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Evaluation of Proposed New LLW Disposal Activity
Disposal of No Dose/Low Dose Scrap Metal in Slit Trenches

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REVIEWS AND APPROVALS

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B. T. Butcher, Level 4 and Reviewer Waste Disposal and Environmental Development	Date
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Solid Waste Division Approval

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L.T. Reid, Solid Waste Division Engineering Manager	Date
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K.A. Stone, Solid Waste Facilities Operations Safety Committee Chairman	Date
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Summary

There is an inventory of activated scrap metal in the 105-L Disassembly Basin. Approximately 1,600 ft³ of the material is characterized as “No Dose/Low Dose” and consists mainly of activated aluminum and aluminum alloy pieces and parts and no stainless steel with a dose rate less than 200 mR/hr. Contaminants in the activated metal will leach more slowly than will contaminants in generic waste. The change in the leach rate will affect analyses for the groundwater pathway and intruder scenarios. For this evaluation, the slower leach rate from the activated metal waste will be neglected for the groundwater pathway, which is conservative because the higher leach rate used tends to produce higher groundwater concentrations and lower inventory limits. For this evaluation, the leach rate was set to zero for intruder scenarios, which is conservative for the inadvertent intruder because a slower leach rate will result in higher levels of radionuclides in the waste zone.

The evaluation concludes that the existing limits are applicable to the disposal of No Dose/Low Dose activated scrap metal in slit trenches so that a Special Analysis is not needed to dispose of this waste stream

Introduction

Activated metal is a special waste that requires evaluation for disposal. Contaminants in the activated metal will leach more slowly than will contaminants in generic waste. The change in the leach rate will affect analyses for the groundwater pathway and intruder scenarios. For this evaluation, the slower leach rate will be neglected for the groundwater pathway, thus producing higher groundwater concentrations and lower inventory limits than would be expected. For this evaluation, the slower leach rate was set to zero for intruder scenarios.

Analyses for all pathways other than the intruder scenarios do not change from earlier Performance Assessments (PAs) and Special Analyses (SAs). The intruder analyses change by neglecting leaching, thus only allowing decay to reduce the fraction of contaminant remaining at the time of the hypothetical intrusion. If the fraction of contaminant remaining is dominated by decay rather than leaching then the inventory limits of an intruder scenario will remain unchanged.

Limits for each pathway are compared and the most restrictive limit is assigned as the operational inventory limit. In this evaluation the operational inventory limit will only change if an intruder scenario produces the most restrictive new limit and that limit is lower than the old operational inventory limit.

The preferred disposal unit for the No Dose/Low Dose activated scrap metal is a slit trench.

The proposed activity is formally stated below and contaminants of concern are described. Each pathway analysis is described with results of calculations for the intruder scenarios. Tables of limits for each pathway and the selection of the most restrictive pathway are provided. Finally, projected inventories are compared against those limits to estimate the inventory consumption.

Description of Proposed Activity

The proposed activity (Reed, 2003) is to dispose of No Dose/Low Dose activated metals in a slit trench.

Contaminants of Concern

Spent Fuel Project personnel identified the following contaminants of concern (Ellis, 2003):

H-3
C-14
Fe-55
Co-60
Ni-63
Sb-125
Pu-239

The progeny are included in the analysis of the parent, thus they will not be discussed further.

Fe-55 and Sb-125 were screened out in the performance assessment because of their short half lives, 2.7 years and 2.8 years, respectively and are not considered further in this analysis.

Performance Assessment Pathway Review

Air Pathways

A Special Analysis (Cook, 2002) that corrected and updated E-Area disposal limits provided the applicable limits for the air pathway analysis (e.g., Table 5.2.1 in the SA) for generic waste. Each disposal unit showed a limit for C-14 of 2.7 Ci for the air pathway. This limit does not change because the air analysis does not consider leaching to reduce the inventory. The C-14 in activated metal would be less available for release to the air pathway than generic waste. Therefore the use of the current air pathway limit is conservative.

