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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of

Louisiana Energy Services, L.P.
National Enrichment Facility

Docket No. 70-3103

ASLBP No. 04-826-01-ML

PETITION ON BEHALF OF NUCLEAR INFORMATION AND RESOURCE SERVICE AND PUBLIC CITIZEN FOR REVIEW OF SECOND PARTIAL INITIAL DECISION ON ENVIRONMENTAL CONTENTIONS

Preliminary statement

This Petition for Review is submitted on behalf of Intervenors Nuclear Information and Resource Service and Public Citizen ("NIRS/PC"), seeking Commission review, pursuant to 10 CFR Sec. 2.341, of the Second Partial Initial Decision (Environmental Contentions)(the "Decision") of the Atomic Safety and Licensing Board (the "Board"), dated March 3, 2006.

Factual background

The license sought herein would allow the construction and operation of the National Enrichment Facility ("NEF"). The Applicant is Louisiana Energy Services, L.P. ("LES"). On January 30, 2004, the Commission issued its Hearing Notice. (69 Fed. Reg. 5873)(Feb. 6, 2004). NIRS/PC filed their petition to intervene on April 6, 2004 (the "Petition").

Commission Staff issued the Draft Environmental Impact Statement ("DEIS") in September 2004 (NUREG-1790)(NRC Staff Ex. 1). Therein, Staff made statements about the prospective environmental impact of disposal of depleted uranium ("DU") from the proposed NEF. (DEIS at 4-58, 4-59). Concerning near-surface disposal, the Draft EIS said as follows:

> "The environmental impacts at the shallow disposal sites considered for disposition of low-level radioactive wastes would have been assessed at the time of the initial license approvals of these facilities. Final disposal of large quantities of depleted uranium at a licensed facility could require additional environmental impact evaluations depending on the location of the disposal facility and quantity of depleted uranium to be deposited." (at 4-58).

Concerning deep disposal, Staff published Table 4-19, at page 4-59. Estimated dose figures at the time of peak dose are given for two generic mine disposal sites. These figures were never before published. The text may suggest that the analysis of the impacts of deep disposal of DU in the NEF case could be derived from that previously presented in the EIS for the Claiborne Enrichment Center ("CEC")(NIRS/PC Ex. 58; also NRC Staff Ex. 46), by assuming that the impacts would be proportional to the amount of DU disposed. The draft EIS doses, however, did not in all cases correspond to those expected from simply scaling up the doses from the CEC final EIS. The NRC Staff admitted that an *additional* arithmetic error was made in the draft EIS. (See Tr. 2851-54) Moreover, the dose figures stated in Table 4-19 are so low as to be unbelievable.

NIRS/PC moved to amend their contentions to add allegations concerning these DEIS descriptions. (Motion to Amend, Oct. 20, 2004). The Board denied leave to amend. (Memorandum and Order, Nov. 22, 2004. Thereafter, on a separate certification by the Board, the Commission ruled that DU from an enrichment facility should be deemed low-level radioactive waste, noting also that the environmental impacts of near surface disposal and whether such disposal would comply with 10 CFR Part 61 remained to be determined. (CLI-05-05, January 18, 2005, at 26). NIRS/PC moved again to amend to assert that impacts from disposal of DU were not correctly described and that DU should be disposed of similarly to Greater than Class C waste. (Motion for Admission, Feb. 2, 2005). Amendment was again denied. (Memorandum and Order, May 3, 2005). NIRS/PC moved again to amend after LES disclosed that it had made a memorandum of agreement with Waste Control Specialists ("WCS"). (Motion for Admission, May 16, 2005). Amendment was denied. (Memorandum and Order, June 30, 2005). After the Final EIS

was issued on June 15, 2005, NIRS/PC again moved to amend to assert that impacts of disposal of DU had not been correctly described. (Motion for Admission, July 5, 2005). Amendment was denied again. (Memorandum and Order, Aug. 4, 2005).

On NIRS/PC's Petition for Review dated June 23, 2005 from the Board's First Partial Initial Decision dated June 8, 2005, the Commission reversed, finding that NIRS/PC had timely challenged the impacts discussion in the DEIS, and remanded for further proceedings to determine "the impacts of near-surface disposal . . . for NEPA purposes". The Commission said:

> "We close with a word of caution. An NRC "impacts" analysis does not require a full-scale site-specific review, an inquiry in the purview of the responsible licensing agency, such as an Agreement State. NEPA also does not call for certainty or precision, but an *estimate* of anticipated (not unduly speculative) impacts. An assessment of the estimated impacts at one or more representative or reference sites can be sufficient. In this type of analysis, the impacts for a range of potential facilities or locations having common site or design features can be bounded. The LES facility will generate large new quantities of depleted uranium for disposal, and therefore it is appropriate for the NRC in its impacts analysis to assess whether the impacts of disposing of the LES depleted uranium are expected to be small, moderate, or otherwise." (CLI-05-20, Oct. 19, 2005, at 30).

NIRS/PC had also asserted that the data in Table 4-19 of the NEF DEIS were unlike any reported in the CEC proceeding and could not be derived from known sources. This contention also was upheld and remanded. (CLI-05-20 at 10, 19-20). The Commission noted that in issuing 10 CFR Part 61, including the waste classifications in section 61.55, it had not analyzed the impact of disposal of DU from enrichment facilities (CLI-05-20, at 28-29). The Commission asked the Board to consider the impacts of disposal of the large amounts of DU that would generated by the proposed NEF, cautioning that proceedings on remand should omit a waste classification finding. (at 29-30). It directed Staff to consider the generic issue of classification separately.

a. evidence about near-surface disposal.

The October 2005 hearing commenced five days after the Commission's decision in CLI-05-20. The remanded issues as to near-surface disposal impacts were incorporated into the hearing. The contention as to deep disposal was addressed in cross-motions for summary disposition.

