M-32

~~Doe~~ NRC99

West Valley Nuclear Services Company, Inc.

P.O. Box 191 - 10282 Rock Springs Road
West Valley, New York 14171-0191
(716) 942-3235

Mr. T. J. Rowland, Director
DOE West Valley Demonstration Project
P.O. Box 191
West Valley, New York 14171-0191

AOC-09
WD:98:0293
April 14, 1998

ATTENTION: D. W. Sullivan

Dear Mr. Rowland:

SUBJECT: Transmittal of Revised "Summary of SDA Selective Exhumation Analysis" Issues Paper Prepared for NRC Review and Comment

Enclosed for your use is a revised issues paper, which was prepared to summarize the results of an evaluation conducted on various selective exhumation scenarios for the State-Licensed Disposal Area (SDA). The original version of the issues paper was submitted to you on April 2, 1998 but has since been revised to incorporate additional NYSERDA comments received on that original submittal.

This paper and the detailed evaluation were prepared in response to questions raised by the NRC and NYSDEC during ongoing discussions involving the West Valley Environmental Impact Statement work. The issues paper provides a historical summary of burial operations as well as a summary of the selective exhumation Performance Assessment results prepared by Science Applications International Corporation (SAIC). The detailed SAIC results are also attached to the issues paper. This document has been reviewed by your staff and by NYSERDA, and all comments have been resolved in this final version. In accordance with the EIS schedule, it is now ready to be transmitted to the NRC for their review and comment.

Please contact Dan Westcott at x-2301 or the undersigned at x-2320 if you require additional information or would like clarification regarding the contents of this transmittal.

Sincerely yours,

WEST VALLEY NUCLEAR SERVICES CO., INC.

Karen C. Malone
K. A. Malone
Sr. Environmental Engineer

KAM

CA:98:0057

NF08/1

Attachments: "Summary of SDA Selective Exhumation Analysis"

cc: P. J. Bembia, NYSERDA
J. E. Hammelman, SAIC
E. A. Lowes, DOE-WV
D. J.C. Franklin, DOE-WV

120074

K6118

9807140067 980414
PDR PROJ
M-32 PDR

ATTACHMENT

Summary of SDA Selective Exhumation Analysis

SUMMARY OF SDA SELECTIVE EXHUMATION ANALYSIS

1.0 INTRODUCTION

The purpose of this paper is to summarize the analysis of selective exhumation for waste currently buried in the State-Licensed Disposal Area (SDA) at the Western New York Nuclear Service Center (WNYNSC) near West Valley, NY. The analysis was performed in response to NRC comments received by the Department of Energy (DOE) and the New York State Energy Research and Development Authority (NYSERDA) following the NRC's review of a regulatory issues paper on the Nuclear Regulatory Commission (NRC)-Licensed Disposal Area (NDA) and the SDA. The issues paper presented a discussion of the disposal areas in the context of the Environmental Impact Statement (EIS) alternatives currently being analyzed for these units, in preparation for DOE and NYSERDA development of a Preferred Alternative and subsequent Record of Decision (ROD) for completion of the West Valley Demonstration Project (WVDP) and closure or long-term management of facilities at the WNYNSC. The analysis is also being conducted to address an inquiry from the New York State Department of Environmental Conservation (NYSDEC) regarding the selective exhumation of Space Nuclear Auxiliary Power (SNAP) generators from the SDA.

In May 1997, the NRC in their role as a cooperating agency provided comments on the informally submitted regulatory issues paper prepared by Project personnel that addressed certain issues and regulatory questions involving the disposal grounds[1]. The NRC made a general comment as follows:

> "DOE should consider the option of partial exhumation of wastes in the NDA and SDA. Wastes that might be considered include the spent fuel, the cladding hulls, other GTCC wastes, and other wastes that present unusual long-term hazards, such as the solvent tanks."

This report summarizes the results of this analysis performed on the SDA.

2.0 BACKGROUND

The SDA was constructed and operated by Nuclear Fuel Services Company (NFS) as a commercial low-level radioactive waste disposal facility. The SDA was operated under the regulatory purview of the New York State Department of Labor (NYSDOL), New York State Department of Health (NYSDOH), and NYSDEC.

