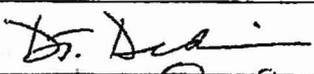
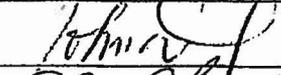
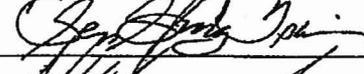


BSC

### Calculation/Analysis Change Notice

1. QA: QA  
2. Page 1 of 5

Complete only applicable items.

|  |   |                 |
|--|---|-----------------|
| 3. Document Identifier:<br>000-PSA-MGR0-00700-000  | 4. Rev.:<br>00A   | 5. CACN:<br>001 |
| 6. Title:<br>Characteristics for the Representative Commercial Spent Fuel Assembly for Preclosure Normal Operations  |   |                 |
| 7. Reason for Change:<br>This CACN is associated with CR 12381-001.<br><br>Calculation 000-PSA-MGR0-00700-000-00A calculates radionuclide inventories for commercial PWR and BWR spent fuel assemblies. Inventories are developed based on the results of ORIGEN isotope generation computer runs for PWRs and BWRs in Calculations 000-00C-MGR0-00100-000-00B and 000-00C-MGR0-00200-000-00A, respectively. The results of the ORIGEN runs are imported into Excel spreadsheets in Calculation 000-PSA-MGR0-00700-000-00A and radionuclide inventories determined by summing contributions from up to four different fuel regions in the ORIGEN runs. The method to perform the summation involves using Microsoft Excel spreadsheet named ranges to identify the location of values within worksheets of a given spreadsheet.<br><br>For three light elements, C-14, Cl-36 and H-3, the spreadsheet for PWR representative fuel did not reference the correct worksheet containing the ORIGEN results. As a result, the PWR representative fuel inventory values for those radionuclides are not correct. The values for C-14 and Cl-36 are higher and H-3 is lower than the correct values.<br><br>This CACN corrects the PWR worksheet cell references and the spent fuel inventories for C-14, Cl-36 and H-3. Additionally this CACN corrects a minor typo related to crud activity units from cubic centimeters to square centimeters. |   |                 |
| 8. Supersedes Change Notice: <input type="checkbox"/> Yes    If, Yes, CACN No.: _____ <input checked="" type="checkbox"/> No   |   |                 |
| 9. Change Impact:  |   |                 |
| Inputs Changed: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  | Results Impacted: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |                 |
| Assumptions Changed: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   | Design Impacted: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |                 |
| 10. Description of Change:<br>There is no change to the calculation method of this calculation by this CACN.<br><br>The Excel spreadsheet for PWR representative fuel, <i>PWR-50-GWd-curies total.xls</i> , was corrected to reference the proper worksheet containing the ORIGEN results for the three light elements, C-14, Cl-36 and H-3. The named range definition for <i>LE_fuel</i> in the worksheet <i>FP-ACT-GAS</i> was changed from 'PWR-4.2%-60GWd-fuel'!\$B\$5:\$M\$32 to 'PWR-4.2%-50GWd-fuel'!\$A\$5:\$M\$67. Also the VLOOKUP function in cells B4 to B6 was changed, for example, from (A4, <i>LE_fuel</i> , 10, FALSE) to (A4, <i>LE_fuel</i> , 13, FALSE). This corrected the PWR representative fuel inventory values for the three light elements, C-14, Cl-36 and H-3 in <i>PWR-50-GWd-curies total.xls</i> . The corrected results for those radionuclides were incorporated into Tables 16 and 20.<br><br>The units in the "Note" following Table 7 were corrected from cubic centimeters to square centimeters.<br><br>To implement the changes: Replace pages: 26, 44, 48 and I-1 with the attached pages and replace the CD with the attached CD that includes the updated Excel spreadsheet <i>PWR-50-GWd-curies total.xls</i> .<br><br>This CACN also carries out the action plan for CR 12381-001.   |   |                 |
| 11. <b>REVIEWS AND APPROVAL</b>  |   |                 |
| Printed Name   | Signature   | Date            |
| 11a. Originator:<br>Dale T. Dexheimer  |   | 10/1/08         |
| 11b. Checker:<br>John H. C. Wang   |   | 10/1/08         |
| 11c. EGS:<br>Sen-Sung Tsai   |   | 10/1/08         |
| 11d. DEM:<br>Michael V. Frank  |   | 10/2/08         |
| 11e. Design Authority:<br>Barbara Rusinko  |   | 10/3/08         |

### 6.1.5. Crud Activity and Surface Area

Commercial spent nuclear fuel assembly initial crud activity is provided in Table 7. Spent Fuel Project Office Interim Staff Guidance – 5 (Reference 2.2.10 [DIRS 160582], Table 7.1) provides the initial <sup>60</sup>Co crud activity per cm<sup>2</sup> and *Spent Fuel Corrosion Product and Fuel Cleaning Assessment* (Reference 2.2.13 ([DIRS 146405], Tables 1 and 2) provides the initial <sup>55</sup>Fe crud activity per cm<sup>2</sup>. The use of <sup>55</sup>Fe crud activity per cm<sup>2</sup> is appropriate since it is conservative and overstates the activity by as much as a factor of 10 (Reference 2.2.13 [DIRS 146405], page 7).

