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Date: Fri, Apr 23, 2004 9:20 AM
Subject: Corrections to 4/22/04 filings in Catawba-LTA proceeding

Dear ASLB and parties,

This is to let you know that I have discovered two errors in the dating of yesterday's filings by BREDL. The date in the top right hand corner of Blue Ridge Environmental Defense League's First Supplemental Response to NRC Staff's First Set of Interrogatories should be April 22, 2004, not April 20. The date at the bottom of page 2 of Blue Ridge Environmental Defense League's Supplemental Information Regarding Proposed Hearing Schedule should be April 22, 2004, not April 19.

I apologize for an inconvenience caused by these errors.

Diane Curran

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SECY-02

April 20, 2004

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
DUKE ENERGY CORPORATION	)	Docket Nos. 50-413-OLA
	)	50-414-OLA
	)	
(Catawba Nuclear Station	)	
Units 1 and 2)	)	

BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE'S FIRST SUPPLEMENTAL RESPONSE TO NRC STAFF'S FIRST SET OF INTERROGATORIES AND REQUEST FOR PRODUCTION OF DOCUMENTS

In accordance with an April 16, 2004, agreement between Blue Ridge Environmental Defense League (BREDL) and the U.S. Nuclear Regulatory Commission ("NRC" or "Commission") Staff, BREDL hereby submits its first supplemental response to Interrogatories 13, 14, 16, 17a, 18, 24, 25, 27, 28, 29, 32, 33, and 24; and Document Production Request No. 7. NRC Staff's First Set of Interrogatories and Request for Production of Documents (March 31, 2004).

INTERROGATORIES

Interrogatory 13. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the analyses described by Duke Energy in its submittal, and supplements thereto, do not adequately account for the differences between an all-LEU core and a core comprised of 189 LEU fuel assemblies and 4 MOX lead test assemblies in assessing the fuel behavior under LOCA conditions.

RESPONSE: As discussed in BREDL Contentions 10, 11, and 12, and in oral argument on January 15, 2004 (transcript at 644-709, 726-739, 766-799), BREDL relies on information provided to NRC by IRSN officials in October 2003 on outstanding questions regarding the behavior of MOX fuel rods compared to LEU fuel rods of the same burnup during a design-basis

LOCA (DB-LOCA); as well as NRC documents showing that current Appendix K requirements do not consider fuel relocation issues that are relevant to this case. *See* slides presented by A. Mailliat and J.C. Mélis, IRSN, at "PHEBUS STLOC Meeting" with NRC Staff (October 23, 2003) (hereinafter October 2003 IRSN Presentation"); Memorandum from Ralph Meyer, NRC Office of Nuclear Regulatory Research, re: Update on Generic Issue 92, Fuel Crumbing During LOCA (February 8, 2001); Memorandum from Ashok C. Thadani, Office of Nuclear Regulatory Research, re: Information Letter 0202, Revision of 10 CFR 50.46 and Appendix K (June 20, 2002).

In particular, BREDL notes that MOX fuel rods may have a greater propensity to experience fuel relocation during a DB-LOCA than LEU fuel rods of the same burnup. In addition, the consequences of fuel relocation with regard to satisfaction of LOCA regulatory criteria may be of greater concern for MOX fuel rods than for LEU fuel rods. BREDL has conducted an additional back-of-the-envelope analysis of this issue, which is presented in its response to Duke's Interrogatory 13. *See* Blue Ridge Environmental Defense League's Response to Duke Energy Corporation's First Set of Interrogatories and Requests for Production of Documents at 8 (April 14, 2004) (hereinafter "BREDL Response to Duke Interrogatories").

Given this information, BREDL maintains that by failing to consider fuel relocation effects in its DB-LOCA analysis, Duke Energy does not adequately account for the differences between an all-LEU core and a core comprised of 189 LEU fuel assemblies and 4 MOX lead test assemblies. BREDL notes that the number of MOX LTAs in the core is of only marginal relevance to the question of whether MOX LTAs will satisfy the NRC ECCS acceptance criteria in 10 C.F.R. § 50.46, because every fuel rod in the core must meet these criteria.

Interrogatory 14. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the analyses described by Duke Energy in its submittal, and supplements thereto, do not adequately account for the differences between an all-LEU core and a core comprised of 189 LEU fuel assemblies and 4 MOX lead test assemblies in assessing the fuel behavior of a core disruptive accident.

