Citizens' Environmental Coalition

Coalition on West Valley Nuclear Wastes

April 16, 2018

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New York State Energy Research and Development Authority

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Ashford Office Complex, 10282 Rock Springs Rd
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Re: Comments on Task 1.3 Technical Memorandum- Selective Removal Scenarios Revision 1 April 2017, West Valley Exhumation Working Group & Enviro Compliance Solutions, Inc. & Also Scoping Comments

Dear Paul Bembia and Bryan Bower, Project Directors &

Lee Gordon and Moira Maloney, Official Phase 1 Communications Contacts:

This letter contains our summary of the work of the Exhumation Working Group and ECS consultants. We have endeavored to take notes and summarize what was presented in Task 1.3, and include comments as appropriate. We also include a Section III that has our major comments and recommendations related to this study.

Since Scoping for the Supplemental EIS has begun shortly, our comments and recommendations should also be considered Scoping Comments—issues and concerns that should be studied in the SEIS.

<u>OUTLINE</u>

I Our Review of the Study under Task 1.3

II Selective Exhumation of Disposal Areas

A. **The State Disposal Area – Here we integrated the Working group results with later dose rate findings. Our comments included.**
B. **NRC Disposal Area – Original Working group results. Our comments included.**

III Major Comments and Recommendations

Appendix: Original Exhumation Working Group Results of the SDA Analysis

I Review of the Study under Task 1.3

Under this task, <u>selective removal scenarios</u> were evaluated for the State Disposal Area (SDA) and the Nuclear Regulatory Commission (NRC) Disposal Area (NDA), in contrast to complete removal. Because they were only evaluating selective removal scenarios, the Waste Tank Farm was not included in this analysis. Three categories of exhumation scenarios were analyzed:

1) Exhumation of the 'long-lived' radionuclides
2) Exhumation of Greater than Class C waste and
3) Exhumation of waste disposal areas most prone to erosion or slope failure

Each scenario was defined in two ways by

- An exhumation target (radiological activity)
- An exhumation standard as a % of the waste targeted –i.e., 90% of Transuranic radionuclides or TRU

Removal Efficiency is defined as the amount of activity removed versus the volume exhumed. They used <u>Volume of waste removed as a surrogate for Project cost for comparative purposes</u>. The Study Team admits this is a rough order of magnitude estimate. Because the NDA has large amounts of cover material overlying the Holes, only volume of waste is used for the estimate, rather than total material.

The major approach was to identify the best targets to exhume first to achieve a particular goal. This approach unfortunately conflicted with the dose rates that can be exhumed without special precautions. So the first analysis relates to evaluating multiple target radionuclides for Removal.

Expected Dose rates for workers were analyzed last in the study. The team goes no deeper than to say some wastes pose difficulties for removal because of dose rates. This is particularly true of the NDA, where doses are high until after 2140 requiring additional radiation protection for workers during removal.

Unfortunately, after reviewing the dose rates the Team did not return to re-evaluate the findings related to the best targets. This task could have integrated the findings from both approaches resulting in more comprehensive recommendations.

II Disposal Areas

A. The State Disposal Area

Selective Removal Scenarios

The team focused on selected risk drivers for the SDA, to reduce the long- term risk potential.

Our Summary of Findings below incorporates dose rate considerations and some comments. For comparison see Appendix (at end of this letter) for Exhumation Working Group's Principal Findings for the SDA.

1. **Target I-129 and Cesium -137**
   I-129 is merely scaled from the amount of Cs-137. Removing 5% of SDA volume removes 50% of I-129 and Cs-137- also with tag along Tc-99 at 39%.
   To achieve 90% removal, 28% of the SDA is needed. This also removes 73.5% of Tc-99.
   Comment: The Exhumation Working Group (ExWG) also suggests that I-129 may have moved with water as leachate and may no longer be present in the SDA. The potential for I-129 to have already left the site is supported by research by Rao and Fehn[1] which found

[1] Rao, U. and Fehn, U., 1997, The distribution of ^{129}I around West Valley, an inactive nuclear fuel reprocessing facility in Western New York. Nuclear Instruments and Methods in Physics Research B123, pp. 361-366.

Rao, U. and Fehn, U., 1999, Sources and reservoirs of anthropogenic iodine-129 in Western New York. Geochimica et Cosmochimica Acta, v. 63, No. 13/14, pp. 1927-1938.

