THE WEST VALLEY CITIZEN TASK FORCE

May X, 2018

Via Email Only to: SEISWestValleySite@emcbc.doe.gov

Mr. Martin Krentz, SEIS Document Manager
West Valley Demonstration Project,
U.S. Department of Energy
10282 Rock Springs Road, AC–DOE
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RE: Comments on SEIS Scope of the Draft Supplemental Environmental Impact Statement (SEIS) for Phase 2 of Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center

Dear Mr. Krentz,

These comments on the scope of the Draft Supplemental Environmental Impact Statement (SEIS) for Phase 2 of Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project (WVDP) and Western New York Nuclear Service Center have been prepared by the West Valley Citizen Task Force (CTF).

The CTF supports the full sitewide removal alternative and recommends that this be selected as the Preferred Alternative. Our various scoping comments are set forth below.

Background

After being convened by the New York State Energy Research and Development Authority (NYSERDA) and U.S. Department of Energy (DOE), the West Valley Citizen Task Force held its first meeting on January 29, 1997. At that meeting we approved and adopted our Ground Rules. Those Ground Rules include, as a major purpose, for the CTF to "*assist in the development of a preferred alternative for the completion of the West Valley Demonstration Project and cleanup, closure and/or long-term management of the facilities at the site*."

The CTF met for approximately 18 months and, on July 29, 1998, issued a Final Report setting forth our Policies and Priorities and Guidelines for the Preferred Alternative. We draw your attention to the Final Report which is attached. Some elements of the Final Report have been implemented, such as vitrification, emptying the drum cell, removal and shipment of the spent

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fuel assemblies, removal of the vitrified waste from the main plant building, and the ongoing building decontamination and demolition activities. The CTF appreciates the progress to date and the work of the agencies and contractors in achieving these milestones. For the work yet to be done, we stand by the conclusions reached in our Report.

Underlying the CTF's goal that the cleanup result in unrestricted release of the Site is the assertion that the Site is not suitable for the long-term storage of long-lived radionuclides. In the years since the Site was selected and the facilities constructed, the government and the public have come to more clearly understand the dangers associated with radioactive wastes and the conditions and criteria that will maximize protection of human health and safety and the environment during the handling, management, reprocessing, storage and disposal of radioactive materials. The Western New York Nuclear Service Center Site does not meet existing (U.S. Nuclear Regulatory Commission (NRC) licensing criteria. Because the Site does not meet current licensing criteria, a logical assumption is that it is not safe for the long-term storage or disposal of wastes. Therefore, the CTF maintains as a goal the release of the Site for unrestricted future use of the land, and the Site should not be used for long-term waste storage. In our understanding, onsite storage would be minimal under the sitewide removal alternative because only about 1% of the waste (by volume) would be "orphan" waste for which offsite disposal is not currently available. Offsite disposal capacity is currently considered available for about 99% of the exhumed waste. Thus, almost all of the waste "is expected to be shipped off site as it is exhumed and processed."[1]

Our detailed comments follow. Respectfully submitted,

The West Valley Citizen Task Force

Detailed Comments

I. Citizen Task Force Role and Support for Site Wide Removal

1. DOE and NYSERDA are planning "to identify a preferred alternative in the Draft SEIS."[2] According to the CTF's early ground rules, "The CTF was formed to 'assist in the development of a preferred alternative for the completion of the West Valley Demonstration Project and cleanup, closure and/or long-term management of the facilities at the site.'"[3] Thus, helping to develop DOE and NYSERDA's Preferred Alternative was – and presumably still is – an important CTF responsibility. One of the currently proposed alternatives listed above, or

[1] West Valley Exhumation Working Group, *Task 3.3: Consolidated Report – Applicability of Exhumation Working Group Findings to WVDP and WNYNSC...*, Revision 1 (September 2017), available at https://www.westvalleyphaseonestudies.org/Documents/EXWG%20Task%203.3%20Consolidated%20Report%20-%20Rev.%201.As%20Submitted.09-20-17.pdf , page 78.

[2] 83 *Federal Register* 7464 (Feb. 21, 2018) at 7467, column 3.

[3] Ground Rules of the Citizen Task Force, as revised and approved on January 29, 1997; CTF Final Report, p. 2, Background.

possibly some other alternative, will be chosen by the agencies as their Preferred Alternative. Twenty years ago, the CTF's recommendation on the Preferred Alternative said:

> The CTF expects that the Site Managers will develop a Preferred Alternative which complies with the Policies and Priorities contained in Section III and responds to the Guidelines in Section IV."[4]

The CTF continues to expect that the Site Managers will develop a Preferred Alternative which complies with our Policies and Priorities. The sitewide removal alternative would allow unrestricted release and would comply with our Policies and Priorities. Hybrid alternatives that leave some waste onsite might do so, but we would need to see convincing evidence that our Policies and Priorities could be met. As discussed below, hybrid alternatives appear to be interim measures that would not meet CTF Policies and Priorities for final site closure.

The CTF has stated that the site does not provide a stable platform for the long term storage of radioactive waste and therefore the Sitewide Close in Place alternative is somewhat misleading. Our contention is that with the instability from extreme weather, erosion, earthquakes, etc. there is no guarantee, in the long term that the waste materials will *stay in place* in perpetuity. Our concerns with the site instability typically involves the potential for an uncontrolled release of radionuclides resulting from soil erosion or bedrock movement. An additional concern would possibly include the potential for site instability resulting in a condition which would make future management, monitoring and/or retrieval of radioactive wastes left on site impractical or impossible.

