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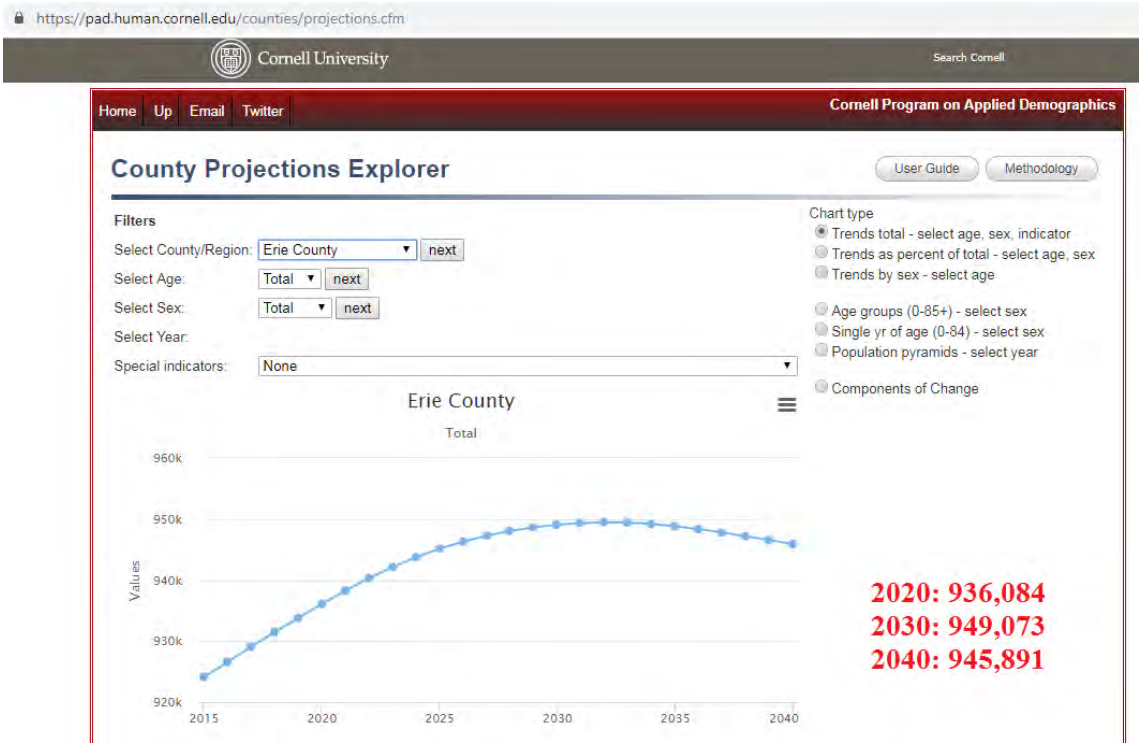
Re: Corrections needed to address errors and omissions in the Conceptual Site Model

Dear Dr. Gordon:

As I mentioned at the 5 PM pre-meeting prior to the May 22nd Quarterly Public Meeting, there are several errors and omissions in the Conceptual Site Model for the West Valley Site (CSM) prepared by Neptune and Company (Neptune), NAC-0073_R3, 23 June 2017, that need to be corrected. Please share this letter with U.S. Department of Energy (DOE) and Neptune so that these corrections can be made.

1. On p. 23 of the CSM, the Erie County population projections are wrong (out of date). The cited source (Cornell University [2016], https://pad.human.cornell.edu/counties/projections.cfm) has been updated and now shows the projections as follows (with values in red copied by me from the online graph):



Compared to the values listed in the CSM, these updated population projections are substantially greater (7% greater, 14% greater, and 23% greater for years 2020, 2030, and 2040, respectively). The Cattaraugus County projections (CSM, p. 22) have also increased, but by somewhat smaller percentages. These should likewise be updated.

2. The magnitude and rapidity of the changes in the Erie County population projections illustrate the pitfall of presenting these projections as deterministic single-valued estimates rather than probabilistic distributions. Underlying demographic trends, especially for the city of Buffalo and the rest of Erie County, have been changing recently. Part of the trend is tied to the pace of new development in Buffalo, including an ongoing demand for housing in the downtown area, a demographic shift toward a younger and well-educated population (for example, see http://time.com/4797956/cities-millennials-moving/), etc. Part of the trend, as noted by Dr. Pat Townsend at the May 22nd pre-meeting, relates to climate change. The Buffalo area is one of the U.S. locations which is considered less vulnerable to climate impacts (for example, see https://www.reuters.com/article/us-usa-climatechange-migration/cool-u-s-cities-prepare-as-future-havens-for-climate-migrants-idUSKCN1RI061), has a relatively stable and sustainable water supply, continues to welcome secondary migration of refugees and other immigrants (https://news.wbfo.org/post/cuomo-urging-state-department-maintain-buffalo-refugee-agencies), etc. Given these trends, it is difficult to know whether Cornell's most recent population projections for Erie County (showing a decrease from 949,073 to 945,891 between 2030 and 2040) will be borne out or, alternatively, whether the county's population will continue to rise, perhaps at an increasing rate. The CSM may be unable to provide well-supported probabilistic distributions for such population estimates but should at least acknowledge the uncertainty in predicting future regional populations.