In 1963, NFS was issued a Radioactive Materials License (RML) pursuant to the Labor Law and Industrial Code Rule No. 38 authorizing the licensee to transfer, receive, possess, and use

[1] J. W. N Hickey to T. J. Rowland, "NRC Staff Comments on the Drum Cell and NDA and SDA Issues Papers," Nuclear Regulatory Commission, Docket No. M-32, May 19, 1997.

radioactive materials. This RML was transferred to the New York State Energy Research and Development Authority (NYSERDA) in March 1983 via Amendment No. 24, which identified NYSERDA, rather than NFS, as the licensee.

NFS was also granted an exemption from the requirements of Section 16.8 of Part 16 of the New York State Sanitary Code, pursuant to the Public Health Law and Part 16 of the Sanitary Code, which permitted NFS to dispose of radioactive materials in the ground. In 1974, NYSDEC and NYSDOH reached an agreement that placed the responsibility for the regulation of radioactive waste disposal facilities with NYSDEC. It was agreed that NYSDEC would use the existing exemption to Part 16 as the NYSDEC permit for disposal, required by 6 NYCRR Part 380. In January 1983, the existing Part 380 permit (the Part 16 exemption) was transferred from NFS to NYSERDA.

The SDA was licensed to accept three types of radioactive wastes: byproduct materials such as H-3 (tritium), C-14, Co-60, Sr-90, I-125, I-131, Cs-137, and Am-241; source materials, including Th-232, U-238, and natural uranium; and special nuclear materials, including U-235, Pu-238, Pu-239, and Pu-240. Additional license terms and conditions existed that, for example, limited the external radiation level at any surface of any package to 200R/hr or less.

SDA disposal operations were active from 1963 through March 1975, during which time approximately 2.4 million ft^3 of waste were buried[2]. The waste was received from various sources, including institutions, industries, government facilities, nuclear power plants, waste brokers, decontamination facilities, and the NFS reprocessing facility. The physical forms of the waste were extremely diverse and included nuclear power plant processing wastes (e.g., resins, filters, evaporator bottoms), biological wastes (e.g., animal wastes, excreta), research wastes and absorbed liquids, sealed sources, and activated metals. Most of the waste was disposed in the original shipping containers, including 5-, 30-, and 55-gallon steel drums, wooden crates, cardboard boxes, cartons, fiber drums, and plastic bags[3],[4],[5]. Waste from the NFS reprocessing facility was limited to general wastes with package contact dose rates of 200 mR/hr or less.

In 1993 to support preparation of the site closure EIS, an analysis of the SDA disposal records was performed to estimate waste volumes, by classification, in accordance with 10 CFR 61. This analysis indicated that approximately 3%, or 68,500 ft^3, of wastes disposed in the SDA

---

[2]Envirosphere Company, "Executive Summary of the Site Stabilization Study for the LLRW Disposal Area at West Valley, New York," NYSERDA Report 87-14-e, 1986.

[3]United States Environmental Protection Agency (EPA), "Summary Report on the Low-Level Radioactive Waste Burial Site, West Valley, New York (1963-1975)," Region II, New York, New York, 1977.

[4]Duckworth, J.P., personal communication, memorandum to W.H. Lewis Rockville, Compilation of West Valley Solid Radioactive Waste Burial Operations, February 23, 1981.

[5]Kelleher, W.J., and E. Michael, "Low -Level Radioactive Waste Burial Site Inventory for the West Valley Site, Cattaraugus County," NYSDEC, Albany, New York, 1973.

would be considered GTCC under 10 CFR 61[6]. A recently conducted data quality review of the SDA database and waste classification resulted in minor changes to the original analysis through correction of data entry errors and reevaluation of certain disposals, but did not significantly change the volumes or waste class percentages of the SDA disposals. This recent report indicates that, as of 1993, approximately 2% (43,950 ft^3) of waste would be considered Greater-Than-Class-C, with approximately 92% of that volume originating at Mound Laboratories[7]. While this recent analysis reduced the estimated GTCC volume by 24,550 ft^3 compared to the 1993 estimate, the distribution of these wastes still encompasses eight of the fourteen trenches in the SDA. The waste contents of specific trenches (excluding Trench 6 and 7) are generally identified within 50-foot sections of the trench length.

The SDA is approximately 15 acres in size and contains 14 disposal trenches. Trenches 1 through 7 are located in the northern portion of the SDA and were used from 1963 through 1969. Trenches 8 through 14 are situated in the southern area and were operational from 1969 through 1975. All of the trenches, with the exception of 6 and 7, are approximately 33 ft. wide and 19 ft. deep.

