NIRS/PC Prefiled Exhibit 205
Docketed 09/23/2005

45 N.R.C. 99, 1997 WL 345666 (N.R.C.)

****1** IN THE MATTER OF
LOUISIANA ENERGY SERVICES, L.P., (Claiborne Enrichment Center)
Nuclear Regulatory Commission

Atomic Safety and Licensing Board

LBP-97-3
Docket No. 70-3070-ML (ASLBP No. 91-641-02-ML) (Special Nuclear Material License)

March 7, 1997

99 Before Administrative Judges: Thomas S. Moore, Chairman; Richard F. Cole; Frederick J. Shon

In this Partial Initial Decision in the combined construction permit-operating license proceeding for the Claiborne Enrichment Center, the Licensing Board resolves in favor of the Intervenor a portion of decommissioning funding contention B.1 and environmental contention J.3 concerning the conversion component of the estimated cost of tails disposal.

RULES OF PRACTICE: BURDEN OF PROOF

The Commission's rules of practice for the conduct of formal adjudicatory hearings provide in 10 C.F.R. § 2.732 that the applicant has the burden of proof in the proceeding. Thus, in order for the applicant to prevail on each contested factual issue, the applicant's position must be supported by a preponderance of the evidence. Philadelphia Electric Co. (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 720 (1985); Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-763, 19 NRC 571, 577 (1984). See 1 Charles H. Koch, Jr., Administrative Law and Practice § 6.44 (1985).

100 USEC PRIVATIZATION ACT: DEPLETED URANIUM TAILS

The USEC Privatization Act, 42 U.S.C. § 2297h-11(a)(1)(B) now makes the Department of Energy, at the request of an NRC-licensed enricher, responsible for the disposal of depleted uranium tails at DOE's disposal costs, including a pro rata share of any of DOE's capital costs.

PARTIAL INITIAL DECISION

(Resolving Contentions B and J.3)

This Partial Initial Decision addresses contentions B and J.3 dealing with decommissioning funding filed by the Intervenor, Citizens Against Nuclear Trash ("CANT"), in this combined construction permit-operating license proceeding. The Applicant, Louisiana Energy Services, L.P. ("LES"), seeks a 30- year materials license to possess and use byproduct, source, and special nuclear material to enrich uranium using a gas centrifuge process at the Claiborne Enrichment Center ("CEC"). The Applicant intends to build the CEC on a site in Claiborne Parish, Louisiana, adjacent to and between the two unincorporated African-American communities of Center Springs and Forest Grove some 5 miles northeast of the town of Homer, Louisiana. The history of this licensing proceeding may be found in our earlier Partial Initial Decisions, LBP-96-7, 43 NRC 142 (1996), resolving contentions H, L, and M that challenged the Applicant's emergency plan and safeguards measures, and LBP-96- 25, 44 NRC 331 (1996), resolving contentions J.4, K, and

Q that challenged the need for the facility, the treatment of the no-action alternative in the final environmental impact statement ("FEIS"), and the Applicant's financial qualifications.

I. DECOMMISSIONING FUNDING CONTENTIONS

A. Contentions B and J.3

2 CANT's contention B, titled "Decommissioning Plan Deficiencies," asserts that "[t]he LES decommissioning [funding] plan does not provide reasonable assurance that the CEC site can be cleaned up and adequately restored upon cessation of operations." Although the Intervenor proffered a number of supporting bases for this contention, the Licensing Board, as then constituted, found three bases supported the contention. In basis B.1, CANT asserts that there is no realistic basis for LES' then estimate (of $9.5 million per year) for the cost of depleted UF_6 tails ("DUF_6") disposal because the Applicant does not have a plan for the offsite disposal of tails. The Intervenor claims in basis B.4 that LES provides no details on how CEC decommissioning costs ***101 were determined. Finally, in basis B.5, CANT declares that the Applicant's summary of decommissioning costs fails to indicate the facilities that will be decontaminated and the extent to which they will be decontaminated. LBP-91-41, 34 NRC 332, 337 (1991). On the strength of these three bases, the Licensing Board admitted contention B "insofar as it challenges the reasonableness of LES' decommissioning funding plan." Id.
In admitting contention B, the Board noted that the Commission's hearing notice for the licensing proceeding directed that the Applicant must have a "plausible strategy" for the disposition of DUF_6 tails. 56 Fed.Reg. 23,310, 23,313 (1991). Additionally, the Board stated that the Commission's regulations, 10 C.F.R. § 70.25(a), (e), require that the Applicant submit a decommissioning funding plan containing a cost estimate for decommissioning and the means for adjusting cost estimates and funding levels periodically over the life of the facility. See also 10 C.F.R. § 40.36(a), (c)(1), (d), (e)(3). In light of these factors, the Board ruled that, although there was no regulatory requirement that the Applicant have a "concrete plan" for the disposal of depleted uranium tails, LES must have a plausible strategy for tails disposition and, in order for the regulations to have any meaning, the Applicant's "cost estimate should contain reasonable estimates for an adequately described decommissioning strategy." 34 NRC at 338. Thus, the Board ruled that CANT's contention B supported by bases B.1, B.4, and B.5 had satisfied the Commission's contention pleading requirements by alleging that "the decommissioning funding plan does not contain reasonable estimates for decommissioning nor does it adequately describe the underlying decommissioning strategy." Id.
CANT's contention J, titled "Inadequate Assessment of Costs Under NEPA," alleges that the Applicant's environmental report ("ER") for the CEC does not adequately describe or weigh the environmental, social, and economic impacts and costs of operating the facility and that the costs of the project far outweigh the benefits of the proposed action. In basis J.3, the Intervenor asserts that LES has not provided a sufficient foundation for its decommissioning cost estimates and incorporates the bases it proffered in support of contention B. The Licensing Board found that bases B.4 and B.5 also supported contention J and admitted the contention. Id. at 350. Although CANT contention J.3 is phrased only in terms of a challenge to the Applicant's ER, the contention necessarily encompasses the Staff's later-filed environmental impact statement as well. See 44 NRC at 337-38. Further, because the Intervenor's contention J.3 challenges the same decommissioning costs (albeit in the context of the Applicant's ER and the Staff's EIS) that are the subject of contention B, all parties addressed the contentions together in their testimony. Similarly, we do not separately address CANT's contention J.3 and our findings and conclusions on contention B also encompass contention J.3.

*102 B. Witnesses and Exhibits

**3 In support of its position on contentions B and J.3, the Applicant presented the testimony of a panel of witnesses consisting of Peter G. LeRoy, Bernard G. Dekker, Richard W. Dubiel, and John M.A. Donelson. Due to a pretrial procedural ruling the prefiled direct testimony of this panel of witnesses appears in the record in two parts, i.e., that of Mr. LeRoy and Mr. Dekker (LeRoy-

Dekker fol: Tr. 1016) and that of Mr. Dubiel, Mr. Donelson, and Mr. LeRoy (Dubiel-Donelson fol. Tr. 1026).
Mr. LeRoy, the Licensing Manager of the CEC, was responsible for compiling the information on decommissioning planning and funding in the LES Decommissioning Funding Plan, the LES Safety Analysis Report, and the Applicant's ER. (LeRoy-Dekker at 2 fol. Tr. 1016.) Mr. Dekker is the Manager of Safety, Safeguards, and Licensing for Urenco Nederland B.V., which operates uranium enrichment facilities at Almelo in the Netherlands. He has held that position since 1984 and, in his over 18 years working for Urenco Nederland, B.V., he has gained extensive experience in the operation, decontamination, and decommissioning of gas centrifuge uranium enrichment facilities. Mr. Dekker was retained by the Applicant to advise LES on various matters with respect to planning and funding for decontamination and decommissioning of the CEC, including the development of the LES Decommissioning Funding Plan. (Id.)
Mr. Dubiel holds a bachelor of science degree in physics and a master of science degree in nuclear engineering and he currently is the Director of Special Programs at Applied Radiological Control, Inc. In that capacity he is responsible for overseeing specialty health physics and radiological decontamination services provided to the United States Departments of Energy and Defense and various NRC licensees. He has over 20 years of experience handling NRC-licensed materials, including classifying, packaging, and shipping radioactive waste for disposal. (Dubiel-Donelson at 2 & Attach. 2 fol. Tr. 1026.) Like Mr. Dubiel, Mr. Donelson also has earned a bachelor of science degree in physics and a master of science degree in nuclear engineering. He is an engineer in the Fuel Management Section of the Nuclear Engineering Division of Duke Power Company and his specific area of responsibility is uranium enrichment. Mr. Donelson is knowledgeable about the characteristics and properties of uranium in various physical and chemical forms. (Id. at 3.)
The prefiled direct testimony of these witnesses on contentions B and J.3 was admitted into evidence pursuant to a pretrial stipulation of the parties and without further objection at the hearing. (Tr. 1016, 1026.) Because the Applicant did not offer these witnesses as experts and, in light of the parties' admissibility stipulation, the Board did not rule at the hearing on the qualifications of these witnesses as experts. Obviously, however, as the LES official responsible for ***103** compiling the information on decommissioning in the LES license application, Mr. LeRoy is qualified to testify on that information and related submittals. Further, we find that Mr. Dekker is qualified by knowledge and experience and that Mr. Dubiel and Mr. Donelson are qualified by education, knowledge, and experience to testify as expert witnesses on the issues involved in contentions B and J.3. [FN1]
****4** In support of its contentions B and J.3, the Intervenor presented the testimony of Dr. Arjun Makhijani, President of the Institute for Energy and Environmental Research. (Makhijani at 1 fol. Tr. 1081.) Dr. Makhijani earned his Ph.D. in engineering from the University of California, Berkeley, where his dissertation subject involved controlled nuclear fusion. He currently serves as a consultant to the United States Environmental Protection Agency ("EPA") Science Advisory Board, Radiation Advisory Committee, and he is a member of the Subcommittee on Radiation Cleanup Standards of the EPA National Advisory Council for Environmental Policy and Technology. He has also been a consultant to numerous other institutions such as the Congressional Office of Technology Assessment, Lawrence Berkeley Laboratory, Tennessee Valley Authority, Ford Foundation, and Edison Electric Institute. Dr. Makhijani has extensive experience in the area of nuclear waste classification and disposal and he has published numerous books and reports on these topics, including co-authoring High-Level Dollars Low-Level Sense: A Critique of Present Policy for the Management of Long-Lived Radioactive Waste and Discussion of an Alternative Approach, Apex Press, New York (1992). (Id. at 1 & Attach.)
The prefiled direct testimony of Dr. Makhijani was admitted pursuant to a pretrial stipulation of the parties and the Intervenor offered his testimony as that of an expert in the field of nuclear engineering. (Tr. 1081.) We find that Dr. Makhijani is qualified ***104** by education, knowledge, and experience to testify as an expert on the issues involved in contentions B and J.3. [FN2]
The NRC Staff presented the testimony of a panel of witnesses consisting of Yawar H. Faraz, John W.N. Hickey, and Dr. Joseph D. Price, although only Mr. Faraz and Mr. Hickey presented the Staff's prefiled direct testimony. (Faraz-Hickey fol. Tr. 1106.) Mr. Faraz holds a bachelor of science degree in nuclear and mechanical engineering and he is a nuclear process engineer in