2. As we understand, most if not all county, city, town, and village governments and school districts throughout Western New York (WNY), and also the Seneca Nation of Indians (SNI), continue to support sitewide removal as the preferred alternative. In 2004 we received dozens of resolutions supporting the CTF end-state-vision resolution that we had adopted. These many communities, probably unanimously, recognize the importance of cleaning up the site and moving on. [5]

II. Issues and impacts that need to be considered if wastes are left onsite, and if site closure and license termination involve Restricted Release

3. Unrestricted release is preferred because it provides greater potential for site re-use and economic development, which in turn may serve as an economic "engine" for the local community and region.

4. Unrestricted release is preferred because it would facilitate reuse of site infrastructure improvements. Such improvements have been substantial during the course of the project and are unique for the local area.

5. Hybrid alternatives that use partial exhumation will target longer-lived radionuclides for removal and allow much of the shorter-lived cesium-137 and strontium-90 to decay in place to

[4] CTF Final Report, p. 1, Introduction.

[5] See http://westvalleyctf.org/Key_documents/2004-01_West_Valley_Citizen_Task_Force_resolution.pdf and http://westvalleyctf.org/Key_documents/Resolutions_RCVD_as_of_040605.pdf.

essentially undetectable levels during the next 300 years or so.[6] For alternatives other than unrestricted release, DOE and NYSERDA are required to assume of loss of institutional controls at some point in the future. Depending on the alternative, passive and active controls may be included, and options such as re-routing of streams may be considered. In looking at hybrid alternatives and their impacts and costs, Neptune and Company will break down source areas into units such that a cost benefit analysis can be performed that includes selective removal or delayed removal. A hypothetical situation is a cost comparison of full removal with selective removal addressing various cost increments and improvement in performance. For example, is there a scenario where 80% of the risk could be removed for 20% of the cost? We would need to see convincing evidence that our Policies and Priorities could be met.

6. Erosion modeling (landscape evolution modeling) of the Buttermilk Creek watershed will be needed if any of the alternatives will depend on re-routing of streams. Current modeling of the Franks Creek watershed cannot support re-routing of streams into Buttermilk Creek.

7. For any alternatives that involve future costs, a discount rate of *zero* should be assumed (in other words, future costs should *not* be discounted) unless a higher rate can be justified.[7] Such justification might be based, for example, on past and present estimates of clean-up costs for the West Valley site. If historical estimates of site clean-up costs have grown more slowly than the rate of inflation, then a discount rate higher than zero may be justified. If not, a discount rate higher than zero would not appear to be justified.

8. For various alternatives, what if there was a future loss of funding? Would this cause delays that would increase the total cost?

9. While the casks of high-level vitrified waste are expected to be removed to a federal repository in accordance with the West Valley Demonstration Project Act, it is possible but unlikely that no repository will be opened and that the high-level waste will remain onsite indefinitely. The ongoing presence of this waste, coupled with the presumption of eventual loss of institutional control, needs to be factored into the risks and impacts that will guide the Phase 2 decision. The ongoing presence of the high-level waste, while not a matter to be decided by the Phase 2 decision, would have impacts that are additive to the impacts currently being analyzed for the Phase 2 decision. As such, the ongoing presence of the high-level waste is a low-probability, high-consequences phenomenon whose combined impacts need to be addressed in accordance with environmental review requirements such as 6 NYCRR 617.9(b)(6)(iii).

[6] Radionuclides generally decay to negligible levels of radioactivity after 10 half-lives. The half-lives of Sr-90 and Cs-137 are both about 30 years, so the time required for these radionuclides to decay to negligible levels is about 300 years.

[7] For example, see A. Napoleon et al., *The Real Costs of Cleaning Up Nuclear Waste: A Full Cost Accounting of Cleanup Options for the West Valley Nuclear Waste Site* (Cambridge, MA: Synapse, 2008), available at http://westvalleyctf.org/DEIS-DP_Docs/Full_Cost_Study/WV_Full_Cost_Accounting_Report.pdf , pp. 9-10 and 81ff.

III. Potentially significant adverse impacts to Community Character from waste left onsite

10. Radiological impacts currently recognized by DOE and NYSERDA include impacts to the general population and onsite workers[8], with such impacts generally being rated against NRC's 25 millirem-per-year exposure standard for unrestricted release of the site. However, for any alternatives in which wastes are left in place, there may be significant adverse impacts to "Community Character" resulting from *radiological releases that substantially exceed background levels but do not exceed NRC's 25 millirem-per-year exposure standard for a maximally exposed individual*. Examples of such impacts are provided below. Note that effects on Community Character are a specific type of impact that must be considered under New York's State Environmental Quality Review (SEQR) requirements.[9] Such impacts would not apply to the No-Action alternative but would apply to the "actions" of any of the other alternatives.

11. For any alternative that leaves waste onsite, the Draft SEIS should address the adverse impacts on the community character of Ashford, including such impacts on the town's residents and its prospects for economic development, resulting from the stigma of radioactive waste.

12. For any alternative that leaves waste onsite, the Draft SEIS should address the adverse impacts on the community character of the Seneca Nation of Indians, including such impacts on the Nation's residents, traditional cultural practices, and prospects for economic development, resulting from any detectable above-background level of radioactive contamination moving along Cattaraugus Creek through the Nation's Cattaraugus Territory.