Table 7. Commercial Spent Nuclear Fuel Assembly Initial Crud Activities

| Radionuclide     | PWR (μCi/cm <sup>2</sup> ) | BWR (μCi/cm <sup>2</sup> ) |
|------------------|----------------------------|----------------------------|
| <sup>60</sup> Co | 140                        | 1,254                      |
| <sup>55</sup> Fe | 5,902                      | 7,415                      |

NOTE: μCi/cm<sup>2</sup> = micro curies/square centimeters

Source: <sup>60</sup>Co crud activities are from Reference 2.2.10 ([DIRS 160582], Table 7.1)

<sup>55</sup>Fe crud activities are from Reference 2.2.13 ([DIRS 146405], Tables 1 and 2)

### 6.1.6 Commercial Fuel Assembly Surface Area

Commercial SNF fuel assemblies have the following surface areas,  $A_{SFA}$  :

- PWR = 449,003 cm<sup>2</sup>/assembly (Reference 2.2.8, p. 27)
- BWR = 168,148 cm<sup>2</sup>/assembly (Reference 2.2.9, Table 45).

These surface areas are bounding estimates based on spent fuel assemblies with the highest known surface areas, which are a South Texas PWR fuel assembly (Reference 2.2.8, p. 27) and an ANF 9 × 9 JP-4 BWR fuel assembly (Reference 2.2.9, Table 45).

### 6.1.7 Waste Stream Input

Reference 2.2.6, Section 7, provides a waste stream scenario that is based on receiving commercial SNF in 25-kW TAD canisters at an annual receipt rate of 3,600 MTHM (Assumption 3.2.1 and Section 6.1.1), which is represented by the file “AvailShipCD-1YFF525kW3600-Norm\_Rev.xls”, worksheet “Revised Report”. This spreadsheet provides the identification and characteristics of each fuel assembly including, enrichment, burnup, discharge year, arrival year, MTHM, and thermal power. The “Revised Report” worksheet of the Excel spreadsheet contains 23,250 records for commercial SNF batches containing 221,714 fuel assemblies totaling 63,000 MTHM arriving at the repository.

Table 16. Radionuclide Inventory For Representative Commercial Spent Nuclear Fuel Excluding Crud

