3 DOE RESPONSE TO COMMENTS

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3.2 DOE RESPONSE TO COMMENTS

Commentor No. 1: Hollinger, Wade

Comment 1

Make a reasonable risk-based, economical decision, hire a team of lawyers and get on with getting rid of the stuff! Just take it for granted someone is going to sue DOE because they want you to make it so that it was never here in the first place (impossible) and put your lawyers to work, by the time it gets out of court you'll have the stuff gone. MAKE THE DECISION AND DO IT! I'm tired of supporting all you do nothing bureaucrats! A NEPA review and going out to the public was not necessary for this. You know what has to be done. DO IT!

Response 1

DOE has determined that the selection of a long-term management strategy for depleted uranium hexafluoride is a major Federal action with potentially significant environmental impacts. As such, the National Environmental Policy Act of 1969 requires DOE, as the responsible Federal agency, to prepare an environmental impact statement. The National Environmental Policy Act also requires DOE to include public involvement activities during EIS preparation. The results of the EIS will be used, together with economic and engineering analyses, to select a management strategy which will be announced in a Record of Decision.

Commentor No. 2: Ragan, Guy

Comment 1

PEIS: S.4 SUMMARY AND COMPARISON OF IMPACTS FOR ALTERNATIVE MANAGEMENT STRATEGIES: What is the basis for the consequences stated? In other words, if the no-action alternative creates 110 jobs over 40 years, that is as compared to what? Compare it to continuation of the present situation? But continuation of the present situation is not an option. The PEIS states its impacts relative to an inconceivable baseline. According to DOE's "Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements, "the no-action alternative provides an environmental baseline against which impacts of the proposed action (and alternatives) can be compared." Therefore, the consequences should be stated as deviations from the no action alternative. For example, as compared to the No Action alternative, for operations, Long-Term Storage creates 10 jobs per year over 20 years. Then there are 110 federal jobs from 20 to 40 years. For construction, no jobs are created relative to No Action. Comparisons like this should be made explicit by stating all consequences as deviations from the No Action alternative. This comment applies to all types of environmental consequences, not just socioeconomic impacts.

Response 1

In EISs for proposed new facilities or programs, the no action alternative does indeed represent an environmental baseline, often described as no change to the existing environment. However, DOE is currently managing existing depleted uranium hexafluoride cylinders in existing facilities; so that, even if DOE were to take no further programmatic action, cylinder storage would continue at the three sites. Continued cylinder management includes steps necessary to maintain the cylinders in a safe and environmentally protective condition, which means that in the future the no action alternative will also have impacts on the natural and human environment. Recognizing this fact, the PEIS evaluates the impacts of all alternatives, including the no action alternative. This allows comparison of the impacts of alternatives in a manner similar to other NEPA assessments and allows alternatives to be compared on equal footing. The impacts of all the alternatives, including the no action alternative, are presented in Chapter 5 and compared side-by-side in Sections 2.4 and 2.5 of the PEIS. Any differences among the alternatives can be discerned from Tables 2.2 and 2.4 and the accompanying text in Sections 2.4 and 2.5.

Commentor No. 3: **Ellison, Phillip**
Idaho National Engineering and Environmental Laboratory

Comment 1

I briefly reviewed the UF_6 Draft PEIS. It appears to be a well developed and documented effort. One area that you may wish to improve is the hazardous analyses of the HF and NH_3 tank farms. Other events, including tornado induced missiles may wish to be addressed. These events may have been covered but I was unable to locate data of the results of the analyses.

Response 1

Impacts associated with potential releases from HF and NH_3 tanks during both normal operations and postulated accidents are addressed in the PEIS. The impacts are summarized in Table 2.2, and discussed in detail in Appendix F, Section F.3, and in the backup report for the PEIS (Policastro et al. 1997; the full citation is provided in Chapter 8 of the PEIS).

The analysis of accident scenarios for continued cylinder storage (Section D.2.2 of the PEIS) was based on the range of potential accident scenarios considered in the safety analysis reports (SARs) recently prepared for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as tornadoes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include tornado scenarios, *which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point.*

For the other cylinder management options (i.e., cylinder preparation for shipment, conversion, long-term storage, manufacture and use, and disposal), analysis of adverse impacts associated with tornado-induced missiles were conducted, but for purposes of conciseness, the results were included in the PEIS only if the accident affected a greater number of people than any other accident in the frequency category (see Sections E.3.2, F.3.2, G.3.2., H.3.2, and I.3.2). Impact estimates for tornado-induced missile accidents are presented in the PEIS for some conversion options (see Tables F.8-F.11) and for some manufacture and use options (see Tables H.6-H.9). Tornado-induced missile accidents were not included in the appendices for cylinder preparation, long-term storage, or disposal because they affected fewer people than other accidents in the same frequency category. However, the results of impact analyses for all accidents considered (including tornado-induced missiles) are given in the backup report by Policastro et al. (1997) referenced in the PEIS. This report and other PEIS supporting documents are available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Commentor No. 4: Dyer, Robert
Dyer Enterprises

Comment 1

I was happy to see that you are getting better at meeting schedules, only six months late in getting out the two volume Draft PEIS for the alternative strategies for the future of the few cylinders of depleted that are stored around.

I have spent some time reading it and thinking about the way it is presented, both from my own point of view as one who knows what the stuff is and also from the point of view of one whose knowledge of depleted UF_6 is from these writings. As you can see by my comments, I think you missed your opportunity to inform the unknowing and get them on your side once you make the long-term management strategy.

I am interested in your reaction to my comments, and maybe we can work together to improve the document.

As a result of several days of pouring through the two volumes of the referenced document, I have the following comments and suggestions to make. I believe that I am qualified to review the work because I have had 53 years of experience in the operation and design of the gaseous diffusion process in Oak Ridge while working 35 years for the operating contractor followed by 15 years for

DOE. I have seen the depleted cylinders at all three plants, I actually filled some of them in Oak Ridge, I know the chemistry and physical properties of UF_6, I was on the committee to investigate the cause and effect of the wall failures of the two Portsmouth cylinders and I am a voting member of the ANSI N14.1 Uranium Hexafluoride-Packaging for Transport standards committee that establishes cylinder design and fabrication criteria. Twice, I have presented my training course "Fundamentals of Gaseous Diffusion Plant Operations" to members of the Argonne National Laboratory staff who have prepared this report. I will start with some general comments and proceed to some specific ones.

<u>*Response 1*</u>

The commentor's qualifications and statement of accomplishments are noted.

<u>Comment 2</u>

UF_6 Storage Cylinder Description: Let me quote some of the words in the box on Page S-1 in Volume 1. "Sufficient information must be included in the EIS for reviewers to evaluate the relative merits of each alternative."

It seems to me that you have to describe the problem in order for reviewers to see the merits of any of the possible solutions, including continued long term storage. In this case, the problem is what to do with the large quantity of depleted uranium hexafluoride that has accumulated at the gaseous diffusion plants in Oak Ridge, TN, Paducah, KY and Portsmouth, OH. I think you have to accept the fact that UF_6 is not a commodity that is familiar to the general public, especially those living in the vicinity of the plants. Therefore the description of the depleted UF_6 in storage cylinders on page S-2 is grossly understated. "Depleted UF_6 is stored as a solid at all three sites in steel cylinders. Each cylinder holds approximately 10-14 tons (9 to 12 metric tons) of material."

The next mention of stored cylinders of UF_6 that I found was on page B1 in Volume 2. "Depleted UF_6 has been stored in steel cylinders in outdoor yards at the three DOE storage sites since the 1950s. Most cylinders have either a 10- or 14-tons (9 to 12 metric tons) capacity and a nominal wall thickness of 5/16 in. (0.79 com or 312.5 mil)." It is a little more correct, in stating the cylinder capacity as 10 or 14 tons but is still oversimplified:

I, as a reviewer, know the details of the design criteria and methods of fabrication for the storage cylinders, and know that the UF_6 is being safely stored at the plants. I do not think the smidgen of information you have included will sufficiently inform and convince the farmer working the fields next to the plant, or the housewife in Wakefield, Ohio, or the new tenant in one of the K-25 buildings that they have nothing to worry about. These people should not (be) forced to imagine what is in those somewhat rusted cylinders they see stored in the yards. I think you should at least use some of the pictures and descriptions of the cylinders form the ORO 651 series of documents. I can give you copies of ORO 651 Rev 5 and ORO 651 Rev 6, but you will have to buy the successor document USEC 651 Rev 7 from the USEC for which they charge $5.00. Also, and more importantly, you should point out that there is an American National Standard, ANSI N 14.1, Uranium Hexafluoride-Packaging for Transport, which governs the quality of the material in and fabrication of these cylinders. You should be sure to point out that the cylinder has only one valve for filling and emptying. This valve is located at the 12 o'clock position on one of the ends.

Assuming you expand your description of the cylinders, then you need to tell the people what is in them. You need to tell them that the U-235 isotope concentration has been reduced from the naturally occurring 0.711% to 0.2-0.3%, resulting in a proportional increase (in) the concentration of U-238.

You need to tell them that UF_6 is a chemical compound that has one atom of uranium combined with six atoms of fluorine. It can be either a solid, a liquid, or a gas depending upon its temperature. In the storage yards it is a solid in the bottom of the cylinders and a gas at subatmospheric pressure in the top. If a cylinder is heated, the solid will melt to a boiling liquid at 147 degrees F. You need to tell them that it is a greater chemical hazard than a radioactive one.

You need to tell them how UF_6 reacts with the iron on the inner surfaces of the steel cylinder to form a corrosion inhibiting, protective surface layer of iron fluoride. This protective coating insures the UF_6 inside the cylinder will not react with and corrode the cylinder wall, i.e., if you protect the outside of the cylinder, and prevent it from rusting away, the UF_6 can stay in storage in the cylinders forever.

Response 2

In response to this comment, more detailed descriptions of the characteristics of both the storage cylinders and depleted UF_6 have been added to Section S.1.1 of the PEIS Summary and Section 1.1 of Chapter 1. Detailed information has been added which addresses the physical characteristics of the cylinders which are used for storage, as well as the physical and chemical characteristics of the depleted UF_6. Photographs have also been included which detail the cylinder and its associated parts which are referenced in the document, such as the cylinder skirt and stiffening rings.

Both the ORO-651 series of documents (DOE's own standard for handling UF_6) and the ANSI N14.1 Standard were reviewed during preparation of the PEIS. The ANSI standard is incorporated under Title 49, Code of Federal Regulations, Section 173.420, the federal regulations governing transport of depleted UF_6. Reference to the 49CFR173 has been added to Section 1.1 of the PEIS.

Comment 3

Cylinder Fill Limits: There are long standing specific requirements that have been used to determine the quantity of UF_6 that can be safely stored in an approved design cylinder. The fundamental concepts of the approach to assuring the safety of the many cylinders of depleted UF_6 stored at Paducah, Portsmouth, and Oak Ridge are certified minimum volume and 5% ullage. In particular, my comment concerns the UF_6 fill-limit and heating temperature limit for 48G cylinders, although the same rationale applies to the other sizes of UF_6 cylinders.

The crucial concept is the certified minimum volume of the cylinder. UF_6 cylinders are fabricated in strict accordance with the drawings and criteria in the American National Standards Institute standard ANSI N14.1, Uranium Hexafluoride-Packaging for Transport. One of the code requirements is that upon final fabrication, in order to determine its exact internal volume, the cylinder will be completely filled with 60°F water and weighed on a scale accurate to 0.1%. The actual water weight obtained is recorded for the individual cylinder certification data and stamped on the cylinder nameplate to conclusively demonstrate that the requirement has been met. For a cylinder to be acceptable, the quotient of the certified full cylinder water weight divided by 62.37 (the weight in pounds of 1 ft^3 of water at 60°F) shall not be less than the published minimum volume. For a 48G cylinder, the minimum volume is 139 ft^3, equivalent to a water weight of 8,669 lbs. Using this method of measurement, the actual internal volume of a cylinder can be determined and if it is not greater than the minimum volume, the cylinder is destroyed.

The density, or weight of a cubic foot of UF_6 has to be known in order to use the certified minimum volume to determine a safe-fill quantity of UF_6 for the cylinder. During the first 20 years of the atomic age, much research work was done to determine the physical properties of UF_6. R. DeWitt of the Goodyear Atomic Corporation made an extensive literature search and compiled the results in a document, GAT 280, "Uranium Hexafluoride: A Survey of the Physico-Chemical Properties January 29, 1960." Data from this source has been used to produce Figures 1 and 2. Solid UF_6 undergoes a significant expansion as it is heated and melts from a solid to a liquid. This is illustrated in Figure 1, Density of Solid UF_6, and Figure 2, Density of Liquid UF_6 235-300°F.

Knowing that all cylinders are larger than the certified minimum volume allows the establishment of a safe UF_6 fill limit for them. This weight is obtained by using the density of liquid UF_6 at the 250°F design temperature of the cylinder and determining how much of this 250°F liquid UF_6 will fill 95% of the cylinder's certified minimum volume. Because all cylinder volumes are certified to be greater than the minimum, this guarantees that there will be at least 5% of the certified minimum cylinder volume as ullage (space above the liquid in the cylinder) when the cylinder is heated to its design temperature of 250°F, and thus there will be no possibility of hydraulic forces developing in the liquid to cause cylinder rupture.

From ANSI N14.1, the minimum volume for a 48G cylinder is 139 ft^3 and from Figure 2, the density of liquid UF_6 at 250°F is 203.7 lbs/ft^3. For a 48G cylinder, the calculation of the fill limit is:

95% (139 ft^3) (203.3/lbs/ft^3 of UF_6) = 26,840 lbs of UF_6

Keep in mind that because all cylinders are required to prove that they have greater than a minimum volume, there will always be at least, if not more than, a 5% ullage to prevent hydraulic rupture at the design temperature. At lower than design temperatures, because the density of liquid UF_6 in lbs/ft^3 increases as the temperature is lowered to the freeze point of 147°F, the percentage of the cylinder volume occupied by gaseous UF_6 will increase and be larger than 5%. For example, prior to going to the storage yards, after all the air was evacuated from inside them, the depleted UF_6 cylinders were filled to the fill limit with liquid UF_6 at a temperature of 160°F with a density of 224 lbs/ft^3. The ullage in this case is at least 14%. There can be no hydraulic rupture as long as gas in the ullage provides a cushion.

This fill-limit calculation assures safety if the cylinder is heated to the design temperature and before any material is removed from it. In diffusion plant practice, the cylinder is never heated above 100°F. As UF_6 gas is withdrawn, there is a smaller mass of liquid UF_6 in the cylinder so the ullage increases. Any volatile impurities that may have been in the cylinder will be expelled when feeding is first started so the pressure of the system will correspond to the vapor pressure of UF_6 for the temperature.

When the cylinder is filled with liquid UF_6 to its proper fill limit, and has cooled to room temperature, based on the data in Figure 1, showing the density of 68°F to be 317.8 lbs/ft^3, the solid UF_6 will occupy 26,840 lbs/317.8 lbs/ft^3 = 84.45 ft^3/139 ft^3 = 61% of the certified minimum volume. The remaining 39% of the volume will be filled with UF_6 gas at subatmospheric pressure or vacuum.

<u>*Response 3*</u>

Comment noted. However, it should also be pointed out that not all of the depleted cylinders in storage have an individual "certified volume" which allows the actual cylinder volume to be calculated and filled accordingly. Some of the older cylinders in storage must be assessed based on the published ANSI N14.1 minimum volume required and therefore will "appear" to be overfilled.

<u>Comment 4</u>

Minimum Cylinder Wall Thickness. The 0.25" minimum wall thickness specified in ANSI N14.1 and the ORO 651 series for the 48G, 48H, 48 HX, 48 O, and 48 OM cylinders is for a pressure vessel rated at 100 psig. However, this pressure is only achieved if the cylinder of solid is heated 147°F to liquefy the UF_6 and the heating of the liquid continued until the temperature of the liquid is increased to 200°F, as is done in gaseous diffusion plant operations requiring rapid emptying of the cylinder's contents. However, if by strict administrative control, the cylinder is only heated to a skin temperature of 133°F, 14 degrees below the liquefaction temperature, the UF_6 gas pressure in the cylinder will be atmospheric pressure (14.7 psia), and the UF_6 can be changed directly from solid into gas without going through the liquid phase in order to remove it from the cylinder at a slow rate. (This is the way the French feed their diffusion plant, and is what you have heard referred to as "cold feeding.")

Response 4

The 0.25" minimum wall thickness indicated in the PEIS is specifically a measure by which the existing cylinder inventory at the three G.D.P. sites was assessed for off-site transportation. The criteria for offsite shipping is a minimum of 250 mils (1/4 inch) for thin-walled cylinders which had an original wall thickness of 312.5 mils (5/16-inch). The minimum acceptable cylinder wall thicknesses for the various depleted UF_6 cylinder models is provided in Table 4-3 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), with a description of the requirements for offsite transportation of depleted UF_6 cylinders given in Section 4.0 (Identification and Comparison of Options) in the engineering analysis report.

Comment 5

Radiation Emanating from a Depleted Cylinder of UF_6. There is another aspect of the filled cylinders that I do not think has been adequately covered. There should be a statement concerning how many, or few, curies or sieverts of radiation emanates from one cylinder. Depleted UF_6 is by definition U-238. The handbooks show U-238 to have a half life of 4.47 billion years (about as long as the earth has been around). The thorium and protactinium daughter products have melting points in the range of 1650-1850°F. This means that any daughter products that may be in a cylinder of normal assay UF_6 being fed into the cascade will not be vaporized and expelled from the cylinder with the UF_6 gas at 200°F. In essence, since no uranium daughter products are fed to the cascade, the only ones in depleted UF_6 are the ones that have grown in the past 50 years. With U-238's half life, there can't be more than a handful!

I know from experience that it is very difficult to measure any gamma radiation when scanning the outer surface of a full cylinder in storage with a radiation meter. However, after a cylinder has been heated, liquefied, emptied, and cooled, the scan will show a small amount of gamma radiation on the bottom of the cylinder. Keep in mind that the purpose for which diffusion plants were built was to prepare uranium for fission, either in a weapon or a nuclear reactor. The diffusion process removes 70% of the fissionable isotope found in naturally occurring uranium. The stored depleted uranium has never been used as a fuel in a nuclear reactor where fission products occur in great abundance. There are very few gamma emitting fission products in the depleted UF_6. The gamma radiation in the depleted uranium is coming from uranium decay daughter products. These non-volatile daughter product form extremely slowly throughout the cake of solid UF_6 as uranium decays. They are homogeneously mixed with the solid UF_6 resulting in their gamma rays being shielded by the uranium atoms. Because the daughters are chemically different from the UF_6, they will not vaporize and be removed from the cylinder as a gas. They concentrate in an ever diminishing pool of liquid until they are all that is left on the bottom. In this location, their radiation is directed downward away from people working with the cylinders. If you sit on top of a cylinder, your butt is at least four feet from the emitters.

I make no pretense of being a Health Physicist, so I find it hard to understand how you can estimate the exposures that people will get, if you don't state the intensity of the radiation at the source. Just one of many examples, Table D.1 page D-6 states as an impact during Storage (1999-2039) the total collective dose to a population within 50 miles (3 sites) will be 0.38 person-rems. How can you be accurate to two decimal points when you don't know how much radiation, if any, is coming from a cylinder of depleted UF_6? Here is an area where you could do a lot of good in taking the hocus pocus out of Health Physics and educating the public about radiation and its effects! Don't let them learn it from the Simpsons on the anti-nuke Fox Network.

<u>Response 5</u>

The radiation exposure of workers handling cylinders was estimated using computer models that calculate the external gamma dose rate in the vicinity of a cylinder. These models account for the ingrowth of gamma-emitting uranium decay products and shielding by both the cylinders walls and the depleted UF_6 itself. The results of the computer modeling were in good agreement with actual radiation measurement results provided by the cylinder storage sites that indicate that the external radiation level on the outside surface of a filled cylinder is typically about 2 to 3 mR/hr, decreasing to about 1 mR/hr at a distance of 1 ft. The methods used to calculate worker dose are summarized in Appendix C, with results provided in Appendix D of the PEIS. For purposes of conciseness, details related to these calculations are provided in the backup report by Cheng et al. (1997) referenced in Appendix C of the PEIS. A discussion of UF_6 cylinder hazards and dose rates has also been added to Sections S.1.1 and 1.1 of the PEIS to address this comment.

The population dose of 0.38 person-rem referred to by the commentor is the estimated radiation dose to the off-site public resulting from uranium potentially released from breached cylinders and transported to the off-site environment by air or water (see Section D.2.1.1 of the PEIS and Cheng et al. (1997) for additional details). The gamma radiation emitted by the cylinders does not contribute to the off-site public dose. Although a large degree of uncertainty is associated with such calculations, dose estimates were presented to two significant figures throughout the PEIS for purposes of comparison among alternatives.

<u>Comment 6</u>

Table S-3 Page S-46: What are the quantities of uranium compounds and HF considered to be released from a "Corroded cylinder spill, dry conditions," and "Corroded cylinder spill, wet conditions"? Without these numbers, it is difficult to understand the postulated consequences. The rest of the table has the same problem of not stating how much UF_6 or HF or UO_2 is released in the accidents.

<u>*Response 6*</u>

Table S.3 is a summary of potential environmental consequences of the preferred alternative. Data and methodologies used to arrive at the numbers presented in this table are given in the Appendices. The amount of UF_6 assumed released from a corroded cylinder spill under dry conditions was 24 lb. The amount of HF assumed released from a corroded cylinder spill under wet conditions (the solid UF_6 would be deposited on the ground and the HF subsequently generated) was 96 lb. This information, along with other details about the accident scenario, is provided in Table D.6 of Appendix D. Similar accident summary tables are provided in Appendix E (Cylinder Preparation), Appendix F (Conversion), Appendix G (Long-Term Storage), Appendix H (Manufacture and Use), and Appendix I (Disposal).

<u>Comment 7</u>

PAGE 1-1 SECTION 1.l BACKGROUND INFORMATION: The statement is made: "At atmospheric pressure, UF_6 is a solid material below a temperature of 134°F and a gas at temperatures above 134°F (additional information about the characteristics of the chemical UF_6 is provided in Appendix A)." When I go to the Appendix A, I was amazed at the paucity of information presented not only for UF_6, but also for the other uranium compounds and HF. I thought at least, I would find the phase diagram of UF_6 that clearly shows the inaccuracy of the above statement but, alas, it wasn't there! UF_6 can be a gas below 134°F as well as above 134°F, and a solid all the way up to 147°F.

<u>*Response 7*</u>

The text on page 1-1 is correct, in that UF_6 is a solid material at atmospheric pressures below a temperature of 134°F and gas at temperatures above 134°F. The commentor is correct in stating that UF_6 can be a solid at a temperature of 147.3°F but this is at a pressure of 22.04 psia, higher than atmospheric pressure (14.696 psia).

Explanatory text and associated phase diagram for UF_6 have been added after the first paragraph of section A.1.1 on page A-1 of Appendix A, as suggested by the above comment.

<u>Comment 8</u>

PAGE 3-50 TABLE 3.13 FOOTNOTE c: The footnote states: "Radiation dose could result from drinking 365 L of K-25-site water (0.3 mrem/yr) and ingesting the maximally contaminated fish (1.6 mrem/yr)." Do you have to drink all 96.5 gallons (365 L) of water and eat the fish at one sitting? If you do, this is nonsense and serves no purpose. If you don't, what is the time period?

<u>*Response 8*</u>

The stated ingestion rates of water and fish are annual consumption rates. The footnote has been revised to make this point clear.

<u>Comment 9</u>

PAGE 4-14 DEFINITIONS: "Involved Worker — Might be exposed to direct gamma radiation emitted from radioactive materials such as depleted UF_6 or other uranium compounds." Here again, the question has to be asked, "How much radiation does depleted UF_6 or other uranium compounds emit/unit quantity of the substance?" Is the UF_6 still in the cylinder? Do you take credit for the shielding of the uranium in the UF_6 in the cylinder? The way this is written does absolutely nothing to allay the fears of the uninformed.

<u>Response 9</u>

The section of the PEIS referred to is intended to define the categories of workers considered in the radiological assessment. The sources of radiation exposure vary according to the category of worker being addressed and the option or alternative being considered in the PEIS. For example, the primary radiation source for involved workers during cylinder management activities is the uranium and decay products contained in the cylinders. However, during conversion, radiation exposures for involved workers considered both radiation from uranium contained in cylinders and from uranium in processing equipment and post-conversion containers. For purposes of conciseness, a description of the methods used to calculate the potential impacts to workers is summarized in Appendix C, with detailed information provided in the backup report by Cheng et al (1997), as referenced in Appendix C of the PEIS.

In response to the question concerning the dose rates associated with UF_6 cylinders, the radiation exposure of workers handling cylinders was estimated using computer models that calculate the external gamma dose rate in the vicinity of a cylinder. These models account for the ingrowth of gamma-emitting uranium decay products and shielding by both the cylinders walls and the depleted UF_6 itself. The results of the computer modeling were in good agreement with actual radiation measurement results provided by the cylinder storage sites that indicate that the external radiation level on the outside surface of a filled cylinder is typically about 2 to 3 mR/hr, decreasing to about 1 mR/hr at a distance of 1 ft. A discussion of UF_6 cylinder hazards and dose rates has been added to Sections S.1.1 and 1.1. of the PEIS to address this comment.

<u>Comment 10</u>

PAGE 9-18 DEFINITION OF TRANSURANIC WASTE: The word "transuranic" means "beyond uranium" i.e. elements that have a greater than the 92 atomic weight of uranium, like plutonium, neptunium, americium, etc. They probably do have half-lives greater than 20 years. Plutonium is deliberately made in nuclear reactors and extracted from spent reactor fuel. In the late '70s, a very small quantity of uranium recovered from spent reactor fuel was refined, converted to UF_6, and fed into the diffusion plant complex. They do not exist in sufficient quantity in depleted UF_6 to be a problem. Here again is a place where you could do good in educating.

<u>*Response 10*</u>

The definition shown on page 9-18 for transuranic waste has been revised to indicate transuranic waste to be "Waste contaminated by alpha-emitting transuranic radionuclides (i.e., radionuclides with atomic numbers greater than 92) with half-lives of more than 20 years and concentrations ...." As indicated by the commentor, the quantity of transuranic elements in the depleted UF_6 is very small. One reason is as given in the comment that there was very little UF_6 fed into the enrichment cascades that came from recycling operations. Another reason is that depleted UF_6 produced as the result of uranium recovered from spent nuclear fuel would not be expected to contain appreciable amounts of transuranic radionuclides. Among the various fluorides of plutonium, only plutonium hexafluoride (PuF_6) is volatile (and thus would be separated during the gaseous diffusion process of enriching uranium). Unlike the stable uranium hexafluoride, plutonium hexafluoride is thermodynamically unstable, dissociating into fluorine gas (F_2) and the relatively nonvolatile PuF_4 (plutonium tetrafluoride). Neptunium hexafluoride, like plutonium hexafluoride, is decomposed in the presence of light. Therefore, they would not end up in the UF_6 stream that was fed into the enrichment cascades.

<u>Comment 11</u>

PAGE A-2 TABLE A-1: It seem incredulous that the particle and bulk density of UF_6 are each 4.6 g/cm^3, and neither one of them is the generally accepted 5.1 g/cm^3 at 68°F.

<u>*Response 11*</u>

The document "Calculational Methods for Analysis of Postulated UF_6 Releases" by W.R. Williams (NUREG/CR-4360, Sept. 1985) provides the following correlation for the density of solid UF_6 in the cylinder:

$$[\text{Density, solid } UF_6 \text{ (lb/ft}^3)] = 330.0 - (0.18 \times [\text{Temperature of solid } UF_6 \text{ (degrees °F)}])$$

so that at 68 °F, the solid UF_6 density is approximately 318 lb/ft^3 or 5.1 g/cm^3. The value in the text has been revised accordingly.

<u>Comment 12</u>

PAGE A-2 TABLE A-1: A.1.2 I think you should mention that uranyl fluoride picks up water of hydration from humid air and in doing so changes color from brilliant orange to yellow. If a cylinder should break open in the storage yard, this color change would probably be observed.

<u>*Response 12*</u>

The text of Section A.1.2 has been revised to include a statement to indicate that uranyl fluoride is hygroscopic and changes in color from brilliant orange to yellow after reacting with water.

Comment 13

PAGE A-4 A.2.1: UF_6 is essentially inert to copper, witness all the copper tubing instrument lines in the plants. Also don't forget Teflon that was developed specially for the Manhattan Project.

Response 13

The text on page A-4 of the PEIS has been revised to indicate that UF_6 is essentially inert to clean aluminum, steel, Monel, nickel, aluminum, bronze, copper, and Teflon and that Teflon is commonly used in the packing and cap gasket for cylinders storing depleted UF_6.

In general, design considerations such as using copper for instrument lines in contact with gaseous UF_6 have been factored into the facility layouts provided in the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The design sign basis and processing parameters for the various options are provided in the EAR, as well as any process considerations such as the material of construction of the various reactors and process equipment.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 14

PAGE B-7, 4TH FULL PARAGRAPH, LAST SENTENCE: "It was assumed that uranium would be released as solid uranyl fluoride (UO_2F_2),which would be deposited on the ground." You should do more than say it lays on the ground. Uranyl fluoride (UO_2F_2) has a characteristic of being very soluble in water, so as soon as it rains, its will go into solution which, because of the HF, will be acidic and be neutralized by the cement or limestone construction materials of the storage yard. The resulting calcium salts will probably be insoluble in water and lay where they have been formed.

Response 14

It is true that uranyl fluoride would react further upon contact with water. The second paragraph of section C.2.1 of the PEIS indicates that the estimation of potential impacts to water resources from cylinder breaches assumed reaction of the uranyl fluoride laying on the ground with water to form hydrogen fluoride and various uranium compounds which could dissolve and infiltrate surface and shallow groundwater resources. Text has been added to Section B.3 to clarify this point.

Comment 15

PAGE C-3, C-2.1 CONTINUED CYLINDER STORAGE, 1ST PARAGRAPH 3RD SENTENCE: "Because of their age, potential direct contact with the ground, and skirted ends, many of the cylinders show signs of corrosion." Unless you include the ORO 651 series of documents, how is the reviewer to know what you are talking about when you suddenly introduce "skirted ends"?

Response 15

A definition of "skirted ends" has been added to the text referenced in the comment.

Comment 16

PAGE E-20, FIGURE E.1: The design of the Horizontal "Clamshell" Overcontainer looks interesting, and since you will have to use it at all three plant sites, while you are at it, why don't you design to be a 100 PSIG pressure vessel and use the steam-heated autoclaves that you have at the plants to empty the defective cylinders? Otherwise you have to come up with an autoclave designed for hot air heating which will require different than your presently approved safety systems to avoid gross overheating with hot air.

Response 16

Air-heated autoclaves were utilized in the design to assure safe vaporization of UF_6 from incoming cylinders that are substandard due to corrosion defects, overpressuring, or overfilling. It was assumed that the use of steam-heated units could result in a steam/UF_6 reaction due to in-leakage of steam in a substandard cylinder. This potential steam in-leakage would result in the formation of uranyl fluoride and hydrogen fluoride, which would be a potential health and safety hazard to the workers supervising cylinder withdrawal. In addition, the hydrogen fluoride produced during steam heating could lead to equipment failure and the potential large-scale release of UF_6 in the vapor state to the atmosphere, which would present an environmental hazard.

Comment 17

PAGE E-21, E.2.2 CYLINDER TRANSFER. You will have some damaged cylinders at all three sites, and if you can't get a DOT permit to ship them off the plant site, how would one of these expensive cylinder transfer facilities at each site be of value to the enterprise?

Response 17

The cylinder transfer facility, if deemed appropriate, would mainly be used to transfer the contents of intact cylinders that do not meet the requirements of the Department of Transportation (DOT) for off-site transport into cylinders that do meet those requirements, if it became necessary to transport the cylinders to another site, for example, for conversion to another chemical form. The damaged cylinders would be handled on a case by case basis.

Comment 18

PAGE F-3, SITE LAYOUT FOR A CONVERSION FACILITY: Why do you store the full cylinders outside, and build the biggest building on the site for the empties to be under cover?

Response 18

It is assumed that the "biggest building on the site" that the comment refers to is the Outgoing Empty Cylinder Storage Building. This building is primarily a warehouse which provides space for three months storage of emptied cylinders during radiological "cooling." Preliminary *estimates have indicated possible dose rates in the range of 1 rem/hr at the lower surface of UF_6 cylinders which have been emptied of their contents, due to the retention of a heel of radioactive daughter products of uranium in the cylinder after emptying. Analysis performed for the engineering analysis report (LLNL 1997a) indicated that a period of approximately three months of on-site storage is required to allow these daughter products to decay to acceptable levels for shipment off-site. The emptied cylinders would be stored inside of a metal-frame building, which would be a restricted area with limited personnel access, to reduce worker exposures. The functions of the Empty Cylinder Storage Building, as shown in Figure F.1, page F-3 of the PEIS, are explained in Section F.2 of the PEIS. There is also a section describing this building in each of the conversion reports in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) (see for example Section 2.1.3.4 in 6.4, U_3O_8: Defluorination/Anhydrous HF Facility).*

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 19

PAGE F-11, 1st PARAGRAPH: Why wash the empty cylinders with water when a nitric acid solution would do a better cleaning job? The used solution could also be evaporated to dryness for disposal.

Response 19

*The PEIS assumes that the empty cylinders would be treated only with water, and that contaminants not removable by simple wash and rinse procedures will remain in the cylinders prior to their disposition. Water would be used to remove the heels from the empty cylinders, as a heel as great as 50 pounds of UF_6 can be treated with 10 gallons of water without exceeding the solubility limit of UO_2F_2 (i.e., about 32%). The UO_2F_2 produced during cylinder washing could then be processed at a UF_6 conversion facility to generate U_3O_8 or UO_2, minimizing costs. Addition of nitric acid would produce uranyl nitrate hexahydrate, $UO_2(NO_3)_2$*$6H_2O$, which would require processing techniques different from those considered in the PEIS to produce either U_3O_8 or UO_2. The uranyl nitrate could be evaporated to dryness for disposal purposes, but this would generate a relatively large amount of uranium-bearing waste (on the order of 500 to 600 tons) that would require disposal as a low-level waste.*

Comment 20

PAGE F-1 3, F.2.3 CONVERSION TO METAL, 3RD PARAGRAPH, 4TH SENTENCE: "The more dense molten uranium/iron would settle to the bottom of the reactor where it would be continuously withdrawn." What kind of material are you going to use for the reactor and liquid uranium/iron draw off piping? I have always been told that liquid uranium at 2100°F, and uranium alloys at lower temperatures are the universal solvents. Nothing, even yttrium lined equipment will contain them for very long.

If you go with the Fe/U alloy just to lower the molten metal temperature, how good a radiation shield will your alloy be as compared to pure uranium?

Response 20

The reactor and associated piping would be both insulated and graphite-lined. The service life of the graphite liner is limited by erosion/corrosion, and is assumed in the PEIS to be on the order of 8 months.

Iron is added to produce an uranium alloy with 3% iron. This small percentage of iron should not significantly attenuate the radiation shielding potential of the uranium-iron alloy compared with pure uranium metal.

Comment 21

PAGE F-14, IMPACTS OF OPTIONS: The amount of HF produced from any of the conversion options should be expressed because it is the big safety hazard. The design rate of 2300 48G cylinders of UF_6 a year equates to 6.3*26,840 lbs or 169,100 lbs UF_6 a day. Using a molecular weight of 352 for UF_6, these 6.3 cylinders contain 480 lb/mols of UF_6. Each lb/mol of UF_6 that reacts with water will create six lb/mols of HF. Thus 480 lb/mols * 6 = 2880 lb/mols HF/day. Using a molecular weight of 20 for HF, this equates to 57,000 lbs or 6600 gallons of anhydrous HF/day produced. Remembering that HF boils at 60°F, this is a lot of HF to handle day in and day out in plastic pipes and tanks. You are buying a much bigger safety problem than I think you are portraying in these tomes. You should know that a drop of this liquid will burn a hole through your unprotected hand and the fumes can kill as happened at Kerr McGhee in Gore, OK!

Response 21

The amount of hydrofluoric acid that would be produced during UF_6 conversion would be on the order of 7,400 gallons per day, assuming complete conversion of DOE's depleted UF_6 inventory within a 20-year period. This daily production rate is equivalent to an annual production rate of about 9,200 MT/year, which is 5% or less of the estimated U.S. annual capacity for HF production. The safety issues associated with the production of hydrofluoric acid have been considered in the PEIS. As an example, the anhydrous HF produced during UF_6 conversion would be stored in tanks and a building cooled to about 50 °F to minimize the HF that vaporizes if a spill should occur. The storage tanks themselves would have high level alarms and interlocks that stop the transfer pump, and would be diked to contain spillage. The building itself would have HF air monitoring instruments and a water spray system that can be activated to absorb HF. Further information concerning the engineering aspects of the production and storage of HF is provided in the engineering analysis report (1997a; the full citation is provided in Chapter 8 of the PEIS).

Comment 22

PAGE F-23, TABLE F.7: In the conversion to U_3O_8 section, the last accident is a U_3O_8 drum spilling its contents onto the floor after an accident with a forklift. These drums contain 1600 lbs of U_3O_8 powders, and you are asking the reviewer to believe that the spill quantity will only be 63 milligrams! This tends to lose your credibility for the whole study! Later on in the Table, you show a 2400 lb drum of UO_2 in a similar accident only spilling 25 milligrams but you have an extremely unlikely 3, UF_6, cylinders bursting from some kind of fire and dumping 24,000 lbs in 30 minutes. I believe you lose integrity when you ignore the historical fact that this cylinder rupture scenario has not occurred, or even come close, in the past 50 years of cylinder storage. On the other hand, you seem to completely accept speculation about future accidents in plants that have not been built. It sure looks like you are trying to make people think this UF_6 stuff is the most hazardous thing there ever was?

Response 22

The accident analysis in the PEIS was performed using standard methodologies based on research and historical experience to determine the accident source terms. The difference in the amount assumed to be released for the accidents is primarily due to the physical form of the material involved (solid versus gas) and type of accident (simple drum spill versus fire-induced rupture of a UF_6 cylinder). The U_3O_8 drum spill accident for the conversion to U_3O_8 option assumed that 50% of the solid U_3O_8 would be released from the breached drum containing 1,380 lb U_3O_8, and that 0.02% of the released amount would be rendered airborne by the accident and contain powder in the respirable range. It should also be noted that the building filtration system would reduce the release by 99.9%, thus resulting in a release to the atmosphere of 0.00014 lb (1,380 lb × 0.5 × 0.0002 × .001).

The fire-induced UF_6 cylinder rupture accident scenario postulates that a vehicle with a large fuel inventory would crash into a UF_6 cylinder storage pad, and that the UF_6 cylinders would hydraulically rupture during heating, releasing UF_6 both as liquid and vapor. It should be noted that the total release of vapor UF_6 is respirable, unlike that of solid U_3O_8 for which a small portion is respirable.

Further information about the details of the source terms for the accident analysis performed in the PEIS can be found in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). This report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 23

PAGE F-29, CYLINDER TREATMENT FACILITY EXTREMELY UNLIKELY ACCIDENTS: Why is the amount released in an earthquake where 50% of the stored drums are breached only 1.9 lbs, whereas in a Tornado that pierces only one drum of U_3O_8 the quantity released is 69 lbs? You need to cross check all these tables you publish. I am sure that I have not found all the inconsistencies.

IBID, PAGE F-29, CYLINDER TREATMENT FACILITY EXTREMELY UNLIKELY ACCIDENTS: The 3.4 lbs of HF released when the evaporator tank fails and the pool of HF evaporates into the building is just plain wrong. I can tell that none of you ever worked at Fernald! If the temperature is above 60°F, 3.4 lbs of anhydrous HF will become 61 standard cubic feet of extremely toxic and obnoxious gas.

Response 23

All the appendix tables summarizing accidents considered for the various options have been checked; there are no known errors. Background information and details on the rationale for the release amounts are given in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), which is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

With respect to the specific questions raised in the comment, the difference in the release amounts for earthquakes and tornadoes is mainly due to the high winds which accompany a tornado. During a tornado, a wind-blown missile could impact a single U_3O_8 drum and release the 1,380 lb inventory of the drum, with 5% of the released amount rendered airborne outside the building and containing powder in the respirable range, resulting in a release of 69 lbs. For an earthquake, it was assumed that 50% of the 28 drums stored in the Solids Product Building would be damaged, 50% of the material in the drums released, and 0.02% of the released amount would be rendered airborne outside the building and contain powder in the respirable range, for a total of 1.9 lbs. An analogous situation would be dropping a bag of Portland cement onto a hard surface. The bag would rupture and a very small amount of fine dust particles would be emitted in the air. In the case of a tornado, the entire contents of the cement bag that had burst open would be entrained by the high winds.

With regards to the evaporator tank failure which was postulated to release 3.4 lb of hydrogen fluoride (HF), the evaporator would contain 154 gallons of 13.3% HF (equivalent to 176 lb. HF) at its boiling point. The accident scenario postulates that the evaporator tank would fail and the entire contents be spilled. Flash evaporation (due to HF being at its boiling point) of the tank contents would result in 1% being vaporized (1.8 lb HF flashed vaporized). Normal evaporation of the HF spill on the concrete floor over a 60-minute period would result in another 1.6 lb HF being released, for a total of 3.4 lb HF over a 60-minute duration.

Comment 24

PAGE G-16, SECTION G.2-2: I don't find recognition of the cylinder sweating problem in any of the inside storage options. During the winter, the 10 or 14 ton cake of UF_6 in each cylinder cools approaching the temperature of the coldest day. When spring comes and the warm humid days return, the outer surface of the cylinders becomes a condenser for the water in the air, not unlike the sweating on your evening rum and coke glass. Unless you air condition the buildings, vaults, and mines, the cylinder wall corrosion will continue especially in the spring.

Response 24

The PEIS assumed that designs for the three storage options would include heating, ventilation, and cooling (HVAC) in order to avoid the effects of temperature and humidity extremes mentioned in the comment. This should limit the potential for cylinder sweating.

Comment 25

PAGE H-16, TABLE H-5: Why is that the drop of a single 2400 lb drum of UO_2 only releases 7.3×10^{-7} pounds (3.3 mg) of UO_2 in this accident whereas the same accident in Table G.6 page G-26 releases 1.1×10^{-4} lbs (50 mg) of UO_2? Once again, what you got don't make no sense!

Response 25

The reason for the difference is the degree of filtration, which would reduce the amount of UO_2 that is released to the environment through the stack. Table G.6 indicates accidents that could occur during storage of UO_2 in a metal building with minimal filtration, while the building design for Manufacture and Use in Table H.5 would include a number of filtration units to reduce emissions.

It should be noted that the amount of released solid material such as UO_2 or U_3O_8 during an accident would be a function of the fraction of the material made airborne at the point of the accident, the fraction of the release in the respirable size range, and the fraction of the material that would be released from the building to the environment after being mitigated by air-treatment attenuation devices such as air filters. The fraction of the material made airborne at the point of the accident would be a function of the type of the material. During conversion of UF_6 to form UO_2, very dense and hard pellets are formed, similar to those used in nuclear reactor fuel. The UO_2 pellets would not be expected to release many airborne particles after simply being dropped, which explains why such a relatively small percentage of the drum contents would be released to the atmosphere.

Comment 26

PAGE J-28, SECTION J.3.4.3, CYLINDER TREATMENT FACILITY: I question the assumption that emptied UF_6 cylinders will retain a 22 lb heel. Why not use dry air to purge the UF_6 gas from the emptied cylinder in the autoclave and let these purge gases go directly to your conversion apparatus. If you do this you should get your heels to be around 10 ppm UF_6. However, even if you do this, you will still have to wash the cylinders to get the daughter product out.

Response 26

The amount of UF_6 remaining as "heels" (22 lbs) was taken from the document "Cost Study for the D&D of the GDPs, Depleted Uranium Management and Conversion," K/D-5940-DF (Sept. 1991). This document presents a preliminary design developed by the Central Engineering Department at the Oak Ridge Site for conversion of the depleted UF_6 to form U_3O_8. This document also indicated that on the order of one pound of insoluble solids per cylinder would be removed during cylinder washing. Reference to this report has been added to Appendix F and Appendix J of the PEIS.

Commentor No. 5: Denton, Dr. Mark S.
Mountain Technologies Network Group

Comment 1

I am currently reviewing the Draft PEIS Summary, Vol. I and Vol. II. Thank you for the opportunity to provide comment. I have been tracking this problem (which I feel is of the highest priority along with the Gunnite Tanks and Melton Valley Storage Tanks at ORNL) since 1992 at Oak Ridge (K-25), PGDP and PORTs.

Response 1

Comment noted.

Commentor No. 6: Weigel, Rudy

Comment 1

Question: I didn't think "economics" was a consideration of the NEPA process. If it's not, why is it presented in the PEIS? It's being presented could adversely influence ultimate decisions for the project-people will look at the dollars instead of the best project option.

Response 1

NEPA and its implementing regulations require that federal agencies address the impacts of proposed actions on the human environment. Consequently, the PEIS addresses socioeconomic impacts on human communities, including changes in employment, local housing demand, public finances, and population in-migration. The ultimate decision on a management strategy will be announced in a Record of Decision. The Record of Decision will consider the results of the PEIS, including socioeconomic impacts, along with other information, such as cost and engineering data, *to select a management strategy. The Record of Decision will document the strategy selected and describe how it was selected from among the different alternatives.*

Commentor No. 7: Peelle, Bob

Comment 1

In discussing possible future uses of depleted uranium, you predominantly mention radiation shielding. True for x-rays and gamma rays, and sometimes true for electrons. Never true for neutrons! (fast or slow). (I was associated with some simple minded experiments 40 years ago that made the point dramatically.) The neutrons produce fissions, and the (subcritical) multiplication ruins the shield. Uranium pellets would ruin concrete blocks, if many neutrons are around. So for any application including around an accelerator, an analysis would have to be made. So, qualify the statements to apply only to x-rays or x-ray shields.

Response 1

Dense materials, such as uranium, are primarily used for shielding x-ray, gamma, and beta radiation. Qualifying statements have been added to the PEIS (Sections 1.5.3 and 2.2.4) to indicate that uranium would be used to shield these types of radiation.

Commentor No. 8: Plansky, Dr. Lee

Comment 1

A. re: Disposal Options U- minerals are deposited in reducing environments. It would seem that you would chose a *grout* that would tend to be chemically neutral or also reducing, perhaps a glass or synroc. The oxidizing environment implied in the present scenario (cement grouts, implies rapidly rusting metal drum, and oxidation of U to U ++++++ (+6, or +5) and we mobilize what we don't want to.

Response 1

The PEIS considers disposal of uranium in the form of uranium oxides such as U_3O_8. Uranium appears in nature as U_3O_8 and this is the generally recommended form for disposal due to its inertness and low solubility.

Grouting of waste materials is widely practiced in the disposal of radioactive waste. Most processes use a cementing or binding agent (for example Portland cement or asphalt). The resulting block of waste, with relatively low permeability, reduces the surface area across which the transfer of pollutants such as uranium can occur. Some versions of waste stabilization involve adjusting the pH and oxidation-reduction conditions in the waste to prevent waste solubilization in groundwater. This is not necessary with uranium oxides such as U_3O_8 due to their low solubility in groundwater.

<u>Comment 2</u>

B. The PEIS downplays the importance of U-toxicity as a metal. Refer to any simple MSDS on U METAL and you and the public will all be shocked.

<u>Response 2</u>

The analyses of potential health impacts conducted for the PEIS addressed both the chemical and the radioactive toxicity of uranium as several different compounds: UF_6, UO_2F_2, UO_2, U_3O_8, UF_4, and uranium metal. For normal operations, the chemical toxicity was addressed by comparing potential exposure amounts with the U.S. Environmental Protection Agency's reference dose for uranium. For accidents, the chemical toxicity was addressed by comparing potential intakes with: 1) the intake of 30 mg given as the threshold for potential irreversible kidney damage under U.S. Nuclear Regulatory Commission (NRC) guidelines for certification of gaseous diffusion plants (NRC 1994a; full citation is provided in Chapter 8 of the PEIS); and 2) the intake of 10 mg, which NRC publications give as the threshold for potential adverse chemical effects (generally temporary, reversible effects occur in the range from 10 to 30 mg of intake). The chemical toxicity analyses for uranium are summarized in Sections 4.3.1.2.2 and 4.3.2.1 of the PEIS, and discussed in greater detail in Sections C.5.1.2 and C.5.2.1.1. Chemical toxicity was assessed for each alternative, and the results of the accident analyses show that the largest potential impacts from accidental uranium releases would be chemical impacts. Please see text in Sections S.4.2.2 and 2.4.2.2, which states "chemical effects (kidney damage) occur at lower exposure levels than radiological effects," and elaborates on the numbers of workers and members of the general public estimated to experience these adverse chemical effects under the various accident scenarios analyzed.

<u>Comment 3</u>

C. The way I understand it, the new proposed 20 micrograms/liter EPA MCL on U-238 is inviolable. Depleted uranium material would be disposed of as low-level radioactive waste. The disposal options assessed in the PEIS were defined on the basis of the chemical form of the uranium and the type of disposal facility. The following disposal options were considered: Disposal as U_3O_8. Depleted uranium could be disposed of as U_3O_8, either ungrouted (bulk) or grouted U_3O_8, following conversion. The disposal facilities considered included shallow earthen structures, below ground vaults, and an underground mine. Disposal as UO_2. Similar to U_3O_8, depleted uranium could be disposed of as UO_2 following conversion, either in ungrouted or grouted form. The disposal facilities considered were the same as those considered U_3O_8: shallow earthen structures, below ground vaults, and an underground mine.

<u>Response 3</u>

The proposed maximum contaminant level (MCL) for uranium was used as a guideline in the PEIS to estimate the potential for adverse environmental impacts to groundwater and surface water of the various alternatives. The potential impacts of the options listed in the comment (e.g., *disposal as grouted or ungrouted U_3O_8 or UO_2 in shallow earthen structures, below ground vaults, or a mine) were considered under the disposal alternative.*

Commentor No. 9: Lemar, Cathy / Goldtooth, Tom / Fahey, Dan
Military Toxics Project / Indigenous Environmental Network / Swords to Plowshares

Comment 1

We believe that all of the strategies that proposed have serious environmental justice concerns and potential impacts to communities that you have not adequately reached with the Draft PEIS. We also believe that the meetings that DOE has held in the past, as well as the ones that are beginning on February 19,1998 in Paducah, are not properly reaching people who are or may be impacted by decisions that your agency will be making regarding the long-term plan for use of this dangerous material.

Response 1

The approach used in the PEIS to assess environmental justice concerns is consistent with guidelines in "Environmental Justice: Guidance Under the National Environmental Policy Act" (Council on Environmental Quality 1997; the full citation is provided in Chapter 8 of the PEIS). The approach taken involved a two-step process to identify impacts associated with environmental justice (see Section 4.3.12 of the PEIS). The first step concerns the presence of disproportionately high percentages of low-income or minority populations in those areas anticipated to experience high and adverse impacts. The second step concerns the presence of high and adverse impacts in general, and thus affecting the total population. Section C.8 of the PEIS provides a detailed discussion of the methods used to identify and assess potential environmental justice impacts.

Because one must know the economic and racial composition of an area potentially affected in order to assess environmental justice impacts, the assessment must be site-specific. In the PEIS, the only alternative components for which locations are known are continued cylinder storage (Appendix D) and cylinder preparation (Appendix E). For these components, environmental justice issues were examined thoroughly (see Sections D.2.11 and E.3.11 which discuss environmental justice impacts). As discussed in these Sections, no high and adverse human health effects or environmental impacts would be expected from continued storage of cylinders or cylinder preparation activities at the Paducah, Portsmouth, and K-25 sites. Because of this general lack of high and adverse impacts, and because minority and low-income populations would not be more prone than the general population to experience impacts from the two site-specific activities, no environmental justice impacts are anticipated. With regard to the remaining four alternative components (that is, conversion, long-term storage, manufacture and use, and disposal), because their locations currently are unknown no environmental justice evaluation could be conducted in the PEIS. If in its Record of Decision for this PEIS DOE selects an approach to the management *of its depleted uranium inventory that involves any of these alternative components, possible sites will be identified and those sites evaluated in subsequent NEPA documents, as described in Section 1.4 of the PEIS. One component of those evaluations would be an assessment of environmental justice impacts.*

With regard to reaching people who are or may be affected by decisions on the management of the DOE depleted uranium inventory, the Department has made a substantial effort as part of the public outreach component of the PEIS to inform all interested parties of the document's preparation and various means of participating in the process of its preparation. DOE distributed PEIS documents and public hearing notices to about 2,400 individuals and organizations identified by the three current storage sites and through the DOE stakeholder mailing list as parties potentially interested in the PEIS. Those contacted included advisory boards, environmental groups, interest groups, local organizations, tribal organizations, and government representatives at the local, state, and federal levels. Publicity for the Draft PEIS and the four public hearings included Federal Register notices, newspaper display advertisements, site press releases and/or newsletters, public service radio announcements, postcard notices to local stakeholders, the Depleted UF_6 World Wide Web site (http://www.ead.anl.gov/uranium.html) and DOE's NEPA Web site (http://tis.eh.doe.gov/nepa). The entire PEIS is available for review on the Depleted UF_6 World Wide Web site. DOE believes all groups were provided adequate opportunity to comment on the Draft PEIS.

Comment 2

Keeping with the spirit and intent of President Clinton's Executive Order on Environmental Justice and Secretary Pena's Openness Initiative, we feel that it would be reasonable to request that the DOE initiate round table meetings, much like the Federal Facilities Restoration Dialogue meetings. We believe that it is necessary and just to bring in grassroots leaders from community, labor, and environmental justice groups to further discuss the implications of strategies that have been proposed.

Response 2

Openness and public outreach were important components of the process to prepare, distribute, and solicit comments on the Draft PEIS. DOE distributed PEIS documents and public hearing notices to about 2,400 stakeholders in December 1997. This distribution included many environmental groups, including environmental justice advocates. Public hearings were conducted in March and April 1998 in Paducah, Kentucky; Oak Ridge, Tennessee; Piketon, Ohio; and Washington, D.C. These hearings provided opportunities for community leaders, labor organizations, environmental groups, and other individuals and organizations to provide oral and written comments on the Draft PEIS and to discuss the Draft PEIS with representatives of DOE's depleted uranium hexafluoride management program. Publicity for the Draft PEIS and the public hearings included Federal Register notices, newspaper display advertisements, site press releases and/or newsletters, public service radio announcements, postcard notices to local stakeholders, the

Depleted UF_6 World Wide Web Site, and DOE's NEPA Web Site. DOE believes all groups were provided adequate opportunity to comment on the Draft PEIS during the 120-day comment period.

<u>Comment 3</u>

We further request that the comment period be extended to six months to give these folks the opportunity to meet with you, in addition to the hearings that are taken place now, as well as the opportunity to obtain expert technical advice regarding the impact of the various different strategies.

<u>Response 3</u>

DOE announced a 120-day public comment period upon publication of the Draft PEIS in December 1997. This comment period was much longer than the 45 days required by Council on Environmental Quality and DOE regulations implementing the National Environmental Policy Act. DOE believes this comment period was of sufficient duration to allow review of the Draft PEIS and submittal of comments by government agencies, potentially affected communities, and other individuals and organizations.

Commentor No. 10: Comment letter was submitted but since withdrawn

Commentor No. 11: Adkisson, Ron
Rio Algom Mining Corporation

<u>Comment 1</u>

One long-term alternative which has not been considered to date for long-term storage of the converted uranium (i.e., UO_2, U_3O_8, etc.) is the placement in a uranium mill tailings impoundment for long-term retrievable storage. Mill tailings impoundments are designed for 1,000 year stability and long-term care and maintenance is legally the responsibility of the Department of Energy. Quivira Mining Company's mill tailings site in New Mexico, for example, is presently licensed to dispose of 5,000,000 tons of byproduct materials even though the structural stability of the site was designed for an additional 43,000,000 tons. The primary advantages of using a mill tailings site are: (1) the inventory would be consolidated and isolated from the environment; (2) placement in a tailings impoundment would be relatively simple and with minimum personnel exposure; (3) it would remain in the custody of the US Government for long-term monitoring and care; and (4) it could be retrieved at any time in the future should the need arise.

<u>Response 1</u>

Uranium mill tailings are the residual wastes of milled ore that remain after uranium has been recovered. Uranium mill tailings are part of a broad category of radioactive wastes called by-product materials. The tailings contain about 0.004 to 0.01% U_3O_8.

Uranium mill tailings are to be disposed of in a tailings impoundment. This must have a cover designed to control radiological hazards for a minimum of 200 years. The Ambrosia Lake uranium mill tailings site operated by the Quivira Mining Company is authorized by the U.S. Nuclear Regulatory Commission to accept 11e.(2) material for disposal. The term "11e.(2)" material means by-product material produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. The basis for the definition of this group of by-product materials is Section 11e(2) of the Atomic Energy Act of 1954. Depleted uranium would not be classified as 11e.(2) material, and as such, could not be disposed of at the Ambrosia Lake uranium mill tailings site (or any other mill tailings site) without relicensing to allow emplacement of depleted uranium. It would be highly speculative within the PEIS to consider amendment of legislation such as the Atomic Energy Act of 1954 to allow disposition of depleted uranium within a mill tailings impoundment.

Commentor No. 12: Balding, Andrew

Comment 1

Appendix D, pg. 5, 1st Para: The assumption that any further breaches would be a result of handling damage vs. corrosion is very valid, however the follow on assumption that this breach or damage would go undetected for 4 years is not a valid assumption. The same detailed Inspection of a cylinder is required each and every time it is handled as it is Quadrennially or Annually, the Inspections in fact almost identical, the same procedures and checklists are used regardless of the type of inspection or frequency. Any damage that might occur under the current regimented and proceduralized handling activities whether during painting, cylinder relocation to improved storage, or just normal storage yard operations, would be immediately noted and dealt with at the occurrence. Therefore there would be no release and no "Environmental Impact" whatsoever, furthermore the one handling damage induced breach (the Paducah cracked cylinder) was caused by handling damage in 1987; since that time this Site has handled thousands of cylinders without breaching a cylinder due to handling damage, the current Project alone has handled over 30,000 cylinder relocations since 1992 without causing damage to a cylinder sufficient to cause a breach. The facts do not support the conclusions of the predicted number of cylinder breaches portrayed in the "No Action Alternative": the estimate of 444 at Paducah over the next 40 years with only one under old handling practices (even disregarding that those practices have been improved) is sensationalistic.

Response 1

The commentor seems to be referring to the text of the Introduction to Appendix D, paragraphs 9 through 11 (found on pages D-3 and D-4 of the Draft PEIS). With regard to the number of breaches estimated to occur during the period of operations, two separate analyses were conducted. The first analysis took credit for the improved management program, and specifically assumed that the painting program would eliminate breaches caused by corrosion. Under these assumptions, the assumed breaches would be the result of mechanical damage occurring during *handling. The number of breaches assumed to occur from handling damage through 2039 were 36 for the Paducah site, 16 for the Portsmouth site, and 7 for the K-25 site (as stated in the text). These assumptions are quite reasonable based on the large numbers of annual cylinder relocations and/or paintings assumed for the three sites; these assumptions were used as the base case for the assessment of continued storage impacts, as presented in detail in Sections D.2.1 through D.2.11 of Appendix D.*

Another reasonably foreseeable scenario for cylinder breaches would be the possibility that the painting program would not be effective in controlling further corrosion, or that the required painting schedule could not be maintained. In order to address this possible (but less likely) scenario, a second assessment based on the assumption that external corrosion was not halted by improved storage conditions and painting was also conducted. Based on these assumptions, the total numbers of breaches estimated through 2039 were 444 for the Paducah site, 74 for the Portsmouth site, and 213 for the K-25 site. The impacts based on these assumptions are presented in Section D.3 of Appendix D as a supplemental analysis.

With respect to the period of time before a breach would be detected (assumed to be 4 years), the PEIS analyses used a reasonable value based on available data. Since all of the cylinders must be inspected at least once every 4 years, this would be the maximum amount of time a breach could go undetected. This assumption was also used because data exist on how much of the cylinder content would be lost during that period of time; a breached cylinder at the Portsmouth site which had been in storage for 4 years prior to discovery of the breach was estimated to have lost 4 lb of uranium (see Section B.3 of Appendix B).

Commentor No. 13: Davis, Mary B., Ph.D.
Ygdrasil Institute

Comment 1

We are writing to you to request that you extend by six months the period for comment on the Draft Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride. The material in the draft is very technical and complex, and many people concerned with the management of the hexafluoride have only recently received copies of it.

Response 1

DOE announced a 120-day public comment period upon publication of the Draft PEIS in December 1997. This comment period was much longer than the 45 days required by Council on Environmental Quality and DOE regulations implementing the National Environmental Policy Act. PEIS documents and public hearing notices were widely distributed and were publicized in Federal Register notices, newspaper display advertisements, site press releases and/or newsletters, public *service radio announcements, postcard notices to local stakeholders, the Depleted UF_6 World Wide Web Site, and DOE's NEPA Web Site. DOE believes the 120-day comment period was of sufficient duration to allow review of the Draft PEIS and submittal of comments by government agencies, potentially affected communities, and other individuals and organizations.*

Comment 2

We should also like to recommend that people in the affected communities be invited to round table meetings like those for the Federal Facilities Restoration Dialogue. The affected communities should include those likely to be at risk if transportation of uranium hexafluoride on a large scale takes place.

Response 2

Openness and public outreach were important components of the process to prepare, distribute, and solicit comments on the Draft PEIS. DOE distributed PEIS documents and public hearing notices to about 2,400 stakeholders in December 1997. This distribution included the communities surrounding the current storage sites that could be affected if cylinders were to be transported from their current locations. Public hearings were conducted in March and April 1998 in Paducah, Kentucky; Oak Ridge, Tennessee; Piketon, Ohio; and Washington, D.C. These hearings provided opportunities for community leaders, labor organizations, environmental groups, and other individuals and organizations to provide oral and written comments on the Draft PEIS and to discuss the Draft PEIS with representatives of DOE's depleted uranium hexafluoride management program. Publicity for the Draft PEIS and the public hearings included Federal Register notices, newspaper display advertisements, site press releases and/or newsletters, public service radio announcements, postcard notices to local stakeholders, the Depleted UF_6 World Wide Web Site, and DOE's NEPA Web Site. DOE believes all groups were provided adequate opportunity to comment on the Draft PEIS during the 120-day comment period.

Commentor No. 14: Whitehead, Corinne
Coalition for Health Concern

Comment 1

We urge DOE to determine all leaking cylinders at PGDP. Transfer the contents of leaking cylinders into heavy gauge new containers. Store in an earthquake proof concrete structure off the floor so they can be monitored for leaks. No major efforts to transfer contents and wash out containers in a process to change to uranium oxide should be at the Paducah facility.

Response 1

An intensive effort is ongoing to improve yard storage conditions at all three cylinder storage sites. New storage yards with stabilized concrete bases and monitored drainage have been constructed at the Paducah and Portsmouth sites. Cylinders are being relocated to allow space for *adequate visual inspections; relocated cylinders are being placed on concrete saddles to keep them out of ground contact. Each site has an intensive cylinder inspection program to allow identification of any damaged or breached cylinders as well as a radiological program to detect leakage from valves. At the Paducah site, for example, approximately 23% of the cylinders are inspected annually. Annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of heavy pitting or corrosion. All other cylinders must be inspected once every four years. Through these efforts, 7 breached cylinders were identified at the three sites before 1998 (one at the Paducah site). An additional breached cylinder was identified at the K-25 site in 1998; see Appendix B, Section B.2 of the PEIS for further details on this cylinder breach. Due to the improved storage conditions and frequent inspections, any breached cylinders identified in the future are expected to be recently breached with little material loss. Breached cylinders are either patched or have the contents transferred to new cylinders to prevent further material loss. See the introduction to Appendix D of the PEIS for more details on the current cylinder management program.*

The proposed action of this PEIS is to select a long-term management strategy for the depleted UF_6 inventory. Options of storage in buildings, cylinder content transfer (including cylinder washing), and conversion to oxide or metal have been considered. The Department of Energy acknowledges the commentor's preference for storage as UF_6 in buildings, and the preference that cylinder content transfers and/or conversion should not take place at the Paducah facility. The selection of a long-term management strategy will be based on environmental analyses, technical and economic studies, national policy considerations, and public input. However, siting decisions are being deferred until after the selection of a long-term management strategy.

<u>Comment 2</u>

DOE has known details of severe seismic potential since the late 1970's and has taken little or no action to protect the workmen or the community. Negligence is not an "Act of God" if acute damage is done to the facility or the community during seismic events. We urge a comprehensive environmental impact study be made with full report to the public. We urge attention to damage and hazard reduction re: the earthquake potential utilizing national and international earthquake engineering and seismic scientists, who are respected in that field.

<u>Response 2</u>

The PEIS addresses the potential for seismic activity at each of the three storage sites in Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1. Of the three storage sites, an earthquake which could cause more than slight damage is considered credible (though highly unlikely) only for the Paducah site.

The analysis of accident scenarios for continued cylinder storage (Section D.2.2 of the PEIS) was based on the range of potential accident scenarios considered in the safety analysis reports (SARs) for each of the three storage sites (LMES 1997f-h; the full citations are provided in

Chapter 8 of the PEIS). The SARs were issued in February 1997 by the DOE's management and operating contractor, and were subsequently reviewed and approved by DOE in March 1997.

The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.

<u>Comment 3</u>

We deplore the use of depleted uranium in military equipment.

<u>Response 3</u>

The commentor's objection to the use of depleted uranium in military equipment is noted. DOE's PEIS for selecting a management strategy for its depleted UF_6 inventory does not establish policy or requirements for depleted uranium uses by the U.S. Department of Defense in munitions or other military equipment. As described in Section 2.2 and Appendix H of the PEIS, the two use options evaluated in the PEIS, use as depleted uranium oxide and use as depleted uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end use or preclude other potential uses in the future. If a use strategy is selected in the Record of Decision, specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks.

Commentor No. 15: Hamblin, L. Lee
Jacobs Engineering Group, Inc.

<u>Comment 1</u>

Page S-1; Para. 2; Sent.4 and Page S-4; Sect. S.1.2; Sent.2: Text states: "Additional NEPA analyses, as appropriate, will be prepared once a long-term management strategy has been selected ....This PEIS examines the environmental consequences of alternative strategies of long term storage, use, and disposal of the depleted UF_6 inventory." This document does not appear to analyze completely the use and disposal of the depleted UF_6 inventory when it defers the analysis of future siting, design, and construction to possible separate NEPA analyses (as appropriate) in the future when, in effect, they appear to be "connected actions" and/or "cumulative actions" and should be evaluated thoroughly in this PEIS.

<u>Response 1</u>

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2 of the PEIS). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities is included in the PEIS. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site-specific evaluations will be performed, including the effects of site-specific projects and range of alternative actions, including a "no action" alternative.

NEPA and its implementing regulations do not require site-specific evaluations when specific projects are not being proposed. Under the CEQ regulations, it states that major federal actions tend to fall into one of the following categories: (1) adoption of official policy, such as rules, regulations and interpretations; treaties; formal documents establishing an agency's policies which alter agency programs; (2) adoption of formal plans, such as official documents prepared or approved by federal agencies which guide or prescribe alternative uses of federal resources, and upon which future agency actions will be based; (3) adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources; and (4) adoption of specific projects, such as construction or management activities located in a defined geographic area. This PEIS evaluates the adoption of a formal guidance upon which future DOE actions will be based (item 2 above).

The Council on Environmental Quality (40 CFR, part 1508.25(a)(1)(I-iii)) defines "connected actions" as those which:

- *"automatically trigger other actions which may require environmental impact statements."*
- *"cannot or will not proceed unless other actions are taken previously or simultaneously."*
- *"are interdependent parts of a larger action and depend on the larger action for their justification."*

This PEIS focuses on the selection of a strategy for the long-term management of depleted UF_6. The action of selecting a management strategy for depleted UF_6 does not automatically trigger (that is, guarantee the selection of) any particular strategy, such as a specific use or disposal.

Similarly, although the selection of some particular approach for the long-term management of depleted UF_6 (including use or disposal) will be based partially on the results of this PEIS, that selected management strategy and its specific implementation do not rely on some other, previous action. Finally, the selection of a particular strategy for long-term management and the implementation of that strategy are not parts of a larger action. Thus, the action in this PEIS and the action of implementing a specific long-term management strategy for depleted UF_6 are not connected actions.

The Council on Environmental Quality (40 CFR, part 1508.25(a)(2)) defines "cumulative actions" as "actions which, when viewed with other proposed actions, have cumulatively significant impacts and should therefore be discussed in the same environmental impact statement." As noted above, this PEIS focuses on the selection of a strategy for the long-term management of depleted UF_6. As such, it estimates the potential environmental impacts associated with each alternative strategy. Following selection of a management strategy, a decision will be made to implement that strategy at a particular location. That implementation, rather than a cumulative action when associated with the selection of a management strategy, is a more specific action which will follow the decision on a depleted UF_6 management strategy supported by the present PEIS.

Based on the considerations given above, cumulative impacts were evaluated only for components of the alternatives for which the locations of the proposed actions were already known. These components were continued cylinder storage and cylinder preparation for shipment, which were individually evaluated for each of the three current storage sites. The cumulative impacts of these components are described in Section 5.8 of the PEIS.

Comment 2

Page S-42; Sect. S.4.13; Sent.1: Text states: "All depleted UF_6 management alternatives would result in environmental impacts that, even when combined with other activities that could occur at the three current storage sites, would be expected to be relatively minor." This statement does not adequately address cumulative impacts from all alternatives considered in this Draft PEIS. This statement conflicts with the statement on page 4-27 that states: "The cumulative impact analysis was conducted by examining those impacts resulting from depleted UF_6 management activities that would occur at the three current storage sites (Paducah, Portsmouth, and K-25). The impacts from these activities- including continued cylinder storage and cylinder preparation- were then added to the impacts of other past, present, and reasonable foreseeable future actions at these sites to assess potential cumulative UF_6 impacts." What past, present, and reasonable foreseeable future actions at these sites (specifically) were assessed, and where is the methodology discussing such assessment?

Response 2

The methods used to estimate cumulative impacts, the issue areas examined, and the results of the cumulative impact analyses are presented in Sections 5.8 and 6.3.8 of the PEIS. For all three current storage sites for depleted UF_6, the impacts of past and existing operations were determined *using data from Annual Site Environmental Reports, assorted sources on environmental restoration activities, and pertinent recent NEPA documents — with both the activities causing impacts and the sources of information cited in Tables 5.12 (Paducah site), 5.13 (Portsmouth site), and 5.14 (K-25 site). The impacts of continued cylinder storage and cylinder preparation options were obtained from PEIS analyses (see Appendices D and E). Reasonably foreseeable future actions varied among sites and are listed under footnote "a" for each of Tables 5.12, 5.13, and 5.14.*

The text referenced from Section 4.3.13 in the comment has been changed to clarify that the site locations are only currently known for continued cylinder storage and cylinder preparation components of the alternative management strategies. Section S.4.13 in the PEIS has also been changed to make it clearer.

Further cumulative impacts analyses would be performed as required by NEPA and DOE regulations for any technology or siting proposals. The results of the analyses would be presented in the site-specific documents.

Comment 3

Page 3-12; Sect. 3.3.6.3; Sent.1: Text states: "No wetlands were identified on the Paducah site by the National Wetlands Inventory (ANL 1991a)." This may be a true statement; however, jurisdictional wetlands were delineated by a wetlands survey performed in 1995 and confirmed by the U.S. Army Corps of Engineers in 1996 in some of the drainage ditches on the Paducah site. So the text stated above may be true, but it is inaccurate as far as the current wetland scenario on the Paducah site. Is it possible old information has been quoted?

Response 3

The text of Section 3.1.6.3 has been changed to reflect the jurisdictional status of the drainage ditches. The appropriate references have been added to the PEIS reference list.

Comment 4

General: Cumulative impacts are not analyzed thoroughly throughout this document. The storage and management scenarios are well known and scoped; however, the unknowns (siting, design, and construction) are described in enough detail (with enough siting criteria described) to narrow the likely locations at which of these facilities possibly will be sited and constructed to be evaluated for cumulative impacts in this document. These "Phase II actions" appear to be "connected actions" and should be analyzed in this PEIS. Phase II is described as "implementation of the strategy selected." (Page S-5, 1st paragraph, 1st sentence). It would be difficult to implement efficiently a strategy of this magnitude that has "connected actions" that are not fully described, planned, and evaluated in this document.

Response 4

Cumulative impacts are analyzed as thoroughly as possible in this PEIS, which is programmatic in focus and designed solely to support the selection of a strategy for the long-term management of depleted UF_6. The only activities associated with the management alternatives considered in this document which have certain known locations are continued storage and cylinder preparation for transportation, which would occur at the three current storage sites; these activities are considered in the calculation of cumulative impacts. The locations of long-term storage, conversion, and disposal activities, in contrast, ultimately could occur at many locations, both government-owned and privately-owned, several of which could not even be speculated on at the time of PEIS preparation given the absence of key information. The PEIS evaluates the cumulative impacts of those activities for which adequate site-specific information is available to support their analysis. Out of necessity, for the purpose of evaluating cumulative impacts the PEIS defers the analysis of activities where locations are unknown — although it estimates their impacts at representative locations to enable a complete assessment of all proposed depleted UF_6 management alternatives (see Sections 2.1 and 2.2 of the PEIS).

The methods, assumptions, and results of examining cumulative impacts appear in Section 5.8 of the PEIS. The use of a two-phased approach to NEPA evaluation is consistent with the Depleted UF_6 Management Program, which also involves two phases (see Section 1.4 of the PEIS). It also is consistent with a "tiered" approach to NEPA analysis, where more general or programmatic issues are evaluated in support of general decisions, and more specific issues are evaluated subsequently once the general choices have been implemented. In the present context, a depleted UF_6 management strategy will be chosen to provide both a sense of direction for the DOE program and a basis for coordination of future decisions related to the future of depleted uranium at the three sites.

Although Phases I and II are related to one another, they are not "connected." The Council on Environmental Quality (40 CFR, part 1508.25(a)(1)(I-iii)) defines "connected actions" as those which:

- *"automatically trigger other actions which may require environmental impact statements."*
- *"cannot or will not proceed unless other actions are taken previously or simultaneously."*
- *"are interdependent parts of a larger action and depend on the larger action for their justification."*

This PEIS focuses on the selection of a strategy for the long-term management of depleted UF_6. The action of selecting a management strategy for depleted UF_6 does not automatically trigger (that is, guarantee the selection of) any particular strategy, such as a specific use or disposal. Similarly, although the selection of some particular approach for the long-term management of depleted UF_6 (including use or disposal) will be based partially on the results of this PEIS, that selected management strategy and its specific implementation do not rely on some other, *previous action. Finally, the selection of a particular strategy for long-term management and the implementation of that strategy are not parts of a larger action. Thus, the action in this PEIS and the action of implementing a specific long-term management strategy for depleted UF_6 are not connected actions.*

Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site- and technology-specific evaluations will be performed, including the effects of site-specific projects and a range of alternative actions, including a "no action" alternative. These subsequent evaluations will include a more complete assessment of cumulative impacts, which will be possible at that time by virtue of the assessment of specific sites.

Comment 5

Pages 5-2, 5-18, 5-55, 5-66, 5-78, and 5-94: No cumulative impacts discussions were included for each of these alternative discussions even though Figure 4.1 on page 4-7 shows "Areas of Potential Impact Evaluated in the PEIS for Each Alternative." The "Cumulative Impacts" box appears in the center at the bottom of this figure.

Response 5

The PEIS text cited in the comment accurately states that cumulative impacts were not assessed for those activities whose locations were not known. Cumulative impacts were assessed only for activities (continued storage and cylinder preparation for transportation) certain to occur at the three current storage sites for depleted UF_6 (see Section 5.8 of the PEIS). Figure 4.1, on page 4-7, has been modified to convey more accurately the areas of potential impact examined in the PEIS by noting that certain issues were not evaluated for activities with unknown locations.

Comment 6

Page 5-104, Sect. 5.8, Sent. 4: Text states: "No non-DOE actions have been identified that would have potential cumulative impacts at the three sites." How was this conclusion reached? What "non-DOE" entities were contacted and what past, present, and reasonably foreseeable actions were analyzed that considered these "non-DOE" entities' actions? Were local governments, municipalities, regional planning agencies, federal agencies, state agencies, local industries, and other non-DOE entities directly communicated with in this PEIS? Are they referenced in this document?

Response 6

The issue of ongoing and reasonably foreseeable actions of other, non-DOE agencies has been reexamined. This reexamination yielded four non-DOE activities to consider under cumulative impacts. Three of these are associated with the Paducah site: continued operation of the Tennessee Valley Authority's Shawnee Power Plant, slightly north of the site; continued operation of the Joppa Power Plant, northwest of the site; and continued operation of the Allied Signal, Inc. UF_6 conversion facility, northeast of the site. The fourth non-DOE activity involves the K-25 site, parts of which

DOE is leasing out for use by multiple private industries. Impacts of all of these activities have been added, as appropriate, to the cumulative impacts at the sites, as discussed in Section 5.8 of the PEIS and noted in Tables 5.12 and 5.14.

With regard to methods used to identify cumulative impacts, a two-step approach was employed to discover both DOE and non-DOE actions that could contribute to the impacts at the three depleted UF_6 storage sites. The first step was to contact management staff at each site specifically to ask about any other activities in the area that might affect the site. Because management staff is very familiar with the area surrounding their respective facilities, this inquiry served to identify issues requiring further examination. The second step was to contact, as appropriate, organizations knowledgeable about the activities identified in the first step, largely to locate documents that might contain pertinent information about other impacts to consider. Those documents are referenced in the PEIS (see Tables 5.12, 5.13, and 5.14).

The two-step process described above augmented the public participation process associated with the preparation of the PEIS, most notably public scoping. This part of the NEPA process involved the notification of local, state, and government officials, local businesses, industries, environmental groups, interest groups, tribal organizations, the media, and interested individuals about the PEIS and the action being investigated, inviting their input on the document through a variety of mechanisms. Experience has shown that due to the broad focus of public scoping within the NEPA process, and the broad audience targeted, pertinent other activities that might affect the action being considered tend to be identified during the scoping period.

Comment 7

Appendix E; Page E-72; Sect. E.3.12; Bullet 2; Appendix J; Page J-39; Sect. J.3.8; Para. 1; Last sent.: Text states: "The impacts would be negligible." What methodology and analysis deem these impacts to be "negligible?" Where is a cumulative impacts analysis performed to make this decision?

No cumulative impacts analysis were seen for these determinations. These actions should be analyzed in this document, not in "connected actions" via a later NEPA document.