13. For any alternative that leaves waste onsite, the Draft SEIS should address the adverse impacts on the community character of Erie County, including such impacts on the county's residents, their enjoyment of Zoar Valley and the lakeshore waterfront, and prospects for tourism and economic development, resulting from any detectable above-background level of radioactive contamination moving along the Lake Erie shoreline from Irving to Buffalo, and along the Niagara River shoreline from Buffalo to Tonawanda.

14. For any alternative that leaves waste onsite, the Draft SEIS should address the adverse impacts on the community character of the City of Buffalo, including such impacts on the city's residents, their enjoyment of the waterfront, and prospects for tourism and economic development, resulting from any detectable above-background level of radioactive contamination moving past and through the city's waterfront.

15. For any alternative that leaves waste onsite, the Draft SEIS should address the adverse impacts on the community character of other downstream communities in the U.S. and Canada, resulting from any detectable above-background level of radioactive contamination moving through their waterways or along their shorelines. Any adverse impacts from wastes left on site,

[8] 83 *Federal Register* 7464 (Feb. 21, 2018) at 7468, column 1.

[9] See NYSDEC, *The SEQR Handbook*, 3rd ed. (2010), pp. 87-89 and 204-05; also *Matter of Village of Chestnut Ridge et al. v. Town of Ramapo et al.*, 45 AD3d 74 (2d Dept. 2007) at 85-87 and 94-95.

the CTF should be afforded the opportunity to determine the accuracy of those impact assessments.

16. The Draft SEIS should include support for an assessments of the surrounding communities that focus on psychological/cultural/physical/spiritual impacts of living near the site. The assessment should be facilitated through the CTF in collaboration with Roswell Park Comprehensive Cancer Center, the SUNY University at Buffalo School of Public Health, and the Seneca Nation of Indians. The schedule for these assessments should be outlined in advance and performed at a minimum of every 10 years. Outcomes should include action-orientated recommendations.[10]

17. In particular and as stated in our 1998 Final Report (attached), the CTF expects the Site Managers to recommend policies that will affect, ameliorate, or replace the losses to the community from the redirection in economic activity at the Center.

IV. Other potentially significant adverse impacts from waste left onsite

18. Any alternative that leaves waste onsite may have other "non-tangible" impacts in addition to Community Character impacts. Any such "non-tangible" impacts to nearby communities and natural resources (including the Great Lakes, for example) should be identified and vetted as scoping issues for any site closure alternative other than full exhumation.

19. For any alternative that leaves or stores waste on any bedrock portion of the site which serves as a recharge area for the underlying bedrock-valley aquifer(s), (e.g., west of Rock Springs Road and some portions of the site east of Buttermilk Creek), the SEIS process would need to include studies to characterize the underlying bedrock-valley aquifer(s), and the Draft SEIS would need to assess impacts to such aquifer(s).[11] Current characterization of this/these aquifer(s) is too sparse to support waste storage or disposal within bedrock portions of the site that serve as recharge areas.

[10] Johnson, J., Baldwin, J., Haring, R. C., Wiechelt, S. A., Roth, S., Gryczynski, J., & Lozano, H. (2008). Chapter 4: Essential information for disaster management and trauma specialists working with American Indians. In (Marsella, A., Johnson, J., Watson, P., & Gryczynski, J., Eds.) *Ethnocultural Perspectives on Disaster and Trauma: Foundations, Issues, and Applications.* New York, NY: Springer SBM Publishing.

[11] See 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. [Note that citations to "Vaughan EIS comments" refer herein to the consolidated EIS comments by R. Vaughan, most of which can be found in the response-to-comments portion of the 2010 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 .]

20. For any alternative that leaves waste onsite, the Draft SEIS should include a detailed and comprehensive future plan for the detection of above-background levels of radioactive contamination that may be released. This should necessarily mean that the determined standards and background levels would remain a fixed constant throughout.

21. For any alternative that leaves wastes on site, this necessarily should include items such as education, equipment, training, emergency response planning, redundant backup responses, medical preparedness, long-term health follow-up, environmental cleanup, and associated adequate funding for said items, for both the public and all federal, state, county, city and town agencies of Western New York, including the Seneca Nation of Indians, as well as the country that is on the northern border of Lake Erie, Canada.

V. Maximally Exposed Individual (MEI) Dose Analysis

22. The dose analysis to the Maximally Exposed Individual (MEI) should include the resident farmer or other person living on the SDA or NDA.

23. As guidance on the magnitude of such dose measurements should be taken either before or during the scoping process to determine concentrations of radon, iodine and other chemically volatile radionuclides under the burial ground geomembrane covers.

VI. Probabilistic Performance Assessment (PPA) methodology issues

24. The PPA computer model runs will require *probability estimates for the input variables* (input parameters) that control or affect the predicted radiological doses. Probability distributions for these variables – potentially including variables such as rainfall, erodibility of till, or abstract variables that represent these real-world variables – are typically based on expert opinion. Scientists working in this field recognize potential problems such as expert overconfidence, lack of calibration, and lack of empirical validation of such probability estimates. Various scientists have recommended procedures that can guard against errors in expert estimates.[12] Such safeguards should be incorporated into the SEIS process, and should be described fully and transparently.

25. PPA computer model runs typically use Bayesian methods that require assumptions about the "prior" probability distributions of different variables.[13] Developing these "priors" or "prior distributions" can be procedurally difficult because the supporting data have not yet been applied to the distribution. Safeguards against poorly chosen "priors" should be incorporated into the SEIS process, and the safeguards should be described fully and transparently.

