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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 RESPONSE TO DUKE ENERGY CORPORATION'S FIRST SET OF INTERROGATORIES AND REQUESTS FOR PRODUCTION OF DOCUMENTS

I. INTRODUCTION

In accordance with the schedule established in the Atomic Safety and Licensing Board's ("ASLB's") March 30, 2004, Order (Confirming Matters Addressed at March 25 Telephone Conference) of Blue Ridge Environmental Defense League ("BREDL") hereby responds to Duke Energy Corporation's First Set of Interrogatories and Request for the Production of Documents.

Template= SECY-035

SECY-02

II. RESPONSE TO INTERROGATORIES

A. General

Interrogatory 1 Identify each person who supplied information for responding to these interrogatories and requests for the production of documents. Note the specific interrogatories for which each such person supplied information.

RESPONSE: Dr. Edwin S. Lyman supplied all factual information that is contained in all of BREDL's responses to Duke's interrogatories and requests for production of documents.

Interrogatory 2 Identify each person whom Intervenor expects to provide testimony or sworn affidavits in connection with Contentions I and II in this proceeding. For each person identified, describe that person's professional affiliation, area of professional expertise, qualifications, and educational and scientific experience. Also, describe the general subject matter on which each person identified is expected to provide testimony or sworn affidavits in this proceeding.

RESPONSE: BREDL expects to provide testimony on Contentions I and II by Dr. Edwin S. Lyman. Dr. Lyman will testify to the safety issues raised in Contentions I and II. BREDL has not yet determined whether it will submit any expert testimony with respect to Contention III. A statement of Dr. Lyman's qualifications was provided in support of BREDL's Supplemental Petition to Intervene (October 21, 2003).

Interrogatory 3 Identify each document, book, periodical, magazine article, technical report, thesis, website, computer output or correspondence that BREDL expects to submit, reference, cite, or otherwise rely upon in connection with testimony or sworn affidavits in support of Contentions I and II.

RESPONSE: BREDL expects to rely on the documents submitted to date in connection with Contentions I and II. At this time, BREDL does not know what other documents it will rely on.

B. Contention I

Interrogatory 4 Identify all specific MOX fuel behaviors that BREDL asserts affect a Loss of Coolant Accident ("LOCA") scenario or analysis, or other Design Basis Accident ("DBA") scenario or analysis, in a manner different than low enriched uranium ("LEU") fuel.

RESPONSE: BREDL asserts that the following specific MOX fuel behaviors will affect a LOCA scenario or analysis in a manner different than LEU fuel:

1. Rod centerline temperature as a function of rod power
2. Magnitude, timing, radionuclide composition and power history dependence of fission gas release (during normal operation)
3. Fuel-clad interaction
4. Peak clad temperature (PCT)
5. Oxidation potential
6. Linear heat generation rate
7. Magnitude of fission product release during gap release phase
8. Magnitude of volatile fission product release during early in-vessel core degradation
9. Rate of volatile fission product release during early in-vessel core degradation
10. Magnitude of semi-volatile fission product release during early in-vessel core degradation
11. Rate of semi-volatile fission product release during early in-vessel core degradation
12. Magnitude of low-volatile fission product release during early in-vessel core degradation
13. Rate of low-volatile fission product release during early in-vessel core degradation
14. Radionuclide inventory of fuel
15. Radial power distribution
16. Axial power distribution
17. Potential for fuel crumbling and relocation following clad ballooning
18. Particle size distribution of fuel pellet fragments as a function of burnup
19. Characteristics of fuel relocation (filling ratio, increase in local linear power density)

We note that BREDL does not assert that all of these behaviors necessarily will have a significant impact.

BREDL makes no assertions regarding design basis accident (DBA) scenarios or accident analyses other than for the design basis LOCA.

> *Interrogatory 5* Identify all specific MOX fuel cladding (M5) behaviors that BREDL asserts affect a LOCA scenario or analysis, or other DBA scenario or analysis, in a manner different than LEU fuel cladding behavior (zircaloy or M5).

