they have not been exceeded.

The 95% confidence interval will be calculated using the Chebyshev inequality based UCL, using the sample mean and sample standard deviation. This is a nonparametric method contained within the EPA "Pro UCL" software package and is not be based on an assumption of normality. Once the analyses have been completed, documented and reviewed by Westinghouse management, the material will be released for shipment to USEI.

8.0 QA Requirements

The HDP quality assurance (QA) program provides the site specific project quality requirements as they apply to the decommissioning site. The Hematite QA program establishes the QA requirements and management controls for safety involving licensed materials and quality-related activities (e.g., actions, processes, tasks or work). The QA program influences the achievement and verification of quality requirements and objectives associated with decommissioning the Hematite site. Waste characterization activities at the Hematite site will be conducted in accordance with the site QA program.

The following specific QA sampling elements will be implemented:

Field Duplicate Samples

Field duplicate samples (lab blind) will be collected at a frequency of 1 per 20. Consistent with section 7.4.1.1 of MARLAP, the results of the field duplicates will be evaluated to determine the relative difference or relative percent difference between the two sets, depending on the mean of the two sample results. The relative difference will be used when the mean of the two samples is less than 27 pCi/g and the relative percent difference will be used when the mean activity is greater than 27 pCi/g. The results will be compared to predetermined warning and control limits (determined based on the methodology in section 7.4.1.1 of MARLAP).

Field Blanks

Field blanks (lab blind) will be collected at a frequency of 1 per 100. The results of these samples will be used to evaluate the presence of a bias in the sample results.

Laboratory Control Samples

Internal laboratory blanks, matrix spike (if applicable), and replicate counts will be conducted at a frequency of one per 20. These results will be reviewed to assess the overall laboratory performance as a part of the validation of incoming analytical data.

9.0 Compliance Calculations

Compliance with the Tc-99 inventory limit (1 Ci) and $UCL_{(0.95)}$ will be determined prior to each shipment of material and will comprise a "running inventory." As each stockpile of material is generated, analytical data from that stockpile will be pooled with the data from all previous stockpile samples to calculate a mean concentration and a 95% Chebyshev UCL on the mean. These two values will be multiplied by the sum of the total mass of material already shipped and the mass of the current stockpile. Once this is done, the two values (representing the mean Tc-99

inventory and $UCL_{(0.95)}$ of the mean Tc-99 inventory) will be compared to the compliance limits (1 and 1.6 for the mean and $UCL_{(0.95)}$ of the mean) to determine if the stockpile may be shipped. An example of this calculation is provided below:

1. 20 truckloads of material (4.82 E 8 grams total) is received at the waste holding area. The Tc-99 sample results (pCi/g) associated with each of the truckloads are as follows:

156.2	79.9	99.0	333.4	16.3
146.0	62.9	121.0	153.6	39.2
17.3	36.3	80.9	544.9	41.1
2.4	47.6	85.2	214.5	24.0

2. The mean and $UCL_{(0.95)}$ is calculated

Mean	st. dev	UCL(0.95)[a]
115.1	128.8	240.6

   a $UCL_{(0.95)}$ is calculated using the Chebyshev inequality using the equation below from ProUCL

$$UCL = \bar{x} + \sqrt{((1/\alpha)-1)}s_x/\sqrt{n}$$

3. Based on these values, the USEI inventory is updated

$$\frac{\text{Inventory} = 0.06 \text{ Ci } (115.1 \text{ pCi/g} * 4.82 \text{ E } 8 \text{ grams})}{UCL_{(0.95)} = 0.12 \text{ Ci } (240.6 \text{ pCi/g} * 4.82 \text{ E } 8 \text{ grams})}$$

   Compliance Decision:
   Since the Inventory value (0.06 Ci) < 1 Ci and the $UCL_{(0.95)}$ (0.12 Ci) < 1.6; the material may be shipped to USEI