Trench 6 is not actually a trench, but a series of holes used for waste, mainly irradiated reactor components, that required shielding. This waste was called special purpose waste and the holes in which it was buried were called Special Purpose Holes. There are 19 Special Purpose Holes with an excavated volume of less than 350 cubic meters (12,358 ft^3).

Trench 7, which extends to a depth of approximately 11 ft., contains 33 packages of high specific activity waste that are surrounded by at least six inches of cast-in-place concrete covered by four (4) feet of earth. Concrete was also poured between the waste packages. The contact dose rate on one of the packages (inside the shielded overpack) exceeded the 200 R/hr limit as specified in NFS license. Special approval to accept the greater than 200 R/hr package and dispose of it in trench 7 was received from NYSDOH[8],[9],[10].

---

[6]WVDP-EIS-022, "State-Licensed Disposal Area Waste Characterization Report," Rev. 2, September 1995.

[7]Krieger, L.E. to T. J. Rowland, "New York State Licensed Disposal Area (SDA) Revised Disposal Database Data Quality Review and Confirmation of Greater-Than-Class C Waste Volumes Report and Revised Tables for SDA Waste Characterization Report," WD:97:1007-EIS, November 19, 1997.

[8]Rutenkroger, E.O. of Nuclear Fuel Services, Letter to Sherwood Davies of the New York State Department of Health, May 17, 1966.

[9]Davies, S. of the New York State Department of Health, Letter to Nuclear Fuel Services, May 23, 1966.

[10]WVDP-EIS-022, "State-Licensed Disposal Area Waste Characterization Report," Rev. 2, September 1995.

Waste Disposal Requirements and Historical Context

At the time of NFS disposal operations in the SDA, the waste classification system and definitions that exist today had yet to be developed. The SDA was licensed to accept three types of radioactive wastes: byproduct materials, source materials, and special nuclear materials. Additional license terms and conditions existed that, for example, limited the external radiation level at any surface of any package to 200R/hr or less, with exceptions granted on a case-by-case basis.

The basis of this waste definition contrasts with those definitions later promulgated in 10 CFR 61, which instead of package dose rate, has as a basis the isotope content and quantity of the waste. It is this change in the nature of waste definitions that has contributed to the uncertainties in more recent attempts to "classify" the SDA waste in accordance with 10 CFR Part 61 for analysis and comparative purposes, because the NFS disposal records do not provide, in most cases, adequate detail on the isotopes associated with the particular waste that was buried. Assumptions as to the generic waste stream radionuclide profile had to be made, and related curies extrapolated from that generic waste stream profile. As already discussed, however, this Part 61 classification was made only for analysis and comparison purposes, since this classification system did not exist at the time of NFS disposal operations at the SDA and is not retroactively applicable to the SDA.

3.0 ANALYSIS OF CANDIDATE SDA WASTES FOR SELECTIVE EXHUMATION

The NRC has requested that the suspect GTCC wastes buried in the SDA be considered as possible candidates for selective exhumation. In addition, NYSDEC has also requested that the Space Nuclear Auxiliary Power (SNAP) generators be considered as possible candidates for selective exhumation. In order to assess the value of selectively exhuming waste from the SDA, a performance assessment was conducted. Appendix A contains a summary of this performance assessment. The performance assessment described in Appendix A uses the risk assessment models developed in the DEIS along with an updated source term distribution to estimate the impacts associated with the SDA under a variety of scenarios. The offsite and intruder scenarios evaluated in the revised performance assessment are essentially the same as the scenarios considered in the DEIS. However, since the revised performance assessment has the additional objective of evaluating the benefits associated with selectively exhuming suspect GTCC waste, the effect of changes to the source term are investigated.

The objective of the selective exhumation analysis is to determine if there are any benefits in terms of reducing peak dose or reducing the amount of time the SDA needs to be managed if suspect GTCC wastes were selectively removed. Benefits can be assessed by comparing the performance assessment results for cases where wastes are selectively removed to potential dose standards and to the performance assessment results for the case where the entire SDA waste inventory remains in place. Since selective exhumation only applies to DEIS Alternative III (In-Place Stabilization) and DEIS Alternative IV (Monitoring and Maintenance), all the scenarios analyzed in Appendix A pertain to these two DEIS

Alternatives. The following two cases of selective exhumation were examined for Alternatives III and IV in Appendix A:

- Exhuming 50-foot trench sections containing waste with a high Pu-238 content, and

- Exhuming 50-foot trench sections containing suspect GTCC (includes all trench sections with high Pu-238 waste).