Rao, U., Fehn, U., Muramatsu, Y., McNeil, H., Sharma, P. and Elmore, D., 2002, Tracing the history of nuclear releases: determination of ^{129}I in tree rings. Environmental Science & Technology, v. 36, no. 6, pp. 1271-1275.

igher levels of 1-129 to be associated with nuclear reprocessing and contamination with I-129 to be widespread in Western NY.

Comment: *However, the team doesn't look at Dose rates for Removal until later in the report. At that point getting to 50% removal appears impossible, because the dose rates are too high in the trench segments needed. A different plan would be needed to achieve 50% and 90% removal. Partial removals by eliminating some trench segments could occur in 2080 without shielding.*

2. **Target Technetium-99**
   Tc-99 is also scaled from Cs-137. To remove 90% of Tc-99, 24% of the SDA would need to be removed.
   Comment: *This analysis also suffers from the dose rate problem and need for shielding-Trench 4 and Trench 6 have high dose rates – see p. 39 & 40 of report. Partial removal by eliminating some trench segments could occur in 2080. Technetium is also very mobile, like I-129, and may have already been removed from the SDA.*

3. **Target Carbon-14**
   This is also scaled to Cs-137, except for a large tritium waste stream.
   47% of the SDA waste would have to be exhumed to achieve 90% removal of C-14.
   Comment: *Possible without shielding in 2080.*

4. **Target Transuranics, Pu-238**
   Table shows that Pu-238, Am-241, Pu-239 and Pu-240 contribute essentially all of the TRU activity. The Fuel Cycle SNAP waste stream contains over 26,000 Curies of Pu-238. Shipping papers listed primarily Pu-238. The team used isotope info to correct for this problem. Pu-239 went from 38.8 curies to 184 curies, nearly 5 times greater. This is significant because of the long half-life of Pu-239.

   Comment: *The inventory information for this SNAP waste stream identifies a problem. Radiological activity of 500-800 Ci/g cannot be explained by plutonium isotopes alone. This should be investigated further when planning for exhumations. Please clarify whether SNAP is referring to a particular nuclear plant or something else.*

Targeting Pu-238 for removal, shows that removing 9.9% of the SDA waste volume removes >96% of Pu-238, along with 51% of GTCC volume. It also removes approx. 50% of Am-241 and Pu-240, and 31% of Pu-239.

To remove 95% of TRU, primarily Pu-238, 14 trench segments need to be exhumed (all Snap waste). To remove 95% of total TRU two additional Trench 9 segments would need to be removed. A problem here relates to the fact that shipments were largely recorded as Pu-238. While adjustments to account for the other isotopes resulted in only a 15 to 21% increase in the inventory for them, there is a dramatic increase in Pu-239 which has a very long half- life.

Given the questions about this inventory it may be that a larger portion of the Pu-239 would be removed under this scenario, but uncertain.

Comment: *Dose rate limitations for TRU are not significant and it would be possible to do this work by 2050 if not somewhat earlier according to Charts on p. 39 & 40. However, we are concerned about the reported 500- 800 Ci/g in SNAP shipments and specific dose rates in SNAP disposal areas would need to be explored further prior to exhumation.*

Comment*: For some reason GTCC was the only radionuclide handled as a volume measurement rather that by activity, used for the other radionuclides. We need an explanation for this and how it affects the results. It is not really explained why GTCC is expressed as volume rather than activity as for the other radionuclides.*

5. Target Uranium 234

50% removal of U 234 achieves 51% removal of U-235 and U-238 by excavating just 7% of the SDA volume. Targeting 80% removal also achieves 79% removal for U-235 and 83% for U-238 by excavating 19% of the SDA volume.
Higher Levels of removal are less efficient.

Comment: *There are dose rates limitations associated with Trench 4, so some segments might need to be deferred.*

6. Target Uranium-233

The entire inventory of this was related to just 2 shipments. So this can be removed by exhuming just one segment of trench 9.

7. **Target -All targeted radionuclides**

   Here they look at activity removed by SDA volume exhumed. The SDA table shows that 90% of the activity of radioactivity can be removed by selective exhumation of 50% of the SDA volume.

