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APR 30 2008

Juan Reyes, Director
Radiation Protection Division
U.S. Environmental Protection Agency
Room 553C
1310 L St, NW
Washington, DC 20005

Subject: Shielded Container Planned Change Request

Dear Mr. Reyes:

As a follow up to your correspondence dated December 7, 2007 and April 15, 2008, this letter provides additional information regarding the Planned Change Request (PCR) for Shielded Containers that the U.S. Department of Energy Carlsbad Field Office (DOE) submitted to the U.S. Environmental Protection Agency (EPA) on November 15, 2007.

Design and Certification Status of Shielded Containers

The design of the shielded container and associated ancillary equipment items is complete and the shielded container has successfully undergone DOT 7A, Type A, and Nuclear Regulatory Commission (NRC) Type B physical testing. A request for certification was submitted to NRC on December 21, 2007 and included an associated Safety Analysis Report (SAR).

The certification application was originally placed in the NRC review queue to follow their review of Revision 22 of the TRUPACT-II SAR. At the request of DOE and WTS, NRC has agreed to incorporate shielded containers into their review of the Revision 22 application package (see the attached letter to NRC dated April 14, 2008). Enclosure A.

Based on the nature of the NRC process and the robust design and testing performed on the shielded container assembly, DOE does not anticipate any changes to the design of the shielded container itself as a result of NRC's review of the application. However, if NRC were to issue a Request for Additional Information (RAI), we believe that we would most likely be able to resolve it with reasoned argument and analysis, or at most, modest additional testing of the current design. DOE does not believe there will be any substantial changes in the amounts of steel, lead, or CPR resulting from any NRC comments relative to the quantities used for the PA analysis in the PCR. DOE will keep EPA informed of developments as NRC's review and approval process proceeds.

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U.S. Department of Transportation (DOT) Specification 7A in 49 CFR §178.350 is a "self-certification" requiring certificate holders to formulate a test report documenting the tests and analyses performed to satisfy 49 CFR §179.465. Washington TRU Solutions (WTS) is assembling the DOT Type A test report and analytical documentation for the shielded container.

DOE-CBFO policy requires 3rd party review of WTS' test report for the shielded container. That 3rd party review process is expected to be completed by the end of May, 2008. We do not anticipate any changes to the design of the shielded container as a result of the 3rd party review of DOT Type A certification package.

After completion of the 3rd party review, DOE will provide EPA with a copy of the DOT 7A certification documentation and associated review. Any shielded containers ultimately fabricated for use within the DOE complex will have to be stenciled with "DOT-7A" in accordance with 49 CFR §178.350. The DOT 7A certification will greatly facilitate DOE's approval of the use of shielded containers under its 10 CFR Part 830 safety basis requirements (see section below).

Candidate Waste for Shipment in Shielded Containers

As explained in the PCR, the activity of Cs^{137} dominates the RH inventory in most cases, with Am^{241} and Co^{60} predominant in a very few cases. Two to three Curies of Cs^{137} in a 30 gallon drum, when packaged in a shielded container, result in a dose rate at the surface of the shielded container of about 200 mrem/hr.

The Microshield™ analyses included in Attachment 2 to the PCR provides an indication of the segment of the overall RH waste inventory that is a potential candidate for shipment in shielded containers. It is impossible to predict the exact amounts of waste that would be shipped to WIPP in shielded containers because characterization will be performed on a drum-by-drum basis, as opposed to the estimate in the PCR which is based on the average activity concentration for a waste stream.

The Microshield analyses do not affect the performance assessment in the PCR, which provides a bounding estimate for all RH waste streams in the inventory. The PCR considered three scenarios: 1) all of the RH waste placed in boreholes in the walls, 2) half of the RH waste placed in boreholes in the walls and the other half placed in shielded containers on the floor, and 3) all of the RH waste placed in shielded containers on the floor. In each of these scenarios, the analyses in the PCR show negligible differences between the releases for the three scenarios and no impact to compliance – i.e., normalized releases will be well below regulatory limits for each of the scenarios.