According to the recent analysis of the SDA disposal records[11], the waste generator that provided the majority of waste with a high Pu-238 content was Mound Laboratory. This waste was shipped during the early 1970's and corresponds to the period of time that Mound was engaged in the SNAP generator program and preparation of neutron sources. Both of these activities used Pu-238, which has a half life of 88 years. The estimated volume of high Pu-238 waste received from Mound is 40,256 ft^3 or approximately 92% of the total suspect GTCC waste buried in the SDA. The location of the high Pu-238 waste disposals is depicted in Figure 1 of Appendix A. Figure 1 also illustrates the location of all suspect GTCC waste disposals.

The results of the selective exhumation performance assessment indicate that there are no significant benefits associated with exhuming all suspect GTCC waste, including high Pu-238 waste. This conclusion was obtained by comparing the performance assessment results for the two selective exhumation cases to potential dose standards and to the performance assessment results for the case where the entire SDA waste inventory remains in-place. Consistent with the DEIS performance assessment, two types of conditions are analyzed in Appendix A: expected conditions, and unexpected conditions (loss of institutional control). The performance assessment results for both of these conditions are discussed below.

> Expected Conditions Cases - Under the expected conditions cases, institutional controls are maintained for Alternatives III and IV. In both of these cases, the groundwater release scenario is the dominant exposure pathway for the Cattaraugus Creek receptor. Potential regulations limit the peak dose to the maximally exposed offsite individual to less than 25 mR/yr. The peak dose to the Cattaraugus Creek receptor for the case where the entire SDA inventory remains in-place is conservatively estimated to be 1.1 mR/yr under Alternative III and 1.4 mR/yr under Alternative IV. Both of these estimates are less than the regulatory limit, and the dominant dose contributor is C-14. If all 50-foot trench sections containing suspect GTCC waste are removed from the SDA, then the estimated peak dose to the maximally exposed offsite individual is 0.95 mR/yr under Alternative III and 1.2 mR/yr under Alternative IV. This represents a small reduction in an already acceptable offsite dose. Also, it is important to note that the marginal dose reduction is not a result of removing the suspect GTCC waste, but rather the result of removing commingled waste (which contains the C-14) in the 50-foot trench sections.

[11]Krieger, L.E. to T. J. Rowland, "New York State Licensed Disposal Area (SDA) Revised Disposal Database Data Quality Review and Confirmation of Greater-Than-Class C Waste Volumes Report and Revised Tables for SDA Waste Characterization Report," WD:97:1007-EIS, November 19, 1997.

Unexpected Conditions Cases - Although Alternatives III and IV involve long-term management of the SDA, scenarios which assume a loss of institutional controls were analyzed. From a decommissioning standpoint, hypothetical intruders that are assumed to occupy the site upon a loss of institutional controls should receive less than 500 mR/yr. The performance assessment results for the entire SDA inventory under Alternatives III and IV indicate that the estimated doses for the Buttermilk Creek intruder and the South Plateau Agricultural/Residential intruder will be much greater than 500 mR in the peak year. Selectively removing all 50-foot trench sections that contain suspect GTCC waste from the SDA will not change this outcome. Summarized below are the performance assessment results for the South Plateau Agricultural/Residential intruder and the Buttermilk Creek intruder.

South Plateau Residential/Agricultural Intruder - As indicated in Table 2 of Appendix A, the estimated peak dose under baseline conditions is 4×10^5 mR in the year 2106. This dose is attributed to Sr-90 and Cs-137. Removing all 50-foot trench sections that contain suspect GTCC does not change the estimated peak dose. The reason for this outcome is that Sr-90 and Cs-137 are present in significant inventories outside the 50-foot trench sections that contain suspect GTCC waste.