Response 7

The text of the PEIS was modified to more accurately describe impact areas considered but not analyzed in detail. The text in Section E.3.12 was modified by deleting reference to threatened and endangered species and wetlands — these impact areas were in fact evaluated in detail in Appendix E of the PEIS. In addition, the statement that "impacts would be negligible" has been deleted; the second bullet in Section E.3.12 now reads "Impacts to the visual environment, recreational resources, and noise levels would be expected to stay the same as they are because cylinder preparation activities would be similar to the cylinder management activities currently ongoing at the three sites." No cumulative impact analyses were conducted for impacts to ecological *and cultural resources, visual environment, recreational resources, and noise levels, because impacts from both continued cylinder storage and cylinder preparation would be expected to be the same as impacts in these areas from ongoing cylinder management activities (i.e., not add to current impacts) ; thus, these were not considered to be major cumulative impact issues.*

<u>Comment 8</u>

Appendix F; Page F-72; Sect. F.3.10; Para. 1; Last sent.; Appendix G, H, I, J; Page G-63; H-34; I-72; J-39; Sect. G.3.10, H.3.10, I.3.10, J.3.8; Para 1; Last Sentence: Text states: "These impacts, although considered, were not analyzed in detail for one or more of the following reasons . . ." How can the "impacts would be negligible" be an accurate statement if the impacts were not analyzed in detail? Were these impacts analyzed for cumulative impacts? If so, where? How is the public going to connect effectively these actions back to this PEIS when the identification and technology analyses for siting, design, and construction are going to be performed in distinctly separate NEPA documents that will be generated at some undefined future dates? Also consider the rationale for the 1st and 2nd bullets.

<u>Response 8</u>

The PEIS is intended to provide an analysis of the potential environmental impacts of broad, programmatic strategies. The Record of Decision for the PEIS will announce the selection of a management strategy, after which DOE will evaluate potential facility sites and specific technologies. The sections referred to by the commentor address inherently site-specific areas of impact (e.g., cultural resources, environmental justice, visual environment, recreational resources, and noise levels) for conversion (Appendix F), long-term storage (Appendix G), manufacture and use (Appendix H), disposal (Appendix I), and transportation (Appendix J) options. For these options, the potential impacts were evaluated in the PEIS for representative or generic environmental settings (see Sections 3.4 and 4.2) because their future locations are currently unknown. The areas of impact listed were not evaluated in detail in the PEIS for these options because (1) they could not be meaningfully determined at a programmatic level without consideration of specific sites and (2) consideration of these impacts were not expected to differentiate between broad programmatic strategies. The phrase "the impacts would be negligible" has been deleted from each of the referenced sections. Site-specific areas of impact would be addressed after the overall management strategy has been selected, as documented in the Record of Decision for this PEIS.

<u>Comment 9</u>

How were the magnitude and significance of cumulative effects determined for the proposed action? What methodology was used to make this determination? Will it be included in an appendix for public review and or comments? What other methods were used to analyze cumulative effects?

<u>*Response 9*</u>

The methods used to assess cumulative impacts, including determining their magnitude and significance, are described in Section 5.8 of the PEIS and thus are available for public review and comment. Cumulative impacts were assessed only for continued cylinder storage and cylinder preparation for shipment, those activities which will occur at known locations (the three current depleted UF_6 storage sites). Both of these activities are components of all alternative depleted UF_6 management strategies except the No Action Alternative, which includes no cylinder preparation; thus they both are components of the proposed action. The cumulative impacts of conversion, long-term storage, and disposal activities could not be estimated in the PEIS because specific sites and technologies have not been designated for these components of alternative depleted UF_6 management strategies. As a result, the cumulative impacts of all activities in the proposed action could not be estimated in this PEIS. The calculation of cumulative impacts for all activities composing the management strategy ultimately selected will occur, as required, once that selection takes place and specific sites and technologies are identified.

<u>Comment 10</u>

Do the cumulative effects of any of the alternatives and the proposed plan exceed the carrying capacity of any resources, ecosystems, or human communities?

<u>*Response 10*</u>

Assessment of the cumulative effects for the site-specific portions of the management strategies did not identify any impacts which would threaten the carrying capacity of the environment at the three storage sites. The management strategies would result in only small incremental impacts to past, present and future impacts at the three current storage sites.

<u>Comment 11</u>

Throughout the PEIS, at the Paducah site, Bayou Creek is referenced as "Big Bayou Creek." This is in error, as the 1978 topographic map for Heath, KY shows the creek as Bayou Creek, not Big Bayou Creek.

<u>*Response 11*</u>

Although the Heath, KY topographic map (1978) identifies the creek as Bayou Creek, site documents for Paducah (e.g., the Annual Site Environmental Report for 1993 — Martin Marietta Energy Systems, Inc., 1994, Figure 4.1) identify the creek as Big Bayou Creek. In order to maintain consistency with this and other site documents for Paducah, the creek will continue to be referred to as Big Bayou Creek.

<u>Comment 12</u>

Is there any correlation between this PEIS and the "Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent

Nuclear Fuel," DOE/EIS-0251, Nov., 1996, specifically with concern to interim consolidated storage of spent nuclear material at some location such as Yucca Mountain or another site?

Response 12

The PEIS and the "Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel," (DOE/EIS-0251) are potentially indirectly related. The Record of Decision on the Navy container system EIS, published in December 1996, specifies that the Navy will use a dual-purpose canister system for the dry storage, transportation, and possibly disposal of naval spent nuclear fuel. It is possible that depleted uranium could be considered as a shielding material for such a dual-purpose canister system, similar to the representative shielding options considered in the use as oxide and use as metal alternatives in the PEIS.

Comment 13

The preferred alternative is not one of the alternatives described and compared in the body of this PEIS but is a combination of alternatives 4 and 5. Why wasn't there another alternative (say #7) that described and compared the use of the entire UF_6 inventory as the preferred alternative? It seems a little difficult to the reader to see that the preferred alternative isn't one of the described and compared alternatives in the body of the PEIS. In combining alternatives 4 and 5, were additive, countervailing, and synergistic effects evaluated? If so, where is this covered in the PEIS?

Response 13

The preferred alternative is described in Section 2.5.1 and in Section 5.7 of the PEIS. DOE's preferred alternative is to begin conversion of the depleted UF_6 inventory as soon as possible, either to uranium oxide, uranium metal, or a combination of both, while allowing for use of as much of this inventory as possible. The discussion of the preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. Thus, the impacts of the preferred alternative may be the same as those presented for the use as oxide alternative (alternative 4) or the use as metal alternative (alternative 5), and may also include impacts from the storage of uranium oxide (see Sections 2.5 and 5.7 of the PEIS). The preferred alternative was not described as a distinct, separate alternative because it will, in practice, combine elements from several of the six alternatives evaluated.

The methods used to combine impacts for the preferred alternative are described in Section 5.7 and Appendix K, Section K.7. Impacts were combined according to the nature of the impact, assuming that facilities for conversion, storage, and manufacturing would be located at separate sites. (The assumption that facilities were located at separate sites was a fundamental *assumption in the PEIS and was intended to provide conservative estimates of impact for two reasons: (1) transportation would be required between facilities and (2) independent facilities would generally require greater amounts of land and resources compared to combined or co-located facilities.) Certain impacts, such as radiological impacts to workers and members of the public, were assumed to be additive. Other impacts, such as the maximum consequences of accidents, are not additive and depend only on the presence of specific facilities. Potential impacts to ecological, water, and air resources are location-specific and were thus discussed separately for each facility required (because facilities were assumed to be located at separate sites). Synergistic or countervailing effects would be unlikely when conversion, storage, and manufacturing are assumed to occur at separate sites. If, however, more than one of the three facilities were to operate at a single site, the occurrence of synergistic or countervailing effects would depend on the site layout and specific site characteristics. Because siting proposals will not be developed until after the Record of Decision, potential site characteristics are highly speculative and uncertain. Thus, the analysis of combined effects of multiple facility operations were considered to be additive.*

Comment 14

Pages 5-109, 5-111, 5-113; Tables 5.12, 5.13, and 5.14: Tables are titled "Maximum Cumulative Impacts of Depleted UF_6 Activities, Existing Operations, and Other Reasonably Foreseeable Future Action at the . . ." The reader does not agree that these tables should be titled "Maximum Cumulative Impacts . . ." because cumulative impacts have not been analyzed in detail and appear to be based on a limited cumulative impacts methodology and evaluation. In addition, the "Impact Categories" are incomplete and do not include other potential impact areas.

Response 14

Cumulative impacts were assessed for those activities certain to occur at known locations, namely the three current depleted UF_6 storage sites. As discussed in Section 5.8, cumulative impacts included continued cylinder storage for some period for all alternatives, and cylinder preparation for shipment for all alternatives except the No Action Alternative. Where possible, the analyses were conservative, that is, they tended to overestimate cumulative impacts. For example, other existing or planned actions at each site were assumed to occur during the period of depleted UF_6 cylinder management operations, and to be collocated with cylinder management facilities to the extent that they affect the same off-site population and maximally exposed individual. Also, some of the impacts estimated for existing operations also are associated with the cylinder management activities assessed under Continued Storage in the PEIS; no adjustment was made for this overlap. In this sense, the cumulative impacts presented in Tables 5.12, 5.13, and 5.14 were maximum impacts, accounting for their "Maximum Cumulative Impacts ..." titles. However, because certain other activities whose locations presently are unknown ultimately may occur at the current storage sites once siting decisions are made, it is possible that cumulative impacts ultimately could be greater than presently estimated. To account for this possibility, the word "maximum" has been deleted from the titles of these three tables and from related text locations.

The cumulative impacts estimated in the PEIS cover a thorough list of key issues under continued storage and cylinder preparation. The issues included in the cumulative impact analysis are those affecting the Paducah, Portsmouth, and K-25 sites felt most likely to contribute to the selection of a long-term strategy for the management of depleted UF_6. Other potential site-specific issues contributing to cumulative impacts may be addressed in the future once locations and technologies are proposed for the depleted UF_6 management strategy selected in the Record of Decision for this PEIS.

Comment 15

Has this action been correlated with the Vortec Vitrification proposed action for the Paducah Site?

Response 15

The DOE Paducah Site is proposing to apply the Vortec Cyclone Melting System technology to vitrify hazardous wastes, such as soils and sludges. This proposal has been added to the cumulative impacts analysis in the PEIS in Section 5.8.2.1.

Commentor No. 16: Anonymous
Paducah Cylinder Handler

Comment 1

Use cylinder drop test results, crash tests and make it public to reassure the public. Put it in the PEIS. Do PR and capitalize on it. We've dropped full cylinders at Paducah from the P&H crane. Use data to show nothing bad will happen.

Response 1

The cylinders, as manufactured, qualify as Department of Transportation, Type A containers which means they have complied with all design criteria and testing for Type A packages, which includes a drop test. This qualification does not originate from the Department of Energy but from other agencies and standards committees.

In the past the Department and its operating and managing contractors performed drop tests when designing cylinder packages. The results of these drop tests, along with other data from the cylinder management program, were used to develop the release quantities for accident scenarios involving cylinder drops or spills (these amounts are given in the Facility Accident sections of the appendices addressing handling of UF_6 — Appendices D, E, F, and G). Discussion of the development of these release quantities is provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS).

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 2

Put on second skin for breaches-send to Paducah and feed out.

Response 2

The commentor's preference for placement of breached cylinders in overcontainers for transfer to the Paducah Gaseous Diffusion Plant to be emptied is noted.

Commentor No. 17: Robison, William A.
U.S. Fish & Wildlife Service

Comment 1

We have no comments at this time, but will remain involved in the public scoping process.

Response 1

Comment noted.

Commentor No. 18: Janaskie, Mark

Comment 1

Is there any consideration by DOE to measure the corrosion rate, and if it turns out that the corrosion rate is slow or benign, is there a chance that DOE will do no coating and simply wait until the date for beginning conversions (2006+)? If the corrosion rate is slow, could DOE consider the risk to cylinders low, and thus simply wait until conversion begins. Is this one of DOE's current options?

Response 1

External corrosion studies on the surface of the cylinders have been ongoing for several years. The rate of corrosion has been estimated from ultrasonic thickness testing data and modeled across the cylinder population. The cylinders that are believed to be the cylinders experiencing the greatest loss of wall thickness are being recoated first. This activity has already begun and will continue until the corrosion has been arrested with 1200 cylinders being recoated in 1997 and 1600 scheduled for 1998. DOE is committed to maintaining safe storage of the cylinders and the recoating program is an integral part of that commitment.

Commentor No. 19: Parrott, Robert C.

<u>Comment 1</u>

1) What does DOE plan to do with the cylinders after conversion occurs? Disposal as waste or decon and sale as scrap or re-use?

<u>*Response 1*</u>

As stated in section F.2 of the PEIS, it was assumed in the PEIS that the cylinders after conversion would be washed with water to remove any residual uranium, and that the treated cylinders with a very low residual radiation level would become part of the Department of Energy scrap metal inventory. Options for the final disposition of the empty cylinders are discussed in the document titled "Analysis of Options for Disposition of Empty Depleted UF_6 Cylinders," authored by Nieves et al. (1997).

The above-cited report by Nieves et al. analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial), and free release. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 2</u>

2) Does DOE have a credible technology to convert the DUF_6? Is it realistic that DOE can convert the material by 2028?

<u>*Response 2*</u>

Technologies currently exist to convert UF_6 into uranium oxides such as U_3O_8 and UO_2. One example is the defluorination process outlined in Section F.2.1 of the PEIS, in which UF_6 is reacted to form U_3O_8 and HF, which is currently practiced by COGEMA in France to convert their UF_6 into U_3O_8. Another example is the batch metallothermic reduction outlined in Section F.2.3 of the PEIS in which UF_6 is reacted with both hydrogen and magnesium metal to produce uranium metal; this process has been used in large-scale applications since the 1950s.

The time period for UF_6 conversion assumes 10 years for siting, design, and construction of any required new facilities, and 20 years for operations. These assumptions are based on experience with similar facilities in the past and are considered to be reasonable for the purposes of analyses in the PEIS; they do not represent a definitive schedule. With the additional consideration of up to 15,000 USEC-generated cylinders in the Final PEIS, the estimated period for *operations has been extended to 26 years. Therefore, for the purposes of analysis, it is assumed that conversion would continue through the year 2034. However, it can be done sooner depending on the number of conversion facilities constructed, the technology chosen for conversion, and the size of the conversion facility or facilities.*

Comment 3

3) The current painting program seems inadequate to control corrosion. Does DOE plan to increase the rate of coating?

Response 3

DOE continues to evaluate the effects of external corrosion as well as the performance of the coating applied to cylinders during the current painting program. Any increase in rate will be determined by technical evaluation as more data are gathered.

Comment 4

4) How will DOE decide whether to transport cylinders in overpacks or transfer the contents to new cylinders?

Response 4

The decision as to whether cylinders would be transported in overpacks or the contents transferred to new cylinders would depend on a number of future considerations. The Record of Decision for the PEIS will specify a management strategy for the depleted UF_6 inventory. After the Record of Decision, additional planning and environmental analyses would be conducted as appropriate to select specific technologies and sites to implement the management strategy. If a site or sites were selected that required transportation of cylinders from the current storage locations, DOE would consider (1) the number of cylinders requiring transportation, (2) the number of cylinders that were in substandard condition, (3) whether the cylinders were being transported for purposes of storage or conversion, (4) the costs and impacts associated with the use of overpacks or cylinder transfer, and (5) regulatory and other considerations.

Commentor No. 20: Radcliffe, Donald W.
Nuclear Fuel Consultant

Comment 1

The cost of enrichment services is much lower and thus the viability of refeeding the DUF_6 at higher assays is much improved at some locations outside the U.S. The PEIS should address the issues of overseas shipping and disposal.

<u>*Response 1*</u>

As noted in Section 2.3.2 (Use) of the PEIS, the quantity of depleted UF_6 that would still require management after reenrichment would be essentially the same as it is now. Thus, options for the management of the depleted uranium remaining after reenrichment would still require resolution. The advantage of reenrichment is that it would conserve natural uranium resources. The long-term storage alternatives analyzed in the PEIS would preserve the option for future development of a more efficient enrichment technology.

Overseas disposal of UF_6 does not appear to be an option. Disposal of UF_6 is currently not practiced, due to its reactive form. Conversion of UF_6 into a less reactive chemical form (such as UO_2 or U_3O_8) would be required for disposal purposes.

Commentor No. 21: Taylor, Willie R.
U.S. Department of the Interior

<u>Comment 1</u>

The Paducah site's proximity to the Reelfoot Rift and the New Madrid fault zones would seem to indicate that an earthquake caused accident could be considerably greater at Paducah than at either the Portsmouth site or the Oak Ridge site. This area has experienced seismic activity within the last two to three months. This should be factored into the analysis.

<u>*Response 1*</u>

The PEIS addresses the potential for seismic activity at each of the three storage sites in Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1. Of the three storage sites, an earthquake which could cause more than slight damage is considered credible (though highly unlikely) only for the Paducah site.

The analysis of accident scenarios for continued cylinder storage (Section D.2.2 of the PEIS) was based on the range of potential accident scenarios considered in the safety analysis reports (SARs) for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs were issued in February 1997 by the DOE's management and operating contractor, and were subsequently reviewed and approved by DOE in March 1997.

The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of *the PEIS has been modified to clarify this point. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.*

Comment 2

S.1.3 Under Proposed action-Contaminants leaking into groundwater may not be detected for several hundred years. The rate of movement of contaminants in groundwater is variable. Because of the long period of time during which the radiation would still be potentially harmful, monitoring of ground-water contamination should continue as long as a risk exists and should cover a large enough area to capture the full geographic extent of possible contamination. The McNairy-Nacatoch aquifer is a very important source of drinking and domestic water for a number of towns in Missouri and Arkansas. Monitoring should be extensive enough to capture any incidence of contamination in these important water sources following a contamination event.

Response 2

In the event of a failure that produced groundwater contamination, it would be critical to monitor groundwater in locations as close to the source as possible in order to provide timely information for remediation. As discussed in the PEIS, groundwater is measured at the Paducah site (the nearest site that would affect groundwater aquifers in Missouri and Arkansas)in more than 200 monitoring wells, residential wells, and Tennessee Valley Authority wells (Section 3.1.5.2). It is very likely that any contamination from a failure would be detected by this monitoring well network. Monitoring would continue as long as necessary.

In addition, the direction of groundwater flow in the vicinity of the Paducah site is toward nearby surface waters such as Big Bayou Creek, Little Bayou Creek, and the Ohio River. Because shallow groundwater from beneath the Paducah site discharges to these surface waters, it is very unlikely that contamination would affect groundwater quality in the McNairy-Nacatoch aquifer in Missouri and Arkansas on the opposite side of the Ohio and Mississippi Rivers.

PEIS analyses for the no-action alternative and disposal alternative included long-term impacts from potential groundwater contamination. Text indicating that these analyses were conducted has been added to Section S.1.3 as well as to Sections 1.3 and 4.1

Comment 3

S.4.5- It is important to note that the Paducah site should be considered a "wet site." A disposal facility failure in this wet environment would impact the ground-water system with uranium concentrations in groundwater greater than 20 mg/L within 1,000 years after the failure.

Response 3

As discussed in the PEIS (Sections 2.4.5, 5.6.4.2.2, and Appendix I, Section I.4.2) and Tomasko (1997; the full citation is provided in Appendix I of the PEIS), uranium concentrations in groundwater would exceed the proposed guideline of 20 µg/L within 1,000 years after a failure of a disposal facility in a wet environment. (Note: The guideline used is 20 µg/L, not 20 mg/L as stated by the commentor). As noted by the commentor, the Paducah site can be considered as "wet," and a disposal facility failure in this area would produce uranium concentrations in groundwater *that would exceed the proposed guideline. It should be noted; however, that the disposal analysis was based on characteristics of generic wet and dry sites. Specific sites (including the Paducah site) were not considered for the disposal options.*

Comment 4

The Paducah site is also vulnerable to changes in the biological and chemical composition of surface water caused by ground-water discharges into surface water streams. If contamination from such a discharge were to occur, it could affect the ecological stability of the surface water environment.

Response 4

For continued storage at Paducah (Appendix D, Sections D.2.4.1 and D.2.4.2), two scenarios were evaluated: direct discharge to surface water, and direct discharge to groundwater. As noted in the comment, no discussion was provided on the effects of contaminated groundwater discharging to surface water. This potential pathway was omitted because direct discharge of runoff from the yards to surface water bounds the calculation for surface water quality at the site. That is, direct discharge of contaminated runoff water to Little Bayou Creek would produce much higher concentrations in the creek than discharge from groundwater because of higher initial concentrations in the runoff water and greater dilution for the groundwater flux.

Comment 5

There is not sufficient information presented in the PEIS to permit an analysis or assessment of the validity of the models; therefore, we cannot confirm that the worst-case accident or other scenarios are reasonable assumptions.

Response 5

The assessment methods used in the PEIS are described in Chapter 4 and in Appendix C for each technical discipline. Additional information, including detailed assessment results, is provided in a series of backup reports that are cited throughout the PEIS. Specifically, supporting information for the various technical disciplines are presented in: Cheng et al. (1997) for the assessment of human health impacts during normal operations; Policastro et al. (1997) for the assessment of accident impacts; Tschanz (1997) for the assessment of air impacts; Tomasko (1997a, 1997b) for the assessment of water impacts; Biwer et al. (1997) for the assessment of transportation impacts; and Allison (1997) for the assessment of socioeconomic impacts. (See PEIS Appendix C for complete citations.) The intent of this presentation was to provide sufficient information in the PEIS to establish the applicability of the methods and assumptions, with detailed information provided in the supporting reports. The supporting reports are available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 6

Most of the strategies for disposing of the inventory or uranium would require construction of processing plants to convert UF_6 to other chemical forms, however, locations of these plants are not identified. The use of generic data for the proposed plant seems to be a weak link in the analysis because of the uncertainty about site location and lack of specific data. Therefore, we cannot confirm the validity of the potential environmental impacts that might be caused by this conversion process.

Response 6

The purpose of the PEIS is to provide an analysis of broad, programmatic alternatives. Consequently, the impacts of some management activities were evaluated using generic or representative environmental settings (see Section 4.2.3 of the PEIS). The characteristics of these settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the alternatives. In many cases, a range of environmental conditions, such as different population densities, precipitation rates, and soil characteristics, were considered in the assessment of impacts in order to address uncertainties related to future site locations. After the Record of Decision for the PEIS, potential facility locations would be evaluated and appropriate site-specific analyses would be conducted for any facilities required to implement the selected management strategy.

Comment 7

The units for measuring contaminant concentrations are reported differently in different parts of the document (e.g., mg/g, µg/mg, etc.) The same is true of hydraulic conductivity (cm/s, ft/d). Consistent unit of measure should be used throughout the PEIS.

Response 7

In general, a consistent unit convention is used in the PEIS, with English units presented first, followed in most cases by metric equivalents. However, in cases where the results of actual measurements were taken from a published source and used in the PEIS, the original units of measure were reported. This practice results in an apparent inconsistency between some sections of the PEIS. The PEIS was reviewed with respect to this comment and units were changed, as appropriate, to make them as consistent as possible throughout the document.

Comment 8

On page 3-28, the assertion that the high thallium concentrations may be caused by a problem in the laboratory analysis should be confirmed or denied, and explained if levels are confirmed to be as high as suggested.

<u>*Response 8*</u>

Although it was suspected that the high thallium concentrations were due to an analytical laboratory problem, this could not be definitively confirmed or denied. Text has been added to Section 3.2.5.1 indicating that subsequent sampling has not shown similar high levels of thallium.

Commentor No. 22: Zahn, Kenneth C.
Lawrence Livermore National Laboratory

<u>Comment 1</u>

Lawrence Livermore National Laboratory has no substantive comments to make on the content of the December 1997 Draft Programmatic Environmental Impact Statement (PEIS) for Alternative Strategies for the long-term Management and use of Depleted Uranium Hexafluoride. We wish to receive a copy of the Final PEIS when available.

<u>*Response 1*</u>

Comment noted.

Commentor No. 23: Arnold, William M.
ESP Eco-Pak Specialty Packaging, Division of CBC

<u>Comment 1</u>

It was a pleasure to meet you last night, at the DOE public meeting in Oak Ridge. Heather and I both feel that the preferred program to convert the stockpiled UF_6 to uranium oxide and uranium metal for future use is the most worthwhile alternative.

Eco Pak Speciality is very interested in assisting in the transport of this material to the future conversion facilities. I am enclosing a brochure on both Eco Pak Speciality Packaging (ESP) and our parent company, The Columbiana Boiler Company (CBC). I hope some of this information helps in the decision making process for this project.

<u>*Response 1*</u>

Comment noted.

Commentor No. 24: **Fahey, Dan**
Swords to Plowshares

Comment 1

Enclosed is a copy of the Depleted Uranium Case Narrative about the health and environmental consequences of depleted uranium munitions. I hope that you will carefully review the information presented here as part of your effort to determine the fate of uranium hexafluoride stockpiles.

Depleted uranium should be stored in safe containers away from humans, water, supplies, and the food chain. The use of depleted uranium in ammunition is an unwise use for chemically toxic and radioactive waste

Response 1

The Depleted Uranium Case Narrative was reviewed by preparers of the PEIS. As stated in Appendix H of the PEIS, the use options evaluated in the PEIS were intended to be representative only, and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses is considered beyond the scope of the PEIS. The impacts associated with specific uses will depend on what use or uses are ultimately identified, and would be considered and evaluated in more detail in future planning and environmental analyses. For instance, any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained. The impact analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions. As with the use of any radioactive material, careful consideration would be given to whether the benefits of the proposed use outweigh the potential risks.

Commentor No. 25: **Quapp, William, P.E.**
Starmet Corporation

Comment 1

Good afternoon, my name is William Quapp, from Starmet Corporation. I have been actively involved in evaluating the management issues associated with depleted uranium hexafluoride since May 1993. At that time and until June 1996, I was employed at the Idaho National Engineering Laboratory. My investigations were performed for DOE Environmental Management Program (EM50). Over these three years, we identified various management options and costs of their deployment. One of the major things we learned is that the management of the depleted uranium inventory must be considered as a system in context with other DOE materials and waste management responsibilities. While the depleted uranium hexafluoride can be processed and useful fluorine byproducts extracted for the recycle value, the residual uranium material — oxide or metal — must be managed as a radioactive material. The fluorine product value will not pay for the total conversion and byproduct management costs. Consequently, DOE must either plan on disposal of the residual uranium materials or identify products that can consume the material and be manufactured at reasonable costs. Additionally, there must be customers for those products. The alternative to products and customers is to manage the depleted uranium as waste.

Response 1

Comment noted.

Comment 2

The INEL program developed and patented one technology — DUCRETE Shielding: A Depleted Uranium Concrete — which has been considered in the DOE PEIS as a potential use for depleted uranium. However, as will be pointed out later, because of the radioactive nature of depleted uranium, certain policies with respect to eventual disposal must be put in place to remove obstacles and encourage the use of depleted uranium in products.

Response 2

The commentor's observation is noted.

Comment 3

Disposal As Waste: The INEL studies addressed this issue in a parametric sense using published costs of conversion of UF_6 to oxide and the then current cost of disposal at the Nevada Test Site and Hanford. The studies showed that the potential cost range was somewhere between $3 to $11 billion assuming that either the Nevada Test Site or Hanford could accept the material and dispose of it in shallow land burial. Parameters considered included 1.) disposal as a compacted oxide and as stabilized oxide, 2.) disposal site locations and costs, and 3.) disposal as LLW versus Mixed LLW (RCRA controlled material).

Response 3

Comment noted. The PEIS and cost analysis teams were aware of the studies cited in the comment. In order to provide a consistent basis for comparison of alternatives, the cost analysis team calculated the costs of all options and alternatives, including the costs of disposal using a consistent set of assumptions and models. Cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 4

RECYCLE USES: We evaluated recycle uses with the recognition that the depleted uranium is a radioactive material and must be controlled, used, and ultimately disposed of in appropriate nuclear waste repositories. We did not consider uses that would allow unrestricted use and disposal.

Response 4

As described in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future, whether restricted or unrestricted. Consequently, discussion of issues related to specific types of use is considered beyond the scope of the PEIS. Any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained. In regard to ultimate fate of the material, the PEIS acknowledges that at the end of their useful lives products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4 and 2.2.5 of the PEIS).

Comment 5

After evaluating numerous concepts (nuclear shielding, flywheels, drill rods, blast shielding, etc.), we concluded nuclear shielding was the only viable use for depleted uranium since it was a controlled nuclear material and will be slightly radioactive forever. Additionally, because of the lower cost of competitive materials, depleted uranium was not an economic alternative for most other applications. Depleted uranium metal makes economic sense when the benefit of its very high density enables a solution that is otherwise not possible with traditional materials (steel, lead, concrete, etc.).

Depleted uranium has been used as metallic shielding in the past for various shipping casks and as shielding for radiation sources. In these applications, depleted uranium was selected because of its higher efficiency for gamma attenuation would allow cask weight limitations and/or size constraints to be met.

We found that one of the biggest impediments to the use of depleted uranium as metal in storage cask shielding applications is the high cost of converting from UF_6, to uranium metal. In a survey performed for DOE by Technics Corporation, the cost was identified to be about \$11.70 per kg-U (\$5.30 per lb-U) for conversion of UF_6, to metal and casting into a shape. Any forming or machining was additional and was priced at \$4.40 to \$22 per kg-U. Some cost reductions could be forecast through larger conversion facilities but these would not be expected to be sufficient to dramatically reduce the costs below those cited. Consequently, since casks could be made with conventional materials at lower total cost, we believed that there was no economic application for depleted uranium metal in storage casks.

This economic reality spawned the invention of DUCRETE Concrete as a potentially economic alternative for using depleted uranium and avoiding the near term investment in disposal. This concept, while not directly cost competitive with conventional concrete, is much cheaper than using depleted uranium metal and has some performance values that can make it economically competitive to traditional materials on a life cycle cost basis. And, by recycling the material, DOE can avoid declaring the material waste.

DUCRETE SPENT FUEL AND HIGH-LEVEL WASTE STORAGE CASKS

1.) DUCRETE Concrete is a technically viable material for spent fuel and high-level waste dry storage casks. Smaller, lighter weight, and more versatile casks can be designed and fabricated. DUCRETE casks can be factory fabricated and shipped to the user facility and reshipped to the interim storage site or the geologic repository as required.

2.) DUCRETE Storage casks can be developed and deployed at DOE sites, commercial utility sites, the DOE Interim Spent Fuel Storage Site, and for shielding in Yucca Mountain. However, there is no industry incentive to independently finance DUCRETE cask demonstrations. Consequently, DOE must support such demonstration.

3.) DUCRETE Casks are competitive with traditional concrete IF DOE pays for conversion of the UF_6 into the depleted uranium aggregate (UF_6 to UO_2, to aggregate). DUCRETE concrete is not a competitive cask material if the cost for conversion from UF_6 to aggregate must be born by the cask fabricator.

4.) DUCRETE Casks will be acceptable to utilities and other users IF DOE agrees to accept them at end of life in a DOE disposal facility such as the NTS or the Spent Fuel Geologic Repository. Without a predefined disposal option, no commercial utility will accept ownership.

5.) DUCRETE concrete is a stable chemical form of material that meets the disposal criteria of the Nevada Test Site as-is. No further processing would be required for disposal.

6.) When used as shielding in casks or other radioactive material containers, DUCRETE concrete is managed by organizations already licensed to hold nuclear materials. Thus, the institutional control required for handling of depleted uranium is in place.

Response 5

As stated in Chapter 2 and Appendix H of the PEIS, the two use options evaluated in the PEIS, use as oxide and use as metal for shielding, were intended to be representative only, and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses is considered beyond the scope of the PEIS. Such issues will depend on what use or uses are ultimately identified, *and would be considered and evaluated in more detail in future planning and environmental analyses.*

With respect to cost, cost estimates for the manufacture and use of the two representative shielding options are provided in the cost analysis report (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS. Assuming that the total inventory of depleted UF_6 is to be converted into casks over a 20-year period, the present worth costs of the metal shielding option is approximately $890 million, versus approximately $860 million for DUCRETE shielding. The majority of the costs for both options are operations and maintenance costs, which account for between 87% to 89% of the total shielding cost. These above-cited costs exclude the cost of converting UF_6 into uranium oxide for the DUCRETE option (between $350 to $820 million), and into metal for the metal shielding option (between $490 to $670 million). Thus the contention in the comment that the DUCRETE option is more cost-competitive than the metal shielding option may not be justifiable.

The six points made by the commentor are addressed individually as follows:
1. *Comment noted.*
2. *Comment noted.*
3. *Comment noted.*
4. *Comment noted.*
5. *Comment noted.*
6. *Comment noted.*

Comment 6

TIMELY ACTIONS REQUIRED: Driven by the need for spent fuel storage in the country, many fuel storage actions are underway by both DOE OCRWM and utility organizations. Since a cask demonstration and licensing program could take up to 4 years, if DOE NE is to be successful in its goal to recycle the depleted uranium into nuclear storage products, prompt funding of demonstration cask projects need to be undertaken. If prompt initiation of such programs is not undertaken, the window of opportunity for the deployment of depleted uranium in spent fuel storage casks will have passed. To take advantages of the unique characteristics of DUCRETE cask systems, the cask design must be compatible with other transportation systems being developed. This necessitates early integration of cask design with other parts of the transportation systems.

Response 6

Comment noted.

Comment 7

POLICIES THAT DOE SHOULD ESTABLISH TO ENCOURAGE DEPLETED URANIUM RECYCLING: 1. Any product manufactured from depleted uranium after the PEIS ROD should be accepted at the NTS or other DOE site for disposal, provided that, a) All depleted uranium products submitted to DOE for future disposal be in a chemical and physical which form meets the current Waste Acceptance Criteria at that DOE disposal site, or, b) DOE shall retain title to the depleted uranium material and, at end of product life, DOE will accept the product for disposal at the NTS provided that the depleted uranium product meets the NTS Waste Acceptance Criteria.

Response 7

The commentor's suggestion is noted. Issues such as these will be addressed in any forthcoming project analysis that follows the record of decision for the PEIS.

Comment 8

POLICIES THAT DOE SHOULD ESTABLISH TO ENCOURAGE DEPLETED URANIUM RECYCLING: 1. The Nuclear Waste Policy Act should be modified to allow disposal of depleted uranium casks or other depleted uranium materials in empty drift space between or other locations within the geologic repository. Presently, the Act restricts disposal of all materials other than spent fuel or high level waste.

Response 8

Modification of the Nuclear Waste Policy Act to allow disposal of depleted uranium materials in the geologic repository is not within the scope of the PEIS.

Comment 9

POLICIES THAT DOE SHOULD ESTABLISH TO ENCOURAGE DEPLETED URANIUM RECYCLING: 2. Empty depleted uranium storage casks in sound physical condition should be accepted at the NTS for re-use and at no cost to the owner. DUCRETE spent fuel or high-level waste casks would be very suitable as high integrity containers for the subsequent disposal of various Greater-than-Class C wastes from reactor decommissioning. DOE has responsibility for receiving such future wastes.

Response 9

The commentor's observation is noted.

Comment 10

OTHER DOE ACTIONS THAT WILL FACILITATE THE RECYCLE OF DEPLETED URANIUM: 1. DOE should stimulate the demonstration of low cost UF_6, conversion technologies to lower the cost of management. Low cost processes to convert the UF_6 to metal or to an oxide are needed to reduce the management cost to DOE and to support any recycle objective.

<u>*Response 10*</u>

The DOE has been conducting such projects since 1996, and will continue to participate with industry in the development of technologies that could contribute to the reduction of management costs, regardless of the strategy chosen.

<u>Comment 11</u>

OTHER DOE ACTIONS THAT WILL FACILITATE THE RECYCLE OF DEPLETED URANIUM: 2. DOE should support the development and licensing of DUCRETE storage casks and mandate their use on DOE storage projects where the total system life cycle cost can be shown to be advantageous to DOE.

<u>*Response 11*</u>

The commentor's preference for the development, licensing, and use of depleted uranium oxide concrete (DUCRETE) shielded storage casks is noted. The manufacture of DUCRETE shielded spent nuclear fuel and high level waste storage casks was evaluated as a representative depleted uranium use in Appendix H of the PEIS. The PEIS will not be used to select a specific end use for depleted uranium or preclude other potential uses in the future. If a use strategy is selected in the Record of Decision, specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks.

<u>Comment 12</u>

OTHER DOE ACTIONS THAT WILL FACILITATE THE RECYCLE OF DEPLETED URANIUM: 3. DOE can consider the provision of DUCRETE storage casks to utilities for interim storage of spent fuel as partial compensation for being unable to receive spent fuel as required by law.

<u>*Response 12*</u>

The commentor's preference for the use of DUCRETE storage casks for interim storage of spent nuclear fuel is noted.

<u>Comment 13</u>

OTHER DOE ACTIONS THAT WILL FACILITATE THE RECYCLE OF DEPLETED URANIUM: 4. DOE should objectively evaluate the use of DUCRETE shielded storage casks for shielding the spent fuel and high level waste packages in the geologic repository as an alternative to operating the repository as a remote handled facility for the 125 year period during emplacement and post-closure monitoring.

<u>*Response 13*</u>

Designs and operating policies for a planned geologic repository are beyond the scope of the PEIS. The manufacture of depleted uranium oxide concrete (DUCRETE) shielded spent nuclear *fuel and high level waste storage casks is evaluated as a representative depleted uranium use in Appendix H of the PEIS.*

Comment 14

CONCLUSIONS: Fifty years of nuclear activities in the US have left a large inventory of material with both unique and undesirable characteristics. To minimize the future cost of management in an environmentally and economically responsible manner, a system solution is needed to assure that the beneficial attributes of depleted uranium are recognized and used while the negative impacts of being a nuclear material are minimized.

During the studies I managed for the DOE, we defined such a system solution where DUCRETE casks were used for spent fuel storage at reactor sites, at the interim storage facility, and for disposal containers in the geologic repository. That concept still appears to me to be the most environmentally responsible solution achievable at the least cost to the US taxpayers.

Response 14

The commentor's preference for use as oxide in the form of DUCRETE is noted.

Commentor No. 26: Dietz, Leonard A.

Comment 1

Remediation of the depleted uranium (DU) storage problem is an important and urgent task of Herculean proportions. My choice of the six options presented is No. 2: Long-Term Storage as UF_6-storage of UF_6 cylinders in yards, buildings, or a mine at a consolidated site. This choice has the least potential to pollute the environment with more DU. I suggest that each cylinder of DU hexafluoride should be placed in a permanent overcontainer filled with one atmosphere pressure of an inert gas such as argon to retard corrosion by preventing water vapor and oxygen from entering the containers. The overcontainers should be sealed hermetically and designed to last for 100 years or more.

I believe that at this time we as a nation do not possess sufficient wisdom or foresight needed to decide on the final disposition of this enormous stockpile of waste uranium. It would be prudent to wait a few decades more before deciding on a final course of action.

Response 1

The commentor's preference for long-term storage of depleted UF_6 cylinders in hermetically sealed overcontainers and deferral of a decision on the final disposition of depleted UF_6 is noted.

Comment 2

Under no circumstance should DU be allowed in a commercially-manufactured consumer goods or be made available to the general public as has been hinted in a New York Times article by Matthew Wald. He mentions industrial use of DU flywheels to store energy and use as a substitute for lead weights. Elsewhere it has been suggested that DU should be used as ballast in the keels of sailboats. Imagine a long-forgotten sailboat sunk in a storm and unretrieveable, its hulk polluting a deep freshwater lake with uranium that slowly becomes soluble and pollutes the water. I became even more convinced that DU should be banned from commercial use when I saw an advertisement for a new driver golf club that contains a sphere of DU metal in its head so that a golf ball can be driven farther. These suggested commercial uses of DU are irresponsible and reckless, and will be dangerous to public health if they are implemented. The average person knows nothing about the technical aspects of uranium or radioactivity and is totally unprepared to deal with this radioactive and pyrophoric material that is highly toxic both chemically and radiologically. Uranium in any chemical form presents significant dangers to health and safety, if it is not handled with scrupulous care.

Response 2

Any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained from the NRC. The NRC analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions. As with the use of any radioactive material, careful consideration would be given to whether the benefits of the proposed use outweigh the potential risks. Because of the regulatory climate in the United States, it is highly unlikely that products containing depleted uranium would be available for large-scale, unrestricted use at this time. Potential impacts from restricted uses, such as use as shielding in the nuclear industry, would likely be small.

Comment 3

"Design of the DU Processing Plant and its Containment Efficiency": The processing of DU hexafluoride into uranium oxide or uranium metal requires extensive chemical processing, melting and casting operations. The pyrophoric nature of uranium makes it inevitable that significant quantities of uranium oxide aerosol particles will be formed. There does not have to be an accident at a DU processing plant for the public to be exposed to dangerous concentrations of aerosol micrometer particles of uranium oxide. Exposure can occur from DU aerosol particles released into the atmosphere during normal operations. To illustrate this, we assume that a well-designed and super-efficient processing plant can be built that would contain 99.99999% of all the uranium it processes. In such a plant only 1 gram in 10 million grams of DU would escape into the environment. We examine how this relates to the large amount of DU proposed to be processed from the years 2009 through 2028 and then compare it with an actual experience in New York State.

Using the data given on page S-2, Vol I, The depleted UF_6 cylinders managed by DOE plus the cylinders produced by the United States Enrichment Corporation total approximately 54,422. They contain about 600,000 metric tons of DU hexafluoride. Continued operation of the Portsmouth and Paducah diffusion plants could double this amount by the year 2028. Therefore, the DU hexafluoride that must be processed each year for 20 years beginning in 2009 is approximately 60,000 metric tons, of which two thirds is the element uranium. Thus, it appears that up to 40,000 metric tons of DU will be processed per year.

Containment of DU within the processing facility or facilities will be a major problem, even with the very best technology available. For example, if as postulated, 99.99999% of the DU can be contained successfully, then in 40,000 metric tons of DU processed each year, 4,000 grams will escape at an average rate of 333 grams per month.

"The New York State Experience with a DU Processing Plant": The estimated rate of 333 grams of DU escaping into the atmosphere per month must be compared with the New York State experience with National Lead Industries, a former DU processing plant near Albany, NY. At NL Industries DU was processed into DU metal penetrators for 30 mm cannon rounds and into airplane counterweights made of DU. In February 1980, a court order by NY State citing public health reasons shut down NL Industries for exceeding a NY State Department of Environmental Conservation monthly radioactivity limit of 150 microcuries (387 grams of DU) for airborne emissions. Recently the highly contaminated plant was razed and a large quantity of radioactively contaminated structural material and soil has been prepared for shipment to a disposal site.

The NL Industries plant caused massive contamination to the residential area and commercial properties outside the perimeter of the plant. In 1984, 1985 and 1988 a total of 950 cubic meters of radioactively contaminated soil were removed by DOE from 53 of 56 vicinity properties (DOE Report No. DOE/OR/21950-888; "Engineering Evaluation/Cost Analysis (EE/CA) for the Colonie Interim Storage Site (CISS) Buildings," June 1993, p. ES-1). My hypothetical super-efficient plant would release 333 grams (129 microcuries) of DU airborne particles per month into the environment. This amount of DU is not significantly different from the 150 microcuries of DU per month limit set by New York State. It is highly unlikely that a release rate of 150 microcuries of DU per month into the atmosphere will ever again be allowed by a local government or by citizens affected by the fallout. The containment efficiency of a DU processing plant would have to be at least 10 times better than I have assumed, allowing less than 1 gram of DU in 100 million grams (100 metric tons) of DU to escape into the environment. This extremely high requirement may be impossible to meet. The control and containment of DU emissions inside the plant would have to be even more stringent. When processing such huge quantities of DU it will be extremely difficult if not impossible to keep workers inside the plant from becoming contaminated with it.

Response 3

The PEIS examined potential doses to workers, doses to the general public, and air emissions that would be associated with the conversion of depleted UF_6 to either U_3O_8, UO_2, or metal under normal operations, and with the manufacture and use of metal products. The results are summarized in Sections F.3.1.1 and F.3.3 of Appendix F (for conversion options), and in Sections H.3.1.1 and H.3.3 of Appendix H (for manufacture options). Doses to workers and members of the public from normal operations at the representative facilities evaluated were estimated to be well below all applicable regulatory limits.

If conversion and/or manufacturing were required under the alternative management strategy selected by DOE, any required facilities would meet all applicable limits and regulations. Future planning and environmental analysis will address issues related to selection of sites and technologies for the depleted UF_6 management strategy selected in the Record of Decision for this PEIS.

Comment 4

"Transport of DU Particles in the Atmosphere": Another serious issue is what happens to the uranium particles that escape into the atmosphere and become dispersed far and wide by wind action. In the fall of 1979 I worked at the Knolls Atomic Power Laboratory in Schenectady, NY. The laboratory was operated by the General Electric Company for the Department of Energy. While troubleshooting a problem for the radiological group, my colleagues and I accidentally discovered DU aerosols collected in environmental air filters exposed at the Knolls site. The source of the uranium contamination was the NL Industries plant in Colonie, 10 miles east of the Knolls site, outside Albany, NY. We also discovered DU in air filters exposed at the Kesselring site in West Milton, NY, where crews for the nuclear Navy are trained, 26 miles NW of the NL plant. This is by no means the maximum fallout distance for uranium aerosols. A radius of 26 miles encompassed an area of more than 2,000 square miles around Albany where this fallout occurred. In January, 1980 I wrote and issued an internal technical report that documents our mass spectrometer measurements (L.A. Dietz, CHEM-434-LAD, "Investigation of Excess Alpha Activity Observed in Recent Air Filter Collections and Other Environmental Samples," Jan. 24, 1980; unclassified technical report, Knolls Atomic Power Laboratory, Schenectady, NY 12301; obtained under the Freedom of Information Act. Copies available from L.A. Dietz. If desired, a certified copy should be available from Schenectady Naval Reactors). Airborne uranium aerosol particles act like dust and can go everywhere that dust goes. The scientific explanation of how micrometer-size uranium particles can easily travel such large distances when airborne is given in a survey paper that is available on the Internet (L.A. Dietz, "How Gulf War Veterans and Others became Contaminated by Depleted Uranium," available on the world wide web at the WISE Uranium Project home page: http://www.nl/~wise/uranium/).

<u>*Response 4*</u>

In the PEIS, the radiation doses to the off-site public from airborne emissions of depleted uranium were estimated by considering an area within a 50-mile radius of the release point. Further details on the methods of analysis for dose from airborne uranium emissions are given in Appendix C of the PEIS, Section C.4.1

<u>Comment 5</u>

"Use of DU Metal in Large Commercial and Military Airplanes": The use of DU metal counterweights in commercial and military airplanes should be banned. Until about 1980 each Boeing 747 passenger jet contained 1,500 kilograms of DU metal counterweights use for dynamic flight control (Lowenstein, P., "Industrial Uses of Depleted Uranium," photocopy in "Uranium Battlefields Home and Abroad: Depleted Uranium Use by the U.S. Department of Defense," Bukowski, G. And Lopez, D.A., March, 1993, p.136.) In a crash and ensuing intense fire DU metal will begin to oxidize rapidly and sustain slow combustion when it is heated in air at a temperature of 500°C. This can cause DU oxide particles to be formed that can become airborne and poison large numbers of people and their surroundings (Parker, R.L., "Fear of Flying," Nature, Vol 336 22/29 Dec. 1988, p. 719.). This scenario has already happened. In 1977 two Boeing 747s crashed into each other and burned on a runway at Tenerife, Canary Is. In 1988 a Boeing 747, Pam Am Flight 103, crashed and burned at Lockerbie, Scotland. And in 1992 an El Al Israeli Boeing 747 crashed into an apartment building and burned in Amsterdam, Holland.

Fire and safety personnel exposed to the combustion products of DU are at risk. How many fire and safety emergency crews at airports or in cities have been trained and provided with equipment that will protect them from uranium particles that have been generated in intense fires?

<u>*Response 5*</u>

Any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained from the NRC. The NRC analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions. As with the use of any radioactive material, careful consideration would be given to whether the benefits of the proposed use outweigh the potential risks. Because of the regulatory climate in the United States, it is highly unlikely that products containing depleted uranium would be available for large-scale, unrestricted use at this time. Potential impacts from restricted uses, such as use as shielding in the nuclear industry, would likely be small.

Commentor No. 27: Resnick, Paul
DuPont Nafion® Products

Comment 1

We are interested in the Depleted Uranium Hexafluoride Management Program and the safe disposal of this material. Our major interest is in the utilization of the fluorine contained in the depleted uranium hexafluoride.

A number of proposals for the chemical conversion for the UF_6 have been made. At present, the conversion of UF_6 into elemental fluorine and uranium metal proposed by BNFL Inc. appears to be the most promising scheme. The preparation of high value fluorine (F_2) makes the most economic sense. We have had and continue to have discussions with BNFL Inc. about this process and our uses for the fluorine product. Although we do not anticipate any interest in the uranium coproduct this may also be its most desirable form for ultimate use or disposal by others. We will continue our discussions and contacts with BNFL Inc. and the Department of Energy.

Please do not hesitate to contact us if we (can) be of any help to you in your work on the Depleted Uranium Hexafluoride Management Program.

Response 1

Commentor's preference for conversion to metal using the BNFL's process and utilization of the fluorine contained in the depleted uranium hexafluoride is noted.

Commentor No. 28: Owsley, John
Tennessee Department of Environment and Conservation

Comment 1

The Tennessee Department of Environment and Conservation DOE Oversight Division (TDEC/DOE-O) would like to request an extension on the comment period for the "Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride." This is an important issue for the State of Tennessee, and we would like additional time to complete a thorough review of this document. An extension of the comment period to May 7, 1998, will be sufficient. Please let us know if this is acceptable.

Response 1

DOE announced a 120-day public comment period upon publication of the Draft PEIS in December 1997. This comment period was much longer than the 45 days required by Council on Environmental Quality and DOE regulations implementing the National Environmental Policy Act. As part of the public review process, DOE held public hearings in Oak Ridge, Tennessee; Paducah, Kentucky; Portsmouth, Ohio; and Washington, D.C.

DOE believes the comment period was of sufficient duration to allow review of the draft PEIS and submittal of comments by government agencies, potentially affected communities, and other individuals and organizations. The DOE Program Manager (Charles Bradley) contacted a representative of the State of Tennessee (Rebecca Charles) and discussed the issue of extension. It was agreed that the comment period would not be changed. Additional comments from the State of Tennessee are addressed under Commentor No. 87.

Commentor No. 29: Moseley-Braun, Carol / Dubrin, Richard / Poshard, Glenn
U.S. Senate and House of Representatives

Comment 1

We are writing to express our interest in the important work underway at the Department of Energy (DOE) to evaluate strategies for the long-term management and use of depleted uranium hexafluoride. As you know, there are over 1 billion pounds of this uranium enrichment by-product stored at the enrichment plants in Ohio and Kentucky, as well as in Oak Ridge, Tennessee. We are aware that the Department is currently soliciting public comments on a Draft Programmatic Environmental Impact Statement on various uranium hexafluoride management strategies. We commend you for moving to address this health, safety and environmental issue for the employees and neighbors of these facilities.

Response 1

Comment noted.

Comment 2

One of the options under consideration by DOE is a technology which can convert uranium hexafluoride to a safe and stable form of uranium suitable for long-term storage, retrievable disposal, or further use. This process is essentially the reverse of the uranium conversion process performed by AlliedSignal in Metropolis, Illinois. The technology, which is being tested through a joint DOE-industry partnership in Metropolis, offers two key benefits.

First, it converts the uranium to a solid, or oxide state, making it safer to store and available for possible future use. Secondly, it captures the Hydrogen Fluoride contained in the uranium hexafluoride which can then be recycled for use in the ongoing uranium conversion process, and for other manufacturing processes such as the production of non-ozone depleting refrigerants.
The benefit to DOE and the country is that the danger posed by the existing uranium hexafluoride containers can be removed and the government can be compensated for the value of the captured Hydrogen fluoride.

We realize that DOE will not make a final decisions on a uranium hexafluoride management strategy until early next year. Our hope is that the time between now and then can be used productively to fully demonstrate this technology so its full costs and benefits can be determined. In order for this to happen, DOE funding needs to continue through fiscal year 1999. We hope that sufficient funding for the current fiscal year is available within the Department's FY 1998 appropriation. Please inform us of the current and future funding plans for this important environmental management program.

Response 2

The commentors' statements regarding benefits of the UF_6 conversion technology being demonstrated in Metropolis, Illinois, are noted. Funding plans for this technology demonstration project are not within the scope of the PEIS.

Commentor No. 30: May, W. G.
University of Illinois

Comment 1

I am interested to see that things are moving ahead much as you told us they would, when we were preparing our National Research Council Report, "Affordable Clean Up." (Dr. Fred Schneider and I wrote the chapter on "Disposition of the UF_6).

At the time we saw little to suggest that conversion to metal made any sense, but I see that mentioned as one of DOE's ambitions. I wonder if you are really serious about that.

Response 1

After careful consideration of comments, DOE revised the preferred alternative for the final PEIS. The preferred alternative, as stated in Sections S.5.1 and 2.5 of this final PEIS, calls for prompt conversion of the depleted UF_6 inventory to U_3O_8 and long-term storage of that portion of the U_3O_8 that cannot be put to immediate use. Under the revised preferred alternative, conversion to depleted uranium metal would take place only if uses for the metal product become available. The impacts of the preferred alternative are discussed in Sections S.5.2, 2.5.2, 5.7, and 6.3.7 of the PEIS.

Comment 2

In your PEIS (Summary version, page S-44) you indicated that DOE is "committed to continuing its support for the development of applications for depleted uranium products and, for as long as is necessary, to continue the safe management of its depleted UF_6 cylinder inventory." Now that position bothers me! We have had this material in storage for 50 years and have been studying options for using the stuff for a large number of those years. Continued storage and study is just a way of avoiding a decision in my opinion. Only DOE would consider such an option!

<u>*Response 2*</u>

The DOE is committed to managing the depleted UF_6 cylinder inventory in a safe and responsible manner. The PEIS will be used, along with cost, engineering, and other data, to select a long-term management strategy that will be announced in the Record of Decision. The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use.

<u>Comment 3</u>

I read where the money allotted to DOE clean-up activities is well below that required for expeditious clean-up. But the UF_6 ought to be on the list somewhere, not just relegated perpetually to the future.

<u>*Response 3*</u>

Issues of DOE program funding are beyond the scope of the PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Commentor No. 31: Fulkerson, William
Friends of Oak Ridge National Laboratory

<u>Comment 1</u>

Roughly 46,000 cylinders containing depleted UF_6 (not counting 8000 under management of the United States Enrichment Corporation) are stored at the three gaseous diffusion sites, about 4,700 of them in Oak Ridge. Each is partially filled with 10 to 14 tons, solid at ambient temperature, for a total in the neighborhood of 500,000 tons. DOE plans between 2009 and 2028 to convert the material to HF and a solid form of uranium, likely U_3O_8. There is an established market for HF, and the hope is to find beneficial uses for the uranium. Barring the breeding of nuclear fuel, not likely in the next few decades, prospects for use of a substantial fraction of it are dim.

<u>*Response 1*</u>

As explained in Section 2.5.1 of the PEIS, DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory. DOE plans to continue its support for the development of government applications for depleted uranium products.

<u>Comment 2</u>

There does not seem to be agreement in estimates of the costs of conversion, except that they will be large. If we assume for discussion, $3 a pound, net of HF value, a total of about $3 billion would be required. Quoted current costs for management of the inventory range from fifteen to thirty million/year. If there were no significant risks involved and if the maintenance costs were to track inflation, there would be no particular urgency for getting on with conversion, because interest on the conversion investment would easily exceed present annual outlays. We have serious doubts about both premises.

Response 2

The context of the statement concerning the premise of the costs of conversion and continued storage is unclear. However, the document, "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS) presents the present-worth costs for the various alternatives considered in the PEIS. The present-worth costs for depleted UF_6 conversion ranges from approximately $270 million to $830 million, depending upon the final form (either uranium oxide or metal) and conversion process. The present-worth cost of continued storage at the three current storage sites is approximately $330 million. A comparison of the costs of conversion versus continued storage (with consideration of the costs of other options such as cylinder preparation, etc.) would indicate that the present-worth costs of conversion are similar to continued storage. The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS. The costs associated with various management alternatives are beyond the scope of the PEIS. However, cost will be one of the factors considered in selecting the long-term management strategy in the Record of Decision that will be issued after the publication of the Final PEIS.

The risks associated with continued cylinder storage are discussed in detail in Appendix D of the PEIS. Continued storage is a part of every alternative analyzed. Therefore, risks associated with continued storage are included in the consideration of risks for every alternative. The results indicate that continued storage does not pose a significant risk over the approximately 40-year assessment period considered in the PEIS.

Comment 3

The cylinders are constructed of carbon steel, of nominal thickness 0.312 inches (older ones were of twice this thickness). Although internal corrosion from UF_6 appears small, so long as integrity of containment is maintained, there is abundant evidence of general external corrosion from exposure to the elements, particularly of those in Oak Ridge, which tend to be older. Of more concern, there is pitting and crevice corrosion. Seven of the cylinders are known to have developed cracks, five involving handling, but two from corrosion alone. In these cases, atmospheric moisture has hydrolyzed the uranium hexafluoride to UO_2F_2, which has acted as a seal. The HF produced has dissipated harmlessly, and the contamination of water with soluble uranium compounds has not yet caused serious embarrassment. The benign effects of these failures seem to have lulled policy makers about untoward events during the thirty years projected before completion of conversion to a form safe for indefinite storage.

Response 3

DOE is aware that, unless certain mitigating actions are undertaken, more breaches will occur in the future. These actions, which have already begun, include placing all cylinders in acceptable storage facilities and establishing a coating on all cylinders which will arrest the rate of external corrosion. The internal corrosion rate has been evaluated and is negligibly small. At a steady temperature of 140 °F, a 5/16-in.-thick steel plate with a roughness factor of 2.5 would be predicted to be corroded through in about one million years. DOE is committed to continuing the safe management of its depleted UF_6 cylinder inventory for as long as necessary.

Comment 4

However, even if events having serious consequences are discounted, steep rises in the annual costs of custodial care and in the eventual costs of conversion seem inevitable. As corrosion worsens, there will be increasing numbers of breaches requiring patches. The weakening of the cylinders will increase the costs and dangers of handling them in periodic painting or in removing the contents for conversion. If all are to be converted at a single site, more and more will have walls that do not meet the minimum 0.25-inch walls DOE specifies for safe transportation by highway or rail.

Response 4

DOE is aware that, unless certain mitigating actions are undertaken, more breaches will occur. These actions, which have already begun, include improving the cylinder storage conditions and establishing a cylinder painting program to control the corrosion of cylinders. As indicated in response to comment 2 above, the cost of alternatives is beyond the scope of the PEIS. Cost will be considered in the ROD in selecting the long-term management strategy for the depleted UF_6.

In regards to converting all of the material at a single site, the location(s) and number of conversion facilities are beyond the scope of the PEIS and will be addressed in future planning and environmental analyses.

Comment 5

Confidence that there is small risk of more damaging events may be misplaced. The cylinders support about 250,000 pounds force from the atmosphere (25000 in^2 times 10 psi differential). In addition to this evenly distributed stress is that from resting on the surface and, for the bottom layer, from those stacked on top. Many of the cylinders are forty years old. The program to clean and paint the outer surfaces lags deterioration.

Response 5

DOE plans to paint about 6800 cylinders at Paducah and 2950 at ETTP over the next five years. This number represents the sum of the cylinders from former G- and F-yards at Paducah and K-yard at ETTP which have been determined to be at risk of corroding to the point that they would have a minimum wall thickness less than the ASME Code allowable for unfired pressure vessels.

If this schedule can be met, DOE will, on a statistical basis, save the most mils of cylinder wall thickness lost due to corrosion and also maintain those cylinders as a code-approved population. Based on the corrosion modeling, the other populations of cylinders do not need painting for some time or possibly not at all to maintain ASME minimum wall thickness. If DOE accelerates disposition of the depleted UF_6, then more painting or faster painting may not be necessary.

Comment 6

There are a number of conceivable scenarios for catastrophic failures of containment, beyond what uranyl fluoride could seal, from an earthquake or transportation accidents, for example. Over the interval before planned conversion, with the number involved, stacked as they are, collapse in place of some is hard to exclude. If such an event occurred in a wet situation, a dangerous plume of HF could be produced. In Table S.2 on page S-17 of the referenced summary, it is estimated that such a failure might occur in 1 to 10 years under dry conditions; on the next page, the frequency of a more serious accident, involving three cylinder apparently being transported, is given as 1 in 100,000 years under wet conditions. Chemical exposure from the latter is projected to have adverse effects on 1900 of the public, and on 1000 non-involved workers (of which 300 would suffer irreversible effects). With the climate here and the difficulty of reaching cylinders in the middle of storage areas, the 1 to 10 year single-cylinder failure might well occur under wet conditions, perhaps with less, but still unacceptable, effects.

Response 6

The PEIS analysis considered a range of potential accidents that could occur at the facilities required by each alternative, as shown in Table D.6 of the PEIS. Three cylinder yard accidents have been analyzed in the PEIS in which corroded cylinders containing solid depleted UF_6 rupture during handling, either during dry conditions, or in two cases, under wet conditions. (In Table D.6, these three accident scenarios are referred to as "Corroded cylinder spill, dry conditions, "Corroded cylinder spill, wet conditions — rain," and "Corroded cylinder spill, wet conditions — water pool.") These accidents involve cylinder failure during handling and movement, activities which are (generally) performed under dry conditions, and do not reflect accidents that could occur during cylinder yard storage.

The frequency of the accident scenario of a corroded cylinder spill under dry conditions takes into account the historical experience at the three current storage sites. This historical experience indicates that the potential for accidents is greater during cylinder handling than during simple storage. The lower frequency for the accident scenario of a corroded cylinder spill under wet conditions takes into account the unlikeliness of a severe rainfall occurring during cylinder handling.

Comment 7

There seems to be general agreement that conversion is eventually necessary. We advocate acceleration. We recommend that conversion begin in Oak Ridge as the pilot. The cylinders here are in the worst condition and are likely most risky to transport. We believe that work should not be delayed until a market for the uranium develops, a long shot at best. We encourage research to lower costs of conversion, but not at the expense of timely action. In the meantime a major overhaul of the cylinder storage situation at Oak Ridge should be a high priority.

Response 7

The commentor's preference for an accelerated conversion program beginning with a pilot in Oak Ridge is noted. DOE's preferred alternative includes prompt conversion of depleted UF_6 to depleted uranium oxide for storage and use.

Cylinders at Oak Ridge (East Tennessee Technology Park) are subject to an active maintenance program that includes visual inspections, ultrasonic testing of cylinder wall thickness, radiological surveys, cylinder coating maintenance, and cylinder yard maintenance.

Comment 8

As we understand it, the cylinders are not considered waste, and as a result, conversion is not on the table when remediation priorities are set. If funding for conversion is not available in the appropriate category, we believe DOE should rise above administrative barriers and assess the possible problems from the cylinders in comparison with the risks from delays of other remediation projects.

Response 8

Issues of DOE program funding are beyond the scope of this PEIS. DOE has managed its depleted UF_6 inventory as a resource with value for future use, rather than as a waste. An alternative management strategy involving conversion of depleted UF_6 to an oxide and disposal of the oxide is evaluated in the PEIS (see Section 5.6). DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Commentor No. 32: Comments from the Paducah, Kentucky hearing
See Section 4.2 for comments and responses

Commentor No. 33: Comments from the Oak Ridge, Tennessee hearing
See Section 4.3 for comments and responses

Commentor No. 34: Comments from the Portsmouth, Ohio hearing
See Section 4.1 for comments and responses

Commentor No. 35: Comments from the Washington D.C hearing
See Section 4.4 for comments and responses

Commentor No. 36: Ortoiger, Thomas W.
State of Illinois Department of Nuclear Safety

Comment 1

The Illinois Department of Nuclear Safety (IDNS) hereby submits its comments on the Department of Energy (DOE) Preliminary Environmental Impact Statement (PEIS) for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (UF_6). IDNS applauds DOE's early recognition of Illinois' unique situation relative to this issue and appreciates the opportunity to comment on the Draft. IDNS considers itself a stakeholder in this process for two reasons. Clearly, IDNS is interested in any environmental impacts from changes in the mission of the Paducah Gaseous Diffusion Plant (PGDP) facility because of its proximity to Illinois. However, IDNS is also interested for a reason not reflected in the PEIS; the close proximity to the subject facility of the AlliedSignal Metropolis Works in Illinois.

Response 1

The Illinois Department of Nuclear Safety's interest is noted.

Comment 2

Fundamentally, IDNS supports the general strategy of converting UF_6 to more chemically stable forms such as U_3O_8 as soon as possible. We agree that DOE needs a longer-term plan for management of UF_6 that goes beyond inspections and repairs of leaking cylinders in storage yards. We also agree with the general strategy of trying to find markets for the by-products of the conversion process, although we have some concerns about radioactive contaminants in these by-products which we will discuss below.

Response 2

The Illinois Department of Nuclear Safety's support and concerns are noted.

Comment 3

The major shortcoming of the PEIS in our view, however, is its failure to recognize that the AlliedSignal Metropolis Works does exist and that there is a reasonably high probability that it will have an important role to play in DOE's UF_6 management strategy. DOE must recognize that given AlliedSignal's experience in the conversion business and the existing infrastructure at Metropolis, the Metropolis Works may be the only facility in the United States capable of handling the UF_6 to oxide conversion at a reasonable cost.

Response 3

The PEIS does not consider the potential role that the AlliedSignal facility might play in the conversion of depleted UF_6 to oxide because the decision has not yet been made to pursue conversion as a depleted UF_6 management strategy. That decision will be made in the Record of Decision (ROD) for the PEIS. After the ROD, should DOE choose to pursue conversion, specific technologies and sites would be evaluated and appropriate site-specific analyses would be conducted for any facilities required to implement the selected management strategy (as discussed in Section 1.4 of the PEIS).

Comment 4

IDNS understands that given the method that DOE generally employs to develop a PEIS, siting issues are not addressed until the second phase of the NEPA approach. However, we feel that the decision to recognize or ignore AlliedSignal, even at this early stage, has significant impact on evaluating the risks and benefits of DOE's management options.

Response 4

Until a long-term management strategy for depleted UF_6 is selected and announced in the Record of Decision for the PEIS, DOE will not know what actions will require selections of technologies or sites. Future planning and environmental analysis will address issues related to selection of sites and technologies for the depleted UF_6 management strategy chosen — including, if appropriate, the AlliedSignal, Inc. facility in Metropolis, Illinois, referenced in the comment.

Comment 5

Page 2-5 — This section describes the option of long-term storage as depleted UF_6. This option is the least desirable from IDNS' point of view. Associated with this option would be all the risks of transportation with none of the benefits of conversion to oxide. We suggest that this option be given no further serious consideration.

Response 5

Comment noted.

Comment 6

Section 3.1.7 — The description of the affected environment surrounding the PGDP fails to recognize the presence of the AlliedSignal Metropolis Works as another major uranium processing facility in the immediate vicinity. AlliedSignal's effluent releases and impacts on the environment are thereby not considered in this review.

Response 6

Section 3.1.7 focuses specifically on the Paducah site and considers neither the AlliedSignal, Inc. UF_6 conversion facility at Metropolis, Illinois, nor other facilities in the vicinity of the site that might have implications for public and occupational health and safety. However, *Section 5.8.2.1 of the PEIS has been modified to incorporate impacts from the AlliedSignal, Inc. facility (and other nearby facilities) in the cumulative impacts for the Paducah site (see Table 5.12).*

Comment 7

Page 3-14 — The region of influence includes Massac County, Illinois (not Massaic).

Response 7

The commentor is correct; Massac County (IL) not Massaic County (IL) is part of the region of influence at Paducah. The text has been corrected.

Comment 8

Page 3.4 — Check the map scale. 3000 km is not roughly equivalent to 2 miles.

Response 8

The scale of miles was incorrect. It has been changed to show 3 km roughly equivalent to 2 miles.

Comment 9

Table F.2 — If AlliedSignal were considered as a site for a conversion facility, most of the health risks and potential benefits would need to be evaluated. Risks and benefits from construction activities would be particularly impacted. While on one hand, ecological and land use impacts would be smaller, economic benefits from increased employment would also be smaller.

Response 9

The PEIS evaluates the potential environmental impacts of broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory. In evaluating these impacts, it considers all of the activities that would be necessary to implement each of the alternatives (as discussed in Sections 2.1 and 2.2). Because of the programmatic, non-site-specific nature of the PEIS, most of these activities are evaluated for representative sites — the exceptions being continued storage and cylinder preparation for transportation, which would necessarily occur at the three current depleted UF_6 storage sites.

Conversion is one of the activities that is not evaluated for a particular site or facility in the PEIS, and as a result it would be inappropriate at this time to include the AlliedSignal, Inc. UF_6 conversion facility in Metropolis, Illinois, in Table F.2. As discussed in Section F.1, as appropriate a more detailed site- and technology-specific analysis of potential environmental impacts would occur in a subsequent NEPA document once DOE selects a long-term management strategy to pursue. If conversion is a component of that strategy, and if the AlliedSignal, Inc. UF_6 conversion facility is judged to be a potential conversion facility, the impacts of using it would be evaluated at that later date.

<u>Comment 10</u>

Page F-11 — Anhydrous HF may have been a valuable product at one time, however, given the glut of UF_6 on the market, one questions the value of a product whose primary use is the production of more UF_6 from ore.

<u>Response 10</u>

The largest use of anhydrous hydrofluoric acid (AHF) is in the manufacture of fluorocarbons, and not in the production of UF_6. The fluorocarbon market accounts for about 65-70% of AHF demand. Only in the unlikely event that AHF produced during UF_6 conversion could not be sold for unrestricted use would it be recycled in the nuclear fuel industry.

It should be noted that the aqueous HF produced by COGEMA in France during the conversion of depleted UF_6 into U_3O_8 is marketed to outside buyers in the glass and steel industries, due to its high purity.

<u>Comment 11</u>

Page F-12 — IDNS is concerned about the depleted uranium content of the anhydrous HF that could be produced by a conversion process. IDNS would be interested in any uncertainties associated with the 1 ppm figure quoted. In any case, we do not believe it is certain that the material will have commercial value if it is known to be contaminated at any level.

<u>Response 11</u>

The PEIS assumed an upper bound limit of 1 ppm uranium in the anhydrous HF produced during conversion of depleted UF_6. Defluorination of depleted UF_6 to produce U_3O_8 and HF is practiced on a large scale industrial basis by COGEMA in France. The uranium content of this high purity HF is below the 0.1 ppm uranium instrument detection levels, well within the 5 ppm specification for aqueous HF sales in Europe.

In the unlikely event that the anhydrous HF recovered during UF_6 conversion could not be sold for unrestricted use, it could still be sold for use in the nuclear fuel industry.

<u>Comment 12</u>

Table F.25 — We assume that the source of the figures in this table are from (LLNL 1997) which is an estimate based on theoretical considerations. We suggest that actual historical low-level radioactive waste generation figures from AlliedSignal would be more useful.

Response 12

Information on commercial uranium facilities were used in the development of the engineering analysis report (EAR) (LLNL 1997; the full citation is provided in Appendix F of the PEIS), which is the source for the waste volumes shown in Table F.25 of the PEIS. Waste generation data from UO_2 fuel fabrication facilities (Columbia, SC; Wilmington, NC; and Hanford, WA) and UF_6 plants (Metropolis, IL; Gore, OK) were reviewed. The data were used as guidelines, but extrapolation was not possible due to different plant design, process, and off-gas treatment.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 13

Page J-7 — The failure to consider existing facilities has led to inconsistencies in making assumptions. In Appendix J, the analysis of transportation risks is based on the assumption that the distance between the storage and conversion facilities is 1000 km. However, in Appendix F, it assumed that the facilities are co-located.

Response 13

The assumptions made in the PEIS are that the empty cylinders are stored at the conversion facility until they are treated at a cylinder treatment facility, which is assumed to be co-located with the conversion facility. The PEIS does consistently assume throughout that storage and conversion facilities are not co-located.

Commentor No. 37: Nurmela, Lillian

Comment 1

The only responsible course for the Department of Energy to follow regarding the huge DU inventory is to establish safe, long-term storage of this material, which remains radioactive for what amounts to eternity.

Response 1

The commentor's preference for long-term storage of depleted uranium has been noted.

Comment 2

DU should definitely NOT be used for military purposes. We must not be responsible for blanketing battlefield areas with this long-lived radioactive material.

Response 2

The commentor's objection to the use of depleted uranium for military purposes is noted. DOE's PEIS for selecting a management strategy for its depleted UF_6 inventory does not establish policy or requirements for depleted uranium uses by the U.S. Department of Defense in munitions or other military equipment. As described in Section 2.2 and Appendix H of the PEIS, the two use options evaluated in the PEIS, use as depleted uranium oxide and use as depleted uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end use or preclude other potential uses in the future. If a use strategy is selected in the Record of Decision, specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks.

Commentor No. 38: Gilliland, R. G.
Oak Ridge National Laboratory

Comment 1

1. Retain adequate depleted UF_6 to support the Surplus Plutonium Disposition Program under the "No action alternative" long-term management strategy for depleted UF_6.

One of the options for dispositioning the surplus weapons-grade plutonium is for use as mixed-oxide (MOX) fuel in light water reactors. A small portion, less than 0.3% of the available supply of the depleted UF_6 (ORNL/TM-13417 Rev. 1), should be set aside and reserved for use in the Surplus Plutonium Disposition Program. The required UF_6 to be removed from inventory is approximately 1400 MT as indicated in ORNL/TM-13466, Rev. 1, which is a Data Report to be released concurrently with the Surplus Plutonium Disposition Environmental Impact Statement.

The depleted UF_6 should be stored at the Portsmouth site since that is the only facility with operating transfer autoclaves for emptying the depleted UF_6 from the 12.7 MT (14 ton) storage cylinders into 2.28 MT (2.5 ton) feed cylinders. The smaller cylinders are required for transporting the depleted UF_6 by truck to commercial conversion facilities where the depleted UF_6 will be converted to uranium oxide and subsequently blended with oxide derived from surplus plutonium to make MOX fuel at a proposed government-owned fuel fabrication facility. The UF_6 cylinders will be selected based on a depleted uranium assay specified by the consortium selected to provide MOX fuel fabrication and reactor irradiation services. The feed requirement for the depleted uranium expected to be required by the Surplus Plutonium Disposition Program is approximately 0.25 wt % as indicated in ORNL/TM-13466, Rev. 1.

The PEIS (Section S.5.1 and Section 1.6) acknowledges that other DOE programs, such as the Surplus Plutonium Disposition Program, have requirements for small amounts of depleted UF_6. It is stated that this small fractional requirement of the UF_6 inventory would not affect the selection of a long-term management strategy in the Record of Decision (ROD) to be issued following the publication of the final version of the PEIS. However, the comments under Item 1 above are relevant in that specific cylinders of excess depleted UF_6 should not be considered surplus to all government programs and will be requested to be stored at Portsmouth for potential use in the disposition of surplus plutonium.

Response 1

The commentor's preference for retaining adequate depleted UF_6 to support the Surplus Plutonium Disposition Program is noted. Any decision for long-term management of depleted UF_6 that includes conversion does not preclude the availability of some amount of the material for specific identified uses. Due to the significant size of the depleted UF_6 inventory and the amount of time (20+ years) required to complete conversion, sufficient depleted UF_6 would be available to support future Departmental decisions regarding the Surplus Plutonium Disposition Program.

Comment 2

2. Consider the benefit of using the depleted uranium in geological disposal sites such as Yucca Mountain and the Waste Isolation Pilot Plant (WIPP) under the "Use as Uranium Oxide" long-term management strategy for depleted UF_6.

Depleted uranium can be used to improve the performance of the repository for disposal of spent nuclear fuel (SNF). Depleted uranium reduces the radionuclide release rate from a SNF waste package and minimizes the potential for long-term nuclear criticality. In this context, the U.S. Nuclear Waste Technical Advisory Panel-the Congressionally-mandated scientific review panel for the DOE Yucca Mountain project- stated (U. S. Nuclear Waste Technical Review Board, Report To The Congress And The Secretary of Energy: 1995 Findings and Recommendations, Arlington, Virginia, April 1996): "The Board suggests that DOE consider increasing the criticality control robustness of the EBS (Engineered Barrier System)... In particular, the use of depleted uranium in filler, invert, or backfill material, or in all three, is a concept the program has not yet explored adequately. Conceivably, increasing the criticality control robustness of the EBS could turn a potentially intractable analysis of external criticality into a comparatively easy one."

The recommendations of nationally recognized, congressionally-mandated scientific review boards on uses of depleted uranium should be explicitly considered in the PEIS. It is also noted that the Spanish repository program is investigating the use of depleted uranium to improve repository performance. This use of depleted uranium is receiving attention worldwide.

Additional information on this option can be found on pages 8-9 of the paper "Beneficial Uses Of Depleted Uranium," authored by Colette Brown of DOE and Allen Croff and M. Jonathan Haire of ORNL. The paper was prepared for the Beneficial Re-Use '97 Conference held in Knoxville, Tennessee, on August 5-7, 1997.

Response 2

The PEIS evaluates two representative use options, use as uranium oxide and use as uranium metal as radiation shielding. These options were intended to be representative only, and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. DOE plans to continue its support for the development of government applications for depleted uranium products, including evaluating potential uses in the repository program. In fact, a workshop was held on July 15-17, 1997 in Las Vegas, Nevada, specifically on this subject (see DOE/EM-0349, Proceedings of a Workshop on Uses of Depleted Uranium in Storage, Transportation and Repository Facilities). The subjects discussed at the workshop were consistent with the recommendations made by the Nuclear Waste Review Board as mentioned in the comment. Specific uses would be considered and evaluated in more detail in future planning and environmental analyses.

Comment 3

3. Expand the discussion in the PEIS of potential "Use Options" of the depleted UF_6, either as Uranium Oxide or Uranium Metal.

The primary use of the depleted UF_6, discussed in the PEIS, either as uranium oxide used to make high density concrete (Section 2.2.4) or as uranium metal (Section 2.2.5), is as shielding for spent nuclear fuel or high-level waste (HLW) storage containers. The detailed discussion should be expanded to include other options which could potentially use substantial amounts of the depleted UF_6, such as its use in industrial counterweights for forklift trucks. Another potential option would be the use of the depleted UF_6 in the manufacture of casks for low-level wastes (LLW), as recently proposed in a Technical Development Initiative for Fernald. The discussion of each "use option," including the use of the depleted UF_6 as shielding, should address the economic and technical viability of each option since these issues have been challenged in the public hearings for this PEIS held in Paducah and Oak Ridge. Additional information on these options can be found in the paper "Beneficial Uses of Depleted Uranium," referenced in Item 2.

Response 3

Descriptions of the various current and potential uses for depleted uranium are presented in the second paragraph of Appendix H. As noted at the end of the paragraph, the PEIS analyzes in detail the potential use of depleted uranium as radiation shielding material because the largest potential market for depleted uranium currently appears to be shielding applications. As described *in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future.*

Comment 4

4. Account for the end of life disposal requirement for any application under the "Use Options" for long-term management strategy for depleted UF_6.

