

ANNEX G to ATTACHMENT F
DATA REQUIREMENTS

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1



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April 22, 2002

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Subject: Sandia's WIPP Inventory Data Needs for Performance Assessment

Per your request [Harvill, 2002], this letter details Sandia's additional data needs regarding the inventory data to be included in the 2002 update to the Transuranic Waste Baseline Inventory Report (TWBIR). In order to conduct a performance assessment of the WIPP for the Compliance Recertification Application (CRA) that (1) accounts for revisions to inventory estimates since certification of the repository, (2) accounts for both currently emplaced waste and to-be-emplaced waste, and (3) is defensible against concerns regarding heterogeneous waste emplacement, we will need the 2002 update to the TWBIR to include the following inventories:

1. **Waste stream volumes.**
2. **Inventory of radionuclides on a waste stream basis for both CH- and RH-TRU waste, decayed to a common base year.** For calculating releases due to cuttings, cavings, and spallings we need inventories on a waste-stream basis for the key radionuclides (i.e. those accounting for >99% of the EPA units in the WIPP plus some of their parents and daughters) [Sanchez et al., 1997]. For the Compliance Certification Application, the key radionuclides were determined to be ²⁴¹Am, ²⁴⁴Cm, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, ²⁴¹Pu, ²³³U, ²³⁴U, ¹³⁷Cs, and ⁹⁰Sr [Sanchez et al., 1997]. Because Sandia will re-evaluate the determination of key radionuclides, this list may grow.

For assessing the impact of heterogeneous waste emplacement on direct brine releases, we will require inventories on a waste-stream basis for a subset of the radionuclides accounted for in the direct brine release model. The required radionuclides are ²⁴¹Am, ²⁴³Am, ²⁴⁴Cm, ²³⁷Np, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, ²⁴¹Pu, ²⁴²Pu, ²⁴⁴Pu, ²²⁹Th, ²³⁰Th, ²³²Th, ²³³U, ²³⁴U, ²³⁵U, ²³⁶U, and ²³⁸U.

For performance assessment calculations of direct brine release and subsurface transport of radionuclides, for determining the waste unit factor, and for re-evaluating key radionuclide determinations, we will require inventories on a WIPP-scale basis for a greater number of radionuclides. Fifteen radionuclides contribute to the waste unit factor: ^{241}Am , ^{243}Am , ^{249}Cf , ^{251}Cf , ^{243}Cm , ^{245}Cm , ^{246}Cm , ^{247}Cm , ^{248}Cm , ^{237}Np , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{242}Pu , and ^{244}Pu [Sanchez, 1996]. Performance assessment models track 29 radionuclides on a WIPP-scale basis: ^{241}Am , ^{243}Am , ^{252}Cf , ^{243}Cm , ^{244}Cm , ^{245}Cm , ^{248}Cm , ^{137}Cs , ^{237}Np , ^{231}Pa , ^{210}Pb , ^{147}Pm , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{242}Pu , ^{244}Pu , ^{226}Ra , ^{228}Ra , ^{90}Sr , ^{229}Th , ^{230}Th , ^{232}Th , ^{233}U , ^{234}U , ^{235}U , ^{236}U , ^{238}U [Garner, 1996; Sanchez et al., 1997]. Re-evaluation of key radionuclides may benefit from tracking 14 additional radionuclides that per EPA regulation contribute to the number of EPA units in the WIPP: ^{227}Ac , ^{14}C , ^{135}Cs , ^{129}I , ^{59}Ni , ^{63}Ni , ^{107}Pd , ^{79}Se , ^{151}Sm , $^{121\text{m}}\text{Sn}$, ^{126}Sn , ^{99}Tc , ^{232}U , and ^{93}Zr [Sanchez, 1996]. Radionuclide inventories for these purposes may be provided on a WIPP-scale basis prior to completion of the 2002 update to the TWBIR, if you wish to minimize the number of radionuclides that must be tracked on a waste stream basis, or may be provided on a waste stream basis within the update. If WIPP-scale inventories are provided prior to completion of the 2002 update to the TWBIR, the same inventories should be included in the 2002 update to the TWBIR.

In summary, please provide waste-stream level inventories of at least

^{241}Am , ^{243}Am , ^{244}Cm , ^{237}Np , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{242}Pu , ^{244}Pu , ^{229}Th , ^{230}Th , ^{232}Th , ^{233}U , ^{234}U , ^{235}U , ^{236}U , ^{238}U , ^{137}Cs , and ^{90}Sr .

