Recertification CARD No. 24
Waste Characterization

BACKGROUND (194.24(a))

Section 194.24, waste characterization, generally requires the U.S. Department of Energy (DOE or Department) to identify, quantify and track the chemical, radiological, and physical components of the waste destined for disposal at the Waste Isolation Pilot Plant (WIPP) that can influence disposal system performance. Much of the waste information and waste estimates remain similar through time, but DOE may add waste and withdraw waste from the inventory. It is a dynamic inventory, and the U.S. Environmental Protection Agency (EPA or Agency) expects changes through the years. However, it is incumbent upon DOE to include the latest information on the inventory estimate in the performance assessment.

Section 194.24 (a) presents the waste inventory reporting requirements that DOE must meet to ensure that sufficient information is available for use in the WIPP performance assessment (PA).

REQUIREMENT (194.24(a))

(a) "Any compliance application shall describe the chemical, radiological and physical composition of all existing waste proposed for disposal in the disposal system. To the extent practicable, any compliance application shall also describe the chemical, radiological and physical composition of to-be-generated waste proposed for disposal in the disposal system. These descriptions shall include a list of the waste components and their approximate quantities in the waste. This list may be derived from process knowledge, current non-destructive examination/assay, or other information and methods."

1998 CERTIFICATION DECISION (194.24(a))

To meet the requirements of Section 194.24(a), EPA expected DOE's Compliance Certification Application (CCA) to provide a description of the existing waste, list approximate quantities of waste components in each description, and provide similar descriptions for to-be-generated waste, to the extent practicable.

DOE provided the required information on existing waste (35% of the total WIPP inventory) by combining similar waste streams into waste stream profiles. The waste stream profiles contained information in the waste material parameters, or components that could affect repository performance. For to-be-generated waste (65% of the total WIPP inventory), DOE extrapolated (or scaled) information from the existing waste streams to determine the future amount of waste. DOE described the waste in Volume 1 and Appendix BIR of the CCA.

EPA reviewed the information provided and determined that DOE's waste stream profiles contained the appropriate specific information on the components and their approximate quantities in the waste. Therefore, EPA found DOE in compliance with Section 194.24(a) (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(a) can be obtained from Docket, A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(a))

To meet the requirements of Section 194.24(a), DOE described and categorized the entirety of transuranic (TRU) waste that is currently emplaced in WIPP and the waste that exists at various DOE facilities. Since the first emplacement of waste in 1999, DOE has tracked the waste emplaced at WIPP using the WIPP Waste Information System (WWIS). For the waste that is stored or to-be-generated at the waste generator sites, DOE developed a descriptive methodology for grouping waste information obtained from each generator site. For the 2004 Compliance Recertification Application (2004 CRA), DOE initiated a complex-wide data call in which DOE's Carlsbad Field Office (CBFO) asked every TRU waste generator site to update the CCA waste profile forms describing the physical, chemical, and radiological constituents in each waste stream that generates or generated TRU waste at that site. This data call reflected the disposal intentions of the waste generator sites as of September 30, 2002. DOE representatives examined the information, clarified questions and then validated the waste stream profile information. This information was synthesized across the waste generator sites and then prepared for input into performance assessment by scaling the inventory and other data reduction actions (e.g., decaying to 2033). This process is captured in the flowchart in Figure 24-1 (Docket A-98-49, Item II-B2-60).

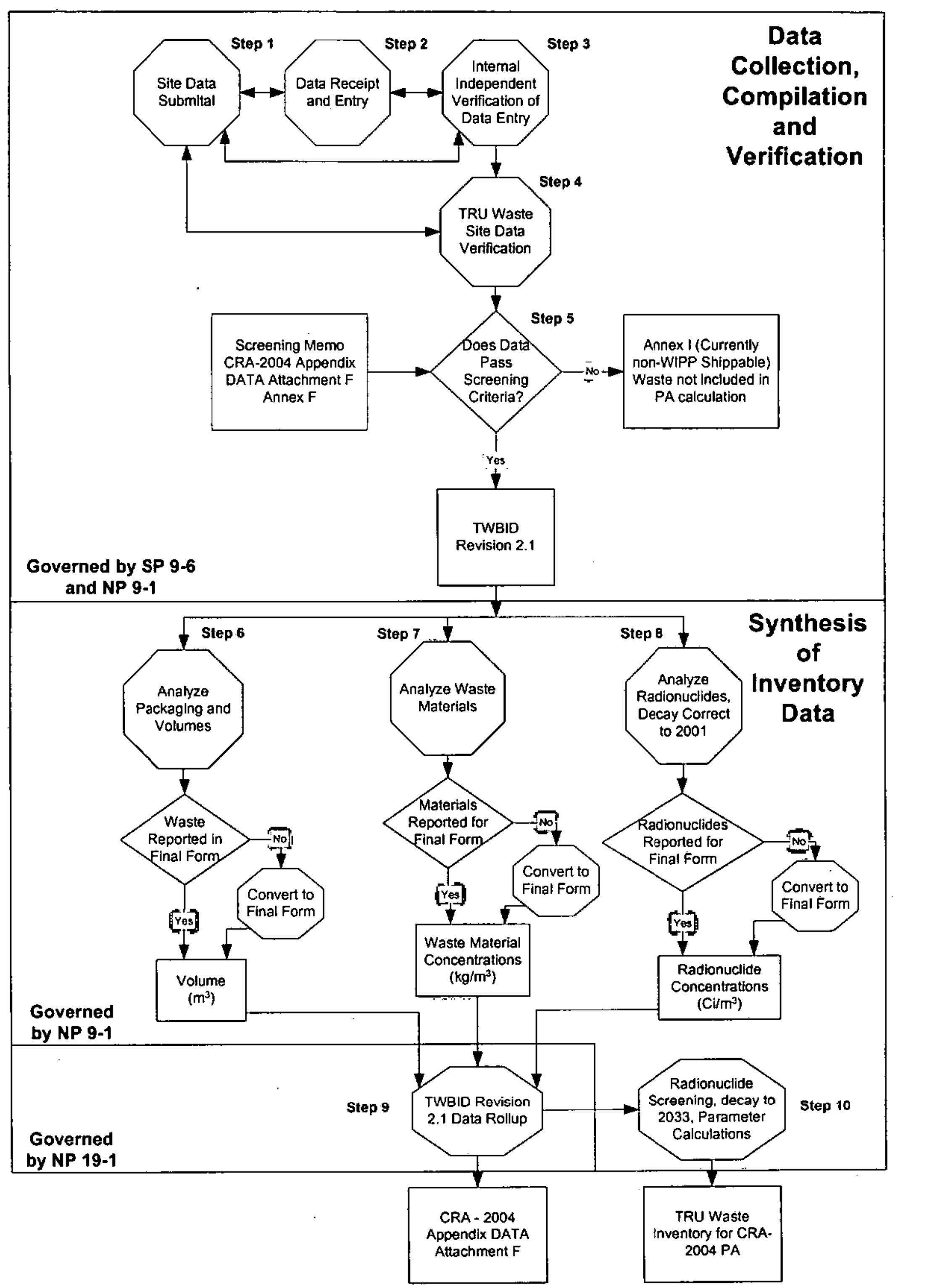
The details of the inventory are presented in 2004 CRA, Chapter 4 Volume 1 and 2004 CRA, Appendix TRU-WASTE. Tables 2004 CRA Appendix TRU-WASTE 1-5, present the most relevant information on the important aspects of the inventory used for the 2004 CRA.

During EPA's review of the PA submitted in the 2004 CRA, EPA questioned aspects of the waste inventory DOE was reporting for recertification. EPA's requests for additional information and DOE's responses can be found in EPA's E-Docket (Federal Docket Management System [FDMS] Docket ID No. EPA-HQ-OAR-2004-0025).

EPA directed DOE to conduct a new performance assessment for recertification to incorporate inventory changes as well as some other technical changes. (EPA Letter, Docket A-98-49, Item II-B3-80) This new performance assessment is now called the Performance Assessment Baseline Calculations (PABC). The new inventory component and radiological estimates for the PABC are summarized in *TRU Waste Inventory for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation*, Sandia National Laboratories, ERMS 541118, September, 2005, hereafter referred to as the "PABC Inventory Report" (Docket A-98-49, Item II-B2-60).

The chemical, physical, and radiological inventory was grouped by DOE and developed in detail from the waste stream profiles from each of the TRU waste generator and/or storage sites. Waste groupings (other than contact handled and remote handled designations) by DOE were based on the chemical and physical aspects of the waste, not the radiological content of the waste (CCA Appendix BIR). However, the radiological constituents were identified and quantified (in Ci/m^3 for each waste stream) on each waste profile form, and information from the forms was used by DOE to develop the radiological inventory for the WIPP. The CCA approach was also used for the PABC. Table 14 of the PABC Inventory Report shows the radiological constituents used for the PABC, including the inventory at the estimated time of disposal (year 2033), and estimated EPA units for each radionuclide.

Figure 24-1 Process for Preparing the CRA-2004 TRU Waste Inventory (Source: PABC Inventory Report, Docket A-98-49, Item II-B2-60, September 2005)



Each WIPP Waste Profile contains information on the physical and chemical waste components (identified as Waste Material Parameters (WMP's) for DOE purposes), as well as radiological waste components, that DOE believes could affect the performance of the repository. DOE's waste material parameters are presented as density values for use in the PA. These density values are calculated by multiplying the average density of individual waste streams from a given waste form by the volume of the TWBIR waste stream and then the total volume of the final waste form.

The approximate maximum, average, and minimum densities for twelve (12) of DOE's waste material parameters were calculated, including iron based metals/alloys, aluminum based metals/alloys, other metal/alloys, other inorganic materials, vitrified materials, cellulosics, rubber, plastics, solidified inorganic matrix, solidified organic matrix, solidified cement, and soils (PABC Inventory Report, Table 9). WIPP Waste Profiles contain information on the WMPs, i.e., components that DOE determined to have the potential to impact repository performance. DOE identified the quantity of physical waste components such as cellulosic material, plastic, rubber, etc., in the PABC Inventory Report. Tables 9 and 10 of the PABC Inventory Report show the anticipated non-radioactive TRU waste inventory for the WIPP for the CCA the CRA and the PABC.

Also, in accordance with 40 CFR 194.24(a), DOE's waste profiles contain specific information on the species and quantities of individual radioisotopes in the waste.

Inventory Description

DOE indicated that to-be-generated waste will be included in those waste streams and final waste forms currently identified at DOE sites (2004 CRA, Chapter 4, Section 4.1.3). Therefore, the waste stream descriptors for existing waste also apply to to-be-generated waste. Existing waste stream information was used by DOE in its description of to-be-generated waste.

DOE described its contact-handled (CH) and remote-handled (RH) inventory as "stored," "emplaced," and "projected" or "anticipated." The stored inventory is generally equivalent to existing waste at the sites, and projected waste is generally equivalent to to-be-generated waste (2004 CRA, Appendix DATA, Attachment F). Emplaced waste is waste that has been put underground at WIPP. The anticipated inventory is the sum of the emplaced, stored and projected inventories (PABC Inventory Report section 4.1.3). Table 4 of the PABC Inventory Report lists the volumes of emplaced CH-TRU waste as of September 30, 2002 (the cutoff for inclusion in the 2004 CRA performance assessment) and August 1, 2005. Table 5 of the same report lists the stored and projected CH-TRU waste estimates used for the CCA, 2004 CRA PA, and the PABC. The projected inventory information was derived from each generator site from the waste stream profile forms, and reflects the site's best determination of the waste expected to be generated.

DOE's estimates indicate that the total expected inventory volume for CH-TRU waste will not reach the maximum disposal capacity of the WIPP for CH-TRU (approximately 168,500 m^3 or 5,950,000 ft^3) (Chapter 4.1.3; PABC Inventory Report, section 4.1.4, p.27). DOE employed a scaling approach to project the impacts of a full repository. The current estimate of waste for disposal at WIPP is 145,000 m^3. DOE developed a scaling factor based upon the approximately 23,500 m^3 of projected CH-TRU inventory it expects to be generated, as DOE believed that any new waste generated to "fill" the outstanding WIPP space would probably be more similar to the projected rather than existing waste inventory. This scaled CH-TRU inventory was described by DOE in TWBIR Revision 3 and was based on the projected TRU waste inventory (e.g., waste components, quantity, types of waste, species and quantity of radionuclides).

As reported in the PABC Inventory Report, the scaling factor calculated by DOE for CH-TRU waste is 1.48 in the PABC. This factor is used in the following formula to project the makeup of the disposal inventory volume (m^3) according to the LWA design limitations:

Emplaced Inventory + Stored Inventory + (Projected Inventory x 1.48) = PABC Disposal Inventory

Unlike in the CCA, the 2004 CRA used this scaling methodology on RH-TRU waste; however, the RH inventory was scaled down. This was necessary because DOE has reported more RH-TRU inventory than there is capacity for as defined in the WIPP Land Withdrawal Act (LWA) (approximately 7,079 m^3 or 250,000 ft^3). The scaling factor has changed considerably between the 2004 CRA and the PABC calculations due to changes in estimates in Hanford's RH-TRU inventory. In the 2004 CRA the scaling factor was 0.172 and in the PABC it is 0.861, reflecting the lesser amount of RH-TRU expected from Hanford because of a double counting error. The RH-TRU inventory is calculated using a similar equation for the CH-TRU disposal inventory calculation.