the Certification Section, Enrichment Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards ("NMSS"). Since April 1994, he has served as the NRC Licensing Project Manager for the CEC. (Id. at 1.) Mr. Hickey earned a bachelor of science degree in mechanical engineering and a master of science degree in environmental health. He is the Chief of the Enrichment Branch, Division of Fuel Cycle Safety and Safeguards, NMSS, which has responsibility for all regulatory matters related to uranium enrichment. (Id. and Attach. 2.) Dr. Price earned his Ph.D. in chemical engineering and currently he is a senior chemical engineer with Science Applications International Corporation ("SAIC"). As task manager, he directed SAIC's effort to develop under contract to the NRC the Safety Evaluation Report for the CEC and, in over 16 years with SAIC, Dr. Price has had extensive experience in safety, transport, and environmental analyses of nuclear waste facilities as well as chemical process modeling and analysis. (Staff Exh. 4.) [FN3] Pursuant to the pretrial stipulation of the parties and without further objection at the hearing, the prefiled direct testimony of Mr. Faraz and Mr. Hickey on these contentions was admitted. (Tr. 1104.) We find that Mr. Faraz, Mr. Hickey, and Dr. Price are qualified by education, knowledge, and experience to testify as experts on the issues involved in contentions B and J.3.

***5** As in the case of the other contentions adjudicated in this proceeding, the Commission's rules of practice for the conduct of formal hearings provide in 10 C.F.R. § 2.732 that the Applicant has the burden of proof in the proceeding. Therefore, in order for LES to prevail on each contested factual issue, the Applicant's position must be supported by a preponderance of the evidence. Philadelphia Electric Co. (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 720 (1985); Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-763, 19 NRC 571, 577 (1984). See 1 Charles H. Koch, Jr., Administrative Law and Practice § 6.44(1985). In ***105** accordance with the Commission's burden of proof rule and pursuant to the stipulation of the parties, the Applicant presented its case on these contentions first, followed by the Intervenor, and then the NRC Staff.

II. BOARD FINDINGS ON PARTIES' POSITIONS

Before turning to contention B, a further brief explanation of the applicable standard for judging the Intervenor's challenge to the Applicant's funding plan is helpful. As previously mentioned, the Licensing Board admitted CANT's contention B to the extent that it challenged the reasonableness of the LES Decommissioning Funding Plan. In so ruling, the Board noted that the Commission's hearing notice required the Applicant to have a plausible strategy for the disposal of DUF_6 tails as part of its funding plan and that the Commission's regulations required the funding plan to contain reasonable cost estimates for the components of the plan. Although in its hearing notice the Commission listed a number of possible generic tails disposal strategies such as storage of tails at the plant site as a possible future resource or conversion of tails to uranium oxide for disposal, the Commission did not specifically define what constitutes a plausible strategy. The plain meaning of these terms, however, provides the answer. The dictionary defines "plausible" as "reasonable" or "credible," Webster's Third New International Dictionary 1736 (1971), and "strategy" as a "plan." Id. at 2256. Thus, in assessing the plausible tails disposal strategy adopted by the Applicant as part of its decommissioning funding plan, we first must determine whether the funding plan contains a reasonable or credible plan to dispose of the DUF_6 tails generated at the CEC and then determine whether the Applicant's cost estimates for the components of the plan are reasonable.

A. LES Tails Disposal Strategy

The Applicant's tails disposal strategy is capsulized in the LES Decommissioning Funding Plan that appears as Exhibit 1 to the LES License Application. In pertinent part, the Applicant's funding plan states:

The annual tails disposal cost is estimated to be $16.175 million. This is multiplied by 30 years to arrive at the $485.3 million figure. Costs are based on converting UF_6 to U_3O_8 with subsequent disposal in a facility under cognizance of the NRC. U_3O_8 conversion costs are based on estimates by a vendor which could make this service available to LES. Disposal costs are based on NRC

recommendations and a study by Martin Marietta. The conversion and disposal costs are added and escalated to 1996 dollars.

***6 *106** (App.Exh. 1, at Exh. 1, at I-4.) Further, the LES funding plan states that the Applicant intends to set aside the annual tails disposal cost component of its overall decommissioning costs in an external trust that meets the requirements of the Commission's funding regulations. (Id. at I-2, I-5, I-8 to -9.) Finally, the LES plan states that the Applicant will update its decommissioning cost estimate at least once every 5 years. (Id. at I-6.)

At the hearing, the Applicant's witnesses, Mr. LeRoy and Mr. Dekker, provided additional details of the LES tails disposal plan. Their testimony recognizes that there currently are no facilities in the United States to convert DUF_6 to U_3O_8, but they stated that COGEMA, Inc., the American affiliate of a French nuclear fuel company, "has indicated to LES in writing its willingness to consider providing, in the United States, conversion services for DUF_6." (LeRoy-Dekker at 24 fol. Tr. 1016; App.Exhs. 5 & 6.) These LES witnesses asserted that, in its letters to LES, COGEMA indicated that the experience gained by its parent company in successfully operating a commercial-size defluorination facility in France could be used as the basis for employing technology in the United States to convert DUF_6 to U_3O_8. As the COGEMA letter states, the "prudent management of depleted UF_6 should consider conversion to U_3O_8 powder, which is insoluble in water, does not react with external chemical agents, is free of fluorine and is the most compact form for storage." (App.Exh. 5.) Additionally, Mr. LeRoy and Mr. Dekker testified that, in 1991, COGEMA estimated its charge for deconversion services to be in the range of $3-5 per kilogram of uranium and its 1995 updated estimate indicated a range of $4-6. These witnesses stated that these estimates assume the construction and operation of a deconversion facility in the United States under NRC standards. (LeRoy-Dekker at 24 fol. Tr. 1016; App.Exhs. 5 & 6)

After conversion of the DUF_6 tails to U_3O_8, the LES disposal strategy provides for the U_3O_8, as waste, to be shipped to a final disposal site for deep land burial such as in a deep mine. Again, the LES disposal plan recognizes that currently there are no operating deep disposal sites, but Mr. LeRoy testified that it is reasonable to assume such a site will be available in the future because in the United States there are dozens of underground uranium mines and other underground mines. (LeRoy-Dekker at 34 fol. Tr. 1016.)

Although the Applicant's tails disposal strategy calls for LES to convert the CEC tails to U_3O_8 and then ship the U_3O_8 for deep burial as waste, Mr. LeRoy candidly admitted in his testimony that, "[a]s a practical matter, LES is holding open its options for disposition of UF_6." (Id. at 19.) He testified that "for purposes of this licensing proceeding, in order to satisfy the Commission's requirement that the CEC license application contain a 'plausible strategy' for disposition of depleted uranium, LES has assessed, and factored into its funding plan the costs of conversion of DUF_6 to DU_3O_8 and land disposal (deep burial) of DU_3O_8 as if it were a waste." (Id.) The Applicant's witnesses stated, however, ***107** that LES did not necessarily plan on disposing of the depleted uranium from the CEC by burying it as waste and that there were other potential options for the future disposition of DUF_6. They noted that the Department of Energy ("DOE") is currently analyzing the tails disposition issue and that European enrichers consider depleted uranium tails a resource rather than a waste product. Further, they testified that Urenco's long-term plan for the disposition of depleted uranium is being studied and that, at present, the plan calls only for the offsite conversion of tails to U_3O_8. (Id. at 20.) Finally, Mr. LeRoy readily conceded that, as a practical matter, LES will follow the same tails disposition option that DOE selects for its stockpile of tails. (Tr. 1076-77, 1069-70.)