Buttermilk Creek Intruder - A hypothetical intruder was assumed to occupy a site along Buttermilk Creek in order to evaluate the impacts associated with uncontrolled erosion. Tables 3, 4, and 5 of Appendix A estimate the erosional impacts on the Buttermilk Creek intruder, assuming that institutional controls are lost after 100 years, 500 years, and 1000 years, respectively. If all 50-foot trench sections containing suspect GTCC waste are removed, the estimated peak dose to the Buttermilk Creek intruder is 19,000 mR/yr, 15,000 mR/yr, and 13,000 mR/yr assuming that institutional controls are lost after 100 years, 500 years, and 1000 years respectively. The results of the performance assessment indicate that removing all 50-foot trench sections that contain suspect GTCC waste will not significantly reduce the estimated peak dose or length of time the SDA needs to be managed. The reason for this outcome is that the radionuclides that drive long-term dose (Pu-239, Pu-240, and Am-241) are still present in significant quantities outside the 50-foot trench sections that contain suspect GTCC waste. The inventory of these long-term dose drivers (Pu-239, Pu-240, and Am-241) is primarily the result of Class C waste generated by Nuclear Fuel Services reprocessing operations being disposed throughout the SDA trenches.

4.0 CONCLUSION

Based on the additional efforts undertaken to date relating to selective exhumation of the SDA, including an additional waste reclassification analysis and an exhumation-specific performance assessment, selective exhumation would not significantly reduce the dose from the SDA, relative to potential offsite or intruder dose limits, nor shorten the timeframe during which institutional controls would need to be maintained.

APPENDIX A

Dose Estimates Following Selective Exhumation at the New York State-Licensed Disposal Area

- prepared by -
Science Applications International Corporation

Revision 0
2/20/98

Science Applications International Corporation
An Employee-Owned Company

February 20, 1998

Mr. Dan W. Sullivan
West Valley Project Office
U.S. Department of Energy
MS-DOE
10282 Rock Springs Road
P.O. Box 191
West Valley, New York 14171-0191

Subject: Dose Estimates following Selective Exhumation at the New York State-Licensed Disposal Area

Contract No. DE-AC24-94ID-13313, Task 11G
SAIC Project No. 01-XXXX-07-1802-XXX

Reference:

1. Memorandum from Dan Westcott, WVNS, "SDA Selective Exhumation," December 10, 1997.

2. Letter from L.E. Krieger, WVNS, to T.J. Rowland, DOE, "New York State Licensed Disposal Area (SDA) Revised Disposal Database Data Quality Review and Confirmation of Greater-Than-Class C Waste Volumes Report and Revised Data Tables for SDA Waste Characterization Report," November 19, 1997.

3. Letter from Jim Hammelman, SAIC, to Dan Sullivan, DOE-WVAO, "Revised Performance Assessment for the New York State-Licensed Disposal Area," February 9, 1998.

Dear Dan:

SAIC has prepared estimates of long-term doses following selective exhumation of certain waste in the SDA. In accordance with Ref. 1, two selective exhumation cases were analyzed:

1. Selectively exhuming trench sections that contain large fractions of the inventories of radionuclides that dominate the long-term dose impacts, and

2. Selectively exhuming trench sections that contain greater-than-Class C (GTCC) waste.

11251 Roger Bacon Drive, Reston, Virginia 20190 • (703) 318-4500
Other SAIC Offices: Albuquerque, Colorado Springs, Dayton, Falls Church, Huntsville, Las Vegas, Los Altos, Los Angeles, McLean, Oak Ridge, Orlando, San Diego, Seattle, Tucson

SAIC
An Employee-Owned Company

The most recent information prepared for the SDA Waste Characterization Report (Ref. 2) was used to identify the trench sections that were considered to be exhumed for each of these two cases.

To analyze Case 1, where the SDA would be selectively exhumed to remove trench sections containing nuclides that dominate the long-term dose, first, the radionuclides that dominated the long-term dose were identified, then their spatial distribution in the SDA trenches was reviewed (computed 1993 activity, Ref. 2). This review was conducted to determine if the radionuclides were relatively uniformly distributed and, therefore, could not be selectively exhumed, or if they were nonuniformly distributed, such that the highest inventories of these radionuclides could be selectively exhumed. The radionuclides that dominated the dose in the revised long-term performance assessment (Ref. 3) were: (a) C-14 for the groundwater release scenarios; (b) Pu-238, Pu-239, Pu-240, and Am-241 (which is produced by the decay of Pu-241) for the erosional collapse scenarios; and (c) Sr-90 and Cs-137 for the on-premises agricultural/ residential intruder scenario.

The review of spatial distributions for the radionuclides showed that C-14, Pu-239, Pu-240, Am-241, Pu-241, Sr-90, and Cs-137 were relatively uniformly distributed throughout the trenches and, therefore, selective exhumation of limited areas of the SDA would not greatly reduce the inventory of these radionuclides. However, Pu-238 was nonuniformly distributed and high inventories are located in discrete trench sections. Therefore, high Pu-238 inventories could be selectively exhumed to produce a change in the SDA inventory of a major dose-producing radionuclide. Figure 1 shows with a double-lined border, the 50-foot trench sections having high Pu-238 inventories that were assumed to be exhumed. These trench sections have Pu-238 inventories that are about one order of magnitude higher than all other trench sections in the SDA.