   Comment: *Alternatively they say excavation of only 10% of the SDA volume can achieve 50% reduction in activity for "many" radionuclides.p. 30 However, this 10% strategy is not true for C-14, GTCC volume and U-234. More explanation is needed here.*

8. **Target- Greater than Class C Waste**

   About 90% of all GTCC waste is due to TRU in three waste streams (SNAP 57.9%, Fuel Cycle MOx 15.3% and Special Purpose Reactor-Naval 16.6%).

   Here they indicate that a 100% removal goal is feasible and it would require removal of less than half of the SDA volume 44.5%, because there are a number of trench segments and holes that do not contain GTCC waste. The chart shows that removing 50% of GTCC is effective at removing 65% of Pu-238, it is not effective at removing other radionuclides. However 100% removal of GTCC, achieves 100% of TRU, 85% removal of I-129, 77% of Tc-99, 70% of C-14 and 57% of U-234.

   It should be noted that there are dose rate limitations particularly related to Special holes in Trench 6. Just 3 holes have dose rate limitations in 2080.

   Comment: *This analysis in Exhibit II-9 refers to GTCC activity rather than volume. Why wasn't activity used in the other GTCC analyses?*

9. **Trench by Trench Exhumation. P.32**

   Here they review a different approach –targeting radionuclides for removal based on the entire trench. Unfortunately this analysis proceeds without taking into account the dose rate—one of the last analyses undertaken. As a result Trench 4 is chosen first for exhumation because of its inventory. Special precautions would be needed for Trench 4 until around 2080. The technical and economic feasibility of the necessary special precautions were not evaluated in this study.

Comment: *Another issue was raised by this study-activation products are located largely in Trench 6. Almost nothing has been said about the types of activation products and what exhumation for this category would entail.*
Findings of this analysis—exhuming all of the top 6 trenches shown in Exhibit II-10 would be equivalent to exhuming 52% of the SDA and would remove almost the entire PU-238 inventory, about 80% of the I-129, C-14 and U-234 inventories, and about 65% of the Tc-99 inventory.
Two additional Charts on p. 34 are useful
One shows radiological activity over time by trench. II-5
One shows the inventory for 6 radionuclides by trench II-6

10. Potential Erosion Areas p.35

In this exercise they chose a few trenches believed to be most susceptible to erosion. Other than proximity to the North and East sides of the SDA, there was no other technical basis for assuming that these trenches would be vulnerable and not adjacent areas. In fact it is stated that "The specific trenches that may be at risk of failure due to erosion are not yet known."

Comment: *As recently presented in the Conceptual Site Model by Neptune consultants the South Plateau has vertical and horizontal fractures that extend from the weathered Lavery Till into the unweathered Lavery Till. Such fractures could also affect the stability of the site, with potential for landslides.*

South Plateau fractures occur in the weathered Lavery Till (WLT) and extend into the unweathered Lavery Till (ULT) and can be connected to sand lenses. "Below the weathered zone, fractures of 4 to 8 m (13 to 26 ft) in length may extend into the ULT and can be hydraulically connected to sand lenses (DOE 2010a; WVNS 1993a)." p. 100 Neptune CSM

Comment: *The most significant map here is shown at a very reduced size on p.37. It is referenced to ECS 2016. However I cannot find this map in either document—Task 1.1 or 1.2. We definitely need a more precise and larger map with a scale and estimated depths and widths of the gullies identified, as well as in what year they developed. It shows multiple gullies surrounding the SDA on the North and East Sides. Possibly an artistic rendering of this map would be useful in providing the needed information*

11. SDA Exhumation Dose Rates. p. 38

This is the analysis of Dose Rates as limitations on Exhumation. Charts on p. 39 and 40 are useful. Generally Trenches 4 & 6 have limitations until approximately 2080.

12. 10% SDA Exhumation p. 42.

Comment: *We don't recommend pursuing just a 10% exhumation for economic reasons. The potential for harm could have greater economic impacts. It should be noted though that under the targeting of either Pu-238 or GTCC, a large amount of the other target is achieved 61% or 53%. Given the strong possibility that I-129 may have already moved off site, we wonder whether it should be a target at all unless there is additional sampling.*

B. NRC Disposal Area

<u>Our Summary of their findings.</u>

The NDA was operated initially by Nuclear Fuel Services, Inc. under a license with the Atomic Energy Commission for disposal of solid radioactive waste generated from on-site fuel reprocessing operations. Starting in 1966 rad waste materials from the Main Plant Process Building that exceeded 200 mR/hr, and other material that was not permitted to be disposed in the SDA was buried in disposal holes in the NDA and backfilled with earth.