Number of Curies

The amount of radionuclide activities expected to be placed in WIPP has decreased from the CCA estimate of 3.44 million curies to 2.32 million curies in the PABC inventory estimate (PABC Inventory Report section 4.4, p. 36). Table 14 of the PABC Inventory Report lists the activities by radionuclide for the CCA PA, the 2004 CRA PA, and the PABC.

New Inventory Items Since 1998: INL Buried Waste

In the 2004 CRA documentation, DOE designates pre-1970 buried waste at INL as non-WIPP TRU waste (Annex I of CRA Appendix Data Attachment F). As a result of an April, 2003 Federal District Court judgment against DOE on the buried waste, DOE decided to include the INL pre-1970 buried waste in the PABC calculations (PABC Inventory Report section 3.2, p. 21). The PABC inventory report estimates 17,998 m^3 of TRU waste in five waste streams from the pre-1970 buried waste.

New Inventory Items Since 1998: Supercompacted Waste

In December 2002, DOE requested EPA's approval to dispose of compressed or super compacted waste from the Idaho National Laboratory's (INL) Advanced Mixed Waste Treatment Facility (AMWTF). In DOE's waste inventory for recertification, this supercompacted waste (waste stream IN-BN-510) accounts for approximately 20,000 m^3 of the inventory. This waste is described as more rigid than typical waste and has much higher content of cellulosic, plastics and rubber material (CPR) than other waste in the CCA inventory.

DOE conducted an extensive analysis of the waste at the direction of EPA (Docket A-98-49, Item II-B3-64) and concluded that the supercompacted waste would act similar enough to uncompacted waste so that it could be considered within the existing waste envelope and performance assessment. In March 2004 EPA determined that supercompacted waste could be disposed of at WIPP and that the characteristics of the waste were adequately reflected in the existing performance assessment (Docket A-98-49, Item II-B3-68). Prior to the shipment of supercompacted waste, EPA conducted a waste characterization inspection to ensure that DOE was able to adequately characterize and track the supercompacted waste (Docket A-98-49, Item II-A4-53). EPA gave its approval to dispose of supercompacted waste in May 2005. This waste is included in the PABC waste inventory estimate (Docket A-98-49, Item II-B3-68).

New Inventory Items Since 1998: Hanford Tank Waste

DOE's CRA inventory included to-be-generated waste from 12 of the 177 tanks at the Hanford site. These 12 tanks include four waste streams. These waste streams and their corresponding tanks and waste generating process are provided in Table 24-1 of this CARD. DOE's documentation states that although these 12 tanks have been managed as high-level waste these tanks actually contain waste from transuranic processes (Docket A-98-49, Item II-B2-47) and are therefore eligible for disposal at WIPP. DOE's documentation provides a technical and regulatory basis for DOE's-Office of River Protection (ORP) determination that 9 of the tanks are TRU waste due to waste origin and confirmed by radionuclide content analysis. This waste will be contact-handled, and has yet to be removed from the tanks.

For the other tanks in the RH waste streams (see Table 24-1), DOE (Docket A-98-49, Item II-B2-47), discusses why they believe that this tank waste is also TRU waste and will be acceptable for disposal at WIPP after the waste is removed from the tanks and treated to meet the WIPP Waste Acceptance Criteria. DOE stated (Docket A-98-49, Item II-B2-47; Enclosure 1, p. 11) that "Two of the double-shell tanks (DSTs) identified in the [2004] CRA inventory update, tanks AW-103 and AW-105, received coating removal waste from dissolution of zirconium clad SNF [Spent Nuclear Fuel]" in the PUREX process. DOE concludes (Ibid, p. 13) that, "the cladding removal process step did not create HLW because it only dissolved the zirconium cladding, leaving the SNF intact. The cladding removal waste originated prior to the SNF being dissolved and reprocessed. The NWPA defines HLW as '…the highly radioactive material resulting from the reprocessing of spent nuclear fuel...' Since SNF was intact during the cladding removal process, reprocessing had not occurred, and therefore, the cladding removal waste is excluded from the HLW definition."

DOE states (Docket A-98-49, Item II-B2-50, p. 15) that "One of the underground storage tanks at the Hanford Site that received PFP waste was DST [double-shelled tank] SY-102. DOE also states that the PFP [Plutonium Finishing Plant] sludge in tank SY-102 is not HLW because it is not the highly radioactive waste material from the reprocessing of spent nuclear fuel, including liquid waste produced directly in the reprocessing and any solid materials derived from such liquid waste that contains fission products in sufficient concentrations. The PFP received plutonium materials product and converted it to forms that were used to fabricate nuclear weapons or for other purposes. The PFP did not receive any SNF or HLW. Therefore, the waste from the PFP sludge is not HLW" (Docket A-98-49, Item II-B2-50). DOE concludes that in addition to this information, the treatment of the waste will make it suitable for disposal at WIPP. This waste is included in the PABC waste inventory estimate.

New Inventory Items Since 1998: Hanford Waste from K-Basin

DOE recertification waste inventory also included two waste streams, RL-W445 and RL-W446, consisting of ~50 m^3, the Hanford K-East and K-West Basins. This waste was in pools of water used to store irradiated fuel prior to SNF processing (Docket A-98-49, Item II-B2-47; Enclosure 2, p. 1). While intended to be temporary, the storage lasted for over 20 years. Furthermore, "over the lifetime of these K-West and K-East Basins, debris, silt, sand, and material from operations resulted in the formation of sludge that accumulated in the bottom of these basins. In addition, the extended storage of the irradiated fuel resulted in corrosion of the fuel cladding and the storage canisters, especially in the K-East Basin, where the fuel was exposed directly to the storage water" (Ibid).

DOE concludes "that this sludge does not meet the definition of high level waste (HLW) or SNF, and if properly processed, will meet the disposal requirements for transuranic waste, and thus be eligible for disposal at WIPP" (Ibid). This waste is included in the PABC waste inventory estimate.

Container Types

While the container types are not used directly in the performance assessment, the type of container is important to estimate the amount of CPR in WIPP (PABC Inventory Report, section 4.2, p. 30). Container types new to the PABC inventory include: ten-drum overpacks (TDOPs), 5x5x8 boxes and 100-gallon drums (Ibid). In addition, DOE used pipe overpacks within drums to contain the high radioactivity salts from Rocky Flats Environmental Technology Site (RFETS). The TDOPs are used primarily at INL and SRS, the 100 gallon drums are used at INL for the supercompacted waste, and the 5x5x8 boxes are in the SRS inventory. The container types are considered in the PABC inventory development process.

Organic Ligands

A ligand is an ion or molecule that binds to a metal. For WIPP the importance of ligands is that they could bind to the radionuclides, and potentially increase the solubility of radionuclides. Organic ligands which attach to the cation at more than one location (by different atoms within the structure of the ligand) are called chelating groups and the complex thus formed is called a chelate. Many synthetic compounds, such as EDTA (ethylenediaminetetraacetic acid)

form chelates. Citrate is an example of a natural organic compound which forms chelates with metal ions using its three carboxylic acid groups.

In the CCA, DOE's analysis used low ionic strength calculations to estimate the potential effect of organic ligands because the FMT (Fracture-Matrix Transport) code thermodynamic database was not complete at the time. Extrapolating to high ionic strength conditions, DOE identified that the EDTA would preferentially bind to transition metals (CCA Appendix SOTERM Section 5). EPA agreed with DOE that chelating agents (organic ligands) will bind to metals other than actinides. In addition, EPA's sensitivity analysis done at the time of the CCA indicated that chelating agents are not important to performance and that the ligands did not appear to have a strong effect on the aqueous speciation of actinides because of competition with major ions that are present at much higher concentrations (CCA CARD 24, 24.C.5, p. 24-40 and 24-41).

Since 1996 both stability constants and Pitzer parameters have been determined, allowing inclusion of the organic ligands in the FMT speciation and solubility calculations (Docket A-98-49, Item II-B2-39). Four organic ligands are included in FMT calculations of actinide solubilities: acetate, citrate, ethylenediaminetetraacetate (EDTA), and oxalate.

DOE (Attachment SOTERM (Section 5.0, p. 42)) calculated the solubilities of the +III, +IV, and +V actinides for the CRA-2004 PA using FMT, an updated thermodynamic database, and concentrations of acetate, citrate, EDTA, and oxalate updated for the CRA (Docket A-98-49, Item II-B1-3, Technical Support Document for Section 194.24). DOE believes that "the results of the FMT calculations for the CRA-2004 PA demonstrate that acetate, citrate, EDTA, and oxalate will not form complexes with the +III and +IV actinides to a significant extent under expected WIPP conditions, and thus will not affect the +III and +IV actinide solubilities significantly" (see Docket A-98-49, Item II-B1-3 for details).

A complete description of EPA's 1998 Certification Decision for Section 194.24(a) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(a))

EPA reviewed the CRA and supplemental information to determine whether it provided a sufficiently complete description of the chemical, radiological and physical composition of the emplaced, existing and to-be-generated waste proposed for disposal in the WIPP. EPA also reviewed DOE's description of the approximate quantities of waste components (for both existing and to-be-generated waste). EPA considered whether DOE's waste descriptions were of sufficient detail to enable EPA to conclude that DOE did not overlook any component that is present in transuranic waste and has significant potential to influence releases of radionuclides.

Chemical, Physical, and Radiological Description of Existing Waste

Descriptions of the chemical, radiological, and physical components of the waste were thoroughly documented in 2004 CRA and supporting documents. This information was collected using similar methods as during the CCA and the process used is reasonable. EPA also conducted several visits to the waste generator sites to better understand the waste estimation process (Docket A-98-49, Items II-B3-75, II-B3-86, and II-B3-87).

EPA concludes on the basis of this information that the CRA and supplemental information adequately describes the chemical, radiological, and physical characteristics of each waste stream proposed for disposal at the WIPP. EPA further concludes that the information presented by DOE in the 2004 CRA provides adequate characterization of existing WIPP waste for use in PA.

EPA noted the following changes in the waste: DOE listed the to-be-generated (projected) waste in waste profile tables in 2004 CRA, Appendix DATA, Attachment F. The projected waste is categorized similarly to existing waste (e.g., heterogeneous debris, filter material, soil). The amounts are ultimately expressed in density terms (kg/m^3) for performance assessment purposes and the projected waste is a minority of the estimated inventory. These factors would limit the potential effects of differences in the current estimates for projected waste and future actual amounts.

EPA concluded that DOE's development of the disposal inventory is sufficient for PA purposes. EPA agrees with DOE that the use of projected waste inventory for scaling the CH WIPP inventory to meet the total WIPP capacity is appropriate. DOE's use of the inventory scaling process is similar to that used in the CCA and is adequate for projecting inventory estimates.

Waste Forms and Packaging: Supercompacted Waste

EPA approved the disposal of supercompacted waste from INL at WIPP (Docket A-98-49, Item II-B3-68). DOE's 2004 CRA adequately characterize represents and considers supercompacted waste in the recertification inventory.

Waste Forms and Packaging: Container Types

The important aspects of the containers to include are the amount of metal. The amount of metal required is a minimum, and DOE's assortment of containers is expected to meet the metal limit regardless of the container type since they all are metal containers. EPA did have a concern about the pipe overpack but DOE included an analysis of the pipe overpack in the compressed waste analysis and found that the pipe overpack properties were also within that of the existing waste envelope (Docket A-98-49, Items II-B2-31, II-B2-32, and II-B3-68). EPA finds the container types to be reasonable.

Waste Forms and Packaging: Inclusion of Waste Packaging in Inventory

During the initial review of the recertification application, EPA found that DOE did not include emplacement materials in the CRA-2004 PA calculations (Docket A-98-49, Item II-B3-73). These materials could contribute to gas generation. DOE stated (Docket A-98-49, Item II-B2-34) that this material accounts for only 12.7% increase in CPR if it is included in the PA and that there would be no effect on compliance if it were included in the PA. However, DOE did include the additional emplacement material volume and mass in the PABC (PABC Inventory Report section 1.3.3, p. 11), thus the emplacement materials are reflected in the release estimates. For the PABC, the inclusion of waste packaging caused the CPR inventory to increase above DOE's stated limit. This is discussed further in CARD 24, Section 24(c)(1) and 24(e)(1) (e)(2). The PABC shows that WIPP still complies with the new CPR amounts, thus the use of increased CPR amounts is adequate, and the amount used in the PABC establishes a new limit.

Number of Curies, Waste Streams and Volume

DOE estimated the number of curies in the inventory on a site by site, waste stream by waste stream level using a reasonable process. EPA requires that DOE produce a "list of the waste components and their approximate quantities." EPA reviewed the estimate in 2004 CRA, Chapter 4, Appendix TRU-WASTE, and the TRU Waste Inventory Baseline (TWIB) database and found these materials to contain sufficiently specific information on the species and quantities of individual radioisotopes in the waste. This is in addition to waste that has been characterized and emplaced in WIPP. Thus, the inventory is based on more information than was available in the CCA, which EPA approved.