RESPONSE: BREDL asserts that the following specific MOX fuel cladding (M5) behaviors will affect a LOCA scenario or analysis in a manner different than LEU fuel cladding behavior (zircaloy or M5).

1. Extent of clad ballooning and impact on fuel relocation
2. Fuel-clad interaction
3. Peak clad oxidation (outer surface)
4. Peak clad oxidation (inner surface)
5. Hydrogen uptake
6. Loss of ductility (as measured by ring compression tests) as a function of clad oxidation AND surface condition, for all burnups
7. Reaction with fission product releases (especially tellurium)
8. Maximum flow blockage consistent with core coolability

We note that it is our understanding that the LEU fuel assemblies now in the Catawba 2 core are clad in ZIRLO, rather than Zircaloy. In addition, we note that BREDL does not assert that all of the behaviors listed above necessarily will have a significant impact, or that there is sufficient experimental evidence in every case to draw such a conclusion. In addition, we note that some of these properties are associated with the interaction between cladding and fuel behavior, and thus overlap somewhat with the response to Interrogatory 4.

> _Interrogatory 6_ Identify all underlying physical or chemical properties, or mechanisms, that BREDL asserts contribute to each specific fuel behavior difference identified in the responses to Interrogatories 4 and 5. Identify the specific behavior differences to which each mechanism contributes.

RESPONSE: The physical and chemical properties of MOX fuel that contribute to each specific fuel behavior difference identified in the responses to Interrogatory 4 are as follows:

1. Lower thermal conductivity of MOX (1, 2, 4, 15, 16)
2. Greater inhomogeneity of MOX (2, 3, 4, 7-13, 17-19)
3. Greater porosity of MOX (7-13)
4. Different fission product yields of Pu-239 and U-235 (2, 5, 6, 7, 8, 10, 12, 14)
5. Different radionuclide composition of initial fuel (2, 5, 6, 7, 8, 10, 12, 14)

The physical and chemical properties of M5 cladding that contribute to each specific fuel behavior difference identified in the responses to Interrogatory 5 are as follows:

1. Greater ductility (1, 6, 8)
2. Differing chemical content (2-7)

> _Interrogatory 7_ Specifically identify each DBA scenario or analysis other than a LOCA that BREDL asserts is affected by fuel behavior differences between LEU and MOX fuel (including cladding).

RESPONSE: BREDL does not assert in this proceeding that any DBA scenario or analysis other than a LOCA is affected by fuel behavior differences between LEU and MOX fuel (including cladding).

> _Interrogatory 8_ For each behavior difference identified in response to Interrogatories 4 and 5, provide a *qualitative* description of the effect of the behavior on fuel, cladding, core or other plant parameters (including, but not limited to, those parameters that relate to the integrity of fission product barriers and to dose to the public) following the LOCA or other DBA (identified in response to Interrogatory 7).

RESPONSE: The differences in behavior can be grouped into a few categories. The first category involves those aspects related to fuel clad ballooning. The second category involves those aspects related to fuel coolability. The third category involves those aspects related to fission product release.

For the first and second categories, the greater balloon size for M5 cladding compared to zircaloy, coupled with the higher stored energy of MOX fuel, and the relocation characteristics of MOX fuel, provide greater challenges to the emergency core cooling systems than an all-LEU core. For the third category, enhanced fission product releases during the gap release could increase internal rod pressure. Moreover, enhanced releases during the early in-vessel phase could increase the dose to the public and thereby affect compliance with Part 100 criteria.

> *Interrogatory 9* For each behavior difference identified in response to Interrogatories 4 and 5, provide a *quantitative* description of the effect of the behavior on fuel, cladding, core or other plant parameters (including, but not limited to, those parameters that relate to the integrity of fission product barriers and to dose to the public) following the LOCA or other DBA (identified in response to Interrogatory 7). If no quantitative assessment is available, state that fact.

