Attachment A. Excerpt from Energy Northwest response letter (dated 17 September 2010) to the Nuclear Regulatory Commission letter (dated 13 July 2010) requesting additional information on seismic hazards for the review of the Columbia Generating Station license renewal application. Red numbers along the left-hand margin of the pages correspond to numbered items/sections in the evaluation.

NRC Request:

3) Provide the following information with regard to the treatment and inclusion of external events in the SAMA analysis:

a. ER Section E.3.2.2 states that the seismic hazard analysis used for the seismic PSA is the same as submitted for the CGS Individual Plant Examination of External Events (IPEEE) except for an extrapolation from the maximum peak ground acceleration to 1.5g. The seismic hazard analysis used for the IPEEE was developed in 1994 and documented in "*Probabilistic Seismic Hazard Analysis WNP-2 Nuclear Power Plant Hanford Washington*". Justify the use of the seismic PSA model given: (1) since then the U.S. Geological Survey (USGS) has updated its assessment of seismic hazards across the U.S. including Washington State, (2) seismic hazard analysis was performed specifically for the Hanford area in 1994 which is documented in WHC-SD-W236A-TI-016, *Seismic Design Spectra 200 West and East Areas DOE Hanford Site, Washington*", to provide better evaluation of subsurface materials and (3) work was performed in 2005 which is documented in PNNL-15089, "*Site-Specific Seismic Response Model for the Waste Treatment Plant, Hanford Washington*" that better characterizes the effect from deep layers of sediments "interbedded" with basalt. Address whether consideration of the more current seismic hazard analysis could impact the results of the SAMA analysis (both SAMA identification and SAMA evaluation).

Energy Northwest Response to 3.a:

The 1994 seismic hazard analysis used at CGS was developed by Geomatrix Consultants for Energy Northwest. A similar hazard model was used by Geomatrix to evaluate the United States Department of Energy (USDOE) facilities located elsewhere on the Hanford site in 1994 (Seismic Design Spectra 200 West and East Areas DOE Hanford Site, Washington, WHC-SD-W236A-TI-016, referenced in the RAI). This USDOE work was superseded by a revised report in 1996 (Probabilistic Seismic Hazard Analysis DOE Hanford Site, Washington, Report Number WHC-SD-W236A-TI-002, Rev. 1, dated February 1996). The application of this hazard model to each different Hanford site requires revision of the distances between the site being evaluated and the known and postulated seismic sources contained in the model. Site specific hazard curves are developed for each site evaluated.

3

The CGS site is located approximately 10 miles southeast of the USDOE Waste Treatment Plant (WTP) that is located adjacent to the 200 East area of the Hanford site. The CGS site has distinct differences from the WTP due to its increased distance from nearby seismic sources and different foundation conditions. The more northerly WTP site is located in close proximity to Central

fault on Gable Mountain (about 6 km north of the WTP site) and is incrementally closer to the other Yakima fold seismic sources compared to the more distant CGS site location to the southeast. Other factors being equal, increased distance from a seismic source tends to reduce the expected ground motions at a site.

At the CGS site the soil structure is thicker than at the WTP. However, the deeper basalt flows and alternating sedimentary interbed sequence is similar between the two sites. The combined thickness of the Hanford and Ringold soil formations is approximately 380 feet thick at the WTP (PNNL-16652, Figure 2.2) in contrast to approximately 480 feet at CGS (FSAR Figure 2.5-28). In general the upper Hanford formation is thinner (250' WTP vs. 65' CGS), and the Ringold sediment section is thicker at the CGS site (130' WTP vs. 415' CGS).

3

A large body of geotechnical data was gathered by Energy Northwest during the initial site investigations for CGS and the adjacent WNP-1 and WNP-4 plant sites. These investigations included the acquisition of extensive velocity data for the combined sites. During initial plant licensing for CGS (FSAR Appendix 2.5Q), Energy Northwest performed comparative site response studies using the soil velocity profile for the CGS site and typical firm alluvial soil profiles representative of California strong motion recording sites. For frequencies above about 3 Hz, the California sites used in the site-specific spectrum showed more amplification than the CGS site (FSAR Appendix 2.5Q, Figures 361.17-23 and 24). The conclusion of that analysis was that the empirical strong motion data from firm alluvial sites in California was appropriate for use at the CGS site (FSAR Appendix 2.5Q and the NRC Safety Evaluation Report, NUREG-0892, Supplement 1). This conclusion was adopted for the CGS 1994 seismic hazard study.