4. 20 more truckloads of material (4.82 E 8 grams total) are received at the waste holding area. The Tc-99 sample results (pCi/g) associated with each of the truckloads are as follows:

47.0	40.9	99.3	225.5	221.5
28.4	172.2	24.1	4.6	30.4
196.7	313.6	27.8	39.0	28.0
144.1	3.1	167.1	23.4	83.7

5. This data is pooled with the previous data

156.2	79.9	99.0	333.4	16.3
146.0	62.9	121.0	153.6	39.2
17.3	36.3	80.9	544.9	41.1
2.4	47.6	85.2	214.5	24.0
47.0	40.9	99.3	225.5	221.5
28.4	172.2	24.1	4.6	30.4
196.7	313.6	27.8	39.0	28.0
144.1	3.1	167.1	23.4	83.7

6. The mean and $UCL_{(0.95)}$ is calculated for the entire dataset

Mean	st. dev	UCL(0.95)
105.5	110.5	181.7

7. Based on these values, the USEI inventory is updated

$$\frac{\text{Inventory} = 0.10 \text{ Ci } (105.5 \text{ pCi/g} * 9.64 \text{ E } 8 \text{ grams})}{UCL_{(0.95)} = 0.18 \text{ Ci } (181.7 \text{ pCi/g} * 9.64 \text{ E } 8 \text{ grams})}$$

Compliance Decision:
Since the Inventory value (0.10 Ci) < 1 Ci and the $UCL_{(0.95)}$ (0.18 Ci) < 1.6; the material may be shipped to USEI

8. 20 more truckloads of material (4.82 E 8 grams total) are received at the waste holding area. The Tc-99 sample results (pCi/g) associated with each of the truckloads are as follows:

209.3	30.1	11.8	214.4	186.2
15.1	179.1	223.0	52.2	53.5
0.3	189.6	8.7	148.3	17.4
16.4	187.7	7.2	74.7	154.5

9. This data is pooled with the previous data

156.2	79.9	99.0	333.4	16.3
146.0	62.9	121.0	153.6	39.2
17.3	36.3	80.9	544.9	41.1
2.4	47.6	85.2	214.5	24.0
47.0	40.9	99.3	225.5	221.5
28.4	172.2	24.1	4.6	30.4
196.7	313.6	27.8	39.0	28.0
144.1	3.1	167.1	23.4	83.7
209.3	30.1	11.8	214.4	186.2
15.1	179.1	223.0	52.2	53.5
0.3	189.6	8.7	148.3	17.4
16.4	187.7	7.2	74.7	154.5

10. The mean and $UCL_{(0.95)}$ is calculated for the entire dataset

Mean	st. dev	UCL(0.95)
103.4	102.3	160.9

11. Based on these values, the USEI inventory is updated

$$\frac{\text{Inventory} = 0.15 \text{ Ci } (103.4 \text{ pCi/g} * 1.45 \text{ E } 9 \text{ grams})}{UCL_{(0.95)} = 0.23 \text{ Ci } (160.9 \text{ pCi/g} * 1.45 \text{ E } 9 \text{ grams})}$$

Compliance Decision:
Since the Inventory value (0.15 Ci) < 1 Ci and the $UCL_{(0.95)}$ (0.23 Ci) < 1.6; the material may be shipped to USEI

10.0 Contingency Plans

Prior to shipment, the following conditions will be evaluated:

