USEC
A Global Energy Company

December 15, 2005
AET 05-0099

Mr. Jack R. Strosnider
Director, Office of Nuclear Material Safety and Safeguards
Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

American Centrifuge Plant
Docket Number 70-7004
Submittal of Additional Information Regarding Seismic for the American Centrifuge Plant (TAC Nos. L32306, L32307, and L32308) – Proprietary Information

INFORMATION TRANSMITTED HEREWITH IS PROTECTED FROM PUBLIC DISCLOSURE AS CONFIDENTIAL COMMERCIAL OR FINANCIAL INFORMATION AND/OR TRADE SECRETS PURSUANT TO 10 CFR 2.390 AND 9.17(a)(4)

Dear Mr. Strosnider:

Pursuant to a conference call held on December 7, 2005 with the U.S. Nuclear Regulatory Commission (NRC) staff, USEC Inc. (USEC) hereby submits additional information related to the seismic design for the American Centrifuge Plant.

Enclosure 1 provides clarifying information in response to the questions on seismic design. Enclosure 2 provides supporting information as referenced within USEC's responses. Changed pages for the Integrated Safety Analysis (ISA) Summary and Addendum 1 of the ISA Summary are being submitted under separate cover (AET 05-0101) due to the documents containing Export Controlled Information.

Enclosure 2 contains USEC Proprietary Information and USEC requests that these enclosures be withheld from public disclosure pursuant to 10 *Code of Federal Regulations* (CFR) 2.390(a)(4). An affidavit required by 10 CFR 2.390(b)(1)(ii) is provided in Enclosure 3.

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NMSS01

If you have any questions regarding this matter, please contact Peter J. Miner at (301) 564-3470.

Sincerely,

S. A. Toelle

Steven A. Toelle
Director, Nuclear Regulatory Affairs

cc: Y. Faraz, NRC HQ
H. Graves, NRC HQ
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R. Wescott, NRC HQ

Enclosures: As Stated

Enclosure 1 of AET 05-0099

Additional Information Related to Seismic
(Non-Proprietary Information)

Enclosure 1 of AET 05-0099

On December 1, 2005 a teleconference was held between the U.S. Nuclear Regulatory Commission (NRC), its consultant, Center for Nuclear Waste Regulatory Analyses – Southwest Research Institute, and USEC Inc. (USEC). This call was conducted to address responses provided to the NRC via USEC letter AET 05-0098 for the American Centrifuge Plant (ACP). As a result of this teleconference clarifications were requested. The following responses are intended to supplement the information provided in USEC letter AET 05-0098 (Enclosure 1). The responses address the necessary clarifications.

1. Clarify which seismic sources were used and indicate why the Queen Charlotte and Cascadia Subduction Zone sources were not used.

USEC Response

The previous response to item #3 of USEC letter AET 05-0098 (Enclosure 1) provided the seismic sources used in the site-specific study conducted in September 2005. The Queen Charlotte and the Canadian Subduction were modeled as a strike and as a subduction fault in the 1995 Beavers analysis. Since neither of these two sources were found to have a considerable contribution to the seismic hazard at the Piketon site, they were dropped from consideration in the September 2005 study. The site-specific study report will be revised to reflect this. The report will be provided to the NRC by January 5, 2006.

2. What is the justification for using the sources and the characteristics in the model? Include the radius of the search.

USEC Response

The model for seismic hazard used is the same that was used by the United States Geological Survey (USGS). The methodology consists of five items each of which considers the seismic hazard. The model is shown in Figure 4 of Reference a. The magnitudes and the time periods that the models utilize are shown. Model 1 was assigned a weight of twice Model 2 and Model 3 (Reference a). The number of events greater than the minimum magnitude was counted on a grid spacing of 0.1 degree in both latitude and longitude. The a-values are smoothed using a Gaussian function. The correlation distance is 50 to 75 kilometers (km), which matches the historic seismic trends in the Central and Eastern United States (CEUS).