RESPONSE: As discussed in BREDL Contentions 11 and 12, and in oral argument on January 15, 2004 (transcript at 938-39 (release fractions) 770-72 (relationship between severe accidents and LOCAs), 784-85 (IRSN severe accident analysis), BREDL relies on information provided to NRC by IRSN officials in October 2003, as well as ERI/NRC 02-202, "Accident Source Terms for Light-Water Nuclear Power Plants: High-Burnup and Mixed Oxide Fuels" (November 2002) (hereinafter "Expert Panel Report on Source Terms"), on outstanding questions regarding the behavior of MOX fuel rods compared to LEU fuel rods of the same burnup during accidents resulting in core damage, including "core disruptive accidents" as BREDL understands the meaning of the term. *See* Blue Ridge Environmental Defense League's Motion for Clarification or Reconsideration of April 8, 2004 Order (April 19, 2004). In particular, BREDL notes that radionuclide release fractions from MOX fuel during core disruptive accidents (especially during the early in-vessel and late in-vessel phases) may be greater than radionuclide release fractions from LEU fuel. *See* pages 37-49 of the Expert Panel Report on Source Terms.

Interrogatory 16. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the analyses described by Duke Energy in its submittal, and supplements thereto, do not adequately account for the differences between an all-LEU core and a core comprised of 189 LEU fuel assemblies and 4 MOX lead test assemblies in assessing the fuel behavior of a hypothetical accident sequence that leads to energetic mechanical dispersal of the fuel.

RESPONSE: BREDL seeks additional clarification on what the Staff means with regard to "a hypothetical accident sequence that leads to energetic mechanical dispersal of the fuel." If the Staff is referring to design-basis accidents other than LOCAs that could result in "energetic mechanical dispersal of the fuel" into the reactor coolant system, such as rod ejection accidents or other power excursion transients, BREDL reiterates its response to Interrogatory 16 of April 14, 2004. If the staff is referring to design-basis LOCAs, BREDL refers to the response to Interrogatory 13 above. If the staff is referring to "energetic mechanical dispersal" of molten fuel from the reactor vessel during a severe accident, BREDL makes no assertion that Duke Energy has not adequately accounted for the differences between an all-LEU core and a core comprised of 189 LEU fuel assemblies and 4 MOX lead test assemblies in assessing the fuel behavior of a hypothetical accident sequence that leads to energetic mechanical dispersal of the fuel, insofar as such differences would affect the likelihood that a core melt would undergo energetic mechanical dispersal during a severe accident. However, BREDL does note the discussion in the Expert Panel Report on Source Terms regarding potential differences in the degradation behavior of MOX and LEU fuels during severe accidents, which could lead to differences in severe accident progression that may well affect the likelihood of energetic mechanical melt dispersal mechanisms such as high-pressure melt ejection or hydrogen explosions.

Interrogatory 17. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the increases in core damage frequency (CDF) or risk associated with the 4 MOX LTAs would not be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

a Provide, in detail, your analysis of CDF or risk associated with use of the MOX LTAs.

RESPONSE: BREDL has not revised its analysis of the CDF or risk associated with use of the 4 MOX LTAs since it performed a back-of-the-envelope calculation and stated its result during the oral argument on December 3, 2003 (transcript at 265-275). As noted in BREDL's response to the Staff's Interrogatory 23, BREDL expects to perform a MACCS2 consequence analysis, which will inform the determination of increased risk associated with use of the 4 MOX LTAs.

> *Interrogatory* 18. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the qualitative judgements by Duke that the 4 MOX LTAs will not impact Probable [sic] Risk Assessment (PRA) success criteria and core damage frequency and will only marginally impact calculated offsite consequences are flawed.

RESPONSE: BREDL maintains that the 4 MOX LTAs will have *some* impact on probabilistic risk assessment (PRA) success criteria and core damage frequency, just as any change to a nuclear plant's design basis will have *some* impact. The question is how great, or how significant, is that impact. BREDL does not make any judgments at this time regarding that question. See BREDL's response to Duke Interrogatory 27. Similarly, BREDL challenges any analysis by Duke that the 4 MOX LTAs "will only marginally impact calculated offsite consequences," since there is no definition of "marginal impact" in NRC regulations and neither NRC nor Duke Energy has attempted to provide one. See BREDL's response to Duke Interrogatories 26, 29 and 30.

BREDL does challenge the methodology used by Duke to calculate the impact of the 4 MOX LTAs on offsite consequences. See BREDL response to Interrogatory 25 below.