NIRS/PC presented detailed testimony by Dr. Arjun Makhijani concerning the likely impact of near-surface disposal of DU from enrichment facilities. Dr. Makhijani's prefiled testimony on several aspects of near-surface disposal was excluded on motions in limine by LES and Commission Staff. (Memoranda and Orders, Oct. 4; Oct. 20, 2005). These aspects included:

1. The need to analyze specific sites for their disposal performance. (Makhijani disposal direct at 7, 56, Sept. 16, 2005).
2. Analysis of the impacts of near-surface disposal at the Waste Control Specialists ("WCS") site. (Makhijani disposal direct at 20-41, Sept. 16, 2005).
3. Analysis of the impacts of near-surface disposal at the Envirocare of Utah, Inc. ("Envirocare") site: (Makhijani disposal direct at 42-45, 48-49, Sept. 16, 2005; rebuttal at 15-19, Oct. 11, 2005).
4. Consideration of uranium's chemical toxicity and the most recent scientific evidence on radiation health risks. (Makhijani disposal direct at 17-19, Sept. 16, 2005; rebuttal at 24-25, Oct. 11, 2005).

In light of the ruling in CLI-05-20, NIRS/PC filed a motion in limine on October 21, 2005, seeking to exclude LES and Staff testimony regarding the classification of DU under 10 CFR 61.55 and to reinstate Dr. Makhijani's testimony concerning the impacts of DU disposal at the WCS site and the plausibility of disposal at Envirocare. (Motion in limine, Oct. 21, 2005). Of the roughly 18 pages of Dr. Makhijani's testimony covered by the motion, the Board reinstated one sentence and one paragraph concerning Envirocare in Dr. Makhijani's rebuttal testimony. (Tr. 1820-22)

Thus, the Board severely, and erroneously, restricted the evidence considered in determining the environmental impacts of shallow land disposal. In particular, Dr. Makhijani's analyses regarding the impacts of disposal at WCS were removed, even though LES relied upon its Memorandum of Agreement with WCS to support its cost estimate. (Makhijani disposal direct 20-

41; LES Ex. 105). The Board also excluded Dr. Makhijani's testimony on recent evidence regarding radiation health risks published by the U.S. National Academy of Sciences. (Makhijani disposal rebuttal 24). Finally, even though EPA limits uranium in drinking water due to chemical toxicity, and the need to consider uranium's chemical toxicity as part of DU disposal was noted by Staff itself in the CEC case (Makhijani disposal direct 17-19; NIRS/PC Ex. 256), the Board excluded Dr. Makhijani's testimony regarding the non-radiological impacts of DU disposal. (Memorandum and Order, Oct. 4, 2005, at 11).

LES (Tr. 2618) and Staff (Tr. 2867) concurred that the dose limits for members of the public in 10 CFR Part 61, Subpart C, must be met by a proposed disposal site. Dr. Makhijani pointed out that the intruder protection rule contained in 10 CFR 61.42 applies "at any time." (Tr. 2975). In addition, 10 CFR 61.59 states that "institutional controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner." (Tr. 2976). Dr. Makhijani stated also that a time limit upon the period analyzed should be imposed only when explicitly stated in regulations. (Tr. 2991-92).

Dr. Makhijani explained that the very long half-lives of uranium isotopes raise a special concern regarding disposal. The EIS includes a dose estimate for mine disposal calculated "[i]n the year of maximum exposure," and such assessments were also done for shallow land disposal. (NIRS/PC Ex. 152 at 4-59; NRC Staff Ex. 36 at 4-63). Sandia National Laboratory did the same in its analysis for the CEC case. (NIRS/PC Ex. 128 at 49). LES's expert conceded that no time limit is specified in Part 61. (Potter, Tr. 2618, 2660). He was asked directly whether he has "a problem with that." He stated: "No. I accept that." (Tr. 2660). Staff acknowledged that there is no time limit and that it would require a rule change to introduce one. (Tr. 2890, 2894). Likewise, the Board repeatedly recognized that there is no time limit in 10 CFR 61.41 or 61.42 and said that it would not insert language that does not exist in the regulation. (Tr. 2699, 2910, 2914-15, 3076).

Generic analyses of disposal in a wet environment indicated noncompliance with the dose limits of 10 CFR Part 61. (See NRC Staff Ex. 46 at 4-67, A-9; NIRS/PC Ex. 190 at 23, 25; NIRS/PC Ex. 128 at 13, 49; Makhijani disposal rebuttal at A12). Commission Staff testified that the report prepared by Sandia in connection with the CEC proceeding is a scientifically reasonable study. (NIRS/PC Ex. 128; Tr. 2889). In 1992, based upon such analyses, Staff stated:

> "Our analysis, using methodology similar to that used for the Part 61 EIS, concludes that ***near-surface disposal of such large quantities of DU tails is not appropriate, both because of its potential radiological impact and its chemical toxicity.*** However, other disposal alternatives under 10 CFR Part 61 may be viable: *e.g.*, deep mine disposal. Therefore, disposal options, other than near-surface disposal, must be considered for the DU tails." (NIRS/PC Ex. 256). (*emphasis supplied*)

Mr. Johnson of Commission Staff confirmed that this document stated the Commission's position. (Tr. 2931-32)(See also NIRS/PC Ex. 277).

The U.S. DOE Programmatic Environmental Impact Statement of 1999 ("DOE PEIS"), cited by LES in its Environmental Report ("ER")(NIRS/PC Ex. 133 at 4.13-10 through 4.13-13) and discussed in Dr. Makhijani's prefiled testimony (disposal direct at 16; rebuttal at 19-21), reported that wet sites would exceed the 25 millirem limit within 1,000 years but that dry sites would not in that time frame. However, at either such site:

> "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; however, this would not occur until several thousand years later, and the exposure could be eliminated by adding new cover material to the top of the waste area." (LES Ex. 18 at I-19)(*emphasis supplied*).

Thus, any support for near-surface disposal in the DOE PEIS is explicitly limited to impacts occurring within the first 1,000 years. The Board observed that the DOE PEIS analysis could not constitute a bounding analysis. (Decision at 60-61 n.38).

Dr. Makhijani, working with IEER Senior Scientist Dr. Brice Smith, prepared two reports that were admitted as exhibits. (NIRS/PC Ex.190, 224). These showed that shallow land disposal would not meet the dose limits in 10 CFR 61 Subpart C. (Makhijani disposal rebuttal at A.3). A

generic screening analysis of a dry site using the ResRad computer model considered erosion rates of 0.05 to 0.1 centimeters per year and found that external pathway doses alone could amount to 30 to 75 rem per year. (Makhijani disposal rebuttal at A.12; Tr. 2985; NIRS/PC Ex. 190 at 23-29). IEER calculated a resident farmer scenario with the assumption that all food and water would be derived from the site. The results of these basic screening calculations all greatly exceed the regulatory limit of 25 mrem per year. (id. Table 5, 23).