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[12] See K. Shrader-Frechette, "Uncertainty Analysis, Nuclear Waste, and Million-Year Predictions," in S.O. Hansson and G. Hirsch Hadorn, eds., *The Argumentative Turn in Policy Analysis* (Springer, 2016), 291-303, esp. pp. 298-99, and sources cited therein.

[13] For example, R.E. Kass and L. Wasserman, "The Selection of Prior Distributions by Formal Rules," *Journal of the American Statistical Association* **91**, 1343-70 (1996); H. Chipman et al., "The Practical Implementation of Bayesian Model Selection," IMS Lecture Notes - Monograph Series **38**, 65-134 (2001), available at http://www-stat.wharton.upenn.edu/~edgeorge/Research_papers/ims.pdf .

26. Before or during the scoping process, the CTF requests that one or more scientists with specialized statistical expertise be invited to speak on these issues (including expert estimates and prior distributions) at a CTF meeting or workshop.

27. The variables and assumptions in the model should be described with more transparency to the CTF and the Public. More information should be presented in the following areas:

- What are the probability distributions for variables under best and worst scenarios that have the greatest influence on the models?
- What is the tolerance of these variables and the strength of the prior data used to support these probabilities?
- Which variables are described with assumptions supported by the weakest or least prior data?
- What degree of influence do these variables have on the final models?
- What procedures were run to describe and adjust for the influence these variables with weak prior data?
- Under the worst case scenarios, what influence do these variables have on the final models?

VII. General Modeling Considerations

28. If future circumstances or variables change greatly, such as an unexpected and severe precipitation or erosion event, then the Draft SEIS should include provisions for easy accessibility to modeling software to update modeling, and to revise procedures.

29. The time frame for site cleanup which is in the order of decades, and the uncertainties of institutional continuity, bring up questions about data, software, computer modeling accessibility, and hardware (equipment) integrity. For any alternative that leaves waste onsite, the Draft SEIS should include a detailed and comprehensive plan that allows for data and equipment integrity, accessibility, and interchangeability far into the future.

VIII. Erosion modeling issues and the related need for extending the Draft SEIS comment period

30. The 10-year time step that is reportedly used by Tucker et al. in the Erosion Working Group (EWG) erosion modeling (landscape-evolution modeling) runs is unacceptably long; it introduces an unrealistic rainfall intensity-frequency distribution[14] into the EWG modeling runs that will be used in the SEIS process to support the Phase 2 decision.[15]

31. Any and all such modeling runs need to have *recognizable* rainfall intensity-frequency distributions. Independent experts and the public must be able to review the rainfall intensity-

[14] Note that the term "intensity" in the widely used phrase "intensity-frequency distribution" corresponds to rainfall "depth" – particularly the "depth" of 24-hour rainfall with a certain recurrence interval or probability – in the terminology of Tucker et al.

[15] For overview, see Vaughan 6-28-17 CTF presentation, slide 10; Vaughan 9-27-17 CTF update presentation, slides 3 and 6-7.

frequency distributions, and must be able to compare them to realistic current rainfall distributions and to defensible estimates of paleo (post-glacial) and future (climate-change-adjusted) rainfall distributions.[16]

32. The EWG erosion modeling runs reportedly do not have directly recognizable rainfall intensity-frequency distributions; they reportedly use surrogate inputs to represent such distributions. Whether independent experts and the public will be able to translate such surrogates into rainfall intensity-frequency distributions in a clearcut and undisputed manner remains to be seen. Such a "translation" effort cannot begin in any case until the EWG erosion modeling report and supporting data files are released for public and expert review, as is scheduled to occur at approximately the same time as the 4/23/18 scoping comment deadline. Any "translation" effort would necessarily take weeks or months after the release date for the report and supporting data. Given the importance of this issue and the impossibility of determining prior to the 4/23 deadline whether or not the model runs are using reasonably reliable rainfall distributions, a time extension such as six months should be granted for the Draft SEIS scoping comments.

33. The various erosion modeling runs employ *other* input parameters in addition to their direct or indirect rainfall-distribution parameters. These other input parameters must likewise be reviewable, such that independent experts and the public can compare them to realistic field-tested or field-testable parameters. If any of these other parameters are not directly recognizable and field-testable, the type of "translation" process described above will be needed[17] and will encounter the same time constraints, thus necessitating a time extension such as six months for meaningful scoping comments to be developed and submitted.

IX. Site stability & integrity issues relating to seismic activity (earthquakes)

34. 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 – was released in 2001 in the Bay Geophysical seismic study,[18] but no follow-up work has been done to identify or clarify the strike of these faults, their geographic extent, their surface expression (if any), and their likelihood of reactivation. Such follow-up investigation is needed in the SEIS process in order to understand long-term seismic risks to site stability and containment integrity.[19]

35. The Sardinia fault identified by the Bay Geophysical seismic survey is particularly relevant because it is aligned with, and may be part of, the seismically active Attica Splay of the Clarendon-Linden Fault. The SEIS process needs to investigate and determine whether the Sardinia fault connects with the Attica Spay at/near Varysburg and also needs to investigate and determine whether it extends southwestward toward the West Valley site – and if so, how closely it approaches the site.

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[16] Regarding paleo and future rainfall distributions, see Vaughan EIS comments §§ 166-71.
[17] Vaughan 9-27-17 CTF update presentation, slide 8.
[18] 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).
[19] Vaughan EIS comment § 57A.

