UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 2 1 2009

OFFICE OF
AIR AND RADIATION

Dave Moody, PhD.
Manager, Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Dr. Moody:

The U.S. Environmental Protection Agency (EPA) received the U.S. Department of Energy's (DOE) 2009 Compliance Recertification Application (CRA-2009) for the Waste Isolation Pilot Plant (WIPP) on March 24, 2009. In addition, staff from DOE and its contractors presented an overview of the CRA-2009 at a meeting with EPA on April 14, 2009. (Copies of presentation materials from this meeting, as well as the full CRA-2009 contents, have been placed in EPA's dockets.)

We received the CRA-2009 in accordance with our WIPP Compliance Criteria (40 CFR 194.11). As written in our regulations, EPA's full technical evaluation for recertification – pursuant to Section 8(f)(2) of the WIPP Land Withdrawal Act (LWA) – shall not begin until the Administrator of EPA has informed the Secretary of DOE, in writing, that EPA has received a complete Compliance Recertification Application. This completeness determination is an administrative step to ensure that the application addresses all the required regulatory elements and provides sufficient information – e.g., discussion of analytical methods and parameters, presentation of results, explanation and justification for conclusions – for EPA to conduct a full technical evaluation. The completeness determination does not reflect any conclusion regarding WIPP's continued compliance with EPA's radioactive waste disposal regulations (40 CFR Part 191, Subparts B and C) or WIPP Compliance Criteria. Our completeness evaluation is conducted according to guidelines described in EPA's "*Compliance Application Guidance*" (EPA Pub. 402-R-95-014) and "*Guidance to the U.S. Department of Energy on Preparation for Recertification of the Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194*" (A-98-49, II-B3-14; December 12, 2000).

Based on our review to date, we have determined that the CRA-2009 is not yet complete. The enclosure to this letter describes completeness issues identified in our initial review, and requests additional information necessary for us to proceed with a full technical review of the application. The comments focus on the performance assessment and chemical portions of the CRA-2009. In the near future, we expect to provide comments related to other portions of the application, and may provide additional comments on sections of the CRA-2009 addressed by the aforementioned enclosure. The lack of comments on any section or topic in the CRA-2009 documentation does not imply that the relevant portion of the CRA-2009 is deemed complete. In accordance with Section 194.11, we will notify the Secretary of Energy, in writing, when we determine that a complete application has been received. Prompt and complete responses by DOE to our inquiries and information requests are critical for EPA to make a timely determination of completeness.

In addition to comments related to our completeness determination, this letter and others issued during our completeness review may also include potential technical issues that arise during our examination of the application. Some of these comments may address information or analyses beyond those initially expected to provide a complete application. However, we believe it is in the interest of EPA, DOE, and the public to raise potential technical issues as soon as they are identified. In this way, we can have a full and open discussion of these issues and maximize the time available for DOE to address our questions and concerns.

EPA also believes it is prudent to notify DOE as early as possible of issues that may impact our completeness determination, one of which is the WIPP performance assessment. As such, the Agency expects DOE to submit a new performance assessment before the CRA-2009 can be deemed complete. The latest inventory must be incorporated to reflect changes since the last performance assessment. Specifically, we are requesting DOE to run a fully compliant performance assessment with the Hanford tank waste removed from the performance assessment inventory. Also, because of the significant increases in organic chemical materials in the recent inventory, these values and their impact need to be included in a compliant performance assessment. Therefore, DOE needs to update and correct the performance assessment as needed (including modifying drilling rate and borehole plugging patterns) to make the new performance assessment baseline calculation (PABC-2009) as representative of present and expected conditions at WIPP as possible.

EPA knows that the CRA-2009 has been a significant effort by DOE and its contractors. The new format has been an improvement and the hyper-linked text has enhanced our review process. If you have any questions regarding these issues, please contact Tom Peake at (202) 343-9765.