In addition to the radioisotope inventory information, DOE also provided sufficient information on the waste components with descriptions in: 2004 CRA, Volume 1, Chapter 4; 2004 CRA, Appendix DATA, Attachment D; 2004 CRA, Appendix DATA, Attachment E, 2004; 2004 CRA, Appendix DATA, Attachment F Annex A-K; 2004 CRA, Attachment F: Transuranic Waste Inventory Update Report, 2003, to Appendix DATA; 2004 CRA, Appendix DATA, Attachment H; 2004 CRA, Appendix TRU WASTE; and PABC Inventory Report.

In the scaling process, DOE does project future waste amounts based on existing waste amounts and that may not be realistic. However, it is a rational method for predicting future unknown waste, which will only account for ~15% of the waste by volume.

DOE did identify a problem with the estimate of the RH waste, in which the Hanford site "double-counted" certain waste. The result of this mistake had little effect because the RH waste volume has a small inventory limit and DOE has more RH waste inventory than legal capacity even without the mistake. In addition, DOE caught this error and incorporated an updated scaling factor for the PABC. DOE has adequately updated the inventory.

Organic Ligands

The Agency reviewed the updated calculations related to the effect of organic ligands on actinide solubility and determined that organic ligands are potentially important (Docket A-98-49, Item II-B1-3). EPA found that DOE needed to provide additional information on findings from the literature since the original certification and the effect of organic ligands on the actinide +V and +VI oxidation states (Docket A-98-49, Item II-B3-74). DOE responded (Docket A-98-49, Item II-B2-39) that while organic ligands greatly affect the solubility of +V oxidation state actinides, neptunium is the only actinide expected to be in the +V oxidation state. EPA agrees with DOE that this is of low significance because the neptunium inventory is too low to significantly contribute to radionuclide releases. Organic ligands had a moderate effect on the +III and +IV actinide solubilities. DOE did include the effects of solubility of organic ligands in the PABC, and with the CRA and supplemental information, therefore, EPA finds that DOE appropriately included organic ligands in the PABC (see Docket A-98-49, Item II-B1-16).

Hanford Waste

In the 2004 CRA, DOE identified that it included waste from 12 tanks from Hanford (see Table 24-1 for a summary of the tank waste). This includes 9 tanks of CH waste and 3 tanks of RH waste. The volume of the CH waste is estimated to be ~3,932 m^3 (~2% of the total CH inventory and ~2% of the total inventory) and the RH waste is estimated at ~4,469 m^3 (~63% of total RH waste, ~2.5% of the total inventory). The issue for this waste is whether the process by which they were created was one that would be considered directly from reprocessing of spent nuclear fuel. DOE has stated that although all the tanks were managed as high-level waste (HLW), some tanks can be considered to be TRU waste. If it is HLW, then by law it can not go to WIPP. DOE included the waste from the 12 tanks in the 2004 CRA PA and the PABC. EPA notes that two tanks (SY-102 and AW-103) have had "non-TRU waste supernatant solutions atop" the sludges in the tanks that DOE considers to be TRU waste.

Table 24-1 Hanford Tank Waste For Which Information was Requested in Docket A-98-49, Item II-B3-78 (Waste Stream Information From CRA Appendix DATA, Attachment F, Annex J Waste Profile Sheets and the September 2004 Hanford Meeting)

Waste Stream (Type)	Tank(s)	Volume (m^3)	Process (resulted in "solidified aqueous waste slurry")
RP-W013 (RH)	SY-102	525	Plutonium Finishing Plant
RP-W016 (RH)	AW-103, AW-105	3944	PUREX TRU Cladding Removal
RP-W754 (CH)	B 201-204 and T 201-204 series tanks	1484	224 Solidified Inorganic Waste
RP-W755 (CH)	T-111	2448	Bismuth Phosphate Process TRU Solids

(RH) = Remote Handled waste
(CH) = Contact Handled waste

DOE provided additional information on the Hanford Tank waste that indicate that the Hanford tank waste will be treated and will eventually be able to meet the WIPP waste acceptance criteria (Docket A-98-49, Items II-B2-47 and II-B2-50). DOE stated that the tank waste that may eventually be disposed of at WIPP is TRU waste or would be TRU waste after treatment. DOE also stated that the tank waste have not been designated as HLW but have been managed as HLW, in accordance with their radioactive waste management procedures. DOE has committed to removing this waste from the tanks and treating it, if needed, to meet WIPP waste acceptance criteria.

DOE provided information stating that the waste in question will be processed so that any high-level waste will be removed, to the extent practical, in its preparation to meet the WIPP waste acceptance criteria, so DOE may be able to show that this waste will have a TRU designation in the future. Thus, EPA allowed these waste to be included in the performance assessment inventory for recertification. By doing so, DOE is demonstrating that with or without the Hanford tank waste, WIPP continues to comply with EPA's disposal regulations. The Agency believes that this is a conservative approach to the performance assessment of the WIPP repository because a broad inventory of waste is being considered. Inclusion in the performance assessment of the facility does not imply or otherwise provide for EPA's approval of such waste for disposal at WIPP. Before any waste can be shipped to WIPP, DOE must demonstrate during characterization that the waste is, in fact, TRU waste that can legally go to WIPP.

Public comments stated that the tank waste are high level waste and therefore cannot go to WIPP. Public comments requested that the tank waste be removed from the WIPP recertification inventory. If the tanks remain in the inventory, the public comments requested that EPA conduct a rulemaking to consider the tank waste for disposal at WIPP.

EPA does not make waste determinations. DOE is responsible for making waste determinations, classifications, or reclassifications. In recognition of the public's concern about the possible future designation of the Hanford tank waste as TRU waste, DOE has proposed a process for developing or changing determinations for waste such as the Hanford tank waste. In a February 2006 letter to EPA, DOE proposed a process (Air Docket A-98-49, Item II-B2-57) for the evaluation of tank waste that includes multiple opportunities for public input prior to the request to EPA for disposal at WIPP. The Agency considers it appropriate for DOE to conduct a public process that will determine the designation or classification of waste prior to requesting EPA's approval for disposal at WIPP.

The Agency currently has a process in place to ensure that waste disposed of at WIPP is TRU waste, as outlined in the requirements listed at 40 CFR Part 194.8, 194.22, and 194.24. The first step in this process is DOE's official request to dispose of TRU waste at WIPP from one of the waste generator sites. Once EPA receives all required information and documentation, the Agency then inspects waste characterization activities at a waste generator site to ensure that the site has the technical ability to adequately characterize and track TRU waste. Confirmation of waste designation is then completed through the waste characterization process at the site. EPA believes that it currently has an adequate process in place for evaluating any DOE requests for

approval of waste for disposal at WIPP. The Agency does not believe that it is necessary to conduct a rulemaking for certain waste streams.

Waste that is not designated as TRU waste will not be considered for disposal at WIPP by EPA. The Agency agrees with commenters that the LWA does not provide for waste determinations to be made during recertification. Prior to disposal at WIPP, EPA will ensure that all waste meets the legal and technical requirements for disposal. Just because waste is included in the WIPP waste inventory, it does not mean that DOE will necessarily seek to ship it to WIPP or that EPA will approve it for disposal at WIPP. Before any waste is approved to be shipped or disposed of at WIPP, EPA ensures that the waste meets the waste acceptance criteria for WIPP and that DOE can characterize and track the waste.

K-Basin Waste

The sludges from the K-Basin storage pools consist of debris, silt, sand and material from operations of the pools at Hanford. The 50.4 m^3 of sludges are contaminated with radionuclides associated with spent nuclear fuel that was exposed to water in the pools. DOE believes that the radioactive contamination in the sludges is primarily from corrosion and chemical processes and is predominately non-radioactive material. DOE identified six sludges from different sections of the K-Basin. For five of the six sludges, the information provided by DOE (Docket A-98-49, Item II-B2-47; Enclosure 2, Table 2) appears to support the contention that this waste is different from spent nuclear fuel (SNF). SNF is prohibited by law from disposal at WIPP. When compared to the other sludges, the sixth sludge (Knock-Out Pot Sludge) has different radiological characteristics—estimated higher radioactivity that is more similar to SNF than the other sludges.

However, the physical properties are that of sludge and the volume is only 0.4 m^3 (with a potential to expand to 7.5 m^3). DOE plans to remove particles greater than ¼ inch, eliminating the greatest radioactivity. However, DOE has not actually measured the Knock-Out Pot Sludge (Docket A-98-49, Item II-B2-50), so its actual characteristics aren't known with certainty. EPA is allowing this waste in the PA inventory since the waste form is similar to other waste going to WIPP, of such low volume and DOE must process and characterize before it goes to WIPP. In addition, DOE must demonstrate that the waste meets the technical and legal requirements for disposal.

INL Waste

The pre-1970 buried waste included in the PABC is found in the 2004 CRA documentation as waste stream IN-Z001 in annex I of Appendix DATA Attachment F. It was designated as non-WIPP TRU waste, but DOE decided to include it in the PABC because of a 2003 judgment against DOE related to its removal at INL. This waste was not included in the 2004 CRA PA because the court judgment came after the September 30, 2002 cutoff date for inventory development (see the PABC Inventory Report and Inventory Data Change Addition Control Form, Docket A-98-49, Item II-B2-61). This waste does appear to be similar to other WIPP waste streams, but must still meet the WIPP waste acceptance criteria and remains subject to EPA's inspection and approval process before being disposed of at WIPP.

Other Issues

DOE identified and corrected one error between the 2004 CRA PA and the PABC, the LANL CH-waste stream LA-TA-55-48. This waste stream was a low volume, high radioactive waste stream that skewed the results of the PA CCDFs upward. Upon further review, DOE identified that this waste stream was mischaracterized; the plutonium fissile gram equivalent (FGE) was greater than shipping requirements allowed (Docket A-98-49, Item II-B2-62). DOE re-evaluated the waste stream, and modified the waste stream radioactivity and volume for the PABC. Since this is an estimate and the waste will be characterized before going to WIPP, the waste stream correction is reasonable.

Commenters pointed out that the radionuclide values were wrong for K-Basin sludge waste streams (Docket A-98-49, Item II-B3-77/RL-445 and RL-446). DOE reviewed the information and lowered the ^{90}Y and ^{137m}Ba concentrations by about 50% for the PABC (Docket A-98-49, Item II-B2-60). This is an appropriate change and will be verified during the characterization process.

RECERTIFICATION DECISION (194.24(a))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), an assessment of the changes since the 1998 Certification Decision, in this CARD and in technical support documents for this section (Docket A-98-49, Items II-B1-3 and II-B1-9, II-B1-16), and the consideration of public comments, EPA determines that DOE continues to comply with the requirements of 194.24(a).

REQUIREMENT (194.24(b)(1))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (1) That all waste characteristics influencing containment of waste in the disposal system have been identified and assessed for their impact on disposal system performance. The characteristics to be analyzed shall include, but shall not be limited to: solubility; formation of colloidal suspensions containing radionuclides; production of gas from the waste; shear strength; compactability; and other waste-related inputs into the computer models that are used in the performance assessment."

1998 CERTIFICATION DECISION (194.24(b)(1))

EPA expected the CCA to provide a detailed description of a waste characterization analysis that identifies a list of waste characteristics retained as a result of the analysis and explains the rationale for excluding any other waste characteristics.

In the CCA, DOE presented the results of its waste characteristic and components analyses pursuant to 194.24(b)(1) in a number of documents. CCA Chapter 4 and CCA Appendices MASS, WCA, SOTERM, and SA are the primary sources. DOE indicated that the characteristics below were expected to have a significant effect on disposal system performance and so were used in the performance assessment (i.e., parameters were developed which account for the effects of each).

- Solubility (including redox state and redox potential).

- Formation of colloidal suspensions containing radionuclides.

- Production of gas from the waste (hydrogen, and microbial substrate/ nutrients for methane gas generation).

- Shear strength, compactability (waste compressibility), and particle diameter.

- Radioactivity in curies of each isotope.

- TRU radioactivity at closure.

EPA concluded in the CCA that DOE generally performed a thorough and well documented analysis, adequately identified all waste characteristics and, except for actinide solubility and shear strength, appropriately assessed them as PA input parameters. In the case of actinide solubility, EPA believed that DOE assumed an incorrect solubility that controls the mineral phase. However, this error led to the use of higher actinide solubilities than what EPA believes will be the case. EPA's review indicated that modified solubility values for actinides were required, and the Performance Assessment Verification Test (PAVT) was run using these values. DOE subsequently performed experiments that identified hydromagnesite as a metastable mineral species. For the shear strength (TAUFAIL) in the PAVT, EPA required the probability distribution of the shear strength parameter to be changed to a log-normal distribution with a different range and median (CCA CARDs 23 and 24). See CCA CARD 24 for a more complete discussion.

CHANGES IN THE CRA (194.24(b)(1)

There were no major changes to the waste characteristics between the PAVT and the CRA-2004 PABC, but DOE did make changes to some of the parameters used in the PA. These are summarized in Table 24-2. Most of these are related to inventory changes described above in section 24 (a). EPA was most concerned with changes affecting solubility and gas generation.