The NDA consists of 99 Deep Holes and 136 Special Holes, 12 WVDP trenches and 3 caissons. (p. 6) (This is based on an additional spreadsheet prepared by Ralph Wild.)

Unlike the SDA, which received waste from many different places, the NDA waste came from the reprocessing building only which makes it more homogeneous. Because of the large amount of soil used to cover the trenches, we are told that the discussion for the NDA uses only waste volume. 50% of the waste volume is in the Deep Holes and the Special Holes, which they claim comprises 99% of the inventory. Deep Holes have a volume of just 13.9% of NDA total volume. Special Holes are larger in size. All of the activation products are found in the Deep Holes.

To remove 50% of radiological activity 13.9% of the NDA volume needs to be removed—essentially from the Deep Holes. To achieve 95% removal of activity, 30% of the NDA volume needs to be removed and the additional amount would come from the Special Holes. They also prioritize holes to be removed by their activity. Removing the Top 25 Deep Holes removes about 70-75 % of activity. Activation products are found only in the Deep Holes. In this case it appears to relate to Cs-137 and Pu-238. Exhuming 50 Deep Holes would remove 90% of activity with 47% of hole volume.

Volume calculations are affected by the fact that volume is only known for 8 Special holes out of 136. The team has estimated volume for all the special holes using this information. This could be a major source of error in these calculations. We recommend a careful look at this source of uncertainty.

Their evaluation of the Special Holes reveals that excavating 50 Special Holes involves 55% of the SH waste volume and removes 95% of waste activity as well as 82% of GTCC volume.

The team suggests that it might be more cost-effective to remove an entire area rather than focus on holes, but this will be analyzed later in the evaluation process.

Dose Rates. The Team found that the dose rates from the NDA are quite high and limit exhumation in the near term. By 2140 over 120 years away the dose rate goal of 2.5 mrem/ hr. is exceeded for 24 of the Top 25 Deep Holes. In addition 88 or 62% of the Deep Holes still exceed the dose rate goal.

The Special Holes also have a similar problem but by 2110, 61 holes fall below the dose rate goal. Unfortunately, the team found that these holes do not contain significant activity.

No assessment of the technical and economic feasibility of earlier exhumations was done for this study.

Below is a summary of the principal results of the NDA selective exhumation analysis from the Report:
Our comments are *italicized.* Note that our Major Comments follow in Section III.

1) The NDA's Deep Holes and Special Holes each contain about 50% of the NDA's activity, while the WVDP trenches contain <1% of the activity. Thus, selectively exhuming the WVDP trenches would not be an effective means of reducing the NDA's activity, and was not further investigated.

   Yet 200,000 cubic feet of material was buried in the trenches.

2) Fission products and TRU radionuclides have very similar profiles across the NDA's Deep Holes and Special Holes. For example, the percentage amount of Cs-137 (representing fission products) in any one hole or group of holes is nearly the same as the percentage of Pu-238 (representing TRU) in the same hole or

group of holes. As a result, targeting specific radionuclides for exhumation is not beneficial for the NDA, since the same holes would be targeted to remove a given percentage of Cs-137 as would be targeted to remove the same percentage of Pu-238 (or any other TRU or fission product).

Your analysis indicates that activity levels are different for different holes, otherwise how could you identify the top 25 holes, etc, but here you say the radionuclide profiles are not. Please explain further.

3) Activation products are an exception to the condition reported in the previous paragraph. The activation products do not appear in the Special Holes, only in the Deep Holes. The Deep Holes contain fuel rod cladding and other fuel assembly hardware, which contain activation products generated in the upstream head end in the reprocessing plant, whereas the Special Holes contain waste from further downstream in the reprocessing plant, after the cladding and hardware had been removed. Within the Deep Holes only, the condition cited in the previous bullet would also apply to the activation products.

   Please clarify what condition you are talking about. We cannot follow this.