To analyze Case 2 where trench sections with GTCC waste would be exhumed, Ref. 2 was used to identify the 50-foot trench sections containing GTCC waste. These trench sections are denoted by "X"s in Figure 1. Figure 1 also shows that the trench sections having high Pu-238 inventories are a subset of the trench sections containing GTCC waste. Thus, it would be expected that exhuming the trench sections containing GTCC waste would result in a greater dose reduction than just exhuming trench sections containing high Pu-238 inventories.

It should also be noted that exhuming trench sections containing either GTCC waste or high inventories of Pu-238 would also remove other radionuclide inventories in those same trench sections.

Tables 1 through 5 present the dose estimates for: (1) the entire SDA using the revised inventory estimates (the results presented in Ref. 3), (2) selectively exhuming trench sections containing

SAIC
An Employee-Owned Company

high inventories of Pu-238, and (3) selectively exhuming trench sections containing GTCC waste. Table 1 presents the doses from the groundwater release scenarios for Alternatives IV (No Action: Monitoring and Maintenance) and III (In-Place Stabilization). Table 2 presents the dose to a postulated on-premises agricultural/residential intruder under Alternative IV; there would be no impacts to this intruder under Alternative III because of the thickness of the engineered cap. Tables 3, 4, and 5 present the doses if the SDA were eroded after 100, 500, and 1000 years, respectively.

Overall, the analysis shows there would be no major benefit in long-term performance from selective exhumation of the SDA:

- For the Cattaraugus Creek and Buttermilk Creek residents under the groundwater release scenarios (Table 1), the doses from the entire SDA (dominated by C-14) was lower than regulatory standards (25 mrem) before selective exhumation. Because C-14 is distributed relatively uniformly throughout all of the trenches, selectively exhuming the trench sections identified in Figure 1 would remove only a small percentage of the total C-14 inventory, resulting in a slight decrease in the dose. The doses to all receptors would still be well below regulatory standards.

- For the agricultural/residential intruder (Table 2), the dose from the entire SDA (dominated by Sr-90 and Cs-137) was much higher than regulatory standards (500 mrem). Because Sr-90 and Cs-137 are relatively uniformly distributed throughout all of the SDA trenches, selectively exhuming the trench sections identified in Figure 1 would only remove a small percentage of the total Sr-90 and Cs-137 inventory and the dose would not decrease.

  A plot of the dose to the agricultural/residential intruder for 10,000 years post-implementation is presented in Figure 2, which shows when the intruder dose would decay to below 500 mrem/yr and the SDA would no longer have to be under institutional control. If portions of the SDA were not selectively exhumed, institutional control would have to be maintained for about 4950 years (i.e., until about year 6950) to allow the inventory to decay so that the intruder dose would be below 500 mrem/yr. Exhuming the trench sections containing high inventories of Pu-238 would reduce the time required for institutional control by about 1300 years (i.e., until about year 5650). Exhuming the trench sections containing GTCC waste would reduce the time required for institutional control by about 1410 years (i.e., until about year 5540).

- For all erosional collapse scenarios (Tables 3, 4, and 5), the doses from the entire SDA were much higher than regulatory standards for all receptors. Selectively exhuming trench sections containing either high inventories of Pu-238 or GTCC waste would lower the peak annual doses, but the doses would still be much higher than regulatory standards. For all

SAIC
An Employee-Owned Company

cases (where SDA erosion begins after 100, 500, and 1,000 years), the dose to a Buttermilk Creek intruder would be greater than 500 mrem/yr until the SDA is eroded away. Because the creek bank would not erode into the SDA trenches for about 240 years, short-lived radionuclides would decay to relatively low levels, and the dose from erosional collapse of the SDA would be from the long-lived radionuclides Am-241, Pu-238, Pu-239, and Pu-240. Because Pu-238 would dominate the dose, for the case of erosion after 100 years, exhuming the trench sections with high inventories of Pu-238 would decrease the doses by 80%. Exhuming trench sections containing GTCC waste would decrease doses by 89%. For the case of erosion after 500 or 1000 years, the Pu-238 inventory would have decayed, and Pu-239, Pu-240, and Am-241 would dominate the dose. Because these radionuclides are relatively uniformly distributed throughout all of the trenches, selectively exhuming the trench sections identified in Figure 1 would only remove a small percentage of their total inventories, resulting in only a slight decrease in the dose.

