

APPENDIX D



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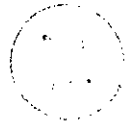
date : June 20, 1996
 to : Russ Bisping (DOE/NTP/CAO)
 from : *L. C. Sanchez*
 L. C. Sanchez, Org 6848, MS-1328, PH-(505)848-0685, Fax-848-0705
 subject : **Correction for Cf252 Decayed Inventory**

Per a request from the TWBIR Team [CH-1], a detailed check was made on the data that was used to perform decay calculations for the stored Cf252 inventory from the Hanford site [SNL-1]. The result of the data check was that the undecayed Cf252 stored CH-TRU inventory for the year 1982 should be 1.08E-03 Ci. The value that was erroneously used for the decay calculations was 1.08E+03 Ci. This means that the Cf252 and its principal decay daughters (Cm248 and Pu240) are overestimated (see Table 1). The WIPP disposal radionuclide inventory in the electronic database should be adjusted to correct these errors. Since Cf252 has a half-life less than 20 yr and the buildup (ingrowth) activities of Cm248 and Pu240 are very small, they have a negligible effect of the EPA Unit calculations (i.e., activity loading) -- they represent a change in the calculated EPA Unit of less than one part in a million (see Table 4 of Ref. SNL-3). Thus, it not necessary for SNL WIPP PA CCA calculations to re-adjust the activity loading values presented in Refs. CCA-2 and CCA-3.

Table 1.				
Activity Calculations Performed With Analytical Solution to BATEMAN Equation (a)				
Nuclide			Solution Using Analytical Solution to Bateman Equation, Decayed to the Year 1995	
ID (b)	Decay Mode (c)	Half-Life [sec] (d)	Existing Inventory [Curies] (e)	Correct Inventory [Curies] (f)
Cf252	α, γ, SF	8.3250E+07	3.5482E+01 (g)	3.5482E-05
Cm248	α, SF	1.0700E+13	8.1266E-03 (h)	8.1266E-09
Pu240	α, γ, SF	2.0630E+11	8.2980E-06 (i)	8.2980E-12

(a) Calculations correspond only to the 1982 inventory of stored Cf252 at Hanford for CH-TRU. These values indicated that the decay calculations of Ref. SNL-1 overestimated the inventory (on a WIPP-Scale basis) of Cf252 (and to an lesser extent for the first two daughters of Cf252, namely - Cm248 and Pu240). The calculations presented here correspond to 1.08E+03 Ci for the "Existing Inventory" and 1.08E-03 Ci for the "Correct Inventory" at year = 1982 for the undecayed stored Hanford CH-TRU. The Existing Inventory value was that value used in Ref. SNL-1. Activity values presented here for Cm248 and Pu240 correspond only to ingrowth activities from Cf252 only.

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- (b) Radionuclides are Cf252 and its first two daughters (these are incorporated into the WIPP PA database to yield Ref. CCA-2).
- (c) Decay mode information taken from Ref. GE-1.
- (d) Half-life values are those incorporated in ORIGEN2, see Ref. SNL-2.
- (e) "Existing Inventory" values correspond to 1982 Hanford CH-TRU inventory (originating from Cf252) decayed to the base year of 1995. The undecayed Cf252 inventory was 1.08E+03. Decay calculations were performed using Ref. KA-1b.
- (f) "Correct Inventory" values correspond to 1982 Hanford CH-TRU inventory (originating from Cf252) decayed to the base year of 1995. The undecayed Cf252 inventory was 1.08E-03. Decay calculations were performed using Ref. KA-1b.
- (g) Using this value in the TWBID resulted in a total decayed WIPP-Scale stored Cf252 inventory of 36.1 Ci [Ref. CH-2] (98.3 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a substantial lowering of the stored and projected inventory of Cf252. Since Cf252 has a half-life less than 20 yr, it does not contribute to the EPA Unit value and does not effect WIPP PA CCA calculations.
- (h) Using this ingrowth value in the TWBID resulted in a total decayed WIPP-Scale stored Cm248 inventory of 3.35E-02 Ci [Ref. CH-2] (24.3 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a substantial lowering of the stored and projected inventory of Cm248. Since the total activity change due to the ingrowth of Cm248 from Cf252 is very small it has a negligible contribution to the EPA Unit (see Table 4 of Ref. SNL-3) and does not affect PA calculations.
- (i) Using this ingrowth value in the TWBID resulted in a total decayed WIPP-Scale stored Cm248 inventory of 6.87E+04 Ci [Ref. CH-2] (less than 2.0E-08 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a negligible lowering of the stored and projected inventory of Pu240 (or any further decay daughters from Cf252). Since the total activity change due to the ingrowth of Pu240 from Cf252 is very small it has a negligible contribution to the EPA Unit (see Table 4 of Ref. SNL-3) and does not affect PA calculations.

REFERENCES

[CCA-2]

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[CCA-3]

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[CH-1] Personal communications (phone) with Sayan Chakraborti (SAIC/CTAC); Subject: "Error in Cf252 Inventory"; date: June 19, 1996.

[CH-2] Personal communications (fax) from Sayan Chakraborti (SAIC/CTAC); Subject: "Stored and Projected WIPP Total Curies"; date: April 19, 1996.

[GE-1] General Electric Company (Nuclear Energy Operations), *Nuclides and Isotopes*, Fourteenth Edition, 1989.

[KA-1] J. Kaplan; *Nuclear Physics (Second Edition)*; Addison-Wesley Publishing Company; Reading, Massachusetts, 1964.

[KA-1b]

Ibid., Equations 10-26 and 10-27, pg. 243.

[SNL-1]

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[SNL-2]

Sandia National Laboratories; Memo from: L.C. Sanchez (Org 6741), to: M. Martell (Org 6749); Subject: "Radionuclide Half-lives and Specific Activities Obtained From ORIGEN2 Data"; dated: March 28, 1996.

[SNL-3]

Sandia National Laboratories; Memo from: L.C. Sanchez (Org 6741), to: Distribution; Subject: "Identification of Important Radionuclides Used in 1996 CCA WIPP Performance Assessment"; dated: April 25, 1996.

LCS:6848:lcs/(96-2113)

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File - SWCF-A WBS 1.1.6.2; PA; PBWAC - WIPP ACTIVITY