Model 4 is the background source zones that are used to quantify hazards in areas that are considered to have potentially damaging earthquakes. Models 1 through 4 were given a weight of 1. Model 5 lists the main earthquakes with potential moment magnitudes greater than 7.0. These earthquakes are discussed in more detail below.

The primary sources used are the New Madrid Fault Zone, Charleston Fault Zone, and CEUS Gridded. The Anna Ohio earthquakes were also considered due to their relatively high magnitude and proximity to the Piketon site. The documentation for these sources is discussed in detail in (Frankel et. al. 1996, 2002). A summary of the fault, point, and area sources are provided below for the main CEUS sources.

New Madrid – The new Madrid is modeled as three parallel faults in an S-shaped pattern that encompasses an area that is depicted by the historic seismicity. The upper bound moment magnitude was originally at 8.0 and has since been reduced to magnitude of 7.4 based on recent work by Bakun and Hopper (2002). The magnitude 7.3 appears to be appropriate for this seismic zone. The Central New Madrid was given a 0.5 weight and the SE and NW each given a 0.25 weight in accordance with the USGS.

The closest distance to the New Madrid Central source is 340 miles (547 km). The peak ground acceleration calculated and presented in Figure 4 of the site-specific report provided by USEC letter AET 05-0079 (dated October 28, 2005) was compared to the Electric Power Research Institute (EPRI) Report (2004) (Reference c) median peak ground motion acceleration for a magnitude 7.0 event at the same distance. The EPRI curves (deterministic) indicate that a median ground motion of 0.01 gravity (see Figure A-2, Page A-5 in EPRI 2004) would be anticipated at a distance of 300 to 400 km. The USGS model shows that for a 10,000-year return period a peak bedrock acceleration of 0.5 gravity should be anticipated. These results are in line or are greater than the EPRI estimates given that the source used is magnitude 7.3. Similar results were obtained for the SE and NW segments of the New Madrid fault source.

Charleston – The USGS model uses an aerial source zone provided by Pradeep Talwani and a larger zone drawn by S. Obermeier and R. Weems. The source is constrained by paleoliquefaction locations however the source does not take into account all of the liquefied sites. The USGS modeling of this source is appropriate. The broad zone of the source lies at a distance of 375 miles (605 km) from the Piketon site and the Narrow Zone is located (657 km) from the site. Equal weight was applied to both the broad and the narrow zones. Due to the distance from the Piketon site, these fault sources do not contribute that much to the seismic hazard and would be anticipated to cause peak bedrock acceleration at the Piketon site of 0.02 gravity for the 10,000-year return period event. The EPRI magnitude 7.0 attenuation curves indicate peak ground acceleration at the Piketon site of 0.01 gravity at a distance of 300 to 400 km. The EPRI attenuation curves are provided in Appendix A of EPRI 2004.

Figures 1, 2, and 3 from Reference d, show the New Madrid and Charleston Fault Zones. A search radius of 1,000 km was used in the probabilistic seismic hazard analysis.

Anna Ohio – The Anna Ohio is modeled as a source with magnitude 7.0 with a closest distance of 73 miles (117 km). Based on Figure 4 of the report provided by USEC letter AET 05-0079 (dated October 28, 2005) the source is anticipated to cause bedrock shaking at the Piketon site of 0.2 gravity for a 10,000-year return period event and 0.7 gravity for the 100,000-year return period event. Due to the proximity to the Piketon site,

this source is a strong contributor to the potential hazard. This was compared to the EPRI mean peak ground accelerations, which indicated a deterministic mean peak ground acceleration of 0.04 to 0.05 gravity at a distance of 70 km. The gridded values and the Anna Ohio source values contribute equally to the hazard for the 10,000- and 100,000-year return period events.