Sincerely,

Elizabeth Cotsworth

Elizabeth Cotsworth, Director
Office of Radiation and Indoor Air

Enclosure

cc: Electronic Distribution
Frank Marcinowski, DOE/EM
Russ Patterson, DOE,CBFO
Steve Zappe, NMED
Nick Stone, EPA Region 6
EPA Docket

Enclosure: CRA-2009 First (1) Completeness Letter

General Comments:

1-G-1. Stakeholder-Water Flow Model Concerns

Text from the Citizens for Alternatives to Radioactive Dumping (CARD) news release on March 25, 2009, raises questions about DOE's conceptualization and, therefore, performance assessment modeling of the shallow hydrology at WIPP. CARD claims that new data and a recent analysis done by Dr. Phillips invalidate the conceptual model, therefore the certification must be "rescinded." CARD also claims that the Culebra hydrology model peer review held by DOE, "...reveals that water levels in the test wells at WIPP rise and fall with rainfall, meaning that, should the site be breached at some future time, as predicted by DOE due to oil deposits beneath the WIPP site, there may not exist a reliable barrier to the migration of contaminated water."

In addition to the news release, the Agency recently received documents from CARD that outline the aforementioned issues. EPA will provide this documentation to DOE separately so that the Department is aware of CARD's issues and can address the concerns raised in their documentation.

1-G-2. Shielded Containers

The shielded container planned change request has been an ongoing activity that was not completed before the CRA-2009 was received by EPA. The Agency considered the idea of including the shielded container request into the CRA-2009 review and decision process. However, after seeking comments from stakeholders EPA determined that it was most prudent to keep the two actions – the shielded container review and the 2009 recertification – distinct and separate. Therefore, EPA will proceed to review and complete the CRA-2009 as required by the LWA. EPA will then continue its review of the shielded container planned change request. This approach will give stakeholders ample opportunity to consider and comment on both actions by the Agency.

1-G-3. Inventory

As outlined in the Executive Summary of DOE/TRU-2008-3379, Rev.1 (ATWIR 2007), DOE has proposed that ATWIR 2008 be used as the inventory source document if EPA requires a new Performance Assessment Baseline Calculation (i.e. PABC-2) to support the 2009 compliance re-certification application. DOE further states in ATWIR 2007 (p. 34) that, "Additional information on EDTA and chelating agents will be collected in the next TRU waste inventory update and, at that time, mass quantities of EDTA will be further refined and quantified and ultimately reported in the *Annual Transuranic Waste Inventory Report – 2008.*"

However, DOE altered its actual reporting in ATWIR 2008 stating on p. 13 that, "Items 4, 5, 6 and 8 above [i.e., complexing agents, oxyanions, cement, and emplacement materials] are not included in this report, which provides information on waste streams only, but are collected for PA and will be reported in a separate report when requested by CBFO." EPA requests that DOE provide the date when such a report will be available.

40 CFR 194.23 – Performance Assessment Models and Computer Codes

1-23-1. **New Compliant Performance Assessment**

EPA believes it is necessary to perform a new performance assessment to capture changes since the last recertification, as was done in 2004. The Agency also believes that even though our CRA-2009 review is not yet complete, it is necessary to notify DOE of this need as soon as possible. In particular, changes in the waste inventory since the 2006 performance assessment baseline calculations must be addressed. Specifically, the organic chemical materials have, in some cases, significantly increased and their impact (e.g., solubilities, etc.) needs to be incorporated into the CRA-2009 performance assessment calculations to verify continued compliance with our regulations. As in the past, DOE is expected to find and correct errors in the previous performance assessments. DOE is also expected to include the new Culebra hydrology model peer reviewed in 2008 and to include the most recent parameters, such as the updated drilling rate and revised borehole plugging patterns.

Chemistry Issues to be Resolved Before New Performance Assessment is Undertaken.

1-23-2. DOE should provide the following references from Appendix SOTERM-2009:
Borkowski, M., J.-F. Lucchini, M.K. Richmann, and D.T. Reed. 2008. *Actinide (III) Solubility in WIPP Brine: Data Summary and Recommendations*. LCO-ACP-08, LANL\ACRSP Report. Los Alamos, NM: Los Alamos National Laboratory.
Lucchini, J.-F., H. Khaing, M. Borkowski, M.K. Richmann, and D.T. Reed. 2009. *Actinide (VI) Solubility in Carbonate-free WIPP Brine: Data Summary and Recommendations.* LCO-ACP-10, LANL\ACRSP Report. Los Alamos: Los Alamos National Laboratory.
Reed, D.T., J.-F. Lucchini, M. Borkowski, and M.K. Richmann. 2009. *Pu(VI) Reduction by Iron under WIPP-Relevant Conditions: Data Summary and Recommendations.* LCO-ACP-09, LANL\ACRSP Report. Los Alamos, NM: Los Alamos National Laboratory.
Richmann, M.K. 2008. Letter report to D. Reed (Subject: Eh/pH Diagrams for Am(III), Th(IV) and Np(V) Based on the FMT Database and Current PA Assumptions). 21 November 2008. Los Alamos National Laboratory, Carlsbad Operations, Carlsbad, NM.