> *Interrogatory* 24. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the introduction of 4 MOX LTAs would create "special circumstances"

that raise questions about whether there is adequate protection, and would meet the criteria for "special circumstances" provided in Appendix D to SRP Chapter 19.

RESPONSE: BREDL maintains that the introduction of 4 MOX LTAs into the core of a reactor in the United States --- a fuel for which the experimental database under severe accident conditions is demonstrably sparse compared to conventional LEU fuel (see response to Interrogatory 32, below) --- indisputably creates "special circumstances" which warrant a risk-informed evaluation by the NRC Staff. To the extent that these special circumstances might result in a significant impact on risk, BREDL has nothing to add to its remarks at the December 3, 2004 oral argument (Transcript, pp. 91-96).

Interrogatory 25. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the set of sequences evaluated in Appendix K of Volume 2 of the SPD EIS (e.g., Table K-39) do not provide a reasonable representation of the most risk-significant beyond-design-basis accidents and release categories for Catawba.

RESPONSE: BREDL intends to submit evidence that the radionuclide release fractions for severe accidents based on the Individual Plant Examination (IPE) for Catawba, which were used by DOE in the calculations of severe accident consequences associated with LEU and partial MOX cores in Appendix K of Volume II of the SPD EIS, are inconsistent with radionuclide release fractions for comparable severe accident scenarios obtained for the Sequoyah plant, a Westinghouse ice-condenser PWR that is nearly identical to the Catawba reactors, as provided in NUREG-1150, Severe Accident Risks for Five Nuclear Power Plants (1990). This is clear from a comparison carried out in a contractor report by Brookhaven National Laboratories for NRC, in which the Catawba release fractions for a severe accident with early containment failure taken from the IPE (and utilized in the SPDEIS, Volume 2, Appendix K, Table I-37, p. K-66), are

shown to be about a factor of four lower than the values for Sequoyah based on NUREG-1150, resulting in collective dose results lower by a factor between 3 and 4. J. Lehner, V. Mubayi, W. Pratt and C. Conrad, "Benefit Cost Analysis of Enhancing Combustible Gas Control Availability at Ice Condenser and Mark III Containment Plants," Final Letter Report, Brookhaven National Laboratory at 17 (December 23, 2002).

BREDL further notes that the release fraction for the low-volatile lanthanide group, a highly relevant parameter in a comparison of MOX and LEU consequences, is nearly 70 times lower in the SPD EIS Appendix K source term than it is in the Sequoyah NUREG-1150 source term. This comparison will form the basis for BREDL's demonstration that the set of sequences evaluated in Volume II, Appendix K of the SPD EIS do not provide a reasonable representation of the most risk-significant beyond-design-basis accidents and release categories for Catawba.

> *Interrogatory* 27. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the behavior of MOX fuel (e.g., fuel relocation temperature) is sufficiently different than LEU fuel, that during a LOCA (or any other postulated sequence) the MOX fuel pellet column will collapse into the lower part of the fuel rod sooner than LEU.

RESPONSE: BREDL does not now maintain that during a design-basis LOCA, the MOX fuel pellet column will collapse into the lower part of the fuel rod sooner than LEU. During a core disruptive accident which progresses to core melt, BREDL relies on information from the IRSN indicating that the melt relocation temperature may be lower for MOX fuel than for LEU fuel, so that molten MOX fuel (which is no longer in the form of discrete fuel pellets contained in fuel rods) may relocate to the lower head of the reactor vessel earlier in the sequence than molten LEU fuel. *See* October 2003 IRSN presentation at page 6.

Interrogatory 28. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses to demonstrate that the differences between the use of M5 cladding with MOX fuel and the use of M5 cladding with LEU fuel are sufficient to increase the probabilities that an accident cannot be mitigated, or to demonstrate that the differences between MOX fuel behavior (e.g., fuel microstructure and oxidation potential) and LEU behavior for the four MOX LTAs are sufficient to increase the release rates and release fractions of fission products and actinides.

RESPONSE: With regard to the differences between the use of M5 cladding with MOX fuel and M5 cladding with LEU fuel, we rely on the statement in the February 11, 2000 memorandum from William D. Travers to the NRC Commissioners, "Agency Plan for Confirmatory Research Associated with the Use of Mixed-Oxide Fuel in Commercial Light-Water Reactors," Attachment, p. 2, which states that "chemical bonding between the pellets and the cladding, which may be different for MOX pellets and UO_2 pellets, may affect the ballooning process and hence the fuel behavior." BREDL does not believe that there is sufficient experimental data to support any conclusion regarding the impact of this phenomenon on the probability that a LOCA cannot be mitigated for any cladding type.

