From: Kevin Hsueh
To: Internet:gary.robertson@ doh.wa.gov
Date: Mon, Oct 23, 2000 3:20 PM
Subject: Sherwood project

Gary,

Please clarify the following loose-ends that WDOH and NRC staff discussed in the past several months.

1. Statement on page 6, top line: "There is no historic seismic data that suggests earthquakes near the Western Nuclear site." This statement may need to be revised. Please see reference provided by Mr. LaVassar in his preliminary submittal ("Sherwood Project - Probabilistic Seismic Hazard Analysis," looseleaf dated September, 2000; specifically the Geomatrix Project 1418A, plate 4, "Seismotectonic Provinces and Instrumental Seismicity in the Study Region"). The map shows five low magnitude events within 23 km of the site.

2. Statement on page 6, first full paragraph: "...(2) no historic earthquakes have originated near the site that by...alignment...indicate a buried capable fault source..." Our understanding is that WDOH will let us know the potential significance of three or four historic earthquakes that were apparently aligned along the fault system that is approximately 28-78 km northeast of the site. The fourth earthquake suggested by NRC staff for review of alignment on the fault (see Geomatrix map cited above) was the Magnitude 2.1 event that occurred at 1:13:32 pm (PDT) on August 31, 2000. The CRR needs to reference the results of the WDOH review of the apparently aligned earthquakes and their potential fault source. It is our understanding that WDOH's preliminary review indicated that one or more of the earthquake events were actually mine or quarry blasts, and therefore, were likely of no consequence in a seismic hazard analysis. Please clarify that.

Kevin

CC: Internet:dorothy.stoffel@doh.wa.gov, Internet:joh...

Attachment 7

From: Kevin Hsueh
To: Internet:gary.robertson@doh.wa.gov
Date: Tue, Oct 24, 2000 10:48 AM
Subject: Comments on revision 1 of the CRR

Gary,

Additional feedback on the revision is as follows:

1. In ground water remediation section (p.18 summary paragraph), we suggest that the CRR include a conclusion statement such as "WDOH has found the Sherwood Project site to be in conformance with the regulatory requirements of criterion 6(7) in 10 CFR Appendix A or equivalent State regulation"

2. In radon emanation section (p.12, 3rd paragraph under Radon 222 Measurement), we suggest that you clarify the term 10 CFR 40, Appendix A, Criterion 6 of the federal Clean Air Act.

3. In geotechnical stability section (p.6, last paragraph under seismic evaluation section), there is a statement "... as there no active faults..." Active faults are not relevant to seismic hazard under Part 40 requirements unless they are capable faults. Please specify the definition of "active faults" in the context of the CRR, or use another term.

4. In geotechnical stability section (p.6, paragraph under liquefaction potential), please include some discussion to support that broad areal failure, or excessive settlement due to liquefaction is unlikely.

Kevin

CC: Dan Rom, Daniel Gillen, Elaine Brummett, Michae...

From: "Robertson, Gary" <Gary.Robertson@DOH.WA.GOV>
To: "Kevin Hsueh (E-mail)" <KPH@nrc.gov>
Date: Thu, Nov 9, 2000 12:40 PM
Subject: FW: WDOH informal responses to NRC's Rev 1 CCR questions

Kevin, see below your six questions from the WDOH CRR Rev 1, followed by WDOH's revised replacement paragraphs proposed to address your questions.

1. Statement on page 6, top line: "There is no historic seismic data that suggests earthquakes near the Western Nuclear site." This statement may need to be revised. Please see reference provided by Mr. LaVassar in his preliminary submittal ("Sherwood Project - Probabilistic Seismic Hazard Analysis," looseleaf dated September, 2000; specifically the Geomatrix Project 1418A, plate 4, "Seismotectonic Provinces and Instrumental Seismicity in the Study Region"). The map shows five low magnitude events within 23 km of the site.

Historic seismic data have been reviewed by Department of Health and Ecology's Dam safety program. Some of the historic seismic data reviewed are presented in reports prepared for Western Nuclear (Volpe 1994; and Volpe 1995), the 1976 Final Environmental Impact Statement for the Sherwood facility (Bureau of Indian Affairs), and the initial engineering report (D'Appolonia 1977). There are no historic seismic data that suggest large-magnitude earthquakes near the Western Nuclear site. Recent earthquake analyses performed by LaVassar have indicated that there have been five low-magnitude events within 23 km of the Western Nuclear site. However, LaVassar's probabilistic seismic assessment has determined that these low-magnitude seismic events are not significant with respect to stability of the site (WDOE, 2000).