DOE is considering using depleted uranium in the manufacture of casks for spent nuclear fuel or high-level waste (HLW) storage containers. One application is to convert the depleted UF_6 to an oxide which in turn would be used as the aggregate to make depleted-uranium concrete. The high density of the uranium allows the same shielding effectiveness with approximately half the thickness of conventional concrete. This concrete would then be used to manufacture oxide-shielded casks.

Another option would be to chemically-convert the depleted UF_6 to uranium metal which could be enclosed between the stainless steel shells making up the body of the casks. The uranium metal would be the primary shielding material in the casks which could be reduced in thickness relative to casks using only steel as the shielding material. The PEIS (pages 2-14 and 2-15) states that no assumptions were made regarding the fate of depleted uranium-concrete casts or the uranium metal casks following use. However, the disposal requirements for depleted uranium at end of life have a major impact on "use options." When the depleted uranium is used for an application such as shielding, at the end-of-life it must be converted into an acceptable waste form. The end-of-life costs to convert depleted uranium into an acceptable form may far exceed manufacturing costs. The consequence of this requirement should be evaluated in the PEIS.

Response 4

The present-worth costs of the various alternative considered in the PEIS are provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

The costs associated with the ultimate disposition of the depleted uranium metal or oxide shielding casks were not considered as they are highly speculative. As discussed in Section 5.9 of the PEIS, at the end of their useful lives products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level radioactive waste.

<u>Comment 5</u>

5. Consider disposal of the depleted uranium at the Yucca Mountain repository for spent nuclear fuel and high-level waste under the "Disposal Alternative" long-term management strategy for depleted UF_6.

The Draft PEIS (Section 2.2.6) lists three options under the "Disposal Alternative": shallow land earthen structures, below ground vaults, and mine disposal. At least two of these three options, shallow-land earthen structures and below ground vaults, do not meet regulatory requirements for protection of public health and safety according to the detailed analysis in Appendix I of the Draft PEIS. The detailed analysis within the Draft PEIS on page 1-23 states:

"The maximum dose to an individual, assumed to live at the edge of the disposal site and use the contaminated water, was estimated to be about 110 mrem/yr which would exceed the 25 mrem/yr limit specified in 10 Code of Federal Regulations Part 61. Possible exposures (on the order of 10 rem/yr) could occur for shallow earthen structures and vaults if the cover material were to erode and expose the uranium material . . ."

The detailed technical analysis within the Draft PEIS Appendix I is consistent with the U.S. Nuclear Regulatory Commission (NRC) analysis that near surface disposal of large quantities of depleted uranium is not acceptable (J. W. N. Hickey, Letter from J. Hickey, Chief Fuel Cycle Safety Branch, U. S. Nuclear Regulatory Commission To Louisiana Energy Services, L.P., Docket No. 70-3070, U. S. Nuclear Regulatory Commission, Washington D.C., September 22, 1992). It is also consistent with DOE performance assessments for near surface disposal at specific sites (Martin Marietta Energy Systems, Inc.; EG&G Idaho, Inc.; and Westinghouse Savannah River Co., Radiological Performance Assessment for the E-area Vaults Disposal Facility, WSRC-RP-94-218, Oak Ridge National Laboratory, Grand Junction, CO., 1994). Additional analysis is necessary to determine the viability of mine disposal of the depleted uranium to meet regulatory requirements for protection of public health and safety.

At the current time, the only facility being planned in the United States that would meet the requirements for disposal of this material is the proposed Yucca Mountain repository for spent nuclear fuel and high-level waste. Because this is the only current option that meets the regulatory requirements for safe disposal of this material, it should be included as a disposal option in the PEIS.

<u>Response 5</u>

The purpose of the PEIS is to provide an analysis of broad, programmatic alternatives. The evaluation of disposal options in the PEIS considered disposal in representative facilities, including shallow-earthen structures, vaults, and mines. Because the PEIS is not intended to identify sites for future management activities, the potential impacts of the disposal options were evaluated using generic environmental settings, and considered both "wet" and "dry" sites. The characteristics of these settings were selected to provide as substantive an assessment as possible and to allow for a *comprehensive comparison of the alternatives. After the Record of Decision for the PEIS, DOE would evaluate potential facility locations and conduct appropriate site-specific analyses for any required facilities.*

The detailed analysis presented for disposal in Appendix I of the PEIS does indicate that the dose to a hypothetical receptor from contaminated groundwater would exceed regulatory limits for a disposal facility in a "wet" environment for all three disposal options considered, including disposal in a mine. The analysis also indicates that groundwater impacts would be less than regulatory limits for a disposal facility located in a "dry" environment. For disposal in shallow-earthen structures and vaults, the analysis also indicates that surface erosion could potentially result in large external exposures; however, this scenario would not be likely for thousands of years and could be eliminated by engineering design and replacement of cover material. It must be stressed, as noted in Appendix I, that such calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required.

In response to the consideration of the potential repository being evaluated at Yucca Mountain, the Nuclear Waste Policy Act (42 USC 10101 et seq.), as amended, authorizes the disposal of only spent nuclear fuel and high-level radioactive waste in the first repository. However, the use of depleted uranium in some fashion to improve the performance of the repository is under consideration as discussed in the response to comment 2 above.

Comment 6

6. Clarify the "no action alternative" long-term management strategy for depleted UF_6 in the PEIS with the preferred waste form for final disposition of depleted uranium favored by the U.S. NRC.

The no action alternative as initially announced in the "Notice of Intent" to prepare this PEIS included eventual chemical conversion of the UF_6 to oxide followed by storage. However, after public scoping and internal DOE reviews, it was determined that the no action alternative should consider the continued storage of UF_6 cylinders indefinitely at the three current storage sites, as indicated on page 2-2 of the PEIS. The NRC stated that the preferred waste form for final disposition of depleted uranium is U_3O_8 (J. W. N. Hickey, Letter from J. Hickey, Chief Fuel Cycle Safety Branch, U.S. Nuclear Regulatory Commission To Louisiana Energy Services, L.P., Docket No. 70-3070, U. S. Nuclear Regulatory Commission, Washington, D.C., September 22,1992). The NRC, in the referenced license application for the private Louisiana Energy Services enrichment plant, further stated that conversion of the depleted UF_6 to uranium oxides should be done on a specific schedule.

It is ORNL's recommendation that the two points of view on the storage form of depleted UF_6 be reconciled between the DOE and NRC.

Response 6

It is unclear from the comment what points of view need to be reconciled between the DOE and NRC. The no action alternative in the PEIS considers the continued storage of depleted UF_6 in cylinders at the three current storage sites through the year 2039. This definition of the no action alternative is intended to provide a baseline against which other management strategies can be measured. In addition, this definition is consistent with CEQ guidance (CEQ's "40 Most Asked Questions") that states that the no action alternative may be thought of in terms of continuing with the present course of action until that action is changed. The no action alternative does not consider conversion or disposal of depleted uranium in any form. With respect to preferred waste forms for storage or disposal, the PEIS considers as alternatives both the storage and the disposal of uranium oxide (both U_3O_8 and UO_2) in several facility types. In fact, conversion to oxide followed by use or storage is part of DOE's preferred alternative. The information from the PEIS will be used, along with other information, to select a strategy for the long-term management of DOE's depleted uranium inventory in the Record of Decision to be issued after the publication of the Final PEIS.

Commentor No. 39: Palau, Gerald L.
City of Oak Ridge, Environmental Quality Advisory Board

Comment 1

The City of Oak Ridge has a strong interest in the future management of the DOE depleted uranium hexafluoride UF_6 inventory, since about 10% of this inventory is stored at the East Tennessee Technology Park (ETTP, formerly K-25 Site) in Oak Ridge. As explained in the draft programmatic environmental impact statement (PEIS), the continued storage of depleted hexafluoride in steel cylinders in outdoor storage yards does not pose an imminent threat to workers, public, or the environment. However, continued safe storage requires an ongoing program of surveillance and maintenance, and the job of assuring safe storage will become more difficult as time passes. Furthermore, the continued presence of this material at ETTP may adversely affect ongoing site reuse initiatives, both by presenting a negative aesthetic image to prospective ETTP tenants and by preventing new uses of the areas occupied by cylinder storage yards.

Response 1

DOE appreciates the City of Oak Ridge's strong interest in the future management of the DOE depleted uranium hexafluoride UF_6. The City's concerns regarding the continued presence of the depleted UF_6 cylinders at the ETTP (formerly K-25) are noted. DOE has also entered into a Consent Order with the Department of Environment and Conservation of the State of Tennessee with respect to the management of the UF_6 stored at the ETTP. DOE has agreed that if it chooses any action alternative as the outcome of this PEIS, it shall, subject to appropriate NEPA review, *either remove all known depleted UF_6 cylinders from ETTP or complete the conversion of their contents by December 31, 2009. In the meantime, the depleted UF_6 Management Program is committed to working with the Reindustrialization Program at the East Tennessee Technology Park to resolve any issues that may come up with respect to cylinder storage at the site.*

Comment 2

Environmental Quality Advisory Board (EQAB) members support the concept, embodied in most of the alternatives considered in the PEIS, of converting the depleted UF_6 to a more stable form (either uranium oxide or metal) that would be suitable for long-term storage, reuse, or disposal. However, we think the timetable for action that is presented in the PEIS is much too slow. Instead of waiting until 2009 to start converting this material (and finishing the job in about 2028), DOE should act now to start the conversion process as soon as feasible. (There appear to be no technical barriers to starting the conversion process.) The Oak Ridge Gaseous Diffusion Plant operated for about 40 years (1945 to 1985); the federal government owes it to this community not to wait an additional 43 years (1985 to 2028) to deal responsibly with the byproducts of gaseous diffusion.

Response 2

The timetable presented in the PEIS was developed to provide a basis for the calculation of potential impacts (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. For the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory. In fact, as explained in Section 2.5.1 of the PEIS, the preferred alternative in the PEIS has been revised to clarify this point. It now calls for beginning prompt conversion of the depleted UF_6 into depleted uranium oxide.

With respect to the ETTP (formerly K-25 site), DOE's Consent Order with the Department of Environment and Conservation of the State of Tennessee stipulates that, if any action alternative is chosen as the outcome of this PEIS, DOE shall, subject to appropriate NEPA review, either remove all known depleted UF_6 cylinders from ETTP or complete the conversion of their contents by December 31, 2009.

Commentor No. 40: Dortch, Jotilley

<u>Comment 1</u>

A PEIS for UF_6 strategies and management must take all available information on the subject into consideration. This PEIS does not cite the following:

1. "Draft Preliminary Report-DOE Independent UF_6 Cylinder Assessment Team;" DOE draft; 25 March 1992;
2. "Integrity of Uranium Hexafluoride Cylinders," DNFSB Technical Report; 5 May 1995;
3. "Affordable Cleanup?-Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities"; National Research Council, 1996.

Why weren't these studies used as a basis for addressing this problem and its solutions?

<u>Response 1</u>

Except for the draft preliminary report, all the reports referenced in the comment were reviewed and used in preparation of the PEIS and supporting documents (for example, the engineering analysis report). A brief discussion of these reports has been added to the PEIS (see new Section 1.7) and references to the reports have been provided. The draft preliminary report was never finalized, so it is not cited in the PEIS.

<u>Comment 2</u>

The above-ground cylinder storage is risky. There are many styles of containers of varying wall thicknesses. Rust, both visible and under the paint, has weakened many. Improper storage-too close to the ground, too close together to be inspected all around, stacking incompatible styles, damage to cylinders in transport all add to the danger. Leaky or degraded valves and cylinder ID tags missing or unreadable are a problem.

<u>Response 2</u>

Previous substandard storage conditions, such as cylinders stacked too close together and cylinders in ground contact, as well as the lack of a regular maintenance program to recoat the exterior of the cylinders, have resulted in some cylinders experiencing accelerated external corrosion.

The UF_6 cylinder project management plan (LMES 1997i; the full citation is provided in Chapter 8 of the PEIS) was developed to eliminate substandard conditions and to eliminate the effects of corrosion through a recoating program. The management plan addresses all phases of the current UF_6 cylinder management project and is based on risk analysis and technical evaluations which determine the activities to be performed. Under this management plan, all cylinders must be stored out of ground-contact. Any cylinders discovered through periodic *inspections to be in ground contact are relocated. Additionally, there are relocation plans to eventually restack all cylinders which will allow cylinder inspectors accessibility between cylinder rows. These plans are being implemented in a graded approach by relocating cylinders in the poorest storage conditions first. This plan is being implemented concurrently with extensive construction and recoating projects which will provide well drained storage yards for the cylinders and also provide protection for the exterior of the cylinders by recoating.*

The sites have also implemented an extensive cylinder inspection program to allow identification of any damaged or breached cylinders. This inspection program also identifies those cylinders requiring maintenance activities such as valve replacement and nameplate replacement. Annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of pitting or heavy corrosion. All other cylinders must be inspected once every four years. Most of this work has already been completed at the three sites or is planned for completion by the year 2002.

The DOE is committed to maintaining adequate safety of the depleted UF_6 cylinder inventory through use of the UF_6 cylinder project management plan. The plan is discussed and referenced in the Introduction to Appendix D of the PEIS. The plan was used in the PEIS as the basis for assumptions to estimate possible adverse environmental impacts of continued storage of UF_6. For example, the cylinder painting and relocation schedules from the plan were used to estimate worker radiological doses, and also to estimate future cylinder breach rates.

Comment 3

How full the cylinders are presents another problem. Many were filled before the current limits were established.

Response 3

The current fill-limit of solid depleted UF_6 within a cylinder for offsite transportation is 62%, and was reduced from 64% in 1987. Appendix E of the PEIS provides information concerning the options that could be used to meet the transportation requirements for depleted UF_6 given by the U.S. Department of Transportation.

Comment 4

The geology of the area at PGDP includes high risk earthquake zones. It is not a stable place to store or reprocess UF_6. It is not a good place to store the produce until a market opens up or a use is discovered.

Response 4

The safety of current storage of depleted UF_6 cylinders was addressed in the safety analysis reports (SARs) recently prepared for each of the three storage sites. The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including *natural phenomena events such as earthquakes and tornadoes. The accidents considered in the PEIS for continued cylinder storage (Appendix D) were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.*

Comment 5

A viable long-term solution is to convert the cylinder contents to U_3O_8, a more stable oxide that can be reconverted if the need arises. France does this very thing.

Response 5

The conversion of depleted UF_6 to uranium oxide (U_3O_8) followed by storage of the oxide is one of the alternatives considered in the PEIS. This alternative will be evaluated along with the other PEIS alternatives, with the ultimate decision on a management strategy being announced in a Record of Decision. The Record of Decision will consider the results of the PEIS, along with other information, such as cost and engineering data, to select a management strategy. The Record of Decision will document the strategy selected and describe how it was selected from among the different alternatives.

Comment 6

The problems that have surfaced since we have come off the "production-at-all-cost" mentality do not need bandaids. They need real and permanent solutions based on sound technology and upon sound geologic grounds.

Response 6

The commentor's preference for a technology- and geology-based permanent solution to depleted UF_6 management is noted. The process to select a long-term management strategy for depleted UF_6 is based on the need to identify sound technology that is consistent with environmental, health, safety, and cost considerations. The process began with the identification of feasible technologies for conversion, storage and disposal. The PEIS evaluated those technologies for environmental impacts. Additional comparisons based on cost will be undertaken prior to the selection of a strategy for implementation. Technologies and geologic conditions will be given further consideration as appropriate in future reviews supporting implementation of the management strategy announced in the Record of Decision for this PEIS.

Commentor No. 41: Lorimer, A. J.
British Nuclear Fuels plc

Comment 1

You will note that one of the main concerns that we have is the omission of an option for depleted uranium metal as a medium for long-term storage/disposal. As you are aware the technology BNFL is currently developing to process our own tails has as products, uranium metal and fluorine gas. BNFL's view is that uranium metal is feasible for long-term storage and disposal and could have clear cost and environmental advantages. This has not been adequately recognized or assessed in the report.

Response 1

Long-term storage of depleted uranium metal was considered but not analyzed in detail in the PEIS. Due to its high density, depleted uranium metal would require less storage space than the other uranium forms considered in the PEIS. This advantage has to be compared against disadvantages of depleted uranium metal which include its higher conversion cost, lower chemical stability than the uranium oxides, and uncertainty about the suitability of the depleted uranium metal form for eventual disposal.

The PEIS also considered, but did not analyze in detail, disposal of depleted uranium metal because of the large uncertainties that currently exist concerning its suitability and acceptability for direct disposal. Reactive waste forms such as depleted uranium metal are specifically excluded from disposal by the Nevada Test Site and Hanford waste acceptance criteria and Department of Energy Orders. Relaxation of current waste acceptance criteria would likely be needed for disposal of uranium metal to occur. The oxide forms considered in the PEIS are more favorable for disposal.

Further details are provided in Section 4.0 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 2

BNFL supports the strategy of safe storage as UF_6 pending the development of suitable uses. These uses would be most likely within the nuclear fuel cycle.

Response 2

The commentor's preference for storage pending development of uses is noted. The commentor's opinion as to eventual use is also noted.

Comment 3

The Engineering Analysis has several significant omissions and inaccuracies which although unlikely to affect the overall environmental impact, could weaken the conclusions of the PEIS and the Cost Analysis.

The Engineering Analysis uses conservative assumptions resulting in excessive rather than realistic costs and tending to preclude meaningful comparison of the options. Examples are: taking 7 years to build a facility, not considering use of several existing facilities in the USA, and the high projected manning levels.

Response 3

As noted in Section 1.5.4 of the PEIS, representative or generic environmental settings were used for conversion, long-term storage, manufacturing, transportation, and disposal activities. The engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) assumes that any new facilities would have to be constructed and operated at greenfield site locations. A summary of the Engineering Analysis Report is provided as Appendix O to the PEIS.

The assumptions in the PEIS were made uniformly among the management options so that the comparison of alternatives are meaningful. To provide a conservative estimate of impacts, it was assumed that new facilities would be constructed for conversion, consolidated long-term storage, manufacturing and disposal. The assumptions were based on industry or government experience with similar facilities or on engineering judgment.

Comment 4

The approach taken for the assessment of the environmental impacts arising from the various management options is good and the methodologies are suitably transparent to scrutiny. However, there are a number of general areas where the assessment methodologies could be improved and these are detailed below.

The treatment of uncertainty in any kind of assessment methodology is a vital issue, especially where generic (non site specific) settings have been used. The uncertainties in the input parameters and assumptions in conceptual models, and their effect on the predicted consequences, need to be determined, usually by a sensitivity analysis technique. Measures can then be taken to reduce the uncertainties.

Uncertainty has been recognized as important in the PEIS but little has been done to analyze the issue. Instead, assumptions have been made with the intention that the various anticipated environmental impacts result in conservative rather than realistic estimates. As it turns out, in most cases (except groundwater contamination in the disposal option) the impacts are still low enough to be acceptable. However, this approach tends to obscure meaningful comparison between the alternatives and is not always appropriate. When a management option and suitable site are chosen, the environmental impacts for that site should be assessed on a realistic basis.

One exception to this conservative approach is the assumption that manufacture of shielded containers would bound any impacts associated with other products. In this case, the shielded containers are as large a product as can be reasonably imagined. Smaller products would require more operators per unit weight of uranium processed, and would be less self-shielded, giving much larger total involved worker doses.

<u>Response 4</u>

As correctly noted by the commentor, the general approach for dealing with uncertainty in the PEIS was to uniformly apply common assumptions to the alternatives and choose assumptions intended to produce conservative and yet realistic estimates of impacts. This approach is intended to enhance the ability to make valid comparisons among the alternatives. A comprehensive sensitivity analysis was not conducted primarily for two reasons: (1) the purpose of the PEIS was to evaluate and compare potential environmental impacts on a broad programmatic level, and (2) the conceptual nature of facility designs and processes at this stage generally does not readily support sensitivity analyses for most parameters. However, uncertainties related to the environmental settings of future management sites was addressed in the PEIS by evaluating a range of conditions for a small number of factors known to significantly affect the magnitude of impacts (i.e., sensitive parameters). These factors included population densities, precipitation rates, and soil characteristics (for disposal sites). It is not expected that more detailed sensitivity analyses would alter the conclusions reached in the PEIS.

After the Record of Decision for the PEIS, DOE would evaluate potential facility locations and conduct appropriate and more detailed site-specific analyses for any required facilities. The uncertainties associated with such analyses would be less and the estimated impacts would be more realistic.

As described in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, were selected as representative options to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to bound the impacts associated with any future use, but rather to identify the types and general magnitude of impacts associated with manufacturing products containing depleted uranium. The impacts associated with specific uses will depend on what use or uses are ultimately identified, and would be considered and evaluated in more detail in future planning and environmental analyses.

Comment 5

The methodologies used in the Cost Analysis are considered to be sound. However the report is based on the Engineering Analysis and the comments made for that report will also have cost implications and might alter the conclusions of the Cost Analysis. In particular, the basis for the revenues or credits for the sale of AHF, CaF_2 and radiation shields require robust justification.

Response 5

Comment noted. The basis for the potential revenue from sale of by-product AHF and CaF_2, and the potential credit for depleted uranium radiation shielding is provided in the cost analysis report (1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 6

Long-term storage as uranium metal has not been analyzed even though it was a feasible recommendation in the Technology Assessment Report and there are significant volume and cost benefits which might make the economics of this route more attractive than U_3O_8 or UO_2.

Response 6

The technology assessment report (LLNL 1995; the full citation is provided in Chapter 8 of the PEIS) considered uranium metal as a potential form of uranium for long-term storage. Long-term storage of depleted uranium metal was not analyzed in depth in the PEIS. Due to its high density, uranium metal would require less storage space than the other forms considered in the PEIS (i.e., UF_6, UO_2, and U_3O_8). However, as noted in Sections 2.3.3 and 2.3.4 of the PEIS, this advantage is outweighed by the higher conversion cost, lower chemical stability than the oxides, and uncertainty about the suitability of the metal form for eventual disposal. In addition, the reactivity of uranium metal would necessitate specialized packaging and storage due to the evolution of hydrogen during the reaction between moisture and uranium metal.

Further information is provided in Sections 4.4 and 4.5 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 7

Disposal as uranium metal has not been analyzed even though it was a feasible recommendation in the Technology Assessment Report and there are significant volume and cost benefits which might make the economics of this route more attractive than U_3O_8 or UO_2. The PEIS shows that reducing the volume of the material disposed significantly reduces the impacts on the environment, suggesting that uranium metal, which has the minimum volume, would minimize the environmental impacts. Although current DOE Orders restrict such disposal, there is no equivalent restriction at the commercial disposal sites.

<u>*Response 7*</u>

The PEIS did consider but did not analyze in detail the disposal of uranium metal because it is very reactive. Water attacks bulk uranium metal at room temperature and rapidly at higher temperatures. UO_2 *and* UH_3 *are formed, heat is evolved, and the metal swells and disintegrates. Uranium oxides such as* U_3O_8 *are chemically stable, insoluble, and of low toxicity in drinking water, all of which are desirable properties for disposal. Also, the following document, which was one of the references consulted when deciding on the reasonable range of alternatives to analyze in the PEIS, concluded that no commercial disposal facility would be a potential candidate for disposal of DOE's depleted uranium: "Depleted Uranium Disposal Options Evaluation," by T.J. Hertzler, D.D. Nishomoto, and M.D. Otis, EGG-MS-11297, May 1994. In addition, correspondence from the U.S. NRC to DOE in response to DOE's request for recommendations published in the November 10, 1994 Federal Register recommended that depleted* UF_6 *be converted to* U_3O_8 *for purposes of disposal. Any commercial facility constructed for disposal of depleted uranium in the U.S. would have to be licensed by the U.S. NRC. Because of these reasons direct disposal of depleted uranium metal was not evaluated in the PEIS, either at DOE sites or commercial sites.*

Appendix A (Low-Level Waste Disposal at DOE Sites) of Chapter 6.13 (Disposal Options for Depleted Uranium Management) of the engineering analysis report indicates that currently only three commercial low-level radioactive waste (LLW) disposal sites are in operations in the U.S. The Richland, Washington commercial LLW disposal site is accepting waste from the northwest compact generators only (which includes the states of Washington, Oregon, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, and New Mexico). The Barnwell, South Carolina LLW commercial disposal site is accepting waste from members of the southeast compact only (i.e., the states of Virginia, South Carolina, Tennessee, Mississippi, Alabama, Georgia, and Florida). It is unlikely that these two commercial disposal sites would be available for the disposal of depleted uranium metal provided by DOE, especially given the large quantities of material to be disposed. The waste acceptance criteria for the Envirocare site in Clive, Utah does allow disposal of depleted uranium, but generally in the form of an oxide.

The current waste acceptance criteria for the Hanford and Nevada Test Site are provided in Appendices F and G of the EAR. It would be highly speculative to consider revision of the waste acceptance criteria for these sites to allow disposal of depleted uranium metal. It should however be noted that these sites would allow disposal of depleted uranium oxides.

<u>Comment 8</u>

The environmental impacts of disposing of, or recycling, the products containing uranium metal or oxide at the end of their useful life should be analyzed.

<u>*Response 8*</u>

The PEIS acknowledges that at the end of their useful lives, products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4 and 2.2.5 and Section 5.9 of the PEIS). At this time, any analysis of disposal after use would be too speculative as it is not known when and at what rate the material would be declared surplus and would be disposed of. These issues are discussed in Section 5.9 of the PEIS.

<u>Comment 9</u>

The suggestions for the Pre-transport Preparations of UF_6 Cylinders appear to be compliant with the recommendations in IAEA Safety Series 6, 7, 8, 37 and 80. An overcontainer used for a cylinder which does not meet DOT requirements would need to contain any leakage from the cylinder. To achieve this, the overcontainer would need to meet the requirements of a Type A Package, as defined by the IAEA. An overcontainer "slightly bigger than the cylinder" which meets DOT regulations may not achieve this. It would be more prudent to plan for the transfer of the UF_6 to a new cylinder to cater for the instance of an over-pressure and damaged cylinder which could not be transported even in an overcontainer.

<u>*Response 9*</u>

The commentor's preference for the cylinder transfer option for transportation of cylinders is noted by DOE. However, it should be noted that if the overcontainer option were selected, the overcontainer would meet the same safety requirements as the conforming cylinders. Therefore, the safety basis for transportation of the cylinders would be the same irrespective of the option chosen for cylinder preparation. For further details on the preconceptual design of the overcontainer, see the (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 10</u>

The engineering required to deal with some of the severely degraded cylinders has been underestimated. It is not reasonable to assume that these cylinders can be placed into overcontainers nor that their contents can be transferred in the manner described.

<u>*Response 10*</u>

The overcontainer concept was developed as a protective overpack that would meet the U.S. DOT requirements for shipping cylinders. Currently ten-ton product cylinders containing solid UF_6 with an assay greater than 1% are enclosed in specially designed overpacks called "Paducah Tigers."

The PEIS assumes that the contents of depleted UF_6 from cylinders would be transferred by sublimination (going from solid to gas) rather than by liquefaction (going from solid to liquid).

This process called "coldfeeding" allows transfer of the contents of even the severely degraded cylinders. The technical feasibility for cylinder transfer of UF_6 is well established.

Further information concerning the cylinder overcontainer concept and the cylinder transfer process are provided in Sections 6.1 and 6.2 of the engineering analysis report (LLNL 1997; the full citation is provided in Appendix E of the PEIS) and in Appendix E of the PEIS. The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 11

Accidents considered for the Cylinder Preparation Options involving cylinders of solid UF_6 assume releases of UF_6 in dry conditions and HF in wet conditions (rain). Accidents involving UF_6 vapour assume releases of UO_2F_2 and HF. Releases of any physical form of UF_6 result in reaction with water vapour in the air, producing UO_2F_2 and HF vapour. The PEIS therefore has underestimated the impacts of such accidents.

Response 11

For PEIS accident analyses it was generally assumed that UF_6 released to the atmosphere would react with moisture in air, or with water vapor generated by combustion (for accidents involving fires) to form airborne UO_2F_2 and HF. In the Appendix tables addressing accidents for options involving UF_6 handling (i.e., Tables D.6, E.4, F.7, and G.6), accident analyses for accidents listing UF_6 as the chemical form addressed both UO_2F_2 and HF releases.

The postulated accident involving a corroded cylinder spill, wet conditions (rain) was an exception to the above, because the UO_2F_2 generated under wet rainy conditions would not be airborne but would deposit as a solid on the ground surface near the cylinder. Therefore, for this accident, only release of HF was evaluated. As a result, the concern raised by the commentor has been addressed in the PEIS and the impacts of such accidents have not been underestimated.

Details on the assumptions used to generate source terms for the accidents are provided in the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The EAR and other supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 12

Emptied Cylinder Treatment: The residue remaining after the cylinder has been washed out and the water has evaporated will be UO_2F_2, rather than a "mixture of uranium and fluorine."

The cleaned cylinders could be cleaned further and monitored for free-release, or could be recycled to fabricate other containers for use in the nuclear industry.

Response 12

The text within the PEIS has been reviewed and the statement "a mixture of uranium and fluorine" has not been identified.

The management of empty cylinders was addressed in the PEIS in association with the conversion options (Appendix F), as well as in a support document entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" (Nieves et al. 1997). Options considered for disposition of the emptied cylinders included recycle, reuse, disposal (i.e., burial), and free release. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses. The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 13

Conversion Module: The vast majority of process and other buildings use reinforced concrete in their construction. The use of reinforced concrete for the conversion process buildings cannot in itself be considered a safety feature.

Response 13

Reinforced concrete is a safety feature in that it provides containment to limit potential releases to the environment from energetic process mishaps (such as explosions) and also to protect process equipment from failure due to natural phenomena effects such as airborne missiles from tornadoes, etc. As explained in Section 1.2.2 of the conversion reports (Sections 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, and 6.10) of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), the facility designs were based on the criteria included in the applicable DOE orders and standards. The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 14

Control of HF vapour by limiting the temperature of the building will not work. The vapour pressure of HF at 32°F is nearly half an atmosphere so even at this low temperature HF will vaporize quite quickly. Control of vapour in the manner described is analogous to saying that a cup of coffee does not give off water vapour because it is below the boiling point of water.

Response 14

Limiting the building temperature is not intended as a primary control of HF releases. The temperature of the HF storage tanks and building are assumed in the PEIS to be cooled to about 50 degrees Fahrenheit, to minimize the amount of HF that would vaporize if a spill should occur. Primary control of HF releases is by the HF Storage Building HVAC system (which will shut down if a HF spill occurs) and by the HF Storage Building water spray system, which is activated when a HF spill occurs to absorb any HF vapor in the building.

Comment 15

Upgrading the concentrated HF as described in both the U_3O_8 and UO_2 options will produce approximately equal quantities of esotropic HF, a highly corrosive liquid, and AHF. The esotropic HF has relatively little value, and no disposal or use route is described. However, the reduction of UF_6 to UF_4 with hydrogen or cracked ammonia to produce metal does indeed produce just anhydrous HF as a by-product.

Response 15

Reduction of UF_6 to form uranium oxides such as U_3O_8 and UO_2 will produce a hot off-gas stream containing HF. The PEIS assumes that this stream is sent to a distillation column for HF purification and recovery. The distillation column produces an anhydrous HF product and an azeotropic mixture of approximately 45 wt% HF and 55 wt% water. This esotropic stream is recycled back in the overall process, to react with the incoming UF_6 to form UO_2F_2. No disposal of the esotropic HF-water mixture is needed.

Comment 16

U_3O_8 Option: A dry conversion process could produce dense U_3O_8.

Response 16

The dry conversion process as evaluated in the PEIS would not produce dense U_3O_8. Production of dense U_3O_8 is possible, potentially through a process similar to that used to produce dense UO_2 (i.e., the U_3O_8 powder would be milled, compacted and granulated, mixed with a dry lubricant, pressed, and sintered under a reducing gas atmosphere). The dry conversion process evaluated in the PEIS to produce U_3O_8 was generally based upon the existing industrial COGEMA process practiced in France. Therefore, it was selected as a representative process for conversion of depleted UF_6 to U_3O_8 and provides an appropriate basis for comparison of alternatives.

Comment 17

UO_2 Option: UO_2 is a metastable oxide which could react with oxygen or air to form *U_3O_8*, with an increase in volume.

Sintering in a hydrogenous atmosphere is required to achieve the densities quoted (9 gm/cc). The hazards associated with hydrogen have not been addressed.

Response 17

As noted in Section A.1.5 (Uranium Dioxide) of the PEIS, UO_2 will gradually convert to U_3O_8 at ambient temperatures.

Hydrogen is used in a number of conversion options, primarily to convert UF_6 to UF_4. Hydrogen is also used in the sintering process for UO_2, in which UO_2 pellets are heated in a reducing atmosphere containing 6% hydrogen, to produce a final density on the order of 9.8 grams per cubic centimeter.

The PEIS did analyze the potential hazards associated with hydrogen, including the potential for a hydrogen explosion (see Table F.7 in Appendix F). A number of accident scenarios were postulated, as identified in Sections 6.5, 6.6, 6.7, and 6.8 of the engineering analysis report (LLNL 1997; the full citation is provided in Appendix F of the PEIS).

The engineering analysis report LLNL (1997) is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 18

Uranium Metal Option: A continuous metallothermic reduction process produces a uranium/iron compound with a lower melting point than that of pure uranium, allowing the operating temperature of the process to be lower. This is necessary to control the magnesium evaporation rate since magnesium has a significant vapour pressure at temperatures well below the melting point of pure uranium. The uranium/iron compound is much less dense than uranium metal and would be a relatively inefficient gamma radiation shielding material. The two metallothermic reduction processes are not therefore equivalent for the production of metal for use and should not be compared.

Response 18

The uranium alloy from the continuous metallothermic process only contains 3 wt% iron, which would not significantly reduce its density and gamma shielding characteristics compared to pure uranium. Besides, the PEIS does not compare the two technologies but evaluates both of them to provide a basis for a potential range of impacts that would result from conversion of the depleted UF_6 to depleted uranium metal.

Comment 19

The Unlikely Accident during Conversion to Metal "Uranium metal fire" would be better described as a conventional fire causing some oxidation of the adjacent uranium derbies. The large size of the uranium derbies would prevent them from catching fire.

<u>Response 19</u>

Depleted uranium is a combustible metal. When the specific surface area of depleted uranium is high, the material is pyrophoric, i.e., capable of self-ignition when exposed to air. Uranium metal burns in air at temperatures around 150 to 175 degrees Centigrade with formation of U_3O_8.

<u>Comment 20</u>

Pressurization of the metallothermic reduction vessel caused by vaporization of excessive magnesium has not been considered. This should be a "Likely Accident."

<u>Response 20</u>

It is assumed that the comment concerns the batch metal reduction process; as stated, pressurization of the metallothermic reduction vessel with some loss of U_3O_8 containing vapor is a likely accident which was not considered in the engineering analysis report or the PEIS. Were this accident considered, a conservative screening-level estimate of the source term results in a release estimate of 0.00165 lb of U_3O_8 through the plant stack (1400 lb uranium metal × 0.1% release oxidizes to 1.65 lb U_3O_8, which is then reduced by the 99.9% HEPA filter efficiency). It is not necessary to add this accident to the likely accidents considered in the PEIS, because the likely accidents already included for conversion to metal involve greater releases (see Table F.7 of the PEIS).

<u>Comment 21</u>

The estimated quantity of uranium released to atmosphere from the conversion facility is very small given the throughput of the facility.

<u>Response 21</u>

The estimated air emissions during conversion (and other options) were determined based upon historic releases from similar facilities, taking into account current best practices for emission reduction (e.g., HEPA filtration for uranium particles). It was assumed in the PEIS that gaseous effluents would be treated as necessary to meet applicable effluent standards. Further information concerning the emission rates for the various PEIS options is provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report and other supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 22</u>

Use Module: For shielding gamma radiation, it is not only the material's density which makes it an effective shield, but, as in the case of uranium, a high atomic number is also significant. There are alternative dense metals such as tungsten for applications which need solely high density and mass: in such applications, uranium is usually preferred only when particular mechanical properties are required in addition to density.

The number of UO_2 shielded casks and the number of uranium metal shielded casks seem to be derived by dividing the weight of uranium in the tails UF_6 by the weight of uranium in each cask. This number should be compared with the number of casks needed by the US nuclear power program for the storage/disposal of irradiated fuel.

Response 22

A comparison of the amount of uranium needed for annular shielding in spent nuclear fuel containers with the number of casks required for the U.S. nuclear power program indicates that the entire DOE inventory of depleted UF_6 would be consumed. Further information is provided in section 6.13 (Potential Shielding Applications of Depleted Uranium in Metal and Oxide Forms) of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 23

Uranium metal is a much more effective gamma shield than UO_2, and so more spent fuel could be loaded into each metal-shielded cask, thereby reducing the transport and final disposal costs of the spent fuel.

Response 23

The PEIS analyzes two options for radiation shielding applications using depleted uranium. The uranium metal option would result in a spent nuclear fuel (SNF) disposal package, primarily as part of a Multi-Purpose Unit (MPU). The uranium oxide option would produce a concrete-like material, which has been proposed for use in SNF storage applications at commercial nuclear power plant sites. The existing PEIS analyses address the shielding property differences of the two forms of depleted uranium that are considered. (See Sections 5.4 and 5.5 and Appendix H of the PEIS.)

Comment 24

The proposed method of fabricating the casks with uranium metal shielding is not practicable and is hazardous. Molten uranium forms low melting point eutectics with Fe, Cr and Ni, therefore the molten uranium will dissolve the steel shells, liberating large quantities of heat and resulting in a major spillage of uranium. There are, however, other, methods available to fabricate casks from depleted uranium that do not have these safety problems.

<u>*Response 24*</u>

It is stated on p. 6.11-1-8 of the engineering analysis report (1997a; the full citation is provided in Chapter 8 of the PEIS) that high stainless steel, nickel or titanium alloys with sufficient strength and melting point margins to accommodate the molten uranium metal without deformation would be used. The shell could be zone cooled during pouring to minimize alloying and to maintain integrity of the shell. As suggested by the commentor, it is possible to develop alternative methods to fabricate the casks, however, the method described in the EAR and used by the PEIS is expected to be representative of and in some cases, bound the impacts of the cask fabrication process. The EAR is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 25</u>

No reason is given why solidified ash waste from the facility producing uranium metal shielding components should require disposal in a special cell or mine.

<u>*Response 25*</u>

The solidified ash waste from the uranium metal shielding facility is expected to be categorized as LLW Class A by the NRC, and should be suitable for near-surface disposal. The empty DUCRETE casks, after storing spent nuclear fuel, may require disposal in a special cell or a mined cavity because the uranium concentration would be on the order of 200,000 pCi per gram. Further information about the potential waste streams from the shielding applications considered in the PEIS is provided in Section 6.11 of the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The EAR, as well as other supporting reports, are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 26</u>

The estimated quantity of uranium released to atmosphere from the manufacturing facility is very small given the throughput of the facility.

<u>*Response 26*</u>

It is assumed that the comment concerns the two use options. The oxide shielding application relies upon simple, low-temperature mixing techniques similar to concrete mixing, and significant releases would not be expected. The second use route uses depleted uranium metal which requires high temperature operations. Furnace discharging of molten metal into annular casks results in the majority of the radioactive emissions from the depleted uranium metal route. The analysis in the PEIS applies an airborne release fraction of 0.006, two sets of HEPA filtration (a decontamination factor of 2×10^{-6}), for an overall release fraction of 1.2×10^{-8}. These parameters are judged to provide a representative assessment of the impacts of these use options. Further *information concerning the airborne release fractions and decontamination factors applied in estimation of the emission rates is given in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS).*

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 27

The release from accidental mishandling/drop of drum/billet inside the plant should be more for the oxide case than the metal case since the oxide is at this stage a loose and powdery material and the metal is in massive billet form.

Response 27

It is assumed that the comment is referring to accident scenarios postulated to occur during potential shielding applications of depleted uranium (see Table H.5 of Appendix H). One shielding application considers using UO_2 in the form of a sintered pellet, which is similar to a ceramic, and is not a loose and powdery material. Uranium metal would have an oxide layer surrounding it, which could be described as a tarnish layer. The amount of uranium released when dropped onto a hard surface would be less for the ceramic-like UO_2 than for the uranium metal, as reflected in the release amounts shown in Table H.5.

Comment 28

One factor which limits the useful market for uranium is its radioactivity which means that at the end of life it cannot be disposed of by the user in a straightforward manner. The Engineering Analysis considers the manufacture and use of the depleted uranium in both oxide and metal forms for the shielding of spent nuclear fuel. However there is only a disposal route defined for the oxide form since uranium metal is not considered suitable for disposal. The environmental impacts of disposing of, or recycling, the products containing uranium metal or oxide at the end of their useful life should be analyzed, including impacts from disposal of the shielding with the spent fuel still in it.

Response 28

The analysis in the PEIS was intended to provide a comparison of reasonably foreseeable environmental impacts for each of the alternatives considered. Consequently, the potential environmental impacts were evaluated for a 40 year assessment period for all alternatives. In addition to this analysis, an evaluation of the long-term impacts for the disposal as oxide alternative was included in the PEIS because such impacts can be reasonably predicted. A life-cycle analysis for the alternatives other than disposal was not performed at this time because actions to be taken beyond the 40 year assessment period are considered highly uncertain and speculative. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, *or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.*

Comment 29

Long-Term Storage Module: Recommendations from the Technology Assessment Report to store the uranium as metal have not been analyzed even though they were considered feasible. Storage of bulk metal does not produce metal flakes so the pyrophoricity issue is not relevant. Corrosion of uranium metal by moisture can produce hydrides in the metal, but these are only a hazard if oxygen (or air) are excluded. The possibility of an explosion if the hydrogen from corrosion is collected in closed containers only arises when the containers are opened and air is admitted. Storage of bulk uranium metal in a building in air, as opposed to closed containers, is entirely practicable and safe. Should the consequent slow corrosion be unacceptable, it is feasible to consider development and application of a protective coating.

Response 29

As explained in the response to comment number 1 by this commentor, long-term storage of depleted uranium metal was considered but was not analyzed in detail in the PEIS. Due to its high density, depleted uranium metal would require less storage space than the other uranium forms under consideration in the PEIS. However, as noted in Sections 2.3.3 and 2.3.4 of the PEIS, this advantage must be weighed against disadvantages such as higher conversion cost, lower chemical stability than the uranium oxides, and uncertainty about the suitability of the uranium metal form for disposal.

Further information concerning options not analyzed in depth in the PEIS (such as long-term storage of depleted uranium metal) is provided in Section 4.0 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 30

In a response to a comment on the storage of uranium in forms other than oxide, received during the scoping process for the PEIS, it was stated that "the rationale for the selection of these chemical forms for analysis will be presented in the PEIS." The same response questions the suitability of uranium metal, as opposed to uranium oxide, for storage on the grounds of "higher conversion cost, lower stability and uncertainty of the suitability of the metal form for eventual disposal." The Engineering Analysis, Cost Analysis and PEIS fail to justify any of these assertions. No account is taken of the introduction of new technologies which would produce uranium metal at significantly lower cost.

<u>*Response 30*</u>

The engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) provides the rationale for why depleted uranium in the form of metal was considered but not analyzed in detail in the PEIS. The EAR is incorporated into the PEIS by reference and summarized in Appendix O of the PEIS. The rationale for considering but not analyzing in detail the long-term storage and disposal of depleted uranium metal is also summarized in Sections 2.3.3 and 2.3.4 of the PEIS.

Section 4.4 of Chapter 4 of the EAR (Summary of Principal Options Not Analyzed in Depth) states that depleted uranium metal storage would require specialized packaging and enhanced facility maintenance compared with depleted uranium oxide storage, because depleted uranium metal slowly oxidizes and releases hydrogen. In addition, Section 1.2 (Background on the Disposal of Depleted Uranium) of Chapter 6.13 (Disposal Options for Depleted Uranium Management) of the EAR states that finely divided uranium metal is pyrophoric and is restricted from disposal by site-specific waste acceptance criteria.

The EAR considered technologies primarily based upon the recommendations received in response to the Request for Recommendations (59 FR 56324). These recommendations were reviewed by a panel of independent technical experts. The EAR analyzed in detail only those technologies that met the criteria used by the independent technical reviewers. One of the criteria was the technical maturity of the technologies reviewed. If in the future new technologies became available that would outperform the technologies analyzed in the EAR and the PEIS, they would be considered as part of the future planning and analysis process that would take place after the Record of Decision is issued for this PEIS.

<u>Comment 31</u>

Disposal Module: Using 30 gal drums for UO_2 disposal is not an optimum solution. There are no real reasons why 55 gal drums (about 2,000 kg weight) cannot be used and handled efficiently. This would reduce the number of drums to be disposed with consequential lower environmental impacts.

<u>*Response 31*</u>

UO_2 is usually stored in 30-gallon drums, because of the density of UO_2 (a 30-gallon drum of UO_2 weighs about 2,350-lb [1,070 kg] filled). A 55-gallon drum of UO_2 would weigh about 4,300 lbs (1,950 kg), and would have to be specially-made so as to not to fail or deform due to the weight of the contents.

<u>Comment 32</u>

Recommendations from the Technology Assessment Report to dispose of the uranium as metal have not been analyzed even though they were considered feasible. Uranium metal is accepted at commercial disposal sites in the USA, and there are no NRC regulations which would prevent such disposal. The DOE Orders which specifically exclude fluorides and metal from the Nevada Test Site and Hanford should be comprehensively reviewed to identify the adverse consequences/impacts, if any, which lead to the dismissal of U metal as a suitable form for disposal.

Response 32

For reasons explained in the responses to comment numbers 1 and 7 from the commentor, disposal of uranium metal was considered but not analyzed in detail in the PEIS. Review and revision of DOE Orders are beyond the scope of the PEIS.

Comment 33

The U oxides are stated to be the preferred forms for disposal because of their stability and slow dissolution rates in water. Uranium metal is slow to dissolve in water, and therefore should be considered for disposal especially when the much smaller volume of metal is taken into consideration.

Response 33

For reasons explained in the responses to comment numbers 1 and 7 from this commentor, disposal of uranium metal was considered but not analyzed in detail in the PEIS.

Comment 34

The reduced volume of the uranium metal would significantly reduce the impacts on the environment as the PEIS shows that most environmental impacts tend to be proportional to volume. The observations that impacts for the denser UO_2 are less than for U_3O_8, and the impacts for ungrouted waste forms are less than for grouted waste forms because the volumes are lower (about 50%) should enhance the case for disposal as U metal because metal volumes will be even lower. Disposal as U metal blocks would not involve grouting and would therefore also have lower environmental impacts through the avoidance of the long term effects of grouting.

Response 34

Please see responses to comments 1, 7, 32, and 33 by this commentor.

Comment 35

It is not correct to describe surface oxidation of U metal as "similar" to HF formation from reaction of uranium fluorides with water. The consequences of the two are very different.

Response 35

It is unclear as to which section of the PEIS that the comment is referring to. The surface oxidation of uranium metal can form a pyrophoric surface because of reaction with air and moisture, which can spontaneously ignite. UF_6 reacts with water to form the soluble reaction products uranyl fluoride (UO_2F_2) and hydrogen fluoride (HF), both of which are toxic.

Comment 36

Areas where the Assessment Methodologies could be improved: Radiation and chemical effects are analyzed by considering the maximally exposed individual (MEI) in three groups, "involved workers," "noninvolved workers" and "members of the general public." However, no account seems to have been taken for cumulative exposures between groups (the MEI in the involved worker group could also be the MEI in the general public group if he/she lives near the site). This approach has resulted in some anomalies, such as in the case of the manufacturing facility where the MEI radiation dose and hazard index of a member of the general public are predicted to be greater than those for a noninvolved worker, under normal operating and certain accident conditions. A preferable approach would be to use a larger number of critical exposed groups, chosen to be mutually exclusive.

The chemical and radiation risk to the MEI for the involved worker group during normal operations has not been quantified. The reason given is that worker activities are uncertain at this stage. However, uncertainties such as this have not stopped the authors from making conservative assumptions in order to quantify environmental impacts in many other areas of the PEIS. The PEIS approach must be consistent.

Response 36

Risks to the maximally exposed individual (MEI) member of the public and the MEI among workers were calculated separately because different exposure pathways and durations apply to each individual. For example, the general public MEI was assumed to be present at the off-site location of highest concentrations of materials released from cylinder management operations for 24 hours per day, 365 days per year. Workers were assumed to spend 8 hours per day, 200 days per year at the on-site location of highest concentrations of materials. Additional exposure pathways are also included for the general public MEI, such as ingestion of contaminated water and food. If a person lived near the site and worked at the site, that person's exposure and risk could be estimated conservatively by adding the MEI public dose to the MEI worker dose. With respect to instances where the dose and risk to the general public MEI are estimated to be greater than the dose and risk to the non-involved worker, this situation is due to the physical behavior of some airborne substances released from stacks. Due to buoyancy effects, substances released from stacks may rise further in the atmosphere prior to deposition on ground surfaces. Where this effect occurs, it causes a receptor at a location closer to the stack to have a lower exposure than a receptor further away. The concentrations of contaminants of concern at various locations away from the assumed release points (stacks) were calculated using verified computer models in wide use in the scientific community. See Section C.1 of Appendix C for more information and references to these computer models.

Radiological impacts were evaluated in the PEIS for involved workers, but the evaluation was limited to external radiation exposure. Radiation doses and chemical exposures from inhalation would be expected to be small because (1) processes would be enclosed, (2) ventilation controls *would be in place to inhibit airborne emissions within facilities, (3) indoor air would be monitored to ensure concentrations were below applicable standards, and (4) workers would be provided with appropriate personal protective equipment (e.g., respirators) if internal exposures were possible. Furthermore, the conceptual nature of the conversion, storage, manufacturing, and disposal facility designs does not allow for an accurate estimate of potential indoor air concentrations at this time. The sites where depleted UF_6 management activities would occur would have approved radiation protection programs in place before the activities begin. Worker exposures would be kept below applicable administrative and regulatory limits and would be subject to the ALARA principles.*

Comment 37

The impacts to the involved workers of clearing up from the assumed accidents have not been considered. The amount of material released inside the plant which the involved workers would have to clean up is likely to be significantly more than the amounts quoted in the PEIS, which are presumably the amounts released to the environment outside the process buildings.

Response 37

After an accident, many precautions would be taken to limit the exposure of clean-up workers, including wearing of protective clothing, use of respirators, and limiting the time spent in the vicinity of released radioactive materials. Additionally, the exposures of clean-up workers would be carefully monitored to ensure that their exposures were kept within regulatory limits. Because of these protective measures, exposures of individual cleanup workers would generally be low. At the programmatic level such as the case for this PEIS, the facility designs are preliminary and many of the sites where the facilities would be constructed are not known. Therefore, any estimates for exposure and intake of clean-up workers would be highly speculative.

Comment 38

The environmental impacts due to human intervention (deliberate and inadvertent) do not appear to have been addressed. While human intervention is most applicable for the disposal option (post-closure phase), where mining and construction activities could bring material back to the surface, there are also human intervention scenarios plausible for all of the other options. No mention is made of any institutional controls likely to be in place to help prevent such occurrences. Assessment of the risks resulting from human intervention is usually carried out by an expert elicitation process to determine the probability and consequences of various human actions.

Response 38

In the PEIS it was assumed that the long-term storage facilities would be monitored throughout their use, and that the disposal facilities would be monitored and maintained (i.e., have institutional controls) for some period of time after placement of the materials. During the monitoring period, any deliberate or inadvertent human intervention would be quite limited and not of significant consequence with respect to the impacts estimated in the PEIS.

The environmental impacts during the post-closure phase of disposal are discussed in Section I.4.1.1 of Appendix I in the PEIS. After the institutional control period, it was assumed that the disposal facilities would fail (that is, release waste to the environment). The analysis of this failure generally assumed that it was due to natural causes (i.e., percolation of groundwater through the disposal facilities). However, Section I.4.1.1 also discusses the radiological impacts that could be caused by external radiation and inhalation of contaminated dust particles if all the cover materials above the disposal site were removed and containers of U_3O_8 or UO_2 disintegrated. This type of analysis could be likened to the analysis of human intervention scenarios in waste disposal where it is assumed that the waste is dug up by individuals and brought up to the surface. The text of Section I.4.1.1 has been modified to acknowledge that human intervention could be the cause of such a scenario. However, detailed analysis of human intervention scenarios, including an assessment of their probability of occurrence, would be performed if site-specific disposal analyses were to be conducted.

<u>Comment 39</u>

The environmental impacts due to the disposal of secondary wastes such as MgF_2 from the conversion options have not been fully addressed. The only impact addressed is the extra burden on the capacity of the disposal sites and the environmental impacts due to the construction of new disposal sites to cope with the increase in demand. The post-closure impacts of such sites are not addressed in the PEIS.

<u>Response 39</u>

All secondary wastes generated from depleted UF_6 management alternatives would be required to be disposed in state- or federally-licensed disposal facilities. The licensing process for such facilities would examine the potential post-closure impacts. The analysis of post-closure impacts on separate licensed disposal facilities is beyond the scope of the PEIS.

<u>Comment 40</u>

The prediction of groundwater contamination is highly site-specific. Most of the calculations in the PEIS connected with this issue have to make large assumptions over the geochemical and hydrological characteristics of generic sites and the value of environmental impacts calculated in this way is questionable. Only site-specific data should be used when calculating risks from a groundwater pathway.

<u>Response 40</u>

Because this PEIS is programmatic, no site-specific groundwater calculations were performed except for continued storage and cylinder preparation in which site-specific data for Paducah, Portsmouth, and Oak Ridge were used (See Table 4.1 and Section 4.2.3 of the PEIS). In addition, the environmental settings of the three current storage sites were used to create a representative range of environmental conditions for conversion and long-term storage options (except for storage in a mine). In order to provide a broad base for alternative comparisons and to *address the potentially large range of groundwater variables, calculations were performed for generic "dry" and "wet" sites for the other management options (long-term storage in a mine, manufacture and use, and disposal). Values for the groundwater parameters used in these calculations were derived from data for sites in these bounding environments. The use of representative and generic sites provides a consistent basis for comparing the strategic management program alternatives at this level of NEPA analysis. Prior to selection of an actual site, more detailed, site-specific calculations would be required, as noted in the comment.*

Comment 41

Specific Comments on the Storage Option: Cylinder yard doses do not seem consistent with a strict care, maintenance and inspection regime. Portsmouth at 2 Mev (196 mrem/yr) is most realistic (probably plausible if a large number of personnel are used, and/or remote inspection equipment or shielding is implemented).

Response 41

The radiation doses listed in Chapter 3 (Table 3.3, 3.8, and 3.13) are the measurement data for the cylinder yard workers and uranium material handlers at the three cylinder storage sites. They are the average doses among the radiation workers who, in addition to working in the cylinder yards, might also work in other places.

The radiation doses listed in Appendix D for the continued storage period and Appendix G for the long-term storage options are estimates based on the assumption that (1) strict, vigorous maintenance activities will be conducted in the future, and (2) all the radiation workers work full time (250 days per year and 8 hours per day) in the storage yards. Because of these two assumptions, the estimated doses are greater than the measurement data listed in Chapter 3. However, they are still below the regulatory limits (5,000 mrem/yr) for radiation workers.

Comment 42

Assumption of 0.0041 breaches per cylinder move (Appendix B, Section B3) would result in 2 × (28,351+13,388+4,683) × 0.0041 = 380 breaches if all containers were moved for painting. This does not seem consistent with number of breaches quoted in Table B1.

Response 42

An incorrect handling breach rate was stated in Section B.3 of the Draft PEIS. The value should have been 0.00014. This value was based on 5 breaches initiated by handling damage and the estimated number of 50,000 cylinder moves during storage to date (i.e., 5/50,000 = 0.0001), plus an additional factor added to account for the possibility of a cylinder breach during handling caused by the cylinder being weakened due to previous corrosion (2/50,000 = 0.00004). Thus, the estimated number of breaches at all three sites assuming each cylinder was painted only once (as assumed by the commentor) would be 2 × (28,351+ 13,338 + 4,683) × 0.00014 = 13. However, the number of breaches assumed to occur through the cylinder management period up to year 2040 was actually

59 (see Table B.1). The value of 59 breaches was arrived at using the assumption that cylinders would be painted every 10 years, and that cylinder breaches due to accelerated corrosion would continue until all the cylinders had been painted (completion of painting scheduled for year 2009). The value for the handling breach rate given in Section B.3 has been corrected.

Comment 43

Comprehensive wall thickness testing at time of refurbishment would aid future decision making. However corrosion rates will be difficult to estimate if initial wall thickness is unknown.

Response 43

There is documentation with each cylinder at the time of purchase that the steel plate used to make the cylinder met or exceeded the minimum wall thickness required. DOE has made some attempts at measuring noncorroded areas of cylinder bodies to get some idea or feel for the initial wall thickness for use in the corrosion modeling. While this is not a "perfect" measurement, it routinely has indicated that the minimum wall thickness was apparently exceeded with some tolerance range to spare on a large number of cylinders.

The rate of corrosion has been estimated based on the measurement of a statistically significant number of cylinders from each subpopulation of cylinders. Using the minimum wall thickness and assuming a statistical distribution of initial thicknesses based upon the minimum required, a wall thickness loss over the age of the cylinder has been calculated. From this, an associated corrosion rate can be calculated. The corrosion rate of exposed steel tends to decrease slightly with time because some amount of protection of the substrate is provided by the rust layer(s). Using curve fitting models, penetration depth as a function of time can be calculated. For cylinders spending some time in substandard storage conditions (e.g. in ground contact), these models produce a rate of 1.6-1.7 mils/year. This value is skewed on the high side due to the condition of ground contact no longer existing. For most other cylinders, the corrosion rate is 0.5 to 0.6 mils/year at the spots of highest corrosion at the location of highest corrosion areas. On very large areas of cylinder surfaces, the corrosion rate is closer to 0.25 mils/year.

Comment 44

Thorough inspection, testing and painting will result in high doses potentially.

Response 44

Dose estimates were made in the PEIS for inspection, painting, and other cylinder maintenance activities. Estimates for involved workers range from 260 to 740 mrem/yr, as detailed in Appendix D, Tables D.2 and D.22. These levels are below the regulatory limit of 5,000 mrem/yr and also below the DOE administrative control limit of 2,000 mrem/yr. In practice, the doses to individual workers could be lowered if more workers were used and time spent on cylinder maintenance activities were limited to less than 40 hours per week.

<u>Comment 45</u>

In the event of aircraft crash on any of the UF_6 storage areas, the environmental impact would be far greater than for any storage option, e.g. UO_2.

<u>Response 45</u>

These differences have been taken into account in the PEIS and are reflected in the data presented in Tables G.7-G.10 of Appendix G, which show far greater impacts for the aircraft crash in UF_6 storage areas than oxide storage areas.

<u>Comment 46</u>

Uranic oxide powders stored in 200 litre drums expose operators to higher dose rates than UF_6 cylinders. Thin drums are stored indoors to prevent corrosion but periodic inspection is required.

<u>Response 46</u>

These differences are reflected in the PEIS analyses. Based on dose rate data provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), U_3O_8 and UO_2 stored in drums would result in higher doses to workers than UF_6 stored in cylinders. For example, surveillance of U_3O_8 and UO_2 drums in warehouse storage would result in a dose rate of 1.7 mrem/hr, while surveillance of UF_6 cylinders would result in a dose rate of 0.95 mrem/hr. Doses from periodic inspection of the stored drums or cylinders were included as part of the worker dose from activities required for normal operations.

<u>Comment 47</u>

Specific Comments on the Disposal Option: There is no description of the methodology used for estimating post-closure risks for the UF_6 disposal option in the PEIS.

<u>Response 47</u>

The assessment methods used in the PEIS, including those applied for disposal impacts, are summarized in Chapter 4 and in Appendix C for each technical discipline. Detailed assessment results and further discussion of the methodologies is provided in a series of backup reports that are cited throughout the PEIS. For the impacts considered in the post-closure phase, supporting information for the various technical disciplines are presented in: Cheng et al. (1997) for the assessment of human health impacts and Tomasko (1997a, 1997b) for the assessment of water impacts. (See PEIS Appendix C for complete citations.) The intent of this presentation was to provide sufficient information in the PEIS to establish the applicability of the methods and assumptions, with detailed information provided in the supporting reports. The supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 48

The term "indefinite period" needs to be defined in the context of monitoring and maintaining a disposal facility post-closure. Monitoring and maintenance in perpetuity is not a realistic scenario.

Response 48

The sentence containing the term "indefinite period" in the introduction to Appendix I has been revised to indicate that monitoring and maintenance would not occur for perpetuity, but would take place in accordance with regulatory and licensing requirements.

Comment 49

The impact of post-closure peak doses from uranium daughters at 1,000 years is not sufficiently long since peak doses from uranium daughters occur much later. A more reasonable assumption would be 10^8 years.

Response 49

Evaluation of disposal impacts over the first 1,000 years after failure provides a consistent, valid basis for comparing UF_6 strategic management alternatives involving disposal. If the strategy selected in the ROD involved disposal, and specific sites were to be evaluated for site suitability in the future, time periods appropriate for the analyses (which may extend beyond 1,000 years after failure) would be considered.

Comment 50

The PEIS finds that groundwater contamination in the post-closure phase of a disposal site in a wet location could lead to both the radiation dose to the public exceeding regulatory limits and the concentration of uranium causing adverse health effects. These effects are dismissed by stating that the water could be treated or an alternative source used. Given that this is one of the few instances in the PEIS that such limits are exceeded, this is neither a scientific nor a publicly-reassuring stance and does not fit in well with the general environmental impact assessment approach used in the PEIS. This is an example where the PEIS would have benefitted from utilizing a full treatment of uncertainty/sensitivity analysis to give realistic rather than conservative estimates.

Response 50

The detailed analysis presented for disposal in Appendix I of the PEIS does indicate that the dose to a hypothetical receptor from contaminated groundwater would exceed regulatory limits for a disposal facility in a representative "wet" environment for all three disposal options considered (the analysis also indicates that groundwater impacts would be less than regulatory limits for a disposal facility located in a "dry" environment). The statement that water could be treated or an alternative source provided was not intended to "dismiss" these potential impacts, but rather to indicate that mitigation measures are available and that the health impacts could be avoided.

The PEIS stresses in Appendix I that long-term disposal calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. These uncertainties were addressed in the PEIS by evaluating a range of conditions for a small number of factors known to significantly affect the magnitude of impacts (i.e., sensitive parameters). These factors included precipitation rates, depth to groundwater, and soil characteristics. A comprehensive uncertainty and sensitivity analysis was not conducted primarily for two reasons: (1) the purpose of the PEIS was to evaluate and compare potential environmental impacts on a broad programmatic level, and (2) the conceptual nature of facility designs and processes at this stage generally does not readily support sensitivity analyses for most parameters. After the Record of Decision for the PEIS, DOE would evaluate potential facility locations and conduct appropriate and more detailed site-specific analyses for any required facilities.

Comment 51

Vaults appear to perform less well than shallow trenches in terms of human health impacts. Does this imply that vaults should be dismissed in favour of shallow earthen structures? Some clarification is needed as to the reasons why ". . . the concentrations from the vault would be greater than those from shallow earthen structure by a factor of 1.2."

Response 51

The PEIS results are not meant to imply that vaults would be dismissed in favor of shallow earthen structures. As stated in Section I.1 of the PEIS, the potential impacts from disposal were considered to be very similar for shallow earthen structures, vaults, and a mine. In addition, Section I.1 states that vault and mine disposal facilities would be expected to last longer than shallow earthen structures before failure and would therefore provide a greater amount of protection. The selection of a specific disposal facility type must take into account all factors considered in an EIS, as well as other information, such as engineering design requirements, cost, and regulatory requirements.

The detailed analysis presented for disposal in Appendix I of the PEIS does indicate that the groundwater concentration beneath a vault would potentially be greater than the concentration beneath a shallow earthen structure for disposal in a "wet" environment. The factor of 1.2 is discussed in Tomasko (1997; the full citation is provided in Appendix I of the PEIS) as mentioned in Section I.4.2 of the PEIS and is associated with design considerations. Briefly, the factor 1.2 comes from increased dilution for the shallow earthen structure as a result of its smaller size (the length of the shallow earthen structure parallel to direction of groundwater flow is 1.2 times less than that for the vault). However, it must be stressed, as noted in Appendix I, that the PEIS analysis is based on generic environmental settings and is subject to a great deal of uncertainty. Actual groundwater impacts would depend greatly on the specific disposal facility design and site-specific *factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility.*

Comment 52

The chemical form of a release due to failure of a uranium metal furnace should be U_3O_8 and not UO_2.

Response 52

U_3O_8 is formed when bulk uranium metal burns at temperatures above 700 degrees Centigrade. The postulated accident considering the failure of a uranium metal furnace assumes spontaneous reaction with air (but, not combustion), to form fine UO_2 particles. Therefore, for the conditions postulated for the accident, formation of UO_2 is more appropriate than formation of U_3O_8.

Commentor No. 42: Karpin, Timothy L., CHMM

Comment 1

In summary, I agree with the DOE's position that depleted UF_6 can and should be reprocessed into either a uranium oxide or uranium metal form for use in commercial or industrial settings. The American public, whether they care to or not, has spent significant funds during the last 50 years on the mining, milling, processing, and enrichment of uranium. It would be economically negligent to reprocess and dispose of depleted UF_6 into a form and location, respectively, that can no longer be of use or benefit to American citizens or industry. Such a process would also be in contrast with America's recognition of the value of recycling valuable raw materials.

Response 1

Comment noted. DOE recognizes the value of depleted uranium based on its unique qualities, the size of the inventory, and history of uses already implemented. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products.

Comment 2

Comments related to Volume II, Appendix E: 1. Why not ship all casks in clamshell cases?

- No UF_6 transfer facility would be needed, which would reduce potential environmental impact and permitting activities.
- The use of clamshell cases could possible reduce the number and cost of ultra-sonic wall thickness tests.
- Clamshell case costs would not go up if a local facility is used to process UF_6 (i.e. it may be more economical to build 2 or 3 facilities near each gaseous diffusion plant).

- Public perception would be more favorable toward the DOE if the DOE shows demonstrated caution by using clamshell cases. The DOE's decision tree would be reduced by one layer, and one area of judgment/opinion would be eliminated.
- Accident scenarios would decrease with regard to potential environmental and health impacts.
- Consider modifying nearby runways and flying MD-17s in and out with clamshell cases. (MD-17s are civilian versions of the new C-17 military transport.) Of course, an economic study would be required to validate this concept.
- The costs and energy/resource consumption of a transfer facility would be very high in comparison to clamshell case use.
- One important issue was not directly discussed. You would need a separate facility or partitioned area at the UF_6 processing facility to decontaminate the clamshell cases (if necessary).

<u>Response 2</u>

The PEIS did consider shipment of all depleted UF_6 cylinders in overcontainers, as noted on page E-2. The environmental impacts associated with cylinder overcontainer operations are provided in Table E.3. With regards to permitting activities, the overcontainers would be designed, tested, and certified to meet all DOT shipping requirements.

The PEIS analysis assumed that the overcontainers would be used primarily for offsite shipment of depleted UF_6 cylinders. The overcontainers could presumably be used for extended, enhanced storage of the cylinders. It would however be expected that the cost of a single overcontainer would be much greater than the annual costs of cylinder inspection by ultrasonics.

It was assumed that the third comment relates to potential conversion of UF_6 at the three current storage sites. The decision of where to site any required conversion facilities would be made in future planning documents. This subsequent analysis would establish the location(s) where any required overcontainers would be fabricated.

The accident scenarios considered for the cylinder preparation options are provided in Table E.4. The use of cylinder overcontainers could potentially reduce the consequences of an offsite transportation accident.

Current U.S. Department of Transportation guidelines (e.g., 49 CFR 172, 49 CFR 173.27) do not allow transport of low-specific-activity radioactive material like depleted UF_6 by cargo or passenger aircraft.

As shown in Table E.2, there would be no impacts on a local or national scale, due to resource requirements for any of the three cylinder preparation methods.

As noted in Table E.16 of the PEIS, it was assumed that decontamination of the overcontainer surfaces would be performed at the conversion/storage facility prior to it being sent back for reuse.

Commentor No. 43: Versgrove, Tom
See responses to Commentor No. 51

Commentor No. 44: Thompson, Thomas
See responses to Commentor No. 51

Commentor No. 45: Donham, Mark / Hanson, Kristi

Comment 1

We are concerned about the failure of DOE to reference or mention the 3 studies and/or reports which specifically address the cylinder problem. These are "Draft Preliminary Report — DOE Independent UF_6 Cylinder Assessment Team," from the Oak Ridge Field Office, Mar. 25, 1992; "Integrity of Uranium Hexafluoride Cylinders" and "Affordable Cleanup? — Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities," National Research Council, National Academy Press, 1996.

Response 1

Except for the draft preliminary report, all the reports referenced in the comment were reviewed and used in preparation of the PEIS and supporting documents. A brief discussion of these reports has been added to the PEIS (see new Section 1.7) and references to the reports have been provided. The draft preliminary report was never finalized, so it is not cited in the PEIS.

Comment 2

One of the first key issues which must be addressed is the earthquake risk at Paducah from the New Madrid fault/rift zone. Any strategy for dealing with the cylinders has to address this problem, as well over half the cylinders are in Paducah. Most of these cylinders are stored on soils with liquefaction potential. Due to the close stacking of the cylinders, and the configuration of the stacks, breach of cylinders due to puncturing from other cylinders in the event of a seismic event strong enough to move the cylinders is probable. Any punctures in the cylinders would result in the slow release of hydrogen fluoride and uranium and other radionuclides, which would then accelerate the further corrosion of the cylinders. Because the tens of thousands of cylinders are stacked in a configuration which makes it virtually impossible to access cylinders in the center of the stacks in a timely fashion. These factors are why the seismic risk at Paducah has to be considered in any long term strategy to deal with the cylinders.

<u>*Response 2*</u>

The safety of current storage of depleted UF_6 cylinders was addressed in the safety analysis reports (SARs) recently prepared for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including earthquakes. The potential for soil liquefaction was also considered. The accidents considered in the PEIS for continued cylinder storage (Appendix D) were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained. .

Recent safety literature indicates that cylinders would not be subject to any significant damage due to earthquake loadings. Due to the weight of the cylinder, some movement may result in enough force to cause failure by physical impact from other cylinders. However, with the UF_6 being solid and the impact area being relatively small, only limited releases of material would be expected.

The stacking configuration is only considered a seismic problem if cylinders have been stacked stiffening ring to stiffening ring (as opposed to stiffening ring to cylinder body), thus allowing a small surface area to support the upper tier cylinder. For those conditions, the operating contractor has placed support wedges between the cylinders providing more surface area support of the upper cylinder. As cylinders are restacked and relocated into the approved stacking configuration, this condition will be eliminated.

<u>Comment 3</u>

In considering the long term seismic risk at Paducah and its effect on cylinder management, the first question to ask is, will any future conversion/storage take place at Paducah. If the answer is yes, and if the plans are to bring cylinders in from Portsmouth and Oak Ridge, then these facilities have to be built to highest earthquake standards available. In addition, transportation risks from Portsmouth and Oak Ridge to Paducah must be considered.

If the answer is yes, but only for the Paducah cylinders, then either three conversion facilities will have to built or the facility will have to be mobile, which means it will have to be transported contaminated or will have to be completely decontaminated. None of these alternatives is looked at in the PEIS.

If the answer is no, there will not be conversion/storage at Paducah, then the massive transportation burden to get the 40,000 cylinders at Paducah, some of which it is doubtful could be moved, from Paducah to wherever the conversion/storage would take place. This is not considered properly in the PEIS.

Response 3

An analysis of the impacts of preparing cylinders for transportation at any of the three storage sites is provided in Appendix E of the PEIS. However, the purpose of the PEIS is to provide an analysis of broad, programmatic alternatives, and not to select sites. The location(s) and number of conversion facilities are beyond the scope of the PEIS and will be addressed in future planning and environmental analyses. Site selection activities would evaluate site characteristics, such as potential response to seismic events, potential for flooding, and site geology to ensure that suitable locations were chosen. Following site selection, any new facilities would be designed and built to meet engineering and construction standards and requirements appropriate for the selected location and the mission of the facility.

Comment 4

Connected Actions/Cumulative effects: To determine the scope of environmental impact statements, agencies shall consider 3 types of actions, 3 types of alternatives, and 3 types of impacts. They include: (a) Actions (other than unconnected single actions) which may be:

(1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

(i) Automatically trigger other actions which may require environmental impact statements.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

(2) Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

(3) Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.

It is clear that the UF_6 DPEIS is inadequate in both its scope and its cumulative effects analysis, and that this flaw is serious.

Certain alternatives for dealing with the DUF_6 cylinders are provided in the DEIS. Those alternatives include conversion to Uranium oxide, conversion to uranium metal, and long term storage.

In order to convert to either uranium metal or uranium oxide, several unavoidable, connected steps must be undertaken. These include (1) building the facilities which will empty the cylinders and convert the DUF_6; (2) the cylinders will have to be moved to the facility; (3) the material will have to be defluorinated; (4) the emptied cylinders will have to be washed and dealt with, and a wastewater treatment plant will need to be built to treat the effluent, which will contain small amounts of transuranics; (5) the hydrogen fluoride will have to be placed into cylinders and stored or disposed, which will require facilities; (6) the empty DUF_6 cylinders will have to be dealt with; (7) the converted material will have to be disposed or stored.

If one of the conversion alternatives is chosen as the preferred alternatives, there is no avoiding any of the above steps. These are all clearly "connected actions" as described above. Yet, the DEIS defers analysis of the effects of the conversion process until a future NEPA document. This future NEPA analysis would come at a time when a decision has already been made committing to one of these alternatives. NEPA requires that information be made available to decision makers and the public before decisions are made and actions taken.

<u>*Response 4*</u>

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. In evaluating potential environmental impacts of these alternatives, the PEIS does indeed consider all of the activities that would be necessary to implement each of the alternative strategies (see Sections 2.1 and 2.2 of the PEIS). However, as a programmatic EIS, it does not propose any site-specific activities — apart from those that can only occur at a current storage site for depleted UF_6 (continued storage and cylinder preparation for transportation). Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to enable a comprehensive comparison of the strategy alternatives (see Section 3.4 of the PEIS). The potential impacts from construction and operation of such representative facilities are included as best possible in the PEIS, given the information that currently is known. Upon implementation of a depleted UF_6 management strategy, which will be selected in the Record of Decision for the PEIS, site-specific evaluations will be performed — including the effects of site-specific projects and range of alternative actions, including a No Action Alternative.

<u>Comment 5</u>

In addition, at all of the facilities involved (Paducah, Portsmouth, and Oak Ridge) there are other cleanup activities ongoing, either under the WM or ER programs of DOE. These activities are clearly "proposals" and could have cumulative effects in regard to releases of radionuclides and other hazardous substances. The cumulative effects analysis of this DEIS (and the segmented NEPA analysis of the other cleanup projects ongoing at the sites) needs to be looked at in combination. The DEIS fails to make this important analysis.

Response 5

Sections 5.8 and 6.3.8 of the PEIS present cumulative impact analyses for each of the three current depleted UF_6 storage sites. As summarized in Tables 5.12, 5.13, and 5.14 for the Paducah, Portsmouth, and K-25 sites, respectively, the calculation of cumulative impacts included impacts of existing operations (both at the sites and close enough to affect them), impacts of the two depleted UF_6 management activities known to occur at those locations (continued storage and cylinder preparation for transportation), and impacts of other reasonably foreseeable future actions (once again, both at and near the sites). The latter are identified in footnote "a" of each of the aforementioned tables and include waste management activities. The topic of impacts resulting from environmental restoration activities has been reexamined. Impacts of recent and current environmental restoration activities whose magnitude can be identified clearly have been added to the cumulative impact calculations for each site, appearing under existing operations and identified in footnote "a" in the tables listed above. As discussed in Section 5.8.1, the impacts of future environmental restoration activities were not included in the cumulative impact analysis because of insufficient characterization of the contamination or because proposals for particular actions were not yet final when the PEIS was prepared; these impacts would be included in pertinent site-specific CERCLA or RCRA program documents.

Comment 6

As is true is most DOE NEPA documents, there are sweeping impact assumptions based upon referenced material, mostly internal DOE information. NEPA requires that agencies which incorporate by reference material in an EIS make that material readily available to the public for review. Yet there is no mention where such referenced material (such as the GENII model) could be reviewed or obtained. This is a serious and blatant flaw in the DEIS.

Response 6

All reports and materials referenced in the PEIS are readily available to the public. As noted on the cover sheet of the PEIS, documents prepared specifically in support of the PEIS are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), or by contacting the DOE program manager (identified on the cover sheet of the PEIS). In addition, other references that are cited in the PEIS can be obtained by directly contacting the program manager at the toll-free number listed on the PEIS cover sheet. This approach is consistent with guidance provided by the Council on Environmental Quality (CEQ) that states: "Material that is not directly related to preparation of the EIS should be incorporated by reference. This would include other EISs, research papers in the general literature, technical background papers or other material that someone with technical training could use to evaluate the analysis of the proposal. These must be made available, either by citing the literature, furnishing copies to central locations, or sending copies directly to commentors *upon request (Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations)."*

Comment 7

NEPA does not allow conclusory assertions of no impact to suffice for a hard look. Assumptions in an EIS must be supported by objective or empirical data. By DOE making sweeping, conclusory statements of no impact (for example, of the environmental impact of the release of radiation from the activities associated with DEIS) based upon internal studies, which are not explained or described and which are not readily available to the public, DOE is violating one of the main tenants of NEPA — to inform the public of their proposed actions.

Response 7

The assessment methods used in the PEIS are described in Chapter 4 and in Appendix C for each technical discipline. Chapter 4 also provides a detailed table that describes the general criteria used to summarize and describe the magnitude of environmental impacts for each area of impact considered in the PEIS. The main body of the PEIS provides a discussion of the types and magnitude of potential environmental impacts for each alternative, with additional supporting technical information provided in the appendices. Detailed assessment results and further discussion is provided in a series of backup reports that are cited throughout the PEIS. Specifically, supporting information for the various technical disciplines is presented in: Cheng et al. (1997) for the assessment of human health impacts during normal operations; Policastro et al. (1997) for the assessment of accident impacts; Tschanz (1997) for the assessment of air impacts; Tomasko (1997a, 1997b) for the assessment of water impacts; Biwer et al. (1997) for the assessment of transportation impacts; and Allison (1997) for the assessment of socioeconomic impacts. (See PEIS Appendix C for complete citations.) The computer models, and exposure and risk assessment methods used in the PEIS are in wide use in the scientific community and are referenced as appropriate in Appendix C and the backup reports.

The intent of the PEIS presentation of results was to provide sufficient information to establish the applicability of the methods and assumptions, with detailed information provided in the supporting reports. The supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Commentor No. 46: Barnwell, Carlene
See responses to Commentor No. 51

Commentor No. 47: Jones, Carol Westerman / Jones, Anthony E.
See responses to Commentor No. 51

Commentor No. 48: Klueter, Karla
See responses to Commentor No. 51

Commentor No. 49: Mobley, E. V.
Coalition 21

Comment 1

I agree with and support the DOE preferred alternative i.e., use rather than disposal of the UF_6.