4) Because of differences in location and depth between the Deep Holes and Special Holes, which could result in a difference in exhumation approach and technologies, it makes sense to analyze the selective exhumation of the Deep Holes separate from the exhumation of the Special Holes.

5) Exhuming the Top 10, Top 25, and Top 50 most radioactive Deep Holes would remove about 45%, 75%, and 90% of the Deep Hole radioactivity, respectively, while removing approximately 10%, 25%, and 47% of the volume, respectively. For the Top 10 Deep Holes the activity removal to removal efficiency is 4.5 to 1; for the Top 25 the efficiency drops to 3 to 1; and for the Top 50 the efficiency is <2 to 1.

6) The dose rate for 24 of the Top 25 activity Deep Holes is greater than 25 mrem/hr until the year 2110. In the year 2140, the dose rate from 24 of the Top 24 Deep Holes remains greater than the 2.5 mrem/hr dose rate goal, implying that some form of direct dose radiation protection would be required for waste removal from the Deep Holes regardless of when the work was performed.

7) When all 99 of the NDA Deep Holes are looked at, the dose rates would exceed 25 mrem/yr in 75 holes in 2020, 54 holes in 2050, 40 holes in 2080, 17 holes in 2110, and 3 holes in 2140. By 2140, the dose rate from 61 of the Deep Holes (62%) would still be greater than the 2.5 mrem/hr dose rate.

8) Exhuming the Top 10, Top 25, and Top 50 most radioactive Special Holes would remove about 63%, 82%, and 96% of the Special Hole radioactivity, respectively, while removing less than 22%, 33%, and 57% of the volume, respectively. For the Top 10 Special Holes, the activity removal to removal efficiency is 2.9 to 1; for the Top 25 the efficiency drops to 2.5 to 1; and for the Top 50 the efficiency is <2 to 1.

Volume calculations are affected by the fact that volume is only known for 8 Special holes out of 136. The team has estimated volume for all the special holes using this information. This could be a source of error in these calculations related to volume removal and removal efficiency.

9) The dose rate for all Top 25 activity Special Holes is greater than 2.5 mrem/hr until the year 2110, at which time only one Special Hole falls below that level. There are a significant number of Special Holes with dose rates below 2.5 mrem/hr (50 holes in 2020, increasing to 100 holes in 2110). Unfortunately, most of these Special Holes do not contain a significant amount of activity. For example, the 40 Special Holes that have the least activity cumulatively contain <0.1% of the total activity of the Special Holes. From an activity reduction point of view, the exhumation of these 40 Special Holes would not have a significant effect of the amount of residual radioactivity if selectively removed.

10) For both the NDA Deep Holes and Special Holes, it may be more effective to target specific areas for removal, rather than specific holes. For example, most of the Special Holes with the highest activity are located on the western side of the NDA. Therefore, it may be more effective to exhume the entire western side of the NDA. Likewise, the Deep Holes with the highest activity are located throughout a 130 foot by 160 foot area. Therefore, it may be more effective to exhume the entire area than attempt to locate and exhume a series of specific Deep Holes.

11) For both the Deep Holes and Special Holes, targeting GTCC waste for removal would not result in any substantial benefit when compared to targeting activity removal. Essentially all the Deep Holes and Special Holes would need to be removed to remove all the GTCC waste, which would be classified as complete removal rather than a selective removal scenario. On the other hand, partial removal that targets GTCC waste would result in leaving behind holes that contain a large portion of the NDA activity.

If GTCC in 97 of the Deep Holes and 94 of the Special Holes represent 99.6% of NDA total activity, why wouldn't GTCC and complete removal be an appropriate target? There is no rule that there can only be one target, so complete removal of GTCC could be combined with removal of a spent nuclear fuel element.

12) Targeting the NDA holes that are commonly believed to be most prone to erosion (i.e., the NDA's northern edges) to prevent or delay the time when an erosion gully could/would expose the NDA waste would remove waste from 78 Special Holes. These 78 Special Holes represent about 57% of the 136 NDA Special Holes, but contain only about 21% of the Special Hole activity, resulting in a negative removal efficiency of about 1 to 2.7.

There was inadequate discussion of the hydrogeological or technical justification for choosing potential erosion areas for this evaluation in the SDA and NDA.

The dose rates for the NDA are very high, but this report has not reviewed the protective measures which would be needed for earlier exhumation. The technical and economic feasibility of earlier exhumation should be evaluated.