TABLE 24-2 Characteristics expected to have a significant effect on disposal system performance and changes from the CCA (PAVT) to the CRA PABC

Waste Component or Characteristic Used in PA	Significance	Increase or Decrease From CCA to PABC
Radioactivity per cubic meter	Used in calculating releases	Decrease
Solubility	Higher solubility can lead to higher releases when brine is present	Increase and Decrease, depending on oxidation state
Organic ligands—complexing agents	Increases solubility	Similar amounts, but is now acknowledged to potentially be important
Amount of Metals	Maintains reducing environment, but also contributes to gas generation	Decrease
Amount of Cellulosics, Plastics, Rubbers	May increase gas generation from microbial processes	Increase
Oxyanions: nitrate, sulfate, and phosphate	Nutrients for microbes, so indirectly affects gas generation	Similar, but overall increase
Cement	Primarily a volume related component	Decrease
Shear Strength	Affects mechanical releases during Low waste shear strength	No change
Particle Diameter	Used to calculate spallings releases	The PABC used the particle diameter determination from expert panel findings during the original certification. The particle diameter used in the CCA was rejected by EPA and not used in the subsequent PAVT calculations so there is not a valid comparison between the CCA and PABC.
Formation of colloidal suspensions	Colloids can facilitate transport of radionuclides in ground water	No change in parameterization, but DOE changed the implementation for the CRA to only include PA vectors that included microbes. This changed again for the PABC back to the original treatment because all vectors were assumed to potentially generate microbes, and thus colloidal suspensions

Assessment of Waste Characteristics and Waste Characteristic Input Parameters

In the CCA, DOE identified several waste characteristics as being potentially important to the performance assessment (CCA Appendix WCA, Section WCA.6, pp. WCA-42 to WCA-43) based on available information, including uncertainties and WIPP system characterization. These analyses were summarized in CCA Appendices WCA, SOTERM, and MASS, and were augmented by DOE's responses to EPA comments (CCA CARD 24). The CRA identified the same important characteristics, although DOE now states that organic ligands can be important to solubility.

Solubility

DOE originally stated in the CCA that solubility of actinides is among the major characteristics of the radionuclides expected to affect disposal system performance (CCA Appendix WCA, Section WCA.4, pp. WCA-30 to WCA-34). DOE assessed the solubility of thorium, uranium, neptunium, plutonium, and americium (see below). DOE states in the 2004 CRA's updated SOTERM (Appendix PA, Attachment SOTERM, p. 1):

> "From the standpoint of their potential effects on the long-term performance of the repository, the order of importance of these actinides is Pu ≈ Am >> U > Th. Other actinides, especially neptunium (Np), have been included in the laboratory and modeling studies used to develop the actinide source term because it was not known at the outset which actinides could significantly affect the long-term performance of the repository."

DOE assumed that cesium and strontium are inventory limited (meaning that 100% of these isotopes would be dissolved) due to their high solubilities; therefore, formal solubility values were not derived for these two radionuclides (CCA, Appendix WCA, p. 30).

DOE used the Fracture Matrix Transport (FMT) geochemical modeling code and its associated database to calculate solubilities. No changes were made to the FMT code or conceptual models for the 2004 CRA performance assessment or PABC. However, revisions were made to the input FMT database since the PAVT. These changes included the addition of new aqueous actinide species to the database and revisions to existing species data because of the availability of new experimental data.

DOE used the GWB Salado brine chemistry formulation instead of the Brine A formulation used in the CCA PA and PAVT. The most significant differences between the brine formulations are the lower magnesium concentration and higher sulfate concentration in GWB relative to Brine A. Comparison of geochemical modeling results using the two brine formulations indicates that GWB brines had slightly lower predicted +III actinide solubilities and higher +V actinide solubilities compared to Brine A.

Performance Assessment Parameters Related to Solubility

Solubility of actinides in the III, IV, V and VI oxidation states for both the Castile and Salado brines were calculated by DOE with the assumption that pH and f(CO_2) are controlled by

$Mg(OH)_2 – MgCO_3$ equilibrium. The solubilities (moles/liter) in Table 24-3 list the CCA and 2004 CRA PA values. Table 24-4 lists the 2004 CRA PA values and the PABC values.

The uncertainty ranges for the actinides in the 2004 CRA PA were the same as those used in the CCA. DOE defined uncertainty limits for actinide concentrations calculated from solubility relationships based on the differences between measured concentrations and those predicted for the solubilities of discrete actinide solids with the FMT or NONLIN computer codes (Bynum 1996b). These solubility differences were measured in a number of experimental studies of different actinide solids in high ionic strength solutions.

These uncertainty limits were determined by DOE to range from 1.4 log units above to 2.0 log units below the actinide concentrations calculated from solubility expressions contained in the FMT model in the CCA. These uncertainty ranges were used for each actinide sampled in the PA, that is for Am(III), Pu(III), Pu(IV), in Castile and Salado brines, U(IV) in Salado brine, U(VI) in both Castile and Salado brine, and Th(IV) in Salado brine. The uncertainties in the actinide solubilities were used to define the range for Latin Hypercube Sampling of the actinide concentrations in the PA, assuming a log cumulative distribution (CCA CARD 24).

Table 24-3 Solubilities of the Oxidation State Analogs, in moles/liter, with MgO Backfill

		Solubilities for PA Material Name and Oxidation State#			
Brine	PA Parameter Name	SOLMOD3 (III)	SOLMOD4 (IV)	SOLMOD5 (V)	SOLMOD6 (VI*)
Salado	CCA SOLSIM	5.82×10^{-7}	4.4×10^{-6}	2.3×10^{-6}	8.7×10^{-6}
Salado	CRA SOLSIM	3.07×10^{-7}	1.19×10^{-6}	1.02×10^{-6}	8.7×10^{-6}
Castile	CCA SOLCIM	6.52×10^{-8}	6.0×10^{-9}	2.2×10^{-6}	8.8×10^{-6}
Castile	CRA SOLCIM	1.69×10^{-7}	2.47×10^{-8}	5.08×10^{-6}	8.8×10^{-6}

Solubility values were changed for the PABC. The solubilities were changed to changes in chemical conditions agreed to by DOE and EPA. See Table 24-4.

* These solubilities were not calculated in the FMT model. In addition, these solubilities were changed to 1×10^{-3} for the PABC as required by EPA due to the failure to incorporate new data that indicated the U(VI) solubilities could be greater than those used in the CCA and CRA-2004 PA. This is discussed more later in the Evaluation of Compliance for Recertification section.

Formation of Colloidal Suspensions Containing Radionuclides

Colloid formation can enhance the quantity of actinides contained in brine, and was evaluated by DOE as an important group of waste characteristics. In the CCA DOE determined that four types of colloids may be present in the WIPP repository: Intrinsic colloids, mineral fragment colloids, humic colloids, and microbe colloids (CCA Appendix WCA, Section WCA.

4.2, pp. WCA-34 to WCA-36). These colloids are still modeled in the PABC and are unchanged from the CCA (see CCA CARD sections 24.B.5 and 24.B.6 for additional information).

DOE did, however, implement the colloidal actinide source term differently in the CRA-2004 PA than in the CCA. In the CCA, DOE assumed all vectors would have a microbial colloid contribution to the actinide source term. For the 2004 CRA PA, DOE assumed there would be microbial colloid transport only in vectors without significant microbial degradation.

Production of Gas From the Waste (Including Microbial Substrate and Nutrients)

Gas generation includes hydrogen gas generation, as well as carbon dioxide and methane generation by microbial degradation. The characteristics of gas generation are linked to the waste components of waste steel, microbial substrates such as cellulosics, rubber, and plastics (CPR), as well as other microbial nutrients (nitrate, sulfate and phosphate) that could be present.

The same conceptual model was used for microbial gas generation in the WIPP repository for both the CCA and 2004 CRA. In the conceptual model, it is assumed that microbial consumption of CPR may occur in the repository and produce methane (CH_4) and carbon dioxide (CO_2). The major pathways for microbial degradation of CPR are predicted to include the following reactions:

$$C_6H_{10}O_5 + 4.8\ H^+ + 4.8\ NO_3^- \rightarrow 7.4\ H_2O + 6\ CO_2 + 2.4\ N_2 \qquad (1)$$

$$C_6H_{10}O_5 + 6\ H^+ + 3\ SO_4^{2-} \rightarrow 5\ H_2O + 6\ CO_2 + 3\ H_2S \qquad (2)$$

$$C_6H_{10}O_5 + H_2O \rightarrow 3\ CH_4 + 3\ CO_2 \qquad (3)$$

where $C_6H_{10}O_5$ is the chemical formula for cellulose. In reactions (1) and (2), one mole of carbon dioxide is produced for each mole of organic carbon consumed. Reaction (3), however produces only 0.5 moles of carbon dioxide per mole of organic carbon consumed. Reactions (1) to (3) are predicted to proceed sequentially according to the energy yield of the reactions (Wang and Brush 1996). As the denitrification and sulfate-reduction reactions (reactions 1 and 2, respectively) proceed, they are predicted to consume the limited amounts of nitrate and sulfate in the WIPP waste inventory. In both the CCA and the 2004 CRA, it was predicted that methanogenesis (reaction 3) would be the dominant reaction pathway and consequently, that approximately half of the organic carbon consumed would be converted to carbon dioxide (CCA Appendix SOTERM Section 8.2.2; 2004 CRA Appendix PA Attachment SOTERM Section 2.2.2).

Microbial gas generation rates used in the average stoichiometry model were based on experimental data from microbial consumption of papers under inundated and humid conditions (Wang and Brush 1996). A gas-generation rate is determined in BRAGFLO for the humid and inundated rates based on the effective liquid saturation (2004 CRA Section 6.4.3.3). These gas generation rates were calculated from the initial linear part of the experimental curve of carbon dioxide as a function of time (US DOE 2004b, 2004 CRA, Appendix PA, Attachment PAR; Wang and Brush 1996).

For the PABC, DOE requested a change to the implementation of the gas generation, based on DOE's review of additional experimental data collected over the last several years. The gas generation rate exhibits two rates: an initial higher rate, and a second lower rate. DOE proposed to EPA that the long-term rate be the gas generation rate used in the PA calculations, with the initial higher rate incorporated as an initial higher pressure.

Performance Assessment Parameters Related to Gas Generation

DOE used Latin Hypercube Sampling (LHS) in PA for the following gas-generation-related parameters:

- Inundated steel corrosion rate
- Probability of microbial degradation of plastics and rubbers (in the event of microbial gas generation)
- Biodegration rate of cellulosics, inundated and humic
- Factor β for microbial reaction

Performance Assessment Parameters Related to Shear Strength, Compactability (Compressibility) and Particle Diameter

There were no changes from the PAVT.

Radioactivity in Curies of Each Isotope

In the CCA, DOE indicated (Sections 3.1 and 3.2 of CCA, Appendix WCA) that the radioactivity of each isotope is important to the performance assessment because it directly affects the waste unit factor (number of million curies of TRU isotopes in the WIPP inventory), which is the normalization factor used to calculate allowable releases for each radionuclide (see Table WCA-1 in CCA Appendix WCA). Since the same approach is used in the 2004 CRA, the CCA approach is summarized.

The following radionuclides were determined important by DOE (CCA Figure WCA-4):

- Cuttings/cavings/spallings release: ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{90}Sr, ^{137}Cs, ^{244}Cm.
- Direct Release in Brine: ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{243}Am, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{229Th}, ^{230Th}, ^{232}Th, ^{237}Np, ^{243}Cm, ^{244}Cm, ^{245}Cm.

- Long-term groundwater release: ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{229Th}, ^{230Th}.

DOE indicated that U and Th isotopes are required in direct brine release assessments because, although they comprise negligible fractions of the total EPA unit, they do influence the total quantity of dissolved radionuclides (p. WCA-22). In addition, DOE indicated that although EPA units for ^{90}Sr and ^{137}Cs at the time of the WIPP's closure are significant, they are not included in direct release of brine because they rapidly decay and result in "negligible impact on the PA from those two isotopes" (p. WCA-26). In addition, DOE indicated that if a direct brine release occurred early after closure, the total brine released would be minimal and the ^{90}Sr and ^{137}Cs would still, therefore, play a minor role in compliance (p.WCA-26).

DOE justified the radionuclide list for the long-term groundwater pathway (releases to the Culebra) based upon the following (CCA, Appendix WCA, Section WCA.3.2.3, pp. WCA-26 to WCA-27):

- ^{233}U can be combined with ^{234}U for transport because their half lives are similar.

- ^{229}Th can also be combined with ^{230}Th because they are in a fixed ratio to each other.

- ^{232}Th can be dropped because it is a constant small fraction of EPA unit throughout the 10,000 year regulatory period.

- ^{240}Pu and ^{242}Pu can be combined with ^{239}Pu. Long half-lives also indicate a fixed ratio between them.

- ^{238}Pu will have decayed to about 0.5% of its initial inventory after 700 years, and its contribution to EPA unit will be negligible because of the long (>700 year) travel time in the Culebra; it was therefore dropped from consideration.