***7** The NRC Staff witnesses, Mr. Faraz and Mr. Hickey, stated in their direct testimony that they found the Applicant's tails disposition plan calling for conversion of DUF_6 to U_3O_8, with subsequent deep subsurface burial, an acceptable plausible strategy. In this regard, the Staff's review of the LES decommissioning plan in the SER states:

Currently there are no facilities designed and equipped for the disposition of large volumes of depleted uranium originating from enrichment facilities. The Department of Energy (DOE) currently possesses essentially the entire depleted UF_6 inventory in the United States. In July 1993, the United States Enrichment Corporation (USEC) took over from DOE low enriched uranium production activities conducted at the two operating gaseous diffusion plants (GDP) located in Portsmouth, Ohio and Paducah, Kentucky. Currently neither DOE nor USEC has in

place a plan concerning final disposition of the DUF_6. The Energy Policy Act of 1992 requires DOE to address this issue. The NRC staff believes that it is premature to require a prescriptive resolution prior to DOE's determination on disposition of DUF_6, which will, to a large extent, determine the disposition options for LES' DUF_6 . For the purpose of estimating funding requirements related to the disposition of DUF_6, the NRC staff finds acceptable the applicant's estimates based on conversion of DUF_6 to U_3O_8, which is much more environmentally stable than UF_6 or uranium tetrafluoride (UF_4), and disposition in a deeper than shallow land burial facility (for example, an abandoned mine cavity).
(Staff Exh. 1, at 15-12.)
Additionally, in the FEIS, the Staff modeled the respective doses for both near-surface and deep burial disposal because there currently are no disposal facilities for large quantities of depleted uranium tails. Because the projected drinking water and agricultural doses from a modeled near-surface burial site consisting of an earth-mounded bunker subject to the environmental characteristics of the humid southeastern United States exceeded the 10 C.F.R. Part 61 limits, the Staff concluded that a deep disposal site is most likely to be selected for tails disposal. (Staff Exh. 2, at 4-66 to -67 & Appendix A, at A-9.) The Staff also modeled a hypothetical deep disposal site. It assumed the site would be an existing cavity, such as an abandoned mine, located in the United States and would have geologic characteristics similar to those of two representative sites that previously have been characterized for disposal of radioactive waste, ***108** i.e., a granite formation overlain by a thin layer of glacial till or a sequence of interbedded sandstone and basalt layers. (Staff Exh. 2, at 4-66 to -67 & Appendix A, at A-10.) The Staff's FEIS analysis concluded that all estimated dose impacts for a deep disposal site are less than those set forth in 10 C.F.R. Part 61. (Staff Exh. 2, at 4-67 to - 68 & Appendix A, at A-10 to -15.)
****8** The purpose of the Applicant's tails disposal strategy is to enable the computation of reasonable cost estimates for the various essential elements of the decommissioning plan, thereby ensuring compliance with the Commission's regulatory requirement that during the CEC's life LES escrows sufficient funds to cover, inter alia, the cost of tails disposal. With this in mind, we find that the Applicant has presented a plausible disposal strategy. The Applicant's plan to convert DUF_6 to U_3O_8 at an offsite facility in the United States and then ship that material as waste to a final site for deeper than surface burial is a reasonable and credible plan for tails disposal. Although no conversion facilities currently exist in the United States, the LES materials license will give the Applicant 15 years before it first must move the accumulated DUF_6 offsite. (App.Exh. 1(e), at 1-2.) The conversion of DUF_6 to U_3O_8, as the COGEMA experience in France demonstrates, is a commercially feasible process using known chemical processes that could be readily employed in the United States by COGEMA or another entity without first having to overcome difficult technical hurdles. (App.Exh. 7, at 18; Staff Exh. 2, at Appendix A, at A-1 to -4.) Thus, contrary to the Intervenor's assertion, [FN4] the fact that there is no currently operating defluorination facility in the United States or a firm commitment by COGEMA or some other entity to build such a facility does not somehow make it unlikely, or unreasonable to assume, that one will be built here in the future to convert DUF_6 tails to U_3O_8. Similarly, in light of the numerous existing uranium and other mines in the United States, it is reasonable to assume an appropriate site for deep burial of U_3O_8 will be available in the future. Indeed, the reasonableness and credibility of the LES disposal strategy is enhanced by the Department of Energy's clear need to address the disposal options for its huge inventory of DUF_6 that, as of mid-1992, amounted to some 534,000 metric tonnes (App.Exh. 8, at 3)--an amount of depleted uranium tails five times the amount of tails the CEC will produce under its 30-year license. Further, CANT's legal challenge to that element of the Applicant's disposal strategy calling for deep burial of U_3O_8 is without merit. It argues that pursuant to the Commission's regulations, 10 C.F.R. § 61.55(a)(2)(iv), deeper than surface burial is unavailable for DUF_6 disposal. According to the Intervenor, DUF_6 waste, which CANT claims is closely comparable in radiological properties to transuranic waste, must be disposed of in a geologic repository (with a ***109** consequent order of magnitude increase in cost) unless the Commission first approves and licenses a specific disposal site. The Intervenor claims, therefore, that LES does not have the option of establishing, based on a generic analysis like that in the FEIS, that the tails can be disposed of in some intermediate waste disposal facility. [FN5] The Intervenor's assertions, however, merely repeat the same arguments CANT made to us in its pretrial "Petition for Waiver of 10 C.F.R. §

61.55(a)(3) and 10 C.F.R. § 61.55(a)(6) and for Classification of Depleted Uranium Tails as Greater Than Class C Radioactive Waste" (Jan. 17, 1995). In a pretrial Memorandum and Order (Mar. 2, 1995) we rejected these same arguments and denied the Intervenor's waiver petition. Our earlier ruling is the law of the case on these issues and forecloses any reexamination here. Thus, in accordance with our earlier ruling, we find that the Applicant's tails disposal strategy is not deficient for failure to treat the CEC tails as greater than class C waste with mandatory disposal in a geologic repository licensed under 10 C.F.R. Part 60.
***9** Although we find that the Applicant's tails disposal plan is a plausible strategy for purposes of estimating LES' tails disposal costs, we note that a recent change in the law by the enactment of the USEC Privatization Act, Pub.L. No. 104-134, 100 Stat. 1321 (1996), will most likely dictate the actual LES disposal strategy. [FN6] That Act now makes DOE, at the request of an NRC-licensed enricher, responsible for the disposal of depleted uranium tails at DOE's disposal costs, ***110** including a pro rata share of any of DOE's capital costs. 42 U.S.C. § 2297h-11(a)(1)(B), (a)(3). As previously indicated, the Applicant's Licensing Manager, Mr. LeRoy, testified that, as a practical matter, LES will follow the same disposal option selected by DOE for the government's DUF_6 stockpile. Similarly, the Staff's witness, Mr. Hickey, testified that the NRC anticipates that LES will use the same tails disposal method that DOE selects. (Tr. 1156-57.) The Intervenor also apparently agrees, for in its proposed findings CANT states that "LES intends to rely on DOE's disposition strategy." CANT PF at 50. Thus, even though the USEC Privatization Act, 42 U.S.C. § 2297h-11(b), provides LES with the option of using other authorized persons for tails disposal, we think it is clear, and all parties apparently agree, that the Applicant's actual disposal method will be to transfer the CEC tails to DOE and pay DOE's disposal charges. [FN7]

B. Cost Estimates for Tails Disposal

While we recognize that DOE's future charges for tails disposal will ultimately determine the Applicant's tails disposal costs, the Commission's regulations require that the Applicant provide reasonable cost estimates for its tails disposal plan at this time in order to ensure that LES sets aside sufficient funds during the life of the CEC to cover its disposal costs. Accordingly, we must determine whether the Applicant's cost estimates for the components of its chosen plan are reasonable on the basis of the record before us. We turn now to those cost estimates, noting that, because DOE's disposal scheme is likely to be the same as the Applicant's plausible strategy, the current hearing record still is relevant to the issue of whether the Applicant's ultimate tails disposal cost estimate is reasonable.
As earlier indicated, the Applicant's Decommissioning Funding Plan provides that the annual tails disposal cost for the CEC is $16.175 million, totaling $485.3 million for 30 years of operation. (App.Exh. 1, at Exh. 1, at I-4.) At the hearing, Mr. LeRoy's direct testimony stated that the annual tails disposal figure includes $0.8 million for shipment costs, $12.0 million for conversion costs of ***111** DUF_6 to U_3O_8, and $3.375 million for disposal of U_3O_8. (LeRoy-Dekker at 23 fol. Tr. 1016.) In the SER, the Staff found the Applicant's estimated facility decommissioning funding, which includes the Applicant's annual tails disposal cost of $16.175 million, adequate. (Staff Exh. 1, at 15-21, 15-23.) At the hearing, Mr. Faraz and Mr. Hickey stated in their direct testimony that the LES tails disposal estimates were reasonable and, more specifically, that the Applicant's estimated cost for U_3O_8 burial was reasonable. (Faraz-Hickey at 7, 9 fol. Tr. 1106.) The Intervenor challenges each of the Applicant's component cost estimates.