| Radionuclide       | Representative PWR<br>(Ci/fuel assembly) | Representative BWR<br>(Ci/fuel assembly) |
|--------------------|--|--|
| <sup>241</sup> Am  | $1.18 \times 10^3$                       | $3.73 \times 10^2$                       |
| <sup>242</sup> Am  | 7.27                                     | 2.87                                     |
| <sup>242m</sup> Am | 7.30                                     | 2.88                                     |
| <sup>243</sup> Am  | $2.30 \times 10^1$                       | 8.63                                     |
| <sup>137m</sup> Ba | $5.70 \times 10^4$                       | $2.27 \times 10^4$                       |
| <sup>14</sup> C    | $3.35 \times 10^{-1}$                    | $2.12 \times 10^{-1}$                    |
| <sup>113m</sup> Cd | $1.39 \times 10^1$                       | 5.24                                     |
| <sup>144</sup> Ce  | $7.26 \times 10^1$                       | $1.73 \times 10^1$                       |
| <sup>36</sup> Cl   | $6.84 \times 10^{-3}$                    | $3.48 \times 10^{-3}$                    |
| <sup>242</sup> Cm  | 6.03                                     | 2.38                                     |
| <sup>243</sup> Cm  | $1.57 \times 10^1$                       | 5.55                                     |
| <sup>244</sup> Cm  | $2.59 \times 10^3$                       | $9.23 \times 10^2$                       |
| <sup>245</sup> Cm  | $3.37 \times 10^{-1}$                    | $9.07 \times 10^{-2}$                    |
| <sup>246</sup> Cm  | $1.16 \times 10^{-1}$                    | $4.26 \times 10^{-2}$                    |
| <sup>134</sup> Cs  | $4.08 \times 10^3$                       | $1.31 \times 10^3$                       |
| <sup>135</sup> Cs  | $3.74 \times 10^{-1}$                    | $1.81 \times 10^{-1}$                    |
| <sup>137</sup> Cs  | $6.04 \times 10^4$                       | $2.41 \times 10^4$                       |
| <sup>154</sup> Eu  | $2.36 \times 10^3$                       | $7.73 \times 10^2$                       |
| <sup>155</sup> Eu  | $4.94 \times 10^2$                       | $1.92 \times 10^2$                       |
| <sup>3</sup> H     | $2.70 \times 10^2$                       | $1.05 \times 10^2$                       |
| <sup>129</sup> I   | $2.27 \times 10^{-2}$                    | $9.22 \times 10^{-3}$                    |
| <sup>85</sup> Kr   | $3.11 \times 10^3$                       | $1.17 \times 10^3$                       |
| <sup>93m</sup> Nb  | $3.44 \times 10^{-1}$                    | $1.58 \times 10^{-1}$                    |
| <sup>94</sup> Nb   | $6.31 \times 10^{-5}$                    | $2.56 \times 10^{-5}$                    |
| <sup>237</sup> Np  | $2.53 \times 10^{-1}$                    | $8.74 \times 10^{-2}$                    |
| <sup>239</sup> Np  | $2.30 \times 10^1$                       | 8.63                                     |
| <sup>231</sup> Pa  | $3.00 \times 10^{-5}$                    | $1.86 \times 10^{-5}$                    |
| <sup>107</sup> Pd  | $8.65 \times 10^{-2}$                    | $3.45 \times 10^{-2}$                    |
| <sup>147</sup> Pm  | $6.36 \times 10^3$                       | $2.11 \times 10^3$                       |
| <sup>144</sup> Pr  | $7.26 \times 10^1$                       | $1.73 \times 10^1$                       |
| <sup>238</sup> Pu  | $2.77 \times 10^3$                       | $1.02 \times 10^3$                       |
| <sup>239</sup> Pu  | $1.80 \times 10^2$                       | $5.41 \times 10^1$                       |
| <sup>240</sup> Pu  | $3.20 \times 10^2$                       | $1.27 \times 10^2$                       |
| <sup>241</sup> Pu  | $5.20 \times 10^4$                       | $1.57 \times 10^4$                       |
| <sup>242</sup> Pu  | 1.68                                     | $7.08 \times 10^{-1}$                    |
| <sup>106</sup> Ru  | $3.40 \times 10^2$                       | $9.05 \times 10^1$                       |
| <sup>125</sup> Sb  | $3.90 \times 10^2$                       | $1.20 \times 10^2$                       |
| <sup>79</sup> Se   | $4.75 \times 10^{-2}$                    | $1.97 \times 10^{-2}$                    |
| <sup>151</sup> Sm  | $2.45 \times 10^2$                       | $6.73 \times 10^1$                       |
| <sup>126</sup> Sn  | $3.97 \times 10^{-1}$                    | $1.61 \times 10^{-1}$                    |
| <sup>90</sup> Sr   | $4.10 \times 10^4$                       | $1.66 \times 10^4$                       |

Table 20. Radionuclide Inventory For Representative Commercial Spent Nuclear Fuel Excluding Crud