Shielded containers offer some clear inherent advantages when compared to shipment using the existing RH-72B shipping package. Up to nine shielded containers could be

shipped in a single shipment using the HalfPACT shipping package, while the RH-72B only accommodates three similar sized containers. For example, the waste shipped in the 136 RH-72B shipments of RH waste from the Idaho National Laboratory that WIPP had received as of April 15, 2008 could have been shipped in as few as 46 shipments if that waste had been packaged in shielded containers and shipped in the HalfPACT with three HalfPACTs per shipment.

The following table illustrates the transportation benefits that could be realized from using shielded containers:

RH Shipping Comparison for a typical 100 m^3 waste stream	**Containers**	**Shipments**
Direct-load RH canisters	112	112 (using RH-72B)
55-gallon drums in canisters	476	159 (using RH-72B)
30-gallon drums in canisters	909	303 (using RH-72B)
Shielded containers	909	101 (using HalfPACT)

In addition, shielded containers offer front end benefits to the DOE waste generator site complex by providing a more flexible storage alternative. For example, many RH debris waste streams are unpackaged and currently stored in hot cells. Shielded containers offer the generator sites a near-term packaging pathway, and safe storage alternative for such wastes with the assurance that such packaged waste can be transported to WIPP without repackaging. This flexibility offered by the shielded containers provides generator sites with the ability to package RH waste sooner, allowing sites to redeploy hot cell space for other activities or to proceed with hot cell decommissioning and demolition activities.

Documented Safety Analysis and WIPP Operations Involving Shielded Containers

10 CFR Part 830, Subpart B, "Safety Basis Requirements," requires DOE to analyze the WIPP facility, the work to be performed and its associated hazards, and to identify the conditions, safe boundaries, and hazard controls necessary to protect workers, the public, and the environment from adverse consequences when handling shielded containers. These analyses and hazard controls constitute the safety basis for ensuring that the WIPP facility can be operated safely when handling shielded containers. The safety basis of receiving, handling, and emplacing shielded containers will be evaluated and documented through the Documented Safety Analysis (DSA) development process.

DOE and WTS have performed some preliminary DSA-related analyses (e.g., criticality) indicating that receipt and handling of shielded containers within the current CH operation is feasible, and can be done safely.

DOE will initiate comprehensive safety analysis activities this summer. Those activities will include hazard identification and analyses, as well as analysis of various accident scenarios, including those related to fires involving shielded containers. The results of these activities and analyses will be documented and reported in the fall of 2008 in accordance with 10 CFR Part 830 and with applicable DOE orders in the form of a DSA. DOE-CBFO will keep EPA informed of safety-analysis-related developments as the DSA activities progress in 2008.

Some stakeholders have inquired about how WIPP's currently authorized hot cell operations for RH waste received in the 10-160B shipping cask would be affected by shielded containers. The currently authorized hotcell operations at WIPP for RH waste received in the 10-160B shipping package will not be affected by shielded containers. Moreover, DOE does not intend to ship shielded containers to WIPP in the 10-160B shipping cask

Stakeholders have also questioned how shielded containers with surface dose rates near the 200 mrem/hr surface dose rate limit will be handled, including possible use of the shielded storage area in the WIPP CH bay. Operational safety of shielded containers in the CH process, including those containers near the 200 mrem/hr surface dose rate limit, will be examined as part of the DSA activities and analyses described above. Additionally, receipt, handling, and storage of shielded containers in the CH bay at WIPP will also be described and addressed in the administrative process for the permit modification that will be submitted to NMED after EPA makes its decision regarding the shielded container PCR. Lastly, the receipt and handling of shielded containers will be controlled by the facility's radiation protection program and associated operating procedures, similar to the CH waste streams received at WIPP.

Responses to EPA's April 15, 2008 First Completeness Comments and Questions

1. Burns 2005 is cited in Crawford and Taggart 2007 as the source of information on masses of some CPR materials. We were not able to locate this document on the CREL system and would like a copy for review. The same comment applies to Donner 2007.

Response: The requested references are included in Enclosure B to this letter.

2. Footnote 1, page 5 of Crawford and Taggart 2007 indicates that there are "87 RH waste streams" while Section 2.2.1 of Dunagan et al. 2007 states that there are

"77 RH waste streams." The 2004 Baseline Inventory Report (DOE/TRU-2006-3344) also lists 77 waste streams in Table E-2. Please clarify the reason for this difference.

Response: The correct number of waste streams is 77. INV-SAR-08 is being corrected in accordance with LANL procedure LCO-QP17-1, Record Management. The specific correction is that the footnote has a typographical error and will be changed to 77 total RH waste streams.