Radon

The Performance Assessment (McDowell-Boyer et al., 2000) analyzed the radon produced solely at 10,000 years from an initial source of U-234. Solid Waste determined that U-234 was not a contaminant of concern for No Dose/Low Dose activated scrap metal, thus the radon pathway is not considered further.

Groundwater

As stated above, the groundwater analysis did not change from the PA. This approach tends to be conservative, because no credit is taken for the slower leaching that is expected from the activated metal.

Inadvertent Intruder

The trench disposal unit intruder analysis calculations were rerun for the contaminants of concern with no leaching, that is the Inventory Reduction Factor in the calculation is determined using only radioactive decay to decrease the inventory over time. The results are shown in Table 1.

Table 1. Results of Revised Intruder Calculations

Radionuclide	Inventory Reduction Factor at 100 years	Inventory Reduction Factor at 700 years	Resident Limit at 100 years (Ci/5 trenches or 1 Engineered Trench)	Agriculture Limit at 700 years (Ci/5 trenches or 1 Engineered Trench)	Post Drilling Limit at 100 years (Ci/5 trenches or 1 Engineered Trench)	Overall Intruder Limit (Ci/5 trenches or 1 Engineered Trench)
H-3	3.5E-03	7.0E-18	No Limit	1.8E+20	1.9E+06	1.9E+06
C-14	9.9E-01	9.2E-01	No Limit	3.5E+02	1.7E+03	3.5E+02
Co-60	2.0E-06	1.1E-40	2.1E+09	2.3E+42	7.3E+08	7.3E+08
Ni-63	5.0E-01	7.9E-03	No Limit	3.3E+06	2.8E+05	2.8E+05
Pu-239	1.0E+00	9.8E-01	No Limit	1.3E+02	1.1E+03	1.3E+02

Table 2 compares the revised intruder limits with the current trench limits. Both tritium and Pu-239 remain limited by groundwater, and C-14 remains limited by the air pathway. The limits for Co-60 and Ni-63 are unchanged. In the Performance Assessment, these radionuclides were screened from the groundwater analysis and therefore no leaching fraction was determined and the only depletion used in the intruder analysis was radioactive decay. The result is that this analysis yields the same limits as the performance assessment. Therefore the limits do not change and a Special Analysis is not needed to dispose of this waste form.

Table 2. Inventory Limits for Slit Trenches and Engineered Trenches; Comparison of PA Limits to Activated Metal Limits

Radionuclide	PA Trench Limit	PA Limiting Pathway	Activated Metal Intruder Trench Limit	Activated Metal Limiting Intruder Scenario
H-3	6.3E+00	gw	1.9E+06	post drilling
C-14	2.7E+00	air	3.5E+02	agriculture
Co-60	7.3E+08	post drilling	7.3E+08	post drilling
Ni-63	2.8E+05	post drilling	2.8E+05	post drilling
Pu-239	1.3E+02	agriculture	1.3E+02	agriculture

Table 3 shows that the sum of fractions represented by the No Dose/Low Dose activated scrap metal is very small.

Radionuclide	Estimated Inventory (Ci)	Trench Disposal Limit (Ci/5 trenches)	Fraction of Limit
H-3	1.5E-07	6.3E+00	2.3E-08
C-14	2.4E-07	2.7E+00	8.9E-08
Co-60	5.8E-01	7.3E+08	7.9E-10
Ni-63	4.8E-01	2.8E+05	1.7E-06
Pu-239	1.3E-04	1.3E+02	1.0E-06
Sum of Fractions			2.8E-06

Evaluation

1. Does the proposed activity involve a change to the Performance Assessment or exceed PA performance measures/conclusions?

No. Existing limits for intruder scenarios have been shown to apply to No Dose/Low Dose activated scrap metal.

2. Does the proposed activity involve a:

- a. change to the basic disposal concept as described in the PA?

No. Existing trench disposal units and radionuclides are considered.

- b. change to the analyses or radionuclide limits as described in the PA?

No. The analysis demonstrates the existing limits can be applied to No Dose/Low Dose activated scrap metal.