In addition, IEER's site-specific analyses of the proposed WCS disposal site showed external doses as high as 44 to 120 rem per year. (NIRS/PC Ex. 224 at 8-24; Makhijani disposal rebuttal at A12; Tr. 2986-89). At the WCS site "[t]he majority of the land within five miles of the Site is used for grazing and ranching activities." (NIRS/PC Ex. 199 at 2-9A). Climate changes could lead to more favorable conditions for agriculture and thus increase the likelihood of human intrusion. (NIRS/PC Ex. 224 at 11). With respect to the potential for erosion at the WCS site, IEER consulted with Dr. James Carr, a Professor of Geological Engineering at the University of Nevada-Reno, who stated as follows:

> "Rates of erosion (denudation) are highest for semi-arid environments; the climate at the WCS site is semi-arid, consequently this geographic location should be expected to have a net loss of sediment with time, not a net accumulation; I agree with the TNRCC Preliminary Staff Memo on this issue that the WCS site is an erosional area." (id. 13)

and that

> "The maximum rate of erosion observed anywhere is that which occurs in Badlands-type topography, up to 1 meter of erosion per year. . . . Rates or denudation in semi-arid regions are 10 to 100 cm over 1000 years (0.01 to 0.1 cm per year) and rates of denudation in arid regions range from as little as 1 cm per 1000 years to a maximum amount that is not known. Given this highly variable rate of erosion, the design of the WCS facility should include erosion control." (id. 13-14).

The rates of erosion cited by Professor Carr are consistent with other ranges used in evaluating shallow land disposal, including the draft EIS supporting 10 CFR 61. (See id. 12)

IEER reproduced the ResRad calculations used in the in the WCS license application, but included the NEF inventory of DU and a non-zero rate of erosion. IEER considered a 100 percent outdoor occupancy and analyzed external, inhalation, and radon pathways to consider exposures to nonresident intruders consistent with current land use. All doses for the higher erosion rates exceed the 25 mrem per year limit by more than three orders of magnitude. (id. 15,16) For the two mean erosion rates considered, the 25 millirem dose limit would be exceeded by an intruder who spent just 1.4 to 2.9 hours on site. The projected doses at WCS are generally consistent with the 1992 Sandia study, which at 10,000 years found an external dose of 13.5 rem per year. (NIRS/PC Ex. 224 at 16)

Testimony was also presented about the performance of the Envirocare site. The Utah radiation control regulations have no time limit for compliance. (NIRS/PC Ex. 259 at R313-25-19). However, the analyses in Utah's 1990 performance assessment for Envirocare (the Baird report) impose a time limit of 1,000 years. (Tr. 2900; NIRS/PC Ex. 170 at ES-4, 2-12, 5-5). The pathways modeled in the Baird report include intruder construction, intruder agriculture, intruder explorer, maximum off-site individual, and on-site worker. (Tr. 2895; NIRS/PC Ex. 170 at Table E1). The Baird report shows likely noncompliance with 10 CFR Part 61 dose limits in the intruder-agriculture and intruder-construction scenarios and noncompliance with the worker dose limit during operation. (See NIRS/PC Ex. 224, at 8; NIRS/PC Ex. 170; Makhijani disposal rebuttal at A10, A11; Tr. 2709-10).

Utah initially used the Baird report to place limits on the allowable concentration of DU. (Tr. 2706; Tr. 2896; NIRS/PC Ex. 170 at 3-3). Such limits would prevent disposal of DU from the NEF. (id. 5-14; Tr. 2709-10; 2897). For example, under the "intruder-agriculture" scenario, the concentration limits for DU yielding a dose of 100 millirem per year were 65.5 nanocuries per gram 30 years after waste placement and 25.1 nanocuries per gram at 1,000 years. A concentration limit

based on worker doses was 110 nanocuries per gram. (LES Ex. 104 at 2; NIRS/PC Ex. 170 at 5-12; NIRS/PC Ex. 171 at 25). Depleted uranium from the NEF would exceed each of these concentration limits. (Makhijani disposal rebuttal at A.11; NIRS/PC Ex. 224 at 8; Tr. 2916-17). In addition, Argonne National Laboratory staff reported (NIRS/PC Ex. 273 at 12):

> "It was noted that the performance assessment for Envirocare's Class A disposal cell license amendment [Envirocare 2000] was based on a spectrum of LLW typical of wastes accepted at other commercial LLW disposal sites *and the potentially large amount of DU product now being considered for disposal was not encompassed in this spectrum of waste."* (NIRS/PC Ex. 273 at 13)*(emphasis supplied)*.

Thus, the analysis cited by Argonne *did not include* large quantities of DU (NIRS/PC Ex. 273, at 13)(Tr. 2717-19) and would not meet the explicit terms of the Commission's remand.

Utah regulators are said to have decided, nevertheless, that DU in large quantities could be disposed of at Envirocare, based upon the 1990 Baird report—with the additional assumption that humans would not reside upon the site, nor use groundwater, nor pursue agriculture, nor visit the site for extended periods, and that the cover material would not be penetrated by natural processes (*e.g.*, erosion) or by human intrusion. (LES Ex. 104 at 2, 3)(Tr. 2649-50, 2875-76; 2910-11). In effect, the Utah regulators simply assumed that the site would never be used. (Tr. 2911).

An April 5, 2005 memorandum of a Staff conference call with the Utah Division of Radiological Control ("DRC")(LES Ex. 104) states that residential or farming scenarios are unrealistic at Envirocare because of "low precipitation," saline soil, "high evapotranspiration rates," and "a lack of suitable irrigation water." (LES Ex. 104 at 2). Commission Staff "relied on the State of Utah's analysis . . . in reaching its conclusion that disposal of DU generated by the proposed NEF at Envirocare would be small." (NRC proposed FFCL at 4.143; see also 4.147; LES proposed FFCL at 4.93).