3. Section 5.1 of Crawford and Taggart 2007 state that activity concentrations were multiplied by gamma factors from Shleien 1992 to identify dominant gamma emitters. Can DOE provide spreadsheets or other documentation that describe the procedures used?

Response: DOE believes that EPA wants to review all aspects of the process that was used for selection of candidate RH waste streams. If this is correct, a meeting between EPA and Los Alamos National Laboratory - Carlsbad Operations (LANL-CO) is probably the most efficient way for EPA to discuss the details of the analyses and calculations. This meeting could occur during the EPA's review of the Shielded Container performance assessment in Carlsbad, NM, tentatively scheduled for June 2008. The relevant spreadsheets and other documentation for the identification of dominant gamma emitters will be provided during this meeting. Gamma Emitter information is also provided in (Schleien 1992).

4. Section 5.1 of Crawford and Taggart also notes that Microshield 6.02 was used to determine the maximum activity loadings for shielded containers to establish the maximum activity that would result in a dose rate of < 200 mrem/hr. Can DOE supply spreadsheets or other documentation that present details of the procedures used? How was conversion from exposure (mR/hr) to dose (mrem/hr). accomplished?

Response: A meeting between EPA and LANL-CO (see Comment 3) is probably the most efficient way for EPA to review the detailed Microshield™ calculations. Relevant spreadsheets will be provided at this meeting.

The conversion from exposure to dose used a quality factor of 0.95. DOE is not proposing to use shielded containers for disposal of any radioactive waste other than penetrating beta-gamma emitters. The one-inch-thick lead shield will ensure there is no beta component to the external dose rate. Neutron emitting RH TRU waste will not be packaged in the shielded containers intended to shield beta-

gamma emitting isotopes. Therefore, the only external dose from waste in the proposed shielded containers will result from penetrating gamma photons, and dose to tissue will follow exposure with a Quality Factor of 0.95.

5. Section 6.2 of Crawford and Taggart 2007 states that the masses of lead and steel in the shielded containers were obtained from "Shielded Container Project Guidance." Please provide this documentation.

Response: The masses of lead and steel were determined from the Shielded Container Project guidance included as Enclosure C to this letter.

6. Where are the input/output files for the Microshield calculations located? How do we obtain copies of selected calculations? We note that the example calculations used in Attachment 2 of Crawford and Taggart 2007 does not include any signoff that the calculations have been checked. Provide information that Microshield has been qualified for its intended use and documentation verifying that these calculations were performed adequately.

Response: The requested information can be made available for review during the proposed June 2008 EPA visit with LANL-CO (see response to Comment 3). MicroShield™ is qualified under the LANL-CO QA program in accordance with LCO-QP19-1 Software Quality Assurance. In MicroShield the input is built into the output and is reported in the attachments to INV-SAR-08 (Crawford and Taggart, 2007). This document has undergone technical review in accordance with LCO-QP9-1, Analyses, and LCO-QP6-2, Controlled Document Review and Approval. The technical review is documented on the document review form in the INV-SAR-08 record package. A list of documents available for EPA review has been forwarded to EPA via an E-Mail from Russ Patterson to Chuck Byrum dated April 23, 2007 (Enclosure D).

7. Section 5.1 of Crawford and Taggart 2007 provides no reference to the data source used to determine the dominant gamma emitters. Please provide us with a reference and a copy of the cited document.

Response: A copy of the reference source for Section 5.1 of the cited document is included in Enclosure E to this letter. The data source for the determination of dominant gamma emitters is a combination of a query performed on TWBID D.4.16 for RH waste, the gamma factors from (Schleien 1992), and the flow diagram provided as Enclosure F. The query and the process to determine the dominant data emitters can be discussed at the proposed meeting between EPA and LANL-CO during the EPA's review of the Shielded Container performance assessment in Carlsbad, NM.