1. Transportation Costs

***10** In his prefiled direct testimony, Mr. LeRoy stated, without elaboration, that the LES estimate of $800,000 per year transportation costs for depleted uranium tails "is based on conversations with shippers of UF_6 and U_3O_8." (LeRoy-Dekker at 25 fol. Tr. 1016.) The Intervenor's witness, Dr. Makhijani, challenged the validity of the LES estimate, asserting that it implicitly assumes that the conversion facility will be located very close to the disposal site. He opined that, because the location of the disposal site is unknown, such an assumption is rash and that it was unlikely any community would accept both a conversion facility and a disposal site. Dr. Makhijani testified that the Applicant's transportation costs should have provided for the cost

of the shipment of U_3O_8 from the conversion facility to the disposal site as well as for packaging the U_3O_8 for shipment. (Tr. 1200.)
The Applicant's testimony setting out the basis for its annual tails disposal cost estimate is sparse, at best. Nevertheless, contrary to Dr. Makhijani's assertion, the reasonable inference from Mr. LeRoy's bare-bones testimony that the LES estimate is based upon information from shippers of UF_6 and U_3O_8 is that the Applicant's estimated shipping costs are based upon the shipment of DUF_6 tails to the converter as well as the shipment of U_3O_8 from the converter to a disposal facility. And, in the end, any weakness in the Applicant's testimony about its transportation costs is rectified by the transportation cost data contained in the 1990 Martin Marietta Report, "The Ultimate Disposition of Depleted Uranium," prepared at Oak Ridge for DOE (App.Exh. 7, at 17-18) and the 1994 EG & G Report, "Depleted Uranium Disposal Options Evaluation," prepared at Idaho Falls also for DOE. (App.Exh. 8, at 48- 50.)
The Martin Marietta Report estimated that the rail transportation cost of shipping DUF_6 from Paducah, Kentucky, the location of one of the gaseous diffusion plants then owned by DOE, to an unspecified West Coast location for conversion and disposal was approximately $0.15/kgU. The EG & G Report estimated that the truck transportation cost of shipping U_3O_8 from Piketon, Ohio, the location of another DOE facility, to the Nevada Test Site ("NTS") in Nevada ***112** was approximately $0.18/kgU in 1993 dollars. In addition, the EG & G Report estimated that 55-gallon drum container costs added another $0.11/kgU to the estimate. Obviously, precise transportation cost estimates cannot be obtained at this time because such costs are dependent on the location of the conversion facility and the ultimate disposal site. But the application of this same rail rate from Paducah to the same West Coast location for the CEC UF_6 tails yields transportation costs of less than half the amount to be set aside by LES for annual transportation costs. Even escalating that cost to 1996 dollars yields an amount that is a little over half the LES estimate. Similarly, the application of this same truck and container rate from Piketon to the NTS for the CEC U_3O_8 yields total transportation costs that are about 90% of the amount to be set aside by LES for annual transportation costs. Even escalating that cost to 1996 dollars yields an amount that is approximately the same as the LES estimate. Although Paducah, Kentucky, and Piketon, Ohio, obviously are not Homer, Louisiana, this comparison serves to illustrate the dimensions of the rail transportation costs of UF_6 and the truck transportation costs of U_3O_8 from east of the Mississippi River to the West Coast and the NTS, respectively. Accordingly, we find that the Intervenor's challenge to the Applicant's annual tails disposal transportation cost estimate is without merit and that the LES estimate of the transportation component of its tails disposal estimate is a reasonable one.

2. Disposal of U_3O_8

***11** The Applicant's annual tails disposal estimate also includes $3.375 million for the deep disposal by burial of U_3O_8. Mr. LeRoy testified that the LES estimate is based upon a June 18, 1993 letter from the NRC to LES. (LeRoy-Dekker at 25 fol. Tr. 1016.) In part, the NRC letter states that "[u] ntil the specific disposal site and method are identified, the estimated cost is uncertain. However, for financial planning purposes, we believe that it is reasonable to assume a disposal cost of approximately $1.00 per kilogram of U_3O_8." (App.Exh. 4h, at 1-2.) In turn, the Staff's basis for the $1.00/kg U_3O_8 relies upon the 1990 Martin Marietta Report and the Staff's tracking of low-level waste burial charges. (LeRoy-Dekker at 26 fol. Tr. 1016; Faraz- Hickey at 9 fol. Tr. 1106.) The Martin Marietta Report estimates the permanent disposal costs of U_3O_8 utilizing the waste disposal fees for shallow burial at the federal NTS and Hanford, Washington disposal sites. It states that, with efficient packaging, low-density U_3O_8 would cost about $0.25/kgU for NTS disposal and $1.00/kgU at Hanford. The Report concludes that the higher-cost disposal estimate of $1.00/kgU represents the prudent basis for current estimates. (App.Exh. 7, at 17.)
Mr. LeRoy explained that the LES estimate stated in kilograms of U_3O_8 is about 15% higher than the estimates from the Martin Marietta Report stated in ***113** kilograms of uranium because U_3O_8 is about 85% uranium by weight. (LeRoy-Dekker at 27 fol. Tr. 1016.) Additionally, he testified that a 1994 EG & G Report indicates that the LES burial estimate of $1.00/kg U_3O_8 remains valid. (Id. at 26.) The EG & G Report estimates the cost of nonretrievable burial of

DU_3O_8 by DOE at the NTS to be $0.15/kgU in 1994 dollars and about 19% more, or $0.18, for a non-DOE generator. Further, the EG & G Report estimates the cost of U_3O_8 burial at the Hanford Site at $1.81/kgU. (App.Exh. 8, at 51; LeRoy-Dekker at 26-27 fol. Tr. 1016.) Thus, Mr. LeRoy concluded that the LES estimate of $1.00/kg U_3O_8 in 1993 dollars, which translates to $1.27/kgU in 1994 dollars, falls squarely within the range of estimates in the EG & G Report of $0.18 to $1.81/kgU in 1994 dollars and remains reasonable today. (LeRoy-Dekker at 27 fol. Tr. 1016.)
Dr. Makhijani challenges the reasonableness of the Applicant's U_3O_8 burial cost estimate asserting that the estimate of the Applicant and the NRC Staff is not based on the Applicant's own plausible strategy for tails disposal. Rather, he asserts that while the LES disposal plan calls for deeper than surface burial, the two studies on which the LES and Staff estimates are based deal only with near-surface burial costs, not deep burial. (Makhijani at 4, 20 fol. Tr. 1081.)
While acknowledging that the disposal cost estimates in the Martin Marietta and the EG & G Reports are based on near-surface disposal, Mr. LeRoy testified that deep disposal should be no more costly than near-surface disposal because deep burial of U_3O_8 does not require expenses for engineered barriers and containers that are usually required for near-surface disposal. He stated that lower costs for deep disposal also would result from reduced security expenses based on the decreased likelihood of an intruder entering a deep burial site. (LeRoy-Dekker at 31-32 fol. Tr. 1016.) Similarly, the Staff witnesses, Mr. Faraz and Mr. Hickey, indicated that several factors will tend to decrease the cost of disposal for depleted uranium including the large volume and uniformity of tails; the economies of scale that will be possible if the CEC tails are buried with those from DOE; and savings in construction costs if the tails are disposed of in an existing underground cavity. (Faraz-Hickey at 10 fol. Tr. 1106.)
***12** Based on this Applicant and Staff testimony, we find that it was not unreasonable for the Applicant to base its cost estimate for deep disposal on the near-surface cost estimates in the Martin Marietta and the EG & G Reports. Accordingly, we find that the LES cost estimate for burial of the CEC depleted uranium tails is a reasonable one. [FN8]