References:

a. Frankel, A., S. Harmsen, C. Mueller, T. Barnhard, E. V. Lyendecker, D. Perkins, S. Hanson, N. Dickman, M. Hopper, USGS National Seismic Hazard Maps: Uniform Hazard Spectra, De-Aggregation, and Uncertainty, Published in the *Proceedings of the FHWA/NCEER Workshop on the Nationals Representation of Seismic Ground Motion for New and Existing Highway Facilities*, NCEER Technical Report 97-0010, pp. 39-73, 1997.

b. Frankel, A., C. Mueller, T. Barnhard, D. Perkins, E. V. Leyerdecker, N. Dickman, S. Hanson and M. Hopper, *National Seismic Hazard Maps: Documentation, USGS Open File Report 96-532*, June 1996.

c. EPRI, Electric Power Research Institute (2004), *CEUS Ground Motion Project, Final Report*, 1009684, December 2004.

d. Frankel, A. D., M. D. Peterson, C. S. Mueller, K. M. Haller, R. L. Wheeler, E. V. Lyendecker, R. L. Wesson, S. C. Harmsen, C. H. Cramer, D. M. Perkins, and K. S. Rukstales, (2002), *Documentation for the 2002 Update of the National Seismic Hazard Maps*, USGS Open File Report 02-420, 2002.

3. How do the input motion time histories affect the average and peak accelerations?

USEC Response

The process used in the dynamic response analysis consisted of the following:

- Establish a site-specific response spectrum from the probabilistic seismic hazard analysis.
- Identify controlling events by de-aggregation of the seismic hazard.
- Estimate the strong motion duration for the controlling seismic events and
- Search the available database for earthquake records that are compatible with the target site-specific response spectrum.

The strong motion records were selected primarily on the magnitude of the event, the distance from the event to the Piketon site and the duration of strong ground shaking. These parameters were obtained by looking at the seismic de-aggregation. The selection of the records was important because the magnitude influences the frequency content and duration of the strong ground shaking. Far-field high magnitude records were selected to

characterize the ground motions at the Piketon site. Three time histories were used. For this number of time histories it is appropriate to spectrally match the time histories to the smooth target design spectrum. This removed the peaks and troughs so that the results are not overly controlled by the particular time history chosen. The time histories were scaled and matched to the target over most of the period range of interest. Some of the high frequency content of the some of the earthquakes did not quite match the target spectrum. This occurred in a range not considered to be critical to the ACP structure of primary concern. Time histories are provided in Enclosure 2 of this letter.

4. Give more detail on the various models used and why?

USEC Response

The models used are consistent with those used by the USGS in the development of the national seismic hazard maps. The 2002 hazard maps include the following attenuation relationship models: Frankel et. al. (1996), Toro et. al. (1997), Atkinson and Boore (1995), Somerville et.al. (2001) and Campbell (2002). Campbell and Somerville are newly added. Somerville is an extended source, finite fault model and was used for the Charleston and New Madrid fault zones. Campbell utilizes a hybrid model that converts empirical Western United States earthquakes to CEUS path and source parameters. All of the relationships are adjusted to the B-C boundary site condition (2,500 feet/second) shear wave velocity condition. A recent assessment has been made between the EPRI (2004) models and the USGS models (Cramer, 2005). It appears that the EPRI relations predict similar ground motions at periods of 0.5 seconds or less but have significantly lower ground motions at longer periods (>0.5 seconds). The difference appears to be due to the crustal wave attenuation model assumed in a few of the Eastern North American relations used in the EPRI model. The discrepancy in the long period appears to be associated with unusual crustal and geometric spreading models used in the EPRI relationships. The models used cover the wide range of potential seismic hazard at the Piketon site and match or exceed the ground motion predicted by the models used in the recent EPRI report.