8. Sections 6.3 and 6.4 of Crawford and Taggart 2007 provide no reference as to the source of data in Tables 9 and 10. Please provide us with a reference and a copy of the cited document. We note that the waste stream volumes in Table 10 are different from the waste stream volumes in DOE 2006. Please explain the source of the differences.
Response: The data used to generate Table 9 of Crawford and Taggart 2007 came from a query performed on the Comprehensive Inventory Database (CID) data version D.6.04 and gamma factors (Schleien 1992) corrected for drum wall thickness. The query was performed on Remote Handled waste in current form. This query will be made available during the inspection defined in comment 3 and 4. The spreadsheets used for data input for MicroShield are also described in comment 3 and 4 and will be made available during a future inspection. Table 10 was derived from the same query as Table 9 screened for Cs-137 activity of 2.0 Ci per 30-gallon container or Co-60 activity of 0.12 Ci per 30-gallon drum. The volumes reported in Table 10 are unscaled current form volumes. It is not clear which tables in the *Transuranic Waste Baseline Inventory Report – 2004* were used by EPA for the comparison. If Appendix E information was used, the volumes in this appendix are based on final form volumes and are scaled. A comparison of the current form volumes from the profiles in Appendix J with the information in Table 10 should be performed if Appendix E was used for the comparison.

9. From 1995 RH TRU Study (DOE/CAO 95-1095) - Solubilities discussed on page 27 (RH Study 1995). Item 1 takes credit for RH emplacement canisters placed in the walls. "provide a barrier to the transport of radionuclides". In the conclusions on page 27 it states: ". . .(2) the RH-TRU waste package and configuration. which will limit brine accessibility to waste during the period when RH radionuclides are present in high concentrations." It would seem appropriate that using the new emplacement configuration this reasoning needs to be revisited. Does any of the new documentation provide sufficient information to deal with this adequately?

Response: The Shielded Container Performance Assessment (SCPA) did not take credit for the integrity of RH waste canisters, as is also the case in the PABC, where no credit is taken for the RH canisters in terms of their ability to limit brine access.

When RH waste is emplaced in shielded containers on the floor of the repository in the SCPA, the shielded containers are considered in all release scenarios including those involving brine. The chemical conditions and release scenarios in the SCPA consider the contributions from the RH waste in shielded containers in the same manner as CH waste. As such, the SCPA accounts for the contribution of shielded containers to cuttings, cavings, DBR, Culebra, marker bed and spallings releases. For example, the entire RH inventory is included in solubility calculations for all groundwater release pathways when the entire RH inventory is placed in shielded containers on the floor. RH waste that is placed in the walls for

the SCPA is treated in the same manner as the RH waste in the PABC. This is identified in the SCPA analysis report in Section 3.1.7 (Dunagan et al. 2007) and sections 6.4.12.3 and 6.4.12.4 in the CRA-2004 (DOE 2004).

- Intrusion Probability: It states on page 40 of DOE/CAO 95-1095 (RH Study 1995); "The probability for the RH-TRU activity level (5) is based on the relative area of RH-TRU waste emplacement to the total waste emplacement area." It also states; "the intrusions into the lower probability RH-TRU canister must he calculated and the release from this intrusion must be significant in comparison to intrusions calculated for the range of activity of [contact-handled] CH-TRU. The identical CCDFs indicate that there were no significant consequences from intrusions into RH-TRU canisters compared to the CH-TRU activity levels." When one considers the new RH waste configuration it seems like this analysis needs to be redone. Does any of the new documentation provided sufficient information to deal with this adequately?

Response: The probability of hitting RH waste was refined for the SCPA analysis in order to represent the location of RH waste in shielded containers on the floor of the rooms versus in canisters in the walls of the repository. The changes made to the RH waste probability of intrusion are identified in the SCPA analysis report in Section 3.3 (Dunagan et al. 2007) and the calculations of the new probabilities are found in Dunagan (2007). Moreover, the SCPA analysis compared three bounding scenarios: 1) all RH waste is in canisters in the walls, 2) all the RH waste is in shielded containers on the floor of the waste rooms, and 3) half of the RH waste is in canisters in the walls and half of the RH waste is in shielded containers on the floor of the waste rooms. The SCPA results showed that total normalized releases are essentially identical for the three bounding scenarios, proving that repository performance is independent of the location of the RH waste (Dunagan et al. 2007).

Are there other "historical" issues, such as assumptions, reasoning, or commitments previously made that may influence taking RH originally planned to he placed in the walls of rooms and placing this RH waste in shielded containers onto the floor of a disposal room?