Performance Assessment Parameters Related to Radioactivity in Curies of Each Isotope

DOE used the information from the update of the CCA inventory to define the isotope inventory for the 2004 CRA PA, which was modified for the PABC. Refer to Section 194.24(a) of this CARD for a discussion regarding the description of this inventory. The PABC Inventory Report (Docket A-98-49, Item II-B2-60) provides the radioactivity in curies of each isotope used in the PABC (See Table 14, p. 37).

TRU Radioactivity at Closure

Table 14 of the PABC Inventory Report lists the DOE inventory at closure, based upon the September 2002 cutoff and updates described in Section 194.24(a) above. The PABC Inventory Report indicated that the inventory estimate to be 2.32 x 10^6 Ci and the waste unit factor is 2.32, with inventory activity for the year 2033, which is the planned date for closure.

Performance Assessment Parameters Related to TRU Radioactivity at Closure

The 2.32 waste unit factor is the number of millions of curies of alpha-emitting TRU radionuclides with half-lives longer than 20 years used in the calculation of the EPA normalized unit. DOE discusses this in 2004 CRA, Chapter 4 and Appendix TRU Waste Section TRU Waste-2 and in the PABC Inventory Report, page 36.

A complete description of EPA's 1998 Certification Decision for Section 194.24 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(1))

For the CCA, EPA reviewed information on waste characteristics and components in a number of technical documents. This review encompassed references, experimental programs, logical arguments, and modeling. EPA determined all relevant waste characteristics and components were identified and evaluated. For the 2004 CRA, EPA focused on changes and new information that could affect DOE's analyses and findings.

EPA concluded that, with the combination of the 2004 CRA, supplemental information, and the PABC, DOE performed an adequate update to the CCA.

Solubility

EPA's review identified two areas that DOE failed to adequately address solubility. First, DOE did not update the uranium (+VI) solubility to incorporate new data that has become available since the certification decision. The data indicates that the +VI solubility should be higher than that used by DOE in the 2004 CRA PA. Second, DOE failed to update the solubility uncertainty ranges used for actinide solubility oxidation states based on new data.

For the PABC, EPA stated that the solubility of U(+VI) needed to be changed to a fixed value of 1×10^{-3} M because of experimental data that became available since the CCA. In addition, EPA required that new solubility uncertainty ranges, based on the FMT database and currently available experimental solubility data, be incorporated into the PABC. DOE made additional changes to the calculation of the +III, +IV, and +V actinide solubilities based on revised thermodynamic data for the +IV actinides, a different Salado brine formulation, and revised concentrations of organic ligands. These changes were properly implemented as discussed in Section 7 of the Technical Support Document for Section 194.24: Evaluation of the Compliance Recertification Actinide Source Term and Culebra Dolomite Distribution Coefficient Values (Docket A-98-49, Item II-B1-3). Table 24-4 lists the actinide solubility values for the PABC and the 2004 CRA PA.

Other changes and improvements incorporated into the calculation of actinide solubilities for the PABC that have been implemented since the PAVT include:

- Incorporation of organic ligand complexation data into the FMT thermodynamic database so the effects of organic ligands on +III, +IV, and +V actinide solubilities can be calculated directly. The organic ligand concentration changes were the result of corrections to the masses of organic ligands and the minimum estimated brine volume required for a release from the repository.

- Refinement of the thermodynamic database using new +III, +IV, and +V actinide data
- Use of GWB instead of Brine A as the Salado Brine formulation for actinide solubility calculations
- Correction of the minimum brine volume necessary for direct brine release
- Revision of the estimated uranium(VI) solubility to account for new data
- Recalculation of actinide solubility uncertainties based on a much larger number of solubility measurements, with separate distributions developed for the +III, +IV, and +V actinide solubilities instead of the single distribution used for the PAVT. The new ranges are provided in Table 24-5.

Table 24-4 2004 CRA PA and PABC Solubilities of the Oxidation State Analogs, in moles/liter, with MgO Backfill

		Solubilities for PA Material Name and Oxidation States			
Brine	PA Parameter Name	SOLMOD3 (III)	SOLMOD4 (IV)	SOLMOD5 (V)	SOLMOD6 (VI*)
Salado	PABC SOLSIM	3.87×10^{-7}	5.64×10^{-8}	3.55×10^{-7}	1×10^{-3}
Salado	CRA SOLSIM	3.07×10^{-7}	1.19×10^{-6}	1.02×10^{-6}	8.7×10^{-6}
Castile	PABC SOLCIM	2.88×10^{-7}	6.79×10^{-8}	8.24×10^{-7}	1×10^{-3}
Castile	CRA SOLCIM	1.69×10^{-7}	2.47×10^{-8}	5.08×10^{-6}	8.8×10^{-6}

Table 24-5 Cumulative Distribution Function (CDF) Ranges Established by the Revised Actinide Solubility Uncertainty Analysis. The CDF Ranges Vary by Oxidation State. No Range Was Used for the +VI Oxidation State Since EPA Required DOE to Use an Upper Bound for the Uranium Solubility.

Actinide Oxidation State	CDF Range
III	-3.00 to 2.85
IV	-1.80 to 2.40
V	-1.95 to 1.95

Colloids

The PAVT included microbial colloid transport of actinides for all vectors. The 2004 CRA PA included different assumptions about the colloidal source term concentrations for microbial and non-microbial vectors, with no microbial colloid transport of actinides assumed for non-microbial vectors. However, for the PABC, it was assumed that all vectors included microbial activity. Therefore, DOE included microbial colloid transport of actinides for all PABC vectors (Brush 2005). This approach therefore was the same for the PAVT and PABC, and was consistent with the Agency's direction that all vectors include microbial activity.

Production of Gas from the Waste

Microbial degradation of CPR may influence WIPP repository performance because of its effects on repository chemistry and gas generation. The Agency reviewed the approach and assumptions used by DOE to model microbial degradation for the 2004 CRA PA. The Agency's review comments to DOE focused on the probability of significant microbial degradation, the nature of the microbial degradation reactions likely to occur in the repository, and microbial gas generation rates. As a result of the Agency's review and comments, DOE changed the modeling of microbial degradation processes for the PABC.

During the review of the 2004 CRA PA, the Agency noted that additional information related to the probability of significant microbial degradation in the WIPP repository had become available since the time of the CCA PA and PAVT. EPA reviewed the information presented by DOE and other available information and concluded that new data regarding the potential existence and survival of microbes had increased the probability of significant microbial degradation of cellulosics. On the other hand, the Agency did not find significant information supporting an increase in the probability of microbial degradation of plastics and rubbers in the repository. Therefore, the Agency instructed DOE to assume that microbial degradation of CPR would occur in all PABC vectors.

Based on the inventories of nitrate and sulfate in the waste, DOE assumed in the 2004 CRA PA that these constituents would be quickly consumed during microbial degradation of CPR in the waste, and that methanogenesis would therefore be the dominant microbial degradation reaction. However, adequate sulfate anions are likely to be available in the Salado anhydrite interbeds and will insure that methanogenesis does not occur regardless of the quantity of sulfate in the waste. Because DOE had not conclusively demonstrated that methanogenesis would be the dominant pathway for microbial degradation reactions, the model required revision. This pathway was eliminated by DOE in the PABC and only denitrification and sulfate reduction reactions were included in the microbial gas generation model. Based on revised PABC inventory values, 4% of the microbial gas generation is from denitrification and 96% is from sulfate reduction. These reactions will produce one mole of carbon dioxide for each mole of CPR carbon consumed by microbial degradation. DOE has adequately revised the microbial gas generation reactions and evaluated the effects on PA.

During the review of the 2004 CRA PA, DOE informed the Agency that the microbial gas generation experiments had continued and additional information related to microbial gas generation rates in the WIPP repository had become available since the time of the CCA PA and the PAVT. In the letter directing DOE to perform the PABC, the Agency allowed DOE to propose a new gas generation rate scheme based on the new experimental data.

Because of the shape of the curve formed by carbon dioxide generated as a function of time, the degradation rates were modeled by obtaining a least-squares fit of two linear functions to the reported mean values for the carbon dioxide gas generation data. In this manner, both a short-term and a long-term rate were determined for each experimental data set. A minimum of three data points were included in each short-term or long-term fit to the data.

The revised microbial gas generation rates were based on long-term experimental data. Therefore, gas generation during the early stages of the repository was accounted for in BRAGFLO by assuming a fixed amount of gas was present in the repository at the beginning of the calculations. The amount of gas in the repository was assumed to be equal to the amount of gas generated per gram of cellulose at the point where the relatively rapid short-term rate changed to the slower long-term rate in the nutrient and nitrate-amended inundated experiments; these experiments were used to evaluate the maximum long-term rate. This amount of gas initially present in the repository was converted to a pressure value of 26.714 kPa using the ideal gas equation and the volume and temperature of the repository. This additional pressure was assumed to be generated immediately upon closure, resulting in an initial total repository pressure of 128,039 kPa.

At the Agency's direction, DOE changed the probability of microbial degradation to account for new evidence regarding the presence and viability of microbes capable of degrading CPR in the WIPP repository. The revised probability parameters resulted in microbial degradation in all vectors for the PABC. However, DOE asserted that uncertainties remained regarding the viability of microbes in the repository because of different conditions in the repository compared to the conditions in the experiments. DOE therefore introduced an additional sampled parameter, BIOGENFC. This parameter, which had a uniform distribution from 0 to 1, was multiplied by the microbial gas generation rates to effectively reduce the humid and inundated microbial gas generation rates from the experimentally determined long-term rates.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(b)(1).

RECERTIFICATION DECISION (194.24(b)(1))

After a modification of the actinide solubility, solubility uncertainty ranges, methanogenesis assumption, and microbial gas generation rate and probability and based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(b)(1).

REQUIREMENT (194.24(b)(2))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (2) That all waste components influencing the waste characteristics identified in paragraph (b)(1) of this section have been identified and assessed for their impact on disposal system performance. The components to be analyzed shall include, but shall not be limited to: metals; cellulosics; chelating agents; water and other liquids; and activity in curies of each isotope of the radionuclides present."

1998 CERTIFICATION DECISION (194.24(b)(2))

To demonstrate compliance with Section 194.24(b)(2), EPA expected DOE to present rationales, logical arguments, applications of screening procedures, results of bounding or sensitivity analyses, etc., beginning from the description required by 194.24(a) and leading to the selection of the important or significant waste components to be limited and controlled to assure compliance with the disposal regulations. DOE identified a number of waste components and characteristics that would be important to performance and EPA reviewed them. EPA identified several issues with DOE's treatment of the waste components and characteristics in the CCA PA, but through independent analysis and changes to the PA in the PAVT, these issues were resolved and EPA determined that DOE complied with this section (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(b)(2))

DOE indicated that the components identified below were expected to have a significant effect on disposal system performance and so were used in the CCA PA, 2004 CRA PA and the PABC:

- Ferrous metals
- Cellulose and other chelating agents (i.e., organic ligands) as they pertain to enhanced actinide mobility
- Radioactivity in curies of each isotope
- $\propto$-emitting TRU radionuclides, $t_{1/2} > 20$ years ($t_{1/2}$ is the half-life)
- Radionuclides
- Solid waste components (e.g., soils and cementitious materials)

- Sulfates and
- Nitrates.

Most of the inventory amounts of the listed components have changed and are discussed in the PABC Inventory Report and EPA's Technical Support Document for Section 194.24: Review of the Baseline Inventory Used in the Compliance Recertification Application and the Performance Assessment Baseline Calculation (A-98-49, Item II-B1-9). The important items have not changed from the CCA, and EPA agreed that DOE's information was adequate and reported this in CCA CARD 24.

The only change of significance is the incorporation of organic ligands in the actinide solubility PA calculations. DOE updated the FMT thermodynamic databases with information related to organics to account for the organic ligands' affect on actinide solubility (2004 CRA, Appendix SOTERM 5.0).

DOE had reported in CCA Appendix SOTERM that organic ligands are not expected to affect the aqueous speciation of actinides, given anticipated repository conditions, because of competition for the ligands with major solutes in the brine and metal ions derived from corrosion of waste materials. In addition, DOE's thermodynamic database did not have the parameters to analyze the effect of organic ligands under the high ionic strength solutions expected at WIPP. EPA conducted an independent evaluation of the effects of organic ligands by conducting modeling runs at lower ionic strengths to examine the effects of the organic ligand EDTA on the aqueous speciation of Th(IV) and the solubility of ThO_2(am). EDTA was considered because it has the greatest affinity for forming aqueous complexes with the actinides compared to acetate, citrate, and oxalate.

The modeling runs indicated that the EDTA concentration would have to increase by at least 1,000 times the maximum concentrations expected for the repository to produce an appreciable change in the aqueous speciation of Th(IV) and solubility of ThO_2(am), and this range was limited primarily to acidic pH conditions. At the pH conditions of 9 to 10 that are relevant to the repository with MgO backfill, the EDTA was complexed predominantly by Ca and Mg ions. These results implied that the organic ligands are unlikely to affect the mobilities of the actinides.

Reported inventories of the four ligands evaluated for the 2004 CRA have changed since the CCA, including increased concentrations of acetate, changes in oxalate and citrate inventories that appear to have been caused by transposing the data during the CCA, and a decrease in the estimated inventory of EDTA (2004 CRA, Appendix PA, Attachment SOTERM, Table SOTERM-4). In addition, new estimates of the available brine necessary for a release have decreased, thus effectively increasing concentrations (from ~30,000 m^3 to ~10,000 m^3).