✓ Please provide WIPP-scale inventories of

^{241}Am , ^{243}Am , ^{249}Cf , ^{251}Cf , ^{252}Cf , ^{243}Cm , ^{244}Cm , ^{245}Cm , ^{246}Cm , ^{247}Cm , ^{248}Cm , ^{137}Cs , ^{237}Np , ^{231}Pa , ^{210}Pb , ^{147}Pm , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{242}Pu , ^{244}Pu , ^{226}Ra , ^{228}Ra , ^{90}Sr , ^{229}Th , ^{230}Th , ^{232}Th , ^{233}U , ^{234}U , ^{235}U , ^{236}U , and ^{238}U .

✓ Consider providing WIPP-scale inventories of

^{227}Ac , ^{14}C , ^{135}Cs , ^{129}I , ^{59}Ni , ^{63}Ni , ^{107}Pd , ^{79}Se , ^{151}Sm , $^{121\text{m}}\text{Sn}$, ^{126}Sn , ^{99}Tc , ^{232}U , and ^{93}Zr .

3. **Inventory of all nonradioactive waste material parameters that were previously tracked in the TWBIR.** These inventories should be provided on a waste stream basis for both CH- and RH-TRU waste. Nonradioactive waste material parameters include: Iron Base Metal/Alloy; Aluminum Base Metal/Alloy; Other Metal/Alloy; Other Inorganic Materials; Vitrified; Cellulosics; Rubber; Plastics; Solidified Inorganic Material; Solidified Organic Material; Cement; Soils; Steel (container material); Plastic/Liners (container material); and Lead (container material for RH-TRU waste only) [US DOE, 1996].

The Cellulosics inventory should include plywood waste boxes and other waste container materials made of cellulosics. This inventory will contribute to gas generation.

If Solidified Organic Material or Solidified Inorganic Material occurs in a waste stream, please specify what materials were used to solidify the waste, and if feasible, in what proportions. The specification can be made within the waste stream

description or in a separate field. These materials may have implications for actinide solubility.

Include only portland cement (and concrete or other cements containing CaO or Ca(OH)₂) in the inventory of Cement. Specify whether the partial mass density of Cement is based on unreacted (dry) cement, reacted (hydrated) cement, or a combination. Do not list portland cement inventory under Other Inorganic Material, Solidified Organic Material, Solidified Inorganic Material, or other waste material parameter. Cement may affect the pH of WIPP brines.

If Vitrified, Solidified Inorganic Material, Solidified Organic Material, or Cement is expected to occur in the final waste form and final waste form inventory data is not yet available, please estimate the partial densities of these waste material parameters that will occur in the final waste form. Appendix B-7 in the TWBIR Rev. 3 [US DOE, 1996] provides an example of how final waste form partial densities may be estimated.

If possible, specify whether a waste stream contains pyrochemical salts, and whether the pyrochemical salts resulted from Direct Oxygen Reduction (DOR) or O₂ sparging. The specification can be made within the waste stream description or in a separate field. This information may have implications for actinide oxidation state.

4. **Inventory of any other nonradioactive waste materials that are discovered to account for a significant portion of a waste stream as a result of changes to the inventory.** We suggest that inventory should be taken for any material not included in the existing waste material parameters and accounting for >5% by weight or volume of a waste stream. These inventories, if they exist, should be provided on a waste stream basis for both CH- and RH-TRU waste.
5. **Inventory of Cellulosics, Plastics, Rubbers, and other biodegradable materials used to facilitate emplacement of waste and MgO in the WIPP.** Waste and MgO emplacement in the WIPP is facilitated by the use of plastic shrinkwrap, cardboard stabilizers, and other materials. Inventory estimates for these materials should be included on a WIPP-scale basis. These materials may contribute to gas generation.
6. **Inventory of organic ligands and of SO₄, NO₃, and PO₄.** We understand from informal conversations with you and members of your team that new estimates of organic ligand concentrations and of SO₄, NO₃, and PO₄ concentrations would not improve upon the estimates available in the TWBIR Rev. 3. Therefore, for waste streams included in the TWBIR Rev 3. (and similar waste streams), we do not need updated inventories of these waste components to be included in the 2002 update to the TWBIR.

If organic ligands (acetate, citrate, oxalate, or EDTA), SO₄, NO₃, or PO₄ will be added to new waste streams during environmental restoration, decontamination and decommissioning, or similar activities, include inventory estimates for these waste components in the new waste streams. These components may affect actinide solubility or gas generation rates.