References:

a. Frankel, A., C. Mueller, T. Barnhard, D. Perkins, E. V. Leyerdecker, N. Dickman, S. Hanson and M. Hopper, *National Seismic Hazard Maps: Documentation*, USGS Open File Report 96-532, June 1996.

b. Toro, G., N. Abrahamson, and J. Schneider, (1997) *Model of Strong Ground Motions from Earthquakes in Central and Eastern North America: Best Estimates and Uncertainties*, Seism. Res. Letters, V.68 pp.41-57.

c. Atkinson, G. M. and D.M. Boore (1995), *Ground Motion Relations for eastern North America*, Bull. Seism. Soc. Am., Volume, 85, pp17-30.

d. Somerville, P., et. al. (2001), *Ground Motion attenuation Relations for the Central and Eastern United States*, USGS Reports under award number 99HQGR0098, June 30, 2001.

e. Campbell, K.W., (2002) Prediction of strong ground motion using the hybrid empirical method: example application to eastern North America, submitted to Bull. Seism. Soc. Am.

f. Cramer, C. (2005), *An Assessment of the Impact of the ERPI (2003) Ground Motion Prediction models on the USGS National Seismic Hazard Maps*. USGS, Post Journal Review Revision of September 19, 2005.

g. EPRI, Electric Power Research Institute (2004), *CEUS Ground Motion Project, Final Report*, 1009684, December 2004.

5. Which software program was used for the spectral matching?

USEC Response

The spectral matching software used is the RSPM Spectral Matching Program and is discussed in detail in a report by N. A. Abrahamson, *Non-Stationary Spectral Matching Program, PG&E Internal Report*, 1998.

6. Describe the smoothing procedure for the 10,000-year return period spectra.

USEC Response

The 10,000-year return period spectra provided in Enclosure 2 is not smoothed. Some smoothing would be required in the high frequency range to account for poor spectral matching with one of the earthquake motions. Because this frequency range is not considered to be of concern for the planned structure, the smoothing was not performed.

7. Discuss the site soil amplification factors.

USEC Response

The amplification factors are generated by the EZ-FRISK software programs for each frequency. The amplification factors are a function of the attenuation or amplification of the vertically propagating shear waves through the site soil profile. The amplification factors for the 10,000-year return period event are provided in Enclosure 4 of this letter.

The 100,000-year return period spectra are provided in Enclosure 4 of this letter. The spectrum was derived from the 100,000-year return period uniform hazard curve

presented in Figure 6 of the site-specific report provided by USEC letter AET 05-0079 (dated October 28, 2005). The amplification factors used for a Site Class C definition were used to account for the site effects. A F_a of 1.0 and an F_v value of 1.55 was used to scale the spectrum.

Reference:

a. Risk Engineering Inc. (2005) EZ-Frisk 7.14, *Users Manual, Software For Earthquake Ground Motion Estimation.*

8. Revise the Integrated Safety Analysis (ISA) to adequately address the justification that seismic events resulting in a release of licensed material such that workers or the public could be adversely affected are highly unlikely.

USEC Response

USEC has revised the ISA Summary to provide additional information and clarification to support the conclusion that seismic events that could result in releases of licensed material will be "Highly Unlikely." Changes were made to Section 6.1.1.7 of the ISA Summary to reflect the reasoning for the conclusions that seismic events are "Highly Unlikely." This reasoning discusses the seismic design criteria for the ACP facilities and equipment, the associated margins of safety, the types of operations occurring (e.g. subatmospheric conditions), low inventories of licensed material, and the equipment configurations combining to support the conclusions for "Highly Unlikely." Changed pages are being provided under separate cover (USEC letter AET 05-0101).

Some consistency changes have also been made to the ISA Summary and Addendum 1 of the ISA Summary due to the changes provided previously. These changed pages are also being provided under separate cover (USEC letter AET 05-0101).

Enclosure 3 of AET 05-0099

Affidavit

AFFIDAVIT OF STEVEN A. TOELLE
SUPPORTING APPLICATION TO WITHHOLD FROM
PUBLIC DISCLOSURE CERTAIN INFORMATION CONTAINED IN
ENCLOSURE 2 FOR THE AMERICAN CENTRIFUGE PLANT

I, Steven A. Toelle, of USEC Inc., having been duly sworn, do hereby affirm and state:

1. I have been authorized by USEC to (a) review the information owned by USEC which is referenced herein relating to Enclosure 2 regarding the site-specific seismic study performed to determine the specific 10,000-year response spectrum for the American Centrifuge Plant and which USEC seeks to have withheld from public disclosure pursuant to section 147 of the Atomic Energy Act (AEA), as amended, 42 U.S.C § 2167, and 10 CFR 2.390(a)(3), 2.390(a)(4), 2.390(d)(1) and 9.17(a)(4), and (b) apply for the withholding of such information from public disclosure by the Nuclear Regulatory Commission (NRC) on behalf of USEC.

