ENGINEERING CALCULATIONS AND ANALYSIS REPORT

ECAR No.: 296 ECAR Rev. No.: 0 Project File No.: N/A Date: 6/19/2008

Title: Source-Term Determination for RH-TRU Waste Container – MFC080083 (SN-179)

1.	Index Codes Building/Type: HFEF (785) SSC ID: N/A Site Area: MFC
2.	Quality Level: 3 *(Required Element)*
3.	Objective/Purpose To document the source-term determination for RH-TRU waste can MFC080083 generated at the Hot Fuel Examination Facility.
4.	Conclusions/Recommendations This waste package characterizes as remote-handled transuranic. Refer to ECAR-296 for details.

5. Review (R) and Approval (A) and Acceptance (Ac)[1]:

		Typed Name/Organization	Signature/Date[2]
Performer/Author		Bruce Adams - FEL	B. Adams 6/30/08
Technical Checker	R	Wendy Gamett – Waste Chr. Spec.	Pages checked: ALL Wendy Gamett 7/23/08
Independent Peer Reviewer[3]	R	N/A	
Performer's Manager	A	T. Miller or P. Smith Environmental Compliance	Paul J. Smith 7/25/08
Requester	Ac		
Nuclear Safety[3]	Ac		

1 Review and Approval are required. See LWP-10200 for definitions and responsibilities.
2 An Electronic Change Request (ECR) indicating final review and concurrence by the listed individuals can be used in lieu of signatures.
3 If Required, per LWP-10200.

6. Additional Distribution: (Name and Mail Stop)	Document Control: Charity Lashley 6-15-08

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Contents

Scope and Brief Description

To determine the source-term for low-density hot-cell generated waste pursuant to proper disposal. The waste consists primarily of CPR (cellulosics, plastics and rubber) and small metal tools. The source-term was determined using the following input elements. First, the fissile contents of the filter (ref. item: MTG # MISGRDFLT2) were provided by the generator. Second, the radionuclide curie contributions were determined from in-cell surface contamination smear analyses. Third, smear analyses variations between hot-cell zones were adjusted by the waste mass contributions from the zones. Finally, this result along with the waste package radiation readings and derived material density is used to seed the MicroShield® software. Total curie quantification is then determined by summation of the known and calculated elements.

Design Inputs and Sources

Quality level source: 3

Results of Literature Searches and Other Background Data

N/A

Assumptions

With the exception of the concentration in the filter a homogeneous distribution of radiologic surface contaminants is assumed. Historical smear and sample analyses provide identification of both the alpha-emitting and beta-gamma emitting contributors. Since the alpha-emitting contributors are shielded by the waste items and container they are quantified as a ratio of the detectable beta-gamma emitters.

Computer Code Validation

a. Computer type: Dell – Optiplex GX-620, Property # 383279
b. Computer program name and revision: MicroShield, Version 6.20, Grove Software Inc.
c. Inputs (may refer to an appendix): Appendix D (reference and source cases)
d. Outputs (may refer to an appendix): Appendix D (inferred source)
e. Evidence of, or reference to, computer program validation: EDF-4068, Verification and Validation of MicroShield, Version 6.
f. Bases supporting application of the computer program to the specific physical problem: Site-wide accepted tool and methodology.

Body

The primary elements that seed the MicroShield® software models are: container type and geometries; source density; the radionuclide species and percentage contributions; and the container's radiation readings. The container type and geometries for the reference case model were fixed and known. The container waste item inventory reports provided the descriptions and masses and were used to calculate the average material density

and to provide specific mass balance information for the Special Nuclear Materials present. Analytical smear data reports specific to the zones in which the waste was generated and the mass contributions of waste from those zones provide the radionuclide species and percentage contributions. An instrumented radiological survey provided the radiation readings (R/hr) element. When the MicroShield® software is seeded with these data an inferred source-term is derived.