Parameter	Action Level	How Monitored	Actions
Total Quantity of Tc-99 shipped to USEI (mean)	>1 Ci	Running total activity, based on laboratory sample results prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; • Ship material to alternate facility.
95% Upper Confidence Level of the mean Tc-99 shipped to USEI (UCL(0.95).	>1.6 Ci	Running confidence interval based on laboratory sample data prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; Ship material to alternate facility.
Total activity contribution from all radionuclides within individual railcar	>3000 pCi/g > 40 μR/hr[a]	Laboratory sample results for stockpile evaluated at 95% UCL prior to shipment Gamma radiation levels on railcars prior to shipment.	• Analyze additional aliquot of composite sample; • Unload railcar (at HDP) and re-load with material containing lower concentration (either blended or alternate material from onsite waste stream); • Ship material to alternate facility.
Unexpected Tc-99 results for stockpile samples	>99th percentile of the site wide dataset (599 pCi/g)[b]	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; • Blend with less contaminated material, resample stockpile and re-evaluate; • Ship material to alternate facility.
Maximum average concentration of Ra-226 and Th-232 within individual railcar	Ra-226 >13 pCi/g Th-232 >16 pCi/g	Laboratory sample results for each railcar evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; Blend with less contaminated material, resample stockpile and re-evaluate; • Ship material to alternate facility.

[a] Based on analysis previously transmitted in HEM-10-46

[b] Value shown is the 99th percentile of the pooled site wide Tc-99 dataset with EP-08-00-SL and EP-10-00-SL excluded using Microsoft® Excel® spreadsheet software[1].

[1] Microsoft, Encarta, MSN, and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Figure 1
Waste Handling Flowchart