Mr. Johnson of Staff confirmed that the pathways considered by the Baird report are "the intruder pathways that are normally evaluated for low level waste disposal facilities." (Tr. 2874-

75). Dr. Makhijani testified that elimination of such scenarios prevented consideration of activities and processes that should reasonably be anticipated—particularly when disposal involves very long-lived radionuclides, and the site has been used for sheep grazing, hunting, and recreation vehicle driving in the recent past. (Tr. 2750, 2909-13, 2975-3005; see also Potter, Tr. 2750; Johnson, Tr. 2901, 2906).). Some locations on earth were once thought uninhabitable, yet they are now inhabited and cultivated. (Tr. 2998). Staff concurred that desert areas have been farmed and water has been shipped over long distances. (Tr. 2909). Therefore, the evidence established that it is not reasonable to eliminate the intruder pathways. (Tr. 2999, 3002).

The Board also recognized that, over time, the cap may be gone, and that someone may wander onto the site. (Tr. 2907). Staff agreed that an intruder onto a site with an eroded cover could receive the 25 millirem dose limit in less than three hours. (Tr. 2912-13). Thus, erosion scenarios should be considered because of the long times involved and because natural processes can generate some "nasty surprises." (Tr. 3002). Therefore, non-compliance could easily occur with brief intrusion by a nonresident, such as that associated with hunting or grazing.

The Board's Decision recognizes that the Commission's remand requires it to determine (a) if Envirocare is licensed to accept large quantities of DU, and (b) if Commission Staff had independently reviewed the determination by Utah and exercised independent judgment in determining the disposal impacts. (Decision at 51). The Board further acknowledged that, absent adequate documentation of particular reasons for excluding all human use scenarios, doses to intruders must be considered in assessing performance. (id. 53). The Board also specifically noted that conclusory terms such as "high salinity" and "low annual rainfall" fail to satisfy NEPA standards. (id. 53 n.34). It also recognized that Staff's deference to the State of Utah cannot satisfy NEPA; rather, it emphasized the requirements of Staff review and independent conclusions. (id.).

However, the Board refused to follow these principles. The Board found that the Staff had, in its view, satisfied the NEPA test of a "hard look" based upon Mr. Johnson's testimony that he had reviewed the 1990 Baird report and found its results "scientifically reasonable" and that the analysis "was done with a model that was considered acceptable." (Tr. 2885 to 2887). Notably, some of the results in the Baird report are physically impossible; in one entry the allowable U-238 concentration per gram of soil would far exceed the weight of the Earth. (Tr. 2979-84).

Most critically, the Board found that the Staff "reviewed and likewise found reasonable the State of Utah's conclusion that it was 'appropriate to drop the intruder pathways because they were unrealistic because of the unique site characteristics of the Envirocare site.'" (Decision at 54). The Board relied on the memorandum, which recited Utah's reports of "low precipitation, high evapotranspiration rates, and high saline content in both the soil and groundwater" (at 55), and ruled that "it was appropriate for the Utah DRC, and the NRC staff, to make a determination that certain scenarios are so unlikely as to warrant elimination from consideration." (at 56). The Board expressly stated that

> "the staff made a reasonable determination, as did the DRC staff, that the high salinity of the soil and groundwater and the low annual precipitation and high evapotranspiration rates make ***any*** intruder scenario so unrealistic, i.e., so unduly speculative, as to fall outside the scope of the staff's NEPA review." (at 57) (*emphasis supplied*).

No mention is made of the *known fact* that the Envirocare site has been used recently for grazing, hunting and recreational vehicle driving. (NIRS/PC Ex. 170 at 4-4, 4-5). The Board also relied upon the same conclusory findings that it had dismissed as "problematic" (at 53 n. 43), and it expressly cited a supposed "determination" that Commission Staff in fact did not make. Staff's conference call clearly does not meet the test of a "hard look," especially where the conclusion that intruder scenarios are highly unlikely conflicts with recent usage at the site.

What follows from the failure of near-surface disposal is the need to consider deep disposal of depleted uranium. Neither LES nor Commission Staff presented a credible deep disposal

alternative. The 2004 report by IEER presented a comparison with disposal methods at DOE's currently operating geologic repository, the Waste Isolation Pilot Plant. (NIRS/PC Ex. 190 at 47-48). Further, Dr. Makhijani addressed the alternative of deconversion of depleted UF_6 to depleted UO_2, rather than depleted U_3O_8, for improved disposal system performance—an alternative that has been studied by DOE and the Commission itself. (See Makhijani disposal direct 56-58; disposal rebuttal 24-25). However, the Board refused to consider the performance of UO_2, stating only that "[t]he Board declined to hear testimony on this subject matter in the context of the February 2005 evidentiary hearing on environmental contentions . . . ,and we will not allow such testimony here." (Memorandum and Order, Oct. 4, 2005, at 5). As Dr. Makhijani testified, the excision of his testimony concerning this option resulted in an artificially curtailed discussion of the form in which depleted uranium is to be disposed—a question that is highly significant to disposal performance:

> "WITNESS MAKHIJANI: . . . And I believe essential aspects of my testimony have been redacted. And, even a word is systematically censored. That word, of course, is a chemical form of uranium that governmental agencies, the Nuclear Regulatory Commission, and the Department of Energy have all written about and examined. But I alone am not allowed to talk about it, even though I have studied it.
>
> . . . WITNESS MAKHIJANI: But, correct me if I am wrong, but I do believe that I was given to understand in February by you that I would be allowed to testify about uranium dioxide in this proceeding a suitable end form for the deconversion process. And I'm not being allowed to do that." (Tr. 2330, 2332).

In direct contradiction to its exclusion of Dr. Makhijani's testimony, the Board relied on Staff's analyses from the CEC final EIS which assume the presence of UO_2 as the dominant disposal phase in connection with deep disposal. (See part b, infra).

b. evidence about deep disposal

After the October 2005 hearing the Board directed the parties to submit the issues about impacts of deep disposal by motion for summary disposition. (Memorandum and Order, Nov. 9, 2005). On November 18, 2005, NIRS/PC and Commission Staff presented cross-motions for summary disposition. The Board may grant such a motion only if there is no genuine issue of

material fact; in other words, the statements in opposing affidavits must be accepted as true. 10 CFR 710(d)(2). Affidavits by Dr. Makhijani and George Rice state as follows:

(a) Scientific results have no credibility if they cannot be reproduced. (Makhijani Aff. par. 5). The information in the CEC Final EIS does not include all necessary source data, and does not disclose modeling methodology sufficiently to permit reproduction of the results shown in Table 4-19 of the draft EIS. (Makhijani Aff. par. 5). Staff have been unable to reproduce the results. Therefore, one cannot attribute any credibility to the results in Table 4-19.