3. The CSM (pp. 22-27 and elsewhere) improperly omits areas of Canada that will be impacted by radiological releases from the West Valley site. Depending on winds and wind-driven currents, contamination released from the site may reach the Canadian shore of Lake Erie, the Canadian side of the upper Niagara River, the Canadian shore of Lake Ontario, and Canadian inland areas. Contamination released from the site will, in any case, reach the Canadian side of the lower Niagara River. The predictable spread of such contamination is illustrated, for example, by satellite imagery of the (non-radioactive) sediment plume from the August 2009 storm and by the published work of S.R. Joshi showing contamination from the West Valley site off the mouth of the Niagara River in Lake Ontario.[1] Thus, it is unacceptable to omit Canada from consideration, as has been done in the map (Fig. 10) on CSM page 25 where Canada is blanked out. Canadian populations, land uses, and impacts need to be included, not only in the CSM but also in Neptune's probabilistic performance assessments and the entire Supplemental EIS process. Part of the reason that Canada must be considered is the Boundary Waters Treaty

[1] S.R. Joshi, "West Valley-Derived Radionuclides in the Niagara River Area of Lake Ontario," *Water, Air, and Soil Pollution* **37**, 111-120 (1988) and "West Valley Plutonium and Americium-241 in Lake Ontario Sediments off the Mouth of the Niagara River," *Water, Air, and Soil Pollution* **42**, 159-168 (1988).

of 1909 (36 Stat 2448, T.S. No. 548), Article IV: "...It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

4. The CSM's treatment of fault systems and seismicity on pp. 73-81 fails to acknowledge and consider the evidence of two deep-seated faults – one at Sardinia and one at the north end of the US 219 bridge over Cattaraugus Creek near Springville – that was released in 2001 in the Bay Geophysical seismic study.[2] While no follow-up work has been done to identify or clarify the strike of these faults, their geographic extent, surface expression (if any), and likelihood of reactivation, they pose long-term seismic risks to site stability and containment integrity. As such, they need to be acknowledged in the CSM and included in the probabilistic performance assessments and Supplemental EIS process.[3] The Sardinia Fault identified in the Bay Geophysical seismic study is particularly relevant because it is on strike with, and probably part of, the seismically active Attica Splay of the Clarendon-Linden Fault. The Attica Splay is known to extend at least to Varysburg, NY, and a line projected along the fault trace passes approximately through Sardinia at a distance of 18 miles beyond Varysburg, as is evident from CSM Fig. 32. Beyond Sardinia, such a line continues south-southwestward and passes three or four miles east of the West Valley site. Whether the Attica Splay extends this far south remains unknown, but the apparent association between the Sardinia Fault and Attica Splay demonstrates a need for either additional geophysical investigation or a probabilistic representation of the fault's uncertain extent and seismicity.

5. Soil liquefaction is improperly dismissed in the CSM (p. 81) without due consideration of the evidence. The CSM fails to acknowledge and consider the report[4] wherein I review the evidence of unstable soils and liquefaction and, based on this evidence, conclude that "at least one sediment layer is somewhat susceptible to seismically-induced liquefaction, and...results are not yet available for the lacustrine sediments that lie beneath a large portion of the site."[5] (The CSM

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[2] Bay Geophysical, *Seismic Reflection Survey to Identify Subsurface Faults near the West Valley Demonstration Project*, report prepared for West Valley Nuclear Services Company (Traverse City, MI: Bay Geophysical, 2001).

[3] Vaughan EIS comments §§ 57A, 82, and 88. [Note that citations to "Vaughan EIS comments" refer herein to my consolidated EIS comments, most of which can be found in the response-to-comments portion of the 2010 West Valley FEIS, available at https://www.wv.doe.gov/final/EIS-0226_F-Vol3-CRDPart1.pdf, on pdf pages 238-303. Some of the Vaughan EIS-comment appendices that were omitted from the 2010 FEIS volumes can be found at http://www.westvalleyctf.org/2008_Materials/2008-01-Materials/Core_Team_Issues-Vaughan_with_Appendices.pdf.]