Response: The SCPA analysis plan (Dunagan and Vugrin 2007) and report (Dunagan et al. 2007) contain a comprehensive analysis of the effects of placing the RH waste in the rooms as applied to performance assessment. DOE is unaware of other historical issues that need to be investigated.

10. Stakeholders have voiced concerns about the possibility of the shielded container lead melting and not being fully protective if subjected to high temperatures that may be encountered with a fire. EPA believes that DOE should respond to this issue. We

understand that lead melts at 621.5 °F (327.5 °C). Would a fire in the repository increase the shielded container internal temperature sufficiently to melt lead as postulated by stakeholders?

Response: Due to the robust construction of the shielded container and the energy required to melt the lead and steel shell that houses the lead, no significant degradation of shielding is expected from the postulated fires. This issue will be examined and documented as part of the DSA-related activities that WTS will perform this summer.

In the meantime, DOE points out that lead will not lose its effectiveness as a radiation shield if it is liquefied, and that temperatures would have to exceed 2600 Fahrenheit (the approximate melting point of plain carbon steel) before the steel shells surrounding the lead shielding begin to melt and lose their shape. At these temperatures, radiation shielding for protecting workers battling the blaze would be the least of the many worker protection problems in this situation.

11. DOE has published an inventory update and that some of the inventory information has changed since the shielded container analysis was conducted. EPA believes it is appropriate to compare the new inventory data to the inventory data used in the calculations done to support the shielded container change request to determine the impact of these changes and their effect on the candidate waste calculation. Therefore, EPA expects DOE to compare the new inventory to the inventory used in the shielded container change request calculations and determine the impact of these inventory changes.

Response: DOE's screening analysis to estimate how much of the RH TRU waste inventory might be considered candidate material for packaging in shielded containers was based on the average activity concentration of individual RH waste streams in the inventory for the Performance Assessment Baseline Calculation (PABC). DOE did not attempt to make a prediction about compliance with that analysis. It was merely a simple calculation to determine approximately how much RH material in the inventory at the time of the PCR submittal might be suitable for packaging in shielded containers. DOE has no intention of ensuring that a certain minimum or maximum amount of RH TRU waste is packaged this way. That is why the SCPA was performed using bounding values for the location of the RH waste (see the response to Comment 9).

The screening analysis using the PABC inventory showed that (based on the estimated final form activity concentrations after packaging) up to about 30% of the RH waste in the PABC inventory might be suitable for packaging in shielded containers. About half of that volume was from the RH waste streams from bismuth phosphate plutonium purification tanks at Hanford. Since the PCR for

shielded containers was submitted, DOE has decided that those related waste streams will not be included in the RH inventory for the CRA-2009 performance assessment. Thus, if DOE were to estimate the amount of RH TRU waste inventory suitable for packaging in shielded containers based on the recently issued inventory update, the analysis would show that the candidate volume would also be reduced by about half.

It is important to remember that all these analyses do not imply that any specific waste stream will be packaged in shielded containers. DOE is not trying to predetermine how any particular waste stream will be packaged. Just like CH waste yet to be packaged, DOE does not require generator sites to commit *a priori* to a particular container packaging form (e.g., 55 gallon drums in 14-pack assemblies vs. Standard Waste Boxes or ten-drum over-packs). That is why the SCPA was performed as a bounding analysis with all, half, or none of the RH inventory packaged in shielded containers. DOE intends to evaluate each RH waste stream on an individual basis as generator sites begin to package the material for ultimate disposal at WIPP. If a candidate waste stream can be shown to meet the requirement that the external dose after packaging in a shielded container will result in a surface dose rate less than the 200 mrem/hr division between the CH and RH classifications, it will be considered for such a disposition path.

12. EPA plans to visit DOE/SNL in the near future to evaluate the shielded container performance assessment calculations (SCPA) done to support the shielded container change request. EPA will examine all aspects of these calculations to confirm that they were performed properly. In addition, the Agency will verify that correct and qualified computer codes, parameter values, input files, and appropriate scripts were used to perform the SCPA calculations. Please provide the appropriate modeling (PA and Microshield) documents.

Response: The run control documentation was included as Appendix B of Dunagan et al. (2007). Enclosure G to this letter is a compact disc containing copies of the SCPA analysis plan, analysis report, and their associated document review and comment forms as well as Dunagan (2007). The Microshield™ calculations were performed by LANL-CO and are not included in this letter; but can best be examined during the June 2008 EPA site visit with LANL-CO.