Refer to this series of appendixes the relevant information and conclusions:

1. See Appendix A, SN-179 RH-TRU Waste Can Loading Log for waste content description.

2. See Appendix B, Curie Data for SN-179 (MFC080083) for the radionuclide percentage contributions. The "Normalized to Waste Mass Contributions" section adjusts the analytical smear data report results to the waste mass contributions coming from the two generating areas. The "Summation of MTG Reported Curies for Item # 4 (2-M Bag # 5) [ref. MISSN179] and Other Zone 2-M and Main Cell Contributors" section is the cumulative curie percent contributions used to seed MicroShield.

3. See Appendix C, Radiological Survey Report, Loaded SN-Type Inner Waste Can (IWC) Rad. Readings, SN-179 for the radiation activity information.

4. See Appendix D, Inferred Source Term Tool for MicroShield 6.20 (Using SN-179 data), Steps 1 -3 for the MicroShield seeding information.

5. See Appendix E, Inferred Curie Content for SN-179 (Steps 4 -5) for the final source term conclusions.

Recommendations / Conclusions
Conclusions

Table 1 – Summation: Final Curie Content (Source-Term) for SN-179
INFERRED CURIE CONTENT for SN-179

Nuclide Name	Nuclide Conc (Ci) for 36000 mR/hr	Nuclide Name	Nuclide Conc (Ci) for 36000 mR/hr	Nuclide Name	Nuclide Conc (Ci) for 36000 mR/hr	Nuclide Name	Nuclide Conc (Ci) for 36000 mR/hr	Nuclide Name	Nuclide Conc (Ci) for 36000 mR/hr
Mn-54	1.089E-02	Rh-106	1.437E-01	Cs-134	2.074E-01	Bi-212	1.991E-06	Pu-236	0.00E+00
Fe-55	3.768E-06	Ru-106	1.437E-01	Cs-135	4.702E-05	Pb-212	1.991E-06	Pu-238	3.529E-02
Co-60	3.814E-02	Ag-108	8.608E-08	Cs-137	1.437E+01	Po-216	1.991E-06	Pu-239	1.290E+00
Ni-59	6.509E-10	Ag-108m	1.118E-06	Ce-144	2.667E-01	Ra-224	1.991E-06	Pu-240	5.430E-03
Ni-63	2.573E-07	Ag-110m	2.451E-09	Pr-144	1.431E-01	Ac-227	1.823E-07	Pu-241	3.740E-02
Sr-90	1.184E+02	Cd-113m	2.956E-03	Pr-144m	1.715E-03	U-233	2.893E-08	Pu-242	1.258E-06
Y-90	1.184E+02	Sn-126	1.562E-04	Pm-147	4.426E-01	U-234	1.420E-04	Am-241	1.442E+00
Nb-94	2.925E-09	Sb-125	4.503E-02	Sm-151	1.945E-01	U-235	8.475E-06	Am-242	2.083E-07
Nb-95	1.458E-08	Sb-126	2.175E-05	Eu-154	1.213E-01	U-236	3.164E-05	Am-243	1.464E-09
Zr-93	9.665E-06	Sb-126m	1.562E-04	Eu-155	1.337E-01	U-237	7.628E-03	Cm-242	1.700E-07
Zr-95	6.555E-09	Te-125m	1.869E-02	Tl-208	7.168E-07	U-238	1.310E-05	Cm-244	4.580E-07
Tc-99	9.037E-04	I-129	1.285E-06	Bi-211	1.838E-07	Np-237	9.144E-06	**Total Ci**	**2.55903E+02**

Table 2 – Transuranic Evaluation

SN-179 TRANSURANIC WASTE EVALUATION			
TRU nCi = 1.004E+5	Waste Mass (g)= 27,613	nCi/gram = 100,414.1	Waste Cat = RH-TRU

MFC080083 (SN-179) waste container characterizes as Remote Handled-Transuranic (RH-TRU).

PE Stamp

Not required.

References

Appendix A

SN-179 RH-TRU Waste Can Loading Log

Appendix B

Curie Data for SN-179 (MFC080083)

Appendix C

Radiological Survey Report, Loaded SN-Type Inner Waste Can (IWC) Rad. Readings, SN-179

Appendix D

Inferred Source Term Tool for MicroShield 6.20 (Using SN-179 data), Steps 1-3

Appendix E

Inferred Curie Content for SN-179, Steps 4-5