(b) The NEF Draft EIS says that impacts from disposal of DU from the NEF will be proportional to the quantity disposed at the CEC facility. However, no waste configuration is given to enable comparison to that of the CEC case. (Makhijani Aff. par. 4).

(c) Well water doses reported in the CEC Final EIS for the granite site are incredibly low, implying a thorium concentration of one atom per liter. In the sandstone/basalt site the U-234 concentration implied is just one atom per 200 liters of water, and thorium concentration is one atom per 1.9 million liters. Such values are unbelievably low. (Makhijani Aff. par. 6-9). Attempts to reproduce this analysis using information from the CEC Final EIS imply unreasonably large dilution. (id.)

(d) For the river scenarios at the granite site, the implied thorium concentrations would be just two atoms per liter. Radium-226 would have a concentration of one atom per 28 liters of water. Such values are again so low as to be unbelievable. (Makhijani Aff. par. 10).

(e) For a 70 kilogram adult, the highest well water dose for U-238 estimated by the NRC Staff in the CEC Final EIS is less than the dose from the disintegration of just 23 U-238 atoms in the entire body over an entire year. In addition, the decay of just a single U-238 atom in a 70 kilogram adult in one year would give a dose nearly five orders of magnitude larger than

the drinking water dose reported in the CEC Final EIS for the river water sandstone/basalt scenario. (Makhijani Aff. par. 8).

(f) The results reported for the granite and sandstone/basalt sites appear to be inconsistent in their treatment of the transport and decay of radium, so that doses from the granite site may be further underestimated by several orders of magnitude. (Makhijani Aff. par. 12).

(g) Although the CEC Final EIS states that depleted U_3O_8 would be the disposal form, it also reports that the dominant solid phase would be UO_2. Modeling UO_2 in the PHREEQC model indicates solubility values several orders of magnitude lower than values based on U_3O_8. (Makhijani Aff. par. 13-15; Rice Aff. par. 5-8). No explanation has been offered for the selection of UO_2 in the CEC analysis. (Makhijani Aff. par. 15; Rice Aff. par. 10).

(h) The specifics of the CEC modeling of groundwater flow and transport of radionuclides are not adequately disclosed. However, a reference to retardation coefficients in the range of 1,200 suggests quite high retardation values. Such values would introduce additional non-conservative bias into the analysis. (Rice Aff. par. 11).

(i) Without knowing all the specific parameter values, the source of the data, and how the models were set up, it is not possible to state what other errors may affect the CEC modeling results – the claimed basis of the values in EIS Table 4-19. (Makhijani Aff. par. 5, 19).

On review, the Commission is required to accept these factual allegations as true. (10 CFR 710(d)(2)). The data in Table 4-19, both in the Draft EIS and in the Final EIS, are both incredible and scientifically unsupported, in that they imply unreasonable levels of geologic containment and contaminant dilution, and that independent scientists and even the NRC Staff's own consultants and contractors cannot reproduce these results.

The Board issued its ruling on March 3, 2006 (Memorandum and Order (Ruling on Summary Disposition Cross-Motions Relating to Remand from CLI-05-20), March 3, 2006), which

it incorporated into its Second Partial Initial Decision (2.15 at 14). The Board held (a) that NIRS/PC's specific challenges to Staff's modeling derived from analyses in the CEC case were untimely, (b) that Staff's NEPA compliance is sufficient, even though Staff have not published sufficient information to enable itself or others to verify the analyses, and (c) that Staff are entitled to rely upon previous Staff conclusions, even though the data and analyses are no longer available. (Memorandum and Order, March 3, 2006, at 28, 30, 31-32). The Board stated that it understood that Staff experts

> "undertook a fresh review of the dose impact analysis contained in Appendix A to the CEC FEIS and concluded that, considering the generic nature of the analysis, the assumptions in the CEC FEIS Appendix A deep disposal analysis appear to be reasonable and appropriate for application in assessing the possible deep disposal doses relative to DU generated by the NEF." (id. 31-32).

Again, in referring to Staff "review" of deep disposal impacts, the Board relied upon a supposed Staff analysis that, in fact, never occurred. Dr. Rateb Abu-Eid, a Staff witness, acknowledged that the analyses contained in the CEC Final EIS cannot be duplicated "because of the lack of detailed input data." (Abu-Eid Aff. par. 4). Results that cannot be duplicated cannot be considered scientifically reasonable, almost by definition of that term.

Argument

a. Near-surface disposal impacts have not been estimated.

There can be no dispute that the Board has failed to comply with the Commission's instructions in remanding this matter for further hearings. The Commission directed the Board to estimate the impacts of near-surface disposal:

a. "at one or more representative or reference sites"

so that

b. "the impacts for a range of potential facilities or locations having common site or design features can be bounded."

The record contains several studies of near-surface disposal at generic or prospective disposal sites, such as those prepared by Sandia (NIRS/PC Ex. 128), DOE (LES Ex. 18), and IEER (NIRS/PC Ex. 190, 224). *Without exception* these studies uniformly preclude any conclusion that impacts of near surface disposal in either wet or dry sites would comply with the regulatory limits of 10 CFR Part 61 at the time of peak dose. The findings made in those studies were not challenged in the hearings. The Board ignored these studies. The Board erroneously eliminated Dr. Makhijani's prefiled testimony concerning the impacts of disposal at WCS and at Envirocare, despite the fact that LES and Commission Staff clearly rely upon such sites. Moreover, no discussion of the non-radiological impacts of disposal was allowed, despite the fact that Staff weighed such impacts in the CEC case, in rejecting near-surface disposal.

Instead of estimating the impacts of near-surface disposal at one or more *representative or reference sites*, to *bound* the impacts of such disposal, the Board espoused Staff's supposed analysis of the Envirocare site, predicated upon a telephone call to Utah regulators. So doing, the Board recognized that it had disobeyed the explicit direction on remand in CLI-05-20:

> "This is not to say that, by any measure, the environmental impacts at the Envirocare site can be considered to be 'bounding.' To reach the conclusion that the disposal impacts at Envirocare 'bound' those that might be found for near-surface disposal at any other site would require the Board to find that impacts at any other site would be similar to, or less than, the impacts at the Envirocare site. This is a finding the Board cannot make based on the record now before it." (Decision at 58-59).