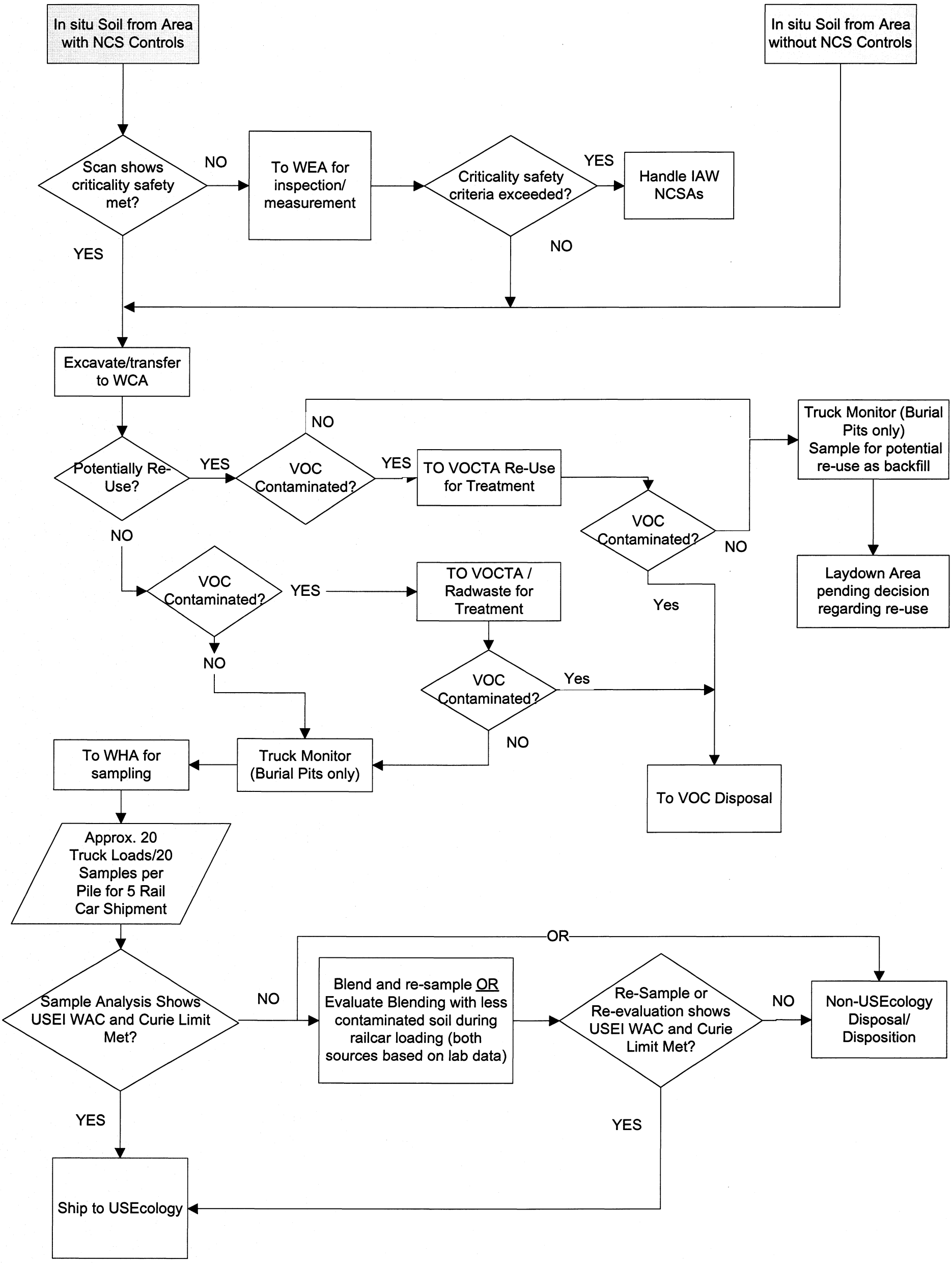


Figure 2