1-23-3. DOE summarizes thermodynamic data for the +III, +IV, and +V actinides that have become available since the CRA-2004 PABC in Appendix SOTERM-2009. DOE should evaluate the possible effects of these additional data on the solubility uncertainty distributions developed by Xiong et al. (2005, ERMS 539595).

1-23-4. AP-137 (Clayton 2008), includes the statement on pages 17 and 18 that the ligand concentrations were expected to increase from the 2004 to 2007 inventories. Clayton (2008) indicated that the effects of increased ligand concentrations would be evaluated using bounding estimates of the mean DBR and total releases at higher organic ligand concentrations. DOE (CRA-2009, Section 24.6.1) notes the existence of the 2007 inventory data, and states, "The DOE anticipates this inventory update will have only a small impact on normalized releases relative to the CRA-2009 PA, and will not be significant for compliance."

The ligand concentrations have significantly increased since the CRA-2004, PABC inventory (Table 1, below). Higher ligand concentrations, particularly EDTA, would be likely to affect actinide solubilities based on calculations conducted during review of the CRA-2004 PA. DOE should provide evidence supporting their statement that the inventory update will not have a significant impact on normalized releases.

Table 1. Changes in Reported Ligand Inventories Between the CRA-2004 PABC and 2007

Ligand	PABC and CRA-2009 Inventory (kg, Leigh 2005 ERMS 539550)	2007 Inventory (kg, DOE 2008)	Change
Acetic acid	142	14,100	99.3×
Sodium acetate	8,510	31,400	3.69×
Citric acid	1190.5	5,680	4.77×
Sodium citrate	400	2,560	6.40×
Sodium EDTA	25.6	423	16.5×
Oxalic acid	13,796	29,500	2.14×
Sodium oxalate	33,940	658	0.019×

1-23-5. In Appendix SOTERM-2009, Section 3.3.2 and SOTERM-2009, Section 3.6.2, DOE states that the pcH of the WIPP brines is expected to be approximately 8.7 or 8.5. Based on FMT modeling performed for the CRA-2004 PABC, however, the pcH of GWB and ERDA-6 are expected to be 9.39 and 9.64, respectively. The pcH values cited by DOE seem to reflect the pH values of 8.69 and 8.94. DOE should correct the cited pcH values and reinterpret the solubility data in light of the correct values.

1-23-6. DOE reports uranium(VI) solubility experiments in the absence of carbonate and ligands (Appendix SOTERM-2009, Section 3.3.2). The results of these experiments indicate that the U(VI) solubility is approximately one order of magnitude higher in GWB than in ERDA-6 at the pcH modeled using FMT for the CRA-2004 PABC (approximately 9.4 to 9.6). The solubility difference was attributed to U(VI) complexation by higher sulfate and borate concentrations in GWB.

Similarly, experimental results with Nd(III) in the absence of ligands indicate higher solubility in GWB than in ERDA-6, and significant Nd(III) complexation by borate is cited as the cause in SOTERM-2009, Section 3.6.2. The Nd(III) solubility experiments in GWB were only conducted at pcH values up to approximately 8.7, which is less than the FMT-modeled pcH of 9.64 from the CRA-2004 PABC.