DOE stated that acetate, citrate, EDTA, and oxalate will not significantly affect the +III and +IV actinide solubilities (2004 CRA, Appendix PA, Attachment SOTERM Section 5.0).

Comparison of FMT calculations with and without organic ligands indicates that this is true for the +IV actinides. However, comparisons of FMT output files for calculations with and without organic ligands indicate that higher +III actinide solubilities are observed in runs with organic ligands than in runs without organic ligands. These higher concentrations occurred because $AmEDTA^-$ constituted approximately one-quarter to one-half of the aqueous americium(III) species in FMT runs with organic ligands. These comparisons also indicated that oxalate complexation significantly increased neptunium(V) solubilities, however, since the neptunium will be present in such low concentrations, there is little effect on releases.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(2))

The concentrations of organic ligands were re-evaluated for the PABC actinide solubility calculations based on a revised estimate of the minimum amount of brine that could lead to a release from the repository. In addition, new data regarding the possible complexation of +IV actinides by EDTA were identified; these data were evaluated to determine its potential significance to the actinide solubility calculations for WIPP repository conditions.

In the PA vectors, the volume of brine used to dissolve the ligands may not be the minimum value that could be released from a single panel. It is also possible that the majority of ligands will be placed in a single panel because most ligands are in a limited number of waste streams. The assumption that all ligands are in the same panel and that these ligands would be mobilized by the minimum brine volume released from a single panel would be the most-conservative scenario for calculating ligands concentrations. However, the probability of a randomly located borehole encountering such a panel, if it existed in the repository, would be correspondingly reduced. The individual PA vectors would be influenced if modeling could be done on a panel-by-panel basis, but the influence on the mean concentrations would probably be small. Therefore, the use of the minimum amount of brine that could be released from the entire repository and assuming that all ligands are dissolved in this amount of brine is likely to be a reasonable approximation for calculating ligands concentrations and the resulting actinide solubilities.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(b)(2).

RECERTIFICATION DECISION (194.24(b)(2))

During EPA's review of the important waste components, EPA identified that only organic ligands have been addressed differently than in the CCA. Organic ligands could increase actinide solubility, but EPA has determined that DOE has adequately included their effects in the PABC.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(b)(2).

REQUIREMENT (194.24(b)(3))

(b) "The Department shall submit in the compliance certification application the results of an analysis which substantiates:

> (3) Any decision to exclude consideration of any waste characteristic or waste component because such characteristic or component is not expected to significantly influence the containment of the waste in the disposal system."

1998 CERTIFICATION DECISION (194.24(b)(3))

To demonstrate compliance with 194.24(b)(3), EPA expected DOE to present rationales, logical arguments, applications of screening procedures, results of bounding or sensitivity analyses, etc., beginning from the description required by 194.24(a) and leading to the selection of the important or significant waste components to be limited and controlled to assure compliance with the disposal regulations.

DOE provided a listing of those waste characteristics and components that were excluded from consideration in the PA for various reasons, such as negligible impact. EPA examined DOE's exclusion of the specified waste characteristics and components to determine whether DOE excluded them appropriately.

EPA evaluated DOE's assumptions, calculations and experimental results and had questions pertaining to assumptions and conclusions made by DOE. EPA's concerns centered around DOE's exclusion of the affects of organic ligands (in particular EDTA) on repository performance because EPA found DOE's justification to be weak. EPA found that the mechanisms concerning organic ligands' behavior that DOE postulated came from fundamental principals existing in relevant literature and is particularly well established. EPA performed a bounding analysis assuming EDTA volumes up to approximately 1000 times that used by DOE. This analysis showed that the solubility of the modeled actinide was unaffected by EDTA quantity at repository pH and pCO_2. EPA therefore concluded that DOE's treatment of organic ligands in the PA is adequate (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(3) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(b)(3))

DOE provided a list of those waste characteristics and components that were excluded from consideration in the PA for various reasons, such as negligible impact (CCA Appendix WCA, Table WCA-4 and 2004 CRA, Appendix TRU WASTE-6). The effect of organic ligands, however, is incorporated into the PABC. These characteristics and components included the following changes from the CCA noted in bold):

Characteristic	Component	Reason Excluded
cellulosics radiolysis	radionuclides	negligible effect on total CO_2
explosivity	other organic compounds	no effect
brine radiolysis	radionuclides	negligible effect on actinide valence
galvanic action	nonferrous metals	negligible effect on PA
complexation with actinides	soil/humic material	actinide mobility
buffering action	cement	negligible; reacts w/CO_2 and $MgCl_2$
heat of solution	cement	negligible effect on PA
Ca^{2+} binding-organic ligands	cement	negligible compared to other metals
buffering action	ferrous metals	would reduce actinide mobility
galvanic action	ferrous metals	negligible effect on PA
binding to organic ligands	ferrous alloy components	can reduce actinide mobility
redox reactions	nonferrous metals	negligible compared to iron
binding to organic ligands	nonferrous metals	can reduce actinide mobility
complexation with actinides	**organic ligands**	**negligible effect (in PABC)**
gas generation	Al, other non-ferrous metals	negligible effect relative to steels
microbial nutrients, CO_2 generation	phosphates	negligible due to MgO-CO_2 reaction
microbial nutrients CH_4 generation	phosphates	negligible
heat generation	RH-TRU	negligible
electrochemical processes	sulfate, nitrate, phosphate	negligible

A complete description of EPA's 1998 Certification Decision for Section 194.24(b)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(b)(3))

There were no changes in the important waste components and characteristics, with the exception that DOE did analyze the effect of organic ligands in the 2004 CRA performance assessment calculations as discussed for section 194.24(b)(3).

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(b)(3).

RECERTIFICATION DECISION (194.24(b)(3))

Since there was no additional exclusions of waste components or characteristics since the CCA and DOE adequately incorporated organic ligands as discussed in Section 194(b)(2) and based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(b)(3).

REQUIREMENTS (194.24(c)(1) and 194.24(e)(1, 2))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (1) Demonstrate that, for the total inventory of waste proposed for disposal in the disposal system, WIPP complies with the numeric requirements of §194.34 and §194.55 for the upper or lower limits (including the associated uncertainties), as appropriate, for each waste component identified in paragraph (b)(2) of this section, and for the plausible combinations of upper and lower limits of such waste components that would result in the greatest estimated release."

(e) "Waste may be emplaced in the disposal system only if the emplaced components of such waste will not cause:

> (1) The total quantity of waste in the disposal system to exceed the upper limiting value, including the associated uncertainty, described in the introductory text to paragraph (c) of this section; or
>
> (2) The total quantity of waste that will have been emplaced in the disposal system, prior to closure, to fall below the lower limiting value, including the associated uncertainty, described in the introductory text to paragraph (c) of this section."

1998 CERTIFICATION DECISION (194.24(c)(1) and 194.24(e)(1, 2))

EPA expected the CCA to specify the limiting value of a given waste component, note whether it is an upper or lower limiting value, and provide the uncertainty associated with each value. EPA also expected DOE to provide: plausible combinations of upper and lower limits and a rationale for these limits; the results of modeling code runs; the demonstration of numeric compliance; and the greatest release estimates.

DOE identified four waste component groupings that require limitations. These waste components groupings and their limiting values are:

- Ferrous metals (iron)—minimum of $2x10^7$ kilograms
- Cellulosics, rubber, and plastic (CPR)—maximum of $2x10^7$ kilograms total

- ♦ Free water emplaced with waste—maximum of 1684 cubic meters and
- ♦ Nonferrous metals (metals other than iron)—minimum of $2x10^3$ kilograms

EPA evaluated the waste limits provided by DOE and determined that the appropriate components requiring limitation were identified and that the applied waste limits were sufficient. EPA found that the CCA adequately described model code runs, maximum calculated releases, and release estimates. EPA also agreed that the PA appropriately accounted for the upper and lower limits because fixed values were used.

EPA reviewed DOE's description of system controls, chain of custody information, controls in place to track WIPP waste, waste record keeping and accountability systems, and WIPP WAC requirements and controls. EPA reviewed the CCA and determined that DOE adequately referenced and summarized the WIPP WAC in the CCA (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Sections 194.24(c)(1) and 194.24(e)(1, 2)) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(1) and 194.24(e)(1, 2))

For the 2004 CRA PA, DOE did not make any changes to the limits identified in the CCA or their implementation into the 2004 CRA PA. In reviewing the 2004 CRA PA, EPA identified that the packaging materials for the INL supercompacted were omitted from the CPR total. For the PABC, DOE included the packaging material as part of the inventory estimate, although it was above DOE's previously stated CPR limit. The limited additional packaging CPR did not significantly affect the results of the PABC.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(1) and 194.24(e)(1, 2))

In the CCA, EPA found that DOE identified those waste components that required limits, and that the limits were reasonable and quantifiable. EPA's main concern is that the waste components are kept to levels that keep the repository in compliance with the disposal standards. The waste components of special concern are the amounts of CPR and their potential to generate gas that contributes increased pressure in the repository.

At the rate iron is being placed in the repository, DOE will easily exceed the lower limit necessary. Other (upper) limits will not be reached until later in the operations at WIPP. Given this and that PA uses projected values of inventory in the PA, the issue of inventory uncertainty is not currently one of compliance with the release limits. However, it could be in the future as the repository approaches disposal capacity. DOE does, however, have the option of changing the limits in the future as long as the changes are supported by a compliant performance assessment.

As with the CCA, DOE did not provide the associated uncertainty for the waste component limits in the 2004 CRA. EPA has identified two related issues with this claim of no uncertainty. First is ensuring that the inventory remains within the limits established by DOE, and second, that the performance of the repository is not compromised by the uncertainty in the inventory. This section requires that DOE identify the associated uncertainty for each limiting value. In the CRA, as in the CCA, DOE stated that the waste component limits are fixed values with no associated uncertainties.

However, EPA requested that DOE review the issue of uncertainty (Docket A-98-49, Item II-B3-89). DOE states (ERMS 542308, p. 6, Docket A-98-49, Item II-B2-63) that the "sum of the weights of individual components in a container can at most differ from the total weight of the container by 5 percent." Thus, DOE now acknowledges that there is a measure of uncertainty, but it appears low. For the CCA, EPA agreed with this approach since the limiting value could be used to represent the "upper end" of an uncertainty value. However, the lack of information on the waste component inventory is of concern for the future, especially with the CPR materials, since they have the most potential to affect performance.

While there is no limit on radionuclides, DOE establishes the radionuclide inventory amounts for use in PA. As stated in the CCA (see CCA CARD 24), EPA considers the radionuclide inventory used in the PA as *de facto* upper bound limits. DOE can't place any more radionuclide inventory in the repository than what is considered in the most recent compliance performance assessment. Responding to EPA's query about the quality of the waste estimates used in PA and actually emplaced (Docket A-98-49, Item II-B2-63), DOE addresses a comparison of emplaced waste at three closed TRU waste sites (RFETS, LBL, and MURR). The comparison indicates a relatively good agreement between the PABC inventory and the actual radionuclide inventory identified in the WIPP Waste Inventory System. Table 24-6 lists the radionuclides with the greatest inventory at RFETS.

Table 24-6 Comparison of Estimated and Emplaced Inventory of Three Radionuclide at RFETS (Source ERMS 542225 in Docket A-98-49, Item II-B2-63)

Site	Am-241 (Curies)	Pu-239 (Curies)	Pu-240 (Curies)	Total Curies
RFETS—WWIS	1.03E+05	2.04E+05	4.63E+04	3.61E+05
RFETS—PABC estimated inventory	1.15E+05	2.09E+05	4.72E+04	3.79E+05

In ERMS 542308 (Docket A-98-49, Item II-B2-63), DOE identifies extremely small errors in the total measured activity for the RFETS inventory, and EPA finds the uncertainty characterization as provided to be suspect. For example, the uncertainty for the total Am-241 is stated to be 127 curies for 103,000 total curies or an uncertainty of 0.12%. However, for an individual container report, the uncertainty is 1 curie for a 2.8 total curie measurement. This is an uncertainty of ~35%. EPA does not agree with DOE's characterization that this is unimportant. While it is not a current issue for compliance with the release limits presently because of the limited emplaced waste, it will become important as the WIPP repository approaches capacity, and it is something that DOE will need to address for the next recertification.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Sections194.24(c)(1) and 194.24(e)(1, 2)).

RECERTIFICATION DECISION (194.24(c)(1) and 194.24(e)(1, 2))

EPA finds that DOE has identified the limits of important waste components and that the PA implementation is adequate. Although DOE increased the modeled CPR inventory above its stated limit to include the packaging material, the PABC shows that the effect on performance is limited. Thus, the PABC CPR inventory establishes a new CPR limit.

Since the inventory emplaced in WIPP is currently at a fraction of the total inventory expected in the future, and since a significant fraction of the inventory is still estimated, and to-be-emplaced in the future, EPA finds that the use of point estimates is acceptable for the waste components and radionuclides for this recertification. In addition, EPA finds that, since only a limited amount of waste has been emplaced, the inventory and its associated uncertainty is below the respective limiting values. However, DOE needs to better demonstrate knowledge of the measurement uncertainty for the next recertification and include these uncertainties into the PA process.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Sections 194.24(c)(1) and 194.24(e)(1, 2)).