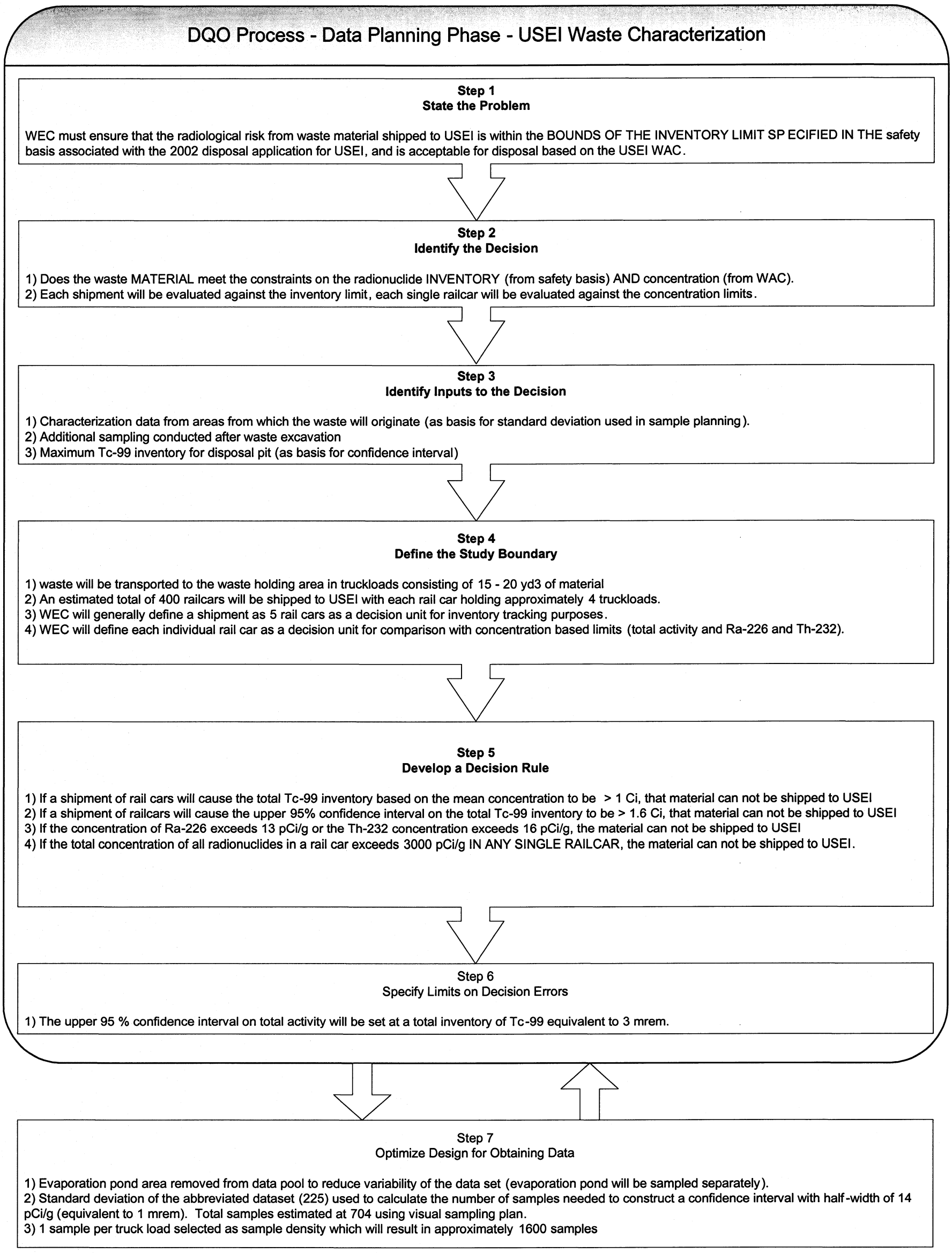
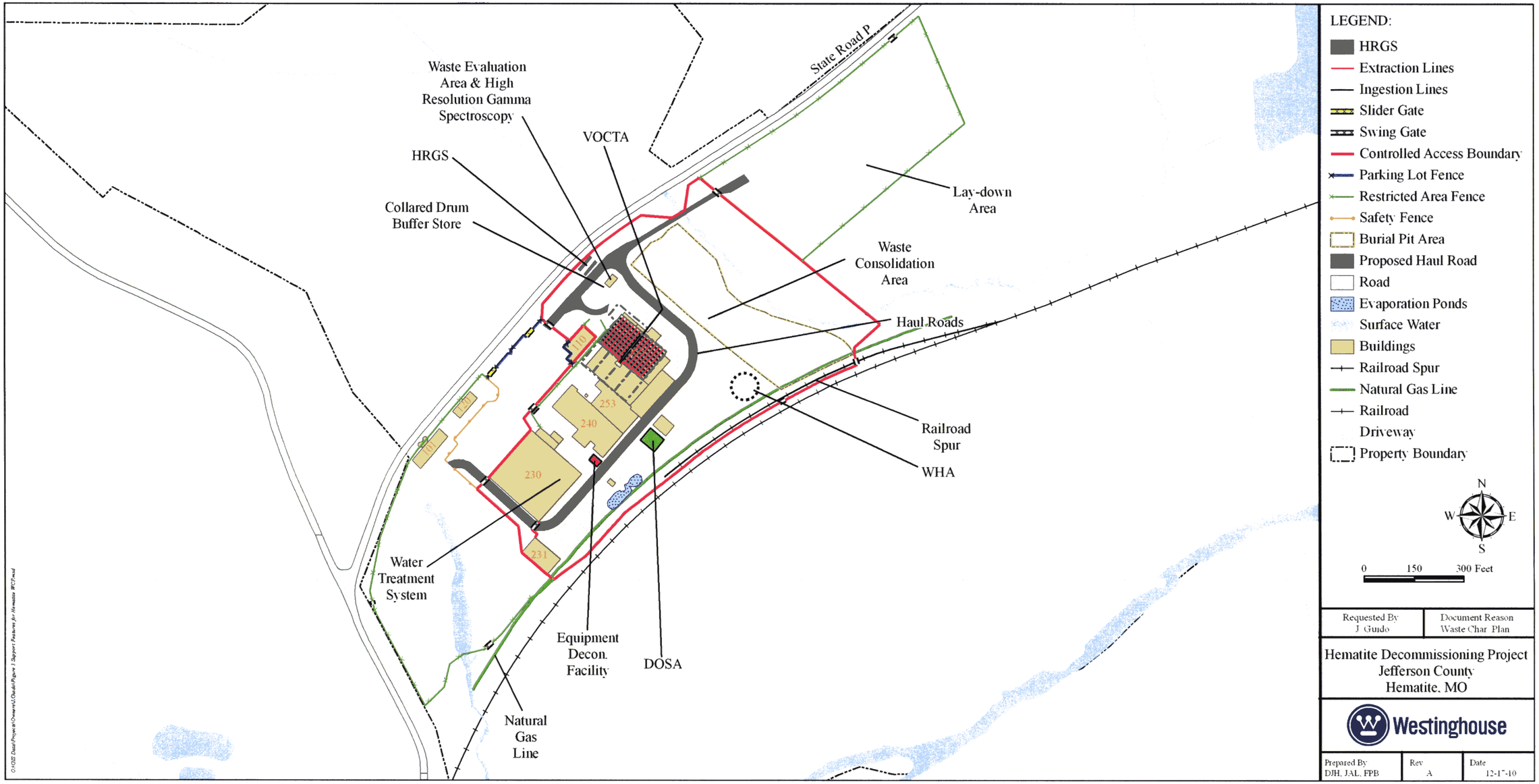