III Major Comments and Recommendations

All of our major comments are reflected here and should also be considered Scoping comments for the SEIS.

1. **The Waste Tank Farm and the remaining sludge in the tanks** represents hundreds of thousands of curies. Unfortunately the Agencies have executed contracts in a way to prioritize the study of selective or partial removals of radionuclides. This is of course inappropriate for the radionuclide mixture contained in the tanks. Evaluating the sludge and the tanks and the technical and economic feasibility of exhuming them are critical tasks that are necessary to be completed in order to make Final Decisions in the SEIS.
   If not being performed by the ExWG, please indicate how these evaluations will be performed. Sufficient Phase 1 studies were supposed to be completed so that an adequate scientific basis would exist to enable Final Decisions for each Phase 2 facility. Where is the scientific information for the Waste Tank Farm?

2. **The public, particularly those most involved in reviewing the status of the West Valley cleanup, have consistently recommended full cleanup or complete removal of radioactive materials at this site.** Ignoring complete removal and public input on this important issue, means the Agencies will not have the best information to make reasoned decisions.

3. **Technical and economic feasibility studies of earlier exhumation with Radiation Protection and Remote-controlled equipment must be done.** The major approach was to identify the best targets to exhume first to achieve a particular goal. This unfortunately conflicts with the dose rates that can be exhumed without special precautions. Dose rates were analyzed last in the study. The team goes no deeper than to say some wastes pose difficulties for removal because of dose rates. This is particularly true of the NDA, where doses are high until after 2140 requiring additional radiation protection for workers during removal. The next step in this evaluation was not pursued. We believe this next step should be pursued—evaluating the technical and economic feasibility of exhumation with remote-controlled equipment and additional radiation protection. This would permit earlier exhumation on this erosion prone site.

4. **Worker Safety Recommendation at Start of Actual Exhumation:**

   In general in this analysis a trench is chosen first because of its large inventory of targeted radionuclides. At the start of <u>actual exhumation</u> activities we recommend a different approach: choosing a location with an expected low level inventory and a minimal dose rate for confirmatory testing of the accuracy of the inventory. Several such tests that sample trench radionuclides and activity will confirm or refute the reliability of existing inventories, based primarily on shipping records. Shipping records have been found to lack accuracy. Large surprises have been found at other nuclear waste sites, such as the Apollo site in Parksville Township in Pennsylvania, where high level wastes were found to threaten a criticality event. The first priority is worker protection and such an approach would be precautionary, before tackling trenches with greater levels of activity.

5. **Other Hazardous Materials**

   The 2010 FEIS has more complete descriptions of the Waste inventories that also include important radionuclides not mentioned in this study as well as significant quantities of other hazardous substances. We need answers regarding these materials and whether they will be removed along with the other targeted materials. Worker protection is relevant for these materials as well.

6. **Another Selective Removal Scenario should be evaluated.**

This entire Exhumation Study was about considering a variety of selective removal scenarios. Within that framework, we believe another selective removal scenario should be seriously evaluated.

Given two factors- the high dose rates in the NDA for the next 120+ years and the vulnerability of the South Plateau to gully erosion, landslides and mass wasting, some consideration should be given to a selective removal of the entire SDA. This includes the finding of horizontal and vertical fractures in the South Plateau. SDA exhumation would reduce the potential for loss of containment of SDA radionuclides. The SDA has dose rates that make exhumation feasible much earlier than the dose rates for the NDA. SDA exhumation would also enable installation of major engineering measures to shore up the NDA on the South Plateau for the next 120+ years—providing greater protection from erosion and possible landslide as well as loss of containment. This recommendation involves anchoring the looser soil to bedrock for the NDA until removal becomes more feasible. This recommendation is only a temporary one. The West Valley Demonstration Project Act requires that this waste be disposed of off-site. We are trying to ensure it does not leave the site catastrophically in a landslide or other severe event. We note that DOE has been exploring remote-controlled work across the nation and this recommendation should only be considered if remote-controlled exhumation of the NDA is found to not be technically feasible.

7. **There are four significant Inventory Problems**

The first relates to the mere dismissal of the waste trenches where 200,000 cubic feet were buried. We need more information about what was buried there and why none of the studies appear to address the trenches or the caissons. How can you determine that the trenches contain less than 1% of the inventory if you don't know what waste was put there?