36. Earthquakes pose a risk to slope stability. Extreme examples were seen in the 1964 Alaska earthquake,[20] while quakes of lesser magnitude will have similar but less dramatic effects on unstable or quasi-stable slopes. Relevant slopes at the West Valley site include the same valley walls, ravine walls, and gully walls that are subject to erosion and slumping. Thus, given the fact that seismic events will accelerate the overall loss of site integrity by causing large-scale landsliding, slumping, and mass wasting,[21] and given the apparent lack of any seismic component in the recently completed EWG erosion modeling runs, *those erosion modeling runs need to be re-done with intermittent (probabilistic) seismic "jumps" incorporated into the model(s).*

37. An example of how seismic effects on slope stability can be modeled can be found in Appendix C-5 of an engineering report for the proposed expansion of a hazardous waste facility.[22] Applying such a model to slopes on the West Valley site would require site-specific values for soils and glacial fill materials, and would also require site-specific seismic information based on characterization of the Sardinia Fault, its relation to the Attica Splay, and other fault structures in the vicinity of the site.

38. Soil liquefaction may in some cases contribute to seismically induced slope failures; however, in other cases a slump-prone slope may fail in an abruptly accelerated episode of slumping without observable liquefaction. In any case, liquefaction of onsite soils adjacent to existing slopes needs to be investigated in the SEIS process and incorporated into landscape-evolution modeling.[23]

X. Site stability & integrity issues relating to possible aseismic movement of rock or soil

39. Aseismic (non-seismic) horizontal movement of large blocks of either *bedrock* or *overlying fill and soil* may be occurring on the site. Any such movement of either rock or soil would be a type of topographic instability with potentially serious but currently uncharacterized effects on long-term site stability and containment integrity. The probability of such movement appears low but cannot be ruled out without further investigation. The SEIS process needs to engage in such investigation and needs to treat horizontal movement of either *bedrock* or *overlying fill and soil* as a low-probability but potentially high-consequences phenomenon in accordance with environmental review requirements such as 6 NYCRR 617.9(b)(6)(iii).

[20] For example, see W.R. Hansen, "Effects at Anchorage," in *The Great Alaska Earthquake of 1964* (Washington: National Academy of Sciences, 1971), available online at http://www.westvalleyctf.org/2008_Materials/2008-01-Materials/Core_Team_Issues-Vaughan_with_Appendices.pdf , at pp. 30-140 of the pdf file.

[21] Vaughan EIS comments §§ 103-04.

[22] Arcadis, RMU-2 Engineering Report (Rev. Nov. 2013), http://modelcity.wm.com/RMU/06-RMU-2%20Engineering_Report_Revised_November_2013.pdf .

[23] See especially Vaughan, "Geologic and Hydrologic Implications of the Buried Bedrock Valley…", *op. cit.*, available online at http://www.westvalleyctf.org/2008_Materials/2008-01-Materials/Core_Team_Issues-Vaughan_with_Appendices.pdf , esp. pp. 203-207 of the pdf file.

40. If investigation shows horizontal movement of large blocks of bedrock, fill, and/or soil, the Draft SEIS should quantify and document the rate(s) of movement and associated implications or impacts on long-term site stability and containment integrity. Alternatively, if investigation shows that horizontal movement of large blocks of bedrock, fill, and/or soil can be ruled out, the Draft SEIS should document this conclusion and how it was reached.

41. *Horizontal bedrock movement?* Evidence of aseismic horizontal bedrock movement at one location in WNY comes from a paper by the late Prof. Wm. Brennan of SUNY Geneseo.[24] Brennan reported horizontal offset (partial blockage) in the steel casing of brine wells in the Wyoming valley near Wyoming and Warsaw, NY. The offset occurred at the depth of the thalweg of the adjacent bedrock valley, implying an essentially horizontal detachment surface or decollement in the local shale at the depth of the thalweg, with the movement of the overlying bedrock block driven by the prevailing regional compressive stress. Given the regional extent of this ENE-WNW-oriented tectonic stress, and given the fact that the Buttermilk valley's NNW-SSE alignment is even more favorably oriented (essentially perpendicular to the regional compressive stress), it is reasonable to investigate whether the type of bedrock movement observed by Brennan is also occurring in the West Valley site's injection wells which have remained inactive since about 1970. Some of the West Valley injection wells are known to be blocked by grout, but others are considered grout-free and could/should be checked for offset and/or casing blockage at the approximate depth of the adjacent bedrock-valley thalweg.

42. Effects of regional compressive stress in WNY bedrock are well-known to at least two members of the Phase 1 Studies Erosion Working Group (Fakundiny and Young), both of whom have written about such horizontally-oriented stress and its role in causing observable displacement of bedrock.[25] Fakundiny and coauthors have noted, for example, that "Foundation instability, produced by lateral expansion of rock into excavation voids, prevails throughout western New York and the Niagara Peninsula of Ontario, Canada…and is generally thought to be the result of regional stresses acting with a high, horizontal compressive component oriented in a generally east-west to northeast-southwest direction at shallow depths in the earth's crust…"[26]

43. *Horizontal soil/till movement?* Soils and tills are typically plastic materials that may undergo slow creep toward unbuttressed voids such as valleys, potentially including the Buttermilk valley. Possible evidence of such movement immediately southeast of the West Valley site has been described by Vaughan, EIS comments, § 105 and Figure 4. The work currently being done by Neptune risks missing such movement if any/every horizontal discrepancy in airphotos