In summary: (1) faults, that have been identified and mapped in and near the site to a distance of 100 miles, have not moved once in the last 35,000 years, or twice or more in the last 500,000 years, do not have macroseismicity associated with them, nor are they associated with capable faults such as the Lake Chelan fault; and (2) no historic earthquakes have originated near the site that by magnitude, alignment, or magnitude-distance relationship to the site indicate a buried capable fault source, or any other earthquake source, that should be considered explicitly in the seismic design basis assessment for the site. WDOH evaluated low-magnitude seismic events that appear approximately 28-78 km northeast of the site by reviewing geologic maps for the area and personal communication with Washington State's seismic experts at the Washington State Geological Survey. Based upon WDOH review conducted in the fall of 2000, WDOH concludes that these low-magnitude seismic events are not associated with earthquakes along the trace of a capable fault, and the data indicate that these events are the result of mine blasts.

2. Statement on page 6, first full paragraph: "...(2) no historic earthquakes have originated near the site that by...alignment...indicate a buried capable fault source..." Our understanding is that WDOH will let us know the potential significance of three or four historic earthquakes that were apparently aligned along the fault system that is approximately 28-78 km northeast of the site. The fourth earthquake suggested by NRC staff for review of alignment on the fault (see Geomatrix map cited above) was the Magnitude 2.1 event that occurred at 1:13:32 pm (PDT) on August 31, 2000. The CRR needs to reference the results of the WDOH review of the apparently

aligned earthquakes and their potential fault source. It is our understanding that WDOH's preliminary review indicated that one or more of the earthquake events were actually mine or quarry blasts, and therefore, were likely of no consequence in a seismic hazard analysis. Please clarify that.

Historic seismic data have been reviewed by Department of Health and Ecology's Dam safety program. Some of the historic seismic data reviewed are presented in reports prepared for Western Nuclear (Volpe 1994; and Volpe 1995), the 1976 Final Environmental Impact Statement for the Sherwood facility (Bureau of Indian Affairs), and the initial engineering report (D'Appolonia 1977). There are no historic seismic data that suggest large-magnitude earthquakes near the Western Nuclear site. Recent earthquake analyses performed by LaVassar have indicated that there have been five low-magnitude events within 23 km of the Western Nuclear site. However, LaVassar's probabilistic seismic assessment has determined that these low-magnitude seismic events are not significant with respect to stability of the site (WDOE, 2000).

In summary: (1) faults, that have been identified and mapped in and near the site to a distance of 100 miles, have not moved once in the last 35,000 years, or twice or more in the last 500,000 years, do not have macroseismicity associated with them, nor are they associated with capable faults such as the Lake Chelan fault; and (2) no historic earthquakes have originated near the site that by magnitude, alignment, or magnitude-distance relationship to the site indicate a buried capable fault source, or any other earthquake source, that should be considered explicitly in the seismic design basis assessment for the site. WDOH evaluated low-magnitude seismic events that appear approximately 28-78 km northeast of the site by reviewing geologic maps for the area and personal communication with Washington State's seismic experts at the Washington State Geological Survey. Based upon WDOH review conducted in the fall of 2000, WDOH concludes that these low-magnitude seismic events are not associated with earthquakes along the trace of a capable fault, and the data indicate that these events are the result of mine blasts.

3. In ground water remediation section (p.18 summary paragraph), we suggest that the CRR include a conclusion statement such as "WDOH has found the Sherwood Project site to be in conformance with the regulatory requirements of criterion 6(7) in 10 CFR Appendix A or equivalent State regulation"

WDOH has made a determination that the closure of WNI's Sherwood facility is in compliance with Washington State ground water regulations associated with uranium mill closure. The closure is specifically in compliance with the following ground water criteria delineated in Chapter 246-252-030 WAC, Criteria 5, 6(g), and 13, which incorporate the basic ground water protection standards imposed by EPA in 40 CFR Part 192, Subparts D and E; and imposed by NRC in 10 CFR Part 40, Appendix A, Criteria 5, 6(7), and 13, which specifies ground water monitoring requirements.