If the entire SDA was left in place, institutional controls would have to be maintained for about 150,000 years to allow Pu-239 to decay long enough for the Cattaraugus Creek resident dose to be less than 25 mrem/yr. If the trench sections containing high inventories of Pu-238 were exhumed, the time required for institutional control would not be reduced; the SDA would still have to be maintained for about 150,000 years. If the trench sections containing GTCC waste were exhumed, the time required for institutional control would be slightly reduced, requiring management for about 143,000 years. This 7,000-year reduction in time is only a 0.05 percent reduction.

Please call me at (703) 318-4628 if you would like to discuss these results.

Sincerely,

SCIENCE APPLICATIONS
INTERNATIONAL CORPORATION

James E Hammelman

James E. Hammelman
Project Manager

Attachments: Figures 1 and 2
Tables 1 through 5

cc: P. Bembia, NYSERDA
D. Wescott, WVNS
P. Swain, SAIC

Figure 1. SDA Trench Sections Assumed to be Selectively Exhumed

Trench	Trench section (feet)												
No.	0-49	50-99	100-149	150-199	200-249	250-299	300-349	350-399	400-449	450-499	500-549	550-599	600-649
1													
2													
3			$\boxed{X}$										X
4	$\boxed{X}$												
5			X				X	X				X	
6													
7													
8	$\boxed{X}$					$\boxed{X}$	X	$\boxed{X}$	X	X			
9		$\boxed{X}$	X		X		$\boxed{X}$						
10	$\boxed{X}$	$\boxed{X}$	$\boxed{X}$	$\boxed{X}$	$\boxed{X}$	X		X					
11	X	$\boxed{X}$	X										
12						X							
13													
14													

$\boxed{}$ = these trench sections have high inventories of Pu-238 which dominates doses from the erosional collapse scenarios and are at much higher activities than other trench sections in the SDA (computed 1993 activity, Ref. 2).

X = these trench sections contain GTCC waste (1993 distribution, Ref. 2).

Table 1. Impact from Selective Exhumation of the SDA from the Groundwater Release Scenario, Alternative IV (No Action: Monitoring and Maintenance) and Alternative III (In-Place Stabilization)[a]

Receptor	Entire SDA[b]	Entire SDA less 50-ft trench sections containing high Pu-238 waste[c,d]	Entire SDA less 50-ft trench sections containing GTCC waste[c]
Alternative IV:			
Buttermilk Creek individual peak annual dose (mrem)[c]	10 (fish, C-14) [2240]	9.9 (fish, C-14) [2238]	9.2 (fish, C-14) [2235]
Cattaraugus Creek individual peak annual dose (mrem)	1.4 [2240]	1.3 [2238]	1.2 [2235]
Off-site population peak annual dose (person-rem)	0.8 [2240]	0.78 [2238]	0.72 [2235]
Cumulative off-site population dose over 1000 years (person-rem)	41	37	33
Alternative III:			
Buttermilk Creek individual peak annual dose (mrem)	8.2 (fish, C-14) [2309]	7.8 (fish, C-14) [2307]	7.2 (fish, C-14) [2304]
Cattaraugus Creek individual peak annual dose (mrem)	1.1 [2309]	1.0 [2307]	0.95 [2304]
Off-site population peak annual dose (person-rem)	0.66 [2309]	0.60 [2307]	0.57 [2304]
Cumulative off-site population dose over 1000 years (person-rem)	41	37	33

a. Doses are for year of maximum impact; the year of occurrence is provided in brackets.
b. From Ref. 1.
c. See Figure 1 for the trench sections assumed to be exhumed.
d. Pu-238 is the only radionuclide that dominated doses which could be selectively exhumed.