[24] W.J. Brennan, "Stress-Relief Phenomena Observed During Solution Mining in Western New York," presented at Fall 1996 Meeting, Solution Mining Research Institute, Cleveland, Ohio.
[25] R. Fakundiny et al., "Structural Stability Features in the Vicinity of the Clarendon-Linden Fault System, Western New York and Lake Ontario," in *Advances in Analysis of Geotechnical Instabilities*, (University of Waterloo Press, 1978), esp. p. 121. The decollements shown therein in Figs. 15B (p. 162) and 19-20 (pp. 169-70) may also be relevant. See also A.S. Nieto and R.A. Young, "Retsof Salt Mine Collapse and Aquifer Dewatering, Genesee Valley, Livingston County, New York," in J.W. Borchers, ed., *Land Subsidence: Case Studies and Current Research* (Association of Engineering Geologists, 1998), esp. Fig. 8 and pp. 322-23.
[26] Fakundiny et al., *op. cit*., p. 121.

(relative to LiDAR maps) is assumed to be from airphoto distortion. The SEIS process should investigate whether horizontal soil/till movement is occurring, document the findings, and address the implications and impacts if any such movement is detected.

XI. Site stability & integrity issues relating to climate

44. Effects of climate change that do not appear to be adequately incorporated into the EWG erosion model runs include lake-effect rain[27] and similar weather systems driven by prevailing winds off Lake Erie and associated precipitation in the "shadow" of the lake. The SEIS process should investigate such precipitation and whether it is changing over time, including whether the winds and precipitation levels have changed in the past 1000 years or so.

45. Erosion modeling for the West Valley site (both EWG and PPA modeling) needs to recognize and incorporate rapidly moving, organized thunderstorm systems, sometimes called *derechos* or mesoscale convective system (MCS)-organized convective storms. Two examples are the July 1942 storm in Smethport, PA (~30 inches rainfall in 4.75 hr), and the July 1996 Redbank storm near Brookville, PA (~5 inches in 4 hr), that have been reviewed and analyzed by Smith et al.[28] Both locations are on the western margin of the central Appalachians, less than 100 miles south of the West Valley site. While the orographic relief of these Pennsylvania sites is not identical to that of the West Valley site, there are similarities not only in topography but in the occurrence of "trains" of storms that stream generally eastward along a relatively stationary track for many hours, delivering exceptional rainfall accompanied by intense lightning. The Redbank storm, for example, "consisted of a system of multicellular thunderstorms that moved rapidly from Lake Erie across western Pennsylvania," involving a "multiple storms that tracked over Redbank Creek," with cloud-to-ground lightning flash densities ranging up to 2-3 strikes per square kilometer. This type of powerful "training" storm system was apparently involved in both the Smethport storm[29] and the August 2009 West Valley derecho or storm.[30] Storms of this type need to be incorporated into EWG and PPA erosion modeling.

46. An article by Prein et al.[31] finds that MCS-organized convective storms with a size of ~100 km are poorly represented in traditional climate models yet are increasing in frequency and intensity. For the West Valley area, these authors show a 50% to 70% increase in the frequency of MCSs (expressed as track density difference) relative to current conditions.[32] This trend,

[27] 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 , esp. p. 6.
[28] J.A. Smith et al., "Extreme rainfall and flooding from orographic thunderstorms in the central Appalachians," *Water Resources Research* **47**, W04514 (2011).
[29] Id.
[30] 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.
[31] A.F. Prein et al., "Increased rainfall volume from future convective storms in the US," *Nature Climate Change* **7**, 880-86 and Supplementary Information (Dec. 2017), esp. Supplementary Fig. 2(e).
[32] Id., Supplementary Fig. 2(e).

discussed by Feng as a "near doubling" of severe storms,[33] needs to be incorporated into EWG and PPA erosion modeling.

47. Climate experts at the August 2012 WVDP climate workshop noted that "Climate Scientists have high confidence that extreme precipitation intensity will increase in the future due to the increases in ocean temperature as greenhouse gas concentrations increase in the atmosphere...[and] that maximum water vapor concentration in the atmosphere will substantially increase during the 21st Century in western New York. For a high greenhouse gas emissions scenario, these increases were in the 20 to 30 percent range by 2100. Although other factors (frequency and intensity of meteorological systems that cause extreme precipitation) could have enhancing or moderating effects on future design storm values, there are no comprehensive studies that assess the magnitude of such influences. As a first order approximation, design storm precipitation totals (see Table 1) may increase by approximately 25 percent by 2100."[34] They also noted that, "During the early part of the 21st century, the frequency of extreme precipitation events has increased by as much as 74% across the Northeastern United States compared to the late 1950s to early 1960s."[35]

48. Evidence continues to grow that intense storms will become more frequent, and that their intensity will increase. For example, a recent article by Prein et al.[36] shows hourly extreme precipitation in the West Valley area increasing by 35% to 49% as a result of climate change in both winter (Dec.-Jan.-Feb.) and summer (June-July-Aug.), where "extreme" precipitation, defined as the 99.95th percentile of hourly precipitation, corresponds to the maximum precipitation that occurs on average once every season.[37] The same article shows the exceedance probability of hourly extreme precipitation increasing by about 130% (winter) and 165% (summer) in the West Valley area, relative to a 2000 to 2013 control period.[38] Such effects of climate change, including larger temperature fluctuations and the resulting changes in both direct rainfall and runoff from snowmelt, and also including periods of increasing drought interspersed with increased storminess, need to be adequately and transparently incorporated into EWG and PPA erosion modeling.