RESPONSE: No quantitative assessment is available. BREDL does not now have access to the proprietary computer codes necessary to conduct such a quantitative assessment. However, with regard to the ability of these codes to accurately assess the impact of the MOX fuel behavior differences in the responses to Interrogatories 4 and 5, given the sparsity of the experimental database for code validation, BREDL shares the skepticism of the Expert Panel on Source Terms for High-Burnup and MOX Fuels, which states that "computer calculations have not been performed as part of the present effort because the ability of the current accident analysis codes to properly predict the degradation of high burnup and MOX fuels is in doubt." ERI/NRC 02-202, "Accident Source Terms for Light-Water Nuclear Power Plants: High-Burnup and Mixed Oxide Fuels" at 8, note 20 (November 2002) (hereinafter "Expert Panel Report on Source Terms").

BREDL does provide some quantitative information on the potential differential impact of fuel relocation on MOX and LEU LOCA analyses in the response to Interrogatory 13 below.

> *Interrogatory 10* Identify any non-compliances with 10 C.F.R. Part 50, Appendix K which BREDL asserts will exist in the LOCA analysis in the license amendment request due to introduction of four MOX fuel assemblies.

RESPONSE: BREDL does not assert that Duke fails to comply with Appendix K.

Interrogatory 11 Identify any non-compliances with regulatory requirements for any DBA analysis (other than a LOCA analysis) that BREDL asserts will exist due to introduction of four MOX fuel assemblies.

RESPONSE: BREDL does not assert any non-compliances with regulatory requirements for any DBA analysis other than a LOCA analysis.

Interrogatory 12 Explain how, in BREDL's view, the phenomena of "fuel relocation" or "fuel slumping" under design basis LOCA or other DBA conditions will differ between MOX fuel and LEU fuel. Explain the basis for this view.

RESPONSE: In BREDL's view, which is informed by the IRSN presentation to NRC in October 2003, phenomena that can affect the likelihood, the timing and the extent of fuel relocation under design basis LOCA conditions include fuel-clad interaction, the particle size distribution of fuel fragments, and the clad ballooning geometry. As discussed in the responses to Interrogatories 4 and 5, these three characteristics are different between M5-clad MOX fuel and Zircaloy-clad LEU fuel of the same burnup. Therefore, the likelihood and progression of fuel relocation during a design basis LOCA will in general be different between the MOX LTAs and conventional LEU fuel.

Interrogatory 13 Explain how, in BREDL's view, the differences between MOX fuel and LEU fuel with respect to "fuel relocation" or "fuel slumping" identified in response to Interrogatory 12 will impact compliance with the acceptance criteria for emergency core cooling systems in 10 C.F.R. § 50.46. Provide a quantitative assessment if available. If none is available, state that fact.

RESPONSE: In BREDL's view, which is based on the information in the October 2003 IRSN presentation to NRC, fuel relocation can result in an increase in peak cladding temperature ("PCT") of 100 Celsius degrees (180 Fahrenheit degrees) and a 5 to 10% increase in the thickness of the oxide layer. Thus, if fuel relocation occurs during a design basis LOCA, it can reduce the margin to the ECCS acceptance criteria for PCT and maximum local clad oxidation in

10 C.F.R. § 50.46, relative to a design basis LOCA in which relocation does not occur. We note that Duke has not taken into account the impact of fuel relocation in its design basis LOCA analysis, even though a change to an acceptable evaluation model that has the potential to increase the calculated PCT by 180 F is a "significant change" as defined in 10 C.F.R. § 50.46(a)(3)(i) and should be estimated according to the requirements of that section.

As we have stated in our response to Interrogatory 12, the likelihood and progression of fuel relocation during a design basis LOCA will in general be different for the MOX LTAs and for conventional LEU fuel assemblies of the same burnup. To the extent that an M5-clad MOX LTA forms fragments at lower burnups than Zircaloy-clad LEU fuel, has a higher linear heat generation rate, has a more heterogeneous power distribution, and develops a larger balloon because of the greater ductility of M5 cladding, the likelihood and consequences of fuel relocation will in general be more severe than would be the case for Zircaloy-clad LEU fuel.