13. A key issue controlling the shipment of RH waste in shielded containers is the Land Withdrawal Act (LWA) requirement that the surface dose of CH waste be 200 mrem/hr or below. EPA has been observing the implementation of procedures used at waste generator sites to measure the surface doses of drums. EPA has observed that the characterization procedure is comparable but implemented slightly differently

between the sites. We noted at Savannah River Site (SRS) that the bottom of the container is actually measured by tilting or lifting with equipment, but at Los Alamos National Laboratory (LANL) they do not measure the bottom of the container for safety reasons. From these visits we have developed some initial questions. For example, how will DOE assure that measurements of surface dose are adequately consistent from site to site? We are concerned that an errant drum may be disposed at WIPP and have to be removed at a later date.

Response: Shielded containers may help DOE significantly improve the packaging, handling, transportation and disposal of TRU waste that would otherwise be Remote Handled (RH) waste, and thereby required to be shipped and emplaced in a less efficient manner. Even though there is no significant difference in hazard to workers or risks to the environment between wastes that exhibit dose rates slightly above or slightly below 200 mrem/hr, there is a statutory bright line drawn by the WIPP Land Withdrawal Act (LWA) that allows a pronounced regulatory distinction between Contact Handled (CH) and RH waste. EPA has called this a "key issue" in its question. DOE does not believe that disposal of a shielded container with a surface dose rate slightly higher than 200 mrem/hr poses any undue risk to workers and certainly has no influence on long-term repository performance. DOE also understands the legal requirement defined by the WIPP Land Withdrawal Act regarding the statutory definition of 200 mrem/hr of surface dose as the dividing line between CH and RH wastes.

To ensure that all shielded containers exhibit a surface dose rate less than 200 mrem/hr when packaged for disposal, DOE will employ a system of controls for packaging and measuring that ensure a very high degree of confidence that this requirement is met. DOE will require a standard surface dose rate measurement geometry and protocol at all sites that package waste into shielded containers. This protocol will be audited under each site's transportation certification.

How will instrument and measurement error be incorporated into the measurement process? How is this handled in current procedures? How will hot spots (close to one side or the bottom of the shielded container) he handled at each site? For example, if a CH drum has a measurement of 190 mrem/hr, given the potential errors, how is it treated now? We understand that for CH waste these issues are part of the work every day, but it seems that the limit of 200 mrem/hr may be approached more often with RH waste. EPA believes that it is important that, for RH waste to be shipped and handled as CH waste at WIPP, a shielded container would have to be below the surface dose requirements of the LWA.

Response: DOE disagrees with EPA's contention "that the limit of 200 mrem/hr may be approached more often with RH waste" packaged in shielded containers. The surface dose rate measurement protocols that DOE uses at the various generator sites involve multiple measurements around each waste container, with the single highest measured value employed as the "dose rate of record" that governs how the container is classified. If this highest reading is greater than 200 mrem/hr, all generator sites repackage to ensure the subsequent container's highest surface dose rate is less than 200 mrem/hr. These same protocols will be employed for shielded containers. This conservative use of the highest surface dose rate measurement to classify the container will ensure (as it already does for CH waste) that RH waste packaged in shielded containers maintains its statutory classification as waste that will be managed as contact handled.

If you or your staff have any questions regarding the information contained in this letter, please contact Russ Patterson at (575)234-7457.

Sincerely,

David C Moody

David C. Moody
Manager

Enclosures

cc: w/enclosures

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Enclosure A – NRC Letter

Enclosure B – Copies of Burns 2005 and Donner 2007

Enclosure C – Copy of document – List of Key Assumptions (2007)

Enclosure D – Compact disc containing the input/output files for Microshield™ and documentation related to review of the calculations

Enclosure E – Copy of reference source for Section 5.1 of Crawford and Taggart 2007, Shleien (1992)

Enclosure F – Copy of Analysis Flow Diagram for data in Tables 9 and 10 of Sections 6.3 and 6.4 of Crawford and Taggart 2007

Enclosure G – Compact disc containing copies of the SCPA analysis plan, analysis report, and their associated document review and comment forms as well as Dunagan (2007)

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