Response 1

Comment noted.

Comment 2

Vol 1, S.5.1, contains an informative summary of possible uses for converted UF_6 in addition to cask shielding, but its location in the document makes it a surprise. I suggest that other possible uses be mentioned in paragraph S.2.

Response 2

By necessity, the summary contains only an overview of the alternatives and analyses conducted in the PEIS. Additional information on use options is provided in the main body of the PEIS, specifically Sections 2.2 and 2.3 and Appendix H.

Comment 3

The radiation effects calculations are based on the linear-no-threshold (LNT) hypothesis (Vol 1, S.4.3.1.1.2 and Vol.2, C.4.2.2). A number of studies, for example those cited in the Scientist, March 3, 1997 and in Nuclear News, June 1997, indicate the LNT hypothesis is excessively conservative and in some cases is detrimental. I suggest an improved analysis practice that includes evaluating the magnitude of the conservatism instead of merely stating that the result is conservative. Data are available for derivation of best-estimate or most-probable health effects. A more realistic presentation in the UF_6 PEIS would result if there were comparison of best-estimate and conservative health effects.

Response 3

Considerable debate exists within the national and international radiation protection communities concerning the appropriateness of the linear, no threshold model for low doses of *radiation typical of environmental and occupational exposure levels. However, it is generally recognized that the linear, no threshold model provides conservative estimates of impact in the low dose range. Consequently, the use of the linear, no threshold dose-response model is a well-established risk management policy throughout the U.S. government, including the Department of Energy, the Environmental Protection Agency, and the Nuclear Regulatory Commission, as well as throughout the world. The health risk conversion factors used in the PEIS, which are based on the linear, no threshold model, are specified in DOE's "Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements (1993)" (commonly referred to as the DOE "green book").*

In addition, it is important to recognize that one of the primary purposes of the PEIS, as well as any EIS, is to provide a comparison of impacts among alternatives. Although the linear, no-threshold model likely results in an overestimate of radiological impacts for low doses, the choice of this model would not effect relative comparisons among the PEIS alternatives.

Comment 4

In Volume 2, paragraphs C.4.1.5, C.4.2.2, and C.4.2.3, it appears that four different dose to health effects conversion standards were used. I suggest some additional explanation to avoid the appearance of confusion.

Response 4

Please see Volume 2, Section C.4 which has been revised to clarify the use of health effects conversion standards.

Commentor No. 50: Wheeler, Norma S.
See responses to Commentor No. 51

Commentor No. 51: Whayne, Sue / Roberts, Mary Lee / Ray, Betty

Commentors No. 43, 44, 46, 47, 48, 50, 52, 54, 63, 66, 67, 68, 69, 70, 73, 74, 77, 78, 79, 83, and 86 submitted the same comments as Commentor No. 51.

Comment 1

The scope of the DPEIS is inadequate to cover the activities required to deal with the cylinders. Implementing either of the conversion alternatives will trigger a series of events which will have to take place in order to complete the conversion. These include building factories to do the conversion and for cleaning the highly radioactive residues out of the emptied cylinders. The DUF_6 will have to be defluorinated, which is a highly dangerous activity. The converted material and the empty cylinders will have to disposed or stored, as will the hydrogen fluoride which is separated from the DUF_6.

<u>*Response 1*</u>

For each of the alternatives, the PEIS considered all of the activities that would be required during implementation, as shown in Figure S.2 and Figure 2.1. The types of activities considered included continued storage of the cylinders for some period of time (Appendix D); preparation of cylinders for shipment (Appendix E); conversion (including defluorination activities) and treatment of emptied cylinders (Appendix F); long-term storage (Appendix G); manufacture and use (Appendix H); disposal (Appendix I); and transportation (Appendix J). The evaluation of potential environmental impacts for these activities included both the construction and operation of facilities during normal and accident conditions. The overall environmental impacts of an alternative were found by summing the impacts from each of the required activities, as appropriate, as described in Section 2.1. Consequently, the analysis in the PEIS addresses all of the events that would be triggered by the selection of a specific management strategy.

<u>Comment 2</u>

These activities are all connected actions which require a hard look in combination with the ongoing cleanup activities at the three facilities where the cylinders are stored — Paducah, Portsmouth, and Oak Ridge. There are clearly cumulative effects from these proposals and projects which are not adequately addressed in the draft.

<u>*Response 2*</u>

Section 5.8 presents calculations and evaluations of cumulative impacts for each of the three depleted UF_6 storage sites mentioned in the comment. With regard to the management alternatives considered in the PEIS, the only activities considered in cumulative impact calculations were those associated with known locations (where the impacts would accumulate) — namely continued storage and cylinder preparation for transportation (both of which would occur at the three storage sites). Added to those impacts are the estimated impacts of waste management activities at each site as well as other activities associated with DOE and non-DOE organizations (see Tables 5.12, 5.13, and 5.14 for a listing of activities and the results of cumulative impact calculations).

The subject of environmental restoration (presumably synonymous with the "cleanup" activities noted in the comment) impacts has been reexamined in the context of cumulative impacts. When adequate information has been available on the impacts of recent and current environmental restoration efforts, those impacts have been added to the aforementioned tables under Existing Operations, and documented accordingly. As discussed in Section 5.8.1, the impacts of future environmental restoration activities were not considered in the calculation of cumulative impacts because of insufficient characterization of the contamination and because proposals for specific actions were not yet final as of the development of the PEIS.

As noted in Section 1.4, the PEIS uses a two-phase approach to NEPA evaluation which is consistent with DOE's implementation of a strategy for the long-term management of depleted UF_6. Cumulative impacts are evaluated as completely as possible within the context of this programmatic document. Once DOE decides which depleted UF_6 management strategy to pursue (the decision supported by the PEIS and to be documented in the Record of Decision), and makes decisions on site- and technology-specific issues, NEPA documents will be prepared to evaluate potential site- and technology-specific impacts. These future NEPA documents will provide more thorough examinations of cumulative impacts associated with particular places and activities at those places.

Comment 3

Although the largest majority of cylinders, some 40,000, are at Paducah, they are inadequately stacked and stored presently. These are vulnerable to the high seismic risk at Paducah from the New Madrid fault. Because it will be decades or longer before this material can be converted, the risks from earthquake damage go greater as time goes on. Any conversion facilities planned for Paducah have to fully consider the earthquake potential at Paducah, and any construction of conversion facilities at Paducah would have to be made to an earthquake standard. The extra costs of this need to be disclosed.

Response 3

The Department of Energy is currently pursuing improvements to depleted UF_6 cylinder storage conditions at the Paducah site. These improvements include both refurbishment of existing storage yards and construction of a new storage yard.

The potential risks from earthquake damage may be expected to decrease with time, as the DOE implements the above improvements. In addition, activities such as a comprehensive cylinder monitoring and maintenance program, with routine cylinder inspections, ultrasonic thickness testing of cylinders, and cylinder painting to prevent corrosion are designed to ensure continued safe storage of the cylinders.

The construction by DOE of any new facilities that result from this PEIS would follow the general design basis provided in DOE Order 6430.1A, "General Design Criteria." This order covers design criteria (including natural phenomena-related standards) for the design of DOE facilities. Any facilities to be constructed at Paducah would take into account the seismic characteristics of the site. If the facilities are constructed by a commercial entity, applicable NRC or other agency codes and regulations would be followed.

The present-worth costs of the various PEIS alternatives are provided in the cost analysis report (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS), which is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program *manager identified on the cover sheet of the PEIS. The costs presented in this document are based upon a generic site location, to agree with the PEIS. The intention of the PEIS is to determine the most appropriate management strategy for DOE's depleted UF_6 inventory. Future planning and environmental analysis will address issues related to the selection of sites and the associated costs.*

Comment 4

If cylinders are going to be transported for conversion, then the risks transportation needs to be considered carefully. This would require many thousands of shipments. Many of the older cylinders may not be capable of being lifted or loaded for transportation. Some may not be able to be heated to be emptied. All of these problems could significantly increase the cost. The DOE needs to be more up-front about the real dollar costs of this problem.

Response 4

As discussed in detail in Appendix E of the PEIS, some fraction of the cylinder inventory may not meet Department of Transportation requirements for shipment and may require some type of preparation if transported. Therefore, in order to estimate the potential health and environmental impacts from transportation activities, the preparation of substandard cylinders for transport was considered in the PEIS. The PEIS considered two cylinder preparation options: the use of overcontainers for substandard cylinders, and the construction and operation of a cylinder transfer facility to transfer substandard cylinder contents to new cylinders prior to transportation (see Appendix E of the PEIS for details on cylinder preparation). The design of the transfer facility assumed that the cylinders would not be heated.

The number of shipments that potentially could be required under each alternative are summarized in Appendix J, with additional details of the transportation assessment given in the supporting report by Biwer et al. 1997 (see Appendix J references for full citation). If transportation of cylinders is required by the selected alternative, several thousand shipments could indeed be required over the duration of the program.

The cost of the various cylinder preparation and transportation options is beyond the scope of the PEIS, but cost estimates are provided in the cost analysis report (LLNL 1997b; the full citation is provided in Chapter 8of the PEIS). The Record of Decision will consider the results of the PEIS, along with other information such as cost and engineering data, to select a management strategy. The Record of Decision will document the strategy selected and describe how it was selected from among the different alternatives.

The cost analysis report and other PEIS supporting reports are available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 5</u>

Although it appears that the best alternative is converting the material from the reactive UF_6 form to the more stable uranium oxide form, the DPEIS doesn't give enough information for the commentors to decide where the best place for conversion would be and the best methods.

<u>Response 5</u>

The purpose of the PEIS is to provide an analysis of broad, programmatic alternatives. Consequently, the impacts of some management activities, such as conversion, were evaluated using representative environmental setting information. The characteristics of these settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the alternatives. However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. Future planning and environmental analysis will address issues related to selection of sites and technologies for the depleted UF_6 management strategy selected in the Record of Decision for this PEIS. This would include technology selection and siting for one or more conversion facilities, if conversion is part of the strategy selected.

<u>Comment 6</u>

Finally, it seems ill-advised to continue to fill more cylinders daily with more DUF_6 while this huge problem of disposal continues to accumulate. If the nuclear industry cannot manufacture its product without creating huge amounts of toxic waste, it should strongly consider ceasing production.

<u>Response 6</u>

Issues regarding the need for uranium enrichment to support fuel fabrication for the nuclear industry are beyond the scope of this PEIS.

Commentor No. 52: Rhodes, Craig / Brown, Charlene
See responses to Commentor No. 51

Commentor No. 53: Hoffman, Eugene E.

<u>Comment 1</u>

How will comments on the Draft PEIS be documented by DOE?

<u>Response 1</u>

All comments received by DOE during the public comment period are presented in this volume of the PEIS (Volume 3). The written documents provided by commentors are found in Section 2.2. Individual comments from those documents are found together with DOE responses in

Section 3.2. Indexes by commentor are included in Section 2.1 and 3.1. Additionally, comments and responses to oral comments from the four public meetings are provided in Chapter 4.

Comment 2

What is the status of the sale of the enrichment plants to USEC?

Response 2

On July 23,1998, USEC stock was made available for public purchase. The privatization was completed on July 28, 1998 with the transfer of the federal government's entire ownership in USEC to the private sector. This was the final step in the USEC privatization process. The gaseous diffusion plants in Portsmouth, Ohio, and Paducah, Kentucky, are leased by USEC and remain the property of the U.S. Government.

Comment 3

The DOE "preferred alternative" (see PEIS, pp. S-42-44) is to "use the entire inventory of material" based on market demand for uranium oxide (UO_2), uranium metal and fluorine products. "Safe management of the cylinder inventory would continue until 100% of the inventory had been converted for use." --- This DOE preferred alternative would be supported by everyone if the DOE assumed use potential had any basis in fact. Every documented evaluation of potential use of the DUF_6 by independent investigators, DOE contractors, and commercial firms in the uranium business during the past ten years has concluded that future use of only a small fraction of the 1,200,000,000 plus pounds of the depleted UF_6 can be projected.

Response 3

Based on the comments received on the draft PEIS, DOE has modified its preferred alternative to include "prompt conversion of the depleted UF_6 into uranium oxide." DOE's revised preferred alternative is to begin conversion of the depleted UF_6 inventory as soon as possible, either to uranium oxide, uranium metal, or a combination of both, while allowing for use of as much of this inventory as possible. This would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and metal products for use.

Comment 4

In the PEIS, DOE evaluated six alternative management strategies (see page S-6). However, an option to continue storage of a reasonable (small) fraction of the DUF_6 (only the best cylinders, under shelter) for future use and begin conversion of the most degraded cylinders to the safe, stable form (U_3O_8) was not considered. WHY??

Response 4

The strategy the commentor describes would fall into the category of a "combination of alternatives," specifically, a combination of continued cylinder storage (a.k.a. No Action Alternative) and long-term storage as oxide. As discussed in Section 2.3.7 of the PEIS, the alternatives assessed in the PEIS were based on the assumption that all facilities would be designed to process 100% of the inventory; this approach was intended to provide a conservative estimate of the impacts that could result from each of the alternatives considered. However, DOE did recognize that it would be possible to select a management strategy that is a combination of the alternatives (e.g., 50% continued cylinder storage and 50% long-term storage as oxide). Therefore, the PEIS includes an analysis of potential environmental impacts for a range of facility sizes to allow for an evaluation of combinations of alternatives. Appendix K presents the potential environmental impacts for facilities designed to process between 25 and 100% of the depleted UF_6 inventory. Section K.7.1 presents an example of how to estimate the impacts for any combination of alternatives. The actual schedule or order in which the cylinders would be converted (if conversion is identified in the Record of Decision) is beyond the scope of the PEIS. However, such considerations would be the subject of follow-on studies and reviews.

Comment 5

The 1100-page draft PEIS did not cite or reference the three independent reports that directly relate to the subject of the PEIS. These are listed below:

a) Draft Preliminary Report — DOE Independent UF_6 Cylinder Assessment Team, "DOE Oak Ridge Field Office, dated March 25, 1992 (never published).

b) "Integrity of Uranium Hexafluoride Cylinders," Defense Nuclear Facilities Safety Board Technical Report DNFSB/TECH-4, May 5, 1995.

c) "Affordable Cleanup? — Opportunities For Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities," National Research Council, National Academy Press, 1996, Chapter 7, Disposition of DUF_6.

Response 5

Except for the draft preliminary report, all the reports referenced in the comment were reviewed and used in preparation of the PEIS and supporting documents (for example, the Engineering Analysis Report). A brief discussion of these reports has been added to the PEIS (see new Section 1.7) and references to the reports have been provided. The draft preliminary report was never finalized, so it is not cited in the PEIS.

Comment 6

The draft PEIS presents brief and totally inaccurate statements regarding the New Madrid earthquake safety issue, which is of particular importance to the Paducah plant site which has in excess of 28,000 of the DUF_6 cylinders. (PEIS reference — page 3-7)

<u>*Response 6*</u>

The PEIS addresses the potential for seismic activity at each of the three storage sites in Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1. Of the three storage sites, an earthquake which could cause more than slight damage is considered credible (though highly unlikely) only for the Paducah site. The text of Section 3.1.4.1 of the PEIS has been revised to be consistent with information presented in the safety analysis report for the Paducah Gaseous Diffusion Plant.

The analysis of accident scenarios for continued cylinder storage (Section D.2.2 of the PEIS) was based on the range of potential accident scenarios considered in the safety analysis reports (SARs) for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs were issued in February 1997 by the DOE's management and operating contractor, and were subsequently reviewed and approved by DOE in March 1997.

The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the safety analysis reports. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the safety analysis reports are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.

<u>Comment 7</u>

The French have been converting hundreds of millions of pounds of their depleted UF_6 to the safe, stable oxide and stored it in steel containers in metal framed, earthquake resistant buildings since 1977 to avoid the hazards, associated with storing UF_6.

<u>*Response 7*</u>

The PEIS considers in Appendix F an option similar to that suggested in the comment, which incorporates the conversion of UF_6 to U_3O_8 practiced on a large scale industrial basis by COGEMA in France. In the PEIS, the U_3O_8 product from the conversion step is then compacted and stored in readily-available 55-gallon drums in a seismically-qualified building, prior to being transported for storage or disposal.

<u>Comment 8</u>

At least 17,475 of the DUF_6 cylinders exhibit accelerated corrosion (Reference: DOE/ORO Work Agreement document, dated 10/30/96). The current DOE schedule for cleaning, inspecting, and re-painting of the cylinders will require at least 30 years, especially when the fact is considered that many of the cylinders will have to be re-cleaned and re-painted at least three times during that period. Each handling operation risks rupture. (Reference: Letter, S.J. Pawel to M.S. Taylor, Feb. 10, 1997, ORNL/CST-SP-021097-05, "Update on Development Activities," page 4, "The life of the paint system presently in use is not analytically known, but current estimates suggest that a 12-year life (on average) prior to significant maintenance or re-painting is reasonable.")

Response 8

The assumptions used to assess the impacts of continued cylinder storage included painting of the cylinders every 10 years. The risks from handling the cylinders were included in the analysis. See the Introduction to Appendix D of the PEIS for further details on the assumptions used to assess the impacts of continued cylinder storage.

Comment 9

The DUF_6 safety and accident concerns presented in the Defense Nuclear Facilities Safety Board report (DNFSB/TECH-4, May 5, 1995) are not cited in the Draft PEIS.

Response 9

The DNFSB's TECH-4 report was followed by their Recommendation 95-1, which requested, among other things, that the safety analysis reports (SARs) for the three sites be updated. These reports (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS) have now been updated and the results were incorporated into the accident analyses conducted for the PEIS. See Appendix D, Section D.2.2, for a discussion of accident impacts under current storage conditions. If the SARs are revised in the future, DOE's cylinder management program at the three storage sites would be revised accordingly and the safety of the cylinders would be maintained.

Comment 10

On February 18, 1998 a USAF B-1 supersonic bomber weighing in excess of 200,000 pounds crashed and burned approximately 40 miles from the Paducah cylinder storage yards. The Barkely Regional Airport is located approximately 2 miles from these storage yards. Has the accident scenario of a large plane crash on a rainy day been analyzed? Under such circumstances a number of cylinders would be ruptured and large quantities of hydrofluoric acid gas would be generated which could cause additional ruptures and make control of the accident very difficult.

Response 10

Plane crashes were considered but only for small planes. Large planes have flight patterns that do not pass close to any of the three sites and as a result, impacts would be considered in the beyond incredible probability range ($<1 \times 10^{-7}$) *for those large planes.*

Commentor No. 54: **Hanson, Kristi / Donham, Mark**
See responses to Commentor No. 51

Commentor No. 55: **Volpe, John A., Ph.D**
Kentucky Radiation Health & Toxic Agents Branch

Comment 1

DOE must immediately move to convert the entire inventory of DU to the oxide for long term storage.

Response 1

The commentor's preference for converting UF_6 to uranium oxide for storage as soon as possible is noted.

Comment 2

Conversion can not wait for ten years or any period of time.

Response 2

The timetable presented in the PEIS was developed to provide a basis for the calculation of potential impacts (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. Actions were not assumed to be delayed until 2009, rather, for the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory. In fact, as explained in Section 2.5.1 of the PEIS, the preferred alternative in the PEIS has been revised to clarify this point. It now calls for beginning prompt conversion of the depleted UF_6 into depleted uranium oxide.

Comment 3

DOE must conduct the conversion to the oxide at its present storage location. No transportation of DU to a conversion facility.

<u>*Response 3*</u>

The commentor's preference for conversion of UF_6 to oxide at the current storage sites is noted.

<u>Comment 4</u>

All cylinders must be checked for integrity prior to moving to the on-site conversion facility. All oxide must be stored on-site under cover.

<u>*Response 4*</u>

The commentor's preference for conversion and storage of the oxide under cover is noted by DOE.

Under the cylinder program management plan, the requirements for moving cylinders on-site are documented in the Cylinder Project's 3-Site Procedure EMEF/EF-P2400 Handling and Inspection of 48" Cylinders. Cylinders are required to be inspected for cylinder integrity prior to being lifted and after they have been relocated. This is to ensure that the cylinder may be lifted safely and that no damage to the cylinder occurred during relocation. The procedures conducted prior to lifting a cylinder are summarized in the Introduction to Appendix E of the PEIS.

Commentor No. 56: Gawarecki, Susan L., Ph.D.
Oak Ridge Reservation Local Oversight Committee

<u>Comment 1</u>

The Citizen's Advisory Panel (CAP) concurs that the alternatives considered in the PEIS are appropriate, but the assumptions which delay action to 2009 with completion in 2028 are not acceptable. We understand that the continued storage of the UF_6 cylinders does not pose an immediate health or environmental threat. However, as time passes, the task of assuring safe storage will become more demanding, with increasing cost for surveillance and maintenance of the deteriorating cylinders.

<u>*Response 1*</u>

The commentor's preference for beginning actions sooner than 2009 is noted. With regard to the statement that the PEIS assumption that actions begin in 2009 is unacceptable, the timetable presented in the PEIS was developed to provide a basis for the calculation of potential impacts (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. Actions were not assumed to be delayed until 2009, rather, for the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental *reviews. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory. In fact, as explained in Section 2.5.1 of the PEIS, the preferred alternative in the PEIS has been revised to clarify this point. It now calls for beginning prompt conversion of the depleted UF_6 into depleted uranium oxide.*

In addition, DOE has entered into a Consent Order with the Department of Environment and Conservation of the State of Tennessee with respect to the management of the UF_6 stored at the ETTP. DOE has agreed that if it chooses any action alternative as the outcome of this PEIS, it shall, subject to appropriate NEPA review, either remove all known depleted UF_6 cylinders from ETTP or complete the conversion of their contents by December 31, 2009.

<u>Comment 2</u>

The condition of the oldest cylinders at Oak Ridge and Paducah should be considered when planning for decontaminating and decommissioning (D&D). The toxicity of the fluorine component is the primary concern with regard to health risk, although release of depleted uranium to the environment could result in a costly public relations disaster.

<u>Response 2</u>

Prior to handling, all cylinders will be evaluated to determine their baseline condition. The oldest cylinders are of the thick wall design and none of these cylinders have been found to have lost wall thickness to less than the minimum required for use. The PEIS considers the toxicity of both fluorine and uranium compounds when evaluating potential accidental releases from cylinders; see Section 4.3.2 for further discussion of how accidental releases of UF_6 were evaluated. It should also be noted that the three storage sites have a great deal of experience in moving and handling these cylinders. For example, over 30,000 cylinder relocations have been conducted since 1992 without causing damage to a cylinder sufficient to cause a breach.

<u>Comment 3</u>

As you may know East Tennessee Technology Park (ETTP, formerly K-25) has an active reindustrialization program underway. The continued presence of the UF_6 cylinders might negatively impact the site reuse activities from an aesthetic viewpoint or as a perceived risk to co- located workers, as well as by the loss of the storage yard land to new uses.

<u>Response 3</u>

The Citizen Advisory Panel's concerns regarding continued presence of the depleted UF_6 cylinders at the ETTP (formerly K-25) are noted. The depleted UF_6 Management Program is committed to working with the Reindustrialization Program at the East Tennessee Technology Park to resolve any issues that may come up with respect to cylinder storage at the site.

Comment 4

DOE has a responsibility to begin reducing its stockpile of UF_6. The CAP urges that an expedited conversion program be started immediately. We have reviewed the voluminous amount of information associated with this subject and the variety of suggestions on how to properly handle this situation.

Response 4

The commentor's preference for starting an expedited conversion program immediately is noted. In response to comments received on the Draft PEIS, DOE has revised its preferred alternative, which now calls for prompt conversion of DOE's depleted UF_6 inventory into depleted uranium oxide (see Section 2.5.1 of the PEIS).

Comment 5

Our recommendations follow:

1. Increase and expedite the current maintenance program to clean and paint all cylinders starting with the most needy.
2. Improve the storage conditions so that all cylinders are accessible and safe.

Response 5

The commentor's recommendations for expedited maintenance and improved storage are noted. These recommendations are already being implemented through the UF_6 cylinder project management plan (LMES 1997i; the full citation is provided in Chapter 8 of the PEIS). This plan was developed to eliminate substandard conditions and to eliminate the effects of corrosion through a recoating program. The management plan addresses all phases of the current UF_6 cylinder management project and is based on risk analysis and technical evaluations which determine the activities to be performed. Under this management plan, all cylinders must be stored out of ground-contact. Any cylinders discovered through periodic inspections to be in ground contact are relocated. Additionally, there are relocation plans to eventually restack all cylinders which will allow cylinder inspectors accessibility between cylinder rows. These plans are being implemented in a graded approach by relocating cylinders in the poorest storage conditions first. This plan is being implemented concurrently with extensive construction and recoating projects which will provide well drained storage yards for the cylinders and also provide protection for the exterior of the cylinders by recoating.

The sites have also implemented an extensive cylinder inspection program to allow identification of any damaged or breached cylinders. This inspection program also identifies those cylinders requiring maintenance activities such as valve replacement and nameplate replacement. Annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of pitting or heavy corrosion. All other cylinders must be inspected once every four years. Most of this work has already been completed at the three sites.

<u>Comment 6</u>

3. Convert the UF_6 to the more stable oxide (triuranium octaoxide) or metal form. There do not appear to be any technical barriers to beginning conversion. Begin the conversion process as soon as feasible.

4. Start conversion with the oldest cylinders and those in the worst physical condition.

5. Place the conversion products in interim storage until a decision is made for permanent storage, use, or disposal.

<u>Response 6</u>

The commentor's preference for converting UF_6 to uranium oxide or uranium metal as soon as feasible, starting with the oldest cylinders and those in the worst condition, and storing the conversion products on an interim basis, is noted. In response to comments received on the Draft PEIS, DOE has revised its preferred alternative (see Section 2.5.1 of the PEIS). DOE's preferred alternative consists of the following elements: continuing the safe, effective management of the cylinders; beginning the prompt conversion of the depleted UF_6 into depleted uranium oxide and HF or CaF_2; storing depleted uranium oxide; converting depleted UF_6 into depleted uranium metals and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabricating depleted uranium oxide and/or metal products for use.

<u>Comment 7</u>

The Energy Policy Act of 1992 provides for payment of the costs of remedial actions at gaseous diffusion facilities from the Uranium Enrichment & Decommissioning Fund. Appropriations received to date have lagged behind the available funds by an approximate factor of two. We urge that this money be made available in a timely manner for the UF_6 processing that is needed.

<u>Response 7</u>

Issues of DOE program funding are beyond the scope of this PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Commentor No. 57: Lamb, Ronald

<u>Comment 1</u>

The cylinders should continue to be stored. The older or compromised cylinders should be placed in over Paks like those used to protect drummed waste. All cylinders should be stored in an earthquake secure facility.

Response 1

The commentor's preference for continued storage of depleted UF_6 in cylinders is noted. The cylinder management program is designed to ensure that cylinders are continued to be stored safely in outdoor yards without the use of overcontainers ("overpacks"). Cylinders are inspected, monitored, and maintained to ensure that they meet safe storage requirements.

The safety of current storage of depleted UF_6 cylinders was addressed in the safety analysis reports (SARs) recently prepared for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs did not find risks from earthquakes to be great enough to require cylinder storage in an earthquake secure facility. The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including earthquakes. The accidents considered in the PEIS for continued cylinder storage (Appendix D) were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point.

If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.

Comment 2

No conversion to U_3O_8 should take place at the Paducah site due to the proximity of the New Madrid Earthquake Fault and the close proximity of the plant neighbors.

Response 2

The commentor's preference that conversion not take place at the Paducah site is noted by DOE. However, if a conversion facility were to be constructed at Paducah or any other site, seismic information would be considered in the design of the facility.

Comment 3

Conversion to U_3O_8 will add to the waste inventory because of the large volume of cylinders. If conversion had been considered at an earlier time the waste streams could have been handled easier.

Response 3

Comment noted.

Comment 4

If cylinders should bump into each other during a seismic episode and break off numerous fill valves, are there procedures in place to handle a large number of valve replacements?

Response 4

This scenario is highly unlikely due to the presence of a valve guard physically welded onto the cylinder body in particular cylinder designs while other designs include a cylinder skirt that acts as a valve guard. The procedure to change a valve would be the same whether it was to change one valve or one hundred valves.

In the event of such an emergency, the sites would first activate emergency preparedness and response procedures to assess the scene. Under normal conditions, the cylinders are stored with a vacuum on the contents. Should a valve be sheared, air would be pulled into the cylinder first until the pressure equalized with the outside pressure. At that time the chemical reaction would begin to take place which would eventually seal the hole left by the valve. Valve changes can still be made to damaged valves and other emergency measures can be taken to seal and contain the contents.

Comment 5

How many broken fill valves in the 30,000 plus cylinders would constitute a emergency?

Response 5

If one or more valves were broken, the storage sites would activate the Emergency Preparedness Teams.

Comment 6

Would stacking the cylinders two high in close rows add to the damage of more fill valves being broken during a seismic episode?

Response 6

The stacking configuration was evaluated in the seismic hazard evaluation of the Safety Analysis Reports for the storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). One of the conclusions was that rocking or rolling-out of saddles will not occur for single or multiple-stacked cylinders; in fact, the stacking of cylinders was found to preclude the "sliding" of an unsticked cylinder in its saddle during a performance category 3 (PC-3) seismic event. A PC-3 seismic event, for this case, is defined with a hazard accedence per year probability of 5×10^{-4}, a return period of 2000 years, a horizontal rock acceleration of 0.12 g's, and a horizontal top-of-soil acceleration of 0.30 g's. (Reference: DOE Standard 1021-93, "Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components.)

Commentor No. 58: Makhijani, Annie / Makhijani, Arjun
Institute for Energy and Environmental Research

Comment 1

The DOE's effort to address the long-term management of the country's depleted uranium hexafluoride, specifically the realization of the importance to convert this material into a stable form is long overdue. The Draft PEIS is seriously deficient because it does not address the most environmentally appropriate option — specifically, the DOE did not include the alternative of disposing of depleted uranium according to the rules of 40 CFR 191 which govern the disposal of transuranic (TRU) wastes. The Institute for Energy and Environmental Research (IEER), in its comments (Mar 22, 1996) on DOE's Notice of Intent (Jan 25, 1996), had already noted that the proposed list of alternatives was incomplete since it did not include the option of disposal under 40 CFR 191. The DOE has rejected our comments without providing any technical or environmental explanation. Our comments of March 22, 1996 are attached. DOE should include this option in the Final PEIS.

IEER recommends that depleted uranium be classified as a waste equivalent to TRU waste for management purposes.

Response 1

Depleted UF_6 is a source material. For purposes of evaluating disposal options in the PEIS, it has been assumed that depleted UF_6 would be converted into an oxide. This oxide form would be considered to be a LLW. By definition, only waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, is classified as TRU waste. Waste containing depleted uranium with no or little TRU radionuclides does not fall within this definition. Therefore, disposal of depleted uranium oxides resulting from the conversion of DOE's depleted UF_6 inventory would not be subject to the regulations specified in 40 CFR 191. The material would be classified as LLW and the disposal alternative evaluated in the PEIS considered it to be LLW.

Comment 2

IEER agrees with DOE that the no action alternative is inappropriate and should be rejected because of the dangers of UF_6 storage. For the same reason, long-term UF_6 storage in new containers should also be rejected. Overall, conversion to oxide would reduce risks. While conversion poses risks to workers and the off-site population, continued storage also poses serious risks.

IEER recommends that UF_6 be converted to an oxide form and declared a waste to be handled on a par with repository-designated TRU waste, with the possible exception of a relatively small quantity to be used for the blending down of highly enriched uranium. This should be the preferred option in the Final PEIS.

Response 2

The purpose of the PEIS is to present and compare the potential environmental impacts from alternative strategies for the long-term management of depleted UF_6, including evaluation of the no action alternative. Although some differences exist, the results of the PEIS indicate that the potential impacts to human health and the environment are generally similar among the alternatives considered. In addition, the results of the PEIS indicate that continued storage under the no action alternative is safe and is not "inappropriate" as stated in the comment.

The commentor's preference for conversion to an oxide form followed by disposal in a manner similar to TRU waste is noted. Please see the response to Commentor 58, Comment 1.

Comment 3

However, the various alternatives the DOE has considered have not been properly assessed in this PEIS.

Conversion of uranium hexafluoride: Most of the alternatives considered involve the conversion of uranium hexafluoride. Three alternatives would convert uranium hexafluoride to an oxide and one alternative would convert uranium hexafluoride to a metal. This conversion would have the positive result of putting the depleted uranium in a more stable chemical form therefore eliminating the chances of an hazardous releases of UF_6 and hydrofluoric acid from aging corroding cylinders. DOE's analysis is incomplete or deficient in regard to the:

- fate of the empty cylinders,
- commercial use of contaminated anhydrous hydrogen fluoride (produced during the conversion process),
- the radiological effects on workers.

Response 3

With respect to the management of empty cylinders, please see the detailed response to Commentor 58, Comment 4 below. Briefly, the management of empty cylinders was addressed in the PEIS in association with the conversion options (Appendix F), as well as in a support document entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" (Nieves et al. 1997). Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses. The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

With respect to the commercial use of anhydrous hydrogen fluoride, DOE plans to continue its support for the development of government applications for depleted uranium products. The use of depleted UF_6 as a fluorinating agent will depend on the conversion process selected, the residual uranium concentrations in the hydrogen fluoride produced, market demand, and both public *acceptance and regulatory considerations. Any commercial use of hydrogen fluoride produced from conversion of depleted UF_6 would take place after review by the U.S. Nuclear Regulatory Commission (NRC). Potential impacts from such use would be analyzed before a license or waiver could be obtained. The impact analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions.*

The PEIS examined potential radiological doses to workers under normal operations that would be associated with continued storage of the cylinders (Sections D.2.1.1 and D.4.1.1), preparation of the cylinders for transport (E.3.1.1), the conversion of depleted UF_6 to either U_3O_8, UO_2, or metal (Section F.3.1.1), long-term storage of the cylinders (G.3.1.1), manufacture and use options (H.3.1.1) and disposal (I.3.1.1). Each of these appendices also addresses potential doses to workers under accident conditions (Sections D.2.2.1, E.3.2.1, F.3.2.1, G.3.2.1, H.3.2.1, and I.3.2.1).

Comment 4

1. Fate of the empty cylinders: DOE admits that ". . . ultimate disposition of the empty cylinders was not analyzed in detail as part as the alternative management strategies." The empty cylinders would become part of the DOE scrap metal inventory. The options for disposition are: recycling ". . . into LLW disposal containers, reuse as LLW containers, free release for re-melting, and disposal as LLW." However DOE has not analyzed the environmental and health impacts of these proposals. This lack of analysis is a serious problem since the volume of contaminated metal involved is large and doses to the public and to workers may be significant.

IEER recommends that the fate of the empty UF_6 cylinders and their proper disposition should be studied.

Response 4

The management of empty cylinders was addressed in the PEIS in association with the conversion options (Appendix F), as well as in a support document entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" (Nieves et al. 1997). In the PEIS, for each alternative requiring conversion, the impacts of constructing and operating a cylinder treatment facility were included in the impact analysis. This analysis assumed an initial storage period of 3 months after UF_6 removal from the cylinders to allow the level of radioactivity associated with the decay products of uranium to decrease to acceptable levels. The cylinders would then be washed with water to remove the heels; finally the cylinders would become part of the DOE scrap metal inventory. As a part of the waste management analyses in the PEIS, the impact of disposal (i.e., burial) of the empty cylinders as low-level waste was also examined (Section F.3.7.4). It was found that the empty cylinders would represent only approximately 3% of the projected DOE complex-wide volume of LLW expected to be generated during the time period examined (i.e., through about 2030).

The above-cited report by Nieves et al. analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial), and free release. Health endpoints assessed included chemical risks, radiation risks, and trauma risks. Total inventory health risks over 20 years of processing ranged from 0.1 to 0.8 total fatalities for the various options. The potential health impacts were similar for each of the options; however, the disposal option would have the greatest adverse environmental impacts due to land-allocations required and removal of the metal mass from any further usefulness. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 5

2. Commercial use of contaminated HF and CaF_2: The DOE has not properly assessed the management of both HF, a by-product of the conversion process, and calcium fluoride (CaF_2), a product of the neutralization of HF. Both these products will be slightly contaminated and in the Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride concerns are expressed as to the public acceptance of the uranium contaminants. Regardless of this concern, the DOE, in its Draft PEIS, assumed that these products could be commercially sold for unrestricted use. It is unacceptable to release a non-labeled contaminated product which has not received public acceptance. The Cost Analysis Report also states that the demand for HF is "still very uncertain." Another option is to use the HF for the production of UF_6. For this option as well as the commercial use option, DOE has not addressed the fact that part of the UF_6 inventory is recycled UF_6 which is contaminated by radionuclides other than uranium-238, such as Tc-99 and U-236 which both have a long half life.

IEER recommends that the fate of the anhydrous hydrogen fluoride and calcium fluoride should be properly studied; that radioactive materials such as HF from UF_6 processing and steel from empty UF_6 cylinders not be circulated in the civilian economy.

Response 5

The PEIS evaluated conversion options under which HF was produced for sale and under which HF was neutralized to CaF_2 which would either be sold, disposed as nonhazardous solid waste, or disposed as LLW. The assumption that HF containing only trace amounts of uranium (less than 1 ppm) could be generated was based on historical industrial experience, as detailed in the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of

Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

The PEIS acknowledges that hydrogen fluoride (HF) produced during conversion could potentially be sold for use. Alternatively, the HF product could be neutralized by the addition of lime to form calcium fluoride. The solid calcium fluoride potentially could be sold for use or disposed of in either a landfill or a low-level radioactive waste disposal facility, depending on the uranium concentration and applicable disposal regulations at the time of disposal. The ultimate decision concerning HF or calcium fluoride production will depend on the conversion process selected, the residual uranium concentrations, market demand, and both public acceptance and regulatory considerations. In response to this uncertainty, the potential environmental impacts of both options (production of HF and neutralization and disposal as calcium fluoride) are considered throughout the PEIS.

In the PEIS the dose from Tc-99 was not evaluated, primarily because this isotope is much lighter than U-238, and is almost completely removed from the depleted uranium during the enrichment process. Radiological doses from Tc-99 would therefore be extremely small in comparison to the doses received from U-238 and decay products. In addition, because only a small fraction of the inventory is derived from recycled uranium, the fact that U-236 will preferentially end up in "product" cylinders compared to depleted "tails" cylinders, and the effective doses per unit activity are very similar between U-238 and U-236, doses from U-236 would also be small in comparison to U-238 and decay products.

Finally, the PEIS assumes that empty cylinders would be treated in a cylinder treatment facility and then become part of the DOE scrap metal inventory. Any commercial use of such scrap metal would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained. The impact analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions.

Comment 6

Radiological effects on workers: In their calculation of radioactive dose assessment, DOE does not take into account internal radiation doses that would be received by involved workers during the conversion process. This is a serious deficiency since involved workers are the most at risk. DOE claims that measures taken to prevent inhalation and ingestion of radioactive material would effectively protect the involved workers. The emphasis on prevention measures is not enough without a monitoring program installed for health purposes. DOE also claims use of respirators will reduce workers doses. But routine reliance on respirators is unacceptable as a radiological control practice. Moreover, some of the depleted uranium comes from the enrichment of UF_6 from recycled uranium from spent fuel. This UF_6 contains some radionuclides of concern such as technetium-99, a long lived beta emitter and uranium-236, a long lived alpha emitter. DOE does not seem to have analyzed the radiological impacts.

For the manufacturing casks as with the conversion process, the contribution to the dose from internal radiation to involved workers has not been assessed.

IEER recommends that the issue of internal radiation for involved workers during conversion and cask fabrication be addressed carefully along with an assessment of the effects of uranium-236 and technetium-99.

<u>*Response 6*</u>

Radiological impacts were evaluated in the PEIS for both involved workers (those involved in hands-on activities) and non-involved workers (workers at the site not directly involved in hands-on activities) during conversion and manufacturing operations. The assessment of the radiation dose to non-involved workers considered internal radiation from the inhalation of radioactive material released through exhaust stacks. The evaluation of the dose to involved workers was limited to external radiation exposure. Internal radiation doses would be expected to be much smaller than external doses because (1) processes would be enclosed, (2) ventilation controls would be in place to inhibit airborne emissions within facilities, (3) indoor air would be monitored to ensure concentrations were below applicable standards, and (4) workers would be provided with appropriate personal protective equipment (e.g., respirators) if internal exposures were possible. Respirators are not used as the primary means of protection from internal exposures but are used only when necessary.

The commentor assumes that no monitoring programs would be in place at the facilities; however, dose monitoring is required for all radiation workers. Radiation workers are routinely monitored for external exposures and, in cases where workers are potentially exposed to free contamination, for internal exposures by the use of bioassay or whole-body counting. The worker doses are kept below approved administrative and regulatory limits. They are also kept as low as reasonably achievable (ALARA). Furthermore, the conceptual nature of the conversion, storage, manufacturing, and disposal facility designs does not allow for an accurate estimate of potential indoor air concentrations at this time.

In the PEIS the dose from Tc-99 was not evaluated, primarily because this isotope is much lighter than U-238, and is almost completely removed from the depleted uranium during the enrichment process. Radiological doses from Tc-99 would therefore be extremely small in comparison to the doses received from U-238 and decay products.

In addition, because only a small fraction of the inventory is derived from recycled uranium, the fact that U-236 will preferentially end up in "product" cylinders compared to depleted *"tails" cylinders, and the effective doses per unit activity are very similar between U-238 and U-236, doses from U-236 would also be small in comparison to U-238 and decay products.*

Comment 7

Uses of depleted uranium: 1. Uses analyzed: DOE's preferred alternative is to use the entire inventory of depleted uranium after its conversion to a metal or an oxide form for radiation shielding in storage casks for spent fuel. However since these casks would have to be licensed by the NRC (6.11-9-1 Engineering analysis report,) this choice is premature. Even if the licensing is approved cask fabrication creates more problems than solutions. The problems are that:

- it is not a final solution since the casks envisioned do not meet the criteria for deep repository disposal. Hence this is not a solution but a stop-gap storage method that would create more contamination and radioactive waste in the form of used casks. The DOE has not done the preliminary work ascertaining the license ability of the casks. DOE's choice of preferred option is premature and inappropriate;

- DOE doesn't say what will happen to the DU in the casks. It only states that: "No assumptions were made regarding the fate of the oxide- and metal-shielded casks after use. The empty casks could be recycled, stored, or disposed of as LLW." (p. H-32).

Response 7

DOE's revised preferred alternative is to begin conversion of the depleted UF_6 inventory as soon as possible, either to uranium oxide, uranium metal, or a combination of both, while allowing for use of as much of this inventory as possible. The discussion of the preferred alternative in the Final PEIS was modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use.

The preferred alternative does not specify the nature of the end-use, rather, it specifies that products would be produced as uses became available. Although the PEIS evaluates two use options, use as uranium oxide and use as uranium metal as radiation shielding for spent nuclear fuel or high-level waste, these options were intended to be representative only, as stated in Section 2.2 and Appendix H of the PEIS. The representative use options were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses, such as the ability to obtain an NRC license for a *storage cask, is considered beyond the scope of the PEIS. Such issues would be considered and evaluated in more detail in future planning and environmental analyses.*

The PEIS did not address in detail the ultimate disposition of uranium after use because actions to be taken beyond the 40 year period considered in the PEIS (with the exception of long-term disposal impacts) are considered highly uncertain and speculative at this time. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.

Comment 8

2. Other uses not analyzed in depth: With the long-term storage options DOE preserves the possibility to pursue the use of depleted uranium in light water reactor fuel cycle, advanced reactor fuel cycles and, dense material applications. The light water reactor option has two sub-options: the reenrichment of DU and the use of DU for MOX. Among these options, the fact that the use of depleted uranium in advanced reactors (that is fast neutron reactors, also known as breeder reactors) is at all considered is particularly disturbing. Depleted uranium being the raw material for plutonium production, by converting it into a material not only much more radioactive but also weapons usable would not only defeat the stated purpose of the PEIS which is to "achieve the safe and effective long-term management of depleted UF_6." It would also have serious proliferation consequences.

Response 8

As described in Section 2.2 and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end use or preclude other potential uses in the future. If a use strategy is selected in the Record of Decision, specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks. Regarding the use of depleted uranium in advanced reactors, the United States has no active breeder reactor program at this time. Implementation of an advanced reactor fuel cycle would require a change in national policy.

Comment 9

3. Uses not analyzed: The feasibility of using depleted uranium hexafluoride for the blending down of surplus highly enriched uranium was not considered in this PEIS. Although it would utilize only a small portion of the stock, this use would have several advantages, among them: the contribution to non-proliferation, a minimum of handling, and incorporation of depleted uranium into spent fuel. This use option could be made part of any of the alternatives except UF_6 storage.

<u>*Response 9*</u>

As stated in Section 2.2.4, Section 2.2.5, and Appendix H, the two use alternatives evaluated in detail in the PEIS, use as uranium oxide and uranium metal as radiation shielding, were selected as representative options for the purposes of comparing the potential environmental impacts of broad alternative management strategies. These options were intended to be representative only, and were not intended to preclude other potential uses in the future. This point has been clarified in Section 1.5.3 of the PEIS by adding text stressing the representative nature of the facilities, processes, and uses evaluated for the purpose of estimating environmental impacts.

Specific uses, such as use for blending down highly enriched uranium, would be considered and evaluated in future planning and environmental analyses, as appropriate. Several alternatives for managing highly enriched uranium were evaluated in the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, issued in June 1996, as summarized in Section 1.6 of the PEIS. It is expected that such uses would require only a small fraction of the depleted UF_6 inventory currently in storage and would not affect the selection of a long-term management strategy.

Note on comment documents No. 58 and No. 59*: Commentor No. 58 (Annie and Arjun Makhijani, Institute for Energy and Environmental Research) resubmitted their comments on the Notice of Intent for this PEIS as an attachment to their comments on the draft PEIS, which is designated as comment document No. 59. All comments made during the scoping period of this PEIS, including the comments made by the Institute for Energy and Environmental Research were considered in the preparation of the draft PEIS. In addition, the responses to those comments were provided in Appendix L of the draft PEIS, which is still included in the final PEIS. The main theme of the IEER's scoping comments was waste classification and disposal of uranium oxides under the provisions of 40 CFR 191 as TRU waste versus disposal as low level waste. This theme was repeated in their comments on the draft PEIS and is addressed in the response to comment No. 1 from commentor No. 58.*

Commentor No. 59: Makhijani, Annie / Makhijani, Arjun
Institute for Energy and Environmental Research

See note at end of responses for Commentor 58

Commentor No. 60: Edmonds, Robert F.
Duke Engineering and Services, Inc.

Comment 1

Volume I, Page S-3: We agree that conversion of the UF_6 to U_3O_8 is the safest next step. This step can and should be initiated soon. The PEIS provides no compelling reason not to proceed with this step. There are abundant safety and environmental reasons, as documented in the PEIS, why continued storage as DUF_6 is not the best alternative. Further, conversion to U_3O_8 does not preclude reuse of the depleted Uranium in the event national defense needs dictate or reuse options are ultimately proven cost effective.

Response 1

The commentor's preference for conversion of depleted UF_6 to uranium oxide is noted. It is not clear what the comment is referring to when it states that "There are abundant safety and environmental reasons, as documented in the PEIS, why continued storage as depleted UF_6 is not the best alternative." The PEIS shows that continued storage under the no action alternative is safe. DOE is committed to continue to safely manage the cylinders until they are emptied.

In response to comments received on the Draft PEIS, DOE has revised its preferred alternative (see Section 2.5.1 of the PEIS). The preferred alternative now includes prompt conversion of DOE's depleted UF_6 inventory to depleted uranium oxide.

Comment 2

Cost Analysis Report, Paragraph 4.1.2 Treatment of Emptied Cylinders: The PEIS Cost Report assumes that empty DUF_6 cylinders are crushed and sent to DOE facilities for disposal. There is no cost associated with disposal. This appears to be a completely unsupported assumption. There will be a cost, possibly a substantial cost, associated with disposal of the empty cylinders. They could be contaminated and require special handling.

Response 2

The PEIS assumes that the cylinders that have been emptied and washed in the cylinder treatment facility would be turned over to the DOE scrap metal program. It is highly unlikely that they would be disposed. They are more likely to be recycled as scrap metal. A PEIS support document by Nieves et al. (1997) entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial), and free release. Health endpoints assessed included chemical risks, radiation risks, and trauma risks. Total inventory health risks over 20 years of processing ranged from 0.1 to 0.8 total fatalities for the various options. The potential health impacts were similar for each of the options; however, the disposal option would have the greatest adverse environmental impacts due to land-allocations required and removal of the metal mass from any further usefulness. Text has been *added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.*

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the EIS.

<u>Comment 3</u>

3. Cost Analysis Report, Paragraph 2.4.2 Use as Uranium Dioxide in DUCRETE for Shielding Applications: Report discusses the conversion of DUF_6 to UO_2 which in turn would be used to make DUCRETE. It should be pointed out that conversion of DUF_6 to U_3O_8 and then to DUCRETE is an equally acceptable option.

<u>Response 3</u>

DUCRETE is a depleted uranium-concrete material considered in the PEIS for shielding applications. DUCRETE can in general be formed from U_3O_8 or UO_2. The PEIS however considers DUCRETE formed from UO_2, because UO_2 is more dense than U_3O_8, and this would result in better shielding characteristics. Further information is provided in Section 1.2.1 (Depleted Uranium in Concrete [DUCRETE]) of Chapter 6.11 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 4</u>

Cost Analysis Report, Paragraph 4.2.2 Revenue from Sale of Byproduct AHF and CaF_2: This paragraph, as well as the PEIS Volume I, speak about sale of AHF byproduct. It should be noted that there is also a market for Aqueous HF. It is an equally acceptable option to make and market Aqueous HF.

<u>Response 4</u>

The PEIS discusses the production and sale of anhydrous hydrogen fluoride (AHF) because there is a considerable market for AHF in North America, while the market for aqueous HF is limited. Nothing in the PEIS would preclude the production and sale of aqueous HF if the market for aqueous HF would improve. However, it should be noted that the sale of aqueous HF would be subject to the same types of restrictions as AHF in terms of licenseability or authorization limits for restricted or unrestricted use.

Commentor No. 61: Barclay, Mike / Janaskie, Mark
DPRA, Inc.

Comment 1

QUESTION: The preferred UF_6 management scenario presented in the PEIS carries with it a huge price tag. As such, would funding availability create performance uncertainties for DOE that need to be acknowledged? Specifically, will the funds to begin conversion be available in the amounts needed to initiate large-scale conversion efforts by the year 2009? Will annual funding be available in sufficient amounts to support conversion of the entire inventory within the expected year conversion period? Both questions point to temporal uncertainties that have a bearing on DOE's strategy for interim storage and maintenance of UF_6 cylinders. Lesser amounts of funding would require longer — potentially much longer — storage, and a much greater emphasis on the corrosion protection and reconditioning of UF_6 cylinders. As best we can discern from the PEIS and from discussions at the public hearings, DOE's strategy for UF_6 cylinder corrosion control is to paint the cylinders with the worst corrosion. Perhaps inherent in this strategy is the idea that conversion efforts will start soon enough (e.g. 2009) and will conclude quickly enough (e.g. 2029) that a larger number of cylinders do not need reconditioning to prevent additional corrosion. Is this generally accurate as to DOE's underlying strategy?

Response 1

Issues of DOE program funding are beyond the scope of this PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

The objective of the cylinder painting program is to maintain sufficient cylinder wall thickness to allow cylinder transportation and heating in autoclaves. If the management strategy announced in the Record of Decision for the PEIS requires conversion, emptying corroded cylinders early in the conversion program will minimize cylinder painting requirements over the life of the program.

Comment 2

How many cylinders does DOE anticipate painting at the three sites? It is our understanding that corrosion coatings from paint will last about ten years. Other corrosion protection options, although slightly more costly initially, offer much longer corrosion protection. Specifically, thermal spray coatings provide 30+ years of corrosion control, and offer other significant advantage including dramatic cost savings potential when life cycle costing is factored into total cost considerations. Has DOE factored life cycle costing into its decision making regarding the choice of paint over other coating options? Why did DOE choose paint as a preferred coating choice?

<u>*Response 2*</u>

DOE plans to paint about 6,800 cylinders at Paducah and 2,950 at ETTP over the next five years. This number represents the sum of the cylinders from former G- and F-yards at Paducah and K-yard at ETTP which have been determined to be at risk of corroding to the point that they would have a minimum wall thickness less than the ASME Code allowable for unfired pressure vessels. If this schedule can be met, DOE will, on a statistical basis, save the most mils of wall lost due to corrosion and maintain those cylinders as a code-approved population. Based on the corrosion modeling, the other populations of cylinders do not need painting for some time or possibly not at all to maintain ASME minimum wall thickness. If DOE accelerates disposition of the depleted UF_6, then more painting or "better," i.e. longer lasting coating, may not be necessary.

DOE elected to perform an evaluated procurement (with a scoring system for price and technical performance factors) for a paint system that was technically judged to provide at least twelve years of low maintenance service life. This scoring system was also designed to consider coatings that perform for longer periods but at higher initial costs. In each case, the initial investment was prohibitively high compared to the money available in any given year. Going to a longer time period, i.e. paint fewer cylinders per year at higher dollars per cylinder, to compensate for a fixed budget is not possible due to the time frame that the cylinders must be recoated to maintain the code compliance.

<u>Comment 3</u>

QUESTION: As stated in the PEIS, DOE's preference is to convert the entire inventory of UF_6 material into usable products. Given the large volume of UF_6, it is unclear whether a correspondingly large market demand exists for products arising from the conversion effort. Has DOE conducted a thorough market analysis (applications, demand) for UF_6 conversion products? If so, please describe the results of this analysis, and an estimate of the percentage of the inventory for which definable, cost-effective usages exist?

<u>*Response 3*</u>

The DOE has performed a market study on the potential uses of depleted uranium. The second paragraph in Appendix H indicates that the PEIS examined using depleted uranium as radiation shielding material because the largest potential market appears to be shielding applications. The reference for this statement is Kaplan, S.A., 1995, "Depleted Uranium Market Study."

<u>Comment 4</u>

QUESTION: Given that there appears to be a limited market for the converted uranium oxide (at least based on current information), what will happen to the remainder of the UF_6 stockpile? In terms of program management, it seems certain that the remainder of unconverted UF_6 will become a waste (per U.S. EPA regulations), and therefore will likely be transferred to DOE's EM program. Given this scenario, is there an integration of efforts currently taking place between

DOE programs to address this kind of future scenario? In addition, have there been any discussions between DOE programs as to how the waste would be formally transitioned into the EM program? Also, given the transition of UF_6 as waste into the EM program, is there an existing remediation/cleanup fund established to manage UF_6 as waste material?

Response 4

DOE has managed its depleted UF_6 inventory as a resource for future use, rather than as a waste. DOE expects that uses will be available in the future for some portion of the depleted UF_6 inventory, and it will continue to support the development of government applications for depleted uranium products. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS. If a disposal strategy would be selected, the specifics of that strategy such as timing, conversion and disposal site selection, specific technologies to be used, interface and coordination arrangements with EM, etc., would be evaluated in future project and environmental reviews to be conducted following the Record of Decision.

Comment 5

QUESTION: The PEIS states that there is a very substantial cost associated with transferring the non-conforming cylinders to a central location for conversion. The actual reference case stated in the PEIS estimates this cost at more than $800 million. Of that $800 million, approx. $161 million is for what DOE terms "overcontainers." Given that reference case in the PEIS, we would appreciate responses to the following questions:

1.) Has DOE looked at other options to "re-engineer" the non-conforming cylinders for transport/shipping, so as to eliminate the need to employ overcontainers?

2.) Is there an actual U.S. Dept. of Transportation regulation/requirement to use overcontainers for the UF_6 cylinders? If so, what is it?

3.) Has the DOE held discussions with the U.S. DOT to discuss the requirements for shipping non-conforming cylinders? If so, is this what DOE based its $161 million overcontainer estimate on in the PEIS?

4.) Using the DOE reference case of $161 million for overcontainers, what is the true unit cost per cylinder for transporting the non-conforming cylinders to a central location for conversion?

5.) Does the term "overcontainers" mean the same as "overpacking," as in waste operations?

Response 5

The preparers of the PEIS were unable to locate the source of the cost numbers presented in the comment. Cost information is not provided in the PEIS, but is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS) (available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), or by contacting the DOE program manager identified on the cover sheet of the PEIS.). Responses to the specific comments listed are provided below:

(1) The PEIS considered two representative options for preparing cylinders that do not conform to Department of Transportation requirements, the use of "overcontainers," and the transfer of the contents from non-conforming cylinders to new cylinders. These two options are described in Appendix E of the PEIS, with additional detailed information provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS).

DOE has funded some preliminary studies into wall thickness requirements to maintain a code vessel status for "unfired pressure vessels" in storage and in use (heating). The Department of Transportation is bound by 49 CFR 173.420 for regulating UF_6 cylinders in transit. The DOE would be required to demonstrate "equivalent levels of safety" for any cylinders not meeting those specific requirements. No work has been performed to "re-engineer" the cylinders with their contents, except for the addition of paint to arrest corrosion and maintain wall thicknesses.

(2) Depleted UF_6 cylinders were originally designed, built, tested, and certified to meet Department of Transportation requirements for shipment. Shipping requirements are specified in Title 49 of the Code of Federal Regulations (Part 173.420) and ANSI N14.1 (American National Standard for Nuclear Material — Uranium Hexafluoride — Packaging for Transport requirements). These requirements include pressure vessel code design, fill limits, wall thickness minimums, pressure limitations, cylinder body damage limitations and repair requirements. DOE has evaluated the inventory of cylinders based on these requirements and has made estimates of the numbers of cylinders that no longer will meet these requirements. Cylinders that conform to the DOT shipping requirements can be prepared for shipment without a protective overcontainer. However, after several decades in storage, some cylinders may no longer conform to the DOT requirements and would require some type of preparation prior to shipment. As described in Appendix E of the PEIS, two options were considered for preparing non-conforming cylinders for shipment; placement of non-conforming cylinders in protective overcontainers that provide equivalent safety or transfer of the contents from non-conforming cylinders to new cylinders.

(3) Representatives from the current cylinder management program have met with DOT regulators on several occasions and have participated in very open and candid discussions regarding the condition of some cylinders. In order to ship cylinders that do not meet current regulations, even under a DOT exemption, DOE must demonstrate that the cylinders meet the "equivalent safety" of a conforming cylinder. There are no 49 CFR requirements to use overcontainers for depleted and normal assay UF_6 cylinders, however, there are overcontainer requirements for shipping enriched UF_6.

(4) Unit costs for transportation are a function of the number of shipments and the distance that those shipments have to be transported. Thus, there is no "true unit cost" on a per cylinder basis due to the dependency on shipping distance.

(5) In the context of the PEIS, the term "overcontainer" refers to a container into which a cylinder could be placed for shipment. The overcontainer would be designed to provide equivalent safety of a UF_6 cylinder which today qualifies as a DOT Type A package. It does not mean overpacking as in waste operations.

Comment 6

We understand at the Nevada Test Site (NTS) has recently changed its Waste Acceptance Criteria in the last year or so, so that it can receive more DOE waste for disposal. Given the scenario that DOE determines that UF_6 conversion is not economically feasible or prudent, would anything prevent the DOE from sending the UF_6 waste to the NTS for disposal, or even interim storage (retrievable storage) prior to DOE developing a better, more economically efficient method to convert the UF_6?

Response 6

DOE considers the depleted UF_6 to be a source material, and not waste. However, even if DOE decided to dispose of the depleted uranium in its depleted UF_6 inventory, disposal in the form of UF_6 would not be acceptable because of the chemical characteristics of UF_6. Prior to disposal the UF_6 would have to be converted into a more stable form, such as uranium oxide. Long-term storage as UF_6 is one of the alternatives analyzed in the PEIS. This type of storage was assumed to take place at a representative site, which could in reality be anywhere in the United States. For this reason, the transportation of UF_6 cylinders over a range of distances was included in the PEIS. If the strategy selected in the Record of Decision for this PEIS is the long-term storage as UF_6, then the site selection would be accomplished as part of the future planning and analysis process.

Commentor No. 62: Ross, Wayne A. / Haass, Mathew, P.E.

Comment 1

We have previously provided information on the Molten Glass Reactor (MGR) Process for the single step immobilization of the uranium hexafluoride. Attached is a copy of the material previous provided in 1995 and 1996 on this process. This process has a factor of at least two lower cost than those included in the EIS. It should also have less environmental impacts. This option was not identified or considered in the EIS and is not within the bounds of the EIS for cost or for impacts. Therefore the EIS failed to consider a reasonable, technically feasible, cost-effective and environmentally favorable alternative for the disposition of the deleted UF_6.

Response 1

The Molten Glass Reactor process is based on in-situ vitrification technology. It was not analyzed within the PEIS because it does not appear to be sufficiently developed to offer hope of significant cost reduction compared to established processes. A recent report by the National

Academy of Sciences (National Research Council 1996; the full citation is provided in Chapter 8 of the PEIS) indicated that a 5-year research and development program would be required to determine feasibility and costs of the MGR process. In addition, the technologies considered in the PEIS were intended to be representative and were not intended to preclude other technologies that may become available in the future. Technology selection, if conversion was required by the management strategy selected in the Record of Decision for the PEIS, would be addressed in future analyses.

Comment 2

We recognize that additional work will be needed to verify the process, but as was stated in the Summary of the Cost Analysis Report Section 3.0 Most technologies would require significant engineering development. Thus the MGR process with the previous developments for high-level and mixed waste vitrification and the development of the In-situ-Vitrification Process (ISV) would make the state of development superior to many of the other proposed alternatives. Thus, the lower state of development of the MGR process is not a sufficient reason for omitting it from consideration.

Response 2

The Molten Glass Reactor process could be considered to be a less mature technology compared to those considered in the PEIS, which are based upon either processes that have been used commercially (such as metallothermic reduction) or are extensions of industrial practices (e.g., revision of the COGEMA process to produce anhydrous hydrogen fluoride). The National Academy of Sciences considered that the MGR process required a 5-year research and development program to determine its feasibility and estimate costs. In addition, the conversion technologies considered in the PEIS were intended to be representative and were not intended to preclude other technologies that may become available in the future. Technology selection, if conversion was required by the management strategy selected in the Record of Decision for the PEIS, would be addressed in future analyses.

Comment 3

The MGR process would be generally consistent with the intent of the preferred alternatives "use of the material." The MGR process would place the uranium in a high concentration in a vitreous state near the earth's surface, thus providing the opportunity to retrieve and reprocess the material as a very high grade ore, if in the future there is a need for depleted uranium. At the same time, the uranium has very low availability to the environment, as the vitreous waste form provides very good containment of the uranium.

Response 3

The Molten Glass Reactor (MGR) process proposed in the comment would convert the depleted UF_6 into a vitreous state, presumably for long-term storage purposes. Vitrification was *considered in the PEIS, but was not analyzed in detail for reasons discussed in Section 2.3.4 of the PEIS.*

Comment 4

The "disposition of other alternatives" in the engineering analysis documents (Section 4.5) stated "Another possible sub-option is vitrification, in which depleted uranium oxide would be enclosed in glass. The basic technology is developed (for disposal of high-level radioactive waste), but other types of waste preparation are generally preferred for depleted uranium. Vitrified waste would require more space for disposal. In addition, a vitrification facility would be more complicated and costly to build and operate than a cementing facility." These statements to dismiss the alternative, while possibly applicable to a stand alone vitrification processing facility that would incorporate the waste into glass in canisters for disposal, are not applicable to the MGR Process and therefore the MGR process does not qualify for exclusion based on it. The MGR would have lower disposal area requirements and lower capital and operating costs than any of the proposed facilities.

Response 4

Currently available literature does not appear to substantiate the claim made in this comment that the process would incur lower costs than other conversion processes. The proposed technology is still in the developmental stage and has not been fully demonstrated. It was considered when the representative technologies were selected for the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), but was not analyzed in detail for reasons given above. The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 5

There does not appear to be a strong basis for the preferred option. All alternatives have similar impacts and costs.

Response 5

The preferred alternative as described in Section 2.5 of the PEIS is the alternative that DOE judges will best fulfill its statutory obligations and defined mission. The management alternatives evaluated in the PEIS have similar environmental impacts and costs because they generally involve similar activities such as continued cylinder storage, transportation, and conversion. The Record of Decision will explain how the selected management strategy was chosen from among the alternatives.

Comment 6

The PEIS Summary document should contain a discussion of the various life cycle cost of the alternatives.

<u>*Response 6*</u>

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives is generally not considered an environmental impact; consequently, cost information is not provided in the summary or main body of the PEIS. However, cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available to the public at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS. Cost information will be considered along with the results of the PEIS and other information in the Record of Decision for the PEIS.

<u>Comment 7</u>

The use of discounted cash flow, while technically justifiable, obscures the actual costs for the various processes. I have not seen many DOE projects where the costs have decreased with time. They nearly always increased. Discounting at a rate of 7% makes major operating costs in the out years very small and meaningless. A constant dollar basis is more meaningful, but probably still optimistic.

<u>*Response 7*</u>

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives is generally not considered an environmental impact; consequently, cost information is not provided in the PEIS. However, cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Discounted cash flow, or present-worth, analysis is typically applied in comparison of the costs of various alternatives. This approach takes into account the time-value of money, in that costs which are incurred in the future, are discounted into present year dollars. As an example, a single dollar placed in an account with a 7% compound interest rate would be equivalent to approximately $870 in 100 years. A shortcoming of stating all costs in constant dollars is that it does not consider this time value of money.

<u>Comment 8</u>

The projection that all of the materials will be used seems highly speculative. I did not identify in the draft how all the uranium would be used. An accounting of the use of the materials should be included in the final EIS. The accounting could identify future uses currently unidentified. Some order of magnitude calculations give the following results. Page H-10 indicates that 933 casks would be produced for 20 years for a total of 18,660 casks. I don't think there is sufficient uranium to produce that many casks based on other information. The current forecast (DOE/RW-0006 Rev 12, page 23) indicates that there will be less than 90,000 MTU of commercial spent fuel. If one uses the Multiple Purpose Cask (MPC) as the model cask, then each cask will hold 11 MTU. Thus, if all the spent fuel was to be shipped in MPC, about 8200 shipments is all that would be needed. It seems unrealistic, however, that all of the fuel would be shipped to the repository in single use casks. It would be far more economical for reactor operators to use reusable casks that can be use for 100's of shipments. Thus the use of most of the inventory for casks seems unrealistic and the preferred alternatives basis that all materials can be used is high speculative. Your position would be greatly strengthen if you had some statements from DOE-RW that they were planning on using the uranium for this purpose. With respect to the Hanford SNF in K-Basins there has been serious concerns expressed about the present of uranium metal in the repository. Further, we anticipate that the use of uranium as counter weights would not be highly regarded by industry, when they found the needs for radiation monitoring and inventory control were necessary. This leads us to the conclusion that a significant fraction of the materials will need to be processed and disposed. The MGR being a modular process could accomplish this very effectively and could be implemented in a relatively short period of time.

<u>Response 8</u>

The engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) contains further information concerning the number of required depleted uranium casks. Section 1.1 of the EAR on page 6.11-1-2 indicates that a total of 10,000 to 12,000 depleted uranium casks would be required for radiation shielding of high-level waste and spent nuclear fuel. At over 40 tons of uranium per cask, essentially the entire DOE inventory of depleted uranium would be consumed. Since the depleted uranium casks are intended for storage purposes, it would be necessary to have a number of depleted uranium casks sufficient in number to safely store the entire inventory of commercial spent nuclear fuel. The EAR is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Insufficient information is available concerning the large scale application of the Molten Glass Reactor (MGR) concept using depleted UF_6, and thus it is not possible to establish the required operating duration for this process, for comparison with the processing duration of 20 years applied in the PEIS analyses.

<u>Comment 9</u>

It was interesting to note that one of the major hazards identified was the shipment of HF. The MGR process converts the fluoride to calcium fluoride and dissolves it in the glass structure thus eliminating the HF hazard. It also means that there is only one transportation operation in the MGR process further reducing transportation impacts.

Response 9

The PEIS did consider options in which HF was neutralized to calcium fluoride (see Appendix F). The PEIS considered technologies that had a sufficient technical basis to carry out reasonably precise, preconceptual designs. The Molten Glass Reactor (MGR) process was not evaluated in the PEIS because it is in the early stages of conceptualization and development.

Further information concerning options not analyzed in depth is provided in the engineering analysis report (LLNL 1997; the full citation is provided in Appendix F of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 10

The concentrated form of the final waste form requires less land space than other options since all of the uranium could be disposed in an area about 1200 ft by 1200 ft (33 acres). Note this is less than the disturbed area for one cask manufacturing facility (36 acres).

Response 10

Comment noted. The Molten Glass Reactor process identified in this comment is similar to in-situ vitrification, and was not retained for analysis in the PEIS for the reasons stated in Section 2.3.4.

Commentor No. 63: Cronin, Bill / Harmon, Melinda
See responses to Commentor No. 51

Commentor No. 64: Murray, Alexander P.
Private Consultant

Comment 1

Disposal and waste management are significant issues not well addressed in the PEIS. It is highly probable that a significant fraction of the DU — perhaps all of it — will end up as a radioactive waste, either as itself or in a reuse "product." It is not until well into the PEIS (Chapter 5) that the reader is informed that near surface disposal will significantly exceed 10 CFR Part 61 limits (for NRC/commercial facilities) and DOE limits for public doses. In other words, codified regulations will be broken. Also, mined cavity disposal, which may be a solution for DU, does not currently exist for LLW, and there are no current plans for mined cavity disposal of LLW in the U.S.

Response 1

Although the results of the disposal alternative indicate that radiation doses to individuals could potentially exceed regulatory limits for disposal in a "wet" environment at some point in the distant future, the analysis also indicates that impacts would remain within regulatory limits for a disposal facility in a "dry" environment. The PEIS also stresses (see Appendix I) that the post-closure disposal analysis is based on generic information and is subject to a great deal of uncertainty. Actual impacts from disposal would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. If disposal were implemented in the future, all disposal activities would take place in accordance with applicable NRC rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option).

Comment 2

Market demand does not and is not likely to exist for the reuse of DU, and the PEIS does not identify routes to build such a market. Currently, cost and liability are almost insurmountable hurdles for the "reuse" of DU, as its competitor for the (most likely) reuse scenarios (spent fuel shielding) is concrete. The use of DU shielding requires an integrated approach to minimize consumer, utility, and DOE costs, and DOE acceptance of DU liability (basically disposal). This implies that even for reuse scenarios, the DU form must be compatible with disposal. Myself and other authors have written on this extensively.

Response 2

DOE expects that in the future, uses will be available for some portion of the depleted UF_6 *inventory. DOE plans to continue its support for the development of government applications for depleted uranium products. As described in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses is considered beyond the scope of the PEIS. Such issues would be considered and evaluated in more detail in future planning and environmental analyses. The PEIS acknowledges that at the end of their useful lives products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4, 2.2.5, and 5.9 of the PEIS).*

Comment 3

No significant uses of DU currently exist in shielding applications. No licensed spent fuel casks use DU shielding, and there are no current plans or pending applications for spent fuel casks using DU. DOE-RW has identified DU as a cost and machining disadvantage for spent fuel casks. The PEIS needs to openly state these points and identify means to resolve them. Again, myself and others have written on this extensively.

Response 3

The PEIS evaluates two representative options for use of depleted uranium for radiation shielding. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses. While it is true that depleted uranium is not used in currently licensed spent fuel storage or transportation casks, this does not preclude development of such a use in the future. In fact, depleted uranium is included as shielding in a transportation cask design currently undergoing licensing by the NRC. If further proposals to use depleted uranium as shielding in storage or transportation casks are put forth in the future, issues related to the efficacy, costs, engineering considerations and environmental considerations would be discussed and evaluated. Your comments on your expertise in this area are noted.

Comment 4

The analyses and alternatives are uneven and neither analyzed at comparable levels nor taken to equivalent endpoints. For example, all of the uranium dioxides will perform differently. The gelation-produced uranium dioxide is equivalent to nuclear fuel in terms of high density and low porosity, and will have improved leach resistance, heat transfer, and sizing as compared to the other oxides (including the lower density uranium dioxide) — in short, it's a better material. Significant items have been left out of the analyses (e.g., disposition of shielding, roll up of disposal impacts, and protective action distance impacts on site sizes). There is no reconciliation between known technologies/impacts and those in the report — for example, the proposed uranium dioxide pellet furnaces used for analysis in the PEIS correspond to 100-200 teU/yr capacity, not the 7,000 teU/yr capacity claimed by the analysis. The same pellet technology also currently requires about 1 FTE/te/yr, not the 0.014 FTE/te/yr used in the PEIS. The conversion reactors (low number and large size) appear to be very optimistic. The gelation facility includes two plants (one to U_3O_8 and one to UO_2) which is not consistent with the technology and explains why its impacts are slightly higher. The PEIS should recognize these shortcomings, limitations, and differences, and be more equivalent in its analyses.

Response 4

This comment deals with a number of specific issues, which are addressed below. In general, the technical bases for the impacts process designs in the PEIS are provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three *current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.*

Issue 1: "The analyses and alternatives are uneven and neither analyzed at comparable levels nor taken to equivalent endpoints. For example, all of the uranium dioxides will perform differently. The gelation-produced uranium dioxide is equivalent to nuclear fuel in terms of high density and low porosity, and will have improved leach resistance, heat transfer, and sizing as compared to the other oxides (including the lower density uranium dioxide) — in short, it's a better material."

Response: The PEIS does take into account the differences between the two uranium oxide forms: U_3O_8 and UO_2. The conversion routes necessary to produce the various uranium oxide forms are examined in the PEIS. The chemical characteristics of the various uranium oxide forms (e.g., density which affects storage area, leaching rate for disposal) are considered in management options such as long-term storage (Section 2.2.3 in the PEIS) and disposal (Section 2.2.6 in the PEIS).

Issue 2: "Significant items have been left out of the analyses (e.g., disposition of shielding, roll up of disposal impacts, and protective action distance impacts on site sizes)."

Response: The disposal of shielding containing depleted uranium was not analyzed in detail at this time because actions to be taken beyond the 40 year period considered in the analysis are considered highly uncertain and speculative. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.

Disposal impacts have been estimated over a period of at least 1,000 years, and are provided in Appendix I of the PEIS. Disposal impacts were estimated for two phases: the operation phase and the post-closure phase. Post-closure impacts were estimated at 1,000 years after the disposal facilities were assumed to fail.

The conversion facility land areas in the PEIS do not include protective action distances (buffer zones). The need for buffer zones surrounding a facility would be determined by site-specific environmental impact studies, which will follow this PEIS.

Issue 3: "There is no reconciliation between known technologies/impacts and those in the report — for example, the proposed uranium dioxide pellet furnaces used for analysis in the PEIS correspond to 100-200 teU/yr capacity, not the 7,000 teU/yr capacity claimed by the analysis. The *same pellet technology also currently requires about 1 FTE/te/yr, not the 0.014 FTE/te/yr used in the PEIS. The conversion reactors (low number and large size) appear to be very optimistic. The gelation facility includes two plants (one to U_3O_8 and one to UO_2) which is not consistent with the technology and explains why its impacts are slightly higher. The PEIS should recognize these shortcomings, limitations, and differences, and be more equivalent in its analyses."*

Response: A typical UO_2 fuel fabrication plant processes enriched uranium in numerous production lines with low capacity equipment (100-200 teU/yr). Low capacity equipment is used for criticality control and ensure strict quality control.

The depleted UO_2 conversion plants assumed continuous process operation using two or three lines of high-capacity equipment (2,000-3,500 teU/yr). Equipment development for the sintering furnaces is needed. But the throughput needed for sintering and pressing is not unusual for the ceramic industry.

Plant staffing for the depleted UO_2 conversion plants was assumed to be similar to a chemical plant using proven processes and equipment. The process was automated and controlled from a central control room, which would reduce the number of required staff. Each process system was assigned 1 to 2 operators, and a supervisor was provided for every 6 operators.

The number of conversion reactors assumed in the PEIS can be assumed to be conservative. Two separate reactors in series was assumed for conversion of UF_6 to U_3O_8, while COGEMA in France use a single reactor for conversion.

The conversion of UF_6 to UO_2 by gelation in the PEIS includes U_3O_8 production and dissolution but it is not two plants. The basis for the gelation process in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) is the Oak Ridge Report ORNL/TM-6850, "Chemical Flowsheet Conditions for Preparing Urania Spheres by Internal Gelation" (July 1979). The two-step gelation process in the PEIS bounds the impacts and is expected to be satisfactory for PEIS purposes.

Comment 5

The limitations of the technologies should be recognized in the PEIS, and means identified to address them. Only the French conversion to U_3O_8 technology has been used on a scale approaching that needed for the PEIS, and it needed compactors to increase the density to circa 3 g/cc. To state that current pelletization technology is established for the throughputs and equipment used in the PEIS is incorrect-the gelation route with VTF's has actually achieved higher equipment rates per unit floor area.

Response 5

The limitations of the technologies considered in the PEIS are considered in the technology assessment report (LLNL 1995; the full citation is provided in Chapter 8 of the PEIS) and in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report also contains information concerning the uncertainties associated with the facility designs, with current throughput scale as one factor that was considered.

Section 6.8 (UO_2: Gelation / Ceramic UO_2 Facility) in LLNL (1997a) contains information concerning the throughput scale of the gelation process, which has been demonstrated at the Oak Ridge National Laboratory at a small laboratory scale.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 6

Recent NRC positions in this area are not stated in the EIS, but are alluded to in the supporting documentation. The NRC (in a response to the FR notice and in a separate EIS) has clearly stated concerns about the lack of a use for the DU, the likely probability that a significant amount (if not all) of the DU will become waste, and the high probability that DU will require "deep disposal" because of the unacceptably high MEI dose rates from near surface disposal. Such significant conclusions by a regulator should be included and discussed in the PEIS.

Response 6

The NRC recommendations, as stated in the agency's response to the Federal Register Notice (59 FR 56324), are reflected in the PEIS by the consideration of the disposal of uranium oxide (U_3O_8) in a mined cavity as one of the alternatives considered. In addition, a new section has been added to the PEIS (Section 1.7) that summarizes studies and reports related to depleted UF_6 management, including the EIS prepared by the NRC, "Final Environmental Impact Statement for the Construction and Operation of the Claiborne Enrichment Center, Homer, Louisiana" (NRC 1994). The findings of this NRC EIS, which support disposal of uranium oxide in a mined cavity, are summarized in the PEIS.

Comment 7

DU metal seems to receive a favorable treatment in the PEIS with impacts significantly below historical experience. This appears because some of the release fractions and impacts are underestimated significantly (beyond technological optimism). This should be corrected in the PEIS.