We note that according to Duke's calculations, the margin to both PCT and maximum local oxidation limits in a design basis large-break LOCA (LBLOCA) is already smaller for the MOX fuel case than for the all-LEU case without accounting for fuel relocation effects. *See* Duke License Amendment Request ("LAR"), Table 3-5 at 3-43 (February 27, 2003). Therefore, any additional reduction in margin due to fuel relocation will be of greater concern for MOX than for LEU. From Table 3-5 of Duke's LAR, one can see that an increase of PCT of 180 F would bring the PCT for the MOX case to 2198°F, only 2°F below the regulatory limit of 2200°F, whereas the PCT would only increase to 2161°F in the LEU case.

> _Interrogatory 14_ Given that the Framatome ANP analysis of MOX fuel lead assembly LOCA evaluated cladding swelling and rupture using M5 properties at the worst-case (unirradiated) conditions, state what BREDL asserts is specifically inadequate about the analysis of the LOCA cladding response. Explain, quantitatively and qualitatively, how

the presence of MOX fuel will adversely impact the cladding performance. If no quantitative assessment is available, state that fact.

RESPONSE: The Framatome ANP design basis LOCA analysis did not take into account fuel relocation effects. Therefore, it did not consider the impact on the likelihood and characteristics of fuel relocation of the larger balloon size that may be expected with M5 cladding compared to less ductile materials like Zircaloy. BREDL has not conducted a quantitative assessment of this phenomenon, but neither has Framatome ANP.

Interrogatory 15 Confirm whether BREDL maintains that the MOX fuel lead assembly program at Catawba should not go forward until MOX fuel LOCA tests as proposed by French "safety authorities" are performed. If so, explain how such a requirement would be consistent with the fact that French "safety authorities" continue to permit many French reactors to operate with MOX fuel in the absence of such tests.

RESPONSE: BREDL believes that the uncertainties regarding the behavior of the MOX LTAs under design basis LOCA conditions are sufficiently large that high assurance of compliance with NRC requirements cannot be provided. Therefore, BREDL maintains that a determination that the use of MOX LTAs at Catawba will provide adequate protection of public health and safety cannot be made without the acquisition of additional experimental data along the lines of that proposed by IRSN at Phébus. BREDL allows for the possibility that results obtained in a Phébus LOCA test utilizing M5-clad reactor-grade MOX fuel irradiated in the French nuclear power program may be adequate for providing an understanding of the relevant phenomena associated with differences between MOX and LEU, if accompanied by additional analyses or separate effects tests as necessary to understand the additional impact of plutonium isotopic composition on design basis LOCAs. Moreover, in and of itself, the fact that French safety authorities permit many French reactors to operate with MOX fuel in the absence of such tests is irrelevant. The question presented here is whether the proposed use of MOX fuel at Catawba meets NRC safety standards.

Interrogatory 16 State whether BREDL considers the information from the VERCORS tests to be germane to the performance of MOX fuel during a design basis LOCA. If so, explain specifically what the information is, and how it is germane.

RESPONSE: BREDL considers the information from the VERCORS tests to be germane to the performance of MOX fuel during a design basis LOCA, as does the Expert Panel Report on Source Terms. In that report, some members of the expert panel stated their belief that the VERCORS tests indicated a greater release rate for fission products during the early in-vessel release phase for MOX fuel than for LEU fuel.

C. Contention II

Interrogatory 17 Define BREDL's understanding of the term "core disruptive accidents." Identify, with specificity, all "core disruptive accidents" of concern to BREDL under Contention II.

RESPONSE: BREDL's understanding of the term "core disruptive accident," in the context of this proceeding and prior to the Board's April 8, 2004, Order (Confirming Matters Addressed at April 6 Teleconference), is an event in which a LOCA or other initiating event occurs but emergency core cooling systems are unable to terminate core damage, leading to a loss of coolable core geometry, core melt, melt relocation and vessel melt-through.