49. The EWG erosion models are employing unrealistically and unacceptably low levels of future climate change. The Multivariate Adaptive Constructed Analogs (MACA) climate scenarios that are being used to represent climate change in the EWG erosion models[39] are adding relatively little intensity and frequency to the current level of intense storms. The EWG

[33] Z. Feng, "Near doubling of storm rainfall," *Nature Climate Change* **7**, 855-56 (Dec. 2017).
[34] Enviro Compliance Solutions Inc., "Climate Guidance for Phase 1 Studies" (Nov. 2012), pp. 9-10.
[35] Id, p. 2.
[36] A.F. Prein et al., "The future intensification of hourly precipitation extremes," *Nature Climate Change* **7**, 48-52 (Jan. 2017). The authors are using a pseudo global warming (PGW) approach to "perturb the lateral boundary conditions of ERA-Interim with a high-end scenario (RCP8.5) 95-year ensemble monthly mean climate change signal from 19 Coupled Model Intercomparison Project Phase 5 Models" (CMIP5).
[37] Id., Fig. 1 and related text.
[38] Id., Fig. 2 and related text.
[39] G. Tucker, "Modeling long-term progressive erosion at the West Valley site," 2/28/18 QPM presentation, esp. slides 19-20.

models are assuming increases of approximately 9% in mean annual precipitation, 1% in mean wet day frequency, and 12% in mean wet day intensity,[40] and the models' three "future climate scenarios" assume increases in the neighborhood of 8% to 12% in mean wet day precipitation.[41] These trivial increases are inconsistent with the increases outlined in the preceding paragraphs. Incorporation of climate change in the SEIS process must be more than a token effort; it needs to reflect current science. Modeling runs that do not adequately represent climate change need to be re-done.

50. The EWG erosion models assume no further climate change beyond year 2100.[42] This is inconsistent with the August 2012 WVDP climate workshop where it was noted that, "Although, as a first-order approximation, design storm values may increase by approximately 25 percent by 2100, this approximation certainly does not represent an upper limit beyond 2100."[43]

51. Genuine uncertainties in numerical values that represent climate change need to be handled probabilistically in a robust and transparent manner. While this should go without saying in PPA modeling, it also an important point in the EWG erosion modeling that will guide the PPA modeling. Specifically, EWG erosion model results based on erroneous or unsupported inputs cannot be accepted as inputs into PPA modeling.

52. Paleo climate needs to be reconstructed based on the best available evidence and needs to be adequately and transparently incorporated into EWG and PPA erosion modeling[44].

53. The period of approximately 4000 years of minimal Buttermilk Creek downcutting (between about 10,000 and 6000 years before present), as identified by the EWG report by Wilson and Young, needs to be linked to causal factors such as reduced rainfall and other climatic and non-climatic factors.

54. It is not that clear that the sensitivity analyses for the EWG erosion modeling runs cover the range of rainfall rates (including a cessation or at least a greatly reduced rate of rainfall) for the period between about 10,000 and 6000 years before present when Buttermilk Creek downcutting was minimal.[45] While there are various possible explanations for this period of minimal downcutting, one such explanation would be a prolonged "paleo drought" (a near-absence of rainfall) during the 4000-year period. Sensitivity analyses showing the sensitivity of EWG model results to the rainfall assumed during calibration runs for this 4000-year period – including results for the limiting case in which no rainfall occurs in any time step during this

[40] Id., slide 19, where values interpreted from the currently available version (a paper copy of the slide) are 1250/1150 = 109%, 0.48/0.475 = 101%, and 7.0/6.25 = 112%.
[41] Id., slide 20, where values interpreted from the currently available version (a paper copy of the slide) are 6.72/6.25 = 108% and 7.0/6.25 = 112% for RCP-4.5 and RCP-8.5, respectively.
[42] Id., slide 20.
[43] Enviro Compliance Solutions Inc., op. cit, p. v.
[44] Vaughan EIS comments §§ 166-68.
[45] G. Tucker, op. cit., slide 6, does not show such a sensitivity analysis, nor is it clear from other slides whether uncertainty in paleo climate is considered an important source of uncertainty (via calibration runs which in turn affect model results for 1000 or 10,000 years into the future). It's unclear whether this sensitivity analysis is provided elsewhere.

period – must be provided. These sensitivity results must also be appropriately incorporated into PPA model runs.

55. Genuine uncertainties in numerical values that represent paleo climate need to be handled probabilistically in a robust and transparent manner. While this should go without saying in PPA modeling, it also an important point in the EWG erosion modeling that will guide the PPA modeling. Specifically, EWG erosion model results based on erroneous or unsupported paleoclimate inputs cannot be accepted as inputs into PPA modeling.

56. It is not that clear that the sensitivity analyses for the EWG erosion modeling runs cover the intensity-frequency increases for intense storms.[46] Sensitivity analyses for these intensity-frequency increases, and for the incorporation of such increases into models employing relatively long (e.g., 10-year) time steps, need to be defensibly and transparently incorporated into the SEIS process.