***114** 3. DUF_6 Conversion Costs

The Applicant's estimate of $12 million annually, or $360 million over 30 years of operation, for the conversion of DUF_6 to U_3O_8 comprises the largest component of the LES tails disposal cost estimate of $16.175 million per year or $485.3 million over 30 years of operation. In their prefiled direct testimony, Mr. LeRoy and Mr. Dekker stated that "[t]he cost of conversion of DUF_6 to depleted U_3O_8 is based on an estimated conversion cost of $4.86 per kilogram of uranium ($1996), which was provided to LES by COGEMA, Inc., the U.S. affiliate of a French nuclear service company." (LeRoy-Dekker at 23-24 fol. Tr. 1016.) The Applicant's witnesses then stated that COGEMA has indicated to LES in writing its willingness to consider providing conversion services for UF_6 in the United States and that, in a 1991 letter (App.Exh. 5), COGEMA estimated that its charge for such services in 1991 dollars would be in the range of $3 to $5/kgU. (Id. at 24.) Referring to Applicant's Exhibit 6, they then stated that "[i]n its more recent letter, COGEMA provided an updated estimate of $4 to $6/kgU ($1995), which is in line with LES' conversion cost estimate of $4.86 ($1996) ($4.67 in $1995)." [FN9] (Id.) They also declared that these estimates assume construction and operation of a conversion facility in the United States and are based on COGEMA's actual experience in construction and operation of a commercial facility in France. (Id.) Mr. LeRoy and Mr. Dekker asserted that these cost estimates also are comparable to actual costs incurred by Urenco for conversion of UF_6 to U_3O_8 in Europe. Further, they testified that "[t]he estimate provided by COGEMA includes the understanding that COGEMA would assume responsibility [for the] handling of any non DU_3O_8 material produced during conversion (e.g., hydrofluoric acid-HF) [[and] LES is responsible for dispositioning the DU_3O_8 only." (Id.) Finally, the LES witnesses declared that this practice is consistent with Urenco's actual conversion experience in Europe, where HF remained with the converter. (Id. at 25.)
At the hearing, the Intervenor's witness, Dr. Makhijani, challenged the validity of the Applicant's conversion cost estimate of $4.86/kgU asserting, in ***115** effect, that the Applicant's failure to break the estimate into constituent parts precludes any evaluation of the estimate or its reasonableness. (Tr. 1205-06.) Specifically, he testified that the Applicant's $4.86 figure understates the cost of conversion because it fails to include the considerable cost of

approximately $1.50/kgU for neutralizing to calcium fluoride ("CaF_2") the hydrofluoric acid ("HF") byproduct that is produced during the conversion of UF_6 to U_3O_8. (Tr. 1206-09.) Such neutralization costs were necessary he asserted because his past evaluation of the demand in the United States for hydrofluoric acid showed that it was a declining market. According to Dr. Makhijani, a very large use of HF is in the production of ozone-depleting chlorofluorocarbons ("CFCs") that now are being phased out pursuant to federal law and international agreements. Although recognizing that HF is used in the initial production of UF_6, Dr. Makhijani testified that large purchases of Russian high-enriched uranium for reactor fuel and the additional release of American stockpiles of high-enriched uranium will further drive down the domestic demand for HF by limiting the need for enrichment services. He further stated that a 1990 Oak Ridge report, "The Ultimate Disposition of Depleted Uranium" (DE 91-006414), that was published before the establishment of any firm deadlines for phasing out CFCs or the American purchase of Russian high-enriched uranium, concluded that there may be no market for contaminated hydrofluoric acid in the United States. Finally, Dr. Makhijani testified that converting high-enriched uranium in the form of uranium metal to reactor fuel can be done using conversion methods that either use or do not use HF and that the process for conversion in this country has yet to be selected.

***13** On the basis of the evidentiary record in this proceeding, we cannot find that the Applicant's estimated cost of $4.86/kgU (totaling $12 million annually and $360 million over 30 years of operation) is a reasonable estimate for converting DUF_6 to U_3O_8. The LES estimate is deficient because it fails to include the significant cost of neutralizing the hydrofluoric acid byproduct of the conversion process. The evidentiary record is clear that the Applicant's cost estimate for converting DUF_6 to U_3O_8 does not include any provision for incurring the additional substantial cost of neutralizing the byproduct HF from the primary conversion process. (LeRoy Tr. 1055, 1049. See also App.Exh. 7 at 17.) [FN10] Instead the Applicant's position assumes that the COGEMA operation ***116** in France, in which HF is recycled as part of COGEMA's extensive nuclear fuel cycle manufacturing activities or otherwise marketed, will be replicated in the United States. It has not, however, provided any supporting evidence that there will be a sufficient market in the United States for the byproduct HF allowing it to be economically recycled or otherwise sold. Without evidence to show that there will be a sufficient market for the byproduct HF in the United States, we can only conclude that a domestic conversion facility, regardless of whether it is ultimately built and operated by COGEMA or some other entity, will have to neutralize the HF as an additional step in the conversion process and that the additional cost must be included in the cost of conversion. Thus, contrary to the assertions of the Applicant's witness that the conversion of HF to CaF_2 is not the Applicant's concern because COGEMA's cost estimate for UF_6 conversion includes the understanding that COGEMA would assume responsibility for all conversion byproducts except U_3O_8 (LeRoy at Tr. 1050), the reasonableness of the LES conversion cost estimate component is not "converter specific" and is not dependent upon COGEMA performing the service. [FN11]

In making this finding, we are aware that the Applicant's witness, Mr. LeRoy, testified that in "the conversations we have had with COGEMA and in the SECY paper [SECY-91-019 (App.Exh. 3)], it is stated that COGEMA, after converting the DUF_6 to U_3O_8 uses the HF that is produced either for the forward process of converting natural U_3O_8 to natural UF_6 or the HF is sold on the industrial market." (Tr. 1049. See also Tr. 1050, LeRoy-Dekker at 29 fol. Tr. 1016.) But this proffer of the COGEMA model in France, with its extensive nuclear fuel reprocessing, manufacturing, and waste disposal activities under one government umbrella, is not sufficient to establish, without significant additional evidence, the feasibility or likelihood that a conversion facility in the United States could economically recycle or otherwise market the byproduct HF from the conversion of the CEC tails.

***14** This failure of proof is especially significant in the circumstance where the domestic chemical market also will be faced with the byproduct HF from the conversion of the huge DOE stockpile of tails as well as the ever- increasing ***117** accumulation of tails from the United States Enrichment Corporation. Indeed, Mr. LeRoy indicated that the Applicant's cost projections for disposal did not include any analysis of the future market for conversion byproducts and he acknowledged that there could be a glut of such byproducts on the market in the future from tails conversion. (Tr. 1051.) He further conceded that the question of the cost of neutralization of HF is not irrelevant to the LES cost estimate. (Tr. 1055-56.) He thus provided nothing to counter

effectively the testimony of the Intervenor's witness, Dr. Makhijani, that his past analysis showed the domestic market for HF was shrinking due to the phase out of CFCs and the decrease in demand for enrichment services from the introduction of Russian and American high-enriched uranium, see LBP-96-25, 44 NRC at 352-60, a conclusion he further buttressed with the 1990 Oak Ridge report indicating that there may be no market in the United States for byproduct HF. Further, we note that in assessing the environmental impacts from the conversion of UF_6 to U_3O_8, the Staff's FEIS assumes that the byproduct HF will be neutralized to CaF_2. (Staff Exh. 2, at A-2 to -4.) More important, however, is the Staff's response in the FEIS to public comments on the draft environmental impact statement concerning the decline in the American market for HF. The Staff described the sale of HF as merely a "possibility" (Staff Exh. 2, Vol. 2, at 1-198) and went on to state in responding to comments about the impacts of transporting HF that "[c]onversion operations would likely result in production of calcium fluoride." (Id. at 1-199.) Similarly, the 1994 EG & G Report introduced by the Applicant that evaluates the disposal options and costs for DOE's depleted uranium and estimates $8.40/kgU as the cost of conversion assumes that all byproduct HF from the conversion of UF_6 to U_3O_8 is neutralized by converting it to CaF_2 and disposing of it in that form. (App.Exh. 8, at 43, 47.) Accordingly, on the basis of this evidentiary record, we cannot find that the Applicant has met its burden of proof and demonstrated by a preponderance of the evidence that the LES cost estimate for the conversion of DUF_6 to U_3O_8 is a reasonable one because it fails to include the substantial costs for neutralizing the byproduct HF from the conversion process. [FN12]

***118** Finally, we note that, in contrast to the detailed final decommissioning plan that LES must submit near the end of the license term, the Applicant's Decommissioning Funding Plan is required only to provide a reasonable cost estimate to ensure that the Applicant sets aside adequate funds to cover, inter alia, the cost of tails disposal. The reasonableness of the Applicant's cost estimate is necessarily dependent upon all the circumstances and the Commission has indicated that "the plan must contain essential elements sufficient to ensure that a reasonable estimate of decommissioning costs can be made." Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), CLI-88-10, 28 NRC 573, 587 (1988). Here, the largest component of the Applicant's estimate for tails disposal is that for the conversion of DUF_6 to U_3O_8. As we have found, however, the Applicant's estimate has not properly accounted for neutralizing the byproduct HF as part of its estimate. This additional cost is substantial and it is not the type of expense, like an increase for inflation or the development of a new technology (see 50 Fed.Reg. 5600, 5604 (1985)), that merely should be added sometime in the future after one of the Applicant's periodic decommissioning funding reviews that the Applicant is committed to performing at least once every 5 years. (App.Exh. 1(e), at 7-1.) Rather, the neutralization of the byproduct HF produced as part of the conversion of DUF_6 to U_3O_8 is clearly an essential element of the conversion cost (and hence the tails disposal cost) that reasonably can be estimated at this time.