a. If the experimental results in GWB are extrapolated to pcH 9.64, the Nd(III) solubility could be approximately two orders of magnitude greater (~4×10^{-5} M) than the value used in the CRA-2004 PABC (~4×10^{-7} M). Higher concentrations seem to be indicated by the experiments even though they did not include EDTA, which is expected to increase the solubility of +III actinides. DOE should address the possible effects of such a large increase in +III actinide solubilities on PA.
b. Given the evidence that borate complexation appears to affect the +III and +VI actinide solubilities, DOE should address whether the +IV actinide solubilities could be similarly affected by borate complexation.
c. The current actinide solubility conceptual model includes the assumption that "The important ions in WIPP brines are H^+, Na^+, K^+, Mg^{2+}, OH^-, Cl^-, CO_3^{2-}, SO_4^{2-}, and Ca^{2+}. Other ions such as PO_4^{3-}, F^-, Al^{3+}, Fe^{2+}, and Fe^{3+}may be important, but their effects are included only in a qualitative understanding of the chemical environment." However, DOE indicates in Appendix SOTERM-2009 that there is significant complexation of actinides by borate species. DOE should address whether the current FMT database is adequate for predicting actinide solubilities for PA when it does not include borate species.

Chemistry (C) Issues Completeness Issues for CRA 2009

1-C-1. DOE states that the characterization data for the Martin Marietta MgO has been obtained from a single lot (SL2980076) of this material (Appendix MgO-2009, Section 3.3.2). DOE should explain why they believe analysis of a single lot is representative and whether additional lots of MgO should be characterized.

1-C-2. The reactivity test used for MgO material acceptance was developed in 1997. At that time, the MgO used as backfill had a lower reactivity, but was acceptable because of the relatively large MgO excess. A much higher MgO reactivity is now necessary because of the smaller excess of MgO since reduction of the excess factor from 1.67 to 1.20. DOE should provide an explanation of whether the current reactivity test would reliably detect MgO with insufficient reactive periclase plus lime (i.e., less than 96±2 mole%).

1-C-3. Appendix PA-2009, Section 7.1.1 attributes slower changes in repository pressure after 2,000 years to cessation of room closure, slowing of brine inflow, and consumption of CPR. DOE should provide information regarding whether the slower rates of microbial degradation assumed for the CRA-2004 PABC and the CRA-2009 PA result in the persistence of CPR for longer than 2,000 years in most realizations.

1-C-4. Appendix MASS-2009 and Appendix SOTERM-2009 do not address the current assumption that plastic and rubber degradation (if occurring) will take place at the same rate as cellulose degradation, when normalized to the assumed carbon content of the CPR. This assumption has been included in all WIPP performance assessments, and should have been included in the description of the CRA-2009 PA. Another issue is that this assumption may no longer be appropriate, based on: 1) WIPP-specific experimental results (Gillow and Francis 2003) showing much lower plastics and rubber degradation rates, 2) evaluations of literature data regarding plastics and rubber degradation processes that have become available since the CRA-2004 PABC (e.g., SCA 2006), 3) evidence obtained during the CRA-2004 PABC that lower microbial gas generation rates resulted in a slight increase in releases. DOE should evaluate the potential effects on repository releases of lower, more realistic microbial gas generation rates from plastics and rubber degradation.

1-C-5. It is stated in Appendix PA-2009, Section 2.3.1, that water is neither created nor consumed by microbial reactions. This assumption has been included in the peer-reviewed gas generation conceptual model since the CCA. However, new evidence, such as EQ3/6 modeling carried out by Wolery and Sassani (2007), has indicated that CPR degradation could result in significant increases in the amount of brine. DOE should address whether including potential production of water by CPR degradation and consumption of water by brucite hydration and hydromagnesite persistence might significantly affect predictions of repository performance.

1-C-6. DOE should provide justification for the statement in Appendix SOTERM-2009, Section 3.7 that "Of the four organic chelating agents considered, only citrate and EDTA are expected to form strong enough complexes to influence the speciation of actinides and potentially increase actinide concentrations under the expected conditions in the WIPP." Previous sensitivity calculations did not indicate that citrate complexation will be important in the WIPP brines. In evaluating this issue, DOE should consider any new data on organic ligand complexation of actinides (e.g., Felmy et al. 2006 *Radiochimica Acta* 94:205-212) and changes in the organic ligand inventory reported in 2007.

1-C-7. Appendix SOTERM-2009, Table SOTERM-1, provides an incomplete list of the current chemistry model assumptions. Examples of important assumptions in the chemical conditions and dissolved actinide source term conceptual models that are not in Table SOTERM-1 include the oxidation-state analogy and the assumption of equilibrium for dissolution and precipitation of actinide-bearing solid phases, but not for redox reactions among the actinides. DOE should revise this table to include all of the chemistry-related conceptual model assumptions as summarized in Appendix A of SCA (2008).