The Decision clearly hinges upon a determination made by the Utah DRC and a second supposed determination by the Commission Staff. Neither "determination" complies with NEPA requirements. The first decision was made by the Utah regulators, when they essentially eliminated all human activity scenarios. As the Board stated at the hearing:

> "JUDGE ABRAMSON: Well, I mean that raises an obvious question, doesn't it? If this table from [the] 1990 [Envirocare performance assessment] says that depleted uranium exceeds—gives a number for depleted uranium, and if it exceeds that number then something must have changed between then and now to make it acceptable." (Tr. 2711).

The record contains no adequate explanation of Utah's decision. Utah regulators reportedly justified their opinion based upon low precipitation, high evapotranspiration, lack of "suitable irrigation water," and soil salinity. (LES Ex. 104, attachment at 2). Neither the number of groundwater measurements nor their sampling methodology was specified. No data were presented as to soil salinity. The Utah DRC did not state the criteria they applied in excluding the possibility of agriculture. The Board itself regarded such conclusory language in a NEPA assessment as "problematic." (Decision at 53 n.34).

Moreover, Utah regulators rested their conclusion partly on the county zoning ordinances applicable to Envirocare (see LES Ex. 104, attachment at 2), suggesting that Utah was relying upon institutional controls. But under 10 CFR 61.59, a regulator may not assume that institutional controls are effective for more than 100 years.

The record does not—nor could it—explain Utah's decision to ignore the history of human use of the Envirocare site. The Baird report expressly states that humans *have historically used the site* for sheep grazing, hunting, and recreation vehicle driving. (NIRS/PC Ex. 170 at 4-4, 4-5). However, Utah chose to exclude any scenarios involving human use.

In addition, the Board recognized that neither 1,000 years nor 10,000 years is "a time limit imposed or approved by any NRC regulation." (Decision at 56). Nevertheless, the Board ruled that it was "appropriate for the Utah DRC, and the NRC staff, to make a determination that certain scenarios are so unlikely as to warrant elimination from consideration." (Decision at 56). There is no indication that either the Utah, Commission Staff, or the Board considered the time period during which human use was excluded as "unlikely." The applicable Commission regulation requires consideration of human use "at any time." (10 CFR 61.42).

The Board, however, based its Decision upon precedents allowing Staff to rely upon determinations by other agencies. The Board recognized that Staff must conduct an "independent

review" and make an "independent judgment" of radiological impacts. (Decision at 57). Precedents hold that Staff may not assume that an another entity's analysis meets NEPA standards, without independent evaluation of that entity's assumptions, calculations, and conclusions. The Commission recently explained:

> "In addition, the NRC staff's expert repeatedly affirmed during the hearing that he had assessed the reasonableness of the DOE assumptions, calculations, and conclusions, even though he did not redo its underlying calculations. Actually redoing the DOE's calculations would have been a duplication of resources not required by law. What an agency cannot do is 'reflexively rubber stamp a statement prepared by others.' Here, the staff's expert found the DOE conversion impacts analyses reasonable 'based on an assessment of the material presented and their supporting documents.' In short, there was an independent evaluation of the DOE conclusions." (CLI-05-28, at 21-22) (*footnotes omitted*).

The Board said that Staff made a "determination" to drop human use scenarios and a "determination" that salinity conditions, precipitation, and evapotranspiration made any intruder scenario "unrealistic." (Decision at 56, 57). But Staff made so such determinations. Staff stated that "[t]he required pathway analysis and environmental assessment were performed as part of the State of Utah's licensing decision." (NRC proposed FFCL at 4.147). Staff conducted no independent pathway analysis or environmental assessment of the Envirocare site or any other site. (Tr. 2882) As Dr. Palmrose expressly stated :

> MR. LOVEJOY: So you are not here to ***explain or defend*** the results contained in any performance assessment?
>
> WITNESS PALMROSE: No, that performance assessment was evaluated by the State of Utah, and accepted by the State of Utah." (Tr. 2883). (emphasis added).

The Board refers to Staff's claim that they "reviewed" the 1990 Baird report and that they "felt that it was scientifically reasonable, that it addressed the appropriate pathways, and was done with a model that was considered acceptable." (id.; Tr. 2885-86). However, even for times less than 1,000 years, the 1990 Baird report found that some of the human use scenarios considered would result in impacts that would violate 10 CFR Part 61. (NIRS/PC Ex. 224 at 7-8). In addition, Dr. Makhijani

pointed out that other results in the Baird report are physically impossible; Staff's failure to note this problem casts serious doubts upon Staff's review of this work. (Tr. 2979-84).

There is no documented explanation of Commission Staff's acceptance of Utah's exclusion of all human use scenarios. Utah appears to have assessed the site based, in part, on the time frame in which zoning regulations will be in effect. However, reliance on such short-term institutional factors would conflict with the rule that "[t]here is no time limit" in 10 CFR Part 61, Subpart C. (Tr. 2660)(See also Tr. 2699, 2910, 2914-15, 3076). A time limitation conflicts with Staff's approach in analyzing deep disposal (NIRS/PC Ex. 58 at A-8; NRC Staff Ex. 36 at 4-63) and in modeling near-surface disposal in the CEC case. (NIRS/PC Ex. 128 at 10).

There is no Staff analysis of the conditions that might justify a decision to eliminate all considerations of human use "at any time" in the future (10 CFR 61.42). No data or supporting documentation for the Utah regulators' claims about ground water and soil salinity were available for the Staff to review. Staff have not even read any analyses of the Envirocare site performed by Utah since the 1990 Baird report. (Tr. 2648, 2711). Utah conducted analyses in 1997-2000. (LES Ex. 104 at 2; Tr. 2726-27). Staff did not even obtain the post-1990 analyses by Utah. (Tr. 2711). Staff have not reviewed any of the analyses, based on which Utah determined that all intruder scenarios that had been *included* in the 1990 Baird report could be *excluded* from analysis. Staff testified that

> "the state of Utah indicated that it had done those analysis. *We have not personally gone back to second guess or reanalyze them for them."* (Tr. 2255)(*emphasis supplied*).

In fact, Staff *did not even request* the underlying reports from Utah,

> "because in our conversations with the State the State assured us that they did not—would not change their conclusion, that disposal—depleted uranium is acceptable without limitation." (Tr. 2711; see also 2744).