****15** Further, because the depleted uranium tails are created as the Applicant performs enrichment services, the Applicant's tails disposal funds must come from a portion of the price charged by LES for the separate work units ("SWUs") it performs. (Arnold Tr. 672-73; App.Exh. 4n, at 4; App.Exh. 1(a), at 11.8-15; Staff Exh. 1, at 15-21.) In order to provide reasonable assurance that there are adequate funds set aside to cover tails disposal, the Applicant must factor the realistic reasonable cost estimate of tails disposal into its market price for SWUs from the initiation of operations. (App.Exh. 4n at 4.) This is especially important in light of the nature of the enrichment market and the Applicant's financial structure. As we found in LBP-96-25, 44 NRC at 355-56, 359-60, 361, ***119** the enrichment market is a fiercely competitive, international one in which the supply of enrichment production capacity and the supply of enriched uranium far exceeds demand and this situation will prevail for the foreseeable future. In such a competitive market, a significant shortfall in the funds set aside to pay for tails disposal cannot simply be remedied by a price increase without harming the Applicant's competitive position and future market prospects. Moreover, unlike a utility reactor operator that can rely upon a public utility commission to set a rate structure adequate to recover all decommissioning costs even after the shutdown of a facility (see 53 Fed.Reg. 24,018, 24,031 (1988)), the Applicant's tails disposal funds can only be collected from its charges for enrichment services on an ongoing basis.

In other words, LES must be totally self-reliant in paying for tails disposal. As we detailed in LBP-96-25, 44 NRC at 378-80, LES is a newly formed entity created to build and operate the CEC. It is structured as a limited partnership and LES has no significant independent assets. Id. at 398-99. Similarly, none of the LES general or limited partners are corporations of worth. Id. Further, under the LES Partnership Agreement, as well as general principles of corporate and partnership law, the corporate parents and other affiliates of the LES general and limited partners have no liability for the obligations of the partnership. Id. at 402 n. 30. In these circumstances, we cannot conclude that the Applicant's tails disposal estimate need only be a rough approximation that can be adjusted in the future upon periodic reviews by the Applicant. Rather, for the LES tails disposal estimate to be a reasonable one, it must include the substantial cost of neutralizing the HF from the conversion of DUF_6 to U_3O_8. Our finding in this regard is without prejudice to the Applicant acting to amend the LES Decommissioning Funding Plan consistent with this Decision and the Commission's regulations.

C. Intervenor's Other Challenges

In addition to its direct challenge to the Applicant's tails disposal cost estimate, [FN13] the Intervenor also challenges the Staff's FEIS alleging that a number of technical deficiencies and other shortcomings undermine its validity, thereby discrediting the LES tails disposal estimate for deep burial of the CEC tails. According to the Intervenor, these various deficiencies so eviscerate the Staff's analysis that the FEIS cannot support the conclusion that deep burial of the ***120** CEC depleted uranium tails will provide adequate protection to the public and the environment. Consequently, the Intervenor asserts that the CEC tails must be disposed of in a licensed geologic repository at a cost likely to be no less than $10/kg U_3O_8 and perhaps much more. (Makhijani at 4-7, 16-17, 20-21 fol. Tr. 1081.) [FN14] We summarily address below the deficiencies in the FEIS alleged by the Intervenor and find them without merit.

1. Use of Inappropriate pH, Retardation Factor, and Redox Potential Values

****16** Dr. Makhijani asserts that the values chosen by the Staff for groundwater regarding pH, retardation factor, and redox potential for use in its FEIS analysis of the environmental impacts of deep disposal of depleted uranium tails at two representative sites (see supra pp. 107-08) could result in a serious underestimation of the doses to the public. (Makhijani at 8-13 fol. Tr. 1081.) Specifically, Dr. Makhijani claims that the pH value--an important factor governing uranium solubility and subsequent uranium transport--of 7.8 that was used by the Staff came from near-surface water data from a location in New York. (See Staff Exh. 2, Appendix A, at A-12.) According to Dr. Makhijani, the pH of groundwater in the basalt rock formations for repository locations has been found to be greater than 9. (Makhijani at 9-10 fol. Tr. 1081.) Contrary to Dr. Makhijani's assertion, however, we find that the Staff's use of a pH value of 7.8 based on New York data was not unreasonable in light of the reference literature for groundwater showing a pH range of 7.2 to 8.5. (Price Tr. 1115; LeRoy Tr. 1164-65.) Thus, the Staff's use of a pH value falling within the reference range was appropriate and reasonable.
Dr. Makhijani also argues that a retardation factor of 1200 should not have been used by the Staff in the FEIS (Staff Exh. 2, Appendix A, at A-13) because it is considerably higher than the retardation factors for granite and basalt rock formations recommended in a report of the National Academy of Sciences. (Makhijani at 10 fol. Tr. 1081.) The retardation factor is determined by dividing the ratio of water velocity by the radionuclide transportation velocity. Radionuclides dissolved in groundwater are adsorbed and exchanged through contact with the surrounding solid phase and thus travel at a lower velocity than ***121** the groundwater. (Staff Exh. 2, Appendix A, at A-13.) The Staff's witness, Dr. Price, as well as the Applicant's witness, Mr. Dubiel, both testified that the value used by the Staff, which was based on a Swedish study, was appropriate because the data were from actual experimental observation for a comparable medium and were corroborated by a second study using such data. (Price Tr. 1115-17, 1235; Dubiel Tr. 1164-65.) Based on this testimony, we cannot find that the Staff's use of a retardation factor of 1200 drawn from actual experimental data, in contrast to theoretical evaluations, was unreasonable.

Dr. Makhijani next claims that the redox potential value ("eH") of minus 100 millivolts used by the Staff in its FEIS analysis (Staff Exh. 2, Appendix A, at A-12) is outside the range of values that the Staff otherwise lists in the FEIS for uranium mines and the FEIS contains no other comparative groundwater eH values. He asserts that the solubility of uranium is critical to the determination of the amount of uranium in groundwater and that the Staff has made arbitrary assumptions that tend to minimize the amount of uranium in solution. (Makhijani at 10-12 fol. Tr. 1081.)

***17** Redox potential, measured in volts or millivolts ("mV"), is a measure of the potential of groundwater to oxidize or reduce (i.e., to change chemically materials disposed of in groundwater). An increased redox potential increases the potential for uranium to dissolve in water. (Id. at 11; Price Tr. 1118.) Although the Staff's comparative table of eH values in the FEIS and the Staff's choice of an eH value of minus 100 mV certainly could have been more clearly explained in the FEIS (Price Tr. 1148-49), we find Dr. Makhijani's criticism without merit. As Dr. Price testified, the Staff chose an eH value of minus 100 mV because it was representative of deep groundwater from experimental observations showing redox potentials of minus 26 mV to minus 210 millivolts, with some reference data going even lower. (Tr. 1118-19.) He stated that the data set forth in the FEIS for uranium mines are not fully representative of deep groundwater and the conditions that will be chosen and prevail for the deep burial of depleted uranium tails will be a reducing environment. (Tr. 1145-49.) The Applicant's witness, Mr. Dubiel, also testified that the reference literature supported the Staff choice of eH value for the groundwater depths involved in the FEIS evaluation. (Tr. 1165-66.) Based on this testimony, we find that the eH value used by the Staff in its analysis is a reasonable one.

2. Failure to Perform Uncertainty Analysis, Consider Range of Geologic Settings, and Fully Analyze Appropriate Chemical Form of Tails for Disposal

Dr. Makhijani next asserts that, contrary to sound scientific practice, the Staff failed to perform an uncertainty analysis of deep burial as part of its environmental impact analysis so that upper and lower bounds for estimated ***122** doses could be obtained. Because of this failure, he asserts that the resulting Staff analysis fails to meet the minimal test of sound science. (Makhijani at 13-16 fol. Tr. 1081.)

In response to this criticism, Dr. Price testified that an uncertainty analysis was impractical and unnecessary here because an actual deep burial site was not being characterized. Rather, he stated that the objective of the Staff's analysis in the FEIS was not to support a licensing position on a disposal site but merely to determine the plausibility of deep burial of depleted uranium as a disposal strategy. Indeed, Dr. Price noted that the analogous NRC branch technical position for low-level waste facilities requires significant site-specific data for the performance of an uncertainty analysis. (Tr. 1120-21.) In these circumstances, we cannot find that an uncertainty analysis was necessary for the Staff's evaluation of the impacts from two representative hypothetical disposal sites.

Further, the Intervenor's witness claimed that the FEIS analysis is deficient for considering only two geologic settings, a granite formation and a basalt formation, instead of considering a wide range of potential geologic settings. Dr. Makhijani indicated that the Staff first should have performed a preliminary screening of all potential geologic settings for their respective advantages and disadvantages and only then selected particular rock types for study. (Makhijani at 9 fol. Tr. 1081.) The Staff witnesses, Dr. Price and Mr. Faraz, both testified that the use of two representative geologic settings was appropriate because the objective of the FEIS analysis was to determine whether deep burial of depleted uranium tails was plausible. (Tr. 1112-13.) All of the Applicant's witnesses concurred in this same view. (Tr. 1163.) Contrary to Dr. Makhijani's charge, we find that the Staff's use of two representative geologic settings was reasonable in light of the purpose of the FEIS evaluation.