Response 7

It is assumed in this response that the comment concerns the conversion of UF_6 into uranium metal via batch reduction, which is a mature industrial process with many years of historical experience.

Information concerning the batch reduction of UF_6 into uranium metal can be found in Section 6.9 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The release fractions used in the accident analysis were based upon the document "Recommended Values and Technical Bases for Airborne Release Fractions, Airborne Release Rates and Respirable Fractions at DOE Non-Reactor Nuclear Facilities" (DOE-HDBK-0013-93, July 1993). This handbook is the recommended resource for airborne release fractions for postulated accident scenarios involving radioactive materials.

The document "Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement" (DOE/EIS-0240, 1996) considered batch reduction of enriched UF_6 into uranium metal, for potential blending with low-enriched uranium. The impacts of postulated accidents in this document are similar to those considered in the PEIS.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 8

Gelation technology appears to receive a less than favorable treatment in the PEIS, using TCE as a solvent instead of oil, tray instead of tube furnaces, and including a U_3O_8 production step, followed by nitric acid dissolution and UO_2 production (the aforementioned two plants in one misrepresentation). While in the final analysis the difference is small, it is incorrect, and the PEIS should correct the misrepresentation. There are recent published articles (which you have copies of) that give a detailed description of gelation technology as applied to DU, and these should be used as references in the PEIS.

Response 8

The PEIS does not misrepresent or unfavorably treat the gelation process. Based on the data and references available, a reasonable (but not optimal) design was prepared. The major uncertainties associated with the gelation design considered in the PEIS are associated with the disposition of the wash effluent and the capacity of the gelation columns.

To answer the specific issues raised in this comment:

1. Using silicone oil as the gelation medium would require adding a gel washing step. The report "Internal Gelation to Prepare (U, Pu)Ox or UO_3 Spheres Using Perchloroethylene Media" (ORNL/TM-9330, 1984) states residual oil adhering to the gel spheres must be washed off using a solvent. The spent solvent would then be distilled to separate the oil and solvent for recycle. The same report suggest using perchloroethylene as the gelation medium. Each gelation medium has its advantages (and disadvantages). Page 6.8-1-2 of the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) states "Using a different gelation *medium such as silicone oil is not expected to significantly affect the environmental impacts of the gelation facility."*

2. Vertical tubes furnaces are simpler than tray tunnel furnaces because there are no trays handling/conveying mechanisms. It should however be noted that the tube furnace diameter (and capacity) may be limited by the requirements to maintain uniform temperature between the tube wall and centerline.

3. The gelation process considered in the PEIS includes U_3O_8 production and dissolution, but it is not two plants. The basis for the gelation process in the EAR is the report "Chemical Flowsheet Conditions for Preparing Urania Spheres by Internal Gelation" (ORNL/TM-6850, 1979). In the ORNL flowsheet, gelation column feed (acid deficient uranyl nitrate, or ADUN) was prepared by dissolving U_3O_8 in a sub-stoichiometric quantity of nitric acid.

4. Only articles on UO_2 fuel fabrication were used in preparing the gelation process. No articles appear to be publicly available that specifically dealt with depleted UO_2.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 9

Costs are not brought forward in the PEIS. Costs from the CAR and from published articles should be discussed and reconciled in the PEIS, as cost is likely to be a significant determinant in the DU disposition option selected.

Response 9

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives (as contained in the cost analysis report [CAR]) is generally not considered an environmental impact; consequently, cost information is not provided in the PEIS. The ultimate decision on a management strategy will be announced in a Record of Decision. The Record of Decision will consider the results of the PEIS, along with other information, such as cost and engineering data, to select a management strategy.

Comment 10

DUSCOBS and PYRUC shielding materials are not discussed in the PEIS. DOE appears to have an interest in these materials, and they are likely to have better properties for disposal than either DU metal or uranium oxide in concrete. As such, they should be mentioned and discussed.

Response 10

As stated in Section 2.2.4, Section 2.2.5, and Appendix H, the two use alternatives evaluated in detail in the PEIS, use as uranium oxide and uranium metal as radiation shielding, were selected as representative options for the purposes of comparing the potential environmental impacts of broad alternative management strategies. These options were intended to be representative only, and were not intended to preclude other potential uses in the future. This point has been clarified in Section 1.5.3 of the PEIS by adding text stressing the representative nature of the facilities, processes, and uses evaluated for the purpose of estimating environmental impacts. Specific uses, such as those mentioned by the commentor would be considered and evaluated in future planning and environmental analyses, as appropriate. One of the uses mentioned in the comment, DUSCOBS, was evaluated by the independent technical reviewers in the technology assessment report (LLNL 1995; the full citation is provided in Chapter 8 of the PEIS) and was found to be not feasible due its lack of maturity and not enough information being available at the time. However, if a use strategy is selected in the Record of Decision, all specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks.

Comment 11

Waste: In Section S.4.8 on page S-40, waste management impacts are discussed. DOE should consider briefly highlighting the potential uranium content of the secondary streams, along with a brief assessment of acceptability for either reuse/nonradioactive disposal or disposal as radioactive waste. DOE should expand the discussion in the last paragraph about uranium disposal as LLW. The DOE may wish to cite regulatory agency positions on the wastes, including the NRC position letter (from Benero) sent to DOE as part of this EIS process and the NRC LES EIS analysis. For example, the NRC documents provide analyses supporting DU disposal as a LLW, but note that its disposal could require a mine or another means of "deep" ("Non near-surface") disposal. Currently, no "deep" disposal sites exist, and all current LLW disposal sites (existing and planned) use near-surface facilities. Thus, it would seem that disposal of DU may have significant impacts and regulatory requirements beyond those listed in the PEIS. DOE should consider adding the cumulative impacts from DU oxide disposal to Section S.4.13 "Cumulative Impacts."

Response 11

Although there are uncertainties in the predicted uranium content of secondary waste streams, estimates of the potential uranium content of CaF_2 are given in Sections S.4.8, 2.4.8, 5.3.7, F.3.7.1, and F.3.7.2 (i.e., less than 1 ppm). An estimate of the potential uranium content of MgF_2 is given in Section F.3.7.3 of the PEIS (i.e., 90 ppm). This estimate has been added to Sections S.4.8, 2.4.8, and 5.5.7, as requested by the commentor.

With respect to the fate of the CaF_2, the PEIS does state in Sections S.4.8 and 2.4.8 that "the low level of uranium contamination expected (i.e.,less than 1 ppm) suggests that sale or disposal as nonhazardous solid waste is most likely." If disposal of CaF_2 is required, the PEIS acknowledges that it may be considered LLW, and assesses the impacts for both disposal as nonhazardous solid *waste and disposal as LLW. Currently there are no known uses for the MgF_2 that would be produced if the use as metal alternative were to be selected; it is therefore assumed that this MgF_2 would require disposal either as nonhazardous solid waste or as LLW. Brief discussions of the market for anhydrous HF and historical industrial experience showing that if produced, it could be purified to contain less than 1 ppm uranium, are provided in Sections 2.3.3 and F.2.1 of the PEIS. Text has been added to Sections S.4.8 and 2.4.8 to clarify the assumption made in the PEIS that if HF were produced, it would be sold for use subject to appropriate review and approval by the U.S. NRC or DOE.*

The PEIS assumes that any depleted uranium oxide disposed of would be classified as LLW. The evaluation of disposal options in the PEIS considered disposal in representative facilities which could be used for the disposal of LLW, including shallow-earthen structures, vaults, and mines. Because the PEIS is not intended to identify sites for future management activities, the potential impacts of the disposal options were evaluated using generic environmental settings, and considered both "wet" and "dry" sites. The characteristics of these settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the alternatives. After the Record of Decision for the PEIS, potential facility locations would be evaluated and appropriate site-specific analyses for any required facilities would be conducted.

The detailed analysis presented for disposal in the PEIS does indicate that the dose to a hypothetical receptor from contaminated groundwater would exceed regulatory limits for a disposal facility in a "wet" environment for all three disposal options considered, including disposal in a mine. However, the analysis also indicates that groundwater impacts would be less than regulatory limits for a disposal facility located in a "dry" environment, including shallow-earthen structures and vaults. (These results are summarized in Section 2.4.5 and presented in detail in Section I.4 of Appendix I). It must be stressed, as noted in Appendix I, that the disposal calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. Rather than cite regulatory agency positions that may not be applicable to the disposal of depleted uranium oxide in the summary of potential waste impacts, text has been added to Sections S.4.5 and 2.4.5 (Water and Soil Impacts) detailing some of the uncertainties of the non-site-specific analysis for disposal, and stating that if disposal were implemented in the future, all disposal activities would take place in accordance with applicable rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option).

Cumulative impacts were evaluated in the PEIS only for components of the alternatives for which the locations of the actions were already known (i.e., continued cylinder storage and cylinder preparation for shipment). The cumulative impacts of these components are described in Section

5.8, and summarized in Section S.4.13. Text has been added to Section S.4.13 to clarify the scope of the cumulative impacts analysis.

<u>Comment 12</u>

Leach Rates — Page 2-22 briefly mentions leach rates and waste forms, and states that grouted wastes are representative of immobilized waste forms with low leach rates, with the implication that grouting is also representative of vitrification. DOE should clarify this text, as grouting may be representative for some parameters (e.g., facility size) but not representative in others (e.g., energy usage, emissions). Also, while grouting should provide for somewhat lower leach rates as compared to the ungrouted material, vitrification would be expected to provide for much lower leach rates than grouting (typically, 5-6 orders of magnitude less), and this may be an issue for some disposal options. Consequently, these items should be discussed.

<u>Response 12</u>

Vitrification of depleted uranium oxides for the purposes of disposal is discussed on Section 2.3.4 of the PEIS and in the technical backup report "Technology Impact Review — Vitrification of Uranium Oxides Resulting from Conversion of Depleted Uranium Hexafluoride," by Swanstrom et al. (1997). The backup report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS. As discussed in the PEIS and in the backup report, technologies for vitrification of depleted uranium oxides are in the early stages of development, and since the PEIS is intended to provide an analysis of broad, programmatic alternatives, a mature and common technology, grouting, was used as the representative technology to evaluate and compare the impacts of stabilization for disposal. If vitrification proves to be a better technology in the future, nothing in the PEIS would preclude its use.

<u>Comment 13</u>

Empty Cylinders — The impacts from disposition of the empty cylinders are not included, although potential options are listed (page 2-23). It would seem reasonable to provide a brief discussion on these options and include impacts from cylinder disposition in the EIS.

<u>Response 13</u>

A PEIS support document by Nieves et al. (1997) entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial), and free release. Health endpoints assessed included chemical risks, radiation risks, and trauma risks. Total inventory health risks over 20 years of processing ranged from 0.1 to 0.8 total fatalities for the various options. The potential health impacts were similar for each of the options; however, the disposal option would have the greatest adverse environmental impacts due to land-allocations required and removal of the metal mass from any *further usefulness. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.*

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 14

Water Impacts — The summary table of impacts (Table 2-2) and the supporting text for the water and soil section (page 2-50) note that the groundwater uranium concentrations will exceed drinking water guidelines. It is recommended that the expected concentrations are also expressed in terms of individual radiation doses.

Response 14

The potential radiation doses to members of the general public from the use of groundwater at the three current storage sites was calculated for the no action alternative and the action alternatives; the doses are given in Sections 5.1.1.1.2 and 5.2.1.1.2. The doses during the post-closure phase for the disposal as oxide alternative are discussed in Section 5.6.1.1.2.

In Table 2-2 it is stated that uranium groundwater concentrations could exceed guidelines under the Disposal as Oxide Alternative, wet environmental setting. The doses and chemical health risks from this exposure have been added to Table 2.2 under Human Health and Safety — Normal Facility Operations. Supporting text has also been added to Section 2.4.1.

Comment 15

Waste — Pages 2-52 et seq present a summary of the waste management impacts from the impacts. Comparisons are primarily with the DOE waste management system, although these facilities could also be commercially operated under NRC or State regulations. Consequently, DOE should consider adding a comparison to commercial LLW generation rates and categorization per 10 CFR Part 61. The section should also include estimated uranium levels for the magnesium fluoride waste (from DU metal production) and discuss the aspects of DU disposal, including the potential need for either a dedicated or a deep disposal facility.

Response 15

Because of the many uncertainties present at this time, the comparison of waste management impacts from depleted UF_6 waste was limited primarily to the DOE waste management system. Currently three commercial facilities (i.e., Barnwell, SC, Richland, WA, and Envirocare in UT) are accepting about 37,000 m^3/yr of commercial LLW, and DOE is disposing of approximately 65,000 m^3/yr LLW at DOE facilities. DOE LLW generation is expected to increase to about 100,000 to 200,000 m^3/yr once environmental restoration operations begin. Commercial facilities which *manage LLW have the capability to expand rapidly and may accept DOE LLW in the future if it can be managed profitably. A summary of this information on commercial LLW generation rates has been added to Section C.10 as background information.*

An estimate of the potential uranium content of MgF_2 is given in Section F.3.7.3 of the PEIS (i.e., 90 ppm). This estimate has been added to Section 2.4.8 as requested by the commentor, as well as to Sections S.4.8 and 5.5.7.

The detailed analysis presented for disposal in the PEIS does indicate that the dose to a hypothetical receptor from contaminated groundwater would exceed regulatory limits for a disposal facility in a "wet" environment for all three disposal options considered (i.e., disposal in shallow-earthen structures, vaults, or mines). However, the analysis also indicates that groundwater impacts would be less than regulatory limits for a disposal facility located in a "dry" environment for all three disposal options (these results are summarized in Section 2.4.5 and presented in detail in Section I.4 of Appendix I). It must be stressed, as noted in Appendix I, that the disposal calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. Text has been added to Sections S.4.5 and 2.4.5 (Water and Soil Impacts) detailing some of the uncertainties of the non-site-specific analysis for disposal, and stating that if disposal were implemented in the future, all disposal activities would take place in accordance with applicable rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option).

Comment 16

Dilution of Effluents — On page 5-51, the text indicates effluent levels exceeding EPA guidelines for uranium, but notes that the concentration would be much lower and below the guideline after dilution in nearby surface water. This should be clarified, and potential dose consequences of these effluents presented.

Response 16

The EPA guideline of 20 µg/L referred to is the proposed maximum contaminant level for drinking water, and thus is strictly applicable only to water samples taken at a tap and not to facility effluents. The applicability of this guideline is discussed in Footnote "f" of Tables S.2 and 2.2. In the context of page 5-51, the guideline was used only for purposes of comparison with estimated levels in surface waters. In order to clarify the applicability of the 20 µg/L levels as a guideline rather than a standard, a sentence has been added to Section 4.3.5 of the PEIS.

Details on dilution calculations for surface water discharges for all of the alternatives are discussed in Sections C.2, D.2.4.1, E.3.4.1, F.3.4.1, G.3.4.1, H.3.4, and I.3.4 of the PEIS, and in the supporting PEIS document titled "Water and Soil Impact Analyses in Support of the Depleted Uranium Hexafluoride PEIS" (Tomasko 1997b; the full citation is provided in Appendix C of the PEIS). The supporting reports are available for review at the DOE public reading rooms near the *three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.*

The dose to the Maximally Exposed Individual from the General Public from all potential exposure pathways is presented in the following tables and figures: Table D.2, Table D.22, Figure E.9, Table F.4, Table G.3, Table H.2, and Table I.6. These doses included ingestion of surface water calculated on the basis of water concentration estimates given in the above-referenced Appendix Sections.

Comment 17

Metal Waste — Page 5-76 of the PEIS presents waste management for the metal cask manufacturing route. Waste management appears to have overlooked secondary wastes related to manufacturing, which are unique to uranium metal. For example, induction furnaces for uranium metal are usually lined with graphite, which requires periodic removal and replacement (sometimes as frequently as every ten charges or so). Also, while the proposed approach appears to use primarily direct casting, some uranium metal machining operations may be required, and, historically, these generate significant wastes containing partially oxidized uranium metal. The PEIS should include these potential impacts that primarily affect only the metal route.

Response 17

The graphite liner wastes from induction furnaces used in casting of uranium metal (mentioned in the comment) are included in the operations waste of the metal manufacturing facility (see page 5-17 of the PEIS). Table H.15 of Appendix H lists the operations waste (LLW) for both the uranium oxide and uranium metal facilities. The difference in the quantities (650 m^3/yr and 126 m^3/yr) is due primarily to the graphite liner wastes mentioned in the comment.

While some machining operations may be required during the uranium metal fabrication process, almost all of this machining will be on uncontaminated stainless steel parts. Very little LLW is expected from the machining of uranium metal.

Comment 18

Doses from DU Disposal: Section 5.6 (pages 5-78 et seq) and Appendix I present the impacts from disposal of the DU, for both the operational phase and the post-closure period. The radiological impacts from the accidents seem unexpectedly high; for example, the analysis shows public doses of up to 1.1 rem and noninvolved worker doses as high as 140 rem, apparently due to earthquake initiated events, without explanation. The routine impacts also seem high for the postclosure phase and appear to follow the radiological order: mine impacts > vault impacts > trench impacts.

Calculations appear to use an infiltration area effect and do not account for chemical form, solubility, and kinetic effects. Table 1.31 contains zero values for the dry site doses for all three disposal approaches, and no collective dose estimates are included. These points are non-obvious and it is recommended that they are explained in more detail.

<u>Response 18</u>

With respect to radiological impacts from accidents associated with disposal options, the earthquake involving release of U_3O_8 was associated with high radiological doses, as noted by the commentor (see Appendix I, Table I.10). The high doses for U_3O_8 are due to the material form and the release height. U_3O_8 is a fibril material which is almost powder-like. This characteristic results in a higher release amount (400 pounds) compared to a similar accident with UO_2 pellets (0.7 pound) (see Appendix I, Table I.9). Additionally, an earthquake is assumed to cause structural failure of the building, during which the uranium oxide containers collapse and release the material at ground level. This is much different than the tornado event assumptions where the wind speeds are larger and there is some upward movement to the released material. The lower wind speed and ground release result in larger releases near the building and the surrounding areas for the earthquake event, and thus result in high worker and public doses. This type of specific accident scenario information is provided in the engineering analysis report (LLNL 1997; the full citation is provided in Appendix I of the PEIS) associated with the PEIS.

The routine impacts for the post-closure phase address the potential impacts from groundwater use. The groundwater could become contaminated as a result of container failures that release U_3O_8 or UO_2 to the environment. Although U_3O_8 and UO_2 are essentially insoluble in water, a conservative estimate of dissolution was obtained by assuming that Schoepite ($UO_3 \cdot H_2O$) would form under the aerobic conditions present in the soil phase. Estimates of groundwater concentrations were then obtained by assuming the leachate concentration in the waste area was equivalent to the solubility of Schoepite. As radionuclides travel downward to the groundwater table, distribution of radionuclides in soil solid and soil liquid phases were assumed in equilibrium. This assumption was acceptable because it would take a very long time (at least several hundred years in the calculation cases) for radionuclides to reach the groundwater table and to reach the maximum concentration level. Potential impacts were calculated with the estimated maximum groundwater concentrations within 1,000 year after failure of the disposal facility.

On the basis of the above assumptions, the relative potential impacts would depend only on the dimensions of the disposal area and the infiltration rate. Factors such as solubility, chemical form, and kinetic effects would be the same for a mine, vault, or shallow earthen structure. Impacts for disposal in a mine would be greater because of the larger disposal area required. As noted in Section I.4.1.1.1, impacts for dry sites would be zero, because it would take more than 1000 years for uranium and its decay products to reach the groundwater table [due to a combination of the depth to the watertable (500 ft — Section 3.4.4.1) and the low rate of infiltration (0.1 in./yr — Section 3.4.4.1)]. Additional details on these calculations can be found in Tomasko (1997; the full citation is provided in Appendix I of the PEIS), as indicated in Section I.4.2.

Collective impacts were not estimated because it would require detailed information on the groundwater flow direction and distribution as well as knowledge of the off-site population that would use the groundwater. Since siting of a disposal facility is not addressed in this PEIS, estimation of collective impacts would involve a large degree of uncertainty, and was therefore not conducted.

The engineering analysis report, Tomasko (1997), and other supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 19

Unspecified Applications: On page S-11 and later in the summary (pages S-42 et seq), DOE identifies the preferred alternative strategy as use of 100% of the DU hexafluoride inventory, as either uranium oxide, uranium metal, or a combination of both, without specifying the use of the material and the potential impacts (positive and negative) from such DU use. The PEIS also does not provide information indicating a market demand capable of consuming 100% of the DU inventory, but the conversion of the DU hexafluoride would occur as ". . . uses for these [uranium oxide and metal] products become available" (page S-43). Without applications for significant quantities of DU oxides and metals, these DU materials may ultimately become a waste material. The discussion does not discuss regulatory and licensing requirements for these DU applications, It is recommended that (1) DOE identifies the likely market consumption of DU oxides and metals over the time frame of the EIS, (2) DOE estimates the impacts from these potential DU uses, (3) DOE considers the potential of the converted DU materials becoming a waste, thus, requiring conversion into forms compatible with disposal, and (4) DOE evaluates the likely regulatory and licensing aspects.

Response 19

The commentor's recommendations are addressed below in the order that they are listed in the comment:

1. The PEIS evaluates two representative use options, use as uranium oxide and use as uranium metal as radiation shielding. As stated in Appendix H of the PEIS, these options were intended to be representative only, and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses is considered beyond the scope of the PEIS. Such issues would be considered and evaluated in more detail in future planning and environmental analyses.

In addition, the PEIS is not intended to provide a detailed analysis of potential market demand. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory. DOE plans to continue its support for the development of government applications for depleted uranium products and, for as long as necessary, to continue the safe management of its depleted UF_6 cylinder inventory.

2. The impacts associated with a specific use will depend on what use or uses are ultimately identified, which is beyond the scope of the PEIS. As mentioned above, the PEIS is not intended to select a specific end-use or preclude other potential uses in the future. Any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained. The impact analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions. As with the use of any radioactive material, careful consideration would be given to whether the benefits of the proposed use outweigh the potential risks.

3. The PEIS acknowledges that at the end of their useful lives products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4, 2.2.5 and 5.9). Potential need for converting metal into an oxide if disposal is required is acknowledged.

4. The purpose of the PEIS is to provide an evaluation and comparison of potential environmental impacts associated with the alternatives considered. Regulatory and licensing aspects are outside the scope of the PEIS, but would be addressed, as appropriate, when specific uses are identified. A listing of environmental, occupational safety, and health permits and compliance requirements is presented in Chapter 6 of the PEIS.

Comment 20

DU as Cask Shielding- DOE appears to be relying upon the potential future use of DU as SNF cask shielding for a large consumption of its DU inventory (see page S-43 and 1-8, and Volume 2 of the EAR, which analyzes a DU cask manufacturing facility as the only use of DU). If this is indeed the case, DOE may wish to describe and discuss it in a little more detail in the PEIS summary and in Section 2.5 (pages 2-54 et seq), and it should be noted that no currently licensed or planned SNF cask uses DU.

Response 20

Appendix H of the PEIS provides information concerning the current and potential uses of depleted uranium. It also provides detailed information on the design and potential future use of depleted uranium as spent nuclear fuel (SNF) cask shielding.

Historically, uranium has been used for shielding applications on a small scale. No existing, licensed, or proposed spent nuclear fuel shielding designs use depleted uranium in quantities exceeding 10 percent of the DOE inventory. The two conceptual shielding designs considered in the PEIS would however consume the entire DOE inventory.

Further information concerning the potential use of depleted uranium in spent nuclear fuel shielding is provided in Section 6.11 (Potential Shielding Applications in Metal & Oxide Forms) of the engineering analysis report (LLNL 1997; the full citation is provided in Appendix H of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 21</u>

Fate of DU Shielding. As currently written, the PEIS does not include a discussion of the eventual fate and potential impacts of the DU SNF cask after its use (e.g., see pages 2-14 and 2-15). Pages 5-55 and 5-65 also mention that DU cask disposition after use is excluded, and page 5-65 notes that disposal would amount to an additional 180,000 cubic meters (6.4 million cubic feet) of waste requiring disposal, with a (calculated) average specific gravity of 2.2. This does not seem inconsequential, particularly if a dedicated disposal facility is required and the impacts are estimated to be similar to disposal (e.g., page 5-83 et seq; exceeding 10 CFR Part 61.41 dose limits). Also, there are statements in the document that question if significant quantities of DU metal are suitable for disposal (e.g., last paragraph on page 2-21). Inclusion of a discussion about the disposition of the DU cask after use, and potential impacts, is recommended.

<u>Response 21</u>

The PEIS acknowledges that at the end of their useful lives, products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4, 2.2.5 and 5.9). At this time, any analysis of disposal after use would be too speculative as it is not known when and at what rate the material would be declared surplus and would be disposed of. Although large quantities of DU metal may not be acceptable for disposal, small quantities of the metal on an annual basis have been disposed of in the past and could again be accepted at some future disposal facilities.

<u>Comment 22</u>

"Uranium Oxides:" The PEIS generally combines all uranium oxide compounds under the title "uranium oxides" for consideration in the alternatives and strategies (see page S-6 et seq). This seems too all inclusive, as uranium oxides have significantly different chemical and physical properties that produce a wide range of ES&H impacts. For example, uranium octaoxide is a high porosity powder, with a low density and a significant respirable fraction. Uranium dioxide powder is also porous, and can spontaneously ignite in air. On the other hand, sintered uranium dioxide has the highest density of the uranium oxides and is essentially pore free. The presence (or absence) of pores also has significant implications for the potential disposal of the material, either as a management option or as an end-use item; a denser, essentially pore free material would appear to be advantageous. Thus, a uranium dioxide material sintered to a lower density (say, 4-5 g/cc) would not be expected to perform as well in a disposal environment as a uranium dioxide sintered to a high density (say, 9-10 g/cc). It is recommended that more qualifiers are given to the term "uranium oxides," perhaps including low and high density as the principal discriminators.

Response 22

The PEIS recognizes the differences noted in the comment among different chemical forms of uranium oxides. In fact, the analyses were done separately for conversion to and storage and disposal of U_3O_8 *and* UO_2*. The results are also reported separately for these two chemical forms (see Section 5 and Appendices D through K). The impacts of long-term storage as oxide and disposal as oxide alternatives are reported in Section 2 and in the Summary as ranges covering both forms of uranium oxide as well as differences in assumptions concerning environmental settings (see section 4.2.3 of the PEIS). The reason for this was to clearly define the differences among the alternatives and at the same time, allow the reader to explore the chemical specific aspects of the management options considered in the PEIS. Although the headings of sections and the names of management options and alternatives refer only to oxides, the results in Section 5 and Appendices are reported as chemical specific.*

Comment 23

Equivalent Bases and Life-Cycle Effects: The text does not seem to incorporate a life-cycle approach to the different management alternatives and compare them on an equivalent basis (see pages S-7 et seq). For example, recycle (if a market exists) and disposal would seem to be the logical endpoints for all of the alternative branches shown in Figure S.2, and may influence the impacts and potential alternative(s) selected. However, disposal is only shown for the disposal as oxide alternative. It would seem that the "manufacture and use" alternatives will ultimately result in impacts from the DU component; for example, the material (perhaps as itself or in a product) could be shipped to a disposal facility. Such potential impacts do not appear to be included in the analysis, and may even preclude some options or require additional conversion and conditioning; for example, without supporting analyses, it is unlikely that significant quantities of DU metal can meet the regulatory requirements of disposal sites. Thus, pursuit of use as a metal option may require another conversion facility (with its impacts) to convert the DU metal into a form compatible with disposal. Other examples of the need for equivalent bases include the oxide conversion routes, due to fundamental differences in the uranium oxide forms. One of the specific oxide conversion routes (gelation) appears to be manufacturing uranium dioxide with properties comparable to high density nuclear fuel which would be anticipated to have improved stability and related properties as compared to the other oxides. The gelation route also appears to include two plants — one for uranium octaoxide production and one for dissolution/uranium dioxide production — which appears inconsistent with literature reports on the process (i.e., only one plant; no production of uranium octaoxide) and the other oxide conversion routes. Long-term storage also appears to lack the realization of ultimate disposal in the future. The PEIS should consider and analyze the alternatives on an equivalent basis with the same/comparable endpoints and include life-cycle effects.

Response 23

The analysis in the PEIS was intended to provide a comparison of reasonably foreseeable environmental impacts for each of the alternatives considered. Consequently, the potential environmental impacts were evaluated for a 40 year assessment period for all alternatives. In addition to this analysis, an evaluation of the long-term impacts from disposal was included in the PEIS because such impacts can be reasonably predicted. A life-cycle analysis for the alternatives other than disposal was not performed at this time because actions to be taken beyond the 40 year period considered in the analysis are considered highly uncertain and speculative. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.

The gelation route in the PEIS includes U_3O_8 production and dissolution, but it is not two plants. The basis for the gelation process in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) is the Oak Ridge Report ORNL/TM-6850, "Chemical Flowsheet Conditions for Preparing Urania Spheres by Internal Gelation" (July 1979). This report provided a complete design to convert UF_6 to U_3O_8, and supplied the process information needed to prepare a material balance and flowsheet to convert U_3O_8 to UO_2 microspheres by gelation. The gelation process in the PEIS has not been optimized, but it is considered to be reasonable and suitable for impact analysis.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 24

Results: Pages S-15 et seq summarize and compare the results of the impacts for the alternative management strategies. Some of these results seem inconsistent and are not intuitively obvious. For example, it is not clear why the use as uranium oxide results in higher impacts than the use as uranium metal (see pages S-20 and S-49) — the opposite would be anticipated. Land use impacts seem uneven; conversion and metal use plants would be anticipated to have larger land use because of facility size and require potentially larger setbacks for potential accident mitigation from uranium releases (see the NRC LES EIS). It is not clear if the disposal analyses include all of the potential long-term impacts and doses from uranium leaching from the disposal area. It is recommended that DOE consider greater consistency in the results and clarify the summary.

Response 24

With respect to differences in impacts from accidents between the use as oxide and use as metal alternatives, many categories of accidents are summarized in Tables S.2 and 2.2 of the PEIS. In general, the impacts of accidents from use as oxide and use as metal are the same (see the Categories Likely Cylinder Accidents, Low Frequency-High Consequence Cylinder Accidents, Low Frequency-High Consequence Accidents at All Facilities-Chemical Accident). The category of accident referred to by the commentor, namely Low Frequency-High Consequence Accidents at All Facilities-Radiological Accident, does have higher consequences for the use as oxide alternatives than the use as metal alternative. This is due to the specific accident scenarios appropriate to the technologies being evaluated; additional information on the accident scenario assumptions for manufacture and use is given in Section H.3.2 of Appendix H, and in the engineering analysis report (LLNL 1997; the full citation is provided in Appendix H of the PEIS). However, in general the results of accident impact analyses for the use as oxide and use as metal alternatives were considered to be approximately the same. (The engineering analysis report is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC [listed in the Notice of Availability], and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.)

The land use requirements for long-term storage and disposal alternatives are greater than those for conversion and use alternatives because of the large land area required to store or dispose of the entire inventory. Conversion facility land areas presented in the PEIS do not include buffer zones. NUREG-1140 p. 30 suggests a 1 mile protective action distance (PAD), which is based on a UF_6 cylinder rupture that releases uranium and HF. The PAD is the recommended distance for which emergency planning would be appropriate to mitigate off-site exposure to accidental releases. A conversion facility is not required to have ownership of the area encompassing the PAD. The PAD for a metal or oxide shielding facility would be much less because UF_6 would not be handled at these facilities. Wherever land use for conversion facilities is discussed in the PEIS, text has been added acknowledging the need for a protective action distance. The engineering analysis report provides more details on land-use assumptions.

The disposal analyses do include long-term impacts and doses from leaching from the disposal area; these impacts are discussed in detail in Section I.4 of Appendix I and presented in Tables S.2 and 2.2 under "Water and Soil." Text has been added to Tables S.2 and 2.2 under "Human Health and Safety-Normal Operations" to indicate long-term post-closure impacts from disposal.

Comment 25

Ranking: The summary of the results (page S-15 et seq) does not include a ranking of alternatives, and implies that all of the alternatives are acceptable. DOE may wish to rank or identify those alternative(s) that appear more favorable than others based upon the analysis. DOE may also want to consider if any of the proposed alternatives are precluded by the analysis; for example, page

5-84 mentions individual (groundwater ingestion) doses of 100 mrem/yr from disposal, thus exceeding 10 CFR Part 61 standards of 25 mrem/yr. Page 5-84 also mentions a scenario for a hypothetical future resident living on the disposal site and receiving radiation doses as high as 10 rem/yr. The PEIS summary also mentions an NOV on storage at the Portsmouth facility, which might imply that a no-action alternative is not a viable option for this site.

<u>Response 25</u>

The purpose of the PEIS is to provide a meaningful evaluation and comparison of the potential environmental impacts of broad alternative management strategies. Thus, the summary and main body of the PEIS provide a discussion and comparison of potential impacts among the alternatives. In general, alternatives cannot be easily or meaningfully "ranked" in an overall sense because potential impacts occur in several different environmental areas, such as impacts to human health and safety, groundwater, air quality, and ecology. No one alternative offers advantages in all environmental areas, making any "ranking" of alternatives very subjective. Consequently, the PEIS discusses and compares the potential impacts of the alternatives in each area separately. The results of the PEIS indicate that all alternatives have generally similar environmental impacts, although differences do exist in the types and magnitude of impacts for some areas assessed, as discussed.

In addition, the PEIS indicates that no alternatives are precluded on purely environmental grounds. Although the results of the disposal alternative indicate that radiation doses to individuals could potentially exceed regulatory limits for disposal in a "wet" environment at some point in the distant future, the analysis also indicates that impacts would remain within regulatory limits for a disposal facility in a "dry" environment. The PEIS also stresses (see Appendix I) that the post-closure disposal analysis is based on generic information and is subject to a great deal of uncertainty. Actual impacts from disposal would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required.

<u>Comment 26</u>

Technology and Equipment Development: The PEIS encompasses numerous technologies that are at different stages of development, in terms of process, understanding, equipment, (potential) impacts, and uncertainties. For example, of the conversion, application, and disposal impacts discussed within the summary, none are practiced on any scale domestically, and only conversion to the octaoxide is practiced on a large scale internationally, producing a low density product. Thus, there is only one direct analogy. DOE should consider including a technology discussion, with status and assessment, perhaps with either a time schedule or probability of success, for some of these technologies. For example, it seems like a significant extension of existing uranium dioxide sintering technology to take pellets from 100 te(U)/yr/line to 7,000 te(U)/yr/line. From the uranium dioxide technology perspective, microspheres (e.g., from gelation) may be the more mature technology because of the (potential) use of tube furnaces and pilot plant tests with equipment processing rates an order of magnitude larger. Similarly, a uranium dioxide/concrete cask approach appears to be a significantly easier technology to understand and scale than casting a 40 te(U) metal shield.

<u>Response 26</u>

Subsection 1.2.6 (Uncertainties) in Section 6.0 of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) discusses the process and equipment uncertainties associated with each option. In general, the conversion to oxide and the batch conversion to metal processes are well known with extensive operating experience. The continuous reduction to metal process requires development and extensive scale up. Oxide shielding manufacture is a simple process but needs to be demonstrated. Metal shield manufacture requires large-scale melting, casting, and machining that needs development.

Conversion of UF_6 *to* U_3O_8*, recovery of 70% HF, oxide compaction, packaging in bins, and storage inside buildings is performed on a large scale (15,000 tonnes per year) by COGEMA in France to stabilize depleted* UF_6*. Recovery and upgrade of the 70% HF to anhydrous HF (AHF) has not been demonstrated. The EAR assumed production of AHF using a process patented by J. Mestepey of Sequoyah Fuels. The AHF process needs verification and demonstration.*

Conversion of UF_6 *to* UO_2 *ceramic pellets is performed in nuclear fuel fabrication plants (500 tonnes per year). The pusher-type furnaces used for fuel pellet sintering would not be suitable for large throughputs. Equipment development is needed for the sintering furnaces. But the throughput needed for pressing and sintering is not unusual for the ceramics industry.*

Production of UO_2 *nuclear fuel microspheres by gelation has been successfully tested in pilot-scale units. For large throughputs, the gelation liquid effluent must be recycled to avoid high reagent costs and waste disposal costs. A recycle process must be developed for gelation to be viable.*

Batch reduction to uranium metal is a mature industrial process used to produce uranium metal for nuclear fuel, penetrators, and armor. Higher production rates can be achieved by adding more batch furnaces. A system to decontaminate the MgF_2 *byproduct was installed at Aerojet (Jonesborough, TN).*

Continuous reduction to metal research was conducted at Oak Ridge Y-12. Extensive development and scale-up would be needed.

Oxide shielding applications (DUCRETE cask) was researched at the INEEL. Development work is continuing at Nuclear Metals Inc. The process is similar to concrete mixing.

Batch melting and casting to produce uranium metal fuel and other products is a standard industrial process. Metal shielding applications (metal cask) will require large-scale melting and casting of uranium metal. The single pour concept to cast the annular shield requires extensive development.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 27

Existing Facilities and Experience: There are obvious analogies with existing, commercial fuel cycle facilities, which process uranium hexafluoride into uranium dioxide (for nuclear fuel) and (to a lesser extent) uranium metal. These facilities are already licensed by the appropriate regulatory agencies. The PEIS does not mention these facilities, either as a source of experience or as a source of processing capacity, particularly during the development of uses for the DU materials and as a means for surge capacity. The PEIS also does not appear to draw upon the operating experience of these facilities, including waste generation and uranium content of byproducts. DOE may wish to include the experience of operating commercial facilities and comment upon their potential use (or non-use) during the development of applications and uses for the DU.

Response 27

The PEIS considered the historic operations of similar existing processes and facilities during the development of process design and estimation of waste generation, atmospheric emissions, etc. for each option. This information is provided in Section 3.0 (Summary of Options Analyzed in Depth) of the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). All new facilities were assumed to be constructed and operated at a generic green field site, as future planning and analysis documentation would determine the exact locations for any new facilities constructed in support of depleted uranium management.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 28

Regulatory Basis for Future Facilities: The PEIS indicates several facilities may be involved for the management alternatives, and may involve DOE, commercial, and/or both types of facilities. DOE should briefly discuss the regulatory basis for these facilities, potential differences (if any), and any impacts, and any effects from facilities transitioning from DOE to the NRC regulatory environment.

Response 28

Major laws, regulations, executive orders, and compliance instruments that would apply to activities of the Depleted Uranium Hexafluoride Management Program under the no action and other alternatives are identified in Section 6 of the PEIS. The PEIS evaluates the environmental impacts of broad programmatic strategies for the long-term management of the depleted UF_6 inventory. It does not propose any site-specific facilities or technologies for conversion, long-term storage, manufacturing, and disposal, nor address whether facilities would be owned or operated by DOE or the commercial sector. Before implementation of the strategy selected in the ROD, site-specific evaluations would be performed and the proposed facilities would have to comply with all applicable regulations and standards.

Comment 29

Economics: The PEIS mentions a separate Cost Analysis Report (CAR) as providing input to the PEIS (e.g., page 1-7). However, program costs do not appear to be included in the analyses. DOE should consider including the costs and other economic impacts in the PEIS, perhaps as part of the summary (e.g., in Table S-2).

Response 29

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives is generally not considered an environmental impact; consequently, cost information is not provided in the PEIS. However, cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

In addition, the cost information is used as input to the socioeconomic analysis presented in both the summary and main body of the PEIS. The PEIS addresses socioeconomic impacts on human communities, including changes in employment, local housing demand, public finances, and population in-migration.

The ultimate decision on a management strategy will be announced in a Record of Decision. The Record of Decision will consider the results of the PEIS, along with other information, including the cost analysis and engineering data, to select a management strategy. The Record of Decision will document the strategy selected and describe how it was selected from among the different alternatives.

Comment 30

DU Quantities: The insert on page S-2 identifies some 46,422 DU cylinders distributed between the three sites. While the total quantity is listed in the main text of the report, it would be helpful to have the approximate masses (as either MTU or $MTUF_6$) for the three sites listed in the summary as well. The insert on page S-2 also notes that an additional 8,000 cylinders have been produced by USEC. It is suggested that this number is also divided between the sites and expressed in mass quantities. It is also recommended that a brief discussion about the USEC DU is included, perhaps as part of the first paragraph on page S-4. While the EIS excludes the USEC DU from its analysis, it also implies that there is a reasonable probability of it becoming DOE's responsibility. Consequently, DOE may want to consider that possibility in its impact analysis.

Response 30

The text of the insert in Section S.1.1 and the text in Chapter 1 of the PEIS have been revised to include the quantity of depleted UF_6 in metric tons.

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became or will become the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citation is provided in Chapter 8 of the PEIS). In order to accommodate these new cylinders, the PEIS has been revised. Rather than increasing the amount of cylinders assumed to be processed annually, the revised PEIS assumes that the work-off period (the period over which the processes assumed in the PEIS, for example, cylinder preparation, transportation, conversion, manufacturing, would take place) has increased by approximately 6 years (i.e., from 20 to 26 years).

Comment 31

Other DU Uses: Page 2-21 mentions non-shield use of DU. No mention is made of quantities or relative percentages of the DU inventory. Also, it is not self-explanatory that DU cask manufacturing and uses bound all of the potential uses; for example, metal uses would appear to require a significant amount of alloying and/or machining, and involve handling and disposal concerns. DOE may wish to include a longer discussion and a better explanation.

Response 31

As described in Section 2.2 and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. If a use strategy is selected in the Record of Decision, specific uses would be considered and evaluated in more detail in future planning and environmental analyses as appropriate. Careful consideration would be given to whether the benefits of any proposed use outweigh the potential risks.

Comment 32

Other Sites: Pages 3-58 et seq present information on the generic sites for wet and dry locations, and mention that the site data for each are derived from actual wet and dry sites. It is suggested that the actual sites which provide the basis for the generic locations are listed.

Response 32

Data taken directly from actual sites (i.e. cities within the U.S.) were the meteorological data used in the impact calculations for disposal options. However, the selection of the meteorological data was performance based and not related to potential locations, other than a dry or wet setting, for a disposal facility. Thus, the identification of these sites in the PEIS has no value. The meteorological data used in the characterization of the "dry" and "wet" settings for the location of a disposal facility were taken from archives of the National Weather Service. Meteorological data from cities that met the dry or wet annual rainfall criteria (approximately 10" and less or 40" and more, respectively) were screened to obtain a set of 5 locations in each case that resulted in the largest range of impacts that is consistent with either a dry or wet setting.

Comment 33

Time frame: Page 4-2 lists a 41 year time period for the EIS (through the year 2039), and indicates activities beyond 2039 would be subject to appropriate NEPA reviews and decisions in the future. This appears to truncate the analyses for some of the alternatives which might influence the selection of the preferred option; for example, impacts from wastes in a disposal cell are unlikely to occur by 2039, major cylinder/container replacements may be required for the storage option in the 10-20 years after 2039, significant applications may not have developed etc. DOE may wish to consider a time period consistent with the logical conclusion of the options or their "life-cycle," which may require a time frame beyond 2039.

Response 33

At the beginning of the PEIS preparation, the 40-year timetable appeared to be the most reasonable, based on consistency among alternatives. It was chosen as a reasonable period over which to estimate and compare the environmental impacts of the alternative management strategies considered in the Draft PEIS (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. For the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. Initial facility operations were based on a 20-year period for processing all of the inventory, which has been extended in the Final PEIS to approximately 26 years to account for processing up to an additional 15,000 cylinders that were previously the responsibility of USEC. Although the 40-yr time frame has been used for the evaluation of operations, potential long-term impacts have been included for both disposal options (Section I.4 of Appendix I) and continued storage options (Appendix D, Table D.1 and throughout). Because of the extensive maintenance assumed for cylinders/containers under *long-term storage options, also assuming that large numbers of containers would have to be replaced in the 10 to 20 years after 2039 was not considered reasonable.*

In response to comments on the Draft PEIS, DOE has determined that, if an alternative requiring conversion is selected, that it is in the best interest of the public and the government to begin conversion as soon as possible. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory.

Comment 34

Failure Rates: Pages 5-3 and 5-19 discuss the estimated cylinder failure rates for the No Action and UF_6 Storage alternative. These appear to use the opposite ends of the failure rate range — No Action uses the lowest failure rate, while Storage uses the highest failure rate-without explanation. Also, the existing cylinders may not have adequate wall thickness under either alternative due to corrosion over the years (see Appendix E), and the DU may have to be transferred to new cylinders within the time frame covered by the EIS. DOE should consider presenting a discussion on these items in the text. Also, on page 5-40, Table 5.4 lists tank rupture accident as "incredible" events. Usually, these are assigned a value corresponding to the "extremely unlikely" frequency bin. A brief discussion is recommended

Response 34

As explained in the Introduction to Section 5.1, two analyses were actually conducted for the No Action alternative; one assuming that the cylinder maintenance and painting program would be effective in controlling further corrosion of the cylinders, and a second analysis which assumed that external corrosion was not halted by improved storage conditions and painting so that cylinder corrosion continued at historical rates. The number of breaches assumed under the action alternatives, including long-term storage as UF_6, fell between the numbers assumed for the two No Action Alternative analyses. This was considered to be a reasonable assumption, because it is less certain that ongoing cylinder yard improvements and cylinder painting would be strictly maintained for the decreasing cylinder inventory under the Action Alternatives. The outcome of the increased number of assumed cylinder breaches for the action alternatives was a slightly higher estimate of impacts on groundwater, air quality, and human health and safety for the action alternatives, although the estimated impacts are still within applicable standards or guidelines. Further details on the assumed cylinder breaches under the action alternatives, and the impact of these assumptions on the analyses, are given in the Introduction to Section D.4 of Appendix D. Text has been added to the Introduction to Section 5.2 (Long-Term Storage as UF_6) to clarify the rationale for breach rate assumptions.

Methods for dealing with cylinders which do not meet DOT transportation requirements (e.g., do not meet minimum wall thickness requirements) are detailed in Appendix E, Cylinder

Preparation. Appendix E evaluates the options of using overpacks or transferring the cylinder contents to new cylinders for up to the entire cylinder inventory.

Table 5.4 of the PEIS indicates the frequency of the HF tank rupture and Ammonia tank rupture accident scenarios to be within the incredible range, i.e., a frequency estimated to occur less than one time in 1 million years of facility operations. This frequency takes into account the initiating frequency of a large seismic or equivalent beyond design basis event (within the extremely unlikely range, i.e., between once in 10,000 years and once in 1 million years of facility operations) and the probability of failure of all active and passive safety features (such as water sprays at the HF storage building, loss of containment features such as building filtration, etc.). The consideration of the frequency of the initiating event with the probability that all mitigation measures would fail simultaneously results in an accident frequency of less than one time in 1 million years of facility operations.

Comment 35

Site Sizes: Page 5-55 identifies land use requirements for the facilities. These seem small, particularly when compared to other proposed facilities performing similar operations (e.g., the LES EIS analyzes a generic conversion facility with a site area of 1,000 acres). The text also does not indicate if any major setbacks, protective action distances (PAD's), or planning zones are likely to be needed around the facility because of the handling of large quantities of DU, the hexafluoride, and/or the metal (including melting operations). DOE should consider a discussion in the text on these subject matters.

Response 35

Conversion facility land areas presented in the PEIS do not included buffer zones. A nominal facility occupies about 30 acres, or 900 × 1500 ft. NUREG-1140 p. 30 suggests a 1 mile protective action distance (PAD), which is based on a UF_6 cylinder rupture that releases uranium and HF. The PAD is the recommended distance for which emergency planning would be appropriate to mitigate off-site exposure to accidental releases. A conversion facility is not required to have ownership of the area encompassing the PAD. The PAD for a metal or oxide shielding facility would be much less because UF_6 would not be handled at these facilities. Wherever land use for conversion facilities is discussed in the PEIS, text has been added acknowledging the need for a protective action distance.

Comment 36

Accident Consequences: Pages 5-55 et seq discuss the use and impacts of uranium dioxide as shielding, and pages 5-66 et seq discuss the use and impacts of uranium metal as shielding. Some of the values imply non-intuitively obvious lower impacts from a metal route as compared to the oxide route; it is recommended that these are discussed and explained in more detail. For example, the text on page 5-71 estimates the highest consequences from an accident with the metal route as 15 mrem (from a fire involving three cylinders, an energetic accident with reactive materials), as compared to 270 mrem (from an earthquake during uranium dioxide storage, a low energy event with non-reactive materials) — there is no explanation for the difference. Also, the supporting information in Appendix H shows similar inconsistencies; the unlikely accidents for the oxide (Table H-5, page H-16) are significantly higher than the corresponding accidents for the metal (page H-17). Page H-17 also contains apparent inconsistencies and incongruences; the mishandling/ dropping of solid DU metal accident releases a greater quantity of uranium than the molten uranium accidents. Upon further review, the source of these apparent anomalies goes back to Section 6.11 of the EAR, where different material at risk and release fractions were used. All of the metal cases examined used the least bounding values, and values inappropriately low for the phenomena being modeled per the DOE accident handbook. These errors should be corrected.

Response 36

The text in Section 5.5.1.2.2 of the PEIS (including page 5-71 of the Draft PEIS) is comparing aggregate results of the highest consequence accidents within 4 frequency categories between the oxide conversion options and the metal conversion options. For the low-probability accidents associated with metal conversion, the highest consequence accident (fire involving three cylinders) still has a relatively low radiation dose of 15 mrem for the maximally-exposed individual (MEI) in the general public, because the accident is associated with a fire, which has a buoyant plume that moves upward and disperses in the atmosphere prior to sinking back to ground level at some distance from the release point. In comparison, the dose of 270 mrem is associated with an earthquake at a U_3O_8 *(not* UO_2*) conversion facility (see Table F.9 for details on each highest consequence accident in each frequency category). Much of the difference in predicted consequences for accidents involving* U_3O_8*,* UO_2*, and uranium metal are associated with the form of the material.* U_3O_8 *is an easily-dispersed powder, whereas only the oxide coating on uranium metal billets can be readily dispersed. Releases from drops of* UO_2 *pellets are somewhat more similar to releases from drops of metal billets. Text has been added to Section 5.5.1.2.2 (page 5-71 of the Draft PEIS) to clarify the reasons that the consequences of some of the accidents associated with the use as metal alternative are lower than those associated with the use as oxide alternative.*

The size of releases from UO_2 *shielding- and metal shielding-manufacturing facility accidents would depend on the exact accident scenarios; in some cases releases from accidents involving* UO_2 *pellets will be smaller than those associated with uranium metal billets. The mishandling/dropping of solid DU metal accident questioned in the comment did have a higher assumed release than the mishandling/dropping of a* UO_2 *drum; this was mainly because the metal billet contained more uranium than the drum, so there was more material at risk (see Section 6.11.7 of the engineering analysis report for further details).*

The DOE accident handbook (DOE-HDBK-3010-94) was used in deriving release fractions for the accidents modeled; in instances where the conditions of the modeled accident supported it, the median values were used instead of the bounding values. See the response to Commentor No. 89, Comment 35 for further details.

Commentor No. 65: Squibb, Katherine S., Ph.D.
University of Maryland

Comment 1

The Department of Energy's (DOE) Draft Programmatic Environmental Impact Statement (D-PEIS) for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DU-HF) is lacking with respect to it's assessment of the long-term impacts of converting and using DU-HF. A review of the summary clearly depicts DOE's strong interest in utilizing this stockpile, but the supporting evidence does not adequately address the legitimate environmental concerns associated with DU use — concerns which are based on a growing body of scientific data. While the summary presents a clear picture of DOE's commitment to provide "support for the development of applications for depleted uranium products," it does not, and with our current knowledge probably cannot, adequately assess the current extent of environmental impacts at the three DU-HF sites. In turn, it cannot assess what impacts to the nearby communities and the local environment will result from future releases of the evaluated alternatives. Without better scientific knowledge of the toxicity of DU, it is impossible to provide even a guess of the potential impacts, which makes the risk projections provided within this summary of little value. As a result, we support the long-term storage of this material, with improved containment and monitoring, until we are better equipped to assess the toxicity and safe uses of the DU stockpile.

Up front, it should be noted that our limited resources only allowed us to review the summary and not the entire PEIS. Thus, we acknowledge that some discussion within the body of the PEIS itself may address a few of the concerns raised in the comments that follow. We believe that it is acceptable for us to comment based solely on the summary, as this is the main document likely to be reviewed by the commenting public. We hope that these comments are still useful for DOE and we request that these comments be considered with the utmost diligence.

Response 1

The commentor's preference for long-term storage of the depleted UF_6 inventory is noted by DOE. Additionally, each of the comments received has been carefully considered by DOE. In order to adequately address some of the comments, the detailed analyses and supporting text provided in the body of the PEIS need to be referenced; the specific sections are cited in the responses to specific comments as appropriate. The current extent of environmental impacts at the three current storage sites was thoroughly addressed in Section 3 of the PEIS, titled "Affected Environment." The impacts from potential future releases of depleted uranium compounds were addressed in Appendix D of the PEIS, titled "Continued Cylinder Storage." A great deal is known about the toxicity of depleted uranium compounds; more detail on the toxicity is given in the responses to Commentor No. 65, Comments 8 and 9. The data used to assess the toxicity of depleted uranium compounds in the PEIS are summarized in Sections C.4.1.2, C.4.2.2, C.5.1.2, and C.5.2.1 of Appendix C.

Comment 2

Current Storage: Significant concerns exist with current storage conditions based on the fact that cylinders now show evidence of corrosion and that at least seven cylinders have developed breaches. While the management plan in place is to "continue safe storage," it seems to be in question whether safe storage is currently taking place. This is supported by community concerns that have been expressed from around the sites, and the Notice of Violation that has been issued by the Ohio Environmental Protection Agency. We assume that the Defense Nuclear Facilities Safety Board has suggested improving both inspection time tables and storage approaches.

Response 2

In May of 1995, the DNFSB issued to DOE a recommendation (Recommendation 95-1) regarding the storage of the depleted UF_6 cylinders. This recommendation was as follows:

1. Start an early program to review the protective coating of cylinders containing the tails from the historical production of enriched uranium.
2. Explore the possibility of additional measures to protect these cylinders from the damaging effects of exposure to the elements, as well as any additional handling that may be called for.
3. Institute a study to determine whether a more suitable chemical form should be selected for long-term storage of the depleted uranium.

In June of 1995, DOE accepted Recommendation 95-1 and emphasized five focus areas for DOE response:
1. Removing cylinders from ground contact and keeping cylinders from further ground contact;
2. Relocating all cylinders into an adequate inspection configuration;
3. Repainting cylinders as needed to avoid excessive corrosion;
4. Updating handling and inspection procedures and site-specific Safety Analysis Reports; and
5. Completing an ongoing study that will include an analysis of alternative chemical forms for the material.

In October of 1995, DOE submitted an Implementation Plan that incorporated completed and near-term actions in accordance with these five focus areas. This plan also committed to managing the cylinders using a systems engineering approach. Through this approach and open dialogue among the DNFSB staff, the following objectives segment the safe storage mission of the program in response to the current condition of the system and the projected life cycle schedule for completing the last phase of the system (Decontamination and Decommissioning):
1. Achieve and maintain acceptable risks
2. Achieve and maintain cylinder integrity
3. Improve conduct of operations
4. Evaluate and monitor containment integrity, and
5. Administer the system

The DNFSB reviews DOE's progress on these items regularly.

Comment 3

While the summary explains that a dense plug is formed by the reaction of moist air with the exposed DU-HF, the summary does not address if any studies have been made to assess the adequacy of such a plug. Certainly, this plug may not be air tight, allowing additional moisture to enter the container thereby acting as a continued source of HF gas. It would seem prudent for DOE to develop a better storage system regardless of the decision to use or store these cylinders. Either way, many of these containers will still house DU-HF for years or decades to come, and will require improved storage capabilities.

Response 3

The statement that a dense plug is formed at the location of the hole in a breached cylinder was not intended to imply that this plug was considered to be a permanent means of patching the cylinder; rather, it was intended to indicate the reason that uranium compounds and HF are not released from breached cylinders at a faster rate. The text in the Section S.1.1 and Section 1.1 has been revised to make this clear.

Since the initial discovery of two breached cylinders at the Portsmouth site in 1990, the cylinders at all three sites have been inspected, 5 additional breached cylinders were identified before 1998, and an extensive cylinder program management plan has been established.

An additional breached cylinder was identified at the K-25 site in 1998; see Appendix B, Section B.2 of the PEIS for further details on this cylinder breach. Breached cylinders are either patched or have the contents transferred to new cylinders to prevent further material loss. The conditions which allowed some breached cylinders to go unidentified for long periods of time have been eliminated. All cylinders are now inspected at least every four years (those with more extensive corrosion or pitting are inspected annually). There is also a radiological program to detect leakage from valves. An intensive effort is ongoing to improve yard storage conditions at all three cylinder storage sites. New storage yards with stabilized concrete bases have been constructed at the Paducah and Portsmouth sites. Cylinders are being relocated to allow space for adequate visual inspections; relocated cylinders are being placed on concrete saddles to keep them out of ground contact. Due to improved storage conditions and frequent inspections, any breached cylinders identified in the future are expected to be recently breached with little material loss (as was the case for the cylinder identified in 1998). The introduction to Appendix D of the PEIS contains additional details about the current cylinder management program.

Comment 4

While the summary lists various technical assessments that have been or are being conducted, none of these studies nor this PEIS really assess the potential environmental impacts from the current production and storage operations or the proposed alternatives. This flaw has been seen in PEISs produced for other purposes by DoD, where the PEIS selects a direction to focus development dollars, but does not consider the specific technologies that may be employed and does not consider the site-specific characteristics. In the end, such factors will strongly influence the extent of contamination and impacts from the general approach (i.e. use as oxide) selected. Once the process reaches the point where these specific factors are assessed, there will be serious pressures to make the approach work given the time and financial investments made. This limits the adequacy of the site specific assessments when they are made. In turn, we strongly suggest that DOE take a serious look at the potential risks from converting DU-HF and its use an oxide or metal before one selects a programmatic alternative. Factors that should be considered in this evaluation are the migrating potential of DU that will be released, the cumulative impacts of such releases in conjunction with preexisting contamination, and the potential impacts on costs of the selected approach when the toxicity of such compounds are elucidated.

Response 4

In the analyses conducted for the PEIS, considerable effort was put into characterizing the potential environmental impacts from the continued storage operations, and from the other components of the alternatives. For example, continued cylinder storage is a component of all the alternatives. Extensive studies on cylinder corrosion rate, as well as historical rates of handling-induced cylinder breaches, were used to estimate the extent of possible material releases from cylinders during the period of cylinder management addressed in the PEIS (that is, through 2039), for both the No Action alternative and the Action alternatives. These estimates were subsequently used to estimate impacts from the released material with respect to air and water quality, worker and general public exposure and risk, and ecological risk. Also, detailed plans for continued cylinder storage activities (such as painting schedules, inspection schedules, cylinder yard reconstruction, and cylinder relocations) were used to estimate potential impacts with respect to worker health and safety, land use, socioeconomics, waste management, and resource requirements. These analyses are site-specific and were conducted separately for each of the three current storage sites. The results are presented in detail in Appendix D of the PEIS, and summarized in Sections 5.1-5.7, and in Section 2.4. The cumulative impacts of continued cylinder storage at the three sites in conjunction with existing operations at those sites are discussed in Section 5.8.

The technologies and options assessed for the other components of the alternatives, such as conversion, long-term storage, manufacture, and disposal, were defined by technical experts on the basis of suggestions from the general public, as summarized in the technology assessment report (see Section 1.4 of the PEIS for further details). Subsequently, an engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) was developed which provided a more detailed, in-depth technical analysis of the representative management options identified in the technology assessment report. The engineering report provides design and operational data for these options, and was used as the basis for characterizing the potential environmental impacts from these management options. For example, the engineering analysis report provided estimates of contaminant levels in stack and water effluents from representative conversion, storage, manufacturing, and disposal facilities. These data were used in the PEIS to estimate impacts to air and water quality and worker and general public health and risk. The engineering analysis report is available for review at the DOE public reading rooms near the three current storage sites and in

Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information (see Section 4.2.3 of the PEIS). The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities is included in the PEIS. Upon implementation of the strategy selected and announced in the Record of Decision for the PEIS, site-specific evaluations will be performed, including the effects of site-specific projects and the range of alternative actions, including a "no action" alternative. NEPA and its implementing regulations do not require site-specific evaluations when specific projects are not being proposed (for further details on the applicability of the analytical approach used in the PEIS, see the response to Commentor No. 15, Comment 1.)

The cost of the various alternative strategies is beyond the scope of the PEIS, but cost estimates are provided in the cost analysis report (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report and other PEIS supporting reports are available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 5

Affected Environment: The summary sorely lacks a description of the environmental sampling that has been conducted at each site. In the case of Paducah, Kentucky, it is mentioned that the effluent discharges are regulated under Kentucky Pollutant Discharge Elimination System, but there is no discussion of whether radiological parameters and/or uranium metal are monitored in this system. While the specifics of such a monitoring program may be beyond the scope of this summary, whether or not environmental sampling from Big Bayou and Little Bayou Creeks has been considered in selecting the proposed alternative is relevant and critical. The extent of contamination in surface water and sediments is a significant issue, since future activity will add to the levels already present even if future emissions do not exceed the governing release limits of the time. There is no discussion of such sampling, and there clearly needs to be in order to determine the current baseline risk level at the site, both for human health and ecological receptors, The potential exposure pathways (see below) and current ambient levels are important for projecting future exposure scenarios.

Response 5

The summary is by necessity a very abbreviated version of the information given in the body of the PEIS; because there are no known environmental or health problems associated with current contaminant levels in sediments or surface water near the Paducah site, it was deemed sufficient to limit the information given in the summary to the statement that the effluent discharges are regulated under the Kentucky Pollutant Discharge Elimination System.

Sections 3.1.5.1 and 3.1.7 give greater detail on the extent of current contamination of surface water and sediments near the Paducah site, and the potential for associated health impacts. In 1993, measured uranium and PCB concentrations in sediments at a downstream monitoring location in Little Bayou Creek were significantly higher than background levels (i.e., 200 mg/kg for uranium and 2 mg/kg for PCBs). However, the results from monitoring at the same location in both 1994 and 1995 showed significantly lower levels (13-22 mg/kg for uranium; <0.1-1.4 mg/kg PCBs). In Section 3.1.7 the potential health impacts of exposure to Little Bayou Creek sediments are evaluated; the results indicate that radiological doses would be well below the maximum radiation dose limit set for the general public, and that adverse health impacts from chemical toxicity would also not be expected.

It should also be noted that at this time the DOE is not entertaining proposals for siting future depleted UF_6 management facilities at the Paducah site or any other site. The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects.

Comment 6

As with the Paducah site, there is no mention of the current extent of contamination in local media at the Portsmouth site in Ohio. Assuming significant contamination is already present as suggested by the groundwater data that are referenced, would it affect the feasibility of the selected alternative if it were deemed necessary to conduct such operations at other sites? This question requires serious consideration, particularly since the conversion technology to be used to produce the oxide or metal is not assessed in the D-PEIS. If contamination is approaching environmental limits, then even the expected discharges may not be acceptable. As with any Brownfields site, the investor (DOE in this case) certainly should want to know whether they will be able to conduct operations at the site or nearby (as suggested on S-14), requiring adequate site characterization. From the description of environmental settings, it is unclear whether the environmental data on the natural environment are limited to climatic conditions or if the site specific environmental data includes current contamination levels.

Response 6

The summary is by necessity a very abbreviated version of the information given in the body of the PEIS. Therefore, the summary affected environment section for Portsmouth only stated briefly *that contamination has been detected in on-site monitoring wells. The details on existing environment, including contamination levels at Portsmouth, are provided in Section 3.2 of the PEIS; information on existing groundwater contamination is provided in Section 3.2.5.2.*

As summarized in Section 3.2.5.2, significant groundwater contamination is present at the Portsmouth site; three areas of contamination have been identified. The groundwater contamination is being addressed through ongoing environmental programs regulated by state and federal entities, and is not associated with releases from the current cylinder storage sites.

The PEIS did evaluate the potential environmental impacts from conversion to either U_3O_8, UO_2, or metal, using representative facility design data and representative site characteristics (see Section 4.2.3 of the PEIS). Based on these representative data, construction and operation of conversion facilities is not expected to cause significant new groundwater contamination (see Section F.3.4.2 of Appendix F).

DOE does not at this time propose to site any of the facilities associated with any of the alternative management strategies. Proposals for selection of technologies and sites for facilities will not be developed until after a strategy is selected as announced in the Record of Decision for this PEIS. The Record of Decision for this PEIS will not by itself support any decision to select technologies, or site, construct, or operate conversion, long-term storage, manufacturing, or disposal facilities. If or when proposals for these future actions are developed after the PEIS ROD, appropriate additional environmental reviews will be conducted. These reviews would be required to address potential cumulative impacts of the proposed alternative together with past, present, and reasonably foreseeable future actions at the specific site for which the new facility is proposed.

Comment 7

Exposure Pathway Assessment: In Table S-2, the chemical exposure of concern for both the non-involved worker and the general public is listed as falling below a hazard index of 1. Did the calculation of such risks include all the pertinent exposure pathways which may apply, including fish/game consumption, drinking water, inhalation, etc? It would be inappropriate to consider just the workplace exposure for the noninvolved worker, if that person lived nearby and fished in the local stream. In predicting future impacts or risks, one must consider the individual's total exposure. This has been a serious flaw within risk assessments at Superfund sites, and improving this approach is not unreasonable to request given that 1) this is a "looking forward" assessment which allows us to be more protective since the contamination has not yet been produced, and 2) we are still unable to adequately assess other parameters, such as synergistic effects, which do reduce the conservativeness of the risk projections being made.

Response 7

Exposure analysis for the various alternatives evaluated in the PEIS was a complex process, and involved considering different exposure pathways for different management options because of the nature of the releases assumed (see Section C.4.1.3 and C.5.1.3 of Appendix C for *details). Calculation of human health risks included all pertinent exposure pathways that may apply. Human exposure via the fish/game consumption pathway was not evaluated in the PEIS because available data indicate that uranium, the primary contaminant of concern, does not biomagnify in the food chain, indicating that significant exposures via consumption of contaminated fish or game are unlikely. In addition, the environmental releases from site-specific operations considered in this PEIS (continued storage and cylinder preparation) at the current storage sites are generally small and consideration of this pathway would not make a noticeable difference in the calculated risks.*

Risks to the maximally exposed individual (MEI) member of the public and among workers were calculated separately because different exposure pathways and durations apply to each individual. If a person lived near the site and worked at the site, that person's exposure and risk could be estimated conservatively by adding the MEI public dose to the MEI worker dose.

Comment 8

Toxicity of Uranium: Based on the limited research that has been completed on the toxicity of uranium metal, it seems quite premature to be selecting an alternative in this PEIS for the next 40 years. In light of the ignorance with which the Department of Defense exposed Gulf War soldiers to DU, DOE should strongly consider whether it wants to make the same short-sighted mistake. We have been intensively studying lead for decades and we are still learning more everyday about its toxicological effects and the low levels at which such effects are exerted. We are still trying to recover from the use of this metal in paint and gasoline, which is a direct result of our inability or disinterest in predicting environmental accumulation and the resulting impacts if the compound turned out to be toxic. As a society, we must not make the same mistake again by blindly pursuing commercial use of the DU-HF stock.

Response 8

Since the start of use of uranium in weapons in the 1940s and 1950s, a large amount of toxicity testing has been conducted with uranium compounds, and knowledge about toxicity has also been gained from the evaluation of occupational exposures that have occurred. It is well established that the main toxic effect of concern for uranium exposures is damage to the kidneys. A discussion of the evaluation of uranium compound toxicity in the PEIS is provided in Section C.5.1.2 of Appendix C. As stated in the text, the U.S. EPA has deemed the data sufficient for the derivation of a chronic oral reference dose, which is defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The uranium oral reference dose of 0.003 mg/kg-d was used for the evaluation of the chemical toxicity of oral exposures in the PEIS. The U.S. EPA has not at this time derived an inhalation reference dose for uranium compounds. When an inhalation reference dose is not available, the oral reference dose is sometimes substituted as the inhalation reference dose. However, in the PEIS, the occupational permissible exposure limit for soluble uranium of 0.05 mg/m^3 was modified to make it protective for sensitive subpopulations — the resulting value was 0.0003 mg/kg-d, which is 10 times lower (or more protective) for evaluating *inhalation exposures than using the oral reference dose would have been. All potential exposures from normal operations evaluated in the PEIS were compared to these benchmark levels. With the exception of possible post-closure exposures due to drinking contaminated groundwater near a disposal facility in a wet environmental setting, all the exposure levels evaluated were much less than the associated reference dose levels. In addition to the evaluation of the chemical toxicity of uranium, the PEIS thoroughly evaluated increased cancer risk associated with the radioactivity of uranium (see Section C.4.2.2 for information on how the increased cancer risks from radiological exposures were evaluated in the PEIS).*

Handling of uranium in the workplace has shown that levels of exposure to uranium compounds that are below the occupational exposure limits do not cause injury to the kidney, or any other observable toxic effect. Although it is possible that some sub-clinical effect does occur in humans at lower exposure levels, such an effect is unlikely to be significant. The issue with the exposures that occurred during the Gulf War seems to be more a lack of knowledge about the extent of exposure than one of data lacking on the toxicity of uranium. The mechanisms of toxicity of lead and uranium are completely different; the toxicity of lead does not bear on the depleted UF_6 PEIS. Data on uranium toxicity are sufficient at this time to evaluate the impacts of potential exposures from the alternative management strategies included in the PEIS.

<u>Comment 9</u>

Given the extensive research currently underway regarding DU, it does not seem appropriate to be completing this PEIS at the present time. Research at the Armed Forces Radiobiology Research Institute suggests that DU may be more mutagenic than lead, and that this metal can reach the brain and fetuses of exposed animals. Additionally, work is currently being conducted on exposed Gulf War veterans at the VA Hospital in Baltimore, Maryland, which may provide valuable information on the distribution of DU within the body and possible impacts on specific organ systems in humans. It would seem logical to learn from our mistakes and select long-term storage until we are better able to assess potential human health impacts from its toxicity as well as its radiological emissions in localized lung tissue.

Until the results of these various investigations are published and reviewed by the scientific community, we cannot know if the projections of adverse effects are accurate. The chemical toxicity of low level DU exposure does not seem to have been adequately considered. The monitoring of effects in soldiers is still in progress, so we question statements describing how "a few workers have been exposed to estimated amounts of uranium approximately three times the guideline levels used for assessing irreversible adverse effects, but none of these workers actually experienced such effects." The effects used to establish the guideline values do not include low level, chronic effects of DU just now being recognized.

<u>Response 9</u>

The commentor's preference for long-term storage is noted by DOE. It should be noted that the data on the toxicity of depleted uranium and its compounds are sufficient for the evaluations *conducted in the PEIS. The reference dose used to evaluate oral exposures incorporates an uncertainty factor of 1,000 (that is, it is 1,000 times lower than the lowest level observed to cause adverse effects in animals). The reference level used to evaluate inhalation exposures is similarly protective (see also the response to Commentor No. 65, Comment 8). Although it is possible that some sub-clinical effect does occur in humans at lower uranium exposure levels, such an effect is unlikely to be significant for the purpose of comparison of alternatives in the PEIS.*

Comment 10

Release and Environmental Fate: Predicting the extent of release and long-term fate of the DU released during its conversion and subsequent use should be meticulously evaluated. On page S-42, the authors state the "potential uses that are capable of consuming a substantial fraction or all of the depleted uranium inventory are not yet fully developed, and it is entirely possible that the 100% use scenario may involve some of the material being converted to an oxide and used, with the remaining portion being converted to uranium metal and used." Without reviewing the specific industrial processes to be implemented in the conversion and use alternative, it is impossible to accurately assess how much DU would be released. This is a serious issue since other industrial sites have been closed down due to the excessive release and migration of DU. This quote also reveals that little is known about what commercial applications will exist for the converted material. Despite these unknowns, the PEIS clearly reflects an entrepreneurial eagerness by DOE to utilize the stock in this fashion. This assessment of the summary is further supported by a statement on the following page in which the authors indicate that "this preferred alternative allows flexibility in responding to changing market conditions and to the continued development of new uses for conversion products." We question whether this is appropriate, as the conversion process may be pushed forward without a clear plan and understanding of its eventual use. This, in turn, will evoke significant pressures to find a use for the oxide or metal and likely reduce the quality of the decision process used to determine acceptable use.

Response 10

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2). However, as a programmatic EIS (PEIS), it evaluates a range of representative technologies for each alternative. Consequently, the impacts of some management activities, such as conversion and manufacture and use, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities are included in the PEIS. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site- and technology-specific evaluations will be performed for the necessary components of the selected strategy. All facilities eventually constructed and operated for the management of the *depleted UF_6 inventory will be licensed by the appropriate agencies and will comply with applicable regulations.*

Proceeding with conversion of the depleted UF_6 inventory might provide other advantages besides the ability to use the material. Conversion to oxide would produce a more stable form for storage of the inventory, and conversion would also address the problem of the slow but continuing deterioration of the cylinders.

Comment 11

Ecological Impacts: The consideration of ecological impacts in the summary is limited. A full paragraph discusses the loss of habitat resulting from carrying out particular alternatives. However, no concrete information is provided regarding the chemical effects of elevated uranium concentrations on ecological receptors, although the potential for such effects is mentioned. While few data exist for specific ecological impacts, a study by Los Alamos on the long-term fate of DU found significant concentrations in various aquatic plant species as well as aquatic organisms such as tadpoles. Detritus, benthic diatoms and phytoplankton were predicted to contain the highest levels of DU in the environment, and the impacts of the conversion and use alternative on these important parameters of the food chain should be considered. In short, an adequate assessment of the data that do exist should be made, and critical data gaps should be pinpointed before we decide whether use of this stockpile is prudent.

Response 11

Although the summary section (S.4.7) does not include details of ecological impacts of uranium or other contaminants in environmental media, such potential impacts were considered in the analyses of the alternatives. A more detailed discussion of the methodology used in the analyses is provided in Section 4.3.7 and additional details have been added to Appendix C, Section C.3. A bioconcentration factor was included in the calculations of radiological dose estimates to aquatic vertebrates and invertebrates (e. g., fish and shellfish) exposed to undiluted effluent. The results indicated dose levels considerably below harmful levels. Dilution of the effluent in a receiving stream by a factor of 8,000 to 111,000, would reduce uranium concentrations further.

Comment 12

Given the lack of discussion regarding the environmental assessments at the sites, a few observations are worth noting. For instance, radioactivity and/or uranium appear to have been found in groundwater at the Portsmouth and K-25 sites, but not at the Paducah site. As for the estimated maximum radiation dose to a member of the general public, the value presented for the Paducah site is 3 mrem, but only 0.07 mrem/yr for the Portsmouth site. This is quite a difference for two similar sites which raises questions with regard to the adequacy of the assessment, or indicates that significant differences exist between the site estimations and/or quality of operations. Such observations within the summary suggest that DOE should take a closer look at the quality of the assessments conducted or the manner in which the assessment was presented in the summary. Even if it is the latter, this is a significant issue as many from the public who provide comments will only have the time or ability to review the summary. It is important for DOE to be as clear as possible and provide the public with the opportunity to constructively assess the PEIS without undue burden.

<u>Response 12</u>

The radiation doses for the maximally exposed individual (MEI) of the general public presented in Sections S.3.1, S.3.2, and S.3.3 and in Tables 3.3, 3.8, and 3.13 were estimated using (1) environmental monitoring data for each of the sites obtained from annual environmental reports and (2) assumptions on potential exposure pathways for the off-site public. Difference in the monitoring data, assumed exposure pathways, and the distance of emission sources to the nearest fence line would result in differences in the estimated MEI doses. For example, the MEI dose for the Paducah site includes a contribution from ingestion of wildlife. However, this pathway was not considered for the Portsmouth site because the monitoring data showed the contamination in wildlife was below the detection limits. It should be noted that neither a dose of 3 mrem/yr nor one of 0.07 mrem/yr would be considered a high dose; the radiation dose limit set for individuals in the general public is 100 mrem/yr, and the average dose from background radiation is about 360 mrem/yr. The summary sections do give the annual dose limits and background radiation rates to aid in interpretation of the doses attributable to the site operations. For practical reasons, further discussion of radiation exposures and effects was provided in the main body of the text. Please see Section 4.3.1.1.1 of the PEIS for a general discussion of radiation exposures and effects, and Sections 3.1.7.1, 3.2.7.1, and 3.3.7.1 for more details on the estimated annual doses to the MEI.

With respect to the summary of groundwater contamination given in the summary, a statement has been added to Section S.3.1 to clarify that a radioactive isotope (technetium-99) has been detected in groundwater at the Paducah site.

Commentor No. 66: Graber, Jean and Dick
See responses to Commentor No. 51

Commentor No. 67: Connolly, Dennis
See responses to Commentor No. 51

Commentor No. 68: Short, Duane
See responses to Commentor No. 51

Commentor No. 69: Ganyard, Patricia E.
See responses to Commentor No. 51

Commentor No. 70: Knopp, Lisa
See responses to Commentor No. 51

Commentor No. 71: Elliott, Guy R. B.
Santa Fe Alloys & Los Alamos Consultants

Comment 1

Comments on the Draft PEIS-This Writer's Opinions: Overall High Quality. Your wise recommendation, as based on the material presented, is to convert the DUF_6 to metal or oxide and to use the DU for shielding of HLW. It was very much needed. That way the DU will be recoverable later while being protected for now.

To emphasize the need to save DU, the reader should recognize that many of the better uranium sources worldwide have already been destroyed to collect and use U-235, but leaving >99.5% of the natural U unused. Saving the remainder (mostly U-238) as breeder fuel would allow its use substantially fully as reactor fuel (as Pu-239) by future generations. Yet some people seriously recommend burying this fuel as waste! Wasting the DU would be an environmental atrocity. (See "Management and Disposition of Excess Weapons Plutonium," National Academy Press, 1994, p.28, and DOE/NN-0007, Jan. 1997, p.39, showing that Pu fuel is now used in other countries.)

Response 1

The commentor's preference for the conversion and use of depleted uranium to conserve it as a valuable resource is noted.

Comment 2

Avoidance of Too Strict Definitions of Processes to Be Used: From a chemical and engineering view, this PEIS should be looked on as sketches of what sort of approach could be used to convert the DUF_6, to metal or oxide. As such these sketches allow realistic broad decisions such as saving the DU for future use, as just discussed.

However, the current overregulation from within and outside of DOE tends to turn such sketches into rigid models before experiment has shown what would be realistic. Consider, for example, the recent failures of numerous radwaste vitrification units-inadequately tested proposals rigidly specified what turned out to inadequate approaches.

Here the decision to use continuous metallothermic reductions for production of uranium for cask shielding is sound. However, as discussed below, the writer recommends versions of reductions that differ significantly from the version described, e.g., UCRL-AR-124080 Vols 1 and 2, Rev 2, Sec 6, 10-4.

However, there is need to examine cost features.