Staff's statement reflects a fundamental confusion of roles: Staff were not required to change Utah's decision. But it emphatically was Staff's role to carry out an *independent review* of the

impacts of near-surface disposal and "exercise independent judgment in determining the radiological impacts of disposal at that particular site." (Decision at 51). Staff have not complied with NEPA, and the Decision must be reversed.

Further, on remand, when it may be expected that near-surface disposal will be unable to meet the dose limits of 10 CFR Part 61, consideration of other disposal methods should not be artificially restricted. The "appropriate alternatives" (10 CFR Sec. 51.45(b)(3)) should include different approaches to deep disposal and different waste forms (such as depleted UO_2) that have been investigated by responsible agencies and expert bodies. This is in accord with the Commission's October 19, 2005 ruling, quoted above at 3. (CLI-05-20, October 19, 2005, at 30).

b. Staff's deep disposal analysis is both incredible and unexplained.

The Commission was quite clear in its October 19, 2005 ruling when it stated that "[a]s we see the record, NIRS/PC timely challenged the "impacts" discussion in the LES Draft Environmental Impact Statement (DEIS)." (CLI-05-20 at 1) The Commission went on to conclude:

> "In light of this unusually complicated procedural history and the factors outlined above, we find that NIRS/PC's second motion did reiterate and thus revive their previous (and timely) challenge to the DEIS analysis of depleted uranium disposal impacts. For clarity's sake, however, we direct the Board and parties to focus on the terms and bases of the contention submitted in the first motion rather than the overbroad claims in the renewed motion. The renewed motion may be considered only to the extent that it ***raises or elaborates upon*** essentially the same 'impacts' analysis arguments made following the DEIS." (id. 12-13) (*emphasis supplied*)

An EIS that quantifies the impacts of a proposed action, but lacks sufficient supporting data and cannot be reproduced or adequately explained by the issuing agency, fails to meet NEPA requirements and is, in fact, unscientific. NEPA requires the federal agency to take a "hard look" at the impacts of a proposed action and appropriate alternatives. *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976). Thus, "Congress wanted each federal agency spearheading a major federal project to put on the table a sufficiently detailed statement of environmental impacts so as to permit

informed decision making." *Lands Council v. Powell,* 395 F.3d 1019, 1027 (9th Cir. 2005). Results that cannot be explained or reproduced cannot "permit informed decision-making."

Rules specify how such analysis is to be "put on the table." Under 10 CFR 51.45, "[t]he analysis for environmental reports shall, to the fullest extent practicable, quantify the various factors considered." Further:

> "The draft environmental impact statement . . . will identify any methodologies used and sources relied upon, and will be supported by evidence that the necessary environmental analyses have been made. . . . The NRC Staff will independently evaluate and be responsible for the reliability of all information used in the draft environmental impact statement." (id.).

The draft EIS must meet the standards of section 51.45, which requires quantification of factors. (10 CFR 51.71(a)). To summarize:

> "We distill from the cases a requirement that, to satisfy NEPA, an agency must go beyond mere assertions. At a minimum, it must provide a detailed, thoughtful analysis drawn from adequate data so that a reviewing court can decide on an objective basis whether the agency fairly assessed other courses of action which might realistically be substituted for the one proposed." *Boston Edison Co.* (Pilgrim Nuclear Generating Station, Unit 2), 7 NRC 774, 779, ALAB-479 (May 25, 1978).

Thus, in *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 and 2), 59 NRC 129, LBP-04-4 (March 5, 2004), the applicant claimed that impacts would be small but withheld its analyses. Intervenors asserted that the applicant failed to quantify its analysis (59 NRC at 149), arguing that the applicant "fails to provide quantitative support for its assertion that the consequences of a severe accident involving use of LTA MOX fuel will increase 0.3% at most." (at 150; see also 153). The Board found a "clearly material" issue. (id. 165).

Here, Staff have failed to quantify fully the factors and adequately set forth the methodologies, sources, and analyses underlying their conclusions—*viz:* that the dose fractions shown in Table 4-19 represent deep disposal impacts. Moreover, the Board received affidavits, and was required to accept as true, that the results presented by the Staff are scientifically unbelievable, cannot be reproduced from the information available, and disagree with other independent analyses.

For example, a Sandia analysis, done for Commission Staff, estimated uranium solubility values of 10^{-6} to 10^{-5} moles per liter for mine disposal. (NIRS/PC Ex. 128 at 31). Recent work for NIRS/PC identified similar solubility values (approximately 10^{-6} moles per liter) for uranium as U_3O_8 (NIRS/PC Ex. 190 at 22). But the CEC Final EIS (NIRS/PC Ex. 58, Table A.6) reports a value for UO_2 as about 4×10^{-10} moles per liter—with no explanation of the choice of UO_2 as the dominant solid phase and the resulting three-order-of-magnitude difference from other analyses.

Nevertheless, the Board said that Staff's analysis meets NEPA tests. It is ironic in the extreme that, while the Board improperly excluded Dr. Makhijani's testimony on the likely need for a UO_2 waste form, Staff have been allowed not only to present results that assume the presence of UO_2 but also to rely on these results to show impacts of mine disposal. This makes no sense, when the CEC EIS was supposedly assuming disposal of DU_3O_8. (NRC Staff Ex. 36 at 4-63). Both the International Atomic Energy Agency and the OECD's Nuclear Energy Agency have noted the importance of the specific deconversion form. (Makhijani disposal direct at 56-58). The comparison of the solubilities for U_3O_8 and UO_2 shows this fact. Consideration of disposal impacts should have incorporated Dr. Makhijani's testimony on the desirability of a UO_2 waste form for deep disposal, especially since UO_2 seems to have been critical to Staff's analysis.

Further, Staff report retardation factors as being "greater than 1,200" (NIRS/PC Ex. 58 at A-13), without stating how much "greater" or whether the same factors were used for all elements. Retardation factors vary greatly from site to site (Rice Aff. par. 11), but Staff offer no explanation of their figures. Nor do Staff disclose the specifics of how they model contaminant transport or vertical and horizontal flow. Independent reviewers could not explore the impact of parameter selection, even if all parameter values had been disclosed.