***18** Finally, Dr. Makhijani asserts that the Staff's analysis is deficient for failing to consider the appropriateness of converting UF_6 to UO_2 instead of U_3O_8 for disposal. Although he concedes that both uranium oxide forms are insoluble in water, Dr. Makhijani asserts that the complexes they form with other chemicals in specific geologic environments could be different, depending on the particular conditions. Therefore, he claims the Staff should have considered UO_2 in addition to

U_3O_8 and presented a comparative analysis showing the legitimacy of its choice of U_3O_8. (Makhijani at 7-8 fol. Tr. 1081.)
Dr. Makhijani's assertion is without merit. The record evidence overwhelmingly demonstrates that U_3O_8 is the preferred form of uranium oxide for disposal. (App.Exh. 4I, at 18-19 & Appendix D, at D-I; App.Exh. 7, at 14-15; App.Exh. 8, at 11-13; LeRoy-Dekker at 30 fol. Tr. 1016.) Further, as Dr. Price testified, it is also necessary to consider how to manage and handle the uranium oxide as it is produced, stored, and transported for burial, and U_3O_8 is more stable upon exposure to the atmosphere than UO_2. (Tr. 1111.) Indeed, as Applicant's ***123** Exhibit 7 states "UO_2 will ignite spontaneously in heated air and burn brilliantly." (App.Exh. 7, at 36.)
Finally, in addition to the foregoing findings, we have carefully considered all of the other arguments, claims, and proposed findings of the parties relative to contentions B and J.3 and find that they are either without merit, immaterial, or unnecessary to this Decision.

D. Concerns of the State of Louisiana

Pursuant to 10 C.F.R. § 2.715(c) of the Commission's Rules of Practice, the State of Louisiana has participated in this proceeding as an interested State. In its proposed findings, the State has requested that we condition any LES license for the CEC to ensure that Louisiana does not have to take responsibility for any radioactive waste from the CEC. Additionally, the State requests a number of corollary conditions designed to ensure that no financial obligations fall on Louisiana from any of the CEC radioactive waste. [FN15]
The State's concern that any LES license authorization be conditioned so that the State cannot be held responsible for any radioactive waste from the CEC has now been resolved by the recent enactment of the USEC Privatization Act. The Act specifically provides that "[n]otwithstanding any other provision of law, no State or interstate compact shall be liable for the treatment, storage, or disposal of any low-level waste ... attributable to the operation, decontamination, or decommissioning of any uranium enrichment facility." 42 U.S.C. § 2297h-11(c). With the enactment of this federal statute, no further consideration of the State's request for license conditions is necessary.

III. CONCLUSION

For the reasons detailed in Part II.B.3, we conclude that the Applicant's cost estimate of $12 million annually for the conversion of DUF_6 to U_3O_8 is not a reasonable one given its failure to include the substantial costs of neutralizing the conversion process byproduct hydrofluoric acid. Thus, to this extent, the Intervenor's contention B.1 is sustained. For the same reason and to the same extent, the Intervenor's contention J.3 is sustained and, pursuant to 10 C.F.R. § 51.102, the FEIS is hereby supplemented by the discussion of the economic costs of tails disposal in this Decision and the underlying adjudicatory record. See Philadelphia Electric Co. (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 706 (1985).
***19 *124** Pursuant to 10 C.F.R. § 2.760 of the Commission's Rules of Practice, this Partial Initial Decision will constitute the final Decision of the Commission on these contentions forty (40) days from the date of its issuance unless a petition for review is filed in accordance with 10 C.F.R. § 2.786, or the Commission directs otherwise. Within fifteen (15) days after service of this Partial Initial Decision, any party may file a petition for review with the Commission on the grounds specified in 10 C.F.R. § 2.786(b)(4). The filing of a petition for review is mandatory in order for a party to have exhausted its administrative remedies before seeking judicial review at the appropriate time. Within ten (10) days after service of a petition for review, any party to the proceeding may file an answer supporting or opposing Commission review. The petition for review and any answers shall conform to the requirements of 10 C.F.R. § 2.786(b)(2)-(3).
It is so ORDERED.
THE ATOMIC SAFETY AND LICENSING BOARD

Thomas S. Moore
Chairman
ADMINISTRATIVE JUDGE

Richard F. Cole
ADMINISTRATIVE JUDGE

Frederick J. Shon
ADMINISTRATIVE JUDGE
March 7, 1997
Rockville, Maryland

FN1 Pursuant to a stipulation of the parties, the following Applicant exhibits were admitted into evidence relating to contentions B and J.3: Applicant's Exhibit 3, SECY-91-019, "Disposition of Depleted Uranium Tails from Enrichment Plants," Jan. 25, 1991 (App.Exh. 3); Applicant's Exhibit 4, correspondence (with attachments) between NRC and LES re decommissioning designated 4(a)- (q) (App.Exh. 4(a)-(q)); Applicant's Exhibit 5, Letter from Frank A. Shallo, Vice President, Market Development, COGEMA, Inc., to W. Howard Arnold, President, LES (Oct. 16, 1991) (App.Exh. 5); Applicant's Exhibit 6, Letter from Frank A. Shallo, Vice President, Market Development, COGEMA, Inc., to W. Howard Arnold, President, LES, Feb. 22, 1995 (App.Exh. 6); Applicant's Exhibit 7, Uranium Enrichment Organization (Oak Ridge, Tenn.), Martin Marietta Energy Systems, Inc., "The Ultimate Disposition of Depleted Uranium," Dec. 1990 (report prepared for U.S. Dep't of Energy [hereinafter Martin Marietta Report] (App.Exh. 7); Applicant's Exhibit 8, Waste Management Technology Division, Science Applications International Corp., "Depleted Uranium Disposal Options Evaluation," May 1994 (report prepared for EG & G Idaho, Inc., and U.S. Dep't of Energy) [hereinafter EG & G Report] (App.Exh. 8); Applicant's Exhibit 9, Bureau of Mines, U.S. Dep't of the Interior, Minerals Yearbook, 1992, at 183- 89, 194, 202, 208 (App.Exh. 9). Previously, Applicant's Exhibits 1, the CEC License Application; 1(a) the CEC Safety Analysis Report; 1(e), the CEC Proposed License Conditions; and 1(h), the CEC Environmental Report, which are also relevant to these contentions, were previously admitted into evidence. (Tr. 31.)

FN2 Without objection, Intervenor's Exhibit I-AM-70. Sandia National Laboratories, "Performance Assessment of the Proposed Disposal of Depleted Uranium as Class A Low-Level Waste," Dec. 1992 (I-AM-70), was offered into evidence by CANT on these contentions and admitted. (Tr. 1081.)

FN3 Without objection, Staff's Exhibit 4 (Staff Exh. 4), a statement of Dr. Price's professional qualifications, was offered into evidence by the Staff and admitted. (Tr. 1106.) Previously, the Staff's Safety Evaluation Report ("SER"), Staff Exh 1, and the Staff's FEIS, Staff Exh. 2, which are also relevant to these contentions, were admitted into evidence in the proceeding. (Tr. 154, 501.)

FN4 Citizens Against Nuclear Trash's Proposed Reply Findings of Fact and Conclusions of Law Regarding Contentions B and J.3 (June 26, 1995) at 21 [[[hereinafter CANT RF]

FN5 Citizens Against Nuclear Trash's Proposed Findings of Fact and Conclusions of Law Regarding Contentions B and J.3 (May 26, 1995) at 28-30, 39-47 [[[hereinafter CANT PF].

FN6 In its entirety, 42 U.S.C. § 2297h-11 provides as follows:

FN(a) Responsibility of DOE
(1) The Secretary, at the request of the generator, shall accept for disposal low-level radioactive waste, including depleted uranium if it were ultimately determined to be low-level radioactive waste, generated by--
(A) the Corporation as a result of the operations of the gaseous diffusion plants or as a result of the treatment of such wastes at a location other than the gaseous diffusion plants, or
(B) any person licensed by the Nuclear Regulatory Commission to operate a uranium enrichment facility under sections 2073, 2093, and 2243 of this title.

(2) Except as provided in paragraph (3), the generator shall reimburse the Secretary for the disposal of low-level radioactive waste pursuant to paragraph (1) in an amount equal to the Secretary's costs, including a pro rata share of any capital costs, but in no event more than an amount equal to that which would be charged by commercial, State, regional, or interstate compact entities for disposal of such waste.
(3) In the event depleted uranium were ultimately determined to be low-level radioactive waste, the generator shall reimburse the Secretary for the disposal of depleted uranium pursuant to paragraph (1) in an amount equal to the Secretary's costs, including a pro rata share of any capital costs.

FN(b) Agreements with other persons

FNThe generator may also enter into agreements for the disposal of low-level radioactive waste subject to subsection (a) of this section with any person other than the Secretary that is authorized by applicable laws and regulations to dispose of such wastes.

FN(c) State or interstate compacts

FNNotwithstanding any other provision of law, no State or interstate compact shall be liable for the treatment, storage, or disposal of any low-level radioactive waste (including mixed waste) attributable to the operation, decontamination, and decommissioning of any uranium enrichment facility.