Despite notations that inventory spreadsheets are included with Task 1.2, they are not present. (NDA Inventory by Hole – Decayed.xlsx) Also mentioned are detailed Ralph Wild spreadsheets provided after the 2000 study. We are specifically requesting that the Ralph Wild spreadsheets and other missing spreadsheets and information pertaining to the inventory in the waste trenches and caissons be provided as soon as possible.

The second problem relates to the SNAP waste stream. The inventory information for this SNAP waste stream identifies a problem. Radiological activity of 500-800 Ci/g cannot be explained by plutonium isotopes alone. What would explain this level of radiological activity? This should be investigated further when planning for exhumations. Please clarify whether SNAP is referring to a particular nuclear plant or something else.

A third problem relates to GTCC waste. GTCC waste is most often dealt with as waste volume, whereas other radionuclides are handled as activity. The rationale for using volume needs to be explained and the implications of comparing radionuclide activity of other radionuclides to GTCC volume fully explained for the public. How exactly does this affect the overall analysis?

A fourth problem pertains to the unknown volumes in the Special holes in the NDA. Actual volume is known for only 8 Special holes out of 136. The team has estimated volume for all the special holes using this information. This could be a significant source of error in these calculations related to volume removal and removal efficiency. Uncertainty should be dealt with in this analysis.

8. **Technical and Economic Feasibility.** In this study dose rates conflicted with the radionuclide targets for analysis. The next step in this evaluation was not pursued. We believe this next step should be pursued—evaluating the technical and economic feasibility of exhumation with additional radiation protection. This would permit earlier exhumation.

9. **Potential Erosion Areas**

There was inadequate discussion of the hydrogeological or technical justification for choosing potential erosion areas for this evaluation of the SDA and NDA. As recently presented in the Conceptual Site Model by Neptune consultants the South Plateau has vertical and horizontal fractures that extend from the weathered Lavery Till into the unweathered Lavery Till. Such fractures could also affect the stability of the site, with potential for landslides. Foundational stability and Slope Stability of the South Plateau should be evaluated. This should be addressed for the North Plateau as well

A very significant map here is shown at a very reduced size at p.37 of Task 1.3. It shows multiple gullies surrounding the SDA on the North and East

Sides. It is referenced to ECS 2016, but I cannot find the same map in either Task 1.1 or 1.2. We definitely need a more precise and larger map with a scale and estimated depths and widths of each of the gullies identified. If the history is known of when these gullies formed that would also be useful. We recommend an artistic rendering of this map to better inform the public.

APPENDIX

Exhumation Working Group Results of the SDA Analysis

The principal results of the SDA selective exhumation analysis are below. We provide *italicized* comments on some of these items. These are also found on p.59-61 of the Full report, Task 1.3.

1) Removal of the long-lived fission products (e.g., I-129, Tc-99, and C-14) would require exhumation of primarily Trench 4, followed by 50-foot segments from Trench 9, and then certain segments from Trenches 5, 2, and 3.

   Trench 4 cannot be dealt with until 2080 because of dose rate limitations.

2) Removal of the long-lived fission products is initially quite cost effective, e.g., 50% of the I-129 activity can be removed by exhuming only 5% of the SDA volume—a 10 to 1 removal efficiency. As more long-lived fission products are removed the efficiency decreases, e.g., exhumation of 28% of the SDA volume is required to remove 90% of the I-129 activity—a 3.2 to 1 removal efficiency.

   I-129 may no longer be present. It may have left the site widely contaminating Western NY.

3) Long-lived fission products are generally located in trenches containing Cs-137; therefore, while a complementary removal of high-activity Cs-137 would be realized, removal of long-lived fission products would generally require either additional dose radiation protection measures or delaying exhumation to allow for decay of the short-lived Cs-137.

4) Removal of transuranic (TRU) waste would require exhumation of certain 50-foot segments primarily from Trench 10, followed by segments of Trenches 11, 8, and 9.

None of this work would be dose rate limited.

5) Removal of TRU is initially quite cost effective, e.g., 50% of the TRU activity can be removed by exhuming 2.8% of the SDA volume—an 18 to 1 removal efficiency. As more long-lived TRU waste is removed, the efficiency decreases only slightly, e.g., 90% of the TRU activity can be achieved by exhuming only 7.1% of the SDA volume—still almost a 13 to 1 removal efficiency.