REQUIREMENT (194.24 (c)(2))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (2) Identify and describe the method(s) used to quantify the limits of waste components identified in paragraph (b)(2) of this section."

1998 CERTIFICATION DECISION (194.24 (c)(2))

To meet this requirement, EPA CCA to specify the waste characterization methods used to quantify the limits of certain waste components. EPA expected the CCA to specify how each method will be used to quantify the amounts of listed waste components, the scale to which the method is applied (e.g., individual waste container, batch, statistical sample of drums, etc.), the instrumentation used and its sensitivity, and the parameter measured and its relationship to the regulated waste component in question.

EPA also expected the CCA to describe how the data obtained by each method meet or exceed quality assurance indicators or data quality indicators that were assumed or derived relative to waste-related inputs to the PA. Finally, EPA expected the CCA to demonstrate DOE's ability to "quantify each of the listed waste components (for purposes of control, at the precision and accuracy adequate to assure that limiting values will not be exceeded in the inventory shipped to WIPP). [See additional requirements at Section 194.24(c)(5) of this CARD]". In other words, DOE had to show that the proposed methods can be performed, using the available technology, at the precision and accuracy necessary to quantify the waste components. The quantification results are then to be summed and tracked against the limiting values to ensure that the limits will not be exceeded.

To quantify TRU waste components of concern, DOE proposed to use non-destructive assay (NDA), non-destructive examination (NDE) consisting of radiography (RTR) and visual examination (VE). DOE described numerous NDA instrument systems and described the equipment and instrumentation for RTR and VE found in facilities. DOE also provided information about performance demonstration programs intended to show that data obtained by each NDA method could meet data quality objectives established by DOE.

EPA found that these methods, when implemented appropriately, would be adequate to characterize the important waste components. EPA found DOE in compliance with the requirements of Section 194.24 (c)(2).

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(2) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGE IN THE CRA (194.24(c)(2))

As noted in Section 194.24(b), DOE did not modify the list of CCA components and characteristics requiring quantification. Therefore, the 2004 CRA did not identify any significant changes to the measurement techniques used in the waste characterization program (i.e., VE, RTR, AK, NDA). Also, the 2004 CRA did not propose changes to the current waste characterization program through use of different NDA and NDE characterization methodologies. The 2004 CRA indicated that the location of NDA and NDE methodology documentation has changed since the CCA, with both the Quality Assurance Program Plan

(QAPP) and Methods Manual supplanted by the CH-Waste Acceptance Criteria (WAC) and the Waste Analysis Plan (WAP). EPA has been aware of this shift in source information location. The 2004 CRA revised some of the information presented in the CCA with respect to quality assurance objectives (QAOs). The 2004 CRA, however, included the following changes to the characterization program as presented in the CCA.

With respect to Waste Characterization (2004 CRA, Chapter 4), DOE removed references to specific characterization methodologies, including statements that measurements shall be obtained on a waste container basis. DOE also modified a diagram that previously described the waste characterization program hierarchy to now present the "QA document hierarchy"; previously this diagram showed 40 CFR 191/194 CCA requirements as being represented in the WAC, but the current 2004 CRA shows the requirements of 40 CFR 194 as ultimately feeding to the QAPD. Also, DOE revised the 2004 CRA to include a description of the 194.8 approval process (Sections 4.1.2 and 4.4 of the 2004 CRA).

The 2004 CRA includes a discussion of the, then pending, RH WC program. The 2004 CRA provides no description of the proposed RH WC program, stating only on page 4-54 that "No RH-TRU waste has been shipped to the WIPP at the time of 2004 CRA. EPA approval of DOE's proposed RH-TRU characterization procedure is pending."

The 2004 CRA was also modified with respect to the description of non-destructive examination, removing the overview discussion of system operations as well as the QAO specifications. Additionally, DOE removed reference to the Methods Manual for related detailed protocols and procedures for visual examination and radiography. DOE also revised the 2004 CRA to state that classified material shall be shipped to WIPP, which was not planned at the time of the CCA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(2))

Since the 1998 Certification Decision, the waste characterization program has been implemented at several DOE waste generator sites. This represents a change in activities since approval of the CCA, since only LANL was approved at that time. Since 1998, EPA has approved WC activities at the larger generator sites namely, Advanced Mixed Waste Treatment Plant, Hanford, Idaho National Laboratory, and Savannah River Site, the small generator sites namely, Lawrence Livermore National Laboratory, and Nevada Test Site and these sites continue to characterize CH-TRU waste for disposal at WIPP. Two DOE sites - Rocky Flats Environmental Technology Site and Argonne National Laboratory – East, have completed CH-TRU WC and no longer ship CH-TRU waste to WIPP for disposal. The 2004 CRA summarized DOE site audit and inspection information in Chapters 5 and Appendix QAPD. Table 8-1 of 2004 CRA CARD 8, includes a summary of EPA waste characterization inspections completed at different sites as of December 2005. On July 16, 2004, EPA modified their 194.8 inspection process to streamline inspection activities and allow site-specific flexibility. This change, however, did not modify fundamentals and contents of inspection process.

EPA approved several changes to DOE's waste characterization program since the 1998 Certification Decision. The changes did not significantly alter the CH-TRU waste characterization program contained in the CCA and related documents and references. These include:

- Modification of Appendix A of the CH-WAC to include AK and NDA measurement requirements. (EPA Docket A98-49, II-B3-22)

- Allowance of RTR and no VE of newly-generated/packaged waste (EPA Docket A98-49, II-B3-49)

- Addition of new Appendix (Appendix E) to the CH-WAC implementing payload management (i.e., inclusion of <100 nCi/g drummed waste with >100 nCi/g drummed waste from the same waste stream in a payload container, ten-drum overpack). (EPA Docket A98-49, II-B3-58)

- Submission of the RH waste characterization program implementation plan (WCPIP). EPA approved the RH framework in WCPIP and identified pre-requisite steps. (EPA Docket A98-49, II-B2-21)

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(2).

RECERTIFICATION DECISION (194.24(c)(2))

Based on a review of the 2004 CRA, including the new information and references presented therein, EPA agrees that the methods used to quantify the limits of waste components have not changed substantially since the 1998 Certification Decision. The Agency has kept abreast of all the changes to the program, including information source document changes that transpired after EPA's 1998 Certification Decision. Changes implemented up to the 2002 CH-WAC and WAP referenced in the CCA have not affected the site's abilities to adequately quantify waste components in individual containers. DOE, therefore, will continue to require each waste site to characterize radiological contents of every container of CH waste streams destined for WIPP disposal using the EPA-approved NDA systems. Similarly each site will continue to examine each TRU waste container to ensure absence of prohibited items using the EPA-approved RTR and/or VE procedures.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(2).

BACKGROUND (194.24(c)(3))

Section 194.24(c)(3) requires DOE to demonstrate that the use of process knowledge to quantify components in the waste conforms with the quality assurance requirements found in §194.22.

REQUIREMENT (194.24(c)(3))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (3) Provide information which demonstrates that the use of process knowledge to quantify components in waste for disposal conforms with the quality assurance requirements found in § 194.22."

1998 CERTIFICATION DECISION (194.24(c)(3))

EPA expected the compliance application to: provide information used in connection with control of the use of process knowledge; cite objective evidence substantiating the degree of implementation of quality assurance for each generator site that is approved to use process knowledge for characterization; and provide an implementation plan for application of quality assurance requirements to process knowledge at remaining sites.

At the time of the 1998 Certification Decision, EPA determined that DOE adequately described the use of acceptable knowledge only for legacy debris waste at the Los Alamos National Laboratory (LANL). DOE did not demonstrate compliance with Section 194.24 (c)(3) for any other waste streams at LANL or for waste at any other waste generator site. EPA instituted Condition 3 of the 1998 Certification Decision which requires EPA to determine that for any other LANL waste streams and any other site, DOE has provided information on how AK will be used for waste characterization of the waste stream(s) proposed for disposal at WIPP.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(3) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(3))

The 2004 CRA was revised to indicate that the AK process is now presented in the CH-WAC. The CH-WAC has been revised to include more discussion of AK with respect to radionuclides (2004 CRA, Appendix A). Modifications made to the CH-WAC since the CCA that are pertinent to AK include, but are not limited to, are the following:

- Use of "existing" (i.e., AK) collected prior to the implementation of a QA program under

40 CFR 194.22(a) may be qualified in accordance with an alternative methodology and employs one or more of the following methods: peer review, corroborating data, confirmatory testing, and collection of data under an equivalent QA program.

- Methods for confirming isotopic ratios using AK (i.e., methods pertinent to sites generating weapons grade plutonium vs. heat grade).
- Required and supplemental AK documentation
- Discrepancy resolution and data limitation identification
- AK- radioassay data measurement comparisons as a means to assess comparability

These modifications effectively focused the CH-WAC to address specific allowances and requirements with respect to AK applicable to radionuclide data, but the overall AK process is still contained in the Hazardous Waste Facility Permit (HWFP) Waste Assessment Plan (WAP). The revised WAP has retained most of the AK requirements of data assembly, compilation, etc. included in the CCA documentation. Also, it is structured differently to include several provisions either not originally included in the CCA Appendix WAP or worded differently than what was presented in the CCA documents. These include but are not limited to the following:

- proceduralization of requirements
- modifications with respect to visual verification
- sealed source characterization based on AK

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(3))

EPA's WIPP regulations require DOE to "provide information which demonstrates that the use of process knowledge to quantify components in waste for disposal conforms with the quality assurance requirements found in § 194.22." For example, 194.22(b) requires that the use of data collected prior to implementation of a QA program as described in section (a) must be qualified by an alternative methodology such as corroborating data, confirmatory testing, peer review, or demonstration that an equivalent QA program was place at the time of data acquisition. At TRU waste sites, PK/AK data for all legacy waste was obtained prior to the establishment of an EPA-approved QA program; therefore, confirmation of PK/AK data by analyzing TRU waste containers using the EPA-approved assay equipment is necessary. EPA found the information presented in the 2004 CRA for §194.24(c)(3) adequate and the adherence of TRU waste sites to the 2004 CRA-based AK process will allow them to meet their regulatory obligation.

Some of the changes to the AK program were made to better define the use of AK (i.e., CH-WAC Appendix A), and EPA has kept abreast of these modifications to be sure that they do not compromise compliance with EPA regulations. Most of the changes presented in the 2004 CRA, however, are to recognize DOE's election to move requirements demonstrating compliance between various documents, and eliminate text within the 2004 CRA that may be repeated in these documents. For example, the QAOs are included in the HWFP WAP and CH WAC (Appendix A), and were therefore removed from the body of the 2004 CRA text.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(3).

RECERTIFICATION DECISION (194.24(c)(3))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(3).

REQUIREMENT (194.24(c)(4))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

> (4) Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text paragraph (c) of this section. The system of controls shall include, but shall not be limited to: Measurement; sampling; chain of custody records; record keeping systems; waste loading schemes used; and other documentation."

1998 CERTIFICATION DECISION (194.24(c)(4))

EPA expected the compliance application to describe: (1) a system for maintaining centralized control over the waste characterization activities; (2) a mechanism for maintaining chain of custody over waste and waste records; (3) controls in place for receipt of waste at the WIPP; (4) a record keeping/accounting/tracking system for controlling limited waste components for verification of emplaced waste; and (5) describe all requirements or controls (i.e., waste acceptance criteria) that are relevant to compliance with 40 CFR Part 194. EPA expected the CCA to discuss evidence (auditable records) necessary for inspection substantiating compliance with WAC limits set under §194.24 showing that waste components for which inventory limits were set are monitored, controlled, and accounted for in a systematic and traceable manner.

DOE described the system of controls for waste characterization activities and required that these be conducted in accordance with approved documentation that describes the management, operations and QA aspects of the program. DOE also indicated that conformance with applicable regulatory (Federal and State), programmatic and operational requirements is to be monitored by the DOE/CBFO audit and surveillance program.

DOE provided descriptions of the documentation, data fields, and features of the WIPP Waste Information System (WWIS). The WWIS is DOE's record keeping and accounting system for tracking waste components and associated uncertainties, controlling limited waste components for verification of placement of the waste in WIPP, and providing notification before the waste component limits are exceeded, in accordance with 40 CFR 194.24(e)(1) and (2). In addition, in the WWIS, DOE identified a sample of 17 waste material parameters fields relevant to compliance that are included in the more than 130 parameters tracked in the WWIS.

DOE described the controls in place to determine completeness and accuracy of the waste container-specific information and a process to identify and resolve discrepancies before receipt of waste at the WIPP. DOE described the type of records for each waste container managed at WIPP that must be maintained for waste characterization purposes as part of the WIPP operating record which to be backed up, secured, and archived. The audit process in the CCA provided on-site verification of characterization procedures, data package preparation and record keeping.