XII. Site stability & integrity issues relating to stream piracy or capture

57. Stream capture, including stream capture initiated by seepage and piping, needs to be incorporated into EWG and PPA erosion modeling.[47]

XIII. Protection of water resources and air quality

58. For any alternative that leaves waste onsite, the scoping process should address attainment of water-resource goals such as "fishable, swimmable, drinkable," other measures of ecological protection,[48] as well as other measures intended to protect public health, safety, and enjoyment of affected waterways such as Zoar Valley and Lake Erie.

59. For any and all exhumation, demolition, or remediation scenarios, there should be an extensive network of equipment to perform real-time monitoring of air and water for possible radionuclide releases, both on- and offsite.

XIV. Anticipating Future Technological Capability and Changing Economic Circumstance

60. The DOE and NYSERDA will be making a decision on a path forward for the West Valley Demonstration Project based upon available technology, economics and safety. The preferred alternative selected as a result of the SEIS process could be sitewide removal, sitewide closure in place, or a hybrid solution. Sitewide removal would meet the CTF's recommendations for a

[46] G. Tucker, op. cit., slide 6, does not show such a sensitivity analysis. It's unclear whether this sensitivity analysis is provided elsewhere.
[47] Vaughan EIS comments §§ 187-88.
[48] Newly completed New York Natural Heritage riparian assessment: See http://buffalonews.com/2018/03/23/watersheds-in-cattaraugus-county-among-healthiest-in-new-york-state-data-shows/ and http://www.nynhp.org/treesfortribsny

Preferred Alternative. A hybrid solution, if chosen over sitewide removal, would likely be based upon the technical complexities associated with sitewide removal, the expense associated with sitewide removal, or the relative safety of partial waste removal. However, these criteria are not static. With the timeframes discussed for implementation of the next phase of site closure, new technology to address the removal of wastes will become available. The economics of a hybrid preferred alternative will also change in time. Lastly, in time, several factors will significantly impact both site worker safety *and the safety of long term on site storage*. Consequently, a decision to implement a hybrid solution for waste removal at the West Valley site cannot be deemed to be a final decision, but only another interim step or Phase 2. Therefore, reassessment of the preferred alternative plan of action, relative to the three criteria identified, would have to be completed again sometime in the future.

61. As described above, the likelihood that new technology will become available is important to consider for any interim hybrid alternative. A useful comparison can be found in the "technology-forcing" provisions of the Clean Air Act. These provisions have allowed enforceable deadlines to be set for *reducing air emissions below levels that could be met with current technology*, the idea being that the deadline would encourage and support the development of new air pollution control technology capable of meeting new emissions standards. By this logic, sitewide removal is a better choice than a hybrid alternative because it would encourage and support the development of new cleanup technology, rather than simply waiting for new technology to appear.

62. The Features, Events, Processes and Scenarios (FEPS) Analysis prepared by Neptune and Company says that: "Deliberate and intentional intrusion scenarios are difficult FEPS to consider in terms of probability. There is no precedent to draw upon (e.g., there has been no known deliberate removal of waste from closed permanent waste disposal facilities). Regardless, intentional intrusion would not be expected to result in appreciably different doses than many unintentional intrusion scenarios involving direct waste exposure (e.g., mining and drilling). Additionally, all of the unintentional intrusion FEPS that are applicable at a waste disposal facility assume that institutional and societal knowledge of wastes has been lost. If such knowledge has been lost, then logically it is highly unlikely that any sort of intentional intrusion would occur (i.e., a potential intruder would have no knowledge of buried wastes). Conversely, if institutional/societal knowledge is not lost, then none of the unintentional intrusion FEPS would be applicable (e.g., it is highly unlikely that a known radioactive waste disposal facility would be mined for gravel). As all regulatory frameworks and previous PAs [performance assessments] assume loss of institutional/societal knowledge and focus on unintentional intrusion, the choice is made here to also focus on this. Therefore, all intentional intrusion FEPS are globally excluded." (5.2.4.4.1, Intentional Intrusion) Given the fluctuations and upheavals seen throughout history in social/civic/ethical attitudes and governance structures, it appears unprotective to assume that intentional intrusion can be entirely ruled out. Recent historical examples of such fluctuations and upheavals can be seen, for example, in parts of Europe in the 1930s, parts of Southeast Asia in the 1970s, and parts of the Middle East at the present time. Intentional intrusion should be included in the scope of the SEIS process.

XV. Conclusion

63. All parties are reminded that the original Citizen Task Force, following nearly two years of study and deliberation in preparation of the 1998 Final Report to help guide decisionmaking for the long term management and cleanup of the WVDP site, came to the unanimous conclusion that the site is in no way suitable for the long term, permanent storage or disposal of long-lived radionuclides. Unlike arid regions of the West which are geologically stable and better suited for storage and disposal of nuclear waste, the West Valley site receives excessive precipitation annually causing routine flooding and rapid erosion events, and is less stable from geologic and seismic forces. Large and small population centers downstream of the site rely on our water resources for drinking water, fishing and other water-oriented recreation, traditional cultural practices, and aesthetic enjoyment by local residents and tourists alike. The ensuing twenty years of additional study and monitoring, documentation of recurring severe storm and erosion events, plus a better understanding of the future effects of climate change on Western New York weather, only serve to reinforce that the West Valley Demonstration Project site is simply unsuitable for the permanent storage or disposal of any radioactive wastes. Based on this primary tenet, current Citizen Task Force members are likewise unanimous in their belief that the only Phase 2 decision which can ensure public health and safety for decades and centuries into the future is the eventual sitewide removal of all wastes.