4. In radon emanation section (p.12, 3rd paragraph under Radon 222 Measurement), we suggest that you clarify the term 10 CFR 40, Appendix A, Criterion 6 of the federal Clean Air Act.

WNI performed radon 222 flux measurements on the tailings impoundment after final cover placement. Measurements were performed in compliance with

requirements of WAC 246-252-030 (10 CFR Part 40, Appendix A). Sampling was performed using the Large Area Activated Charcoal Canister (LAACC) method. Measurements of the approximately 80-acre surface were performed October 2-3, 1996. A mean radon 222 flux rate of 0.51 +/- 0.03 pCi/m2s was measured (PQL of 0.5 pCi/m2s). This measurement is well below the regulatory standard from state regulation WAC 246-252-030, Criterion 6 (10 CFR 40 Appendix A, Criterion 6), and consistent with analytical evaluations, using realistic assumptions and expectations, performed at the Sherwood site (WDOH 1998, pg. 42).

5. In geotechnical stability section (p.6, last paragraph under seismic evaluation section), there is a statement "... as there no active faults..." Active faults are not relevant to seismic hazard under Part 40 requirements unless they are capable faults. Please specify the definition of "active faults" in the context of the CRR, or use another term.

Two geophysical seismic surveys were conducted for the subsurface around the tailings impoundment by a WNI contractor (Cooksley 1992; and Cooksley 1995). WDOH staff independently reviewed the information provided in the Cooksley reports and determined that there is no evidence presented in these reports of a capable fault at depth.

The PSHA was performed, as there are no known credible faults in the general vicinity of the project. The PSHA considered as loads the suite of earthquakes between Magnitude 5 and the Maximum Credible Earthquake for each seismotectonic source zone as is accepted practice in the field. The resulting cyclic shear stresses (load) induced in the soil column by the suite of earthquakes were assessed with SHAKE91. The cyclic shear resistance (capacity) was estimated from an empirical relationship based on the SPT N-value data from site borings. The Seed-Idriss criteria were employed to predict the occurrence of liquefaction. One boring (B-7) was selected as representative of the worst-case conditions in the tailings material. The PSHA considered uncertainty in the maximum magnitude of earthquakes, attenuation relationships, and the magnitude-frequency of earthquakes.

6. In geotechnical stability section (p.6, paragraph under liquefaction potential), please include some discussion to support that broad areal failure, or excessive settlement due to liquefaction is unlikely.

Earthquake potential to cause liquefaction was evaluated by WNI and reviewed by professional engineers from the Dam Safety regulatory program. Both the dam embankment and the tailings slimes and sands were evaluated. The dam embankment was found to be incapable of liquefaction due to low probability for soil moisture saturation. However, since the tailings slimes and sands are expected to remain saturated over the long term, they could become "liquefied" during a significant seismic event, which could produce rafting of the surface if a conventional thin clay barrier surface cover had been used. As indicated in the Seismic Evaluation section, an annual probability of experiencing liquefaction within some zone of the tailings is 0.000363 (1/2752 annually), based on conservative assumptions.

The cover design approved and constructed for the Sherwood site is a thick (13.6 feet minimum) cover of non-cohesive local borrow soils, which ameliorates the liquefaction concern. The potential for surface expression of slimes or sand boils is limited because of the thick cover design, which

is expected to continue performing as designed because of its self-healing nature (WDOH 1998, pg. 15). Also, tailings slimes and sand layers are lenticular, not interconnected, and do not have broad lateral extent over the impoundment. The potential for liquefaction was modeled in the Seismic Evaluation using very conservative assumptions about thickness and lateral extent of the slimes and sand layers. Therefore, in the unlikely event of liquefaction of some areas of tailings at depth, there is an even more remote chance of performance defects over large areas of the impoundment. As indicated on page 7 under Seismic Evaluation, if such a large seismic event were to occur within a minimum epicentral distance (probability of recurrence of less than 1 chance in 10,000 years), then an inspection (and corrective action, if needed) of the site by the custodial agency is recommended.

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