With regard to the second part of the question, please see the Response to Interrogatory 14.

Interrogatory 29. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and/or in its examination of applicant or staff witnesses, to demonstrate that Duke Energy has not adequately established that operation of the Catawba plant with four MOX lead test assemblies will not result in offsite radiation doses in excess of 10 C.F.R. 100.11 or 10 C.F.R. 50.67, as applicable, as a result of design basis accidents.

RESPONSE: As discussed in the Response to Interrogatory 14, above, BREDL relies on information from the IRSN and the Expert Panel Report on Source Terms that design basis

radionuclide release fractions (in particular for the early in-vessel release phase) may be greater for MOX fuel than for LEU fuel. Thus BREDL maintains that Duke Energy, by failing to consider this effect, has not adequately established that operation of the Catawba plant with four MOX LTAs will not result in offsite radiation doses in excess of 10 C.F.R. § 100.11 or 10 C.F.R. § 50.67, as a result of design basis accidents.

> *Interrogatory* 32. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and in examination of applicant or staff witnesses, to demonstrate that" the experimental database for MOX fuel performance during LOCAs is woefully inadequate."

RESPONSE: As discussed in BREDL Contentions 10, 11, and 12, and in oral argument on January 15, 2004 (transcript at 644-709, 726-739, 766-799), BREDL relies on information provided to NRC by IRSN officials in October 2003, as well as the Expert Panel Report on Source Terms (*see* pages 71-79), to support its contention that the experimental database for MOX fuel performance during LOCAs is "woefully inadequate."

> *Interrogatory* 33. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and in examination of applicant or staff witnesses, to demonstrate that due to unknowns regarding the behavior of MOX fuel during a LOCA, Duke does not have a factual basis for "assuring that the existing emergency core cooling systems at Catawba will meet the acceptance criteria in 10 C.F.R. § 50.46.

RESPONSE: *See* response to Interrogatory 13, and all references cited therein.

> *Interrogatory* 34. Identify and describe in detail, providing bases and justification for, any analyses or evaluations that BREDL or its experts, have performed and/or expect to rely upon in its testimony and in examination of applicant or staff witnesses, to demonstrate that the use of MOX fuel at Catawba "appears to pose a risk that plant safety systems will not be adequate to stop a LOCA from progressing to a core melt."

RESPONSE: *See* response to Interrogatory 33. To the extent that Duke Energy has failed to

demonstrate adequately that the use of 4 MOX LTAs at Catawba will not adversely affect the ability of the existing ECCS to comply with 10 C.F.R. § 50.46 acceptance criteria, it is evident that Duke Energy has also failed to demonstrate that plant safety systems will be adequate to stop a LOCA from progressing to a core melt.

REQUEST FOR PRODUCTION OF DOCUMENTS

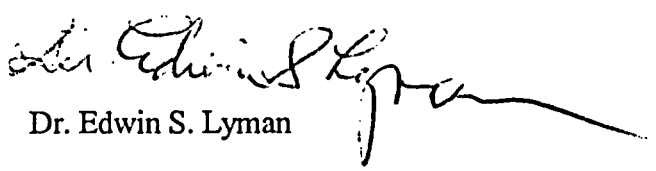
Document Production Request 7. All documents that you intend or expect to rely upon or to introduce as exhibits in any hearings to be held in this proceeding.

RESPONSE: BREDL expects to rely on the documents identified in the interrogatory responses above. In addition, BREDL expects to rely on the following additional documents:

- E. Lyman, "Public Health Risks of Substituting Mixed-Oxide for Uranium Fuel in Pressurized Water Reactors," Science & Global Security 9 (2001)
- Regulatory Guide ("RG") 1.174, Rev. 1, An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis at 1.174-6 (2002).

Declaration of Dr. Edwin S. Lyman

I certify that the facts in the foregoing discovery responses are true and correct to the best of my knowledge, and that the opinions expressed therein are based on my best professional judgment.



Dr. Edwin S. Lyman

Respectfully submitted,

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April 22, 2004

CERTIFICATE OF SERVICE

I hereby certify that on April 22, 2004, copies of Blue Ridge Environmental Defense League's First Supplemental Response to NRC Staff's First Set of Interrogatories and Request for Production of Documents and Blue Ridge Environmental Defense League's Additional Information Regarding Proposed Hearing Schedule were served on the following by e-mail and/or first-class mail, as indicated below.

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