We note that the Board's Order of April 8, 2004, defines "core disruptive accident" in a different way than we have here. BREDL will seek a clarification from the Board in order to come to a common understanding of the term.

Interrogatory 18 Describe the sequence of events that BREDL asserts would result in a core disruptive accident at Catawba, as defined in response to Interrogatory 17, due to the introduction of four MOX fuel assemblies in a core (with one assembly located in each core quadrant).

RESPONSE: BREDL does not assert that the sequence of events that would result in a core disruptive accident at Catawba, as defined in response to Interrogatory 17, would change due to the introduction of four MOX fuel assemblies in a core. The sequences of events, in general, consists of a transient or other initiator that results in an inability to provide adequate heat removal from the core, coupled with the unavailability or failure of emergency core cooling systems or other heat removal mechanisms, leading to the situation described in Interrogatory 17. BREDL asserts, however, that the likelihood and/or consequences of such sequences of events would change due to the introduction of four MOX assemblies in a core.

> *Interrogatory 19* Identify all specific MOX fuel behaviors (including those associated with M5 cladding) that BREDL asserts affect core disruptive accidents (as defined in response to Interrogatory 17) in a manner different than LEU fuel.

RESPONSE: We incorporate by reference the responses to Interrogatory 4 and 5, insofar as specific MOX fuel behaviors, including those associated with M5 cladding, that affect design basis LOCAs in a manner different than LEU fuel also have the same potential to affect the initial stages (*e.g.,* gap release and early in-vessel release phases) of core disruptive accidents resulting from beyond-design-basis LOCAs.

BREDL also asserts that during a core disruptive accident, MOX fuel will relocate at a temperature 200 degrees C – 300 degrees C lower than LEU fuel, as IRSN stated in in its October 2003 presentation to NRC. The degradation of MOX fuel in a core disruptive accident may also be quite different than the degradation of conventional ("LEU") reactor fuels, including a greater likelihood of fuel foaming rather than fuel candling, which could affect radionuclide release fractions. Letter from Dana Powers to Jason Schaperow (February 27, 2002), Expert Panel Report at 77.

BREDL does not assert that the presence of four MOX LTAs in a Catawba core (the subject of this proceeding) will affect the likelihood of core disruptive accidents resulting from non-LOCA initiators in a manner different than LEU fuel.

Interrogatory 20 Identify all underlying physical or chemical properties, or mechanisms, that BREDL asserts contribute to each specific fuel behavior difference identified in response to Interrogatory 19. Identify the specific behavior difference to which each mechanism contributes.

RESPONSE: *See* BREDL's Response to Interrogatory 6.

With regard to the underlying mechanism for the lower relocation temperature of MOX fuel during melting, BREDL does not have information that this phenomenon is fully understood. It may be related to the fuel foaming mode of degradation expected for MOX fuel, which is due to the "high gas content of localized, plutonium-rich regions of the fuel." Letter from Dana Powers to Jason Schaperow, Expert Panel Report at 77.

Interrogatory 21 For each behavior identified in response to Interrogatory 19, provide a *qualitative* and *quantitative* description of the effect of the behavior on fuel, cladding, core, and plant parameters (including, but not limited to, those parameters that relate to the integrity of fission product barriers and to dose to the public) following a core disruptive accident. If no quantitative assessment is available, state that fact.

RESPONSE: *See* BREDL's responses to Interrogatories 8 and 9.

In principle, the relocation of MOX fuel at a lower temperature than LEU fuel (and hence at an earlier time) during core melt could speed the progression of a core disruptive accident and shorten the time to vessel failure, which in turn could affect the time of containment failure and large radiological release to the environment. No quantitative assessment of this phenomenon is available to BREDL or to anyone else, to BREDL's knowledge, as a result of the lack of sufficient experimental data to revise and validate MELCOR or other severe accident codes to evaluate core disruptive accidents involving MOX fuel. The magnitude and rate of release of fission products from core to containment could also be affected by the fuel foaming mode of degradation of MOX fuel.