However, we are concerned about the reported 500- 800 Ci/g in SNAP shipments and specific dose rates in SNAP disposal areas would need to be explored further prior to exhumation.

6) The direct dose rates for the trench segments associated with TRU exhumation are generally less than 2.5 mrem/hr; therefore, less robust measures to protect workers from radiation exposure would be required if targeting TRU waste removal.

7) Uranium-234 is spread out over much of the SDA, including Trench 4 (south end), Trench 5, and Trenches 8 through 14. Removal of U-234 is initially quite cost effective, e.g., 50% of the U-234 activity can be removed by exhuming 7% of the SDA volume—a 7 to 1 removal efficiency. As more U-234 is removed the efficiency decreases, e.g., exhumation of 28% of the SDA volume is required to remove 90% of the U-234 activity—a 3.2 to 1 removal efficiency. Targeting the removal of U-234 would also effectively remove U-235 and U-238, but would not be an effective strategy for removing long-lived fission products or TRU.

8) The direct dose rates for many of the trench segments associated with U-234 exhumation are generally less than 2.5 mrem/hr. However, a few of the segments contain high dose rates (e.g., in Trenches 4 and 9) that would result in requiring additional dose radiation protection measures.

9) Targeting a combination of long-lived fission products, TRU, and U-234 would require exhumation of segments from Trench 4, and then from Trenches 5 and Trenches 8 through 11, and a few others.

10) Removal of a combination of radionuclides is initially quite cost effective, e.g., exhumation of 10% of the SDA volume would remove 60%, 53%, and 18% of the I-129, TRU, and U-234 activity, respectively. Exhumation of 50% of the SDA volume would remove 91%, 97%, and 88% of the I-129, TRU, and U-234 activity, respectively. Since these removal percentages are so high, exhumation of the SDA beyond 50% would not be cost-effective for these radionuclides. Of course, for any one radionuclide, these efficiencies are not as effective as targeting that radionuclide, e.g., when TRU is targeted,

exhumation of only 7.1% of the SDA volume is required to remove 90% of the TRU activity.

11) Targeting GTCC waste would initially target the same trench segments as targeting TRU, which accounts for nearly 90% of the GTCC volume. Next, specific 50-foot segments from Trench 4 would be targeted, likely due to the presence of Cs-137, and finally Trench 6 holes would be targeted, due to the presence of Ni-63 and Nb-94.

Trench 4 & 6 have dose rate limitations.

12) No advantage has been identified for targeting the GTCC waste when compared to targeting either TRU or a combination of radionuclides.

The team did identify 100% removal feasibility.

13) Targeting the segments commonly believed to be most prone to erosion (i.e., the SDA's northern and eastern edges) would remove waste from the area within 50 feet of the edge of the SDA, thereby decreasing the potential and delaying the time when an erosion gully could/would expose the waste. However, this selective exhumation scenario is not effective at removing activity from the SDA, i.e., exhumation of 21% of the SDA volume to protect against erosion would remove only 30%, 16%, and 20% of the I-129, TRU, and U-234 activity, respectively.

There needs to be a geological or other technical basis for identifying trenches as vulnerable. An expert should review foundational stability and slope stability for the SDA and the South Plateau.

14) For the trench by trench removal scenario, Trench 4 would be the most effective target and Trench 6 the least effective for the analyzed radionuclides. Removing six complete trenches under an optimum scheme would require exhuming 52% of the SDA volume and would remove 80%, 100%, and 79% of the I-129, TRU, and U-234 activity, respectively.

15) Lastly, if it is desired to only exhume 10% of the SDA (implying a 90% cost reduction), then the exhumation should occur in Trench 4 and several other 50-foot segments in other trenches. The specific non-Trench 4 segments would depend on the secondary goal of the exhumation (e.g., TRU removal, long-lived fission product removal, or erosion protection).

We believe cost reduction related to exhumation must be weighed against the costs of a serious radioactive release from the disposal area.

Thank you for consideration of these comments.

Sincerely,

Barbara Warren

Citizens' Environmental Coalition

Joanne Hameister

Coalition on West Valley Nuclear Wastes