DQO Process - Data Planning Phase - USEI Waste Characterization
Step 1
State the Problem
WEC must ensure that the radiological risk from waste material shipped to USEI is within the BOUNDS OF THE INVENTORY LIMIT SP ECIFIED IN THE safety basis associated with the 2002 disposal application for USEI, and is acceptable for disposal based on the USEI WAC.
Step 2
Identify the Decision
1) Does the waste MATERIAL meet the constraints on the radionuclide INVENTORY (from safety basis) AND concentration (from WAC).
2) Each shipment will be evaluated against the inventory limit, each single railcar will be evaluated against the concentration limits.
Step 3
Identify Inputs to the Decision
1) Characterization data from areas from which the waste will originate (as basis for standard deviation used in sample planning).
2) Additional sampling conducted after waste excavation
3) Maximum Tc-99 inventory for disposal pit (as basis for confidence interval)
Step 4
Define the Study Boundary
1) waste will be transported to the waste holding area in truckloads consisting of 15 - 20 yd3 of material
2) An estimated total of 400 railcars will be shipped to USEI with each rail car holding approximately 4 truckloads.
3) WEC will generally define a shipment as 5 rail cars as a decision unit for inventory tracking purposes.
4) WEC will define each individual rail car as a decision unit for comparison with concentration based limits (total activity and Ra-226 and Th-232).
Step 5
Develop a Decision Rule
1) If a shipment of rail cars will cause the total Tc-99 inventory based on the mean concentration to be > 1 Ci, that material can not be shipped to USEI
2) If a shipment of railcars will cause the upper 95% confidence interval on the total Tc-99 inventory to be > 1.6 Ci, that material can not be shipped to USEI
3) If the concentration of Ra-226 exceeds 13 pCi/g or the Th-232 concentration exceeds 16 pCi/g, the material can not be shipped to USEI
4) If the total concentration of all radionuclides in a rail car exceeds 3000 pCi/g IN ANY SINGLE RAILCAR, the material can not be shipped to USEI.
Step 6
Specify Limits on Decision Errors
1) The upper 95 % confidence interval on total activity will be set at a total inventory of Tc-99 equivalent to 3 mrem.
Step 7
Optimize Design for Obtaining Data
1) Evaporation pond area removed from data pool to reduce variability of the data set (evaporation pond will be sampled separately).
2) Standard deviation of the abbreviated dataset (225) used to calculate the number of samples needed to construct a confidence interval with half-width of 14 pCi/g (equivalent to 1 mrem). Total samples estimated at 704 using visual sampling plan.
3) 1 sample per truck load selected as sample density which will result in approximately 1600 samples

Figure 3

Support Features For Hematite (Conceptual)



Appendix A

Waste Characterization Plan

1.0 Waste Characterization Activities

1.1. Material to be loaded for shipment to USEI will be staged at the Waste Holding Area.

1.2. Three types of stockpiles will generally be present: one that is accepting material from the excavation areas, one that has been sampled and for which results are pending, and one that is being actively loaded into railcars.