Interrogatory 22 Provide a description of the physical mechanism whereby a postulated local effect (in one MOX fuel assembly isolated in one quadrant of the core and surrounded by conventional low enriched uranium fuel) that results from a behavior as identified in response to Interrogatory 19 would propagate to other fuel assemblies, ultimately resulting in a core disruptive accident (as described in response to Interrogatory 17).

RESPONSE: One has to assume that if design basis criteria are not met, that a more severe condition will arise; and that the condition may not be easily mitigated. In this case, BREDL is concerned that the ECCS criteria are not met for MOX fuel. If the ECCS acceptance criteria are not met for any element of the core, one must assume that a beyond design basis LOCA will occur, and any fuel melting will lead to the possibility of a beyond design basis event.

Interrogatory 23 Identify all environmental factors that BREDL asserts have not been properly addressed or quantified by Duke's environmental report ("ER") related to four MOX fuel assemblies. For each such factor, describe how it is affected by four MOX fuel lead assemblies and the potential impact that factor could have on the environment. Describe in detail the quantification that BREDL asserts is needed in the ER. Provide a quantitative estimate of the relative magnitude of impact the four MOX assemblies will have on these factors. If no quantitative assessment is available, state that fact.

RESPONSE: BREDL asserts that Duke's ER has not properly addressed or quantified the consequences of a core disruptive accident with early containment failure or bypass when the four MOX LTAs are in the core. Both the radionuclide inventory and the release fractions for fission products and actinides will be different for the MOX LTAs than for the LEU fuel assemblies in the core. The Department of Energy's Surplus Plutonium Disposition Environmental Impact Statement, upon which Duke relies, only accounts for the first difference, and not the second, and in any event uses the radionuclide release fractions taken from Duke's Individual Plant Examination for Catawba, without any independent validation of these values.

Factors that need to be taken into account to obtain a more accurate estimate of the increase in accident consequences associated with the introduction of four MOX LTAs include the increase in volatile and semi-volatile releases from MOX fuel observed in the VERCORS tests, the impact of the greater tellurium release fraction observed in the VERCORS and Phébus tests on the increased consequences of MOX releases (tellurium isotope inventories are greater in irradiated MOX fuel), and the greater ruthenium and actinide releases associated with late in-vessel degradation in air (both ruthenium and most actinide inventories are greater in MOX fuel).

Interrogatory 24 The paper "Public Health Risks of Substituting Mixed-Oxide for Uranium Fuel" by Dr. Edwin S. Lyman, *Science and Global Security*, 2000 was cited as a basis for contentions related to MOX fuel lead assembly use. Please provide the following information relative to that paper and the analyses discussed therein.

a. The version of the MACCS2 code used in the consequence analyses.

RESPONSE: The MACCS2 code executable file used in the consequence analyses is being provided under separate cover.

b. Details on the derivation of the simplified accident source terms and release fractions from the Sequoyah PRA (see Table 3 in the paper) that are sufficient to allow an independent derivation of the values from publicly available information.

RESPONSE: The simplified accident source terms and release fractions in Table 3 of the Lyman paper were not derived by the author but were taken from R. Davis et al., NUREG/CR-6295, *Reassessment of Selected Factors Affecting Siting of Nuclear Power Plants* at 3-19 (1997), as referenced in endnote 52 (note the error in page number). We have not attempted to independently verify these values.

c. The actual radionuclide release fractions used in the sensitivity studies (see Table 5 in the paper).

RESPONSE: This information is contained in endnote 56 of the Lyman paper.

d. The ranges of the release fractions considered in developing the actual radionuclide release fractions in 12.c, and the basis for those ranges.

RESPONSE: We assume that this is an error and 24.c is what is intended. See endnote 56 of the Lyman paper.

e. An assessment of the validity of the scaling technique used in Appendix A in the paper converting results for 40% MOX fuel cores to MOX fuel lead assembly cores, and the basis for that assessment.