| Radionuclide       | Representative PWR<br>(Ci/fuel assembly) | Representative BWR<br>(Ci/fuel assembly) |
|--------------------|--|--|
| <sup>241</sup> Am  | $1.18 \times 10^3$                       | $3.73 \times 10^2$                       |
| <sup>242</sup> Am  | 7.27                                     | 2.87                                     |
| <sup>242m</sup> Am | 7.30                                     | 2.88                                     |
| <sup>243</sup> Am  | $2.30 \times 10^1$                       | 8.63                                     |
| <sup>137m</sup> Ba | $5.70 \times 10^4$                       | $2.27 \times 10^4$                       |
| <sup>14</sup> C    | $3.35 \times 10^{-1}$                    | $2.12 \times 10^{-1}$                    |
| <sup>113m</sup> Cd | $1.39 \times 10^1$                       | 5.24                                     |
| <sup>144</sup> Ce  | $7.26 \times 10^1$                       | $1.73 \times 10^1$                       |
| <sup>36</sup> Cl   | $6.84 \times 10^{-3}$                    | $3.48 \times 10^{-3}$                    |
| <sup>242</sup> Cm  | 6.03                                     | 2.38                                     |
| <sup>243</sup> Cm  | $1.57 \times 10^1$                       | 5.55                                     |
| <sup>244</sup> Cm  | $2.59 \times 10^3$                       | $9.23 \times 10^2$                       |
| <sup>245</sup> Cm  | $3.37 \times 10^{-1}$                    | $9.07 \times 10^{-2}$                    |
| <sup>246</sup> Cm  | $1.16 \times 10^{-1}$                    | $4.26 \times 10^{-2}$                    |
| <sup>134</sup> Cs  | $4.08 \times 10^3$                       | $1.31 \times 10^3$                       |
| <sup>135</sup> Cs  | $3.74 \times 10^{-1}$                    | $1.81 \times 10^{-1}$                    |
| <sup>137</sup> Cs  | $6.04 \times 10^4$                       | $2.41 \times 10^4$                       |
| <sup>154</sup> Eu  | $2.36 \times 10^3$                       | $7.73 \times 10^2$                       |
| <sup>155</sup> Eu  | $4.94 \times 10^2$                       | $1.92 \times 10^2$                       |
| <sup>3</sup> H     | $2.70 \times 10^2$                       | $1.05 \times 10^2$                       |
| <sup>129</sup> I   | $2.27 \times 10^{-2}$                    | $9.22 \times 10^{-3}$                    |
| <sup>85</sup> Kr   | $3.11 \times 10^3$                       | $1.17 \times 10^3$                       |
| <sup>93m</sup> Nb  | $3.44 \times 10^{-1}$                    | $1.58 \times 10^{-1}$                    |
| <sup>94</sup> Nb   | $6.31 \times 10^{-5}$                    | $2.56 \times 10^{-5}$                    |
| <sup>237</sup> Np  | $2.53 \times 10^{-1}$                    | $8.74 \times 10^{-2}$                    |
| <sup>239</sup> Np  | $2.30 \times 10^1$                       | 8.63                                     |
| <sup>231</sup> Pa  | $3.00 \times 10^{-5}$                    | $1.86 \times 10^{-5}$                    |
| <sup>107</sup> Pd  | $8.65 \times 10^{-2}$                    | $3.45 \times 10^{-2}$                    |
| <sup>147</sup> Pm  | $6.36 \times 10^3$                       | $2.11 \times 10^3$                       |
| <sup>144</sup> Pr  | $7.26 \times 10^1$                       | $1.73 \times 10^1$                       |
| <sup>238</sup> Pu  | $2.77 \times 10^3$                       | $1.02 \times 10^3$                       |
| <sup>239</sup> Pu  | $1.80 \times 10^2$                       | $5.41 \times 10^1$                       |
| <sup>240</sup> Pu  | $3.20 \times 10^2$                       | $1.27 \times 10^2$                       |
| <sup>241</sup> Pu  | $5.20 \times 10^4$                       | $1.57 \times 10^4$                       |
| <sup>242</sup> Pu  | 1.68                                     | $7.08 \times 10^{-1}$                    |
| <sup>106</sup> Ru  | $3.40 \times 10^2$                       | $9.05 \times 10^1$                       |
| <sup>125</sup> Sb  | $3.90 \times 10^2$                       | $1.20 \times 10^2$                       |
| <sup>79</sup> Se   | $4.75 \times 10^{-2}$                    | $1.97 \times 10^{-2}$                    |
| <sup>151</sup> Sm  | $2.45 \times 10^2$                       | $6.73 \times 10^1$                       |
| <sup>126</sup> Sn  | $3.97 \times 10^{-1}$                    | $1.61 \times 10^{-1}$                    |

**ATTACHMENT I.**  
**COMPUTER FILES**

Attachment I consists of a compact disk that contains the following electronic files.

Table I-1. List of Computer Files

| <b>File Name</b>                       | <b>Size (kB)</b> | <b>Date</b> | <b>Time</b> |
|--|------------------|-------------|-------------|
| AvailShipCD-1YFF525kW3600-Norm_Rev.xls | 12,677           | 02/07/2007  | 12:43 PM    |
| WASTESTREAM_TAD_YFF525kW3600.TXT       | 3,251            | 02/08/2007  | 10:28 AM    |
| WPLOAD_OUTPUT_case1a.TXT               | 38,651           | 02/12/2007  | 7:33 PM     |
| Representative SFA-3600.mdb            | 44,052           | 09/07/2007  | 3:23 PM     |
| TAD-Based Representative SFA-3600.xls  | 829              | 05/03/2007  | 3:59 PM     |
| Enrichment.xls                         | 3,478            | 05/01/2007  | 5:44 PM     |
| PWR-50Gwd-Curies total.xls             | 207              | 09/04/2008  | 12:54 PM    |
| PWR-4.2-watts.xls                      | 49               | 04/17/2007  | 11:23 AM    |
| PWR-4.0-watts.xls                      | 55               | 04/17/2007  | 10:56 AM    |
| BWR-4.0%-50Gwd-Curies total.xls        | 148              | 05/03/2007  | 9:15 AM     |
| BWR-4.0-watts.xls                      | 46               | 04/17/2007  | 4:19 PM     |
| PWR-80GWd-curies total.xls             | 114              | 05/03/2007  | 9:48 AM     |
| BWR-75GWd-curies total.xls             | 121              | 05/03/2007  | 9:48 AM     |