Response 2

The PEIS considers two representative options for converting UF_6 to uranium metal, a batch metallothermic reduction process and a continuous metallothermic reduction process. The two representative metal conversion options were used to provide a basis for comparing the environmental impacts of broad, programmatic alternatives. The PEIS does not recommend a specific conversion process nor will the PEIS be used to select a specific conversion process. The Record of Decision for the PEIS will consider the results of the PEIS along with other information, such as cost and engineering data, to select a management strategy.

Comment 3

Locations and Types of Facilities Needed for UF_6 Conversions to Metal or Alloy: Alternative to Hydrogen reduction of UF_6 to UF_4: Historically this reduction has been used before the continuous metallothermic reductions of UF_4 by Mg in molten salt as done by Sante Fe Alloys (SFA) prior to its work for AVLIS with ORNL (Lockheed Martin) and LLNL.

However, an alternative continuous metallothermic approach (description proprietary by LAC) by SFA would convert UF_6 to UF_4 in molten salt prior to continuous Mg reductions to metal or alloy.

Incorporating this LAC metallothermic reduction to UF_4 as a precursor to the U-metal production would (a) avoid the cost of separate hydrogen reduction facility and operations, (b) integrate well with the molten salt operations of the Mg-UF_4 reductions, and © avoid some shipping and handling.

Response 3

Comment noted.

Comment 4

Alternative to Aqueous Separation of MgF_2 By-product from NaCl Molten Salt Additive: Because of experimental flaws in ORNL pilot tests, which seemed to invalidate containers used by SFA for continuous metallothermic reductions, the separation of MgF_2 by-product continuously from molten salt was abandoned in the system of the PEIS-instead batch aqueous separations were incorporated into the DOE plans.

However, SFA is eager to correct the ORNL flaws and demonstrate that continuous circulation of molten salt carrier with removal of solid, clean MgF_2 by-product can be maintained.

Response 4

Comment noted.

Comment 5

Alternative to Formation of U-3%Fe Alloy in UF_4-Mg Reductions: As described, the continuous metallothermic reductions lead to U-Fe alloy, which has the advantage of a lower melting point than pure U. However, the U-Fe alloy is brittle in castings and unwanted in breeding. Therefore, the production and casting of pure U should be evaluated also.

Response 5

Comment noted. Production and casting of pure U are evaluated in the engineering analysis report (Sections 6.9 and 6.10) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) and in the PEIS (Appendix F, Section F.3). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 6

Location of U-Metal Production Facilities: To avoid the expenses and hassles of shipping radioactive materials by people's houses, it seems best to move the DUF_6 cylinders on-site at Paducah, ORNL, and Portsmouth to already HEPA-filtered buildings. Then, movable, also HEPA-filtered, UF_6-UF_4 units for continuous metallothermic reductions can be operated to produce U castings already suitable for use in casks. Then, with one radioactive shipment, the unshielded casks and the shielding castings could be assembled at the HLW site.

It seems reasonable, and in accord with many environmentalists' wishes, that the casks could be stored long-term in underground mausoleums, where they were available for remote monitoring and eventually for HLW recycle and DU reactor use.

Response 6

Because DOE is not proposing or selecting sites for conducting management activities at this time, it was assumed for the PEIS analysis that conversion and manufacturing facilities would be located at separate, independent sites, requiring transportation of materials between them. If conversion were required by the alternative ultimately selected by DOE, locating a conversion facility at one or more of the existing storage sites or using mobile treatment facilities could indeed reduce the transportation and cylinder preparation requirements. However, the location, number, and type(s) of conversion facilities that may be required is beyond the scope of the PEIS and will be addressed in future planning and environmental analyses. Following use, products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste.

Comment 7

Reduction of Costs for Operations and Maintenance on the Manufacture of Metallic Shielding: With some $800 million as the cost of Operations and Maintenance (Cost Analysis, UCRL-AR-127650, May 1997, p.57) for manufacturing metallic shielding, it becomes very important to move the material rapidly through the processing, e.g.,in ten years.

If an SFA continuous metallothermic reduction unit produced 1 cu ft of DU/hr full time for a year, the unit would produce 8760 cu ft of U. With 620,000 cu ft of U in cylinders, it would take 70.8 unit years to dispose of the DUF_6. With those assumptions, 10 SFA units could dispose of the DUF_6 within ten years.

Response 7

Comment noted.

Commentor No. 72: Patton, Paul E. / Voinovich, George V. / Sundquist, Don
Governors of Kentucky, Ohio and Tennessee

Comment 1

More than forty years ago the U.S. Department of Energy began the uranium enrichment initiative that created a common link between Ohio, Kentucky, and Tennessee. This commonality includes the U.S. Department of Energy's legacy of waste, a significant portion of which is made up of depleted uranium hexafluoride. Today, our three states are working together in order to recommend the selection of an appropriate and lawful alternative for the long-term management and use of depleted uranium hexafluoride. We believe that such an alternative must minimize impacts on human health and the environment, as well as benefit the overall mission of our states and the U.S. Department of Energy ("DOE").

Response 1

The DOE is committed to working with the States of Ohio, Kentucky, and Tennessee to ensure that the management of depleted UF_6 is conducted in a manner protective of human health and the environment and consistent with the mission of both the State and Federal governments.

Comment 2

DOE should consider the immediate conversion of all depleted uranium hexafluoride (DUF_6) to the less hazardous uranium oxide (U_3O_8) and provide above ground storage of the U_3O_8. We do not believe that waiting for possible market demands for the DUF_6 is justification for delaying this project. It is incumbent upon DOE to immediately begin seeking funds from Congress for this conversion. We urge DOE to complete conversion by the year 2018 or earlier and reduce the mortgage of maintaining the cylinders.

Response 2

The commentor's preference for immediate conversion to U_3O_8 followed by above-ground storage is noted.

The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products. (See Section 2.5.1 of the PEIS.)

DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Comment 3

A long-term strategy for DUF_6 must include DOE's entire cylinder inventory, including heel and small cylinders. The 10,000+ cylinders of DUF_6 generated by the United States Enrichment Corporation (USEC), which will revert to DOE ownership upon privatization of USEC, must also be considered in any plans.

Response 3

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became or will become the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citation is provided in Chapter 8 of the PEIS). In addition, the management of heel and small cylinders has been clarified in the Final PEIS. (See Sections 1.5.2 and F.3 of the PEIS).

Comment 4

An estimated $480 million has been accrued by USEC since 1993 in order to offset the cost of the future conversion of DUF_6 generated by USEC. DOE should work with Congress now to ensure this fund is not diverted into the federal treasury for an unrelated use. In addition, DOE might consider partnering with the future owner of USEC in a long-term strategy for managing and converting DUF_6, in order to avoid redundancy of efforts. Any partnering effort, however, must not slow progress toward conversion.

Response 4

Legislation ensuring that amounts accrued by USEC for the disposition of depleted UF_6 are used for that purpose has been passed by Congress and signed by the President. Any future partnering with USEC regarding the management of depleted UF_6 would be described in appropriate documents that could include contracts, memoranda of agreement, or legislation.

<u>Comment 5</u>

Natural phenomena events or accidents may not have been adequately considered in the PEIS. DOE must identify the "worse-case" cylinder conditions and explicitly use this information in the hazard modeling descriptions.

<u>Response 5</u>

Natural phenomena events such as earthquakes or tornadoes were considered in the impact analysis for all options and alternatives in the PEIS. The condition of the cylinders was considered in the hazard modeling through the analysis of accident events in which corroded cylinders would be breached during handling (see Section D.2.2 of Appendix D).

The PEIS Appendices D through J list the accidents analyzed and provide the results of analyses. The results are summarized in Sections 5 and 2, and in the Summary. The accidents selected in the PEIS for representing the impacts of accidents were those that had the highest consequences of all accidents considered in each frequency range. Further details are provided in the safety analysis reports prepared by DOE for the three current storage sites (LMES 1997a-c), and in the engineering analysis report (LLNL 1997). See the reference list for Appendix C for the full citations for these references.

<u>Comment 6</u>

In order for states to effectively evaluate the potential impacts of the preferred alternative, DOE must provide information on the location of the site where conversion would occur and how wastes generated from this process will be managed. In order to avoid the undue risk of transporting deteriorating cylinders, we recommend that DOE evaluate the feasibility of on-site conversion plants.

<u>Response 6</u>

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2 of the PEIS). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. (NEPA and its implementing regulations do not require site-specific evaluations when specific projects are not being proposed.) Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities, including impacts from wastes which would be generated, is included in the PEIS. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, additional NEPA reviews for any site-specific proposals would be prepared identifying the environmental impacts of site-specific projects and a range of alternative actions, including a "no action" alternative.

The commentor's preference for on-site conversion is noted by DOE. If conversion is part of the management strategy selected, a range of possible conversion sites, including the current storage sites, would be considered and evaluated in detail in future planning and environmental analyses.

Comment 7

DOE must ensure that funding for safe storage and maintenance of DUF_6 cylinders and storage yards is at an adequate level to protect human health and the environment.

Response 7

Issues of DOE program funding are beyond the scope of the PEIS. Budget submissions are consistent with implementing required safety practices to protect workers, the public, and the environment.

Commentor No. 73: Hartzog, Georgeann
See responses to Commentor No. 51

Commentor No. 74: Stanhnke, Linda
See responses to Commentor No. 51

Commentor No. 75: Daniell, Robert H.
Kentucky Department for Environmental Protection

Comment 1

DOE's Preferred Alternative: DOE's preferred alternative, as repeatedly mentioned in PEIS is to use the entire inventory of DUF_6 as metal or oxide. However, no evidence has been documented in the PEIS, which suggests that the market demand exists or will be found for all or even a significant part of DUF_6 inventory in the near future. Moreover, two independent studies ("Integrity of Uranium Hexafluoride Cylinders" DNFSB TECH-4, May 5, 1995, and "Affordable Cleanup?.- Opportunities for Cost Reduction in the Decontaminating and Decommissioning of the Nation's Uranium Enrichment Facilities," Board on Energy and Environmental Systems, Commission on Engineering and Technical Systems, National Research Council of the National Academy of sciences, February 9, 1996) also report that the market demand doesn't currently exist for the DUF_6 or its conversion products, nor is the demand anticipated in the near future. In light of the present uncertainties in the market demand, the Division therefore recommends that the DOE should consider converting the entire inventory immediately to the more stable form U_3O_8. The long-term storage of this material is much safer than the current storage of DUF_6, and it can also be retrieved if future demand is obtained.

<u>*Response 1*</u>

The commentor's preference for conversion of depleted UF_6 to depleted uranium oxide for storage is noted.

The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products. (See Section 2.5.1 of the PEIS)

<u>Comment 2</u>

Time Frame: The PEIS doesn't justify the 40-year time frame considered. Justification is warranted for the same. The PEIS recommends storing the cylinders until 2010, after which 20 years would be required to convert the entire inventory of DUF_6 using DOE's preferred alternative. During these years, there is continued storage of DUF_6 required, which will also necessitate the continued monitoring activities. The Division therefore recommends that the process of conversion should be expedited in order to minimize the risk to the human health and the environment from continued storage of deteriorating cylinders. This would also help in cutting down the cost on the annual maintenance and surveillance activities.

<u>*Response 2*</u>

The timetable presented in the PEIS was developed to provide a basis for the calculation of potential impacts (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. The PEIS does not recommend storing the cylinders until 2010, rather, for the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable. In response to comments received, DOE has revised its preferred alternative. As indicated in the response to comment 1 above, it now includes prompt conversion of DOE's depleted UF_6 inventory into uranium oxide and HF or CaF_2.

<u>Comment 3</u>

Management of USEC cylinders: The PEIS doesn't take into account the cylinders (~8000) produced by United States Enrichment Corporation (USEC) since its privatization. The ownership of these cylinders has yet to be determined. It is the Division's understanding that under the current agreement between DOE and USEC, the USEC will be able to return to DOE, any waste not easily disposed of commercially. In this scenario, if these cylinders are considered waste, there is a possibility that they could be returned to the DOE. This represents a significant increase in the inventory. Hence the Division recommends that a contingency plan should be incorporated in the PEIS to address the USEC cylinders.

<u>Response 3</u>

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became or will become the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS). (See Sections 1, 2, 6, and the Summary of the PEIS.)

<u>Comment 4</u>

Conversion Facilities/Site Selection: It is the Division's understanding that the DOE has not yet come to the conclusion of final selection of the site, as is evident from the PEIS. The PEIS describes the impact on the environment, considering various generic settings. However, the Division believes that site specific impact is also necessary after final selection of the site. For example, it is clear from the PEIS that the DOE has not given enough attention to the earthquake prone regions, and the seismic activities at the sites proposed for storage of the waste. The Division believes that it is critical and the site-specific information should be included in the PEIS. If PGDP is selected as one of the conversion facilities for example, then new facts gathered about this should be considered. The summary of some recently gathered seismic data at Paducah site is given in the specific comments.

<u>Response 4</u>

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities are included in the PEIS. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site-specific evaluations will be conducted. Site selection activities would *evaluate site characteristics, such as potential response to seismic events, potential for flooding, and site geology to ensure that suitable locations were chosen. Following site selection, any new facilities would be designed and built to meet engineering and construction standards and requirements appropriate for the selected location and the mission of the facility.*

Comment 5

Generation of Secondary Waste: Preliminary calculations performed by Division indicate that if DOE's preferred alternative were used, large amounts of secondary waste could be generated. More specifically, around 70% of the product stream will consist of Uranium (in the metal or oxide form) and 30% will be in the form of other products (anhydrous HF, CaF_2, or MgF_2). The Division believes that the potential exist that all the handling, transportation, and disposal for uranium left at the end of the treatment process will meet Low-Level Waste (LLW) requirements. Moreover, unless the specific technology is available to totally remove all the radioactive contamination from these secondary products (e.g. HF, CaF_2, MgF_2, etc.), all the disposal, handling, and treatment activities for this waste must follow the (LLW) management guidelines. Please provide a description of all potential anticipated wastes that may be derived from the preferred alternative.

Response 5

The waste management analyses in the PEIS assumed that if HF could not be sold for reuse, it would be converted to CaF_2, which would either be disposed as LLW or as nonhazardous solid waste. Similarly, it was assumed that MgF_2 produced in the conversion to metal process would either be disposed as LLW or as nonhazardous solid waste. The impacts of these waste management assumptions with respect to the Preferred Alternative are summarized in Tables S.3 and 2.4 under "Waste Management." Please see Sections 5.4.7, 5.5.7, 5.7.8, and 6.3.7.7 of the PEIS for more detailed discussion of potential waste management impacts under the preferred alternative.

Comment 6

One of the chemicals of potential concern (COPC) identified in the conversion (to oxide or metal) is ammonia. Provide a brief discussion regarding the generation of ammonia.

Response 6

Approximately 662,000 to 2,900,000 lb per year would be required as a process chemical for conversion of UF_6 to either uranium oxide or metal. The ammonia is assumed to be commercially available and to be transported to the conversion site in 11,000-gallon rail cars. The ammonia is used in the conversion process to generate hydrogen (and nitrogen). A description of the use of ammonia in the conversion processes is given in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), which is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 7

DOE has proposed a 40-year time frame for the proposed alternatives. Please provide a detailed justification for the proposed 40-year time frame.

Response 7

At the beginning of the PEIS preparation, the 40-year timetable appeared to be the most reasonable, based on consistency among alternatives. It was chosen as a reasonable period over which to estimate and compare the environmental impacts of the alternative management strategies considered in the PEIS (see Section 2.1). The schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives. For the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. Initial facility operations were based on a 20-year period for processing all of the inventory, which was extended in the Final PEIS to approximately 26 years to account for processing up to an additional 15,000 cylinders that were previously the responsibility of USEC. These estimates were meant to provide a consistent analytical timeframe for the evaluation of all of the PEIS alternatives and do not represent a definitive schedule.

In response to comments on the Draft PEIS, DOE has determined that, if an alternative requiring conversion is selected, that it is in the best interests of the public and the government to begin conversion to oxide as soon as possible (see Section 2.5.1 of the PEIS). The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory.

Comment 8

Consideration of "no-action"alternative should include at a minimum, implementation of Recommendation 95-1 of the Defense Nuclear Facilities Safety Board.

Response 8

Implementation of Recommendation 95-1 of the Defense Nuclear Facilities Safety Board regarding the storage of depleted UF_6 in cylinders is included in the analysis of the no action alternative as presented in Appendix D of the PEIS. In its acceptance of Recommendation 95-1, DOE committed to a systems engineering approach to UF_6 cylinder management that includes visual inspections, ultrasonic testing of cylinder wall thickness, radiological surveys, cylinder coating maintenance, and cylinder yard maintenance. This approach has been implemented through a 3-Site Management Project to ensure technical consistency and equivalent safety at the three current storage sites.

Comment 9

It is clear from the PEIS that DOE has not given enough attention to the earthquake prone regions, and seismic activities at the sites proposed for storage of the waste. The Division believes it is critical that site specific information is included within the PEIS.

The following is a summary of new information discovered at the PGDP: Dr. Ronald Street of the University of Kentucky, Department of Geological Sciences commenced an investigation of earthquake related features in the vicinity of the PGDP ("Acquisition of Shear Wave Seismic Reflection and Refraction Data in the Area of the Northwestward Trending Contaminant Plume at the PGDP"). The purpose of this investigation is to map geologic contacts between the Mississippian limestone, the McNairy Formation, the lower Continental Deposits, and the upper Continental Deposits. It has been proposed that faulting has created horst and graben features in these units and that these features may affect groundwater flowpaths in the area on the Northwest and Northeast plumes. A pilot study conducted by Dr. Street located a small graben structure north of the PGDP. As part of the current project, Dr. Street has collected 17.3 km of six and twelve fold reflection and refraction data using a 24 bit floating point seismograph unit. Work on this project started in May of 1997 and a final report is due to AIP in May of 1998.

Preliminary interpretations of the data collected in this study were presented to the AIP in February 1998. These interpretations, which are subject to change, indicate that the PGDP is underlain by a series of northeast trending fault zones exhibiting substantial vertical offset on the surface of the Mississippian Limestone as well as the upper surface of the McNairy formation.

In other work conducted by Dr. John Nelson of the Illinois Geological Survey northeast trending faulting was found in sediments north of the PGDP in Southern Illinois. Dr. Nelson identified faulting in road cuts and railroad cuts. He also identified a graben in the surface of the McNairy formation with a vertical offset of 200+ feet.

Dr. Tom Hildenbrand (USGS, Menlo Park) compiled magnetic, seismic moment, and gravity maps for the Paducah region. An anomalous feature appeared approximately 5 miles northwest of the PGDP on all three maps, gravity high, a magnetic high, and a cluster of small earthquakes. This feature has been interpreted as a mafic intrusion located near the community of Needmore. Earthquakes in the vicinity of this possible intrusion are thought to be the result of the regional compressive stress field being deflected around the structure.

This evaluation indicates that the probability of significant seismic activities within this region is high and that further consideration is needed within the PEIS.

Response 9

The PEIS addresses the potential for seismic activity at each of the three storage sites in Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1. Earthquake initiated accidents are considered at the three *sites for the continued cylinder storage and cylinder preparation activities, the only activities that were analyzed on a site-specific basis in the PEIS. The analysis of accident scenarios for continued* *cylinder storage and cylinder preparation (Sections D.2.2 and E.3.2 of the PEIS) was based on the range of potential accident scenarios considered in the safety analysis reports recently prepared for each of the three storage sites (LMES 1997a-c). The SARs do recognize and discuss the potential for multiple cylinder failures in association with an earthquake. See the reference list for Appendix C for the full citations for the SARs.*

The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes. Each of the three SARs has several page presentations of seismic data and discussion of the earthquake hazard for the associated site. This material can be found in Section 1.5 of each SAR. For the Paducah site earthquake hazards associated with the New Madrid fault are discussed in detail.

The accidents considered in the PEIS for continued cylinder storage and cylinder preparation were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include earthquake scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point.

The recent report by Dr. Ronald Street of the University of Kentucky, Department of Geological Science (as cited in the comment), was not yet available as of the preparation of Volume 3 of this document (November 1998). Work conducted by the USGS was utilized in preparing the SARs. DOE will review and evaluate new data that become available (e.g., the report by Dr. Ronald Street). Based on the results of the review, DOE will take appropriate action, which may include updating the SARs and instituting new safety features, to maintain the safety basis of its cylinder management program.

Comment 10

The PEIS should describe clearly the criteria for choosing the sites for treatment/disposal. The Division believes that such information is crucial. It is the Division's understanding that several options will be available for the conversion process of UF_6 to either oxide or metal and production of anhydrous HF. Because there are varying chemical products and potential waste products generated with different conversion methods; DOE must provide a general description of waste products and waste which are anticipated to be generated. If a method has been selected, please state the method.

Response 10

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2). However, as a *programmatic EIS (PEIS), it does not propose specific sites or specific technologies. Instead, the impacts of the management activities were estimated using representative facility designs and environmental settings. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site-specific evaluations will be conducted. Site selection activities would evaluate site characteristics, such as potential response to seismic events, potential for flooding, and site geology to ensure that suitable locations were chosen. Following site selection, any new facilities would be designed and built to meet engineering and construction standards and requirements appropriate for the selected location and the mission of the facility. The approach of preparing a broad, strategic evaluation of programmatic alternatives, followed by detailed site-specific analyses, is supported by case law. Please see the response to Commentor 75, Comment 4 for further details on requirements for preparing programmatic EISs.*

The PEIS evaluated 2 representative options for conversion to U_3O_8, 2 representative options for conversion to metal, and 3 representative options for conversion to UO_2. The engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) provides the rationale for the selection of the representative technologies. The EAR is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

The options selected for analysis were based on industrial experience with the technology and proven feasibility of implementation. Experimental technologies were not evaluated at this stage of the management strategy selection process. If conversion were to be required under the management strategy selected, the specific technology used may differ from those evaluated in the PEIS. For each of the representative conversion technologies evaluated, a summary of expected wastes generated was given in Section F. 3.7 of the PEIS.

Comment 11

Additionally, DOE must address the management and disposal of miscellaneous wastes that will be generated during the conversion process. This would include management and disposal of potentially large volumes of low-level wastes from the neutralization of HF; also various filters and filtered materials.

Response 11

The PEIS evaluated 2 representative options for conversion to U_3O_8, 2 representative options for conversion to metal, and 3 representative options for conversion to UO_2. For each of the representative conversion technologies evaluated, a summary of expected wastes generated was given in Section F.3.7 of the PEIS. This summary includes low-level wastes which would be generated if an option involving neutralization of HF were chosen. Filters and filtered materials are also included in the estimated waste amounts; specific assumptions about these types of wastes are given in the engineering analysis report (EAR) (LLNL 1997; the full citation is provided in Appendix F of the PEIS). The potential impacts from management and disposal of these wastes are *also discussed in Section F.3.7, as well as in Sections S.4.8, 2.4.8, 5.3.7, 5.5.7, 5.7.8, 6.3.3.7, 6.3.5.7, and 6.3.7.7 of the PEIS.*

The EAR is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 12

Finally, discussion is needed for the management of "cylinder heels" from the bottom of the DUF_6 cylinder. This material contains a variety of radionuclides (i.e. daughter products and other contaminants) that are not suitable for conversion into uranium oxides or uranium metal.

Response 12

For alternatives that include conversion of the UF_6 to oxide or metal, removal of the cylinder contents would be required. After the bulk removal of depleted UF_6 from a cylinder, some depleted UF_6 (i.e., less than 50 lb) that contains a small amount of uranium decay products remains in the cylinder; this material is called the cylinder "heel." For conversion options, it was assumed in the PEIS that a cylinder treatment facility would be co-located with the conversion facility (see Appendix F). Prior to treatment at the cylinder treatment facility the cylinders containing heels would be stored for 3 months, during which time most of the activity from the short-lived daughter products of uranium-238 would decay away. The cylinders could then be handled safely. At the treatment facility the cylinders would be washed with an aqueous solution to remove the heels. The UF_6 from the heel would be converted to U_3O_8 which would be sent for either disposal or storage. Wastewater from the process would be treated to meet the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and discharged to nearby surface waters, or to an appropriate wastewater sewer, depending on the location of the treatment facility. More detailed information on the potential impacts from management of the cylinder heels in a cylinder treatment facility is provided in Sections F.3.1.1.4, F.3.1.2, F.3.2, F.3.3, F.3.4.1.4, F.3.4.2.4, F.3.4.3.4, F.3.5.4, F.3.6, F.3.7.4, F.3.8, and F.3.9.4.

A small number of cylinders (less than 500) each containing less than 50 lb of depleted UF_6 are also currently in storage at the sites. These cylinders have been in storage for more than 3 months and thus do not present a hazard due to the radiological activity of U-238 daughter products. The PEIS has been expanded to include the treatment of these heels cylinders. (See Sections 1.5.2 and 4.2.1 of the PEIS.)

Comment 13

While evaluating the alternative "conversion of UF_6 to oxide or metal form," different steps have been delineated as is the case with the other alternatives. In this particular case, the facilities for conversion process, storage of converted uranium form, and the manufacturing of the casks (which is the end use for this alternative, and this is DOE's preferred alternative) are all planned to be located at separate locations. There will be transportation required between these locations. The

PEIS should address the impacts of the transportation, including the potential impacts on the environment, human health. However, the transportation impacts could be minimized if DOE would integrate the conversion and manufacturing plants in one complex. This would reduce the amount of land required thereby decreasing possible habitat loss. It is not clear whether DOE has considered this alternative. If not, we recommend that this option be considered.

Response 13

The purpose of the PEIS is to provide an analysis of broad, programmatic alternatives, and not to select sites at this time. Consequently, for the PEIS analysis, facilities for conversion, storage, and manufacturing were assumed to be located at separate sites, requiring transportation of materials between them. The impacts of transportation are addressed in the PEIS for distances ranging from 155 to 3,100 miles (250 — 5,000 km), with detailed information provided in Appendix J and the supporting report by Biwer et al. (1997) entitled "Transportation Impact Analyses in Support of the Depleted Uranium Hexafluoride Programmatic Environmental Impact Statement." Transportation impacts could be minimized by collocating facilities at one site; however, the location, number, and type(s) of facilities that may be required is beyond the scope of the PEIS and will be addressed in future planning and environmental analyses after an overall management strategy is selected in the ROD.

The Biwer et al. report and other PEIS supporting reports are available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 14

A correction is needed on page 3-7, Section 3.1.4. 1; the reference to the earthquake magnitude of 7.3 should have been referenced as the "Nuttly Scale" and not as the "Richter Scale." Although, the Nuttly Scale does converts to 8.0 on the Seismic Moment scale sometime referred to as the Richter scale.

Response 14

The discussion on earthquakes has been completely revised to be consistent with information presented in the Safety Analysis Reports (SAR) for the three sites under the continued-storage alternative. For Paducah, the earthquake is now referenced as magnitude 7.3.

Comment 15

Section 3.1 Paducah Site; U.S. EPA has authorized the Commonwealth of Kentucky for the Resource Conservation and Recovery Act (RCRA) Program. Therefore, when references are made to the U.S. EPA RCRA program, the Kentucky Hazardous Waste should also be referenced.

<u>Response 15</u>

The text of Section 3.1 has been revised to indicate that the Commonwealth of Kentucky, Division of Waste Management administers the RCRA program for the Paducah site.

<u>Comment 16</u>

Pages 2-60 and 2-61; 2-64 and 2-65; 2-68 and 2-69; 3-2 and 3-4; Figure 3.1 of Volume I of the Draft DUF_6 PEIS are missing. A comprehensive review could not be performed due to the lack of these pages. Provide the missing pages.

<u>Response 16</u>

DOE regrets the printing error which caused several pages to be missing from some copies of the Draft PEIS. The missing pages have been sent separately to parties who have informed DOE of their absence.

<u>Comment 17</u>

Page 5-108, Section 5.8.2.1 Paducah Site; the last paragraph states that 11 pollutants have been detected in the groundwater effecting quality. This statement is incorrect. Numerous pollutants have been detected at the PGDP. In fact, one of the most predominant contaminants at the site is omitted, Technetium 99. Other radionuclides and organic contaminants have been detected in groundwater throughout the PGDP.

<u>Response 17</u>

The pollutants specified in Section 5.8.2.1 were those that had exceeded standards or guidelines, as reported in the Annual Site Environmental Report for 1993 (MMES 1994b; the full citation is provided in Chapter 8 of the PEIS). Technetium-99 was not mentioned because it had not exceeded the derived concentration guideline of 4,000 pCi/L (see Section 3.1.5.2 of the PEIS). However, the commentor is correct that pollutants in addition to the 11 compounds stated in Section 5.8.2.1 have been detected in groundwater at the PGDP. The text in Section 5.8.2.1 has been modified to include discussion of groundwater contamination with technetium-99 and other pollutants.

Commentor No. 76: Schregardus, Donald R.
State of Ohio Environmental Protection Agency

<u>Comment 1</u>

There is no evidence to suggest that market demand exists or will be found for all or even a large part of DOE's DUF_6 inventory in the near term or the foreseeable future. Therefore, conversion should begin as soon as possible and be completed by 2018 or earlier. DOE should begin now to seek funds from Congress for conversion, and should consider the immediate conversion of all the DUF_6 to U_3O_8, and long-term above-ground storage of this material. According to the Draft PEIS, the preferred alternative for long-term use of DUF_6 is conversion of 100% of stockpiled DUF_6

to oxide (i.e., U_3O_8 and/or UO_2) and depleted uranium metals. Conversion would not begin until 2010, and would occur over a twenty year period on the basis of market demand. However, in the Draft PEIS, DOE states that "the actual percentage of depleted UF_6 inventory for which uses will be identified within the time frame assessed in the PEIS (i.e., up to the year 2040) will be determined as uses develop and conversion begins." In other words, this market demand is uncertain.

The National Research Council of the National Academy of Sciences (NSF) conducted a review in 1996 of possible uses for depleted uranium in shielding applications, as a fluorinating agent, and for re-enrichment by Atomic Vapor Laser Isotope Separation (AVLIS)("Affordable Cleanup?: Opportunities for Cost Reduction in the Decontaminating and Decommissioning of the Nation's Uranium Enrichment Facilities," Board on Energy and Environmental Systems, Commission on Engineering and Technical Systems, National Research Council of the National Academy of Sciences, February 9, 1996.). According to the NSF, market demand does not currently exist for DUF_6 or its conversion products, nor is demand anticipated in the near future. This is corroborated by the DNFSB who stated in a 1995 report ("Integrity of Uranium Hexafluoride Cylinders," Defense Nuclear Facility Safety Board Technical Report, May 5, 1995) that according to DOE, only a "small fraction" of depleted uranium has a use in the "foreseeable future."

We recognize that market demand is, at best, uncertain. DUF_6 can be stored more safely in a converted state. Therefore, rather than wait for market demand to drive conversion, DOE should begin now to seek funds from Congress for conversion, and should consider the immediate conversion of all the DUF_6 to U_3O_8, and long-term above-ground storage of this material, which can be retrieved if demand is established. If a market exists for a small percentage of DUF_6, only those cylinders in the best condition should remain unconverted for use by the market.

<u>*Response 1*</u>

The commentor's preference for conversion of depleted UF_6 to depleted uranium oxide as soon as possible followed by storage of the oxide is noted.

The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products. (See Section 2.5.1 of the PEIS).

Issues of DOE program funding are beyond the scope of the PEIS. Budget submissions are consistent with implementing required safety practices to protect workers, the public, and the environment.

<u>Comment 2</u>

The Draft PEIS provides no assurance that DOE will fund and implement an adequate long-term program of inspecting and coating cylinders throughout the life of the DUF_6 cylinders, prior to conversion. Safe cylinder management requires an adequate inspection program combined with an aggressive cylinder coating program. Several times throughout the PEIS, it is indicated that funding for a cylinder coating program is "uncertain." However, DOE states in the PEIS that coating is expected to be successful and therefore, minimal releases of DUF_6 from cylinders to air and groundwater are expected. It is unclear how DOE can assume coating will be successful if funding is uncertain and the success rate of coating cylinders is unknown. Even if funded, there is no assurance that coating will be adequately applied and renewed frequently enough to prevent or slow corrosion. DOE must comply with all DNFSB recommendations for management of cylinders and yards, and with the DUF_6 management plan contained in Ohio orders.

<u>Response 2</u>

Although it is expected that the cylinder coating program will be effective in prohibiting further corrosion of the cylinders, DOE acknowledges in the PEIS uncertainties related to the coating effectiveness. In response to these uncertainties, the environmental impacts in the PEIS were evaluated for two cases, one in which the coating is assumed to be effective in preventing continued corrosion, and one in which coating is assumed to be ineffective (see Appendix D). The results of both cases are discussed in Chapter 5 and in detail in Appendix D. DOE is committed to continuing for as long as necessary the safe management of its depleted UF_6 cylinder inventory and to complying with the depleted UF_6 management plan contained in the Ohio orders. DOE has accepted and implemented the DNFSB recommendations for safe storage of depleted UF_6.

<u>Comment 3</u>

DOE should ensure that the PEIS addresses the management of DUF_6 in compliance with RCRA and state hazardous waste law. The February 28,1998 Director's Findings and Orders reiterated Ohio EPA's view that DUF_6 is a mixed waste regulated under RCRA and state hazardous waste law. These Findings and Orders provide an exemption from state hazardous waste requirements for a 10 year period to allow DOE to identify and implement an appropriate and lawful strategy for use, reuse, or conversion of this material. The Findings and Orders require compliance with a safe management plan for the DUF_6 during the 10-year period. Ohio has also reserved legal rights to reassert state hazardous waste requirements. Thus, it is imperative that the PEIS address the management of DUF_6 as a mixed waste under RCRA and state hazardous waste law.

<u>Response 3</u>

As stated by the Commentor, the February 28, 1998 Director's Findings and Orders provides an exemption from state hazardous waste requirements (including management of the depleted UF_6 as a mixed waste under RCRA and state hazardous waste law) for a 10 year period to allow DOE to identify and implement an appropriate and lawful strategy for use, reuse, or conversion. Although the Director's Finding and Orders state that the Ohio EPA has determined that the depleted UF_6 is a "waste" as defined by ORC Section 3734.01 and OAC rules 3745-50-10 *and 3745-51-03, it is also stated that DOE disagrees with Ohio EPA's determination, notwithstanding DOE's agreement to the Orders. In all management strategies evaluated in the PEIS, DOE takes the position that depleted uranium, whether as UF_6, oxide, or metal, would be managed as source material as defined by the Atomic Energy Act of 1954 as amended. Source material is exempt from regulation under the Resource Conservation and Recovery Act (RCRA) and authorized state hazardous waste programs.*

In accordance with the Director's Finding and Orders, the current depleted UF_6 management practices at the Portsmouth facility are consistent with the safe management plan described in the Orders. Additionally, the PEIS assesses the potential environmental impacts of alternative plans for the long-term management of the depleted UF_6. Following the PEIS, the selection of a plan will partially satisfy the requirements of the Director's Findings and Orders — that the DOE reconsider its original plan to begin conversion in 2020, and that DOE make a good-faith effort to identify uses for the material.

<u>Comment 4</u>

A variety of independent and DOE estimates regarding breached cylinders are available but not considered in the Draft PEIS. The Draft PEIS estimates that 59 breaches and releases from cylinders could occur over the next forty years, assuming control of external corrosion by painting cylinders. Assuming no control of corrosion, the Draft PEIS estimates that 731 breaches and releases could occur. However, according to the Defense Nuclear Facility Safety Board (DNFSB) (Recommendation 95-1 to the Secretary of Energy pursuant to 42 USC 2286a(5) Atomic Energy Act of 1954, as amended) it has been stated by DOE and the former MMES that 200 cylinders are expected to breach if no corrosion control is undertaken, and more than 1000 cylinders have the potential to breach in storage within 22 years (by the year 2020).

<u>Response 4</u>

As correctly stated by the commentor and explained in the Introduction to Appendix D, two analyses were conducted for continued cylinder storage under the No Action alternative. The first analysis took credit for the improved cylinder management program, and specifically assumed that the painting program would eliminate breaches caused by corrosion. Under these assumptions, the assumed breaches would be the result of mechanical damage occurring during handling. The number of breaches assumed to occur from handling damage through 2039 were 36 for the Paducah site, 16 for the Portsmouth site, and 7 for the K-25 site (as stated in the text). For assessment purposes it was assumed that cylinders damaged during handling would be restacked without knowledge of the damage so that the breach and subsequent material loss would proceed slowly over a period of 4 years. In practice, these conditions are highly unlikely because any abnormal occurrences during handling are recorded and the involved cylinders carefully monitored thereafter. However, the breaches and material loss were assumed in order to assess potential impacts of releases of depleted UF_6 to soil, surface water, air and groundwater (and associated human health and ecological impacts).

Another reasonably foreseeable scenario for cylinder breaches would be the possibility that the painting program would not be effective in controlling further corrosion, or that the required painting schedule could not be maintained. In order to address this possible (but less likely) scenario, a second assessment based on the assumption that external corrosion was not halted by improved storage conditions and painting was also conducted. Based on these assumptions, the total numbers of breaches estimated through 2039 were 444 for the Paducah site, 74 for the Portsmouth site, and 213 for the K-25 site. The impacts based on these assumptions are presented in Section D.3 of Appendix D as a supplemental analysis.

The numbers stated in DNFSB Recommendation 95-1 were based on early estimates and did not account for improved cylinder storage yard conditions that have been implemented under the cylinder project management plan (LMES 1997d — see Introduction to Appendix D for details on this plan). The estimates used in the PEIS were based on ongoing corrosion studies as summarized in Appendix B. Project personnel continue to develop more information regarding the physical condition of cylinders and the corrosion rate of the steel. As cylinder monitoring continues and new corrosion data become available, DOE will use these data to guide the cylinder management program and continue the safe management of the inventory.

Comment 5

DOE's estimate of three to four cylinder spill accidents from breaches due to corrosion appears unrealistically low. The Draft PEIS estimates that as a result of all activities associated with the preferred alternative, three to four spill accidents will occur by 2038 as a result of cylinders that will breach due to corrosion. However, DOE records show that from 1990 to 1992, seven cylinders stored at the DOE three gaseous diffusion plants have breached due to corrosion. In light of DOE's own predictions mentioned in comment #2 above, as well as the current age of the cylinders, unknown cylinder corrosion rates, and the uncertainty of a long-term, ongoing cylinder coating program, a more realistic estimate of cylinder spill accidents due to corrosion must be made.

Response 5

The seven breached cylinders were identified in the period between 1990 and 1992 due to a newly-implemented intensive cylinder inspection program. Of the seven breaches, only two were the result of external corrosion. The remaining five breaches were the result of poor handling causing damage to the cylinder wall. The identification of a breached cylinder does not necessarily lead to a spill accident. When a breached cylinder is identified, stringent handling procedures are followed to patch the cylinder and remove the contents if necessary. These procedures greatly minimize further material loss from the breached cylinder. One additional breached cylinder was identified in 1998; see Appendix B, Section B.2 of the PEIS for further details on this cylinder breach.

The cylinder spill accidents referenced by the commentor were modeled in the PEIS to evaluate the possibility that a cylinder weakened by external corrosion would develop a hole during handling. The low frequency of such an occurrence was estimated on the basis of actual experience *in the cylinder yards. Over 30,000 cylinder relocations have been conducted at the three storage sites since 1992 without causing damage to a cylinder sufficient to cause a breach. Additionally, the UF_6 cylinder project management plan (LMES 1997i; the full citation is provided in Chapter 8 of the PEIS) has been developed to eliminate substandard cylinder storage conditions and to eliminate the effects of corrosion through a recoating program. Under this management plan, annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of heavy pitting or corrosion. All other cylinders must be inspected once every four years. This inspection schedule is based upon detailed knowledge of the chemistry of UF_6 and the rate of reaction if the cylinder wall should be compromised through external wall thinning from corrosion or handling damage. Any cylinders suspected of being in weakened condition due to extensive corrosion or other reasons would require special handling precautions, thus minimizing the chances of cylinder spill accidents. Because of the ongoing extensive cylinder management project, the assumed low frequency of 3 to 4 cylinder spill accidents was considered justified.*

Comment 6

If cylinder breaching rates have been underestimated, all other calculations made in the Draft PEIS that were based on this breach rate, such as the impact of a release of DUF_6 to soil, groundwater, human health, etc., have also been underestimated. These estimates should be revised accordingly.

Response 6

As explained in the Introduction to Appendix D, two analyses were conducted for continued cylinder storage under the No Action alternative. The first analysis took credit for the improved cylinder management program, and specifically assumed that the painting program would eliminate breaches caused by corrosion. Under these assumptions, the assumed breaches would be the result of mechanical damage occurring during handling. The number of breaches assumed to occur from handling damage through 2039 were 36 for the Paducah site, 16 for the Portsmouth site, and 7 for the K-25 site (as stated in the text). As explained in the response to Commentor 76, Comment 5 above, these breaches are different from the 3 to 4 corroded cylinder spills assessed for Accident Conditions in Section D.2.2 and summarized in Tables S.2 and 2.2; for assessment purposes it was assumed that cylinders damaged during handling would be restacked without knowledge of the damage so that the breach and subsequent material loss would proceed slowly over a period of 4 years. In practice, these conditions are highly unlikely because any abnormal occurrences during handling are recorded and the involved cylinders carefully monitored thereafter. However, the breaches and material loss were assumed in order to assess potential impacts of releases of depleted UF_6 to soil, surface water, air and groundwater (and associated human health and ecological impacts).

Another reasonably foreseeable scenario for cylinder breaches would be the possibility that the painting program would not be effective in controlling further corrosion, or that the required painting schedule could not be maintained. In order to address this possible (but less likely) *scenario, a second assessment based on the assumption that external corrosion was not halted by improved storage conditions and painting was also conducted. Based on these assumptions, the total numbers of breaches estimated through 2039 were 444 for the Paducah site, 74 for the Portsmouth site, and 213 for the K-25 site. The impacts based on these assumptions are presented in Section D.3 of Appendix D as a supplemental analysis.*

Comment 7

Conversion of DUF_6 to U_3O_8 should be expedited in order to minimize the risk to human health and the environment from continued storage of deteriorating cylinders. In order to implement the preferred alternative in the Draft PEIS, DOE recommends storing cylinders until 2010. Then, a period of twenty years, at a cost of $200 million per year, would be required to convert the entire DUF_6 inventory to either depleted metals or oxide at one conversion plant, the site of which has not yet been determined. During conversion, aqueous HF would be generated and marketed. According to the National Research Council, a twenty year conversion rate and was chosen to reduce the cost of plant investment (spread the cost out over twenty years) and to render the HF production rate less disruptive to the market. The rate at which HF would be generated over twenty years is equal to approximately 2% of the estimated annual market in North America. It is recommended that conversion be completed by 2018 or earlier. Expediting conversion will minimize the risk of continued storage and defray the annual cost for cylinder maintenance and surveillance, which is estimated by DOE at $12 to 15 million.

Response 7

The commentor's recommendation for completing conversion by 2018 is noted. The timetable presented in the PEIS was developed to provide a basis for the calculation of potential environmental impacts (see Section 2.1 of the PEIS). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. The PEIS does not recommend storing the cylinders until 2010, rather, for the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. Facility operations were based on a 20-year period for processing all of the inventory for all alternatives, independent of whether or not HF is produced and marketed. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable. In response to comments received, DOE has revised its preferred alternative. As indicated in the response to comment one above, it now includes prompt conversion of DOE's depleted UF_6 inventory into uranium oxide and HF or CaF_2.

<u>Comment 8</u>

Rather than construct a conversion plant at a single location and transport all cylinders to the conversion site, DOE should evaluate the feasibility of on-site conversion of DUF_6 to U_3O_8. According to DOE, 50% to 95% of the DUF_6 cylinders have corroded to the point that they are not capable of being handled and transported without undue risk. The Draft PEIS states that cylinders would be over packed or their contents transferred into new containers prior to transporting them to an undetermined conversion plant. If cylinders can be converted onsite without transporting them, this will minimize the number of times they are handled, therefore, limiting the risks associated with transferring cylinder contents and transporting them to conversion sites. In addition, the time required for over packing, transferring contents, and transporting cylinders could be saved. The use of a mobile treatment unit that could be transported to each GDP site should be considered. In the alternative, DOE could construct a plant onsite at each GDP (if seismic conditions allow), within an existing, unused gaseous diffusion building.

<u>Response 8</u>

The State of Ohio's preference for on-site conversion is noted. In the PEIS analysis, to provide a conservative estimate of potential environmental impacts, it was assumed that conversion facilities would be located at separate sites, requiring transportation between them. If conversion were required by the alternative ultimately selected by DOE, locating a conversion facility at one or more of the existing storage sites or using mobile treatment facilities would indeed reduce the transportation and cylinder preparation requirements. However, the location and number of conversion facilities is beyond the scope of the PEIS and will be addressed in future planning and environmental analyses.

<u>Comment 9</u>

Seismic and flooding concerns were not adequately discussed in the Draft PEIS. For example, Paducah, Kentucky is located approximately 60 miles from the New Madrid fault. Earthquakes of a magnitude of 8.4 to 8.8 on the Richter scale have been measured in the region. These have the potential to damage stored cylinders. The majority of cylinders are stored at Paducah. Seismic issues for Ohio, Kentucky and Tennessee must be adequately considered in the PEIS, especially in light of continued storage of cylinders until at least 2010, and conversion at an unknown site.

<u>Response 9</u>

The safety of current storage of depleted UF_6 cylinders was addressed in the safety analysis reports (SARs) recently prepared for each of the three storage sites (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes and floods. The accidents considered in the PEIS for continued cylinder storage (Appendix D) were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake *scenarios, which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.*

Comment 10

DOE should evaluate a long-term strategy for DUF_6 that would include DOE's entire cylinder inventory including heel and small cylinders as well as the current inventory of 10,000+ cylinders of DUF_6 generated by USEC since it's 1993 inception. When privatization occurs, these USEC-generated cylinders will become the responsibility of DOE. Pursuant to the federal privatization legislation, funds have been accrued for each kilogram of DUF_6 generated by USEC in order to pay for future treatment of tails. Currently, this fund may now hold as much as $480 million. When USEC is privatized, this fund will be turned over to the federal treasury. DOE should take steps to secure these funds to offset the cost of conversion of the DUF_6 to be acquired from USEC, as well its existing inventory of DUF_6.

Response 10

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became or will become the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS). In addition, the PEIS has been expanded to include the treatment of several hundred cylinders containing depleted UF_6 heels that are stored at the three current storage sites. (See Sections 1.5.2 and 4.2.1 of the PEIS.)

Issues related to DOE program funding, including any funds obtained from USEC, are beyond the scope of the PEIS. Budget submissions are consistent with implementing required safety practices to protect workers, the public, and the environment. However, a bill (S.2316) was recently passed by Congress and signed by the President (Public Law 105-204) directing DOE to submit to Congress a plan to ensure that amounts accrued by USEC for the disposition of depleted UF_6 will be used to treat and recycle depleted UF_6.

Commentor No. 77: Watkin, Mary Ellen / Monteith, Jerry
See responses to Commentor No. 51

Commentor No. 78: Belletire, Kathy
See responses to Commentor No. 51

Commentor No. 79: Coots, Lou
See responses to Commentor No. 51

Commentor No. 80: Colley, Vina
Portsmouth-Piketon Residents for Environmental Safety and Security

Comment 1

We are here today to speak about one of the biggest problems facing the public from the DOE/DOD programs: the uranium hexafluoride tails (UF6) DU cylinders. A hazardous materials specialist, David Kozlowski was quoted as saying "Uranium hexafluoride is highly corrosive," its effect to those hydrochloric acid. Sites such as Piketon, he said, are regarded as potential "general emergency" sites by the DOE, meaning if there were gas formation, it could require evacuation of nearby areas. While in DC last year with the national groups we were told by another top person for the DOE that painting these cylinders was like putting lipstick on a corpse. Slightly contaminated DU cylinders become a problem equal to high level radioactive waste as they age because of the decay daughter product to radium.

Response 1

It is true that uranium hexafluoride reacts with water to form toxic chemicals. However, as explained in Appendix A, Section A.2.1 of the PEIS, it is inert to clean aluminum, steel and some other materials. Therefore, as long as it is inside the cylinders, which are made of steel, isolated from moist air, it does not react. The Portsmouth site, as other DOE sites, does have an Emergency Plan (see the response to comment No. 4 from this same commentor below). DOE recognizes that painting the cylinders is not a permanent solution. The paint wears out over time. As long as the cylinders are kept in storage, DOE plans to repaint them every 10 years. It is true that after millions of years the radioactivity in depleted uranium would become comparable to the radioactivity in what is high-level waste today. That is because all that would remain in those materials (aside from the stable radioisotopes that don't decay) would be the long-lived radionuclides such as uranium-238 and their decay products such as radium-226. The risks from such materials would be comparable to risks from natural uranium ores in the crust of the earth where uranium has been in existence throughout the earth's history.

Comment 2

I would like to remind you of the 1978 spill here at the plant when over 21 thousand LBS left this site by air, ground and water many workers where affected.

Response 2

On March 7, 1978, there was an incident that resulted in a liquid uranium hexafluoride release at the Portsmouth Gaseous Diffusion Plant. At approximately 4:36 p.m., in the X-745B cylinder storage lot, a 14-ton cylinder, 5/16" wall thickness, containing liquid natural uranium hexafluoride, was dropped 8-10 inches and ruptured. The result was the release of 21,125 pounds of feed material in less than five minutes. Emergency notifications and responses were rapid and there were no injuries to personnel and all exposure to radioactive materials were within allowable limits of the plant. The time of the release, having occurred after shift change, reduced the number of persons on site. Additionally, the wind direction from the northeast to southwest caused the path *of the UO_2F_2-HF cloud to be in a direction which affected the least number of facilities with the distance of travel to the site boundary. Precipitation in the form of snow, coupled with cold temperatures, minimized the off-site impact. There was a reported fish kill as a result of runoff from the incident area caused by treating the runoff with lime and causing a pH change in the water. This lime treatment aided in the prevention of off-site uranium contamination. An investigation of the incident determined that failure of the cylinder handling equipment used to transport the cylinder occurred. As a result, modifications were made to improve this equipment as well as eliminating the transport of uranium hexafluoride in the liquid state.*

Comment 3

In September of 1996 another airborne plume went off site in between the lithium storage building and the national guards building. This airborne plume headed toward Wakefield. I have been told that workers were paid over time and to stay inside, I also called a reporter when this was happening, he called the plant and they lied about the release and two days later put there own story in the paper.

Response 3

On September 19, 1996, during routine movement of empty UF_6 cylinders, the operator of a cylinder handler inadvertently backed into one of the empty UF_6 cylinders that contained approximately 15 pounds of depleted uranium hexafluoride. This action resulted in the rear tire of the cylinder handler striking and severing a pipe nipple in the valve port of the cylinder, which resulted in a release of uranium hexafluoride. Two employees were in the immediate area at the time of the incident and both were evacuated. One employee contacted the Plant Shift Superintendent via hand-held radio and requested emergency assistance. An emergency 911 call was also made. A small, low-lying plume, which is the result of the chemical reaction of UF_6 and air, was evident at the base of the cylinder. This plume dissipated rather rapidly and there was no off-site impact. The area was isolated and the leak was stopped utilizing a standard plug. Health Physics surveys were conducted and the radiological contamination was verified to be contained within a four-foot square area beneath the valve end of the cylinder. An "all clear" for the area outside this boundary was given approximately 1-1/2 hours later. A DOE news release was issued within two hours of the incident to five area newspapers and four local radio stations. Environmental Compliance personnel determined that there was no CERCLA Reportable Quantity exceeded and no Emergency Planning and Community Right to Know Act (EPCRA) reportable quantity exceeded.

Comment 4

I would like someone to tell me why we have alarms and run through drills and when there is an actual potential dangerous releases there is no sound of alarms to warn the citizens of the surrounding communities. Residents didn't know about the situation so therefore didn't know to stay inside.

Response 4

The Portsmouth Site has an Emergency Plan in effect and conducts periodic emergency drills and exercises to prepare for any emergency situation. There are two levels of emergencies at the Site: (1) Alert — An Alert is declared if emergency hazards could affect plant personnel, but not the general public outside the plant boundaries. Local government officials are advised so that their resources and emergency responders are ready to assist on-site if needed. (2) Site Area Emergency — A Site Area Emergency is declared if the hazards could affect the general public within a two-mile radius of the plant boundaries. This is the most serious emergency situation and means that a significant release of hazardous materials may occur. All individuals within this notification area would be notified immediately by audible voice alert from the plant. Additionally, messages can be directed immediately to local radio and television stations which provide protective actions that are recommended. These recommendations could be to evacuate or to shelter in place. Local government officials are also notified immediately so that their resources, which may include deputies and officers as well as volunteer fire personnel, may quickly focus on protecting the general public. Experts from the Site, Federal Agencies, and State and Local Officials coordinate emergency actions. Warning sirens are in place to sound for public alert should a Site Area Emergency be declared. There have been no such emergencies requiring warning sirens since the warning system was placed in operation in 1988. Periodically, the sirens are sounded for routine testing or during drills.

Comment 5

Charles Bradley you didn't seem to believe me about the airborne plume from the DU cylinder could form, you thought it would suck back inside the cylinder like the video that was shown here. That video is misleading in ways.

Response 5

The video referred to was shown at the public hearings. In part it illustrated how, when the workers opened the valve on a depleted UF_6 cylinder, air was drawn into the cylinder rapidly due to the less-than-atmospheric pressure inside the cylinder, making an audible sound. After a short while, a cloud of mist containing HF gas started to come out of the cylinder slowly. However, in the PEIS a wide spectrum of cylinder accidents was analyzed, including small breaches similar to the opening of the valve as illustrated in the video, and large catastrophic breaches. Details of the cylinder accident scenarios are provided in Section D.3 of Appendix D, and the impacts are discussed and summarized in Section 2.4.2 and Table 2.2.

Comment 6

I would like to view another picture of children standing around DU cylinders. This should not be allowed with all the information about the hazard of this product, and the problems with on site hazards here at Piketon.

Response 6

The commentor is referring to a photograph of a tour conducted by Martin Marietta Energy Systems Public Affairs on March 11, 1993 for a group of high school students enrolled in the vocational school's electricity class. The purpose of the tour was to provide information regarding the uranium enrichment process and the ultimate customer of this process, the nuclear industry. The students were pictured at the plant's Product Sampling and Shipping Facility where cylinders of enriched uranium product are readied to ship to customers. Plant tours are conducted to better inform the public and are strictly governed by plant safety procedures regarding access to different areas of the plant. The depleted uranium hexafluoride storage yards are not typically on a tour route unless specifically requested by the tour group.

Comment 7

PRESS (Portsmouth-Piketon Residents for Environmental Safety and Security) considers a decision that there is little effect to the public and it's workforce to be a serious environmental justice concern and was not address adequately in the Draft PEIS.

PRESS along with the Military Toxic Project is asking for the comment period to be extended to six months to give folks the opportunity to meet with you in a roundtable meetings, much like the Federal Facilities Restoration Dialogue meetings. We need to have the opportunity to discuss the strategies that have been proposed.

I am putting in records the letter form the Military Toxic Project.

Response 7

The approach used in the PEIS to assess environmental justice concerns is consistent with guidelines in "Environmental Justice: Guidance Under the National Environmental Policy Act" (Council on Environmental Quality 1997; the full citation is provided in Chapter 8 of the PEIS). The approach taken involved a two-step process to identify impacts associated with environmental justice (see Section 4.3.12 of the PEIS). The first step concerns the presence of disproportionately high percentages of low-income or minority populations in those areas anticipated to experience high and adverse impacts. The second step concerns the presence of high and adverse impacts in general, and thus affecting the total population. Section C.8 of the PEIS provides a detailed discussion of the methods used to identify and assess potential environmental justice impacts.

For the response to the request for extension of the comment response period and for responses to other comments included in the letter from the Military Toxics Project, please see the responses provided to the Comment Document No. 9.

Comment 8

PRESS, an(d) other viewer(s) should see in writing all agreement(s) between the state's of all three facilities Oak Ridge, Paducah, and Piketon. All agreements between CONGRESS, the USEC, DOD, DOE, and any others involved.

Response 8

The commentor's preference is noted. Public documents containing information about the three storage sites are available in the DOE reading rooms located near each storage site, specifically, Waverly, Ohio; Kevil, Kentucky; and Oak Ridge, Tennessee. Specific requests for public documents related to depleted UF_6 management may also be made at these locations.

Comment 9

I would like to remind you that Piketon has never been licensed to accept or store radioactive waste and we have broken many laws by doing so. You have consistently withheld information from the citizens about radioactive release whether planned, routine, or accidentally. PRESS feels that there is a number of cylinders no longer (in) inventory and would like to know who is hiding them, or were they stolen, or is someone already doing conversion?

Response 9

The Ohio EPA has issued permits for the DOE Site to have storage areas for hazardous and mixed (radioactive and hazardous) wastes. These permits do not apply to the depleted uranium cylinders because the uranium is considered a source material and not a waste; however, the Ohio EPA has entered into an agreement with DOE for the management of the depleted uranium stored at the site. This agreement is entitled " Ohio EPA Director's Final Findings and Orders" and is the result of the State's Notice of Violation issued against DOE.

DOE's depleted UF_6 cylinder inventory at Portsmouth was the same until May 1998. In May and June of 1998, two memoranda of agreement were signed between DOE and USEC (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS) that transferred management responsibility of a certain number of cylinders from USEC to DOE. All of the cylinders being transferred are already at Portsmouth. Therefore, no new depleted UF_6 cylinders are being brought to Portsmouth. Also, no DOE cylinders have been shipped off the Portsmouth site.

No one is doing conversion on a commercial scale in the United States, however, several companies may be looking into the economics of performing conversion in the future.

Comment 10

PRESS is worried that a earthquake would create multiple cylinder failures at all the sites, also worried over the possibly of aircraft wrecking and hitting the cylinders.

Response 10

The seismic risk text in Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1 of the PEIS has been modified to be consistent with material presented in the safety analysis reports (SAR) for the three sites (LMES 1997a-c; the full citations are provided in Appendix C of the PEIS). The SARs do recognize and discuss the potential for multiple cylinder failures in association with an earthquake. The PEIS considered potential accident scenarios with frequencies as low as 1 in 10 million years, in accordance with NEPA guidance for environmental impact statements (EISs). This frequency range *includes small plane crashes, which are analyzed in the PEIS. The flight paths of large planes avoid the site leading to an extremely low accident probability. Large plane crashes occur in the beyond incredible probability range (less than once per 10 million years), which the PEIS does not analyze.*

Comment 11

PRESS feels we need to look at some real problem that the National Research Council as put on the table.

Response 11

It is not clear what National Research Council study the commentor is referring to, however, it is believed that the referenced study is the National Research Council report entitled "Affordable Cleanup? Opportunities for Cost reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities." A chapter in that report (Chapter 7) is on the disposition of depleted UF6. The report was reviewed as part of the preparation of this PEIS; the results from this review were included in the PEIS analyses as appropriate. The report is referenced and discussed in Section 1.7 of the PEIS.

Comment 12

We feel that until we find a safe way to handle these cylinders they should be put in earthquake proff containers or maybe find a way to neat them up in the place where stored, then put them in new cylinders until new safe technology comes along.

Response 12

As noted in the PEIS, (see discussion of impacts under the no action alternative in Sections 2.4 and 5.1 and Appendix D), the continued storage of depleted UF_6 cylinders at the three current storage sites would be safe. The safety of current cylinder storage is supported by the revised safety analysis reports (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). In support of the PEIS, a number of options for off-site transportation of depleted UF_6 cylinders were reviewed and evaluated. One option for overfilled cylinders was a mobile system which would remove the overfilled portion of an existing depleted UF_6 cylinder while stored. Preliminary analysis of this option and other relevant options resulted in the consideration of the two cylinder preparation options in Appendix E of the PEIS, one of which transfers the contents of a substandard cylinder into a new cylinder, using cold feeding, a process similar to the one suggested by the commentor, except the transfer occurs in an onsite facility instead of in the cylinder yard.

Comment 13

I would like to put in record a report from Gene Hoffman. At request, I will make a copy for people here that would like one. Also a letter sent to NY TIMES BUREAU Leonard A. Dietz about the DU issue.

Response 13

A copy of the report attributed to Mr. Gene Hoffman can be found in the attachment to Mr. Hoffman's comment document (No. 53) in Chapter 2 of this document. Responses to comment document No. 53 are provided in this chapter. Mr. Hoffman was also a speaker at the Oak Ridge, Washington, D.C., and Paducah public hearings. Detailed responses to his hearing comments are provided in Oak Ridge public hearing comments and responses 29-41 and in D.C. public hearing comments and responses 24-48.

Leonard Dietz's letter was printed as an attachment to comment document No. 80 (see Chapter 2 of this document). The concern raised in the letter focuses on the increased radioactivity of depleted uranium due to the build up of U-238 decay products. The PEIS analyses considered the impacts associated with the build up of U-238 decay products. In fact, the PEIS analyses assumed that Th-234 and Pa-234, the two short-lived decay products of U-238, were in secular equilibrium with U-238. See Section F.2 of the PEIS.

Commentor No. 81: Quapp, W. J.
Starmet Corporation

Comment 1

These comments are prepared to identify the required research in depleted uranium production that must be funded by the DOE to reduce the production cost. Without such cost reduction, some applications, while technically feasible, will never be economic compared to alternative metal options such as steel, lead, and copper. As will be discussed later, the performance advantage of depleted uranium metal must be very high to overcome the high product cost of metallic uranium components. This paper identifies some opportunities and offers suggestions for reducing the economic penalty of using metallic depleted uranium.

Response 1

Comment noted.

Comment 2

3. Metallic Uranium Applications, 2.1 Radiation Shielding Applications: Depleted uranium is an excellent gamma shield having 2.4 times the density of steel and 1.7 times the density of lead. Depleted uranium offers a significant advantage over lead in transportation casks during the postulated fire accident scenario due to its much higher melting point — 1135°C compared to 327°C. Depleted uranium offers advantages over steel in radiation attenuation in proportion to its density efficiency for spent fuel shielding applications. For some specific isotopes (specific photon energies), uranium is much more efficient than the density ratio alone would imply. However, depleted uranium alloys have never been established as an ASME code material so that no structural credit for depleted uranium is given by the NRC in cask applications regulated under 10 CFR Part 71. Consequently, the surrounding steel, which is also required to preclude oxygen from reaching

the depleted uranium, must provide the structural requirements even though some depleted uranium alloys have very high strength and toughness.

Given that selected depleted uranium alloys have been used by the US Army for penetrators and tank armor, it appears that there is ample precedent for using depleted uranium metal in high technology and demanding applications where corrosion protection can be assured.

Response 2

Comment noted. DOE plans to continue its support for the development of government applications for depleted uranium products based on their unique properties.

Comment 3

3.2 Counterweight Applications: As stated previously, aircraft counterweights have been in use in wide-body aircraft for about 30 years. These counterweights are generally very small and are used to adjust the center of gravity and to balance loads on various aircraft components. Modern aircraft design techniques have reduced the need for counterweights. In addition, some aircraft owners are switching to tungsten to avoid issues associated with radioactive materiel. For example, Japan prohibits any aircraft using depleted uranium counterweights. Consequently, this market is relatively stagnant and little future use is projected.

Other potential counterweight applications include equipment such as fork lifts which require massive (several ton) counter weights to balance lifting loads. This market does not currently exist but if economic issues could be overcome (as well as regulatory and public acceptance issues), a large market might develop. One promoter of this application has suggested major warehouse cost savings and forklift safety improvements associated with forklifts using depleted uranium counterweights. The claimed cost savings come from more compact warehouses. The safety benefits come from a lower center of gravity. If all forklift production was converted to using depleted uranium counterweights, the entire inventory of depleted uranium could be consumed in a few years.

However, regulatory and public acceptance issues aside, the major barrier to commercial depleted uranium counterweight use is the cost of production. This is addressed in the next section.

Response 3

Comment noted. DOE plans to continue its support for the development of government applications for depleted uranium products.

Comment 4

4. Depleted Uranium Metal Production Costs, 3.1 Current Production Costs: The method used commercially for uranium metal production is the Ames process. In this process, UF_6 is reacted with hydrogen to produce UF_4 or "greensalt" and HF. In a separate step, the greensalt is mixed with magnesium metal chips and is ignited in a graphite lined retort (a high temperature chemical reactor)

at about 800°C. The magnesium reduces the UF_4 to uranium metal and forms MgF_2. This solid phase reaction liberates tremendous heat and the entire mass of uranium and MgF_2 become molten. Due to density differences, the U metal liquid phase separates by gravity from the MgF_2 salt to form a "derby" which takes the shape of the crucible. After this material is cooled, the uranium metal derby is manually separated from the MgF_2 salt. The MgF_2 salt is disposed as a radioactive waste as it typically contains 1% to 2% uranium by weight. The metal is then cleaned and alloyed, as required, in a vacuum casting furnace. The metal is then shaped via extrusion, rolling or casting into its product form.

The Starmet CMI facility in Barnwell, SC, is the only remaining commercial US producer that manufactures uranium metal from UF_6. Some DOE conversion capability exists at the Y-12 and Los Alamos weapons facilities. Starmet CMI uses the Ames process. This facility has converted UF_4 to metal since 1983 for use by the US Army (as well as the British and French) for depleted uranium penetrators. The UF_6 to UF_4 capability was added in about 1987. These are the same processes that were employed at the DOE Fernald site prior to its shutdown.

Uranium derbies are shipped from Starmet CMI in South Carolina to the Starmet facility in Concord, MA, for alloying, casting and forming into products. After alloying, the uranium is cast into either ingots or slabs. Ingots to be used for penetrators are extruded into rods for subsequent machining operations. Starmet also casts slabs that are sent to the DOE INEEL facility in Idaho for use in fabricating armor for the Abrahms tank. These uranium slabs are fabricated at the Concord facility in vacuum melters from scrap uranium being recycled from prior operations at the INEEL facility.

The biggest non-regulatory impediment to the use of depleted uranium metal in commercial applications is the high cost of converting from UF_6 to uranium metal. In a survey performed for DOE in 1993 by Technics Corporation, the cost was identified to be about $11.70 per kg-U ($5.30 per lb-U) for conversion of UF_6 to metal and casting into a shape. Any forming or machining cost was additional and was priced at $4.40 to $22 per kg-U. Some cost reductions could be forecast through larger conversion facilities but these would not be expected to be sufficient to dramatically reduce the costs below those cited.

3.2 Market Production Cost Requirements: In a recent meeting between Starmet personnel and a Japanese forklift manufacturer, the manufacturer stated that the counterweight must not cost more than its steel equivalent. Thus, unless the performance advantage of forklifts designed with uranium counterweights justifies the higher costs, none will be sold unless the cost of uranium metal production is reduced.

Response 4

Comment noted.

Comment 5

3.3 Cost Reduction Opportunities, 3.3.1 Continuous Metallothermic Reduction: This process was developed at Oak Ridge National Laboratory in support of the AVLIS Enrichment process that uses a uranium-iron eutectic as feed material. The process uses a bath of molten magnesium into which uranium tetrachloride is injected. The magnesium reduces the uranium tetrachloride and forms magnesium chloride that can be recycled to recover the magnesium. The molten uranium is alloyed with iron during this process to reduce the melting point from 1135°C to about 700°C. This reduces the uranium vapor pressure and simplifies subsequent operations. The potential cost reduction for this process, compared to the AMES process, is not known due to proprietary restrictions associated with the AVLIS technology.

Conceptually, this process might be adapted to uranium hexafluoride however, the process has not yet been successfully demonstrated at production scale. Furthermore, the advantages of using the eutectic mixture for AVLIS would probably be unavailable for counterweight applications since the metallurgical properties of the uranium-iron alloy are very poor. During cooling, shrinkage cracks develop and the alloy is very brittle at room temperature. By casting the alloy in a steel sheath, these metallurgical property deficiencies might be made irrelevant.

Response 5

Comment noted.

Comment 6

Cost Reduction Opportunities: 3.3.2 Direct Plasma Conversion of UF_6 to Uranium Metal Technology Description: This technology was conceived at the INEEL as a possible method for a lower cost production of uranium metal from UF_6. Conceptually, the process operates as shown in Figure 1. The UF_6 is injected as a gas into the center of a hydrogen-rich plasma operating at about 5000°C. At this temperature, the UF_6 dissociates to U metal and elemental fluorine. The fluorine combines with the hydrogen to form HF. As the gas exits the plasma reactor, it must be cooled rapidly to avoid the back reaction of HF with U. At the exit of the reactor, the gas (HF and unreacted H_2)with the entrained U metal vapor enters a cyclone where the cooled metal particles are separated from the gas stream. The system operates with excess hydrogen and to maximize conversion of the fluorine to HF. This excess hydrogen must be separated from the HF gas and recycled.

Advantages of this direct conversion approach must be contrasted with the traditional method for uranium metal production — the Ames process. The INEEL plasma conversion process consumes only hydrogen and liberates only anhydrous HF and H_2 as byproducts. The H_2 is extracted from the HF and recycled. The HF gas is comparably easy to purify of uranium using filtration techniques. The metal formed from this process is nanometer sized particles that are very pyrophoric. A method must be developed to solidify the uranium particles into an ingot before exposure to air.

In all past uranium metal production operations, because of the relatively small production, the HF was captured in a scrubber to form aqueous HF that was subsequently reacted with $Ca(OH)_2$ to form CaF_2 and water. The water was evaporated and the CaF_2 was disposed as a radioactive waste.

The greensalt reduction reaction to produce uranium metal consumes magnesium and produces MgF_2 as a radioactive by-product waste. Methods to separate the uranium contamination from the MgF_2 have been considered but not deployed.

The INEEL process was successfully demonstrated at the small bench scale under a program funded by DOE EM-50 in 1994. The major challenge with the plasma reduction process is associated with the design and maintenance of a plasma reactor operating at such high temperature. INEEL researchers identified methods for designing such plasma reactors but further demonstration was beyond the scope of the funded program.

Estimated Cost Savings: After the proof-of-concept, bench scale test was successfully completed, an engineering conceptual design was performed for INEEL by Morrison Knudsen to estimate the total life cycle cost of this approach. In summary, this report identified that a reasonably sized facility could produce uranium metal at about $3.00 per kg-U. This compares to estimated commercial costs from the Ames process of about $8.80 per kg-U.

To achieve this production cost reduction, substantial research support will be required and probably at least ten years of effort will be needed before large-scale production could be achieved.

<u>*Response 6*</u>

Comment noted.

<u>Comment 7</u>

5. Conclusions: Applications for depleted uranium metal have been identified. These applications include radiation shields and industrial counterweights.

Barriers to using radiation shielding applications are minimal as numerous precedents have been set for use in transportation casks. Barriers to industrial counterweight applications are institutional and economic. The institutional barriers are public acceptance and legal possession limits. Such regulatory barriers may be resolvable, as the real toxic health effects of depleted uranium are less than for lead. The radiation issues from depleted uranium are minuscule provided the material is not ingested into the lungs. Resolution of public acceptance issues are difficult to predict but in an industrial setting, but they must be solved.

Thus, the largest barrier to the use of depleted uranium metal is production costs. Unless the forklift industry can sell the concept of substantially increased performance for the depleted uranium counterweight forklift designs, then the counterweight must have a similar cost to a steel counterweight. With steel casting costing in the range of $1.54 per kg versus uranium casting costing over $12 per kg, it is clear that reduced manufacturing costs are needed for commercial applications.

The direct plasma conversion of UF_6 to uranium metal offers significant cost reduction potential but will require substantial research investment to demonstrate commercial feasibility. Even then, assuming success and that the economics are as predicted, the estimated costs are still over a factor of two greater than a cast steel counterweight.

Consequently, wide scale application would be contingent upon either 1.) justifying to forklift buyers that the increased performance of a forklift with depleted uranium counterweights justifies a higher price, or 2.) alternatively, DOE could subsidize the conversion cost to neutralize the cost differential as a preferred action to managing the UF_6 for disposal. If the direct plasma conversion process were successful, the DOE subsidy would be less than the currently expected disposal costs — assuming the counterweights remained continuously in commerce and ultimately did not require disposal.

In summary, large scale industrial use of depleted uranium metal in applications such as counterweights will require development of a lower cost production technology for economic deployment. The INEEL process is one potential process which comes close to the needed production cost point.

Response 7

Comment noted. DOE plans to continue its support for the development of government applications for depleted uranium products; however, issues of DOE program funding are beyond the scope of the PEIS.

Commentor No. 82: Hollister, Nancy P.
State of Ohio Lieutenant Governor

Comment 1

With this in mind, I support the near-term conversion of the significant stockpile of DUF_6 to U_3O_8 at the Portsmouth plant. Under "normal" circumstances, one would wait until a market for a given product develops before engaging in such an activity. However, the DUF_6 is stored in canisters of somewhat questionable integrity, and for which funding for long-term maintenance is noted in the PEIS as "uncertain." Thus, converting the DUF_6 to a "safer" product as soon as possible is the more prudent option.

Response 1

The Ohio Lieutenant Governor's preference for the conversion of UF_6 to U_3O_8 at the Portsmouth plant as soon as possible is noted. In response to comments received on the Draft PEIS, DOE has revised its preferred alternative. As explained in Section 2.5.1 of the PEIS, the preferred alternative now includes prompt conversion of DOE's depleted UF_6 inventory into uranium oxide or CaF_2.

<u>Comment 2</u>

Assuming that conversion is chosen as the preferred option, U.S. DOE should carefully reassess the status of these cylinders and the practicality (safety) of transporting them through the region to a central conversion site. The deteriorating condition of the cylinders may make on-site conversion at each plant a safer, preferred alternative. On-site conversion may also serve to maintain employment in each region.

<u>Response 2</u>

The commentor's preference for on-site conversion is noted by DOE. Due to the deteriorated condition of some of the cylinders, the DOE included in the PEIS evaluation of two methods for transport of cylinders which do not meet DOT transportation requirements: (1) the use of overcontainers which would meet DOT requirements, and (2) on-site transfer of the substandard cylinder contents to new cylinders. Because the number of cylinders which will not meet DOT requirements at the time of transport is not known, the analysis assumed a range of values, including a worst-case assumption of 100% of the cylinders at each site. The details of the analysis of cylinder preparation for transport are given in Appendix E of the PEIS.

<u>Comment 3</u>

DOE should work with Congress now to ensure that funds presently accrued by the US Enrichment Corporation to offset DUF_6 conversion are maintained for that specific purpose, and to lay the groundwork for the on-site conversion efforts.

<u>Response 3</u>

Issues of program funding are beyond the scope of this PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Commentor No. 83: Miller, Jane E.

See responses to Commentor No. 51

Commentor No. 84: Bailey, Susan

<u>Comment 1</u>

I am concerned that the Draft PEIS does not include the alternative of disposing of depleted uranium per the rules of 40 CFR 191. Long-terms storage of uranium poses serious risks which makes the no action alternative and the new containers (for long term storage) option inappropriate and unacceptable. The waste classification of depleted uranium should be re-examined and should be put in the same category as transuranic waste. The scientific basis for this concern was well-documented in the comments of the Institute for Energy and Environmental Research.

Response 1

Depleted UF_6 is a source material. For purposes of evaluating disposal options in the PEIS, it has been assumed that depleted UF_6 would be converted into an oxide. This oxide form would be considered to be a LLW. Only waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years is classified as TRU waste. Waste containing depleted uranium with no or little TRU radionuclides does not fall within this definition. Therefore, disposal of depleted uranium oxides resulting from the conversion of DOE's depleted UF_6 inventory would not be subject to the regulations specified in 40 CFR 191. The material would be classified as LLW and the disposal alternative evaluated in the PEIS considered it to be LLW.

The results of analyses presented in the PEIS show that the risks posed by either the no action alternative or the long-term storage as UF_6 alternative would be acceptable. Please see Section 2.4 of the PEIS for further details on the comparison of impacts between alternatives.

Commentor No. 85: Cavazos, Alberto, Sgt.

Comment 1

My question is, if someone comes is exposed to depleted uranium . . . what are some of the symptoms? I am curious to know . . . I read an article in the Army Times recently and also I served in the Persian Gulf War from 901216 to 910427.

Response 1

The primary toxic effect of exposure to uranium compounds is kidney damage. The extent of the kidney damage depends on how much uranium gets into the body and the chemical form of the uranium. For example, water-soluble uranium compounds are more toxic than insoluble compounds because they are more readily absorbed into the body. If exposure is severe, acute renal damage and renal failure may result in death. However, for smaller exposures, there are often no clinical symptoms. Although some damage to kidney tissue may occur that can be detected through laboratory tests, once the exposure stops the tissue is regenerated and recovery of the kidney occurs. Symptoms of lower-level uranium exposures include weight loss and urine containing abnormally high levels of protein and damaged kidney cells.

Uranium is also a radioactive substance. A portion of ingested uranium is eventually deposited in the bones and tissues of the body, with some portion of inhaled uranium deposited in lung tissue. This retained uranium will emit low-levels of radiation, which can potentially cause an increased cancer risk over a lifetime. Different uranium isotopes exhibit differing levels of radioactivity. The most abundant isotope in depleted uranium (U-238) has a relatively low level of radioactivity, so that increased cancer risk from exposure to depleted uranium compounds is fairly low. Both the potential for kidney toxicity and increased cancer risks from uranium exposures are evaluated for all the alternatives addressed in the PEIS. See Sections 4.3.1.2, 4.3.2.1, C.5.1.2, *C.5.2.1.1, and C.5.2.1.2 of the PEIS for further details on how uranium toxicity was addressed in the PEIS.*

Commentor No. 86: Rustin, Ruth / Rustin, Frank / Casteel, Nathan
See responses to Commentor No. 51

Commentor No. 87: Wilson, Justin P. / Leming, Earl C. / Mobley, Michael H. / Hoyal, Mike
State of Tennessee

Comment 1

We prefer conversion of the entire inventory of stored Uranium Hexafluoride (UF_6) material which is recommended by the proposed alternative; however, the time line presented for the proposed alternative is unduly long considering the questionable condition of the stored inventory and potential health and environmental risks associated with leakage. As Governor Sundquist emphasized in his joint letter with the Governors of Kentucky and Ohio, the State of Tennessee urges the DOE to "consider the immediate conversion" of UF_6. The proposed alternative will provide the most rapid reduction of hazard to the environment and public if the time line for conversion is shortened . This recommendation applies only to the current scope of alternatives presented.

After review, the Division would like to express its support of the preferred alternative of converting uranium hexafluoride to oxide and/or metal. Tennessee has joined with Kentucky and Ohio in challenging DOE to begin the conversion immediately and complete the conversion by 2018, The PEIS has not properly addressed the need to provide adequate funding for the safe maintenance of the cylinder yards and implement requirements that protect the workers, public, and environment at and adjacent to the sites.

The State agrees with the preferred alternative as stated in Section 2.5, Page 2-54 of converting uranium hexafluoride to oxide and/or metal. Given, however, the numerous reports that cast doubts on the integrity of uranium hexafluoride cylinders and their environmental safety, the State, as shown in a recent letter from the Governors to Secretary Pena on the same subject, would prefer that fabrication and conversion facilities be sought as early as possible and not wait until the year 2005 as stated in the PEIS.