1-C-8. The fourth paragraph of Appendix SOTERM-2009, Section 2.3.2 states:

> "the expected pH, when little or no carbonate is present, is 8.69 in GWB brine and 8.94 for ERDA-6 brine. In both cases, this pH is established/buffered by the brucite dissolution reaction. The presence of microbial activity will potentially contribute significant amounts of carbon dioxide and leads to a model-predicted pH of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively.

DOE also states that the ERDA-6 pH is 9.02 in the text immediately following equation SOTERM.4. These statements appear to confuse the results of FMT modeling for the

CRA-2004 PABC and the CRA-2004 PA. The pH values of 8.69 and 8.94 for GWB and ERDA-6 brine, respectively, were obtained for microbial vectors with organic ligands for the CRA-2004 PABC. The pH values of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively, were obtained for microbial vectors with organic ligands for the CRA-2004 PA. DOE should clarify this statement, in light of the fact that all vectors for the PABC were assumed to include microbial degradation of cellulose or cellulose, plastics, and rubber.

1-C-9. DOE states that carbonate complexation of Nd(III) is unimportant at conditions expected in WIPP brines (Appendix SOTERM-2009, Section 3.6.2). However, examination of the ERDA-6 Nd(III) solubility data (Borkowski et al. 2006b) shows that there is significant scatter in the results above pcH 9. In the GWB experiments, no data were obtained above pcH 8.7. Consequently, it is difficult to draw firm conclusions regarding the effects of carbonate on An(III) solubilities at the pcH values expected in ERDA-6 (9.64) and GWB (9.39). In Appendix SOTERM-2009, Figure SOTERM-15, experiments in 5 M NaCl seem to indicate that Nd(III) concentrations decline at pcH values greater than 10. However, the information provided for this figure does not indicate whether these experiments in 5 M NaCl included carbonate. DOE should provide information regarding the carbonate concentrations used in the 5 M NaCl experiments.

1-C-10. In Appendix SOTERM-2009, Section 4.4, DOE states that the chemical potential (μ^0/RT) for $Th(OH)_4(s)$ was changed in the FMT database since the CRA-2004 PA. However, only the chemical potential for $Th(OH)_4(aq)$ changed between the CRA-2004 PA and the CRA-2004 PABC (Xiong et al. 2005). DOE should correct this statement.

1-C-11. In Appendix SOTERM-2009, Section 4.4, DOE should explain what is meant by their statement that, "The effects of hydromagnesite and calcite precipitation were added…" to the FMT database for the CRA-2004 PABC, because hydromagnesite and calcite thermodynamic data have been included in the database at least since the CCA PAVT. In addition, SOTERM-4.4 states that the version of the code used was FMT_050405.CHEMDAT, which is the database version, not the code. DOE should correct this misstatement.

1-C-12. In the caption for Appendix SOTERM-2009, Figure SOTERM-11, DOE states that the Eh-pH diagram demonstrates that Pu(IV) species would be stable at near-neutral pH. However, at the reducing conditions expected in the repository (near the lower stability limit for water), Pu(III) species appear to be the most stable ($PuCO_3^+$ and $Pu(CO_3)_2^-$). DOE should explain this apparent discrepancy.

1-C-13. DOE should provide the carbonate concentration, total americium concentration, and assumed ionic strength for generation of Appendix SOTERM-2009, Figure SOTERM-16. In addition, DOE should correct a typographical error in the figure, where the subscript "3" was omitted from $Am(OH)_3(s)$.

1-C-14. DOE states in Appendix SOTERM-2009, Section 4.6 that organic ligands do not significantly affect actinide solubilities, despite data presented in Appendix SOTERM-2009, Table SOTERM-19 showing that ligands increased the calculated +III actinide solubilities by factors of 1.71 (GWB) and 3.32 (ERDA-6) and +V actinide solubilities by factors of 1.50 (GWB) and 1.53 (ERDA-6). This statement is also at odds with the assertion in SOTERM-3.7 that EDTA and citrate could potentially affect actinide solubilities in WIPP brines. DOE should correct this statement, especially in light of the data indicating that ligand concentrations in the inventory have increased significantly since the CRA-2004 PABC.