FN7 As a practical matter, the enactment of 42 U.S.C. § 2297h-11(a) and (c) making DOE responsible for depleted uranium tails upon the request of the enricher and insulating any state or interstate compact from liability for such wastes, also moots the Intervenor's legal argument that the LES tails disposal strategy is implausible because it fails to provide that the tails from the CEC must be disposed of in Louisiana, or within the states of the Central Interstate Compact of which Louisiana is a member, under the provisions of the Low Level Radioactive Waste Policy Act ("LLRWPA"), 42 U.S.C. § 2021b et seq., and the practical workings of that law. CANT PF at 7-10, 30-34; CANT RF at 15-17. The Applicant already has indicated that its actual disposal method will be to transfer the CEC tails to DOE--a view shared by the Staff and the Intervenor. Therefore, in light of the new federal option available to the Applicant, it is a virtual certainty, for many of the reasons urged by the Intervenor in its argument, that no State or interstate compact will undertake the time-consuming, expensive, and politically difficult task of licensing a facility for depleted uranium tails, thereby further ensuring that the Applicant will request DOE to dispose of the CEC tails. Thus, the Intervenor's elaborate argument under the LLRWPA has been overtaken by the passage of the USEC Privatization Act.

FN8 In its proposed findings, the Intervenor argues that the LES estimate for burial of U_3O_8 is also unreasonable because it fails to take into account the costs of siting, characterizing, and licensing a disposal facility. CANT PF at 36, CANT RF at 19-20. But the argument the Intervenor now makes in its proposed findings is not one it sought to support at the hearing with evidence. In making its evidentiary presentation, the Intervenor sought to demonstrate that neither LES nor the Staff had proposed or provided for the contingency that there may be no disposal site available in 15 years or even 30 years at the end of the CEC license term. The Intervenor thus argued that a careful analysis of the safety and durability of UF_6 storage cylinders was necessary. (Makhijani at 22-23 fol. Tr. 1081.) There is ample evidence in the record about the safe useful life of UF_6 cylinders that addresses the Intervenor's concern about cylinders. (App.Exh. 7, at 9-11.) The Applicant and the Staff are not required to counter an evidentiary case that the Intervenor never made.

FN9 The Applicant did not explain further the derivation of the LES conversion cost "estimate" provided to LES by COGEMA of a rather exact $4.86/kgU in 1996 dollars or $4.67 in 1995 dollars when the 1991 COGEMA letter (App.Exh. 5) and the subsequent 1995 letter (App.Exh. 6) referred, respectively, to a charge in the range of $3-5/kgU and $4-6. In responding to a June

18, 1993 Staff request for revised tails disposal cost estimates (App.Exh. 4h), however, the Applicant informed the Staff that "[t]he cost of conversion of DUF_6 to depleted uranium oxide (DU_3O_8) is based upon an estimate of $4.00 per kilogram uranium. This estimate was provided to LES by COGEMA." (App.Exh. 4o.) It appears that the $4.00 is merely the mid-range of COGEMA's 1991 estimate of $3-5 escalated from 1991 to 1995 and 1996 dollars using the Applicant's standard 4% per year escalator yielding $4.67 in 1995 dollars and $4.86 in 1996 dollars.

FN10 The EG & G Report establishes that the conversion costs of neutralizing HF to CaF_2 are significant and contribute about $1.50/kgU to the total conversion cost of $8.40 in 1992 dollars. (App.Exh. 8, at 47; Hickey Tr. 1133- 35.) This HF neutralization cost estimate in 1992 dollars is derived from the EG & G Report and excludes any construction or other miscellaneous fees. It also assumes that the disposal cost for CaF_2 is minimal due to its slight contamination and likelihood of disposal as ordinary waste. (Hickey Tr. 1134- 35.) The Staff's witness, Mr. Hickey, agreed that the estimate of $1.50/kgU for the neutralization of byproduct HF to CaF_2 was reasonable and that he had no other estimate to offer. (Tr. 1135.) Adding the conservative $1.50 cost of HF neutralization to the Applicant's estimated costs for converting DUF_6 to U_3O_8 results in a more than 30% increase to the LES conversion costs, increasing the Applicant's annual conversion costs from $12 million to $15.7 million and, over 30 years of operation, from $360 million to $471 million. The addition of this increase in conversion costs to the LES total tails disposal cost estimate increases it from $485.3 million over 30 years of operation to almost $600 million.

FN11 Indeed, for this same reason we rejected the Intervenor's assertion in considering the Applicant's transportation cost estimate that the Applicant's disposal strategy was not plausible because LES did not have a firm commitment from COGEMA, Inc., to build a conversion facility in the United States. The Applicant offered no evidence that COGEMA, Inc., actually would build and operate a conversion facility in the United States. Rather, it only offered an expression of interest letter stating "COGEMA Inc.'s willingness to consider the possibility of providing, in the United States, conversion services." (App.Exh. 6.) Because the Applicant had no such commitment, the Intervenor asserted that the LES transportation estimate would have to include the costs of shipping the DUF_6 to France and returning the U_3O_8 to the United States. CANT RF at 21-22. The record indicates those costs would add some $4-5 million a year to the LES transportation costs. (App.Exh. 4(1) at Appendix E, at E-2; LeRoy Tr. 1059-60.)

FN12 In this regard, we note that the Staff's witness, Mr. Hickey, testified that the Applicant's "estimate of $4.86 per kilogram [of uranium] for conversion, we believe, includes the possibility that the option of converting to calcium fluoride will be exercised." (Tr. 1130-31.) Besides being contradicted by the Applicant's testimony (LeRoy Tr. 1055), Mr. Hickey's assertion to the effect that the LES conversion cost estimate covers both the conversion of DUF_6 to U_3O_8 and the conversion of HF to CaF_2 is not supported by the record as a whole.

FNFurther, Mr. Hickey opined that the Applicant's conversion cost estimate of $4.86 nevertheless was adequate to cover the additional cost of converting byproduct HF to CaF_2, stating
[t]he prices that were quoted to us from LES that came from COGEMA, we believe were over-inflated and included a lot of profit on the part of COGEMA. And, in fact, a conversion facility could be built in the United States, and they could dispose of the hydrogen fluoride in the form of calcium for less than $5 a kilogram.
(Tr. 1131.) Mr. Hickey then used the conversion cost estimate in the EG & G Report of $8.40 that includes byproduct HF neutralization to illustrate his assertion. (Tr. 1131, 1135-36; App.Exh. 8, at 47.) According to Mr. Hickey, after 5 years of operation of the hypothetical conversion facility in the EG & G Report, the initial plant costs would have been recovered and, thereafter, the cost per kilogram for conversion would amount to about $4.80. (Tr. 1136.) But Mr. Hickey attempts to prove too much. He not only failed to escalate his estimate from the 1992 dollars of the EG & G Report to the 1996 dollars of the LES estimate--a step that raises his estimate considerably--but his assumptions about the EG & G Report estimate (assumptions that are not explicit in the EG & G Report) raise more questions than are answered regarding such things as return of

capital, depreciation, carrying costs, taxes, decontamination costs, and profit margins. Because the record provides no corroborating support for the proposition that a future domestic conversion facility is to be built and operated without a healthy regard for profits, we are unable to accept Mr. Hickey's assertions regarding the cost of conversion of depleted uranium tails, including the neutralization of byproduct HF. In so concluding we are not unmindful of Mr. Hickey's candid appraisal that the Staff's forecasting accuracy of disposal costs has been "very poor." (Tr. 1153.)

FN13 At the hearing, the Intervenor did not pursue the specific assertions set forth in CANT's original bases B.4 and B.5 and the Intervenor did not include findings on these bases in filing its proposed findings. Hence, the Intervenor has waived these claims and, pursuant to 10 C.F.R. § 2.754(b), is in default as to these claims. In any event, the Applicant and the Staff presented testimony and other evidence on these matters. (LeRoy-Dekker at 15-18, 43-47 fol. Tr. 1016; App.Exh. 1(a), at 11.8-10 to -16; Faraz-Hickey at 11-12 fol. Tr. 1106) and the Applicant has met its burden of proof on these claims. Hence, the claims in Intervenor's bases B.4 and B.5 cannot be sustained.

FN14 The Applicant argues that its tails disposal cost estimate was developed before the environmental impact statement was prepared and was not based on any information in the FEIS. It implies, therefore, that the Intervenor's challenges to the technical underpinnings of the FEIS are irrelevant to the LES disposal cost estimate for deep burial. (Tr. 1066; Applicant's Proposed Findings of Fact and Conclusions of Law (May 26, 1995) at 402-03.) But the Applicant's position ignores the thrust of the Intervenor's argument that because of numerous deficiencies in the Staff's analysis deep burial of U_3O_8 has not been shown to protect the environment thereby mandating disposal in a geologic repository at a much higher cost. The Applicant's witnesses also testified, however, that on the basis of their review of the Staff's analysis of deep disposal in the FEIS they found the analysis satisfactory. (Dubiel-Donelson at 11-15 fol. Tr. 1026.)

FN15 Louisiana's Proposed Findings of Fact and Conclusions of Law in the Form of an Initial Decision Relative to DUF_6 Waste Generated at the Proposed LES Facility (June 23, 1995) at 3-5.
END OF DOCUMENT

(C) 2005 Thomson/West. No Claim to Orig. U.S. Govt. Works.