The 2002 update to the TWBIR should have the following characteristics:

- ✓ 1. Waste-stream level inventories of radionuclides and nonradioactive waste material parameters for waste currently emplaced in the WIPP should be included. The currently emplaced inventory should be distinct from the inventory remaining at waste generator sites. Inventories supplied by the waste generator sites should not include waste already sent to the WIPP.
2. Waste-stream level inventories of radionuclides and nonradioactive waste material parameters supplied by the waste generator sites should include estimates for (1) stored inventory, (2) projected inventory, (3) stored plus projected inventory (anticipated inventory), and (4) inventory scaled to fill the WIPP (disposal inventory). A definition for each type of inventory is given in the TWBIR Rev. 3 [US DOE, 1996].
3. To the extent possible, the waste streams identified in the 2002 update to the TWBIR should remain the same as the waste streams identified in previous versions of the TWBIR. Such consistency will (1) ensure that inventory data is available at the level of detail required for performance assessment calculations, and (2) allow us to continue to reference previous versions of the TWBIR for any information not collected for the 2002 update.

In order for the 2002 update to the TWBIR to be fully incorporated into CRA performance assessment calculations, we will need to receive it by your proposed deadline of the end of October, 2002. If any of the preliminary assessments of inventory issues that we carry out prior to October, 2002 indicate a need for additional or more specific data, we will notify you immediately in writing.

Sincerely,

Dr. Emily R. Giambalvo
(Senior Member of Technical Staff)

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ERG:6821:erg/(2002-1002, Rev. A)

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June 10, 2002

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Westinghouse TRU Solutions
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Subject: Waste Inventory: Level of Detail Required for Performance Assessment

At the April 22, 2002 meeting between Westinghouse TRU Solutions and Sandia National Laboratories regarding Sandia's waste inventory needs for performance assessment (Giambalvo, 2002), you indicated that:

1. The waste categories included in the 2002 update to the Transuranic Waste Baseline Inventory Report (TWBIR) would be more coarsely defined than were the waste streams included in the TWBIR Revisions 2 and 3. This coarsening would decrease the number of waste categories from ~970 contact-handled (CH-) and remote-handled (RH-) transuranic (TRU) waste streams to <200 CH- and RH-TRU waste categories.
2. As planned, the 2002 update to the TWBIR will account for all of the waste currently emplaced in WIPP in a single waste category. No significant difficulty would arise from categorizing the emplaced waste by waste stream or other waste category that could capture the heterogeneity of the emplaced waste.

In subsequent informal conversations, you indicated that the waste categories included in the 2002 update to the TWBIR are likely to remain very similar to the waste streams in Revisions 2 and 3 of the TWBIR due to the way in which the generator sites categorize the waste.

This letter is intended to clarify Sandia's needs regarding categorization of waste. The points listed below, where different from those listed in my letter to you of April 22, 2002 (Giambalvo 2002), supercede the points made in the previous letter.

1. A probabilistic Performance Assessment (PA) can be carried out with a lesser number of waste categories than were provided by the waste stream classification in Revisions 2 and 3 of the TWBIR. Using a very small number of waste categories may lead to PA results being questioned by the regulator and/or stakeholders.
2. If the waste categories used in the 2002 update to the TWBIR are not the same as the waste streams defined in Revisions 2 and 3 of the TWBIR (plus any new waste streams), then we prefer that
 - a) the waste categories be called something other than "waste streams,"
 - b) the 2002 update to the TWBIR include a description of how the new waste categories relate to the old waste streams, and

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- 2 of 2 -

- c) the 2002 update to the TWBIR include a justification for the change in waste categorization method.

These conditions are required so that Sandia may explain to the regulator the associated differences in PA calculations, and so that we may continue to reference Revisions 2 and 3 of the TWBIR for any information not collected for the 2002 update to the TWBIR.

3. The emplaced waste inventory should be provided with the same level of detail that is provided for the waste remaining at the generator sites (to-be-emplaced waste). If to-be-emplaced waste is categorized by waste stream, then the emplaced inventory should be categorized by waste stream. If to-be-emplaced waste is more coarsely categorized, then the emplaced inventory should be categorized with a similar resolution of detail. For instance, the emplaced waste could be categorized according to final waste form (US DOE, 1996), waste matrix group (Strum, 2002), or other characteristic consistent with the categorization scheme used for the to-be-emplaced waste.

As you gather information for the 2002 update to the TWBIR, please let me know if any of the requests made in this letter or in the letter dated April 22, 2002 (Giambalvo, 2002) cannot be fulfilled.

Sincerely,

Emily R. Giambalvo

References:

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ERG:6821:erg/(2002-1002, Rev. A)

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