[4] See R.C. Vaughan, "Geologic and Hydrologic Implications of the Buried Bedrock Valley that Extends from the Western New York Nuclear Service Center into Erie County, N.Y.", in *Geology Reports of the Coalition on West Valley Nuclear Wastes* (East Concord, NY, 1994), available online at http://www.westvalleyctf.org/2008_Materials/2008-01-Materials/Core_Team_Issues-Vaughan_with_Appendices.pdf, at pp. 180-207 of the pdf file. See also Vaughan EIS comments §§ 50-56.

[5] R.C. Vaughan, "Geologic and Hydrologic Implications of the Buried Bedrock Valley" report, op. cit., p. 11 (*Geology Reports*, p. 72; pdf page 191).

cites a critique[6] of my report but not the report itself!) A better evaluation of soil liquefaction is needed before it can be ruled out in the CSM.

6. The CSM's treatment of intense precipitation, probable maximum precipitation (PMP), and probable maximum flood (PMF) on pp. 93-96 fails to acknowledge and consider the 1942 Smethport storm and other readily available evidence of intense precipitation events near the West Valley site. (Smethport, PA, for example, is only slightly farther from the West Valley site than the Buffalo weather station is.) See, for example, the West Valley Citizen Task Force (CTF) 2015 memo on climate change,[7] the CTF 2018 scoping-comment letter,[8] my own scoping-comment letter dated May 23, 2018, and climate-related sources cited in all of these. Intense precipitation, PMP, and PMF need to be covered more realistically in the CSM.

7(a). The CSM provides a very misleading characterization of the recurrence interval[9] for the August 2009 storm; this needs to be corrected. Page 96 of the CSM refers to a "recurrence interval of 200 to 500 yr" which applies to Perrysburg, NY, not to the Cattaraugus Creek basin upstream of Gowanda where the West Valley site is located. For the basin upstream of Gowanda, including the West Valley site, the storm had a recurrence interval of about 45 to 100 years (based on past data). Going forward into the future, this interval can be expected to shorten in response to climate change. The CSM needs to recognize the site-specific recurrence interval of about 45 to 100 years for the August 2009 storm, and also needs to acknowledge that such an interval will tend to shrink as a consequence of climate change.

7(b). The CSM's recurrence-interval characterization is misleading because no other recurrence interval is mentioned aside from the "200 to 500 yr" which applies to the location (Perrysburg) where an observer recorded a 24-hour rainfall of 7.27 inches and a 90-minute rainfall of 5.98 inches. Both the CSM and the cited USGS report by Szabo et. al.[10] clearly indicate that these records pertain to Perrysburg. What the CSM fails to mention is 1) that the basin upstream of Gowanda, including the West Valley site, received less rainfall than Perrysburg, and 2) that the USGS report by Szabo et. al. lists a 45-year recurrence interval for the streamflow associated with the August 2009 storm.

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[6] Z.Z. Zadins, *A Hydrogeologic Evaluation of "Geologic and Hydrologic Implication of the Buried Bedrock Valley that Extends from the Western New York Nuclear Service Center into Erie County, NY,"* Dames & Moore technical report, prepared for DOE and West Valley Nuclear Services Co. (August 1997).

[7] CTF memo entitled "Actions Needed Related to Potential [Climate] Change Impacts," July 27, 2015, available at http://westvalleyctf.org/2015_Materials/07/2015-07-27_Memo-Climate_Change_Considerations_Incorporation_in_Decisionmaking.pdf.

[8] See http://www.westvalleyctf.org/2018_Materials/05/2018-05-21_CTF_SEIS_Scoping_Comments.pdf, esp. section XI (§ 55 ff.).

[9] Lest there be any doubt, "recurrence interval" is a widely accepted term that can also be understood as a *probability* of recurrence. It does not imply recurrence at regular intervals.

[10] C.O. Szabo, W.F. Coon, and T.A. Niziol, *Flash Floods of August 10, 2009, in the Villages of Gowanda and Silver Creek, New York*, USGS Scientific Investigations Report 2010-5259, p. 3.