2. Consistent with the provisions of 10 CFR 2.390(b)(4) of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

i. The information sought to be withheld from public disclosure is owned and has been held in confidence by USEC.

ii. The information is of a type customarily held in confidence by USEC and not customarily disclosed to the public. USEC has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute USEC policy and provide the rational basis required. Under that system, information is held in confidence if it falls in one or more of

several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where presentation of its use by any of USEC's competitors without license from USEC constitutes a competitive economic advantage over other companies.

b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage (e.g., by optimization or improved marketability).

c) Its use by a competitor would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of USEC, its customers or suppliers.

e) It reveals aspects of past, present, or future USEC or customer funded development plans and programs of potential commercial value to USEC.

f) It contains patentable ideas, for which patent protection may be desirable.

g) It reveals information concerning the terms and conditions, work performed, administration, performance under or extension of contracts with its customers or suppliers.

iii. There are sound policy reasons behind the USEC system which include the following:

a) The use of such information by USEC gives USEC a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the USEC competitive position.

b) It is information, which is marketable in many ways. The extent to which such information is

available to competitors diminishes USEC's ability to sell products and services involving the use of the information.

c) Use by our competitors would put USEC at a competitive disadvantage by reducing their expenditure of resources at USEC expense.

d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components or proprietary information, any one component may be the key to the entire puzzle, thereby depriving USEC of a competitive advantage.

e) Unrestricted disclosure would jeopardize the position of prominence of USEC in the world market, and thereby give a market advantage to the competition of those countries.

f) The USEC capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

iv. The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

v. The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

3. The proprietary information sought to be withheld is contained in Enclosure 2 to USEC letter AET 05-0099. Specifically, the enclosure contains figures from the revised "Report of Site-Specific Seismic Study for the USEC American Centrifuge," originally dated October 2005 and provided in USEC letter AET 05-0079. The proprietary information submitted by USEC is information committed to be provided to the NRC in a response to a request for additional

information. As part of the design effort for the American Centrifuge Plant, USEC stated that a site-specific seismic study would be performed to determine the specific 10,000-year response spectrum. Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of USEC because it may enhance the ability of competitors to position and provide similar products. Moreover, disclosure of the details of the seismic analyses may provide insights into the design of USEC's American Centrifuge technology, including structures, systems, and components.

This information is part of that which will enable USEC to:

- Deploy the American Centrifuge Plant;
- Verify the adequacy of the design for the existing facilities; and
- Design new facilities in accordance the appropriate seismic design values.

Further, this information has substantial commercial value as follows:

- The development of the information described in part is the result of applying many hundreds of person-hours and the expenditure of thousands of dollars; and
- In order for a competitor of USEC to duplicate this information, a similar process would have to be undertaken and a significant effort and resources would have to be expended.

Further the deponent sayeth not.

Steven A. Toelle, having been duly sworn, hereby confirms that I am the Director, Nuclear Regulatory Affairs of USEC, that I am authorized on behalf of USEC to review the information attached hereto and to sign and file with the U.S. Nuclear Regulatory Commission this affidavit and the attachments hereto, and that the statements made and matters set forth herein are true and correct to the best of my knowledge, information, and belief.

S. A. Toelle

Steven A. Toelle

On this 15th day of December 2005, the individual signing above personally appeared before me, is known by me to be the person whose name is subscribed to within the instrument, and acknowledged that he executed the same for the purposes therein contained. In witness hereof I hereunto set my hand and official seal.

Karen Bentley

Karen Bentley
Notary Public - State of Ohio
My Commission Expires October 12, 2007