Page S-3, Section S.1.1. Background: "Under the current management plan, if alternative uses for the depleted uranium have not been found to be feasible by approximately the year 2010, steps would then be taken to convert the UF_6 to triuranium octaoxide (U_3O_8) beginning in the year 2020." Conversion to an oxide should be completed by 2018 whether the material has a useful purpose or not.

The PEIS document considers a number of different options for dealing with the Depleted Uranium Hexafluoride. Several of the options include the conversion of the material from UF_6 to either uranium oxide or uranium metal. In their analysis of this option, they always consider the conversion beginning in the year 2008 (PEIS 2-6, 2-9, 2-12, 2-15). This seems to be an unreasonably long time before starting conversion. Even considering that it will take time to decide what to do with the material, and to build the facilities if conversion is the chosen option, it does not seem that 10 years should be necessary before conversion can begin.

Response 1

At the beginning of the PEIS preparation, the 40-year timetable appeared to be the most reasonable, based on consistency among alternatives. It was chosen as a reasonable period over which to estimate and compare the environmental impacts of the alternative management strategies considered in the PEIS (see Section 2.1). The representative schedule for facility construction and operation was determined on the basis of engineering judgment that was applied consistently to allow for a meaningful comparison among the PEIS alternatives; it does not represent a definitive schedule. For the purposes of the analysis, it was generally assumed that it would take approximately 10 years for activities such as technology selection, facility design, site selection and preparation, facility construction, and appropriate environmental reviews. Initial facility operations were based on a 20-year period for processing all of the inventory, which was extended in the Final PEIS to approximately 26 years to account for processing up to an additional 15,000 cylinders that were previously the responsibility of USEC.

In response to comments on the Draft PEIS, DOE has determined that, if an alternative requiring conversion is selected, that it is in the best interests of the public and the government to begin conversion as soon as possible. The actual implementation schedule will depend on a number of factors, including the management strategy selected in the Record of Decision, site and technology selection activities, budget constraints, and procurement requirements. However, DOE is committed to implementing the selected alternative as early as practicable and, for as long as necessary, to continuing the safe management of its depleted UF_6 cylinder inventory. (Please see also the response to comment number 2 below).

In addition, on February 2, 1999, DOE entered into a Consent Order with the Department of Environment and Conservation of the State of Tennessee with respect to the management of the UF_6 stored at the ETTP. DOE has agreed that if it chooses any action alternative as the outcome of this PEIS, it shall, subject to appropriate NEPA review, either remove all known depleted UF_6 cylinders from ETTP or complete the conversion of their contents by December 31, 2009.

Comment 2

Up to this point the DOE has not fully funded the proper storage, inspection, testing and maintenance of stored cylinders of material nor does the PEIS address this pressing need for funding. Previous DOE documents have underscored its importance. Current inventories, however, remain in improper storage conditions and inspections of these inventories are limited, Improperly stored cylinders are at risk to natural catastrophes such as earthquakes and tornadoes. In order to fully assess the hazards associated with long-term storage versus conversion of UF_6, the DOE must address these funding concerns in the PEIS.

Funding must be addressed in the PEIS to provide for regulatory compliance and the continued storage of Cylinders including the heel and smaller cylinders. The "Draft Preliminary Report-DOE Independent UF_6 Cylinder Assessment Team" dated 03-25-92, still in draft form states the primary issues with cylinder management is funding to properly store, inspect, and maintain. Site visits by the State in July 1997, confirmed that funding has not been fully appropriated to maintain the yards or the cylinders.

Page S-8, Table S-1: The No Action and Long-Term Storage alternatives state ". . . cylinders would be subject to a comprehensive monitoring and maintenance program...." Describe how this program differs from those already proposed. The document "Draft Preliminary Report-DOE Independent UF_6 Cylinder Assessment Team," dated 03-25-92, made specific observations and recommendations for UF_6 cylinder management, but is still in draft form. DOE has proposed many plans, but has failed to appropriate the funding to fully carry out those plans. The PEIS must take into consideration historical management plans and DOE's failure to fund or comply with its own requirements.

DOE continues to state there is to be maintenance and monitoring plans, but the PEIS state that funding is questionable for some cylinder activities, such as coating. Current cylinder conditions leave no question that funding has been less than adequate. DOE must take aggressive action to ensure whatever alternative is selected and there will be no reduction or elimination of necessary maintenance and inspection activities due to lack of funding.

Page 1-5, paragraph 2, Section 1.1, Background Information: The Division concurs "The DOE has responsibility for continued management of the depleted UF_6 cylinders generated by DOE and stored at the Paducah, Portsmouth and K-25 sites." However, the proposed time table does not adequately address the safety and environmental concerns of the State of Tennessee. It has been estimated that there are an additional 12 undiscovered breached cylinders in the inventory, in addition to 7 already identified, and that the number may be as high as 200. Since some cylinders (with approximately 3 curies per cylinder) have experienced a 1/3 to 1/2 wall thickness loss due to corrosion, the continued storage of cylinders does not seem prudent or reasonable. The timetable should be accelerated to convert the UF_6 to triuranium octaoxide (U_3O_8) as soon as possible. The U_3O_8 or metal form of depleted uranium represents "safe" storage of depleted uranium.

Response 2

Issues of DOE program funding are beyond the scope of the PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

DOE's current systems engineering approach to safe cylinder storage includes visual inspections, ultrasonic testing of cylinder wall thickness, radiological surveys, cylinder coating maintenance, and cylinder yard maintenance (see LMES 1997i, UF_6 Cylinder Project Management Plan, K/TO-30, Rev 2; the full citation is provided in Chapter 8 of the PEIS). This comprehensive monitoring and maintenance program would be modified to meet any new or revised requirements or to incorporate improved practices or technologies that become available for protecting the safety and health of workers, the public, and the environment.

Periodic cylinder inspections and other cylinder maintenance activities have revealed no additional cylinder breaches other than the seven previously identified.

The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use.

The State of Tennessee's preference for accelerated conversion to U_3O_8 is noted.

<u>Comment 3</u>

Beyond the condition of stored cylinders, issues concerning the handling of cylinders for transport have been insufficiently addressed or neglected in the PEIS. DOE's inspection of stored cylinders has been limited raising the concern that breaches in corroded cylinders may exist. Handling such corroded cylinders as well as cylinders that have been overfilled or cylinders containing "heel." materials--conditions which do not meet Department of Transportation's specifications for transport--will require costly training of personnel to repackage materials, The DOE cannot adequately assess alternatives for long-term management of stored inventory without realistically assessing these hazards and costs in the PEIS.

More than 50% of the cylinders were not constructed to Department of Transportation (DOT) specifications. After thirty years in storage, a much higher percentage of the cylinders may not meet DOT specifications for transportation purposes and may need to be overpacked if they are moved for processing. Also, deteriorated cylinders may require cold extraction of the contents. The personnel needed to handle the cylinders will need to be trained for extreme conditions. The costs of recruiting and training appropriate personnel for the duration of the processing operations will have to be factored in the cost-benefit analysis.

<u>Response 3</u>

The PEIS evaluated the impacts from continued storage of the cylinders in Appendix D, including impacts from possible cylinder breaches, and from handling cylinders. Additionally, Appendix E of the PEIS evaluated the potential impacts of preparation for transport of cylinders not *meeting DOT transportation requirements. Cylinders not meeting transportation requirements were defined as (1) overfilled cylinders; (2) overpressured cylinders; and (3) substandard cylinders (that is, dented, damaged, or corroded). Two technologies were evaluated for cylinders not meeting DOT transportation requirements: the use of overcontainers to ship the cylinders, and transfer of cylinder contents to new cylinders using cold extraction. Because the number of cylinders not meeting DOT transport requirements which would exist at each site at the time of shipping is unknown, the PEIS evaluated the cylinder preparation options assuming a range of numbers of such cylinders; for each site an evaluation was conducted assuming the worst case of 100% of the cylinders not meeting requirements. The activities of cold feeding, cylinder inspection, transporting, and overpacking, are all activities associated with an operating gaseous diffusion plant, and therefore, are not new technologies that require extensive training and testing. The cost of cylinder preparation for shipment assuming the same range of numbers of cylinders as the PEIS assumed was evaluated in the cost analysis report (CAR) (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The CAR and other supporting reports are available for review at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.*

With respect to cylinders not constructed to DOT transportation requirements, in fact only a small percentage of cylinders used to store depleted uranium today were not code stamped at the time of fabrication. Title 49, Code of Federal Regulations, Transportation, while quite specific in many requirements, defers this particular requirement to ANSI N14.1, American National Standard for Nuclear Materials–Uranium Hexafluoride–Packaging for Transport. Should any cylinder not meet the requirements of 49 CFR or those deferred to by this regulation, a request for exemption would need to be submitted to DOT. In order to receive this exemption, DOE would be required to demonstrate that the cylinder in question provided the equivalent safety of one that met all of the requirements.

DOE has evaluated the number of cylinders which are filled in excess of the 62% solid volume required by the Department of Transportation under 49 CFR 173.420. It is estimated that only 29% of the cylinders exceed this fill capacity. An exemption from DOT would also be required in order to transport these cylinders. Many of the cylinders still meet the requirements of 49 CFR 173.420 today. Each cylinder would be inspected individually by a certified code inspector prior to being approved for shipment. Cylinders containing "heel" amounts of depleted UF_6 *pose no special handling problems. DOE believes that issues related to the handling of cylinders for transport have been adequately addressed in the PEIS.*

Comment 4

We further request that the PEIS address the Inventory of the United States Enrichment Corporation (USEC) which may come into DOE possession. Omission of this significant inventory represents an incomplete analysis.

United States Enrichment Corporation (USEC) since its privatization, has produced about 8000 cylinders (now reported to be upwards of 10,000) and is estimated to be currently producing 2 to 4 cylinders daily. The exact number of cylinders in question must be identified in the PEIS. The ownership of these cylinders has yet to be determined. The decision regarding USEC's 8000 cylinders should be made now, not as described in a "future Memorandum of Agreement between the USEC and the Office of Management and Budget." If the 8000-10,000 cylinders were considered part of DOE's inventory, it would represent a significant increase in total cylinder inventory.

A long-term strategy for DUF_6 must include DOE's entire cylinder inventory, including heel and small cylinders as well as the 10,000+ cylinders of DUF_6 generated by USEC since 1993. The USEC cylinders will revert to DOE ownership upon privatization of USEC. DOE might consider partnering with the future owner of USEC in a long-term strategy for managing and converting DUF_6 in order to avoid redundancy of efforts, so long as the partnering does not slow progress toward conversion. An estimated $480 million has been accrued by USEC since 1993 in order to offset the cost of future conversion of the DUF_6 generated. DOE should take steps now to ensure that this fund is not diverted into the federal treasury for an unrelated use.

Response 4

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became or will become the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS) after publication of the Draft PEIS (see Sections 1, 2, 6, F.3, and Summary of the PEIS). In addition, the treatment of several hundred heels cylinders has been added to the PEIS. Issues of DOE program funding are beyond the scope of the PEIS. Budget submissions are consistent with implementing required safety practices to protect workers, the public, and the environment.

Comment 5

In order for Tennessee to effectively evaluate the potential impacts of the preferred alternative, the PEIS must provide information on the location of the sites where conversion might occur and how waste and materials generated from this process will be managed.

Response 5

The PEIS evaluates broad programmatic strategies for the long-term management of the depleted UF_6 cylinder inventory, including strategies of long-term storage, use, and disposal. The evaluation of potential environmental impacts in the PEIS includes all of the activities that would be necessary to implement each of the alternatives (see Sections 2.1 and 2.2 of the PEIS). However, as a programmatic EIS (PEIS), it does not propose any site-specific projects. Consequently, the impacts of some management activities, such as conversion, long-term storage, manufacture and use, and disposal, were evaluated using representative facility designs and environmental setting information. The characteristics of these representative designs and settings were selected to provide *as substantive an assessment as possible and to allow for a comprehensive comparison of the strategy alternatives. The potential impacts from construction and operation of such representative facilities, including waste management impacts, are included in the PEIS. Upon implementation of the strategy to be selected in the Record of Decision for the PEIS, site-specific evaluations will be performed, including the effects of site-specific projects and range of alternative actions, including a "no action" alternative.*

In the PEIS, site-specific impacts were evaluated only for components of the alternatives for which the locations of the actions were already known. These components were continued cylinder storage and cylinder preparation for shipment, which were individually evaluated for each of the three current storage sites. The cumulative impacts of these components are described in Section 5.8 of the PEIS. Management of wastes and materials that would be generated under each of the management alternatives and options is addressed throughout the PEIS. See for example Sections S.4.8, 5.1.7, 5.2.7, 5.3.7, 5.4.7, 5.5.7, 5.6, 5.7.8, D.2.7, D.4.7, E.3.7, F.3.7, G.3.7, H.3.7, Appendices I and J.

Comment 6

The Draft PEIS fails to address two major issues. The first is the treatment, recycling, or reuse of Uranium Hexafluoride (UF_6) in a timely manner. The second issue is the final safe disposition of the "heels" component of the UF_6 cylinders containing a high energy (gamma emitting) RCRA mixed waste like material. The Division estimates there to be 120 million pounds of this material in cylinders stored on the Oak Ridge Reservation. Of paramount concern under the No Action or Long-Term Storage alternatives, is the slow migration of the "heel" material into the groundwater/surface water and the release of UF_6 into the air, due to the corrosion and failure of the cylinders. The Draft PEIS is unclear on the criteria used for hazard modeling. The PEIS must identify the "worst-case" cylinder conditions and explicitly use this information in the hazard modeling descriptions. The PEIS must describe the modeling parameters such as total wall area found to be less than minimum thickness, age of the cylinder, manufacturing requirements (ASME or other design/construction), denting/bulging, and if the cylinder is in an "overfilled" condition. These conditions then must be coupled with the natural phenomenon hazards in determining the risk. The PEIS must accurately identify the cylinder population with these conditions.

Page 5-119 and 5-120. Section 5.13, Pollution Protection And Waste Minimization. This section should address the "heels" component of the UF_6 cylinders. These heels contain a high energy (gamma emitting) RCRA like mixed waste.

Response 6

With respect to the first issue of treatment, recycling, or reuse of Uranium Hexafluoride (UF_6) in a timely manner, the PEIS addresses the alternatives of continued storage as UF_6, long-term storage as UF_6 at a consolidated site, conversion and long-term storage as oxide, conversion and use as either oxide or metal, and conversion and disposal. A comparison of the potential impacts from these alternatives is provided in Section 2.4 of the PEIS. The preferred *alternative in the PEIS has been revised to indicate that conversion of the depleted UF_6 would start promptly.*

On the second issue regarding the final safe disposition of the "heels" component of the cylinders, as long as the cylinders remain in storage at ambient temperatures there is minimal health and safety concern with respect to the high energy decay products from uranium-238 present in the cylinders, because as long as the uranium-238 remains in the cylinders, it has the effect of shielding the gamma emissions from the decay products, so that the dose rate at the cylinder surface is fairly low (typically about 2-3 mrem/h at the surface, decreasing to about 1 mrem/h at a distance of 1 foot). (This is confirmed by actual measurements at the cylinder surfaces). Also, if breaches develop in a few of the cylinders, the property of the UF_6 of forming a plug of solid uranium and iron compound would limit the amount of depleted UF_6 leaving the cylinders (see Section 1.1 of the PEIS). Because of the fact that U-238 decay products are uniformly distributed in solid depleted UF_6 in full cylinders (they concentrate in the bottom of the cylinder only after the cylinder is emptied) and that their concentration is low compared to U-238, any effect their release from breached cylinders would have on human health and safety would be negligible compared to the effect of UO_2F_2 and HF (reaction products of UF_6 and H_2O in air). The potential impacts from releases of UF_6 in the form of UO_2F_2 and HF from breached cylinders are analyzed in the PEIS in Sections D. 2, D.3, and D.4 of Appendix D. In these analyses, both a most likely and a worst-case number of cylinder breaches are assumed in order to fully characterize the possible impacts from an unknown number of cylinder breaches that could occur in the future. Furthermore, the potential impacts from accidents during continued storage, including natural phenomenon hazards, have been analyzed and presented in Sections D.2.2 and D.4.2 of Appendix D.

For alternatives that include conversion of the UF_6 to oxide or metal, removal of the cylinder contents would be required. After the bulk removal of depleted UF_6 from a cylinder, some depleted UF_6 (i.e., less than 50 lb) that contains a small amount of uranium decay products remains in the cylinder; this material is called the cylinder "heel" and is not a RCRA material. For conversion options, it was assumed in the PEIS that a cylinder treatment facility would be co-located with the conversion facility (see Appendix F). Prior to treatment at the cylinder treatment facility the cylinders containing heels would be stored for 3 months, during which time most of the activity from the short-lived daughter products of uranium-238 would decay away. The cylinders could then be handled safely. The empty cylinders would be washed with an aqueous solution and would then become part of the DOE scrap metal inventory. Text has been added to Section 5.14 to clarify that the heels would be removed from the empty cylinders under the cylinder treatment facility option.

A small number of "heels" cylinders (less than 500) each containing less than 50 lb of depleted UF_6 are also currently in storage at the sites. These cylinders have been in storage for more than 3 months and thus do not present a hazard due to the radiological activity of U-238 daughter products. The PEIS has been expanded to include the treatment of these heels cylinders. (See Sections 1.5.2 and 4.2.1 of the PEIS.)

<u>Comment 7</u>

The PEIS does not identify storage and maintenance of the overfilled cylinders. The K-25 site has determined there are approximately 2300 14-ton and two 10-ton cylinders that contain more UF_6 than is allowed for off-site shipment by DOT regulations. Although the cylinders are determined to be overfilled for transportation, they must also be properly evaluated for long-term handling and storage.

<u>Response 7</u>

The limit on the amount of depleted UF_6 that can be placed in a cylinder is based on a safety factor of heating a cylinder to 250°F to evacuate the contents and the cylinder's design envelope which includes the size, design pressure, and wall thickness. DOE has evaluated the entire inventory of depleted UF_6 cylinders with regards to the requirements in Title 49, Code of Federal Regulations. Some of these requirements are deferred to ANSI N14.1, American National Standard for Nuclear Material–Uranium Hexafluoride–Packaging for Transport. 49 CFR 173.420 requires that the volume of solid depleted UF_6 may not exceed 62% of the certified volumetric capacity of the packaging. Each type of cylinder that has been used over the years is listed in ANSI N14.1 with it's required minimum volume. It is a requirement, when fabricating a cylinder, that each cylinder be filled with water, the water measured, and the "certified" volume in pounds of water be stamped on the cylinder's nameplate. Cylinders fabricated prior to this requirement must be considered to meet the minimum volume requirement listed in ANSI N14.1, when in fact they might possibly be larger. From this information, DOE has determined that a percentage of the inventory is filled to 65% of the minimum volume instead of 62%.

Cylinders that are overfilled do not pose any special handling problems or storage problems. The volume of depleted UF_6 inside the cylinder is only a concern if the cylinder is heated, as in the process for emptying a cylinder. Based on the actual volume in the cylinder and the density of the depleted UF_6, temperatures can be lowered to provide safe evacuation of the contents. An assumption in the PEIS is that all cylinders would be emptied at reduced heat which eliminated the need for special evaluation.

<u>Comment 8</u>

The document does not address potential waste issues arising out of leaks (breach or rupture) in the cylinders and/or leaks caused by the handling of the cylinders. Prolonged storage of the UF_6 in outdoor yards can and has been shown to cause corrosion events. The products of corrosion include radioactive and hazardous wastes. In so far as the products of corrosion are not collected and recycled, they are wastes. With age, the probability of corrosion and external breach for the cylinders increases. Thus leakage from the long-term storage of Uranium hexafluoride cylinders could result in hazardous waste violations and non-compliance with applicable DOE Orders.

<u>Response 8</u>

The major objective of the current cylinder management project is to safely store the inventory until ultimate disposition. A cylinder inspection schedule has been put in place to ensure that if a cylinder was breached, it would be discovered in ample time to alleviate the environmental effects. The amount of waste created, if a breached cylinder should be discovered, should be minimal due to the schedule now in place for inspections and the chemical characteristics of UF_6 in its present storage condition. The PEIS evaluated the waste management implications of continued storage of the cylinders, both under the No Action Alternative (Section D.2.7 of Appendix D) and under the Action Alternatives (Section D.4.7 of Appendix D). As detailed in those Sections, the analysis included low-level-waste generated from breached cylinders (the emptied cylinders themselves and materials released from them), failed valves, and solid process residue from cylinder painting. The number of cylinder breaches assumed through the period of evaluation is summarized in Appendix B.

The possibility of cylinder rupture during handling was also addressed in Section D.2.2 of Appendix D. Assuming the most-likely scenario that the rupture would occur during dry weather conditions, the amount of UF_6 assumed released would be 24 lb (see Table D.6). In the Draft PEIS, this type of accident was estimated to have a probability of occurring 3 times during the 40 year period evaluated (three is the total estimated number of occurrences for all the sites combined). With the addition of the USEC cylinders, the estimated number of occurrences in the Final PEIS is four. The amount of waste generated from these accidents could readily be accommodated by the existing waste management facilities at the sites.

If a breached cylinder is discovered or if a cylinder rupture should occur, the situation will be handled with approved procedures, in compliance with any storage site requirements, including any DOE Orders, or state and federal regulations.

Comment 9

The PEIS has not presented supporting evidence that mines, shallow earthen trenches, and other underground sites are suitable for long-term storage. The State cannot continue to rely on "later determinations," "future treatments," or other vague options for storage and/or disposal. DOE has failed to approve long-term storage and disposal sites for other materials/wastes thus the State could expect the same lengthy time period for decision making on UF_6. Placing any of the UF_6 materials for long-term storage or disposal in shallow earthen structures, below ground vaults, and/or underground mines should not be an alternative consideration.

Response 9

The PEIS considers several options for long-term storage, including yards, buildings, below-ground vaults, and underground mines; shallow-earthen structures ("trenches") are considered only as a disposal option. The technical suitability of these options is addressed in two reports. The first report is the "Technology Assessment Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1995), available through the National Technical Information Service (NTIS) by calling 1-800-553-NTIS (6847) or (703) 605-6000. The second report *is the "Depleted Uranium Hexafluoride Management Program; Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS), which is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), or by contacting the DOE program manager identified on the cover sheet of the PEIS. As required by NEPA, the PEIS has considered all reasonable alternatives for long-term management and use of DOE's depleted UF_6 inventory. The selected alternative will be announced in the Record of Decision. The results from the PEIS, costs of alternatives and other factors will be considered in the selection process, which will be documented in the ROD. DOE is committed to implementing the selected management strategy as early as practicable. The State's opposition to long-term storage or disposal in shallow earthen structures, below ground vaults, and/or underground mines is noted.*

Comment 10

The PEIS must give a clear definition for "heel" and list the word in the definition section.

Response 10

The term "heels" was included and defined in the glossary of the PEIS (Chapter 9).

Comment 11

Page S-6. Section S.2, Description of Action: This section describes an alternative for "long-term" management. DOE has defined long-term in previous NEPA documents as storage for up to 50 years. This document does not identify any time frame in its definitions. The continued storage of these cylinders under the No Action alternative has already reached the long-term storage definition.

Response 11

The time frame considered in the PEIS is defined and discussed in Section S.1.3 and Section S.2 of the summary, as well as in Chapter 1 (Section 1.3), Chapter 2 (Sections 2.1 and 2.2), and Chapter 4 (Section 4.2). As discussed in these sections, the PEIS considers an approximately 40-year time frame, 1999 through 2039, for the evaluation of all alternatives. (Generally 10 years for siting, design, and construction of any required new facilities; about 26 years for operations; and, when appropriate, about 4 years for monitoring.) These timeframe estimates were meant to provide a consistent analytical timeframe for the evaluation of PEIS alternatives and do not represent a definitive schedule. Although some previous NEPA documents may have defined "long-term storage" as storage for up to 50 years, there is no standard definition of this term.

Comment 12

Page S-13. Section S.3.3 K-25 Site on the Oak Ridge Reservation: "Which consists of three major facilities. . . ." The K-25 site contains more than three storage yards.

Response 12

The reference to three major facilities was intended to be for the Oak Ridge Reservation facilities of the K-25 site, the Y-12 site, and the Oak Ridge National Laboratory. The referenced text in Section S.3.3 has been modified to clarify this point. In the same Section (Section S.3.3) the PEIS does state that the K-25 site contains three storage yards for DOE-managed depleted UF_6 cylinders. Although there are more than three storage yards at the K-25 site, the other storage yards contain cylinders that are not included in the depleted UF_6 cylinder inventory addressed in the PEIS (for example, cylinders containing natural uranium or enriched uranium).

<u>Comment 13</u>

Page S-32, Section S.4.1: ". . . exposures of workers and members of the public to radiation and chemicals were estimated to be within applicable public health standards and regulations during normal facility operations." The K-25 facility is no longer in normal operation status, and yet poses a significant gamma exposure risk to members of the public and to "reindustrialization workers." The Division has recorded the annual radiation dose (by method of thermoluminescent dosimetry monitoring) at the fences of K-1066-K Yard to be 1240 mrem, E yard to be 950 mrem, and J Yard to be 260 mrem. Members of the public have access to the fence line at the K-1066-K area. The Division questions the methods DOE used for the estimated radiation exposures of "workers and members of the public."

<u>Response 13</u>

For the continued storage options (Appendix D), radiation exposures of involved workers in the cylinder storage yard were estimated by using the MicroShield computer code, information on the radioisotopes in the cylinders, and the projected worker activities in the yards throughout the period of cylinder management addressed in the PEIS. The dose rates estimated by MicroShield at the cylinder surface and at a distance of 1 m away from a cylinder were in good agreement with the actual measurement data. After the dose rate was estimated, it was multiplied by the predicted activity duration, number of workers involved, and number of performances required each year to get the total annual dose for that activity. The total annual doses from all the activities were added to give the total annual exposure for workers. The total annual exposure was then divided by the total number of workers predicted to get the average annual dose for individual workers. The average individual dose for workers was estimated to be 410 mrem per year for the K-25 site for the continued storage alternative. This can be compared to the measured dose of current workers in the K-25 cylinder yards which ranges from 32 to 92 mrem/yr (given in Table 3.13 of the PEIS).

The worker dose estimates stated above were obtained assuming that each individual worker would spend 5 hours per day, 228 days per year in the cylinder yard. The doses cited in the comment appear to have been estimated using an assumption that the receptor would stand at the fence line of the cylinder yards for 24 hours per day, 365 days per year. Such an exposure situation could not occur at this time, because the fence line of the cylinder yard could not be an area used as a residential location.

Direct gamma radiation from the depleted UF_6 cylinders was not considered for the off-site public because the radiation would be negligible at the locations where the public resides. This assumption was consistent with the current distribution of the off-site public around the K-25 site. To receive an external dose equal to the allowable limit for a member of the general public (100 mrem/yr), an individual would have to stay at the fence line for an extended period of time (about 700 hrs per year). Considering the remote location of the cylinder yards on the Oak Ridge Reservation at the K-25 site, and that residential use of Oak Ridge Reservation property is not allowed, it is very unlikely that anyone would remain at the fence line of any of the cylinder yards for that period of time annually. DOE believes that based on the discussion given, the analyses performed are appropriate for the PEIS.

Comment 14

Page S-38, Section S.4.5, Water and Soil: ". . . (based on the U. S. Environmental Protection Agency (EPA) proposed maximum contaminant level (MCL) of 20 micrograms/L for drinking water, and on the EPA health-based guideline of 230 micrograms/g for residential soil)." This is not the spirit or the letter of environmental and nuclear regulatory acts and the laws that codify these regulations. The spirit or the letter of environmental and nuclear regulatory limits and the laws is to minimize contaminant migration at its earliest and most effective point.

Response 14

The proposed maximum contaminant level (MCL) for uranium (20 µg/L for drinking water at the tap) and the soil guideline were used in the evaluation as guidelines to estimate the potential for adverse environmental effects of the various alternatives to groundwater, surface water, and soil. Use of these guidelines in this context, provides a more conservative estimate of the impacts than would actually occur in practice. For example, since the MCL is applicable to drinking water at the tap, its application to groundwater at the boundary of a release site is fairly stringent. Similarly, the soil guideline was derived on the basis of residential land use assumptions; whereas the hypothetical locations at which it was used for comparison were generally industrial. Nonetheless, the use of these levels as guidelines in the PEIS in no way is intended to indicate an acceptance of contamination to these levels. The DOE is committed to its "As Low As Reasonably Achievable" (ALARA) policy for both emissions and environmental contamination levels, which means the best available technology is used to limit levels to as low as reasonably achievable BELOW standards and guidelines. The cylinder project management plan (LMES 1997d; the full citation is provided in Appendix D of the PEIS) described in the introduction to Appendix D is an example. The plan is designed to provide sufficient inspection and maintenance of the cylinder inventory such that no releases would occur during continued storage. However, for purposes of analysis in the PEIS, cylinder breaches and releases were assumed to occur, and resulting contamination levels in water and soil were estimated and compared with the guideline levels stated above. This analysis was conducted only to provide a basis for comparison of the potential environmental impacts of the various alternatives. Because of the provisions of the cylinder project management plan, DOE considers that safety of stored UF_6 cylinders can be effectively maintained and that storage is a viable option for the depleted UF_6 management program.

Comment 15

Page S-42, Section S.5. DOE's Preferred Alternative: The State supports DOE's Preferred Alternative of simultaneously implementing both use as uranium oxide and use as uranium metal as described in this section. Disposal as Oxide should be retained as an option as these uses progress, since it may be necessary to pursue the disposal options for some of the material.

Response 15

The State's preference for implementing both use as uranium oxide and metal while retaining a disposal option is noted.

Comment 16

Pages 2-54 and 2-55, Section 2.5, DOE's Preferred Alternative: ". . . (1) continuing the safe, effective management of the cylinders and (2) beginning conversion of the depleted UF_6 into depleted uranium oxide and/or metal products as uses for these products become available."

This document should address the safety concerns raised by the National Defense Facilities Nuclear Safety Board (DNFSB) in 1995 on the integrity of Uranium Hexafluoride Cylinders.

In its conclusions, DNFSB noted in 1995 "DOE has stored depleted UF_6 in transportation cylinders for more than 40 years and may continue to store them for an additional 30 years. The analysis of the adequacy of the existing cylinders for use as storage systems over this extended time period has not been systematic and has not addressed all the pertinent concerns.
Specifically, the following areas need further assessment:

1. the potential for failure by accelerated corrosion mechanisms needs to be better characterized and then quantified;
2. the inspection program, used to characterize the condition of the cylinder population and monitor continued adequacy for storage, needs significant overhaul to achieve these purposes;
3. cylinder handling procedures need to be analyzed and then revised to incorporate precautions for handling degraded cylinders; and
4. the safety analysis for the cylinder storage yards need to he upgraded to: include insights gained through the above reviews; investigate the unique problems presented by a breach in the vapor space; investigate the hazards associated with moving degraded cylinders; and incorporate structural analyses of the cylinders.

The PEIS does not include the DNFSB report in its Reference Section. In the absence of effective management reactions to these recommendations, storage of the cylinders in their present location and present condition may not be continued safely. Continued safety is questionable as the probability of loss of container integrity and external corrosion increase with time.

Response 16

The DNFSB recommendation 95-1 of May 1995 was listed in the reference section of the Draft PEIS, but on review of the text it is agreed that further details on the recommendation and its relationship to this PEIS would be informative. A summary of the DNFSB report and DOE's actions in response to the DNFSB recommendations has been added to the PEIS (see new Section 1.7).

The UF_6 cylinder project management plan (LMES l997i; the full citation is provided in Chapter 8 of the PEIS) was developed to address the concerns of the DNFSB through elimination of substandard cylinder storage conditions and through control of further corrosion through a cylinder recoating program. The management plan addresses all phases of the current UF_6 cylinder management project and is based on risk analysis and technical evaluations which determine the activities to be performed. Under this management plan, all cylinders must be stored out of ground-contact. Any cylinders discovered through periodic inspections to be in ground contact are relocated. Additionally, there are relocation plans to place all cylinders in a configuration which improves the ability of inspectors to make visual inspections from each end of the stacked cylinders. These plans are being implemented in a graded approach by relocating cylinders in the poorest storage conditions first. This plan is being implemented concurrently with extensive construction and recoating projects which will provide well-drained storage yards for the cylinders and also provide protection for the exterior of the cylinders by recoating.

The sites have also implemented an extensive cylinder inspection program to allow identification of any damaged or breached cylinders. This inspection program also identifies those cylinders requiring maintenance activities such as valve replacement and nameplate replacement. Annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of pitting or heavy corrosion. All other cylinders must be inspected once every four years. Most of this work has already been completed at the three sites or is planned for completion by the year 2002.

The DOE is committed to maintaining adequate safety of the depleted UF_6 cylinder inventory through use of the UF_6 cylinder project management plan. The plan is discussed and referenced in the Introduction to Appendix D of the PEIS. The plan was used in the PEIS as the basis for assumptions to estimate possible adverse environmental impacts of continued storage of UF_6. For example, the cylinder painting and relocation schedules from the plan were used to estimate worker radiological doses, and also to estimate future cylinder breach rates.

Comment 17

Also continued long-term storage of the cylinders is in conflict with the accelerated clean-up program of DOE. The availability of skilled and trained workers for the extraction and treatment of UF_6, ten or twenty years beyond 2006 will be more expensive. If the present conditions of storage persist, a greater population of the containers will be structurally unsound and the risk of release by rupture will be compounded.

Response 17

Continued storage of depleted UF_6 cylinders is not considered to be in conflict with DOE's accelerated clean-up program. The accelerated clean-up program is concerned with the clean-up of waste material (primarily contaminated media such as soil and groundwater) from historical DOE activities. Depleted UF_6 is outside the scope of the clean-up program because it is not considered nor managed as a waste material. Issues related to the costs associated with the management of UF_6 cylinders for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

In regard to the future condition of cylinders, DOE is committed to continuing the safe management of its depleted UF_6 cylinder inventory for as long as necessary. Current practices for managing the cylinders include visual inspections, ultrasonic testing of cylinder wall thickness, radiological surveys, surveillance and maintenance of the cylinders and cylinder yards, and the coating of a portion of the inventory to prevent continued corrosion. These practices will continue or be modified, as necessary, to meet any changing requirements or to incorporate improved practices or technologies that become available for protection of worker and public health and safety and the environment.

<u>Comment 18</u>

Page 3-42, Section 3.3. 1. Cylinder Yards: "The four breached cylinders have been patched to restore their integrity, segregated from other cylinders in K- and E-yards, and placed under temporary awnings. No estimates of material loss are available for these cylinders. "

Appendix B-2: Breached cylinders and material loss — conflicts with the statement above. The following information has been obtained from the "Investigation of Breached Depleted UF_6 Cylinders at the K-25 Site " dated 10-94:

Cylinder Number	Hole Diameter	Total Weight of Material Collected External to the Cylinder	Uranium Content of Material
101244	6 inch	Not Available	0.160
114951	8 - 12 inch width by 15-17 inch length	11.8 kg	1.8 kg
7953	9 inch	9.8 kg	2.2 kg
116797	2 inch	------	-----

Breach of the Cylinder 116797 is presumed to be mechanically induced cylinder breach and the reason for the absence of Uranium containing deposits. Estimated amount of UF_6 lost is 0-4 pounds for cylinder 116797 versus 17 pounds to greater than 109 pounds of estimated loss for Cylinder 114951.

Response 18

The report the commentor is referring to (Barber, E.J. et al, 1994; the full citation is provided in Appendix B of the PEIS) gave the additional information: " . . . without measurements of the present cylinder weights, the extent of uranium loss from the four breached cylinders at the K-25 Site cannot be determined at this time. In the case of cylinders 114951 and 116797, rough estimates of uranium lost to the environment can be derived from the calculated losses for the PORTS breached cylinders . . ."

The referenced report also stated ". . . these values for the two K-25 breaches in K-1066-E yard are provided only as a comparison to the PORTS experience and not as calculated values for the material loss estimates."

The text in Section 3.3.1 has been revised to indicate that because the present cylinder weights are not available at this time, the extent of uranium loss from the four breached cylinders was not determined. The estimates given in the report referenced by the commentor are highly uncertain, and therefore are not be included in the PEIS text. For PEIS analyses of the impacts from material loss from breached cylinders, the data on loss from a breached cylinder at the Portsmouth site that had been in storage 4 years prior to breach detection were considered representative of the material loss that might occur during the time period assessed in the PEIS (i.e., 1999 through 2039). See Appendix B, Section B.3 for further details.

Comment 19

Page 3-46, Chapter 3, Section 3.3.5.1, Surface Water: Monthly sampling plan does not include a means to identify, contamination of the storage yards and run-off from the UF_6 material, The timing of the sampling with that objective should be immediately after a precipitation event, since Uranyl fluoride is extremely soluble in water. Thus the discussion of the results of the monthly sampling and analyses is not relevant to the storage of UF_6 cylinders.

Response 19

The surface water and sediment data provided in Section 3.3.5.1 were intended to provide a general picture of the affected environment for the whole K-25 site, and not just for the cylinder storage yards. The sampling conducted at the K-25 site meets all state and federal permit requirements.

Comment 20

Pages 4-2 through 4-5, Section 4.2. Major Assessment Assumptions and Parameters. The reports from the Oak Ridge and Paducah assessment teams on the UF_6 Cylinders, 1992 and 1994 respectively, have noted many deficiencies with regard to cylinder integrity and thinning of walls due to internal and external corrosion. Corrosion has occurred to the extent that special training is required for personnel engaged in the monitoring of the cylinders. Also, the safety analysis performed on the cylinders is incomplete and does not include effects due to high winds, tornadoes, earth movements, and etc. Some of the cylinders have been reported to have thinning of the walls in the middle. Handling of such cylinders may be cause for concern. Under these circumstances, the No Action alternative will be a potentially hazardous alternative.

Response 20

The mission of the UF_6 cylinder project is to safely store the DOE-owned UF_6 inventory until its ultimate disposition. The major objectives identified are:

1. Achieve and maintain acceptable risks
2. Achieve and maintain cylinder integrity
3. Improve conduct of operations
4. Evaluate and monitor containment integrity
5. Administer the system

Cylinder conditions, such as thinning walls, have been baselined and cylinder personnel have been trained in the safe handling of cylinders. Steps are being taken to arrest the external corrosion rate with the recoating of cylinder bodies. The condition of the cylinders was considered in the PEIS hazard modeling through the analysis of accident events in which corroded cylinders would be breached during handling (see Section D.2.2 of Appendix D).

The Site's Safety Analysis Reports (SARs) were revised in 1997 and include natural phenomena threats (earthquakes, floods, and wind) as well as external man-made threats such as aircraft crashes, highway accidents, barge traffic accidents, natural gas pipeline ruptures, and toxin and asphyxiant releases (LMES 1997f-h; the full citations are provided in Chapter 8 of the PEIS). The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes and tornadoes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake scenarios which were found in the SAR analyses to have lesser consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point.

The analyses in the SARs and the PEIS indicate that continued cylinder storage at the three current storage sites is safe. If the SARs are revised in the future, DOE will modify its cylinder management program to ensure that the safety of the cylinders is maintained.

Comment 21

In addition, the stated assessment period of forty years is in conflict with DOE's accelerated clean-up plan for K-25. While the cylinder storage yards have not been identified as hazardous waste sites, the fact that breached cylinders exist and have the potential to leak out toxic substances is of major concern to the State of Tennessee. While the release so far may not meet the reportable quantity requirements, DOE has a responsibility for any environmental impact due to the breaches. Also, there is the possibility that future leaks will be of a greater magnitude. In spite of known breached cylinders, DOE has not undertaken any action to determine the degree of contamination to the soil and to the water stemming from the breaches.

Response 21

DOE and its operating contractor take full responsibility for the cylinders and their contents. Many activities of the cylinder project are funded to prevent future breached cylinders, to determine which cylinders might breached and when, and to discover breached cylinders before they have lost any appreciable quantity of material to the environment.

This program is aware of other DOE cleanup efforts at the three storage sites and plans to coordinate actions with other activities even though the objectives and time periods may differ.

Water samples are taken monthly at each storage site from the sampling locations listed on the NPDES water permits. When cylinder breaches were identified soil samples were obtained from areas impacted by the breaches; soil with elevated contaminant levels was excavated and disposed of.

Comment 22

Page 5-69, Section 5.5.1.1.2, General Public: ". . . the total dose would be about 1 mrem, and the resulting chance of dying from a radiation-induced latent cancer would be less than 1 in 1 million." The risk of dying from a radiation-induced latent cancer associated with a total dose of 1 mrem is closer to 1 in 30,000. Please provide a citation or reasoning to support a 1 in 1 million radiation-induced latent cancer risk.

Response 22

As described in Section 4.3.1.1 of the PEIS, the risk of developing a fatal latent cancer following radiation exposure is calculated by multiplying the radiation dose by an appropriate health risk conversion factor. The health risk conversion factors used in the PEIS to relate radiation dose to potential latent cancer fatalities were those recommended by the International Commission on Radiological Protection ("1990 Recommendations of the International Commission on Radiological Protection," ICRP Publication 60), as described in Section 4.3.1.1 and Appendix C. The conversion factors are 0.0004 latent cancer fatalities per person-rem for workers, and 0.0005 latent cancer fatalities per person-rem for members of the public. For a total dose of 1 mrem to a member of the public, the risk of a latent cancer fatality is calculated as 1 mrem x 0.001 rem/mrem × 0.0005 latent cancer fatalities/rem = 0.0000005. This risk is equivalent to a 1 in 2 million chance, which is less than 1 in 1 million, as stated in the PEIS.

Comment 23

Page 5-72, Section 5.5.1.2.2, Accidents Involving Releases of Radiation or Chemicals. "All doses would be considerably below the 25 rem maximum allowable dose specified in NRC regulations (10 CFR Part 76)." The regulation with which 10 CFR 76 refers is 10 CFR 20, which is the regulation with the widest applicability "Standards for Protection Against Radiation." The 10 CFR 20 applies to all activities licensed by the NRC which encompasses all commercial uses of radioactive material. Part 20 provides extensive details on "subsets" of exposure such as hourly exposure and exposure of minors. For comparative purposes, Part 20 ties whole body dose to 5 rem for personnel in restricted areas and 0.5 rem for personnel in unrestricted areas. The term "unrestricted area" is usually interpreted to extend to the site boundary, but not beyond to the "environment." This interpretation keeps 10 CFR 20 from conflicting with 40 CFR 190. It also assumes that the licensee has at least some minimal control over the personnel exposed.

The 40 CFR 190 regulates doses received by members of the general public in the "general environment" resulting from the nuclear fuel cycle. This is a different scope than 10 CFR 20 since 40 CFR 190 includes all processes and facilities in the nuclear fuel cycle (excluded is any dose due to occupational exposure as part of the nuclear fuel cycle). The "general environment" means the environment outside the boundary of the facility covered by the regulation. This keeps 40 CFR 190 from conflicting with 10 CFR 20. The whole body exposure limit specified by 40 CFR 190 is 25 mrem. The 25 rem "maximum allowable dose" is not really a "maximum allowable dose" at all, but rather, the dose at which notification to the NRC must be made. Section 20.403 states that "Each licensee shall immediately report any events involving byproduct, source, or special nuclear material possessed by the licensee that may have caused or threatens to cause: (1) Exposure of the whole body of any individual to 25 rems or more . . ."

Response 23

The Part 76 NRC regulation cited in the PEIS is relevant because this regulation is used for the certification of gaseous diffusion plants, and is the basis for the certification of both the Paducah and Portsmouth plants. The 25 rem dose given in 10 CFR Part 76 is specified as a benchmark for assessing the adequacy of protecting public health and safety from potential accidents (the radiation level at the facility boundaries caused by hypothetical accidents within the facility are compared to the 25 rem level). The text of Section 5.5.1.2.2 has been modified to indicate that all doses would be considerably below the 25 rem dose specified for assessing the adequacy of protecting public health and safety from potential accidents in NRC regulations (10 CFR Part 76).

Comment 24

Page 5-76, Section 5.5.7, Waste Management: Generation of "1 cubic meter/yr- of LLMW" seriously underestimates the "heels" component of the UF_6 cylinders containing a high energy (gamma emitting) RCRA mixed waste. The Division estimates there to be 120 million pounds of this material in cylinders stored on the Oak Ridge Reservation.

Response 24

The generation rate of 1 m^3/yr LLMW in the referenced text pertains only to LLMW waste generation from the metal conversion facility operations, and does not include waste generation from the cylinder treatment facility, which would treat the "heels" component of cylinders emptied for conversion. The cylinder treatment facility would generate about 0.2 m^3/yr of LLMW. A summary of the LLMW and other waste generation from a cylinder treatment facility is included in Section F.3.7.4 of the PEIS; text has been added to Sections 2.4.8, 5.3.7, and 5.5.7 to summarize potential waste management impacts from such a facility, including the "heels" component of the UF_6 cylinders. Based on information provided in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) it was assumed that each cylinder would contain a maximum of 50 lbs of residual depleted UF_6 after being emptied. Other details on the design and operation of a cylinder treatment facility are provided in the engineering analysis report. The empty cylinders would be washed with an aqueous solution to remove the heels. The UF_6 from the heels would be converted to U_3O_8 which would be sent either for disposal as LLW or storage. Wastewater generation from a cylinder treatment facility is discussed in Section F.3.4.1 of the PEIS.

The statements made in the comment with regards to the "heels" material being a RCRA mixed waste and weighing 120 million pounds at ORR are both incorrect. The "heels" component of the cylinders is not a RCRA mixed waste. If all the K-25 cylinders were emptied at K-25, the total quantity of heels (assuming 50 pounds per cylinder) would be about 230,000 pounds. The amount of U_3O_8 generated at the cylinder treatment facility from the treatment of all of the depleted UF_6 cylinders currently at K-25 would be about 190,000 pounds. It is likely that the cylinder treatment facility would be colocated with the conversion facility. (Please see response to comment 6 above from commentor 87 for more discussion of "heels.")

<u>Comment 25</u>

Page 5-108, Paragraph 3, Section 5.8.2.1, Paducah Site
Page 5-110, Paragraph 3, Section 5.9.2.2, Portsmouth Site
Page 5-112, Paragraph 3, Section 5.8.2.1, Oak Ridge Reservation K-25 Site
Page 5-115, First bullet, Section 5.9, Mitigation

The Clean Air Act contains a Particulate Matter 2.5 (PM2.5) standard.

<u>Response 25</u>

The setting of air quality standards is a process that, although required by the Clean Air Act, is literally done separately from the Act. The new standards for PM2.5 were announced on July 17, 1997. In the fact sheet accompanying the announcement, distinction is drawn between "coarse" fraction particles (from 2.5 to 10 micrometers in diameter, for which the PM10 standards still apply) and "fine" particles (those smaller than 2.5 micrometers in diameter, which are the concern of the new standards). Coarse particles are said in the fact sheet to "come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic," while fine particles "are generally emitted from activities such as industrial and residential combustion and from vehicle exhaust." The major particulate emissions anticipated for *the depleted UF_6 options would come during construction and would be mainly coarse particles (dust) associated with earth moving operations. Particulate emissions anticipated from combustion sources during any phase of the options would be of substantially smaller magnitude. The PM10 analyses currently included in the PEIS are believed to assess the worst case for particulate concentrations for the various options, and are adequate for NEPA analysis. Text has been added to Section C.1 of the PEIS relative to the PM2.5 standard and appropriateness of analyses conducted for the PEIS.*

Comment 26

Page 5-108, Paragraph 4, Section 5.8.2.1, Paducah Site: "Cylinder breaches occurring at Paducah before the year 2020 could result in groundwater concentrations of uranium exceeding 20 µg/L" is not provided for under the Clean Water Act.
Page 5-110, paragraph 4, Section S.5.8.2.2, Portsmouth Site
Page 5-112, Paragraph 5, Section 5.8.2.3, Oak Ridge Reservation K-25 Site
"Uncontrolled corrosion until about 2025 before groundwater concentrations of uranium would approach 20 µg/L" is not provided for under the Clean Water Act or SDWA.

Response 26

The proposed maximum contaminant level (MCL) for uranium (20 µg/L for drinking water at the tap) was used as an evaluation guideline to estimate the potential for adverse environmental effects of the various alternatives to groundwater and surface water. This analysis was conducted only to provide a basis for comparison of the potential environmental impacts of the various alternatives. The text of the three Sections listed in the comment has been revised to indicate that the 20 µg/L level was used as an evaluation guideline, and is not applicable as a standard.

Comment 27

Page 5-115, Third bullet, Section 5.9, Mitigation: "Future impacts on groundwater from failure of a disposal facility could be minimized by selection of a site in a dry environmental setting" should be highlighted and recognized as a major siting factor. The same argument could be made for the storage of "awaiting conversion" cylinders, that are currently deteriorating and corroding.

Response 27

Comment noted. Such factors would be addressed in future studies and analyses if disposal were selected as the management strategy in the Record of Decision for the PEIS.

With respect to cylinders currently in storage, previous substandard conditions such as ground contact and poor drainage in cylinder storage yards have been identified as the cause of external cylinder corrosion. The UF_6 cylinder project management plan (LMES 1997i; the full citation is provided in Chapter 8 of the PEIS) was developed to eliminate these substandard conditions. (The plan is discussed and referenced as LMES 1997d in the Introduction to Appendix D of the PEIS.) Under this management plan, all cylinders must be stored out of ground-contact with enough space to allow for periodic complete inspections. These requirements have necessitated *some yard reconstruction and cylinder relocations; most of this work has already been completed at the three sites. The DOE is confident that the activities required under the cylinder project management plan will maintain adequate safety of the depleted UF_6 cylinder inventory. If the long term storage as UF_6 alternative is chosen in the Record of Decision for the PEIS, future planning and analysis documents would consider a wet versus dry environment as one of the factors in selecting the storage site.*

Comment 28

Page 6-1, Section 6, Environmental, Occupational Safety, and Health Permits And Compliance Requirements: The Clean Water Act/SDWA should also be included as a "potential requirement."

Response 28

The text in Section 6, paragraph 2, states that under Executive Order 12088, federal agencies (including DOE) must comply with applicable administrative and procedural pollution control standards of the Clean Water Act and Safe Drinking Water Act (among others). The next paragraph lists potential requirements "in addition to those in Executive Order 12088." Therefore, the text already states that the Clean Water Act/SDWA must be complied with.

Comment 29

The Division of Radiological Health has the following comments: The discussion of the statistical nature of the hazards posed by radiation exposure was a good addition to this report.

Response 29

The comment is noted by DOE.

Comment 30

Chapter 5 of the PEIS discusses the environmental impacts of the various alternatives. As support for the discussion several graphs are included. On page 5-20 a single graph compares the long term cancer risk (radiation risk) if the material is maintained as UF_6. Pages 5-37 and 5-39 compare the long term cancer risk (radiation risk) for conversion to an oxide and the probability of injury (nonradiation risk) if the material is converted to an oxide. While the report states that the chemical hazards of the material in its UF_6 form are greater than if it is converted to an oxide the omission of a graph showing the probability of injury if the material is maintained as UF_6, leads to an unbalanced representation of the hazards of these two options for the disposition of the material. Also, the combination of all non-radiation hazards as "risk of injury" is a misleading representation.

Response 30

The PEIS presents results in a graphical format in cases in which it was determined that the graphs provide information that supplements that presented in the text. In some cases, such as the number of estimated injuries from on-the-job accidents for long-term storage of UF_6, it was determined that a graphic did not supplement the material presented in the text. The PEIS does not *combine all non-radiation hazards as "risk of injury" as implied by the commentor. The graph on page 5-39 referred to by the commentor is titled "Total Estimated Number of On-the-Job Injuries" and is presented in the section on physical hazards (on-the-job injuries and fatalities from physical accidents). As described in the accompanying text, this graph presents the estimated number of injuries from physical causes and does not present either risk or probability of injury.*

Comment 31

References to the usefulness of the depleted uranium in either its oxide or metallic forms are unsupported. The document states that changing circumstances have made the specific uses mentioned unlikely for the future and yet no other possible uses are adequately addressed. (PEIS 2-20) This makes the position that this material is a resource as opposed to a waste tentative at best. If there are realistic scenarios for the future use of this material, they should be presented in the PEIS. If there are no realistic future uses, then the material should be treated and disposed of as waste.

Response 31

The section referenced in the comment (PEIS 2-20) presents a discussion of uses that were not considered in detail in the PEIS for various reasons. Other uses, such as use as radiation shielding, that are feasible and realistic are discussed in Section 2.2.4, Section 2.2.5, and Appendix H of the PEIS. Depleted UF_6 is not considered a waste material because it contains usable quantities of uranium that under current regulations is considered a source material. The DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products. The State of Tennessee's suggestion that the material should be disposed of if no realistic future uses are identified is noted.

Comment 32

Recommendation number 15 of the Draft Preliminary Report — DOE Independent UF_6 Cylinder Assessment Team dated March 25, 1992, states "All cylinders in or near ground contact should be removed from those conditions, . . . and ultrasonic wall thickness examinations be performed of all cylinders with significant corrosion to determine the amount of residual thickness remaining." At the time of the PEIS, it is mentioned that ultrasonic testing is now part of the cylinder maintenance. (PEIS 2-56) It is also stated. however, that "Because the ultrasonic tests are time consuming and costly only a small portion of the entire inventory has been measured." (PEIS B-2) This is a problem for two reasons. First, it does not begin to meet the minimum of testing all cylinders with significant corrosion. Second, this brings doubt to statements such as "the cylinder breaches were assumed to go undetected for [at most] 4 years (the inspection interval for most cylinders)." (PEIS 2-5) The inspection for most of the cylinders consists only of a visual inspection. The visual inspection method, as described, does not appear to be adequate since many of the cylinders can not be seen on all sides and cylinders that are leaking may not be detected visually since the color of the paint matches the color of the leaking material exposed to air.

Response 32

The inspection program has been upgraded since the 1992 report with improved procedures and training of personnel. Additionally, the relocation program has removed all cylinders in ground contact and storage conditions are being improved at all storage sites. All cylinders have received a baseline inspection, with those cylinders experiencing accelerated corrosion being inspected on an annual basis. These older cylinders have very little paint left on the cylinder body and any reaction products would stand out in contract to the rust color on the cylinders.

From the Ultrasonic data, which continues to be collected, a corrosion model of the cylinder yards has been developed. This model predicts the cylinder population that has lost the greatest wall thickness. This population, once identified, becomes the first candidates for recoating to arrest the corrosion and maintain the wall thickness.

Comment 33

The PEIS states on page 4-3 that "While in storage at the three current storage sites, cylinders were assumed to be inspected and maintained in safe storage consistent with current management practices and plans." Based on the number of breaches detected, the rusting of the cylinders, the improper storage conditions and the documented lack of adequate surveillance of these cylinders, the assumption that material is in safe storage is only true when qualified by the phrase "consistent with current management practices and plans." Essentially DOE is defining their practices and procedures as safe. This allows them to say that a process is safe simply because it meets the standards of the procedure, not because an unbiased safety analysis has been performed.

Response 33

In May of 1995, the DNFSB issued to DOE a recommendation (Recommendation 95-1) regarding the storage of the depleted UF_6 cylinders. This recommendation was as follows:

1. Start an early program to review the protective coating of cylinders containing the tails from the historical production of enriched uranium.
2. Explore the possibility of additional measures to protect these cylinders from the damaging effects of exposure to the elements, as well as any additional handling that may be called for.
3. Institute a study to determine whether a more suitable chemical form should be selected for long-term storage of the depleted uranium.

In June of 1995, DOE accepted Recommendation 95-1 and emphasized five focus areas for DOE response:
1. Removing cylinders from ground contact and keeping cylinders from further ground contact;
2. Relocating all cylinders into adequate inspection configuration;
3. Repainting cylinders as needed to avoid excessive corrosion;
4. Updating handling and inspection procedures and site-specific Safety Analysis Reports; and

5. Completing an ongoing study that will include an analysis of alternative chemical forms for the material

In October of 1995, DOE submitted an Implementation Plan that incorporated completed and near-term actions in accordance with these five focus areas. This plan also committed to managing the cylinders using a systems engineering approach. Through this approach and open dialogue among the DNFSB staff, the following objectives segment the safe storage mission of the program in response to the current condition of the system and the projected life cycle schedule for completing the last phase of the system (Decontamination and Decommissioning).

1. Achieve and maintain acceptable risks
2. Achieve and maintain cylinder integrity
3. Improve conduct of operations
4. Evaluate and monitor containment integrity, and
5. Administer the system

The DNFSB reviews DOE's progress on these items regularly. Additionally, the Board visits the storage sites on a regular basis and has a resident member in Oak Ridge. Therefore, DOE's cylinder management program has been independently evaluated and responses to these evaluations have been undertaken. Accordingly, the safe long-term storage of depleted UF_6 cylinders is a viable option to be considered in the PEIS analysis of management alternatives.

Comment 34

Appendix G of the PEIS, table G-6 compares accident consequences associated with the long term, storage of the material in different chemical forms. Why are the accidents considered differently for the different forms. For example, an earthquake or a tornado are considered under unlikely accidents for the uranium oxide but neither scenario is considered for the UF_6. A comparison of this type would seem to be most useful if it compares the same types of accidents. Another difference is that "unlikely" accidents, for UF_6, are described as having a possible frequency of "l in 10,000 to 1 in 1 million years," while under the uranium oxide option the "unlikely accident" is described as having a frequency of "l in 100 years to 1 in 10,000 years." It is not clear why an "unlikely accidents" would have a different probability associated with it for a different chemical composition?

Response 34

Appendix G of the PEIS describes long-term storage of depleted uranium in three forms: as UF_6, UO_2, and U_3O_8. The difference in the accident scenarios and the frequency of these accidents between the three uranium chemical forms is due to differences in the container holding the material (UF_6 is stored in 14-ton cylinders, while UO_2 and U_3O_8 are stored in 30-gallon and 55-gallon drums, respectively), the response of the uranium physical form to the accident (U_3O_8 is a powder that is relatively unaffected by fire, while solid UF_6 becomes a gas at higher temperatures that reacts with water to form HF and UO_2F_2), and type of storage facility (UF_6 can be stored on outdoor concrete pads while UO_2 and U_3O_8 are stored in buildings). Each of these differences result *in accident scenarios being relatively more important for one chemical form than another. (As an example, a mishandling and drop of a UF_6 cylinder would not lead to any appreciable releases, because UF_6 is a monolithic solid, while a mishandling and drop of a U_3O_8 drum could result in drum failure and entrainment of the particulate U_3O_8 by atmospheric air. The consequences of this postulated accident scenario would be greater for U_3O_8 compared to UF_6.)*

The description of the frequency range for "Unlikely Accidents" in Table G.6 has been corrected to indicate that an Unlikely Accident will have a frequency of between 1 in 100 years to 1 in 10,000 years.

Comment 35

There are a number of questions about the characterization of the hazards from earthquakes at the Paducah, KY location. These questions are outlined in an attached memo from a State geologist.

Regarding the information you provided on the above referenced document, please refer to the attached information from the Center for Earthquake Research and Information (CERI), at Memphis University.

The Draft PEIS seems to not only down-play past seismic events but gives very little information on future potential events. By all accounts, the Paducah area is located in a high-risk area for major damage from earthquakes (see attached seismic risk map). In comparison, the Oak Ridge, area is located in a moderate-risk area and experiences fewer and less severe earthquakes. The information presented by this document might be more accurate for the East Tennessee area but seems to be an understatement for the Paducah plant area.

Response 35

Specific questions from the State of Tennessee about the characterization of earthquake hazards at the Paducah site are addressed in individual responses to specific comments (i.e., see responses 34 and 36 to Commentor No. 87. The safety of current storage of depleted UF_6 cylinders was addressed in the safety analysis reports (SARs) for each of the three storage sites that the Department issued in February 1997 (LMES 1197f-h). The PEIS reference list (Chapter 8 of the PEIS) provides the full citations for these references.

The SARs considered a range of potential accident scenarios that could be associated with current storage activities, including natural phenomena events such as earthquakes and tornadoes. The accidents considered in the PEIS for current depleted UF_6 cylinder storage were extracted from those evaluated in the SARs. The accidents selected for the PEIS analysis were those accident scenarios in the SARs that resulted in the greatest potential consequences at each of the three storage sites. These accidents did not include the earthquake scenarios which were found in the SAR analyses to have lessor consequences than the accident scenarios discussed in the PEIS. The text in Section D.2.2 of the PEIS has been modified to clarify this point. If the safety analysis reports are *revised in the future, DOE will modify its cylinder mangement program to ensure that the safety of the cylinders is maintained.*

<u>Comment 36</u>

The article on earthquake intensity gives a good explanation for how we can determine the extent of damage a seismic event can cause to manmade and natural objects in a particular place. The Modified Mercalli Scale describes intensities in physical terms that can be related by personal or observable results, thus more subjective. By contrast, the Richter Scale is a specific measurement of magnitude or energy released during an earthquake and is determined at the time of the event. While every earthquake can have many intensities, depending on distance from the epicenter, it can only have one measurement of magnitude. While magnitude measurement provide useful data for scientific research, including accurate comparison of earthquakes, they give no specific information about the damage or other effects caused by an earthquake.

For specific information an the probability or frequency of significant seismic events, please refer to the CERI attachment.

<u>Response 36</u>

The discussion on seismic events for all three sites for continued storage has been modified to include references to Safety Analysis Reports in which much more detailed information on seismic risk can be found. (See Sections 3.1.4.1, 3.2.4.1, and 3.3.4.1 of the PEIS.)

Commentor No. 88: Thornton, Tara
Military Toxics Project

<u>Comment 1</u>

The Military Toxics Project adamantly opposes any use of the depleted uranium for military purposes such as in weaponry and munitions. First used in the Persian Gulf War in 1991, U.S. and British forces used depleted uranium as both armor piercing bullets and as tank armor. When uranium weapons burn, when they corrode and when they are machined, uranium oxide dust is created. The U.S. Department of Defense estimates approximately 315 tons (630,000 pounds) of depleted uranium were fired in the Gulf. This firing resulted in the release of large amounts of DU dust which contaminated thousands of tanks, vehicles and land.

<u>Response 1</u>

Comment noted.

<u>Comment 2</u>

Recently, the Military Toxics Project released a report with Swords to Plowshares and the National Gulf War Resource Center called the Depleted Uranium Case Narrative. The report details how hundreds of thousands Gulf War Veterans may have been exposed to DU radioactive dust in the Gulf War. I have enclosed a copy for your review.

The task you are charged with now is to find the most safe and effective way to manage/use DU. When reviewing the comment for the Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management of Depleted Uranium Hexafluoride, we hope you will weigh these comments on how DU is used. Dealing with the tremendous stockpiles of Depleted Uranium Hexafluoride is a monumental task. We wish you well and if you have any questions, please don't hesitate to call.

Response 2

Comment noted. The DOE is using all available information to determine the most appropriate management strategy for the depleted UF_6 inventory.

Comment 3

All too often we see industry and government with end of the pipe mentality, redefining waste as a product to be used. For example the paper industry's waste they call fertilizer and spread sludge on unsuspecting communities, further exposing citizens to toxics. Changing the medium doesn't necessarily reduce the risk. We hope the Department of Energy will start working towards more preventative based solutions in the future.

Response 3

Comment noted.

Commentor No. 89: Paperiello, Carl J.
U.S. Nuclear Regulatory Commission

Comment 1

Assumption of Future Potential Use: While we agree that the use of UF_6 is desirable, we recommend that DOE include in the PEIS an alternative that addresses UF_6 for which no use can be found. The PEIS does not provide information indicating a market demand capable of consuming 100% of the depleted uranium (DU) inventory and notes that "potential uses that are capable of consuming a substantial fraction or all of the inventory . . . are not yet fully developed . . . ." In fact, very little of the material has been used in the decades over which it has been generated and it is not clear that all of it will be used in the future, as DOE has assumed in its preferred alternative. The existing management plan for depleted uranium described on page S-3 explicitly recognizes that future uses may not be found. In this regard, the Council on Environmental Quality (CEQ) recommends that an environmental impact statement (EIS) contain ". . . all reasonable alternatives . . . Reasonable alternatives include those that are practical or feasible [emphasis in original text] from the technical and economic standpoint and using common sense, rather than simply 'desirable' [emphasis in original text] from the standpoint of the applicant." ["Forty Most

Frequently Asked Questions Concerning CEQ's NEPA Regulations, 46 FR 18027, March 23,1981]. An alternative that recognizes that uses may not be found seems appropriate for the PEIS, given this CEQ guidance.

Furthermore, CEQ recommends that existing management plans be included as alternatives in EISs. One of the two CEQ interpretations of the "no action" alternative is "no change" from current management direction, i.e, continuing with the present course of action. Under the current DOE management plan for UF_6, if alternative uses have not been found to be feasible by approximately the year 2010, steps would be taken to convert the UF_6, to U_3O_8, beginning in the year 2020. The U_3O_8 would be safely stored until there was a determination that all or a portion of the depleted uranium was no longer needed. At that point, the U_3O_8 would be disposed of as low-level radioactive waste. Thus, our concern about future uses not developing as projected in the PEIS would be addressed by following this CEQ guidance.

<u>*Response 1*</u>

After careful consideration of comments, DOE revised the preferred alternative for the final PEIS. The preferred alternative, as stated in Sections S.5.1 and 2.5 of this final PEIS, calls for prompt conversion of the depleted UF_6 inventory to U_3O_8 and long-term storage of that portion of the U_3O_8 that cannot be put to immediate use. Under the revised preferred alternative, conversion to depleted uranium metal would take place only if uses for the metal product become available. The impacts of the preferred alternative are discussed in Sections S.5.2, 2.5.2, 5.7, and 6.3.7 of the PEIS.

The no action alternative evaluated in the PEIS involves continued storage and maintenance of depleted UF_6 in cylinders at the three current storage sites through the year 2039. This definition of the no action alternative is consistent with the CEQ guidance as outlined in the comment. The no action alternative was intended to provide a baseline against which other management strategies could be measured, including strategies involving conversion, storage, and disposal of depleted uranium oxide.

<u>Comment 2</u>

Also, the discussion does not address regulatory and licensing requirements for the DU applications. It is recommended that (1) DOE identifies the likely market consumption of DU oxides and metals over the time frame of the EIS, (2) DOE estimates the impacts from these potential DU uses, (3) DOE considers the potential of the converted DU materials becoming a waste, thus, requiring conversion into forms compatible with disposal, and (4) DOE evaluates the likely regulatory and licensing aspects of potential uses.

<u>*Response 2*</u>

The U.S. NRC's recommendations are addressed below in the order that they are listed in the comment:

1. The PEIS evaluates two representative use options, use as uranium oxide and use as uranium metal as radiation shielding. As stated in Appendix H of the PEIS, these options were intended to be representative only, and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Consequently, discussion of issues related to specific uses is considered beyond the scope of the PEIS. Such issues would be considered and evaluated in more detail in future planning and environmental analyses.

2. The impacts associated with a specific use will depend on what use or uses are ultimately identified, which is beyond the scope of the PEIS. As mentioned above, the PEIS is not intended to select a specific end-use or preclude other potential uses in the future. Any commercial use of depleted uranium would take place under a U.S. Nuclear Regulatory Commission (NRC) license or a waiver from the NRC. Potential impacts from such use would be analyzed before a license or waiver could be obtained. The impact analysis would focus on demonstrating the protection of the health and safety of both the public and workers from the proposed use and would consider both normal and accident conditions. As with the use of any radioactive material, careful consideration would be given to whether the benefits of the proposed use outweigh the potential risks.

3. The PEIS did not address in detail the ultimate disposition of uranium after use because actions to be taken beyond the 40 year period considered in the PEIS (with the exception of long-term disposal impacts) are considered highly uncertain and speculative at this time. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.

4. The purpose of the PEIS is to provide an evaluation and comparison of potential environmental impacts associated with the alternatives considered. Regulatory and licensing aspects are outside the scope of the PEIS, but would be addressed, as appropriate, when specific uses are identified.

Comment 3

In addition, DOE's assumption that all of the depleted uranium can be used in the future appears to mean that the UF_6 would be stored onsite as it is stored now, until uses actually develop. The PEIS states that conversion to metal or oxide would not begin until uses for these products become available, and that safe management of the cylinder inventory in accordance with existing practices would continue until all of it had been converted for use. Thus, if no significant uses were to develop, the PEIS would in effect be endorsing an alternative that continues to spend resources indefinitely on maintaining and monitoring the steel containers, to expose workers to radiation in performing these functions, and to put off a long-term plan for disposal.

Response 3

The preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of applications for depleted uranium products. There is currently no long-term plan for disposal.

Comment 4

Additional Evaluation of Combination of Alternatives: While the combination of 50% use as uranium oxide and 50% use as uranium metal is evaluated in the PEIS, other combinations, assuming DU applications are not forthcoming, would be beneficial. One example would be to assume only 50% inventory use altogether, and the remaining 50% requiring conversion to a more stable form and disposal. Again, this seems appropriate due to the uncertainty of inventory use.

Response 4

It is possible that DOE will select as a management strategy a combination of two or more of the six PEIS alternatives, such as converting and using some portion of the inventory and storing the remainder. Because it is impossible to evaluate all possible combinations of alternatives, the parametric analysis presented in Appendix K of the PEIS was included to allow the environmental impacts of such combinations to be estimated. The discussions of the preferred alternative in Sections 2.5.2 and 5.7 show one example combination. Additional examples of how the impacts are calculated for different combinations of alternatives are provided in Section K.7 of Appendix K.

Comment 5

Ranking of the Alternatives: The summary of the results (page S-15 et seq) does not include a ranking of alternatives, and implies that all of the alternatives are acceptable, but that there is one "preferred alternative." DOE may wish to rank or identify those alternative(s) that appear more favorable than others based upon the analysis. DOE may also want to consider and mention if any of the proposed alternatives are precluded by the analysis. For example, page 5-84 mentions individual doses from groundwater ingestion of 100 mrem/yr from disposal in shallow earthen structures, far in excess of 10 CFR Part 61 standards of 25 mrem/yr. Page 5-84 also mentions a scenario for a hypothetical future resident living on the disposal site and receiving radiation doses as high as 10 rem/yr. These limitations should be included in the summary.

Response 5

The purpose of the PEIS is to provide a meaningful evaluation and comparison of the potential environmental impacts of broad alternative management strategies. Thus, the summary and main body of the PEIS provide a discussion and comparison of potential impacts among the alternatives. In general, alternatives cannot be easily or meaningfully "ranked" in an overall sense because potential impacts occur in several different environmental areas, such as impacts to human health and safety, groundwater, air quality, and ecology. No one alternative offers advantages in all environmental areas, making any "ranking" of alternatives very subjective. Consequently, the PEIS discusses and compares the potential impacts of the alternatives in each area separately. The results of the PEIS indicate that all alternatives have generally similar environmental impacts, although differences do exist in the types and magnitude of impacts for some areas assessed, as discussed.

In addition, the PEIS indicates that no alternatives are precluded on purely environmental grounds. Although the results of the disposal alternative indicate that radiation doses to individuals could potentially exceed regulatory limits for disposal in a "wet" environment at some point in the distant future, the analysis also indicates that impacts would remain within regulatory limits for a disposal facility in a "dry" environment. The PEIS also stresses (see Appendix I) that the post-closure disposal analysis is based on generic information and is subject to a great deal of uncertainty. Actual impacts from disposal would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required.

Comment 6

Use of the Term "Uranium Oxides": The PEIS generally combines all uranium oxide compounds, U_3O_8, and UO_2, under the title "uranium oxides" for consideration in the alternatives and strategies (see page S-6 et seq). This seems too all inclusive, as uranium oxides have significantly different chemical and physical properties that produce a wide range of environmental health and safety impacts. For example, U_3O_8 is a high porosity powder, with a low density and a significant respirable fraction. UO_2 powder is also porous, and can spontaneously ignite in air. On the other hand, when UO_2 is sintered, a process involving high temperatures to reduce porosity, increase density, and decrease volume, it has the highest density of the uranium oxides and is essentially pore free. The presence (or absence) of pores also has significant implications for the potential disposal of the material, either as a management option or as an end-use item; a denser, essentially pore free material would appear to be advantageous due to lower leaching potential. Thus, a dioxide material sintered to a lower density (i.e. 4-5 g/cm^3) would not be expected to perform as well in a disposal environment as a uranium dioxide sintered to a high density (i.e. 9-10 g/cm^3). It is recommended that more qualifiers are given to the term "uranium oxides," perhaps including low and high density as the principal discriminator.

Response 6

The PEIS recognizes the differences noted in the comment among different chemical forms of uranium oxides. In fact, the analyses were done separately for conversion to and storage and disposal of U_3O_8 and UO_2. The results are also reported separately for these two chemical forms (see Section 5 and Appendices D through K of the PEIS). The impacts of long-term storage as oxide and disposal as oxide alternatives are reported in Section 2 and in the Summary as ranges covering both forms of uranium oxide as well as differences in assumptions concerning environmental settings (see section 4.2.3 of the PEIS). The reason for this was to clearly define the differences among the alternatives and at the same time, allow the reader to explore the chemical specific aspects of the management options considered in the PEIS. Although the headings of sections and the names of management options and alternatives refer only to oxides, the results in Section 5 and Appendices are reported as chemical specific. In evaluating the impacts of the long-term storage as oxide, use as oxide, disposal alternatives, and the preferred alternative, the PEIS evaluated two conversion technologies that produce UO_2 with vastly different densities. Therefore, included in the ranges of impacts provided for options involving UO_2 are differences in performance due to density variations. Because the PEIS is not intended to select specific technologies, the advantages or disadvantages of the density variations among the various forms of depleted uranium oxides are sufficiently addressed in the PEIS for the comparison of the broad programmatic alternatives.

<u>Comment 7</u>

Equivalent Bases and Life-Cycle Effects, the Cradle-to-Grave Approach: The text does not seem to incorporate a life-cycle approach to the different management alternatives and compare them on an equivalent basis (see pages S-7 et seq). For example, even if a market exists for potential uses of the depleted uranium (DU), at the end of the product's useful life it is still radioactive ($t_{1/2} = 4.5 \times 10^9$ years) and will require disposition. Thus, disposal would seem to be the logical endpoint for all of the alternative branches shown in Figure S-2, instead of only for the disposal as oxide alternative. Following the DU product from cradle to grave thereby influences the impacts and potentially the alternative(s) selected. It would seem that the "manufacture and use" alternatives will ultimately result in impacts from the DU component, for example, the material (perhaps as itself or in a product) could be shipped to a disposal facility. Such potential impacts do not appear to be included in the analysis, and may even preclude some options or require additional conversion and conditioning. For example, without supporting analyses, it is unlikely that significant quantities of DU metal can meet the regulatory requirements of disposal sites due to high solubility and the formation of hydrides. Thus, pursuit of use as a metal option may require another conversion facility to convert the DU metal into a form compatible with disposal. In addition, the long-term storage alternative also appears to lack the realization of ultimate disposal in the future. The PEIS should consider and analyze the alternatives on an equivalent basis with the same/comparable endpoints and include life-cycle effects.

Other examples of the need for equivalent bases include the oxide conversion routes, due to fundamental differences in the uranium oxide forms. One of the specific oxide conversion routes (gelation) appears to be manufacturing UO_2 with properties comparable to high density nuclear fuel. This process would be anticipated to have improved stability and related properties as compared to the other oxides. The gelation route detailed in the PEIS appears to include two plants — one for U_3O_8 production and one for dissolution/UO_2 production:

$$UF_6 \rightarrow U_3O_8 \rightarrow UO_2$$

This appears inconsistent with literature reports on the process which maintain that no production of U_3O_8 is necessary. The process described in the PEIS would cause double the impacts by performing a two step process when the same result is achievable in a one step conversion from UF_6 to UO_2.

<u>Response 7</u>

The analysis in the PEIS was intended to provide a comparison of reasonably foreseeable environmental impacts for each of the alternatives considered. Consequently, the potential environmental impacts were evaluated for a 40 year assessment period for all alternatives. In addition to this analysis, an evaluation of the long-term impacts from disposal was included in the PEIS because such impacts can be reasonably predicted. A life-cycle analysis for the alternatives other than disposal was not performed at this time because actions to be taken beyond the 40 year period considered in the analysis are considered highly uncertain and speculative. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.

The gelation process analyzed in the PEIS includes U_3O_8 production and dissolution, but does not require two plants. The basis for the gelation process in the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) is the Oak Ridge Report ORNL/TM-6850, "Chemical Flowsheet Conditions for Preparing Urania Spheres by Internal Gelation" (July 1979). The ORNL flowsheet provided a complete design to convert UF_6 to U_3O_8, and supplied the process information needed to prepare a material balance and flowsheet to convert U_3O_8 to UO_2 microspheres by gelation. The gelation process described in the above referenced ORNL report and used in the PEIS was judged to be the best available. However, this technology has not yet been fully developed and improvements are likely to occur. The process used for the PEIS can be considered to be reasonable and suitable for impact analysis.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 8</u>

Results of the Analyses: Pages S-15 et seq summarize and compare the results of the impacts for the alternative management strategies. Some of these results seem inconsistent and are not intuitively obvious. For example, it is not clear why the use as uranium oxide results in higher impacts than the use as uranium metal (see pages S-20 and S-49)- the opposite would be anticipated. A more rigorous analysis of the assumptions made in the Engineering Analysis UCRL-AR-124080 is recommended (see specific comments #20 (now 35)). In V2, Section 6.11, Potential Shielding Applications, a large disparity is evident between the damage fractions assumed for uranium metal (1%) and those assumed for uranium dioxide (100%). Again, this seems questionable based on the pyrophoricity of uranium metal upon heating. Furthermore, the airborne release fractions are orders of magnitude lower than what is recommended in the DOE Accident Analysis Handbook 3010-94. These calculations should be examined more closely to confirm DOE's conclusion.

Furthermore, it is unclear whether or not the disposal analyses include all of the potential long-term impacts and doses from uranium leaching from the disposal area. It is recommended that DOE consider greater consistency in the results and clarify the summary.

<u>Response 8</u>

With respect to differences in impacts from accidents between the use as oxide and use as metal alternatives, many categories of accidents are summarized in Tables S.2 and 2.2 of the PEIS. In general, the impacts of accidents from use as oxide and use as metal are the same (see Categories "Likely Cylinder Accidents," Low Frequency-High Consequence Cylinder Accidents, Low Frequency-High Consequence Accidents at All Facilities-Chemical Accident). One category of accident, namely Low Frequency-High Consequence Accidents at All Facilities-Radiological Accident, does have higher consequences for the use as oxide alternative than the use as metal alternative. This is due to the specific accident scenarios appropriate to the technologies being evaluated (see also response to Commentor No. 89, Comment 35); additional information on the accident scenario assumptions for manufacture and use is given in Section H.3.2 of Appendix H, and in the engineering analysis report (LLNL 1997; the full citation is provided I Appendix H of the PEIS). However, in general the results of accident impact analyses for the use as oxide and use as metal alternatives were considered to be approximately the same. (The engineering analysis report is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC [listed in the Notice of Availability], and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.)