7(c). National Weather Service NEXRAD radar shows that the basin upstream of Gowanda, including the West Valley site, received less rainfall than Perrysburg during the August 2009 storm. My own stepwise integration of Cattaraugus Creek streamflow at the Gowanda gage shows that the basin upstream of Gowanda, including the West Valley site, received less than 7 inches rainfall, most likely 5 inches or slightly greater. These two complementary approaches, combined with the historic understanding that a 5.2-inch rainfall in the West Valley area has a recurrence interval of 100 years,[11] provide a good basis for concluding that the August 2009 storm's rainfall at the West Valley site had a recurrence interval of about 100 years – which will trend toward a shorter interval due to climate change. For NEXRAD radar showing less rainfall in the basin upstream of Gowanda (including the West Valley site) than in Perrysburg, see Fig. 2 of the USGS report by Szabo et. al.[12] or Fig. 5 of my 2009 EIS comments.[13] For my stepwise integration of Cattaraugus Creek streamflow which shows that the basin upstream of Gowanda, including the West Valley site, received about 5 inches rainfall during the August 2009 storm, see my 2009 EIS comments.[14]

7(d). According to the USGS report by Szabo et. al., "The peak flow in Cattaraugus Creek at Gowanda was computed, using the slope-area method, to be 33,200 cubic feet per second with an annual exceedance probability of 2.2 percent (recurrence interval of 45 years)."[15] This is not acknowledged in the CSM but should be. While streamflow cannot be exactly correlated with rainfall due to variations in the ratio of runoff to rainfall, the two measures are closely correlated in any major storm event.[16] Furthermore, to the extent that there is a difference between the two measures, surface flow such as streamflow will tend to be a more relevant measure than rainfall when evaluating site erosion. Thus, the CSM needs to acknowledge that both 45 years and 100 years are applicable site-specific estimates of the August 2009 storm's recurrence interval, based on historic streamflow and rainfall data; that either or both of these is a better site-specific value than 200 or 500 years; and that these 45- and 100-year recurrence intervals are trending toward smaller values due to climate change.

8. The CSM's treatment of groundwater hydrology on p. 96 and elsewhere is overly simplistic; it provides no meaningful assessment of subsurface flow into the bedrock valley and along its

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[11] USDA Technical Release No. 55, June 1986, Type II Soil Conservation Service rainfall depths, as listed in 2008 West Valley DEIS, Appendix F, p. F-22. Similarly, NOAA's Atlas 14 and online Precipitation Frequency Data Server show a recurrence interval of 100 years for a 24-hour rainfall of 5.39 inches at the West Valley site.

[12] Szabo et al., op. cit., Fig. 2.

[13] Vaughan EIS comments, Fig. 5 – but note that Fig. 5 was omitted from the response-to-comments portion of the 2010 West Valley FEIS. Copy available upon request.

[14] Vaughan EIS comments §§ 210-215 and Table 2 – but note that Table 2 was omitted from the response-to-comments portion of the 2010 West Valley FEIS. Copy available upon request.

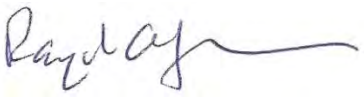
[15] Szabo et al., op. cit., p. 1; see also pp. 11-16. For comparison to peak flows in other years, see my scoping-comment letter dated May 23, 2018, Table 1.

[16] See discussion of the runoff-to-rainfall ratio in Vaughan EIS comments § 212 and in my scoping-comment letter dated May 23, 2018, §§ 55-62. See also the statement that "Saturated soil conditions existed prior to the intense storm that caused the flooding" in Szabo et al., op. cit., p. 3.

thalweg. The CSM should acknowledge my report on the bedrock valley[17] and provide at least a defensible qualitative treatment of such flow. Such a treatment should, in part, reconcile the mismatch between CSM Fig. 44 and CSM Fig. 51, where the flow arrows in the latter figure show flow through fractured/decomposed bedrock into the thalweg (and show no exit flow, implying lateral/northward flow along the thalweg?) while flow arrows in the highly generalized Fig. 44 show no such flow.[18] Ideally, the CSM would go beyond my 25-year-old report on the bedrock valley and address newer information such as pumping test data collected during installation of the site's current potable-water system. Such data appear to show a large flow rate of groundwater diving into the bedrock valley, with the source, sink, and other details of this flow remaining poorly characterized.

The above list of necessary corrections is based on a relatively quick review of the CSM. I may supplement this list if there are other points that warrant correction.

Sincerely,



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Professional Geologist/Environmental Scientist

cc: U.S. Nuclear Regulatory Commission
West Valley Citizen Task Force members

[17] R.C. Vaughan, "Geologic and Hydrologic Implications of the Buried Bedrock Valley" report, op. cit.
[18] Disagreement between Figs. 44 and 51 is noted, but the uncertainty is not resolved, on pp. 112-13 of the CSM.