1-C-15. In Appendix SOTERM-2009, Table SOTERM-21, the parameter descriptions for PHUMCIM and PHUMSIM indicate "actinide solubilities are inorganic only (complexes with man-made organic ligands are not important); solubilities were calculated assuming equilibrium with Mg-bearing minerals (brucite and magnesite)." DOE should correct these statements to clarify that organic ligands were considered during calculation of the solubilities used with these proportionality constants for the CRA-2004 PABC, and that the solubilities were calculated assuming equilibrium with brucite and hydromagnesite.

1-C-16. In Appendix SOTERM-2009, Section 2.4.1.1, DOE cites "degradation of solubilizing organic ligands, leading to lower actinide solubility" as a possible effect of microbial activity in WIPP. DOE should include in this list the possibility of the production of solubilizing organic ligands by cellulosics degradation. This effect was observed in WIPP-specific inundated cellulosics experiments, in which increased organic acid concentrations were observed (Gillow and Francis 2003). The possible production of isosaccharinic acid (ISA) during cellulose degradation under alkaline conditions has also been observed, and ISA can complex actinides, although it is not certain that ISA will be produced under WIPP conditions.

1-C-17. In Appendix SOTERM-2009, Section 2.3.2, Brush et al. (2006) is cited as part of the documentation for the CRA-2004 PABC, but this report was prepared after the CRA-2004 PABC. DOE should replace it with the correct reference (Brush 2005).

1-C-18. In Appendix MgO-2009, Section 4.2.2, DOE claims that hydromagnesite will completely convert to magnesite during the 10,000 year WIPP regulatory time period. However, DOE's evaluation of the likely conversion of hydromagnesite to magnesite ignores information about this issue presented in SCA (2008). As part of a thorough evaluation of the likely conversion rate for hydromagnesite to magnesite, SCA (2008) cited data from Vance et al. (1992) that showed hydromagnesite can persist for as long as 6,200 years. In addition, DOE does not consider that slow CPR degradation will result in continuous brucite carbonation during the 10,000 year regulatory period, rather than hydromagnesite formation that occurs only for a short time following repository closure. Consequently, even if hydromagnesite formed in the repository converts to magnesite within a few thousand years, hydromagnesite is likely to remain in the repository and would be likely to influence carbon dioxide fugacity for the entire 10,000 year regulatory period. DOE should revise this discussion to show that hydromagnesite is likely to be present in the backfill throughout the WIPP regulatory period.

1-C-19. In Appendix MgO-2009, Section 5.1, DOE states that the actinide solubilities in WIPP brines calculated for the CRA-2004 PA and CRA-2004 PABC differed because of "changes in the thermodynamic databases for the An(III), An(IV), and An(V) models." The thermodynamic database for the An(IV) model changed between these two PA calculations when the chemical potential (μ^0/RT) for $Th(OH)_4(aq)$ was revised. On the other hand, the An(III) and An(V) solubility results changed because of a recalculation of ligand concentrations. EPA was not informed of any changes to the thermodynamic data for the An(III) and An(V) oxidation states. DOE should either correct this statement or document the revised thermodynamic data.

1-C-20. In the discussion of MgO uncertainties (Appendix MgO-2009, Section 6.2.4.4), DOE does not include the uncertainties associated with the chemical composition of the cellulose, plastics, and rubber in the WIPP inventory. DOE should acknowledge this uncertainty in the discussion.

1-C-21. Appendix PA-2009, Table PA-10 does not include units for the concentrations, which should be moles/L.

1-C-22. Appendix PA-2009, Section 4.9 includes a statement that releases are controlled almost entirely by direct releases to the surface as cuttings, cavings, and spallings. DOE should correct this statement to include cuttings, cavings, and direct brine release, as explained in Appendix PA-2009, Section 9.0.

1-C-23. To facilitate EPA's technical review, DOE should provide EPA with copies of all FMT input and output files used to update the actinide solubility uncertainty analysis (Comment 1-23-3), evaluations of the effects of ligand inventory changes on actinide solubility (Comment 1-23-4), or any other solubility calculations performed for the CRA-2009 PABC. In addition, if the FMT database is modified from the version used for the CRA-2004 PABC (FMT_050405.CHEMDAT), DOE should provide the revised database and documentation of all changes.