EPA determined that DOE provided an adequate description of the system (controls and processes) for maintaining centralized command and control over waste characterization activities. At the time of the 1998 Certification Decision, EPA was able to inspect and verify that LANL had demonstrated an adequate system of controls. Conditions 2 and 3 of the 1998 Certification Decision specified that DOE was prohibited from shipping waste for disposal at WIPP until EPA approved site-specific waste characterization programs and controls.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(4) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(4))

According to the 2004 CRA, while the WWIS used the Oracle (Version 7) database management system at the time of the CCA, the current computing system uses Oracle (Version 9) but otherwise remains unchanged. DOE also inserted a statement in the 2004 CRA that "[a]dditional computing system upgrades may be implemented in the future."

CCA and 2004 CRA, Section 4.3.2 includes a sample of the more than 130 important parameters tracked in the WWIS the 2004 CRA. The data fields listed in 2004 CRA are a subset of the total list included in the WWIS data tracking system. EPA examined the WAP and WWIS users manual and verified that DOE is tracking more than 130 data fields in the WWIS. EPA was able to verify that the parameters listed in 2004 CRA, Section 4.3.2 are included in the WWIS tracking system, plus many more parameters.

The 2004 CRA, Section 5.0 of Appendix TRU WASTE (Page 52) briefly describes the WWIS as part of a system of controls that address the requirements of 40 CFR §194.24(c)(4) and (5), requirements for computer software for nuclear facility applications.

The WWIS is currently only used for the CH-TRU program, and does not include all data fields required for the disposal of RH-TRU waste. According to Section 9.4.19.1 of the 2004 CRA (Page 9-148), WWIS will be modified by the addition of data fields to meet additional tracking and control requirements imposed on RH-TRU waste by the LWA.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(4))

EPA determined that the general description of the WWIS in the 2004 CRA is adequate. Hardware modifications and software upgrades described in the 2004 CRA are necessary to maintain system reliability, security, and performance. EPA has reviewed the WWIS during its inspections of the WIPP and TRU waste generator sites and is aware of the changes to the WWIS since the CCA. EPA has determined that the WWIS adequately gathers, stores, and processes information pertaining to TRU waste destined for or disposed of at the WIPP.

DOE stated that a majority of the 130 WWIS data fields are pertinent to demonstrate compliance with TRU waste transportation and disposal requirements. EPA verified that DOE has adequately tracked more than these 130 data fields in the WWIS and that DOE has not changed its tracking methodology and in fact has added parameters to be tracked in the WWIS.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(c)(4).

RECERTIFICATION DECISION (194.24(c)(4))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(4).

REQUIREMENT (194.24(c)(5))

(c) "For each waste component identified and assessed pursuant to paragraph (b) of this section, the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) of each limiting value, of the total inventory of such waste proposed for disposal in the disposal system. Any compliance application shall:

(5) Identify and describe such controls delineated in paragraph (c)(4) of this section and confirm that they are applied in accordance with the quality assurance requirements found in §194.22."

1998 CERTIFICATION DECISION (194.24(c)(5))

EPA expected DOE to provide a description of all Performance Demonstration Programs (PDPs) used to certify the capability and comparability of radiological measurements at waste generator sites, and to provide standardized waste characterization methodologies, if not provided under §194.24(c)(2). EPA also expected DOE to cite objective evidence of the status of current implementation methods or procedures. Finally, EPA expected the CCA to include documentation of QA for waste characterization activities from the point of generation (for to-be-generated waste) to the point of disposal at the WIPP.

See Section 194.22(a)(2)(I) in CARD 22-- Quality Assurance for additional discussion of quality assurance for waste characterization activities.

DOE described the PDP for NDA designed to ensure compliance with the Quality Assurance Objectives identified in the QAPP by providing a test program that each generator site must pass prior to waste shipment. The PDP is crucial because it is the only means of qualifying some of the NDA equipment (which is state-of-the-art and first-of-a-kind in most cases) and each site must demonstrate its measurement performance on a semiannual basis. The PDP is a multiple (approximately 12)-cycle program for a site's NDA system(s) to test their ability to detect radionuclides from various source standards in different waste matrices. The CBFO is the reviewing and approving authority for the PDP and uses the PDP to assess, evaluate, and approve DOE facilities for waste measurement and characterization before the waste is shipped to the WIPP. The PDP standards address activity ranges relative to WAC limits, QAPP QAOs, and NDA method detection limits. The isotopes analyzed under this program include, but are not limited to, ^{238}Pu, ^{239}Pu, ^{240}Pu and ^{241}Am. When a site passes a particular PDP cycle, the site has demonstrated its ability to accurately assay waste contained in a matrix for which the PDP test matrix was representative.

EPA reviewed the updated PDP Plan for NDA and concluded that the DOE provided adequate information regarding the PDP for NDA. However, in its CCA DOE did not provide the status of the current implementation of PDPs at the generator sites in the application. This information was only available for LANL and RFETS at the time of inspections.

The QAPP did not contain specific radiological waste characterization (i.e., NDA) procedures, but did provide VE and RTR procedures that can be found in QAPP Chapter 10. EPA understood that each generator site must meet the QAPP-provided guidelines regardless of the NDA technology used so that generator sites can have flexibility to analyze waste with different techniques, as appropriate.

EPA confirmed through inspections at LANL that the system of controls—and in particular, the measurement techniques—are adequate to characterize waste and ensure compliance with the limits of waste components, and also that a QA program had been established and executed in conformance with NQA requirements. Moreover, DOE demonstrated that the WWIS is a functional system at LANL. During the CCA review process, DOE had not demonstrated compliance with these requirements for any other waste generator site.

DOE did not provide documentation of QA for waste characterization activities from the point of generation (for to-be-generated waste) to the point of emplacement and disposal at the WIPP. Instead, DOE implemented a QA program by preparing several QA procedural documents and conducting audits. These QA documents were described further in CARD 22--Quality Assurance.

A complete description of EPA's 1998 Certification Decision for Section 194.24(c)(5) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(c)(5))

DOE describes the changes to the PDP program in Section 4.3.3.1 PDP (pg 4-49) of the CRA. There are three significant changes in this section relative to the CCA; a) the QAPP is no longer referenced as the document defining the PDP QAO requirements, b) the PDP Plan has been removed as a reference and replaced by the statement that "the PDP NDA plans are revised as required", and c) the section no longer contains a detailed description of the isotopes to be analyzed and the configuration of the PDP tests. Additionally, the PDP tests have been changed from a semi-annual to an annual schedule, a change of which EPA was previously notified. DOE also changed the item that is approved by the PDP test. The CCA stated that "waste analysis can only be performed by measurement facilities that have demonstrated acceptable performance in the PDP" to "NDA analysis of drums or boxes is performed by measurement systems that have demonstrated acceptable PDP performance." This wording change applies the PDP results to equipment rather than a facility.

DOE also revised the Quality Document hierarchy for waste characterization activities by making the CBFO QAPD as a higher tier document and the QAPP as of lesser importance. This new document hierarchy is shown in 2004 CRA, Figure 4-3, which replaced CCA Figure 4-6.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(c)(5))

The QAPP and the Methods Manual have been replaced by the WAC, as noted in previous sections of this document. EPA has been aware of these changes to the program requirements documents. The wording changes regarding the description of the PDP test and the removal of the PDP plan do not affect EPA's ability to ensure that DOE has implemented a series of intercomparability tests for NDA equipment that develop similar results. The elimination of the PDP test description from the 2004 CRA requires that DOE makes available to EPA the PDP plans and test descriptions so that EPA can ensure that the program is indeed acting as a "true blind sample" program. The change in PDP certification from the facility to the equipment is acceptable, since a facility many time uses multiple NDA equipment for measuring radiological contents of TRU waste containers to meet the expedited shipment schedule.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.25(c)(5).

RECERTIFICATION DECISION (194.24(c)(5))

EPA continues to ensure, through audits and inspections, that the waste characterization program meets QA controls sufficiently. The inspection program is the primary method by which EPA determines the implementation of QA controls to the waste characterization program.

DOE's changes to the PDP program do not affect EPA's ability to assess the implementation of quality controls to the waste characterization program. The wording changes allow DOE more flexibility in developing PDP test now that the initial series of test have been completed since the CCA. The changes to the QA document hierarchy do not lessen the implementation of quality controls to the waste characterization program.

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(c)(5).

REQUIREMENTS (194.24(d) and 194.24(f))

(d) "The Department shall include a waste loading scheme in any compliance application, or else performance assessments conducted pursuant to § 194.32 and compliance assessments conducted pursuant to § 194.54 shall assume random placement of waste in the disposal system."

(f) "Waste emplacement shall conform to the assumed waste loading conditions, if any, used in performance assessments conducted pursuant to §194.32 and compliance assessments conducted pursuant to §194.54."

1998 CERTIFICATION DECISION (194.24(d) and 194.24(f))

EPA examined the CCA to determine whether DOE provided a final plan for waste loading that addresses the emplacement of radioactive waste and implements any assumptions about the distribution of the waste that were used in the performance assessment. EPA expected DOE to cross-reference the waste distribution assumptions from the waste loading plan with the waste distribution assumptions used in the PA. Finally, EPA examined DOE's description of how the planned distribution of waste (as assumed in the PA) would be achieved. This discussion should identify both the acceptance criteria for implementation and the controls that will be in place to assure proper implementation of the plan.

EPA determined that, because DOE had (1) assumed random waste loading and (2) evaluated the potential consequences resulting from the non-random loading of the highest-activity waste stream containing at least 810 drums, a final waste loading plan was in fact unnecessary. EPA determined that DOE was therefore not required to describe how the planned distribution of radioactive waste (as assumed in the PAs) would be achieved because the random distribution of waste containers in the WIPP resulted in compliance (i.e., it did not matter to compliance how the drums were placed in the WIPP). EPA therefore concluded that DOE adequately cross-referenced the resultant waste distribution assumptions from the waste loading plan with the waste distribution assumptions used in the PA (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Sections 194.24(d) and 194.24(f) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

CHANGES IN THE CRA (194.24(d) and 194.24(f))

DOE did not use a performance based waste loading scheme for waste emplacement, and DOE assumed random waste loading in its performance and compliance assessments. Prior to the CRA, EPA requested that DOE analyze waste loading with respect to supercompacted waste, and DOE identified that clustering of waste would not affect performance (Docket A-98-49, Item II-B3-64; Item II-B2-31; also see Docket A-98-49, Item II-B3-68).

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24(d) and 194.24(f))

In performance assessments to date, DOE has assumed random waste emplacement. In the CCA, EPA asked for additional analysis assuming clustering of waste. DOE did an analysis and showed that clustering of even higher than average waste streams would not significantly affect results. Indeed, RFETS waste was eventually clustered in the WIPP (Docket A-98-49, Item II-B2-31). In addition, EPA required DOE to conduct another analysis assuming non-random waste emplacement as part of the review of supercompacted waste from INL. The results again showed that non-random placement of waste was not significant (e.g., 2004 CRA, Appendix PA, Attachment MASS 21.0). Thus, no waste loading assumptions are necessary in performance assessment calculations.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Sections 194.24(d) and 194.24(f).

RECERTIFICATION DECISION (194.24(d) and 194.24(f))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), and because DOE has shown that waste loading assumptions are not necessary for use in PA, EPA determines that DOE continues to comply with the requirements for Sections 194.24(d) and 194.24(f).

REQUIREMENT (194.24 (g))

(g) "The Department shall demonstrate in any compliance application that the total inventory of waste emplaced in the disposal system complies with the limitations on transuranic waste disposal described in the WIPP LWA."

1998 CERTIFICATION DECISION (194.24 (g))

EPA expected the compliance application to describe the WIPP waste inventory in terms of the units specified in the limitations of the LWA and to describe how these limitations will be assured through implementation of the required system of controls. DOE identified the following limits:

- ♦ Curie limits for RH-TRU waste: 5.1 million curies (app. 19.8 x 10^{16} Becquerels).

- ♦ Total capacity of RH and CH-TRU waste that may be disposed: 6.2 million cubic feet (175,564 cubic meters).
- ♦ Waste will not exceed 1,000 rem per hour, no more than 5 percent by volume of RH will exceed 100 rem per hour, and RH will not exceed 23 curies per liter.

DOE provided numerous tables that presented the WIPP waste inventory in terms of curies and total volumes. In addition, DOE presented information pertaining to the WIPP WWIS, which tracks and controls waste emplaced in WIPP. EPA reviewed this information, which included the process DOE outlined for controlling the waste and the use of the WWIS, and determined that DOE had an adequate program for tracking and controlling the waste (CCA CARD 24).

A complete description of EPA's 1998 Certification Decision for Section 194.24(g) can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

EVALUATION OF COMPLIANCE FOR RECERTIFICATION (194.24 (g))

DOE has several years of experience with the WWIS and, through EPA's inspections, DOE has shown the WWIS to be effective in tracking and controlling waste disposed of at WIPP. Results of EPA inspections related to the WWIS can be found in Docket A-98-49, Categories II-A1, II-A4, and II-B3. DOE has not characterized or shipped any RH-TRU waste at this time, but it will have to meet WIPP waste acceptance criteria in a process similar to CH-TRU waste.

EPA did not receive any public comments on DOE's continued compliance with the requirements of Section 194.24(g).

RECERTIFICATION DECISION (194.24 (g))

Based on a review and evaluation of the 2004 CRA and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.24(g).