RESPONSE: As was stated in oral argument on December 3, 2003, the scaling procedure used in Appendix A was intended to obtain an estimate of the radionuclide inventory of a partial MOX core. The justification for the accuracy of the scaling procedure is explained in the section of Appendix A entitled "Extrapolation to Partial MOX Cores." We note that this scaling approach has no relationship to the scaling of the *radiological consequences* of a radiological release that Duke employed in the LAR, since the dependence of the radiological consequences of a radiological release on the core inventory is highly non-linear.

> *Interrogatory 25* State whether it is BREDL's position that an ER must be based on a fully-developed probabilistic risk assessment ("PRA") whenever an applicant maintains a PRA.

RESPONSE: BREDL does not assert, and has never asserted in this proceeding, that an ER must be based on a fully developed PRA. However, when a PRA is available to an applicant, BREDL believes that it is reasonable to expect that PRA information will be used to quantify the environmental impacts of a proposed action to the extent practicable.

> *Interrogatory 26* Explain BREDL's position on what constitutes a *significant change* in "risk." Identify and explain any qualitative or quantitative thresholds that BREDL asserts should be applied in evaluating the acceptability of a license amendment. Explain the basis for those thresholds.

RESPONSE: BREDL does not have a definition for the term "significant change in risk," and is not aware of any definitive guidance from the NRC on this subject. BREDL does not believe it is necessary or appropriate for BREDL to define a threshold for distinguishing "significant" from "insignificant" changes in risks of nuclear accidents. The NRC should make that determination in the first instance. Nevertheless, BREDL believes that a change in the likelihood or consequences of credible accidents that would result in serious injury or death to any additional individual could not be dismissed as insignificant.

Interrogatory 27 Explain whether (and if so, how), in BREDL's view, the addition of four MOX fuel assemblies will impact core damage frequency ("CDF") at Catawba. Identify any specific accident sequences that will be impacted. Provide any quantitative assessment that BREDL has made or will rely on, and if none exists confirm that fact.

RESPONSE: To the extent that the existing emergency core cooling systems may not be adequate to mitigate a LOCA with MOX fuel in the core, the contribution by LOCAs to core damage frequency is increased. We have no quantitative assessment of this likelihood, for the same reasons that we have stated in the response to Interrogatory 9.

Interrogatory 28 Explain whether (and if so, how), in BREDL's view, the addition of four MOX fuel assemblies will impact large early release frequency ("LERF") at Catawba. Identify any specific accident sequences that will be impacted. Provide any quantitative assessment that BREDL has made or will rely on, and if none exists confirm that fact.

RESPONSE: To the extent that core damage frequency is increased, and conditional containment failure probability remains constant, the large early release frequency would also increase. *See* BREDL's response to Interrogatory 27.

Interrogatory 29 Explain any other qualitative or quantitative basis that BREDL asserts for concluding that four MOX fuel lead assemblies will lead to a "significant change" in risk (as defined in response to Interrogatory 26) at Catawba.

RESPONSE: At this time, BREDL does not assert that the change in risk is significant. BREDL asserts that Duke has failed to show that the change in risk is insignificant.

Interrogatory 30 Identify and explain any quantitative information that BREDL have that indicates that higher release rates and higher release fractions in four MOX fuel lead assemblies, if present, would lead to a "significant change" in the consequences of a severe accident.

RESPONSE: *See* response to Interrogatory 29.

III. DOCUMENT PRODUCTION REQUESTS

Request 1 All documents that are identified, or referred to, in responding to all of the above interrogatories.

RESPONSE: The documents are identified in each interrogatory response. All are publicly available or have been previously provided to Duke.

> *Request 2* All documents that Intervenors intend to use, exhibit, or otherwise rely upon in this proceeding to support their position on Contentions I and II.

RESPONSE: *See* Response to Interrogatory 3.

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,

Diane Curran
Harmon, Curran, Spielberg, & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
e-mail: dcurran@harmoncurran.com

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