During a design review, the Defense Nuclear Facilities Safety Board questioned the original WTP seismic design (based on their 1996 hazard analysis) regarding the assumptions used in developing the original seismic criteria and the adequacy of the WTP site geotechnical surveys. To allow the project to proceed until new data could be acquired, a very conservative interim seismic design spectrum was developed that was documented in PNNL-15089 (2005, referenced in the RAI). Geotechnical work was initiated in 2005 to obtain new WTP site-specific data. This work was primarily directed at obtaining new shear wave velocity data including an improved understanding of the velocity contrast between the basalt flows and intervening sedimentary interbeds.

In 2007 USDOE issued another round of reports based on the new data provided by the site-specific geotechnical investigations (see reports PNNL-16407, PNNL-16652, and PNNL-16653). In general, the overall ground motion response was less than the interim values estimated in 2005 due to the new velocity

Attachment A (Continued) .Excerpt from Energy Northwest response letter (dated 17 September 2010) to the Nuclear Regulatory Commission letter (dated 13 July 2010) requesting additional information on seismic hazards for the review of the Columbia Generating Station license renewal application. Red numbers along the left-hand margin of the pages correspond to numbered items/sections in the evaluation.

information that indicated a greater shear wave velocity contrast between the basalts and interbeds and new data from the sediments that reflected greater damping.

3

Of importance to the CGS site is their conclusion regarding the 1996 ground motion models which was based on the seismic hazard model adopted from CGS. They concluded in PNNL-16653 (Updated Site Response Analysis for the Waste Treatment Plant, DOE Hanford Site, Washington, 2007, page 37), that "the hazard results obtained using the new ground motion models at the WTP site are similar to those obtained using the 1996 set of ground motion models." The relative amplification function (ratio of Hanford / California response) for the WTP site based on the updated site response model is generally below 1.0 (i.e., WTP site response is less than predicted using California recordings) with the exception of minor isolated peaks at 2, 4 and 20 Hz (see PNNL-16653, Figure 33). This is a large reduction over the interim relative amplification factors developed for the WTP in 2005 (PNNL-15089, Figure 3.3.9) where the Hanford response is predicted to be greater than the California data for most frequencies greater than about 1 Hz.

2

The United States Geological Survey (USGS) recently updated (2008) its assessment of seismic hazard for the United States. The results of this national program provide an opportunity for an updated independent validation of the results determined by Geomatrix for the CGS site. The USGS website offers its results either in the form of a contour map or more directly by the gridded data set that was used to construct the maps. The grid file (0.05 degree increment) was used to avoid interpolation of the small scale map contours. The USGS hazards results from two of the grid files (for 119.35° W, 46.50° N) are compared with the mean results from the Geomatrix 1994 report for the CGS site in Table 3.a-1 below. The Geomatrix (CGS) values are similar but slightly larger than those calculated by the USGS.

Table 3.a-1: Comparison of USGS and Geomatrix (CGS) Data

Study	PGA for T = 500 years (10% in 50 years)	PGA for T = 2500 years (2% in 50 years)
USGS 2008	0.072 g	0.169 g
Geomatrix 1994	0.081 g	0.178 g

1

Although differences exist in the methods used to develop the individual site response models for different Hanford facilities, Energy Northwest concludes that the recent site-specific work performed by USDOE for the WTP validates earlier conclusions regarding the applicability of the California strong motion database to the estimation of ground motions at Hanford. Further, it should be noted that the other aspects of the hazard analysis such as fault locations, earthquake magnitudes and frequencies and attenuation relationships were not reexamined

1

in the course of the USDOE studies (PNNL-15089, Summary statement, page iv) and thus those fundamental components of the earlier hazard studies have not changed and would still apply. Comparison of the mean CGS hazard to the independently determined 2008 USGS hazard calculations verifies that the CGS model is conservatively predicting an appropriate ground motion for the CGS site. Accordingly, Energy Northwest concludes that the 1994 seismic hazard study still provides an adequate seismic input to the PSA models to effectively identify all relevant SAMA candidates.