The Board acknowledged that the alleged impacts shown in Table 4-19 could neither be fully explained nor reproduced. (Decision at 33 n.11). The Board nevertheless ruled that Table 4-

19 suffices as a NEPA analysis, because it derives from results in an *earlier* EIS and Staff consider it "reasonable." (Decision at 32). The Board relied upon the affidavits by two Staff scientists. However, Dr. Palmrose did not review the CEC analyses. Rather, he states that an unnamed "member of the proposed NEF EIS team with expertise in hydrology reviewed *the information in the CEC FEIS* regarding the parameters and the models that were used and determined that they were appropriate." (Palmrose Aff. par. 3)(*emphasis supplied*). How this unnamed scientist concluded that results of a complex modeling exercise "appeared reasonable" without access to that analysis and all of its source data is unexplained by Dr. Palmrose.

The other Staff scientist, Dr. Rateb Abu-Eid, also confined his review to the CEC EIS. (Abu-Eid Aff. par. 2). He states that the CEC EIS provided "*certain* sensitive flow path parameters" and "*certain* chemical constituents of the deep groundwater" (*emphasis supplied*). (Makhijani Declaration at 4, 5, 13-15, 19). He states that solubility of uranium was calculated at 10^{-4} mg/L, "assuming that the dominant solid phase was UO_2," but he omits any basis for that assumption, given that LES plans to dispose of DU_3O_8. The parameters used in PHREEQC analyses to derive solubility values are not fully known (Makhijani Aff., par. 13), nor do we know whether CO_2 was assumed to be present in the repository (Rice Aff., par. 5), , nor do we know whether the CEC analyses assumed the presence of complexing minerals. (Makhijani Aff., par. 15).

Dr. Abu-Eid concedes that the EIS gives only a "summary of approaches and methodology" and "estimates of the most sensitive parameters" *without* disclosing "detailed input and output of data and parameters." (Abu-Eid Aff. par. 4). But without such data, his repeated statement that the modeling was "reasonable" is simply another unfounded assertion. (Abu-Eid Aff. par. 2; see Rice Declaration, Nov. 18, 2005, par. 11). Finally, he admits that the CEC analysis has not been, and cannot be, duplicated, "because of the lack of detailed input data." (Abu-Eid Aff. par. 4).

Thus, the fundamental fact remains: *no one can fully explain where the reported estimates for the impacts of DU disposal came from.* At the hearings, the Board stated that it would undertake to investigate the underlying validity of the dose results:

> "MS. CLARK: Well, I think on this specific issue we see that the scope of this contention is very narrow. And I believe that on this specific issue –
>
> JUDGE ABRAMSON: On the terms of the math error?
>
> MS. CLARK: In terms of the, yes, of the allegation that the Staff did not do an adequate evaluation, then I think we can get sufficient testimony, that I believe we can resolve this issue.
>
> I know that Mr. Lovejoy has a different view of that.
>
> JUDGE ABRAMSON: So does the Board. Weren't we clear yesterday? Maybe you can repeat, Judge Bollwerk, what we said.
>
> * * *
>
> MR. LOVEJOY: Our problem, as the Board says, goes beyond the arithmetic.
>
> JUDGE ABRAMSON: And that is what we said, quite clearly, yesterday. That once the arithmetic was – it was quite clear, to us, that there was an alleged error, and there was an alleged omission.
>
> And that fixing the alleged error would have then put NIRS/PC in a position of having the right to submit an amended contention challenging whatever it saw, now, from the correct, in the results from the corrected error.
>
> And our idea, the Board's view, as expressed yesterday was that we were going to collapse that process, so that we don't spend time fixing the error, and then having to have another contention that we are going to let the parties deal with that, generally, which is the allegation that this didn't take a sufficiently hard look in this area." (Tr. 2844-46).

Thus, the Board expressly invited NIRS/PC to pursue the validity of the results in Table 4-19 after Staff's arithmetic errors were corrected.[1] On that inquiry, *not one scientist* testifying for Commission Staff could reproduce or explain the dose results contained in Table 4-19. But "to satisfy NEPA, an agency must go beyond mere assertions." *Boston Edison Co.* (Pilgrim Nuclear Generating Station, Unit 2), 7 NRC 774, 779, ALAB-479 (May 25, 1978). Here, no records indicate all of the parameters and modeling methods used in generating the Table 4-19 results. Staff

[1] Therefore, the suggestion in the Decision (at 28-29) that NIRS/PC should be precluded from raising certain problems with the CEC analyses, because they were not sooner raised in response to the DEIS, conflicts with the Board's rulings at the hearing that NIRS/PC should proceed to present the underlying problems with the data presented in Table 4-19. Fundamentally, NIRS/PC did assert that the numbers in that table were unexplained and unfounded (Motion, Oct. 20, 2004, at 13, 16). However, it took vigorous discovery efforts and the rectification of several Staff errors before NIRS/PC ascertained how Staff claimed to have derived those numbers, that the underlying analysis supporting the results presented in Table 4-19 were no longer available and that the NRC Staff itself could not reproduce the results. (See NIRS/PC reply, Dec. 8, 2005, at 3-5).

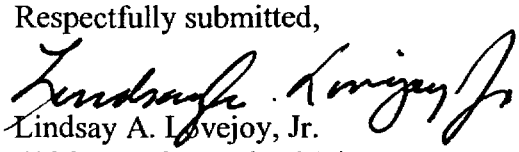
cannot argue that an expert has "review[ed]" the analysis and "found it appropriate and reasonable," because the analysis is unavailable for anyone to review, and the results are transparently incredible.

To rely on previous work, Staff must evaluate that work, understand it, endorse it, and explain its acceptance of that work. This Commission has forbidden Staff to adopt previous analyses by "rubber stamp [of] a statement prepared by others." (CLI-05-28, at 21-22). Without access to the substance of the previous analysis and without the ability to reproduce similar results from independent work, approval can only take the form of a "rubber stamp." Staff have applied a rubber stamp to a study that no one participating in the NEF licensing proceeding can reproduce or adequately defend. Such action violates Commission directives.

Conclusion

For the foregoing reasons, the Commission should undertake review and reverse the Board's Decision to reject the environmental contentions made by NIRS/PC.

Respectfully submitted,



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March 20, 2006

CERTIFICATE OF SERVICE

Pursuant to 10 CFR § 2.305 the undersigned attorney of record certifies that on March 20, 2006, the foregoing Petition on behalf of Nuclear Information and Resource Service and Public Citizen for Review of Second Partial Initial Decision was served by electronic transmission and first class mail upon the following:

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