1.3. The activity concentration in the stockpile accepting material will be based on a weighted average. As material is added to the stockpile, the weight of each load and the activity concentration within each load (as determined from laboratory analysis of a composite samples collected at a frequency of one composite sample collected from four locations within each truck load which is approximately 15- 20 cubic yards) will be used to define the weighted average concentration within the stockpile (based on the mass of each individual truck load of material). Each of the four samples which will eventually comprise the composite sample will be maintained in a separate container and transported to the analytical laboratory where equal aliquots will be collected and mixed to form the composite sample.

1.4. A final weighted average concentration will be determined for the stockpile based on the information described above prior to the rail cars being approved for shipment.

1.5. As documentation of disposal, a running inventory of the average radionuclide concentrations (i.e., total activity and total mass shipped) of each radionuclide will be maintained.

1.6. The two major streams of USEI candidate waste material coming into the waste holding area are anticipated to be a result of the following material handling processes:

- Material Originating From Areas Requiring NCS Controls, and
- Material Originating From Areas **Not** Requiring NCS Controls

The waste characterization techniques that apply to each of these material handling processes are detailed below.

2.0 Material Originating From Areas Requiring NCS Controls

2.1. The surface of the material will be scanned within the excavation prior to each successive lift. Scanning will be performed using sodium iodide detectors with approximate scanning sensitivity for total uranium as indicated in Table 1, below.

Table 1
MDC for Total Uranium Based on Degree of Enrichment

Enrichment (wt% U-235)	Total U[a] (pCi/g)
3	65
20	77
50	95
75	109

[a] MDC values assume a surveyor efficiency of 0.50.

2.2. In addition to the radiological scanning, a visual examination will be performed to identify materials which due to their specific material characteristics warrant removal and additional investigation.

2.3. Discrete sources of elevated activity or other items that cannot be adequately characterized to meet the requirements for NCS based on the results of radiological scanning will be removed from the material stream and taken to the Waste Evaluation Area for isotopic quantification. This will also provide information regarding suitability for disposal at USEI.

2.4. Once scanning of each lift has been completed and any sources of elevated activity or other items have been removed, the material will be loaded into a 15 - 20 cubic yard container and transported to the Waste Consolidation Area (burial pits) or Waste Holding Area (balance of site).

2.5. Four sample aliquots will be obtained at random from each 15 – 20 cubic yards of material as the material is placed onto the stockpile.

2.6. One composite sample will be created from these four aliquots. Laboratory analysis will include gamma spectroscopy and Tc-99 analyses.

2.7. The estimated minimum detectable activities for radionuclides that are measured directly using gamma spectroscopy are provided in Table 2.

Table 2[a]
Estimated MDA Values for Gamma Spectroscopy System – Gamma Emitters

Count Time (minutes)	Ra-226 MDA (pCi/g)	Th-232 MDA (pCi/g)	U-235 MDA (pCi/g)	U-238 MDA (pCi/g)
Variable	3	3	5	20

[a] Estimated MDA values shown based on expected system performance with samples analyzed without drying and homogenization.

2.8. The estimated minimum detectable activity for Tc-99 will be 1 pCi/g. The U-234 activity will be inferred based on the measured U-238/U-235 ratio and the associated degree of enrichment.

2.9. The estimated minimum detectable activity for U-234 (inferred) is based on the detection levels indicated in Table 2 and a calculation based on the degree of enrichment defined by the ratio of U-235/U-238. The results for varying degree of enrichment are provided in Table 3.

Table 3
Estimated Inferred MDA Values for Gamma Spectroscopy System – U-234

Count Time (minutes)	Natural U (pCi/g)	5 wt% U-235 (pCi/g)	20 wt% U-235 (pCi/g)	95 wt% U-235 (pCi/g)
Variable	105	91	100	159

3.0 Material Originating From Areas Not Requiring NCS Controls

3.1. Scanning will be performed using a sodium iodide detector with approximate scanning sensitivity for total uranium as indicated in Table 4 at the time that the material is unloaded.