Much of the difference in predicted consequences for accidents involving U_3O_8, UO_2, and uranium metal are associated with the form of the material. U_3O_8 is an easily-dispersed powder, whereas only the oxide coating on uranium metal billets can be readily dispersed. Releases from drops of UO_2 pellets are somewhat more similar to releases from drops of metal billets. Text has been added to Section 5.5.1.2.2 (page 5-71 of the Draft PEIS) to clarify the reasons that the consequences of some of the accidents associated with the use as metal alternative are lower than those associated with the use as oxide alternative.

The DOE accident handbook (DOE-HDBK-3010-94) was used in deriving release fractions for the accidents modeled; in instances where the conditions of the modeled accident supported it, *the median values were used instead of the bounding values. See the response to Commentor No. 89, comment 35 for further details. In general, the methods used in the engineering analysis report required that the damage fraction and release fraction be considered together.*

The disposal analyses do include long-term impacts and doses from leaching from the disposal area; these impacts are discussed in detail in Section I.4 of Appendix I and presented in Tables S.2 and 2.2 under "Water and Soil." Text has been added to Tables S.2 and 2.2 under "Human Health and Safety-Normal Operations" to indicate long-term post-closure impacts from disposal.

<u>Comment 9</u>

Waste Management: In Section S.4.8 on page S-40, waste management impacts are discussed. DOE should consider briefly highlighting the potential uranium content of the secondary streams (i.e. CaF_2, MgF_2), along with a brief assessment of acceptability for either reuse/nonradioactive disposal or disposal as radioactive waste. The uses and demands for the by-products of conversion (HF, CaF_2,) should be explored and discussed. DOE should expand the discussion in the last paragraph about uranium disposal as low-level waste (LLW).

<u>Response 9</u>

Although there are uncertainties in the predicted uranium content of secondary waste streams, estimates of the potential uranium content of CaF_2 are given in Sections S.4.8, 2.4.8, 5.3.7, F.3.7.1, and F.3.7.2 (i.e., less than 1 ppm). An estimate of the potential uranium content of MgF_2 is given in Section F.3.7.3 of the PEIS (i.e., 90 ppm). This estimate has been added to Sections S.4.8, 2.4.8, and 5.5.7, as requested by the commentor.

With respect to the fate of the CaF_2, the PEIS does state in Sections S.4.8 and 2.4.8 that "the low level of uranium contamination expected (i.e.,less than 1 ppm) suggests that sale or disposal as nonhazardous solid waste is most likely." If disposal of CaF_2 is required, the PEIS acknowledges that it may be considered LLW, and assesses the impacts for both disposal as nonhazardous solid waste and disposal as LLW. Currently there are no known uses for the MgF_2 that would be produced if the use as metal alternative were to be selected; it is therefore assumed that this MgF_2 would require disposal either as nonhazardous solid waste or as LLW. Brief discussions of the market for anhydrous HF and historical industrial experience showing that if produced, it could be purified to contain less than 1 ppm uranium, are provided in Sections 2.3.3 and F.2.1 of the PEIS. Text has been added to Sections S.4.8 and 2.4.8 to clarify the assumption made in the PEIS that if HF were produced, it would be sold for use subject to appropriate review and approval by the U.S. NRC or DOE..

As noted in Section I.4 of Appendix I, the disposal calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be *considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. Rather than cite regulatory agency positions that may not be applicable to the disposal of depleted uranium oxide in the summary of potential waste impacts, text has been added to Sections S.4.5 and 2.4.5 (Water and Soil Impacts) detailing some of the uncertainties of the non-site-specific analysis for disposal, and stating that if disposal were implemented in the future, all disposal activities would take place in accordance with applicable rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option).*

Comment 10

Furthermore, the DOE may wish to cite the Louisiana Enrichment Services (LES) Final EIS (NUREG-1484) analysis. The NRC documents provide analyses supporting DU disposal as a LLW, but note that its disposal could require a mine or another means of "deep" (rather than near-surface) disposal. Similar to the conclusion drawn in the PEIS, the LES EIS determined near-surface disposal would cause accedence of 10 CFR Part 61.41 requirements. Currently, no "deep" disposal sites exist, and all current LLW disposal sites (existing and planned) use near-surface facilities.

Response 10

A brief discussion of the LES EIS, including comparison of doses from disposal in near surface and deep disposal sites, has been added as part of the new Section 1.7 of the PEIS. It should also be noted that the disposal calculations in the PEIS are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. Text has been added to Sections S.4.5 and 2.4.5 (Water and Soil Impacts) detailing some of the uncertainties of the non-site-specific analysis for disposal, and stating that if disposal were implemented in the future, all disposal activities would take place in accordance with applicable rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option). (Please see also the response to comment number 5 from Commentor 89.)

Comment 11

DU Use as Spent Nuclear Fuel (SNF) Cask Shielding: DOE appears to be relying upon the potential future use of DU as SNF cask shielding for a large consumption of its DU inventory (see page S-43 and 1-8, and Volume 2 of the EAR, which analyzes a DU cask manufacturing facility as the only use of DU). If this is indeed the case, DOE may wish to discuss it in more detail in the PEIS summary, and it should be noted that no currently licensed or planned SNF cask uses of DU.

Response 11

As described in Section 2.2 of the PEIS and in detail in Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, were selected as representative options to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses. While it is true that depleted uranium is not used in currently licensed spent fuel storage or transportation casks, this does not preclude development of such a use in the future.

Comment 12

Fate of DU SNF Cask Shielding: As currently written, the PEIS does not include a discussion of the eventual fate and potential impacts of the DU SNF cask after use (pages 2-14 and 2-15). Pages 5-55 and 5-65 mention that "no assumptions are made regarding the fate of the cask after use," and page 5-65 notes that disposal would amount to an additional 180,000 cubic meters (6.4 million cubic feet) of waste requiring disposal, with a (calculated) average specific gravity of 2.2. This does not seem inconsequential, particularly if a dedicated disposal facility is required and the impacts are estimated to be similar to disposal (e.g., page 5-83 et seq; exceeding 10 CFR Part 61.41 dose limits). Also, there are statements in the document that question if significant quantities of DU metal are suitable for disposal (e.g., last paragraph on page 2-21). Inclusion of a discussion about the disposition of the DU cask after use, and potential impacts, is recommended.

Response 12

The PEIS acknowledges that at the end of their useful lives, products containing depleted uranium could be stored, recycled for other uses, or treated and disposed of as low-level waste (see Sections 2.2.4, Section 2.2.5, and Section 5.9 of the PEIS). At this time, any analysis of disposal after use would be too speculative as it is not known when and at what rate the material would be declared surplus and would be disposed of. These issues are discussed in Section 5.9 of the PEIS.

Comment 13

Technology and Equipment Development: The PEIS encompasses numerous technologies that are at different stages of development, in terms of process, understanding, equipment, (potential) impacts, and uncertainties. For example, of the conversion, application, and disposal impacts discussed within the summary, none are practiced on any scale domestically, and only conversion to U_3O_8 is practiced on a large scale internationally, producing a low density product. Thus, there is only one direct analogy. DOE should consider including a technology discussion, with status and assessment, perhaps with either a time schedule or probability of success, for some of these technologies. For example, it seems like a significant extension of existing uranium dioxide sintering technology to take pellets from 100 te(U)/yr/line to 7,000 te(U)/yr/line. From the uranium dioxide technology perspective, microspheres (e.g., from gelation) may be the more mature technology because of the (potential) use of tube furnaces and pilot plant tests with equipment processing rates an order of magnitude larger. Similarly, a uranium dioxide/concrete cask approach appears to be a significantly easier technology to understand and scale then casting a 40 te(U) metal shield.

<u>Response 13</u>

Subsection 1.2.6 in each Section 6.0 of the engineering analysis report (EAR)(LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS) discusses the process and equipment uncertainties associated with each option. In general, the conversion to oxide and the batch conversion to metal processes are well known with extensive operating experience. The continuous reduction to metal process requires development and extensive scale up. Oxide shielding manufacture is a simple process but needs to be demonstrated. Metal shield manufacture requires large-scale melting, casting, and machining that needs development.

Conversion of UF_6 to U_3O_8, recovery of 70% HF, oxide compaction, packaging in bins, and storage inside buildings is performed on a large scale (15,000 tonnes per year) by COGEMA in France, to stabilize depleted UF_6. Recovery and upgrade of the 70% HF to anhydrous HF (AHF) has not been demonstrated. The EAR assumed production of AHF using a process patented by J. Mestepey of Sequoyah Fuels. The AHF process needs verification and demonstration.

Conversion of UF_6 to UO_2 ceramic pellets is performed in nuclear fuel fabrication plants (500 tonnes per year). The pusher-type furnaces used for fuel pellet sintering would not be suitable for large throughputs. Equipment development is needed for the sintering furnaces. But the throughput for pressing and sintering is not unusual for the ceramic industry.

Production of UO_2 nuclear fuel microspheres by gelation has been successfully tested in pilot-scale units. For large throughputs, the gelation liquid effluent must be recycled to avoid high reagent costs and waste disposal costs. A recycle process must be developed for gelation to be viable.

Batch reduction to uranium metal is a mature industrial process used to produce metal for nuclear fuel, penetrators, and armor. Higher production rates can be achieved by adding more batch furnaces. A system to decontaminate the MgF_2 product was installed at Aerojet (Jonesborough, TN).

Continuous reduction to metal research was conducted at Oak Ridge Y-12. Extensive development and scale-up would be needed.

Oxide shielding applications (DUCRETE cask) was researched at the INEEL. Development work is continuing at Nuclear Metals Inc. The process is similar to concrete mixing.

Batch melting and casting to produce uranium metal fuel and other products is a standard industrial process. Metal shielding applications (metal cask) will require large-scale melting and *casting of uranium metal. The single pour concept to cast the annular shield requires extensive development.*

The technologies used in the PEIS to analyze the environmental impacts of the management options and the alternatives were selected based on the evaluation and recommendations of a panel of independent technical reviewers (ITRs). One of the criteria used by the ITRs to evaluate the technologies was the technical maturity. For the technologies that had no prior history, the ITRs were asked to estimate time-to-availability and consider the probability of success. Only those technologies that were estimated to be available in the time frame when they would be needed were considered in the engineering analysis report and the PEIS. The reviews by and the recommendations of the ITRs are documented in "Technology Assessment Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1995). The technology assessment report is available through the National Technical Information Service (NTIS) by calling 1-800-553-NTIS (6847) or (703) 605-6000. The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 14

Existing Facilities and Experience: There are obvious analogies with existing, commercial fuel cycle facilities, which process uranium hexafluoride into uranium dioxide (for nuclear fuel) and (to a lesser extent) uranium metal. On an international scale, COGEMA has been converting UF_6 to U_3O_8, compressing it in steel containers, and storing the containers in metal reinforced seismic buildings since 1977 to avoid the hazards of storing UF_6. These facilities are already licensed by the appropriate regulatory agencies. The PEIS does not mention these facilities, either as a source of experience or as a source of processing capacity, particularly during the development of uses for the DU materials and as a means for surge capacity. The PEIS also does not appear to draw upon the operating experience of these facilities, including waste generation and uranium content of byproducts. Reliance upon existing facilities may lessen environmental impacts associated with the construction of a new facility. Thus, DOE may wish to include the experience of operating commercial facilities and comment upon their potential use (or nonuse) during the development of applications for the DU.

Response 14

Information on commercial uranium facilities were used in the development of the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). Emission and waste generation data from UO_2 fuel fabrication facilities (Columbia, SC; Wilmington, NC; and Hanford, WA) and UF_6 plants (Metropolis, IL; Gore, OK) were reviewed. The data were used as guidelines, but extrapolation was not possible due to different plant design, process, and off-gas treatment.

The UF_6 to U_3O_8 conversion process in Section 6.5 ("U_3O_8: Defluorination/HF Neutralization Facility") of the EAR is based on the COGEMA process practiced in France. Similarities included using identical chemical reactions, reagents, and temperatures to convert UF_6 to U_3O_8, and compacting the oxide product to increase its bulk density. Differences included using two separate reactors in series instead of a single reactor for conversion, and neutralizing the 70% HF product to form CaF_2.

Nuclear Metals Inc. (Concord, MA), a producer of uranium metal for commercial applications, is assisting in the development of depleted uranium uses. The company currently has a contract to develop oxide (DUCRETE) shielding material.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 15

Economic/ Socioeconomic Analyses: The PEIS mentions a separate Cost Analysis Report (CAR) as providing input to the PEIS (page 1-7). However, program costs do not appear to be included in the analyses. DOE should consider including a brief comparison of the costs and other economic impacts in the PEIS, perhaps as part of the summary (e.g., in Table S-2). Also, from a socioeconomic standpoint, all the alternatives considered will create jobs. DOE should address whether or not the areas chosen for construction can sustain the necessary development that will accompany the influx of workers.

Response 15

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives is generally not considered an environmental impact; consequently, cost information is not provided in the PEIS. However, cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

In addition, the cost information is used as input to the socioeconomic analysis presented in both the summary and main body of the PEIS. The PEIS addresses socioeconomic impacts on human communities, including changes in employment, local housing demand, public finances, and population in-migration. More detailed site-specific analysis including whether or not the areas chosen for construction can sustain the necessary development that will accompany the influx of workers would be addressed in future planning and analysis documents.

<u>Comment 16</u>

Fuel Cycle Process: In the background section of the summary on pages S-1, S-2, DOE may want to briefly explain the fuel cycle process and point out the various forms of uranium at each stage. This would help elucidate the natural occurrence of U_3O_8 and substantiate its suitability for disposal alternatives.

<u>Response 16</u>

The discussion of the properties of depleted uranium hexafluoride has been expanded in the background section of the summary and Chapter 1 of the PEIS to provide additional information concerning the material's properties. However, a discussion of the fuel cycle was not considered necessary for the purposes of the PEIS in that the PEIS considers management options for the by-product (depleted UF_6) of one phase (enrichment) of the entire fuel cycle. The suitability of different uranium compounds for disposal is summarized in Appendix I of the PEIS.

<u>Comment 17</u>

Mass of DU: The insert on page S-2 identifies some 46,422 DU cylinders distributed between the three sites. While the total quantity is listed in the main text of the report, it would be helpful to have the approximate masses (as either MTU or $MTUF_6$) for the three sites listed in the summary as well.

<u>Response 17</u>

The text of the insert in Section S.1.1 and the text in Chapter 1 of the PEIS have been revised to include the quantity of depleted UF_6 in metric tons.

<u>Comment 18</u>

United States Enrichment Corporation DU: The insert on page S-2 also notes that an additional 8,000 cylinders have been produced by USEC. It is suggested that this number is also divided between the sites and expressed in mass quantities. It is also recommended that a brief discussion about the USEC DU be included, perhaps as part of the first paragraph on page S-4. While the EIS excludes the USEC DU from its analysis, it also implies that there is a reasonable probability of it becoming DOE's responsibility. Consequently, DOE may want to consider that possibility in its impact analysis.

<u>Response 18</u>

The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993 that became the responsibility of the DOE by the signing of two Memoranda of Agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS). In addition, the text in the summary and in Chapter 1 of the PEIS have been revised to include the quantity of depleted UF_6 in metric tons.

Comment 19

Summary Table S.2: On pages S-17 and S-18, irreversible adverse health effects as well as adverse effects are identified for cylinder accidents. This terminology should be defined and explained by a footnote in the table. A more quantitative measure of chemical effects should be included, as uranium toxicity is a major concern that needs to be addressed. In addition, the cylinder accident scenarios should indicate estimated quantities of the releases of uranium and HF shown in the table including the time period of exposure and length of time of the release. Finally, DOE should indicate exposures to involved workers instead of only exposures to the public and non-involved workers.

Response 19

Due to the great volume of material summarized in Table S.2 (titled "Summary Comparison of Potential Environmental Consequences of Alternative Management Strategies), when additional information is desired, it is necessary to consult the accompanying text. Brief definitions of the terms "adverse effects" (mostly mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function) and "irreversible adverse effects" (effects permanent in nature, such as lung or kidney damage) are given in Section S.4.2.2. A more detailed discussion of these terms is provided in Section 4.3.2.1 of the document. The quantitative levels that are associated with these effects are stated in Section 4.3.2.1.

Again, because Table S.2 is summarizing impact analyses for all technical areas (not just accident impacts), the inclusion of release quantities and durations for specific accidents was considered to be too detailed for this table. These release quantities and durations are given in Tables D.6, E.4, F.7, G.6, H.5 and I.9 for all the accidents evaluated for the various management options. The supporting document entitled "Facility Accident Impact Analyses in Support of the Depleted Uranium Hexafluoride Programmatic Environmental Impact Statement" (Policastro et al. 1997) also discusses the assumption that the period of exposure is approximately equal to the length of time of the release. This document is available for review at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

The reason that effects of accidents on involved workers are not quantitatively estimated is summarized in the text of Sections S.4.2.2 and 4.3.2.1. The risk to involved workers is very sensitive to the specific circumstances of each accident and would depend on how rapidly the accident developed, the exact location and response of the workers, the direction and amount of the release, the physical and thermal forces causing or caused by the accident, meteorological conditions, and characteristics of the room or building if the accident occurred indoors. Impacts to involved works under accident conditions would likely be dominated by physical forces from accidents themselves so that quantitative dose/effect estimates would not be meaningful. For these reasons, the impacts to involved workers during accidents are not quantified in the PEIS. However, it is recognized that injuries and fatalities among involved workers would be possible if an accident did occur.

Comment 20

New Madrid Seismic Zone: Page S-34 mentions "the conversion accidents estimated to have the largest potential consequences were . . . involving the rupture of tanks of anhydrous HF or ammonia" would be caused by a large earthquake which has an assumed frequency of less than 1 in 1 million per year of operations. DOE should mention that a facility built near the Paducah Gaseous Diffusion Plant would be located near the New Madrid seismic zone. Additional seismic analyses would need to be performed for such a facility as well as an accident analysis taking into account the seismicity of this area.

Response 20

If a conversion facility were to be constructed at the Paducah site, seismic hazards associated with such a facility would be considered. Future planning and environmental analysis will address issues related to selection of sites (including site-specific seismic considerations) for the depleted UF_6 management strategy selected in the Record of Decision for this PEIS.

Comment 21

Non-Shield Use of DU: Page 2-21 mentions uses for DU such as developing penetrators, vehicle armor, and industrial ballasts. No mention is made of quantities or relative percentages of the DU inventory that these uses would require. Also, it is not self-explanatory that DU cask manufacturing and uses bound all of the potential uses. For example, metal uses would appear to require a significant amount of alloying and/or machining, and involve handling and disposal concerns. DOE may wish to include a longer discussion and a more comprehensive explanation.

Response 21

As described in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, were selected as representative options to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to bound the impacts associated with any future use, but rather to identify the types and general magnitude of impacts associated with manufacturing products containing depleted uranium. The impacts associated with specific uses will depend on what use or uses are ultimately identified, and would be considered and evaluated in more detail in future planning and environmental analyses. Existing analyses using the representative use options are considered to be appropriate for the PEIS.

Comment 22

Leach Rates for Disposal: Page 2-22 briefly mentions leach rates and waste forms, and states that grouted wastes are representative of immobilized waste forms with low leach rates, with the implication that grouting is also representative of vitrification. DOE should clarify this text, as grouting may be representative of vitrification for some parameters (e.g., facility size) but not representative in others (e.g., energy usage, emissions). Also, while grouting should provide for somewhat lower leach rates as compared to the ungrouted material, vitrification would be expected to provide 5 to 6 orders of magnitude lower leach rates than grouting. Furthermore, a quantitative mention of the values of the leach rates is beneficial, as each uranium form will exhibit different rates. These factors may be an issue for some disposal options and consequently should be discussed.

Response 22

Vitrification of depleted uranium oxides for the purposes of disposal is discussed on Section 2.3.4 of the PEIS and in the technical backup report by Swanstrom et al. (1997). The backup report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS. As discussed in the PEIS and in the backup report, technologies for vitrification of depleted uranium oxides are in the early stages of development, and since the PEIS is intended to provide an analysis of broad, programmatic alternatives, a mature and common technology, grouting, was used as the representative technology to evaluate and compare the impacts of stabilization for disposal. If vitrification proves to be a better technology in the future, nothing in the PEIS would preclude its use.

Comment 23

Disposition of Empty Cylinders: Often when a cylinder is processed, an amount of UF_6 (the heel, containing U-235 daughter products) remains in the cylinder. DOE should describe how the cylinders will be cleaned and how the heels are going to be dealt with. Furthermore, though potential options for the disposition of empty DU cylinders are listed on page 2-23, the impacts are not included. It would seem reasonable to provide a brief discussion on these options and include impacts from cylinder disposition in the EIS.

Response 23

The management of empty cylinders is addressed in the PEIS in association with the conversion options (Appendix F), as well as in a support document entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" (Nieves et al. 1997). In the PEIS, for each alternative requiring conversion, the impacts of constructing and operating a cylinder treatment facility were included in the impact analysis. This analysis assumed an initial storage period of 3 months after UF_6 removal from the cylinders to allow the level of radioactivity associated with the decay products of uranium to decrease to acceptable levels. The cylinders would then be washed with water to remove the heels; finally the cylinders would become part of the DOE scrap metal inventory. See Appendix F of the PEIS for specific impact analyses for the cylinder treatment facility. As a part of the waste management analyses in the PEIS, the impact of disposal (i.e., burial) of the empty cylinders as low-level waste was also examined (Section F.3.7.4). It was found that the empty cylinders would represent only approximately 3% of the projected DOE complex-wide volume of LLW expected to be generated during the time period examined (i.e., through about 2030).

The above-cited report by Nieves et al. analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial), and free release. Health endpoints assessed included chemical risks, radiation risks, and trauma risks. Total inventory health risks over 20 years of processing ranged from 0.1 to 0.8 total fatalities for the various options. The potential health impacts were similar for each of the options; however, the disposal option would have the greatest adverse environmental impacts due to land-allocations required and removal of the metal mass from any further usefulness. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 24

Water and Soil impacts from DU Disposal: The summary table of impacts (Table 2-2) and the supporting text for the water and soil section (page 2-50) note that the groundwater uranium concentrations will exceed drinking water guidelines. It is recommended that the expected concentrations are also expressed in terms of individual radiation doses.

Response 24

The potential radiation doses to members of the general public from the use of groundwater at the three current storage sites was calculated for the no action alternative and the action alternatives; the doses are given in Sections 5.1.1.1.2 and 5.2.1.1.2. The doses during the post-closure phase for the disposal as oxide alternative are discussed in Section 5.6.1.1.2.

In Table 2-2 it is stated that uranium groundwater concentrations could exceed guidelines under the Disposal as Oxide Alternative, wet environmental setting. The doses and chemical health risks from this exposure have been added to Table 2.2 under Human Health and Safety — Normal Facility Operations. Supporting text has also been added to Section 2.4.1.

Comment 25

Waste Management: Pages 2-52 et seq present a summary of the waste management impacts from the alternatives. Comparisons of the amounts generated are primarily made relative to the DOE waste management system, however, these facilities could also be commercially operated under NRC or State regulations, Consequently, DOE should consider adding a comparison to commercial LLW generation rates. The section should also include estimated uranium levels for the magnesium fluoride waste (from DU metal production) and discuss the aspects of DU disposal, including the potential need for either a dedicated or a deep disposal facility.

Response 25

Because of the many uncertainties present at this time, the comparison of waste management impacts from depleted UF_6 waste was limited primarily to the DOE waste management system. Currently three commercial facilities (i.e., Barnwell, SC, Richland, WA, and Envirocare in UT) are accepting about 37,000 m^3/yr of commercial LLW, and DOE is disposing of approximately 65,000 m^3/yr LLW at DOE facilities. DOE LLW generation is expected to increase to about 100,000 to 200,000 m^3/yr once environmental restoration operations begin. Commercial facilities which manage LLW have the capability to expand rapidly and may accept DOE LLW in the future if it can be managed profitably. A summary of this information on commercial LLW generation rates has been added to Section C.10 as background information.

An estimate of the potential uranium content of MgF_2 is given in Section F.3.7.3 of the PEIS (i.e., 90 ppm). This estimate has been added to Section 2.4.8 as requested by the commentor, as well as to Sections S.4.8 and 5.5.7.

The detailed analysis presented for disposal in the PEIS does indicate that the dose to a hypothetical receptor from contaminated groundwater would exceed regulatory limits for a disposal facility in a "wet" environment for all three disposal options considered (i.e., disposal in shallow-earthen structures, vaults, or mines). However, the analysis also indicates that groundwater impacts would be less than regulatory limits for a disposal facility located in a "dry" environment for all three disposal options (these results are summarized in Section 2.4.5 and presented in detail in Section I.4 of Appendix I). It must be stressed, as noted in Appendix I, that the disposal calculations are subject to a great deal of uncertainty and would depend greatly on the specific disposal facility design and site-specific factors, such as soil characteristics, water infiltration rates, depth to groundwater, and the chemical characteristics of uranium and the soil beneath the disposal facility. Such factors would be considered during site selection, facility design, performance assessment, and licensing activities if disposal were required. Text has been added to Sections S.4.5 and 2.4.5 (Water and Soil Impacts) detailing some of the uncertainties of the non-site-specific analysis for disposal, and stating that if disposal were implemented in the future, all disposal activities would take place in accordance with applicable rules and regulations for disposal of LLW (regardless of whether shallow earthen structures, vaults, or mines were the chosen disposal option).

Comment 26

DOE's Preferred Alternative: Section 2.5 (pages 2-54 et seq) presents DOE's preferred alternative. This section would benefit from a greater discussion of the potential uses of DU, including the SNF storage casks.

Response 26

Comment noted. The PEIS discusses several potential uses for depleted uranium (see Sections 2.2.4, 2.2.5, and Appendix H of the PEIS), including the representative shielding options evaluated in detail.

Comment 27

Generic Sites: Pages 3-58 et seq present information on the generic sites for wet and dry locations for disposal, and mention that the site data for each are derived from actual wet and dry sites. It is suggested that the actual sites which provide the basis for the generic locations be listed.

Response 27

Data for actual sites (i.e. cities within the U.S.) were the meteorological data used in the impact calculations for disposal options. However, the selection of the meteorological data was performance-based, and not related to potential locations, other than a dry or wet setting, for a disposal facility. Thus, the identification of these sites in the PEIS has no value. The meteorological data used in the characterization of the "dry" and "wet" settings for the location of a disposal facility were taken from archives of the National Weather Service. Meteorological data from cities that met the dry or wet annual rainfall criteria (approximately 10" and less or 40" and more, respectively) were screened to obtain a set of 5 locations in each case that resulted in the largest range of impacts that would be consistent with either a dry or wet setting.

Comment 28

PEIS Time Period: Page 4-2 lists a 41 year time period for the EIS (through the year 2039), and indicates activities beyond 2039 would be subject to appropriate NEPA reviews and decisions in the future. This appears to truncate the analyses for some of the alternatives which might influence the selection of the preferred option; for example, impacts from wastes in a disposal cell are unlikely to occur by 2039, major cylinder/container replacements may be required for the storage option in the 10-20 years after 2039, significant applications for use of the DU may not have developed etc. DOE may wish to consider a time period consistent with the logical conclusion of the options or their "life-cycle," which may require a time frame beyond 2039.

Response 28

The analysis in the PEIS was intended to provide a comparison of reasonably foreseeable environmental impacts for each of the alternatives considered. Consequently, the potential environmental impacts were evaluated for roughly a 40 year assessment period for all alternatives. In addition to this analysis, an evaluation of the long-term impacts from disposal (up to a period of 1,000 years beyond the assumed failure of a disposal facility) was included in the PEIS because such impacts can be reasonably predicted. A life-cycle analysis for the alternatives other than disposal was not performed at this time because actions to be taken beyond the 40 year period considered in the analysis are considered highly uncertain and speculative. For instance, products containing depleted uranium potentially could be stored, recycled for other uses, or treated and disposed of as low-level waste. In addition, future regulatory requirements concerning disposal may differ *significantly from current requirements. To address such issues, a discussion related to potential life-cycle impacts and the final disposition of products containing depleted uranium has been added to the PEIS in Section 5.9.*

Comment 29

Background Radiation: On page 4-15, the example with background radiation appears to have left "year" out of the units.

Response 29

The referenced example was modified to indicate that the calculation includes a 1 year exposure time which causes the "year" not to appear in the final units.

Comment 30

Waste Management Approach: Page 4-25 lists the waste management approach. Inclusion of waste categorization methods and categories (e.g., per 10 CFR 61), and current commercial capabilities would be beneficial. DOE may also want to discuss if there are any waste management situations that require the development of additional waste management capabilities and/or capacity.

Response 30

A brief discussion of waste categories has been added to Section 4.3.8. As stated in Section 4.3.8, where new waste management facilities would be required for the various options, the impacts of constructing and operating such facilities are already included in the Appendices addressing those options (e.g., see Figure F.1 of Appendix F, Conversion, which includes waste treatment facilities in the facility design).

Comment 31

No Action and Storage Alternatives: Pages 5-3 and 5-19 discuss the estimated cylinder failure rates for the No Action and UF_6 Storage alternative. These appear to use the opposite ends of the failure rate range — No Action uses the lowest failure rate, while Storage uses the highest failure rate — without explanation. Also, the existing cylinders may not have adequate wall thicknesses under either alternative due to both internal and external corrosion over the years (see Appendix E), and the DU may have to be transferred to new cylinders within the time frame covered by the EIS. Furthermore, if the cylinder wall thicknesses deteriorate significantly, they may not meet American Society of Mechanical Engineering (ASME) code for processing. DOE should consider presenting a discussion on these items in the text.

Response 31

As described in Section 5.1 and Appendix D of the PEIS, the analysis of the No Action alternative considered both the lowest estimated cylinder failure rate (assuming cylinder coating effectively halted corrosion) and the highest estimated failure rate (assuming cylinder coating was not effective in halting corrosion). The results of both analyses are discussed in the PEIS. For the *action alternatives, including long-term storage of depleted UF_6, the higher estimated failure rates were used in the analysis for the reasons discussed in Appendix D.*

The DOE acknowledges that a fraction of the cylinder inventory may require preparation before shipment or processing due to external corrosion. Consequently, two options for cylinder preparation are considered and discussed in the PEIS for all alternatives, as described in Chapters 1 and 2. A detailed description of cylinder preparation options is provided in Appendix E.

Comment 32

Tank Rupture Frequencies: On page 5-40, Table 5.4 lists tank rupture accidents as "incredible" events, when typically they are assigned a value corresponding to the "extremely unlikely" frequency bin. A brief discussion of the basis for DOE's assessment is recommended.

Response 32

The accident frequencies used in the PEIS analyses were obtained from the engineering analysis report (EAR) (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The HF and ammonia tank rupture accidents in question were described in Section 7.0 of the EAR.

The HF accident involves both tank failure and confinement building failure due to a seismic event (earthquake). The EAR (pp. 6.4-2-12 and 6.4-8-1) states the HF building is category PC-4 and the HF tanks are either PC-3 or PC-4. Based on DOE-STD-1021-93, failure of PC-4 structures, systems, or components (SSC's) caused by a seismic event exceeding the design basis earthquake (DBE), or failure of PC-4 SSC's caused by the DBE, is considered incredible. Similarly, failure of PC-3 SSC's is considered extremely unlikely. Therefore tank failure may be extremely unlikely as suggested, but the accident in question is incredible because the PC-4 building also fails.

The ammonia accident involves an earthquake-induced tank failure that releases the entire tank contents (25,000 gallons) in 20 minutes. The EAR (p. 6.5-8-1) states the ammonia tank is PC-3 or PC-4. If it is PC-4, then failure due to earthquake is indeed incredible. If it is PC-3 as suggested, then failure is extremely unlikely.

The EAR and other supporting reports are available for review at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 33

Surface Water Dilution of Effluents: On page 5-51, the text indicates effluent levels greatly exceeding EPA guidelines for uranium, but notes that the concentration would be much lower and below the guideline after dilution in nearby surface water. This should be clarified, and potential dose consequences of these effluents presented.

Response 33

The referenced text in Section 5.3.4.1 of the document is addressing the conversion component of the long-term storage as oxide alternative. Calculations for the oxide conversion facility were performed for a "representative site." As described in Section 3.4.1 of the PEIS, the representative site characteristics for conversion options were derived from information on the three existing storage facilities (Paducah, Portsmouth, and Oak Ridge). For the estimated range of wastewater generation rates (15 to 140 million gal/yr), dilution in final receiving waters (nearby rivers) would range from about 8,000 to 450,000 (for representative flows, see Tomasko 1997b; the full citation is provided in Appendix C of the PEIS). For this range of dilution, the concentrations of uranium in the receiving water would be below the proposed EPA MCL of 20 µg/L used as a guideline in the PEIS.

If conversion were to be a component of the management strategy selected in the Record of Decision for the PEIS, site-specific calculations would be required prior to construction. These site-specific environmental analyses would address specific contaminant levels to be expected in surface waters near the sites. Text has been added to Section 5.3.4.1 to clarify that all releases from actual conversion facilities would be in compliance with applicable regulations and site-specific permits.

The potential total doses to the general public associated with releases from conversion facilities (including releases to surface waters) were presented in Table F.4 of Appendix 4, and summarized in Sections 5.3.1.1.2 and 5.5.1.1.2. As stated in the text of Sections F.3.1.1.1, F.3.1.1.2, and F.3.1.1.3 pertaining to the general public doses from conversion facilities, the doses associated with drinking contaminated surface water would be at least two orders of magnitude less than those from exposure to airborne emissions. The total doses were all much less than the dose limits specified in DOE Orders (see text).

The Tomasko 1997 report and other supporting reports are available for review at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 34

Land Use Requirements: Page 5-55 identifies land use requirements for the facilities. Contrary to the small land requirements indicated in the PEIS, conversion and metal use plants would be anticipated to have larger land use because of facility size and require potentially larger setbacks for potential accident mitigation from uranium releases. The LES EIS maintains the amount of land required for a generic conversion facility is 1000 acres whereas the PEIS indicates only 30-40 acres are necessary. The text also does not indicate if any major setbacks, protective action distance (PADs), or planning zones are likely to be needed around the facility because of the handling of large quantities of DU, the hexafluoride, and/or the metal (including melting operations). DOE should consider a discussion in the text on these subject matters.

<u>*Response 34*</u>

Conversion facility land areas presented in the PEIS do not include buffer zones. A nominal facility occupies about 30 acres, or 900 × 1500 ft. NUREG-1140 p. 30 suggests a 1 mile protective action distance (PAD), which is based on a UF_6 cylinder rupture that releases uranium and HF. The PAD is the recommended distance for which emergency planning would be appropriate to mitigate off-site exposure to accidental releases. A conversion facility is not required to have ownership of the area encompassing the PAD. The PAD for a metal or oxide shielding facility would be much less because UF_6 would not be handled at these facilities. Wherever land use for conversion facilities is discussed in the PEIS, text has been added acknowledging the need for a protective action distance.

<u>Comment 35</u>

Oxide and Metal Accident Consequences: Pages 5-55 et seq discuss the use and impacts of uranium dioxide as shielding, and pages 5-66 et seq discuss the use and impacts of uranium metal as shielding. Some of the values imply non-intuitively obvious lower impacts from a metal route as compared to the oxide route; it is recommended that these are discussed and explained in more detail. For example, the text on page 5-71 estimates the highest consequences from an accident with the metal route as 15 mrem (from a fire involving three cylinders, an energetic accident with reactive materials), as compared to 270 mrem (from an earthquake during uranium dioxide storage, a low energy event with non-reactive materials) — there is no explanation for the difference. Also, the supporting information in Appendix H shows similar inconsistencies; the unlikely accidents for the oxide (Table H-5, page H-16) are significantly higher than the corresponding accidents for the metal (page H-17). Page H-17 also contains apparent inconsistencies; the mishandling/dropping of solid DU metal accident releases a greater quantity of uranium than the molten uranium accidents. Upon further review, the source of these apparent anomalies goes back to Section 6.11 of the Engineering Analysis Report (EAR). These anomalies and inconsistencies include:

- Page 6.11-7-6 uses a damage fraction of 30% for the metal and 100% for the oxide; comparable or lower values would seem appropriate for the oxide.

- Page 6.11-7-7 uses a damage fraction of 1% with molten uranium metal and 100% for the oxide for a mixer/melter accident; these values for the damage fraction appear to be contradictory and may have been inadvertently reversed (i.e., they should be 100% for the metal and 1% for the oxide).

-A similar incongruity exists for the Mixer/Melter Discharging Accidents on pages 6.11-7-7 and 6.11-7-8, where the damage fraction for metal use is 1% while 100% is used for the oxide route.

-On page 6.11-7-8, the metal shield failure uses a damage fraction of 0.1% while the oxide shield failure damage fraction uses 100%; again, these appear to be reversed. Also, the failure modes may be completely different, and this does not appear to have been captured by the scenarios and calculations.

- The stated release fractions for the metal accidents on these pages appear to be unconservatively low; DOE-HDBK-3010-94 recommends 1×10^{-2} as bounding for "disturbed molten metal surface with high turbulence" and 1.0 for "small molten metal drops hurled through air or explosion of entire metal mass." The melter failure and discharge accidents would appear to be in the latter category, and most of the other accidents would appear to be bimodal, with some portions of the release in both categories. These effects would increase the source terms for the analyses.

- The oxide and metal design basis events are analyzed with different bases; the high efficiency particulate air (HEPA) filters for the metal facility are assumed to keep functioning, while the oxide HEPA system does not function. This seems inconsistent.

- The oxide release fractions appear to be based upon fuel pellet data sintered from powders (i.e., submicron grain size), sintered too close to the theoretical density of uranium dioxide (11 g/cc). It is not clear how this data applies to the lower density uranium dioxide pellets (i.e., 6 g/cc, expect a somewhat higher release fraction) and the density of the solution formed gelation particles (much larger grain sizes — expect a lower release fraction).

- Table H-5 of the PEIS categorizes a furnace failure as an "incredible" event while the EAR (page 6-11-7-6) implies 8×10^{-5}/yr.

These points should be discussed and explained better in the PEIS, and values corrected as required.

<u>*Response 35*</u>

The text in Section 5.5.1.2.2 of the PEIS (including page 5-71 of the Draft PEIS) is comparing aggregate results of the highest consequence accidents within 4 frequency categories between the oxide conversion options and the metal conversion options. For the low-probability accidents associated with metal conversion, the highest consequence accident (fire involving three cylinders) still has a relatively low radiation dose of 15 mrem for the maximally-exposed individual (MEI) in the general public, because the accident is associated with a fire, which has a buoyant plume that moves upward and disperses in the atmosphere prior to sinking back to ground level at some distance from the release point. In comparison, the dose of 270 mrem is associated with an earthquake at a U_3O_8 (not UO_2) conversion facility (see Table F.9 for details on each highest consequence accident in each frequency category). Much of the difference in predicted consequences for accidents involving U_3O_8, UO_2, and uranium metal are associated with the form of the material. U_3O_8 is an easily-dispersed powder, whereas only the oxide coating on uranium metal billets can be readily dispersed. Releases from drops of UO_2 pellets are somewhat more similar to releases from drops of metal billets. Text has been added to Section 5.5.1.2.2 (page 5-71 of the Draft PEIS) to clarify the reasons that the consequences of some of the accidents associated with the use as metal alternative are lower than those associated with the use as oxide alternative.

The size of releases from UO_2 shielding- and metal shielding-manufacturing facility accidents would depend on the exact accident scenarios; in some cases releases from accidents involving UO_2 pellets will be smaller than those associated with uranium metal billets. The mishandling/dropping of solid DU metal accident questioned in the comment did have a higher assumed release than the mishandling/dropping of a UO_2 drum; this was mainly because the metal billet contained more uranium than the drum, so there was more material at risk (see Section 6.11.7 of the EAR for further details). The other specific questions regarding the EAR assumptions are addressed individually below.

For page 6.11-7-6, the release fraction and damage fraction must be considered together. For the metal, the 30% damage fraction indicates that 30% of the billet would be "broken up" on hitting the floor; the respirable release fraction was 4×10^{-3}. For the oxide, a damage fraction of 100% was assumed because all the small pellets would be released; however, the respirable release fraction was lower than that for the metal accident (1×10^{-7}).

For pages 6.11-7-7 and 6.11-7-8, again the damage fraction and release fraction must be considered together. The 6×10^{-3} release fraction is for a disturbed molten metal surface, and was measured using very small amounts of material. The damage fraction of 1% was based on the amount of the molten metal that would be exposed to the ideal release conditions, the rest would be part of the "glob" that solidifies on the cool surface on which it lands. The release fraction of 5×10^{-5} for UO_2 pellets is based on the dense, hard nature of the pellets; however, the damage fraction for the pellets is 100%.

For the "Shield Failure After Casting" accident on page 6.11-7-8, again the damage fraction and release fraction must be considered together. For the metal-shielded cask, a damage fraction of 0.1% was assumed in conjunction with a release fraction of 6×10^{-3} (i.e., a combined factor of 6×10^{-6}). For the UO_2-shielded cask, the combined factor of 1×10^{-7} was given in the text. This was comprised of a release fraction of 5×10^{-5} and an assumed damage fraction of 0.2%.

With regard to the release fractions assumed for metal accidents, DOE-HDBK-3010-94 page 4-2 states the bounding ARF (airborne release fraction) is 1×10^{-3} for oxidation of stationary metal, 1×10^{-2} for free-falling metal droplets, and 1.0 for explosive dispersal of metal droplets. Explosive dispersal is based on generating metal drops by the exploding wire technique and accelerating the drops to sonic velocity by an electrostatic device. A molten uranium spill due to loss of containment (failed melter or piping) is not expected to be this violent. The EAR used an ARF of 6×10^{-3}, which is the median ARF for free-falling molten uranium drops (p. 4-40 of DOE-HDBK-3010-94).

For analysis of the oxide and metal design basis events, the earthquake scenario is based on an unlikely accident. The oxide shielding process building is Performance Category (PC)-2, which implies failure of the structure and confinement systems is an unlikely event. Thus the oxide earthquake assumed complete failure of HEPA filtration. The metal shielding process building is

PC-3, which implies complete failure of the structure and confinement is an extremely unlikely event. Thus the HEPA filters were assumed to continue to function (with some degradation) in the metal facility. The regulatory basis for the design and assignment of PCs for the two shielding manufacturing facilities is provided in Section 6.11-2 of the EAR. The main reason for assignment of different PC's for the two buildings is the difference in their hazard rating; the low temperature oxide shielding facility is ranked as a low hazard facility whereas the high temperature metal shielding facility is ranked as a moderate risk facility.

With respect to the UO_2 pellet density assumptions, the UO_2 pellets were assumed to be sintered to 90% of the theoretical density, or a particle density of 9.8 g/cc. The bulk density was assumed to be about 5.9 g/cc, based on a pellet packing factor of 0.6. Particle density for UO_2 nuclear fuel pellets, oxide shielding pellets and microspheres will be similar, and the release fractions can also be assumed to be similar.

The incredible event in Table H-5 is the simultaneous failure of eight melters, the structure, and the confinement system. The 1.1×10^{-5}/operation shown on page 6.11-7-7 of the EAR is the frequency of melter failure only, not the structure or confinement. The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

<u>Comment 36</u>

Metal Cask Waste: Page 5-76 of the PEIS presents waste management for the metal cask manufacturing route. Waste management appears to have overlooked secondary wastes related to manufacturing, which are unique to uranium metal. For example, induction furnaces for uranium metal are usually lined with graphite, which requires periodic removal and replacement (sometimes as frequently as every ten charges). Also, while the proposed approach appears to use primarily direct casting, some uranium metal machining operations may be required, and, historically, these generate significant wastes containing partially oxidized uranium metal, The PEIS should include these potential impacts that primarily affect only the metal route.

<u>Response 36</u>

The graphite liner wastes from induction furnaces used in casting of uranium metal are included in the operations waste of the metal manufacturing facility (see Section 5.5.7 of the PEIS). Table H.15 of Appendix H lists the operations waste (LLW) for both the uranium oxide and uranium metal facilities. The difference in the quantities (650 m^3/yr and 126 m^3/yr) is due primarily to the graphite liner wastes mentioned in the comment.

While some machining operations may be required during the uranium metal fabrication process, almost all of this machining will be on uncontaminated stainless steel parts. Very little LLW is expected from the machining of uranium metal.

Comment 37

Waste Disposal Section 5.6 (pages 5-78 et seq) and Appendix I present the impacts from disposal of the DU, for both the operational phase and the post-closure period. The radiological impacts from the accidents seem unexpectedly high. For example, public doses of up to 1.1 rem and noninvolved worker doses as high as 140 rem are determined, apparently due to earthquake initiated events, without explanation. The routine impacts also seem high for the post-closure phase and appear to follow the radiological order: mine impacts > vault impacts > trench impacts. Calculations appear to use an infiltration area effect and do not account for chemical form, solubility, and kinetic effects. Table I.31 contains values of zero for the dry site doses for all three disposal approaches, and no collective dose estimates are included. These points are not obvious and it is recommended that they are explained in more detail.

Response 37

With respect to radiological impacts from accidents associated with disposal options, the earthquake involving release of U_3O_8 was associated with high radiological doses, as noted by the commentor (see Appendix I, Table I.10). The high doses for U_3O_8 are due to the material form and the release height. U_3O_8 is a fibril material which is almost powder-like. This characteristic results in a higher release amount (400 pounds) compared to a similar accident with UO_2 pellets (0.7 pound) (see Appendix I, Table I.9). Additionally, an earthquake is assumed to cause structural failure of the building, during which the uranium oxide containers collapse and release the material at ground level. This is much different than the tornado event assumptions where the wind speeds are larger and there is some upward movement to the released material. The lower wind speed and ground release result in larger releases near the building and the surrounding areas for the earthquake event, and thus result in high worker and public doses. This type of specific accident scenario information is provided in the engineering analysis report (LLNL 1997; the full citation is provided in Appendix I of the PEIS) associated with the PEIS.

The routine impacts for the postclosure phase address the potential impacts from groundwater use. The groundwater could become contaminated as a result of container failures that release U_3O_8 or UO_2 to the environment. Although U_3O_8 and UO_2 are essentially insoluble in water, a conservative estimate of dissolution was obtained by assuming that Schoepite ($UO_3 \cdot H_2O$) would form under the aerobic conditions present in the soil phase. Estimates of groundwater concentrations were then obtained by assuming the leachate concentration in the waste area was equivalent to the solubility of Schoepite. As radionuclides travel downward to the groundwater table, distribution of radionuclides in soil solid and soil liquid phases were assumed in equilibrium. This assumption was acceptable because it would take very long time (at least several hundred years in the calculation cases) for radionuclides to reach the groundwater table and to reach the maximum concentration level. Potential impacts were calculated with the estimated maximum groundwater concentrations within 1,000 year after failure of the disposal facility.

On the basis of the above assumptions, the relative potential impacts would depend only on the dimensions of the disposal area and the infiltration rate. Factors such as solubility, chemical *form, and kinetic effects would be the same for a mine, vault, or shallow earthen structure. Impacts for disposal in a mine would be greater because of the larger disposal area required. As noted in Section I.4.1.1.1, impacts for dry sites would be zero, because it would take more than 1000 years for uranium and its decay products to reach the groundwater table [due to a combination of the depth to the watertable (500 ft — Section 3.4.4.1) and the low rate of infiltration (0.1 in./yr — Section 3.4.4.1)]. Additional details on these calculations can be found in Tomasko (1997; the full citation is provided in Appendix I of the PEIS), as indicated in Section I.4.2.*

Collective impacts were not estimated because it would require detailed information on the groundwater flow direction and distribution as well as knowledge of the off-site population that would use the groundwater. Since siting of a disposal facility is not addressed in this PEIS, estimation of collective impacts would involve a large degree of uncertainty, and was therefore not conducted.

The engineering analysis report, Tomasko (1997), and other supporting reports are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 38

Other Uranium Forms: The primary uses the PEIS focuses on are uranium in concrete and DU metal for the shielding material. Other uses exist such as vitrified pellets with UO_2, and UO_2 composite material in a SNF cask. These have been published in the open literature and should be mentioned and referenced.

Response 38

As described in Section 2.2 of the PEIS and Appendix H, the two use options evaluated in the PEIS, use as uranium oxide and use as uranium metal as radiation shielding, are representative and were selected to provide a basis for comparing the potential environmental impacts of broad, programmatic management strategies. The selection of these use options for analysis in the PEIS was not intended to imply that the PEIS will be used to select a specific end-use or preclude other potential uses in the future. Although several other uses are noted in the PEIS, such as in Sections 2.2, 2.3, and Appendix H, the PEIS is not intended to present an exhaustive list of current or potential future uses of depleted uranium.

Comment 39

Low Estimates of Staffing Levels: The estimated numbers of staff required for several of the alternatives in the PEIS seem low. For example, the UO_2 pellet approaches use similar technologies to existing fuel fabrication facilities of 1,000 te/yr capacity which employ several hundred people. However, the PEIS estimates only 300 workers will be needed for a plant of 20,000 te/yr capacity. This seems low even considering economies of scale.

Response 39

A typical UO_2 fuel fabrication plant processes enriched uranium in numerous production lines with low capacity equipment (due to criticality concerns associated with concentrating a high mass of enriched uranium in a single location). The fuel fabrication plants have strict quality control, criticality control, security, and nuclear material accountability requirements. In addition to producing ceramic pellets, a typical UO_2 fuel fabrication plant perform fuel pin loading and assembly of nuclear fuel, scrap recovery, waste processing, and process development. As a result, the number of employees is high.

The depleted UO_2 conversion plants considered in the PEIS assumed continuous process operation using two or three lines of high-capacity equipment. Plant design and staffing was assumed to be similar to a chemical plant using proven processes and equipment. The process was automated and controlled from a central control room. Process operations were continuous so that startup/shutdown was infrequent. The labor intensive operations were cylinder handling and product drum handling. Each process system was assigned 1 to 2 operators. A supervisor was provided for every 6 operators. Management, technical, maintenance, and administrative personnel were mainly on-day shift. Operators and security personnel were on 3 shifts. Depleted UO_2 conversion plant employees typically numbered 230 persons. An approximate 5% contingency was provided in operation cost estimates for possible labor increase.

Employment data for comparison include: The Cameco Blind River plant purifies uranium concentrates to UO_3 product by dissolution, solvent extraction, and denitration. This is a modern plant built in 1984. Production was 12,000 tonnes uranium per year in 1997 with 100 employees. The Cameco Port Hope plant started up new units in 1980 and 1984 to produce UF_6 and UO_2. Production was 12,000 tonnes per year in 1997 with 300 employees. The LES Clairborne Centrifuge Enrichment Plant Environmental Impact Statement (NUREG-1484, August 1994) stated 180 employees will be needed.

The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Commentor No. 90: Bowers, Brian

Comment 1

The PEIS describes the preferred alternative as "to use the entire inventory of material." This is misleading. The goal is to use the material but since there is little demand at present, the actual action is continued storage indefinitely. Demand for use of the material, as stated in the PEIS, is quite limited at present. It is accurate to say that the material would be converted and reused as demand dictates but it is misleading to emphasize the speculative portion of the alternative when, in reality, it could be stored as UF_6 for a long time. I agree that the best alternative is to continue the safe storage of the UF_6 and convert/use it as demand dictates, but I think the PEIS needs to clearly present the preferred alternative in those terms rather than mislead the reader into focusing on uses that have yet to be identified.

Response 1

The preferred alternative is described in Section 2.5.1 and in Section 5.7 of the PEIS. The discussion of the preferred alternative in the Final PEIS was modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products.

Comment 2

The main conclusions of the cost analysis report should be included in the analysis of socioeconomics in the PEIS. It is misleading and irresponsible to analyze only the perceived benefits (employment, increased local revenues) and not consider the costs. Who is going to pay for these actions and how much is it going to cost? In this era of taxpayer dissatisfaction, consideration of costs must be included in any socioeconomic analysis as this is certainly a potential impact on the human environment.

Response 2

The purpose of the PEIS is to provide an analysis and comparison of the potential environmental impacts of alternative management strategies. The cost of alternatives is generally not considered an environmental impact; consequently, cost information is not provided in the PEIS. However, cost information for the PEIS alternatives is provided in the document "Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride" (LLNL 1997b; the full citation is provided in Chapter 8 of the PEIS). The cost analysis report is available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

In addition, the cost information is used as input to the socioeconomic analysis presented in the PEIS. The PEIS addresses socioeconomic impacts on human communities, including changes in employment, local housing demand, public finances, and population in-migration. These socioeconomic impacts may be either positive (increased employment or revenues) or negative (decreased employment or revenue).

The ultimate decision on a management strategy will be announced in a Record of Decision. The Record of Decision will consider the results of the PEIS, including socioeconomic *impacts, along with other information, such as cost and engineering data, to select a management strategy. The Record of Decision will document the strategy selected and describe how it was selected from among the different alternatives.*

Comment 3

The PEIS does not adequately evaluate the impacts associated with the empty steel cylinders that would be generated in the event of conversion and/or reuse of the material. What to do with over 46,000 14-ton, radioactively contaminated steel cylinders is an extremely important part of the long-term management strategy and must be appropriately analyzed and considered in any decision making. The PEIS does not demonstrate adequate analysis of this issue.

Response 3

The management of empty cylinders is addressed in the PEIS in association with the conversion options (Appendix F), as well as in a support document entitled "Analysis of Options for Disposition of Empty Depleted Uranium Hexafluoride Cylinders" (Nieves et al. 1997). In the PEIS, for each alternative requiring conversion, the impacts of constructing and operating a cylinder treatment facility were included in the impact analysis. This analysis assumed an initial storage period of 3 months after UF_6 removal from the cylinders to allow the level of radioactivity associated with the decay products of uranium to decrease to acceptable levels. The cylinders would then be washed with water to remove the heels; finally the cylinders would become part of the DOE scrap metal inventory. See Appendix F of the PEIS for specific impact analyses for the cylinder treatment facility. As a part of the waste management analyses in the PEIS, the impact of disposal (i.e., burial) of the empty cylinders as low-level waste was also examined (Section F.3.7.4). It was found that the empty cylinders would represent only approximately 3% of the projected DOE complex-wide volume of LLW expected to be generated during the time period examined (i.e., through about 2030).

The above-cited report by Nieves et al. analyzed the potential health and cost impacts associated with various options for the empty cylinders after treatment, including recycle, reuse, disposal (i.e., burial) as LLW, and free release. Health endpoints assessed included chemical risks, radiation risks, and trauma risks. Total inventory health risks over 20 years of processing ranged from 0.1 to 0.8 total fatalities for the various options. The potential health impacts were similar for each of the options; however, the disposal option would have the greatest adverse environmental impacts due to land-allocations required and removal of the metal mass from any further usefulness. Text has been added to Sections 2.3.6 and F.2 of Appendix F of the PEIS to summarize the results of the Nieves et al. analyses.

The Nieves et al. report and other PEIS supporting documents are available to the public through the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 4

General — I understand the accident analysis methodology in terms of probability and consequence. However, I could not find in the PEIS where such "statistical" accidents were matched to real accident scenarios. From comments on other documents, it is clear this is what the public wants to know. They want to know about the probability and consequences of a tornado and an earthquake. I could not tell if such scenarios were adequately represented in the PEIS.

Response 4

The PEIS considered a spectrum of accidents, from accidents that could occur relatively frequently (e.g., handling accidents involving UF_6 cylinders) to those that could potentially occur once during 1,000,000 years (e.g., a vehicle-induced fire that affects a total of 3 cylinders). The summary tables in the PEIS (e.g., Tables S.2 and 2.2) provide information concerning the accidents with the highest consequences for various frequency ranges. Natural phenomena events such as earthquakes and tornadoes were considered and analyzed in the Safety Analysis Reports for the three sites (LMES 1997a-c; the full citations are provided in Appendix C of the PEIS), and in the engineering analysis report (EAR) (LLNL 1997; the full citation is provided in Appendix C of the PEIS); the results were presented in the PEIS when the consequences of the natural phenomena accidents were the highest of all accidents in that frequency category (see Sections D.2.2, E.3.2, F.3.2, G.3.2, H.3.2, and I.3.2 for details on the accidents considered). These sections contain information about both expected frequency and consequences of specific accidents.

Further information concerning the consequences of the various accident scenarios considered in the PEIS is provided in the following document:

Policastro, A.J., et al., 1997, "Facility Accident Analyses in Support of the Depleted Uranium Hexafluoride Programmatic Environmental Impact Statement."

The EAR, the Policastro et al. document, and other supporting reports are available for review at the DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover sheet of the PEIS.

Comment 5

There are still numerous places where the West Kentucky Wildlife Management Area is incorrectly referred to as the Western Kentucky Wildlife Management Area.

Response 5

The term "Western Kentucky Wildlife Management Area" has been corrected to read "West Kentucky Wildlife Management Area" in Sections S.3, 3.1, and 3.1.6.3 of the PEIS.

Comment 6

p. S-3, para. 2 — I challenge the notion that the current management plan calls for conversion to triuranium octaoxide. Where is this written? How would conversion and disposal be paid for?
This is not considered part of No Action.

<u>*Response 6*</u>

As stated in Section 1.1 of the PEIS, the former management plan for depleted uranium hexafluoride is described in a 1992 memorandum from P.G. Sewell (Deputy Assistant Secretary for Uranium Enrichment, Office of Nuclear Energy, NE-30) to L.P. Duffy (Office of Environmental Restoration and Waste Management, EM-1) entitled "Plans for Ultimate Disposition of Depleted Uranium Hexafluoride." This memorandum states that if no alternative uses are found to be feasible by 2010, then steps would be taken to convert UF_6 *to triuranium octaoxide beginning in the year 2020 and then stored or disposed of. It is not specified in this memorandum how conversion and disposal would be paid for.*

The no action alternative originally announced in the Notice of Intent to prepare the PEIS (61 FR 2239) was based on the actions outlined by Sewell. However, after public scoping and based on internal DOE reviews, it was determined that the no action alternative should consider the continued storage of depleted UF_6 *in cylinders at the three current storage sites through the year 2039. This definition of the no action alternative was intended to provide a baseline against which other management strategies could be measured, including strategies involving storage, use, and disposal of uranium oxide.*

<u>Comment 7</u>

Section 3, general — Based on the text on page 3-1 and Figure 3.1, the PEIS describes the "Paducah site" as including all of the land owned by DOE including that licensed to the Commonwealth of Kentucky. The PEIS describes the "PGDP" as a 750-acre industrial area within the Paducah site. As there is a security fence around the 750-acre area (actually 748 acres) and the area outside this fence is primarily wooded, it is appropriate to discuss these separately, where necessary, to distinguish differences in the two environments. However, the PEIS makes numerous mistakes when describing various aspects of the two environments, apparently due to confusing the "Paducah site" with the "PGDP." For example, Section 3.1.6.3 states that there are no wetlands "identified on the Paducah site by the National Wetlands Inventory." This statement would be correct for PGDP but not the Paducah site. These errors are pointed out in the specific comments below.

<u>*Response 7*</u>

The text of Section 3.1.6.3 of the PEIS has been corrected to distinguish the PGDP and the Paducah Site. No other instances of this error in the use of "the Paducah site" term were located.

<u>Comment 8</u>

In addition, the PEIS often does not use the most current and accurate information readily available. For example, the National Wetlands Inventory does not provide very useful information for anyone wanting to know about wetlands that occur on the Paducah site. Two reports that should be used include:

U. S. Department of the Army, Corps of Engineers — Nashville District and Waterways Experiment Station, Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area McCracken County, Kentucky, Volumes I — V, May 1994

CDM Federal Programs Corporation, Investigation of Sensitive Ecological Resources Inside the Paducah Gaseous Diffusion Plant, August 19, 1994, Document Control Number 7916-003-FR-BBRY

The first document reports on wetlands, flood plains, cultural resources, and threatened/endangered species on and near the PGDP , primarily outside of the plant security fence. The latter document reports on wetlands and threatened/endangered species inside the plant security fence. There have been some informal updates to these reports since they were issued.

<u>Response 8</u>

The National Wetlands Inventory is the only consistent wetland information for U.S. wetlands and is typically included in NEPA analyses. The references indicated in the comment have been included in the Final PEIS, with text added to Section 3.1.6.3.

<u>Comment 9</u>

Two sensitive resources common to the DOE reservation at PGDP but not analyzed in the PEIS are 100-year flood plains and prime farmland. Granted, there would not be much analysis based on the PEIS approach of deferring site-specific evaluations to later NEPA documents. However, the PEIS should include these resources in site descriptions and evaluate for potential impacts at the appropriate time. Information on flood plains at PGDP is reported in the Corps of Engineers report referenced above. Prime farmland information is available from site personnel or local offices of the Natural Resources Conservation Service.

<u>Response 9</u>

As noted by the commentor, as a programmatic EIS (PEIS) this document does not propose new site-specific projects, although site-specific impacts from continued cylinder storage and cylinder preparation for transport are evaluated (Appendix D and Appendix E, respectively). Future planning and environmental analysis will address flooding potential and prime farmland, as appropriate.

Comment 10

Section 3 should be thoroughly reviewed and revised to accurately describe the affected environment. Consequently, analysis of potential impacts should be revised, where necessary.

Response 10

Section 3 has been revised in response to specific comments (for example, discrepancies between use of the term "PGDP" and "the Paducah site" have been eliminated). The background material used to prepare Section 3 consisted mainly of annual site environmental reports prepared for each of the three current storage sites. DOE is not aware of any additional inaccurate information in Section 3 which requires revision.

Comment 11

Sec. 3.1 — The PEIS does not provide an accurate portrayal of the size and location of the West Kentucky Wildlife Management Area (WKWMA). WKWMA totals about 6823 acres of which the state owns 3106, 1986 acres are licensed from DOE, and 1731 acres are licensed from the Tennessee Valley Authority. WKWMA completely surrounds PGDP. Much of the area referred to in the PEIS as the Paducah site is also part of WKWMA. This is not reflected in Figure 3.1 or in some of the analyses of impacts.

Response 11

The Paducah Site Annual Environmental Report for 1996 (LMES 1997c; the full citation is provided in Chapter 8 of the PEIS) states that "Of the 3062 ha (7566 acres) acquired by the Atomic Energy Commission, 551 ha (1361 acres) were subsequently transferred to the Tennessee Valley Authority (Shawnee Steam Plant site) and 1125 ha (2781 acres) were conveyed to the Commonwealth of Kentucky for use in wildlife conservation and for recreational purposes (West Kentucky Wildlife Management Area)." The value of 2781 acres of DOE land licensed to the WKWMA is consistent with the value given in Section 3.1 of the PEIS. However, the text in the Draft PEIS did imply that the land licensed from DOE comprised the entire WKWMA; text has been added to indicate that this is only part of the WKWMA.

Comment 12

Sec. 3.1.5.1 — DOE received a new KPDES permit on March 13, 1998. The PEIS should be revised accordingly to reflect the changes.

Response 12

Section 3.1.5.1 has been revised to incorporate the two new Kentucky pollutant discharge permits (DOE [four outfalls — 3 to Big Bayou Creek at mile points 5.6, 6.2 and 7.1; and 1 outfall to an unnamed tributary of Little Bayou Creek at mile point 0.25] and USEC [10 outfalls — 5 to Little Bayou Creek at mile points 4.6, 4.8, 5.0, 5.3, and 5.6, one to an internal outfall to Big Bayou Creek, and 4 to Big Bayou Creek at mile points 6.0, 6.3, 6.8, and 6.6]

Comment 13

Sec. 3.1.6.3 — The PEIS is incorrect — there are many wetlands on the Paducah site. In fact, some were filled in to build the latest cylinder storage yard.

Response 13

The text of Section 3.1.6.3 has been revised to more clearly differentiate "Paducah site" and "PGDP" wetland occurrences. Additionally, the text has been revised to state that wetlands occur on the Paducah site and in some ditches on the PGDP.

Comment 14

Sec. 3.1.6.4 — The information here with regards to threatened and endangered species is misleading. First, there is a lot of significant potential summer habitat for the federally endangered Indiana bat so it is quite likely it occurs on the Paducah site. Second, there is no state list with any enforceable protection standards. I applaud the PEIS for looking at these "state-listed" species but their legal status should be made clear.

Response 14

The Indiana bat habitat, initially considered to be outside the "site," is in fact outside the PGDP but on the DOE "site." Text in Section 3.1.6.4 has been changed accordingly. The legal status of state-listed species and DOE's consultation requirements would be determined in a future site-specific analysis.

Comment 15

Sec. 3.1.10 — Overall, the description of cultural resources is current and well done. However, there is at least one cemetery on the Paducah site, just north of PGDP.

Response 15

The text has been changed to reflect that no cemeteries are located within the PGDP (rather than on the Paducah site). The two cemeteries north of PGDP, Harmony Cemetery just outside of the PGDP security fence near the landfill, and an unnamed, unmaintained cemetery to the northeast of the PGDP, are mentioned.

Comment 16

Sec. 5.8 — The PEIS purports to include other past, present, and future actions, and non-DOE actions in its cumulative impacts analysis. However, no specific actions are identified. In order for the reader to assess if cumulative impacts were adequately assessed, the PEIS needs to include specific information on what other activities were considered.

Response 16

Footnote "a" on each of Tables 5.12 (Paducah site), 5.13 (Portsmouth site), and 5.14 (K-25 site), which occur in Section 5.8 of the PEIS, documents the other reasonably foreseeable future actions considered at each current storage site for depleted UF_6. The topic of environmental *restoration has been reexamined, and the impacts of those activities in the recent past and present for which adequate information on associated impacts is available also have been added to the cumulative impact calculations — identified once again in footnote "a" of each of the above tables. As discussed in Section 5.8, the PEIS assessed cumulative impacts only for those sites as they are the only locations at which activities are certain to occur (and thus where impacts are certain to accumulate).*

Comment 17

Pages D-3 to D-5 tell me all I really need to know regarding potential impacts. Continued storage (No Action Alternative) would result in an estimated worst case of 59 cylinder breaches through 2039. Impacts from these breaches would be minimal. On the other hand, the action alternatives would result in an estimated worst case of 731 breaches through 2039. On the basis of potential impacts alone, it is clear that No Action is environmentally preferable. The PEIS needs to clearly state this in all summary text areas.

Response 17

As explained in the Introduction to Section 5.1 and the Introduction to Appendix D, two analyses were actually conducted for the No Action Alternative; one assuming that the cylinder maintenance and painting program would be effective in controlling further corrosion of the cylinders, and a second analysis which assumed that external corrosion was not halted by improved storage conditions and painting so that cylinder corrosion continued at historical rates. The commentor is correct that a total of 59 cylinder breaches through 2039 was estimated for the "base" case of the No Action Alternative (i.e., assuming that further cylinder corrosion is controlled); however, the estimate of 731 breaches through 2039 was actually for the second No Action Alternative analysis (i.e., assuming that cylinder corrosion continued at historical rates), and not for the action alternatives as stated by the commentor. The rationale and supporting references for the assumed breach rates are detailed in Appendix B of the PEIS.

The number of breaches assumed under the action alternatives, including long-term storage as UF_6, fell between the numbers assumed for the two No Action Alternative analyses. Under the action alternatives, corrosion was assumed to continue at historical rates, but the cylinder population was assumed to be decreasing at 5% per year. These were considered to be reasonable assumptions, because it is less certain that ongoing cylinder yard improvements and cylinder painting would be strictly maintained for the decreasing cylinder inventory under the Action Alternatives. The outcome of the increased number of assumed cylinder breaches for the action alternatives was a slightly higher estimate of impacts on groundwater, air quality, and human health and safety for the action alternatives, although the estimated impacts are still within applicable standards or guidelines. Further details on the assumed cylinder breaches under the action alternatives, and the impact of these assumptions on the analyses, are given in the Introduction to Section D.4 of Appendix D.

Comment 18

General (Overall Conclusion) — The PEIS clearly supports continued storage of the material as UF_6 until viable uses are identified (called No Action in the PEIS). Continued storage, with the assumption of at least partial use by the year 2039, is shown to have the fewest environmental impacts. It is also, by far, the least costly alternative although the PEIS is deficient in showing this. Finally, continued storage for several more years with little adverse impact would allow for further demands for the material to be developed and speculative measures, such as conversion or consolidation, would not be necessary at this time. It is disappointing that all of DOE's effort did not result in any significant, realistic near-term uses for the material but at least the PEIS shows that continued storage as UF_6 at the current sites would not present unmanageable problems.

Response 18

The commentor's preference for the No Action alternative is noted by DOE. It should be recognized that the results of the PEIS indicate that all alternatives have generally similar environmental impacts, although differences do exist in the types and magnitude of impacts for some areas assessed, as discussed. No alternative offers clear environmental advantages in all areas, and no alternatives are precluded on purely environmental grounds. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products.

Commentor No. 91: MacMullen, Michael W.
U.S. Environmental Protection Agency

Comment 1

It is our agency's opinion that the depleted uranium hexafluoride (UF_6) should be converted to a form that is more stable and less hazardous, such as uranium oxide (U_3O_8) for long term storage or until an alternative use can be found and we applaud your management program for proposing this alternative.

Response 1

The EPA's preference for conversion of depleted UF_6 to uranium oxide for long-term storage until uses are identified is noted. In response to comments received from the U.S. EPA and others on the Draft PEIS, DOE has revised its preferred alternative. As described in Section 2.5.1 of the PEIS, the revised preferred alternative consists of the following elements: continuing the safe, effective management of the cylinders; beginning prompt conversion of the depleted UF_6 into depleted uranium oxide and HF or CaF_2; storing depleted uranium oxide; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabricating depleted uranium oxide and/or metal products for use.

Comment 2

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, we have reviewed the information that you submitted. Based on the information provided, we have rated this DEIS EC-2. The EC portion of the rating indicates that we have environmental concerns and the 2 portion of the rating indicates additional information data, analyses or discussion should be included in the final EIS. To satisfy these concerns, please provide additional discussion, data, and/or analysis to address the following:

Response 2

EPA's rating of EC-2 for the PEIS is noted. DOE has reviewed EPA concerns and provided a discussion of these as indicated in response 1 above and in the following responses. These responses indicate where the PEIS has been revised in response to EPA's comments.

Comment 3

A single location for a conversion pilot plant should be identified to evaluate the engineering and other demands of converting the material. After experience has been gained operating a stabilization process in a single location, consideration should be given to whether the single plant, or plants at multiple locations would be best suited to converting any remaining material.

Response 3

The purpose of the PEIS is to provide a meaningful evaluation and comparison of the potential environmental impacts of broad alternative management strategies. The Record of Decision for the PEIS will announce the selection of a management strategy, but will not specify sites or specific technologies to be used. Thus, consideration of the construction and operation of pilot plants is beyond the scope of the PEIS. Future planning and environmental analyses will address issues related to engineering and site-selection for depleted UF_6 management strategies, consistent with all applicable laws and regulations, including the public law 105-204 which was signed into law in July 1998.

Comment 4

Until such time as the DUF_6 is converted to a more stable form, a long-term storage strategy should be developed to address issues surrounding deteriorating storage canisters.

Response 4

A storage strategy has been developed to address continued storage of the cylinders. This plan is described in the cylinder project management plan for the three sites (LMES 1997i; the full citation is provided in Chapter 8 of the PEIS). Under this plan, new storage yards with stabilized concrete bases and improved drainage have been constructed at the Paducah and Portsmouth sites. Cylinders are being relocated to allow space for adequate visual inspections; relocated cylinders are being placed on concrete saddles to keep them out of ground contact. Each site has an intensive cylinder inspection program to allow identification of any damaged or breached cylinders as well *as a radiological program to detect leakage from valves. Annual inspections are required for those cylinders that have previously been stored in substandard conditions and/or for those that show areas of heavy pitting or corrosion. All other cylinders must be inspected once every four years. Due to the improved storage conditions and frequent inspections, any breached cylinders identified in the future are expected to be recently breached with little material loss.*

Comment 5

Before transporting DUF_6 in storage canisters with deteriorated or uncertain integrity, secondary containment or other engineering measures should be employed to ensure safety comparable to that provided by new canisters.

Response 5

Due to the deteriorated condition of some of the cylinders, the DOE included in the PEIS evaluation of two methods for transport of cylinders which do not meet Department of Transportation requirements: (1) the use of overcontainers which would meet DOT requirements, and (2) on-site transfer of the substandard cylinder contents to new cylinders. Because the number of cylinders which will not meet DOT requirements at the time of transport is not known, the analysis assumed a range of values, including a worst-case assumption of 100% of the cylinders at each site. The details of the analysis of cylinder preparation for transport are given in Appendix E of the PEIS. It should be noted that if the overcontainer option were selected, the overcontainer would meet the same safety requirements as the conforming cylinders. Therefore, the safety basis for transportation of the cylinders would be the same irrespective of the option chosen for cylinder preparation. For further details on the preconceptual design of the overcontainer, see the engineering analysis report (LLNL 1997a; the full citation is provided in Chapter 8 of the PEIS). The engineering analysis report is available for review at DOE public reading rooms near the three current storage sites and in Washington, DC (listed in the Notice of Availability), and can also be obtained by contacting the DOE program manager identified on the cover of the PEIS.

Comment 6

U.S. Department of Energy (US DOE) and the United States Enrichment Corporation (USEC) should apply a single, compatible methodology to discharge their respective responsibilities for the materials.

Response 6

EPA's suggestion is noted. The scope of the PEIS has been expanded to include up to 15,000 cylinders produced by USEC after July 1, 1993, that became or will become the responsibility of DOE by the signing of two memoranda of agreement between DOE and USEC after publication of the Draft PEIS (DOE & USEC 1998a-b; the full citations are provided in Chapter 8 of the PEIS). USEC, a private corporation, is responsible for decisions regarding the disposition of other depleted UF_6 *that it produces. There may be coordination between DOE and USEC on the management of their respective depleted* UF_6 *inventories in the future but this coordination is outside the scope of the PEIS.*

Comment 7

Conversion of this material should not be dependant on market demand. DOE should include plans to seek funds from Congress for conversion of all DUF_6.

Response 7

The EPA's preference for not basing conversion on market demand is noted. In response to this comment and similar comments from others, the preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. DOE expects that in the future, uses will be available for some portion of the depleted UF_6 inventory and plans to continue its support for the development of government applications for depleted uranium products. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Comment 8

An appropriate budget should be submitted to adequately fund this process for the necessary time periods. Funding needs to be provided to insure the reduction of potential risks to the environment and to public health.

Response 8

Issues of DOE program funding are beyond the scope of this PEIS. DOE will seek appropriate funding to implement the depleted UF_6 management strategy announced in the Record of Decision for the PEIS.

Comment 9

Be advised that you may require a Section 404 permit from the U.S. Army Corps of Engineers if wetlands will be impacted during this project. You should be in contact with them to determine whether this project will require such a permit. In accordance with the Section 404(b)(1) guidelines of the Clean Water Act, wetland impacts must be avoided and/or minimized whenever possible, and satisfactory compensation for unavoidable impacts must be provided.

With respect to the provision of compensatory wetlands, our Agency routinely finds that a minimum of 1.5 acres of compensatory wetlands are necessary to offset the loss of each acre of naturally occurring wetlands impacted by the project at issue. In addition, the compensatory wetlands should be designed to replicate as closely as possible the specific mix of types, functions and values provided by the project-impacted wetlands. The compensatory wetlands should be established via the process of restoration to the extent feasible, and they should be located in an area as close as practicable to the project-impacted wetlands.

Response 9

Comment noted. As a programmatic EIS (PEIS), this document does not propose site-specific projects. Future planning and environmental analysis on site-specific projects will address impacts to wetlands, including requirements for compensatory wetlands.

Commentor No. 92: Barber, Alex / Kuryla, Timothy
Kentucky Department for Environmental Protection

Comment 1

The Division (of Water) finds the current facility emergency response contingency plans appear to be adequate. If UF_6 were to be used or stored in Kentucky, then pursuant to 401 KAR 5:037, a groundwater protection plan would be required.

Response 1

Comment noted.

Commentor No. 93: Elliott, Guy R. B.
Santa Fe Alloys

Comment 1

I believe that DOE offers reasonable evaluations and wise preferences among the alternative strategies, i.e., preferring 100 percent use of the UF_6 (i) for conversion to uranium as oxide or metal and (ii) using as much of the material as DOE can to leave it recoverable.

Roughly 99 times the potential energy of the bomb U-235 material remains with the U-238 DU residue- as some of your readers will know. This DU could all be used in breeder reactors to generate future electric power, and then it would have high economic value.

It would be an environmental tragedy to throw it away, yet many people urge discarding this "useless" metal.

I commend DOE's for trying its best to save the material and for how it has identified DU use for radiation shielding. This would leave the DU available and not wasted. Other uses are sought.

One of the saddest parts of this situation is that all the DU metal could be saved if we would--the DU volume from all UF_6 (and all that energy) could be stored in a cube less than 100 feet on the edge. But such storage is probably not politically feasible at this time.

Response 1

Commentor's support for the conversion and use of uranium metal is noted. The preferred alternative is described in Section 2.5.1 of the PEIS. The discussion of the preferred alternative in the Final PEIS has been modified to clarify that it would be accomplished through continuing the safe, effective management of the cylinder inventory; beginning prompt conversion of the depleted UF_6 into uranium oxide and HF or CaF_2; interim storage of the uranium oxide pending use; converting depleted UF_6 into depleted uranium metal and HF or CaF_2 as uses for depleted uranium *metal products become available; and/or fabrication of depleted uranium oxide and/or metal products for use. Thus, the impacts of the preferred alternative may be the same as those presented for the use as oxide alternative (alternative 4) or the use as metal alternative (alternative 5), and may also include impacts from the storage of uranium oxide (see Sections 2.5 and 5.7 of the PEIS). The preferred alternative was not described as a distinct, separate alternative because it will, in practice, combine elements from several of the six alternatives evaluated.*

It should be noted that there are no current or future plans in the U.S. for a breeder reactor program.

Comment 2

The Draft PEIS serves well in justifying the DOE preference above, but care must be taken that postulated processes are reasonably justified experimentally before they are heavily funded. Sometimes an overall process is not well evaluated to see if the pieces have been combined ways that are not awkward.

Specifically, in the case of the selected CMR production of depleted uranium metal, there should be evaluations and experimental confirmation of whether the old hydrogen reduction of UF_6 should be a precursor of the metal production, or if other approaches are better. Also, features such as minimization of radioactive transport (which the public dislike) should also be considered carefully.

Response 2

Commentor's recommendations for careful evaluation of processes are noted. DOE agrees with the commentor on the need for such careful evaluation. Please note that the implementation of any conversion processes will be by a competitive procurement process, which will allow for such evaluation, as recommended by the commentor.

Comment 3

The people doing the postulated process writeups have done well but further input is needed. Your public meetings may provide the input, especially as combined with private meetings from outside DOE.

Response 3

DOE agrees with the commentor's suggestions. To that end, DOE has held a number of public meetings in and around the three sites, as well as meetings in other locations to obtain the greatest input from public and industry representatives on the disposition of the depleted UF_6. DOE will continue to hold such meetings and to solicit input on the various processes or technical issues of conversion or uses.