- c. change in the disposal authorization (USDOE-HQ, 1999) that leads to a significant change in projected dose?

No. The proposed activity will not result in a significant change in projected dose.

- d. change in the results in the approved PA that is greater than 10%?

No. The proposed activity will not cause the results in the PA to change more than 10%.

- e. change of greater than 10% in the dose calculated in the approved PA?

No. The proposed activity will not increase the dose calculated in the PA for any isotope by more than 10%.

- f. Does the proposed activity modify the analysis or conclusions provided in the Composite Analysis (WSRC, 1997 and Cook, et al., 1999)?

No. The projected inventories are very low relative to the inventory limits, thus the analysis and conclusions of the CA are not modified.

- g. change to the Disposal Authorization Statement (USDOE-HQ, 1999)?

No. The proposed activity does not necessitate a change to the Disposal Authorization Statement.

Conclusion

The proposed activity, disposing of No Dose/Low Dose activated scrap metal in slit trenches, can be implemented using existing radionuclide inventory limits.

References

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CATEGORICAL EXCLUSION UNREVIEWED SAFETY QUESTION { USQ-SWE-2001-0049 superseded by USQ-SWE-2002-0097 }

CAT X USQ #	SEQ. #	DATE	EO / QR	REFERENCE DOCT ID	REV. #	BRIEF DESCRIPTION /JUSTIFICATION
USQ-SWE-2002-0097	2770	5/20/2003	Shawn R. Reed	WSRC-RP-2000-00218	1	The proposed activity is to allow disposal of SFSD scrap metal containing activated metals. Disposal of activated metals is prohibited based on the referenced UDQ. Slit Trench disposal is preferred. This activity was reviewed against section B of the Cat X USQ, all questions were answered NO. This activity was also reviewed against the UDQ criteria in Section 2, all questions were also answered NO, except criteria #4 (waste retards the release rate of radionuclides). Therefore, a UDQ-E is required.

Signature: 

Note: The Brief Description/Justification section is more than the document title. Please input justification.

Design Review Instructions

Review instructions for Evaluation of Proposed New LLW Disposal Activity: Disposal of No Dose/Low Dose Scrap Metal in Slit Trenches.

1. Check the assumption regarding how the analysis for No Dose/Low Dose activated scrap metal should differ from generic waste
2. Check the equation used
3. Check all inputs and results in tables
4. Check that the inventory limits do not change.

Design Review performed by Tom Butcher

1. Check the assumption regarding how the analysis for beneficial reuse containers should differ from generic waste.
2. Check the equation used.
3. Check all inputs and results in tables.
4. Check that inventory limits do not change.

Jim: The following are the results of the Reactor Scrap UDQE design check:

1. Check the assumption regarding how the analysis for reactor scrap should differ from generic waste.

The assumption made is that radionuclides are held up much longer in activated metal (reactor scrap) than generic waste that is assumed in the PA. Thus more radionuclides are available in the waste zone for potential inadvertent intruders. The treatment of this phenomenon by assuming that no leaching takes place, only decay, is conservative for the intruder analysis. On the other hand, leaching, as in the case of generic waste, is assumed for the groundwater analysis which is also conservative for that pathway.

2. Check the equations used.

All spreadsheet equations related to the pathways in question were checked and confirmed to be correct.

3. Check all inputs and results in tables.

The source of all inputs used in the equations were checked to confirm that the correct inputs were used. This involved going back to the E-Area PA (WSRC-RP-94-218, rev.1), then New Pu chemistry SA (WSRC-TR-2002-00154) and the SA on Correction and Update of E-Area Disposal Limits (WSRC-TR-2002-00047). Transcription of information from the excel spreadsheet to the tables in the UDQE and between tables within the UDQE was checked. All entries were found to be correct with exception to those items noted in the marked up copy of the UDQE placed on your chair.

The results of pertinent equations in spreadsheet calculations were cross-checked by hand calculations and found to be correct.

4. Check that inventory limits do not change.

Inventory limits in the UDQE were compared with the appropriate source document and found to have not changed.