Table 4
MDC for Total Uranium Based on Degree of Enrichment

Enrichment (wt% U-235)	Total U[a] (pCi/g)
3	65
20	77
50	95
75	109

[a] MDC values assume a surveyor efficiency of 0.50.

3.2. In addition to the radiological scanning, a visual examination will be performed to identify materials which due to their specific material characteristics warrant removal and additional investigation. Examples include intact containers, or bulky objects with sufficient mass to impede characterization through the scan survey.

3.3. Discrete sources of elevated activity or other items that cannot be adequately characterized by radiological scanning will be removed from the material stream and taken to the Waste Evaluation Area for detailed characterization. This will also provide information regarding suitability for disposal at USEI.

3.4. Four sample aliquots will be obtained at random from each 15 – 20 cubic yards of material.

3.5. One composite sample will be created from these four aliquots. Laboratory analysis will include gamma spectroscopy and Tc-99 analyses.

3.6. The estimated minimum detectable activities for radionuclides that are measured directly using gamma spectroscopy are provided in Table 5.

Table 5[a]
Estimated MDA Values for Gamma Spectroscopy System – Gamma Emitters

Count Time (minutes)	Ra-226 MDA (pCi/g)	Th-232 MDA (pCi/g)	U-235 MDA (pCi/g)	U-238 MDA (pCi/g)
Variable	3	3	5	20

[a] Estimated MDA values shown based on expected system performance with samples analyzed without drying and homogenization.

3.7. The estimated minimum detectable activity for Tc-99 will be 1 pCi/g. The U-234 activity will be inferred based on the measured U-238/U-235 ratio and the associated degree of enrichment.

3.8. The estimated minimum detectable activity for U-234 (inferred) based on the detection levels indicated in Table 5 and a calculation based on the degree of enrichment defined by the ratio of U-235/U-238. The results for varying degree of enrichment are provided in Table 6.

Table 6
Estimated Inferred MDA Values for Gamma Spectroscopy System – U-234

Count Time (minutes)	Natural U (pCi/g)	5 wt% U-235 (pCi/g)	20 wt% U-235 (pCi/g)	95 wt% U-235 (pCi/g)
Variable	105	91	100	159

4.0 Summary of Sampling Data to Characterize Stockpile Concentrations

4.1. A composite sample will be created for each 15 – 20 cubic yards of stockpile material. This sample will be analyzed by gamma spectroscopy and for Tc-99.

4.2. The stockpile concentration will be calculated based on the weighted average of the radionuclide concentrations from the individual input material stream concentrations, along with the associated U-234 concentrations. The U-234 concentrations are calculated values based on the U-235/U238 ratio.

4.3. The running total Tc-99 inventory (both mean and at the 95% UCL) will be updated and evaluated verses established limits prior to the release of the rail shipment.

4.4. If it is determined that the updated mean Tc-99 activity and 95% UCL are within the established limits (i.e., mean of 1 Ci and 95% UCL of 1.6 Ci), the material will be authorized for shipment.

5.0 Summary of Detection Capabilities

A summary of the detection capability for key nuclides which were sensitive in the performance assessment evaluation is presented below. The requisite capabilities of detection are based on the ability to detect 16 and 13 pCi/g for Th-232 and Ra-226, respectively and 27 pCi/g of Tc-99.

5.1. Ra-226

Composite samples submitted for gamma spectroscopy will be counted on a HPGe system with an estimated minimum detection sensitivity of 3 pCi/g.

5.2. Th-232

Composite samples submitted for gamma spectroscopy will be counted on a HPGe system with an estimated minimum detection sensitivity of 3 pCi/g.

5.3. Tc-99

Composite samples submitted for offsite analysis will have an estimated minimum detection sensitivity of 1 pCi/g.