Table 2. Impact from Selective Exhumation of the SDA on the Agricultural/Residential Intruder, Alternative IV (No Action: Monitoring and Maintenance)[a]

Intruder	Entire SDA[b]	Entire SDA less 50-ft trench sections containing high Pu-238 waste[c,d]	Entire SDA less 50-ft trench sections containing GTCC waste[c]
Agricultural/residential intruder peak annual dose (mrem)	4.0×10^5 (garden, Sr-90 and Cs-137) [2106]	4.0×10^5 (garden, Sr-90 and Cs-137) [2106]	4.0×10^5 (garden, Sr-90 and Cs-137) [2106]

a. Doses are for year of maximum impact; the year of c..currence is provided in brackets. (Note that the agricultural/residential intruder scenario is credible for Alternative III (In-Place Stabilization), but there would be zero impacts.)

b. From Ref. 1.

c See Figure 1 for the trench sections assumed to be exhumed.

d. Pu-238 is the only radionuclide 'hat dominated doses which could be selectively exhumed.

Table 3. Impact from Selective Exhumation of the SDA Assuming Erosion[a] after 100 Years[b]

Receptor	Entire SDA[c]	Entire SDA less 50-ft trench sections containing high Pu-238 waste[d,e]	Entire SDA less 50-ft trench sections containing GTCC waste[d]
Buttermilk Creek individual peak annual dose (mrem)	170,000 (fish, Pu-238 77%, Am-241 10%, Pu-239 8%, Pu-240 5%) [2340]	34,000 (fish, Pu-239 42%, Am-241 28%, Pu-240 23%, Pu-238 7%) [2640]	19,000 (fish, Am-241 37%, Pu-239 36%, Pu-240 26%, Pu-238 1%) [2540]
Cattaraugus Creek individual peak annual dose (mrem)	22,400 [2340]	4,500 [2640]	2,500 [2540]
Off-site population peak annual dose (person-rem)	13,000 [2340]	2,700 [2640]	1,500 [2540]
Cumulative off-site population dose over 1000 years (person-rem)	38,000	14,000	8,600

a. For the case where releases are not limited by solubility. Because waste within a trench may be unconsolidated, the erosional collapse scenarios assume that an entire trench would collapse and fall into the creek at one time.

b. Erosional collapse after 100 years could apply to Alternative III (In-Place Stabilization) or IV (No Action: Monitoring and Maintenance) in the Draft EIS, where local erosion controls are maintained during the 100 years of institutional control. Doses are for year of maximum impact; the year of occurrence is provided in brackets.

c. From Ref. 1.

d. See Figure 1 for the trench sections assumed to be exhumed.

e. Pu-238 is the only radionuclide that dominated doses which could be selectively exhumed.

Table 4. Impact from Selective Exhumation of the SDA Assuming Erosion[a] after 500 Years[b]

Receptor	Entire SDA[c]	Entire SDA less 50-ft trench sections containing high Pu-238 waste[d,e]	Entire SDA less 50-ft trench sections containing GTCC waste[d]
Buttermilk Creek individual peak annual dose (mrem)	36,000 (fish, Pu-239 38%, Am-241 24%, Pu-240 22%, Pu-238 15%) [2740]	26,000 (fish, Pu-239 53%, Pu-240 28%, Am-241 19%) [3040]	15,000 (fish, Pu-239 44%, Pu-240 31%, Am-241 25%) [2740]
Cattaraugus Creek individual peak annual dose (mrem)	4,700 [2740]	3,400 [3040]	2,000 [2740]
Off-site population peak annual dose (person-rem)	2,800 [2740]	2,100 [3040]	1,200 [2740]
Cumulative off-site population dose over 1000 years (person-rem)	12,000	9,800	6,800

a. For the case where releases are not limited by solubility. Because waste within a trench may be unconsolidated, the erosional collapse scenarios assume that an entire trench would collapse and fall into the creek at one time.

b. Note that erosional collapse after 500 years was not analyzed in the Draft EIS, but is provided here for information. This case could apply to Alternative III (In-Place Stabilization) or IV (No Action: Monitoring and Maintenance) in the Draft EIS, where global erosion controls last for 500 years including time after institutional control is lost, or where local erosion controls are maintained for 500 years during post-implementation. Doses are for year of maximum impact; the year of occurrence is provided in brackets.

c. From Ref. 1.

d. See Figure 1 for the trench sections assumed to be exhumed.

e. Pu-238 is the only radionuclide that dominated doses which could be selectively exhumed.

Table 5. Impact from Selective Exhumation of the NDA Assuming Erosion[a] after 1000 Years[b]

Receptor	Entire SDA[c]	Entire SDA less 50-ft trench sections containing high Pu-238 waste[d,e]	Entire SDA less 50-ft trench sections containing GTCC waste[d]
Buttermilk Creek individual peak annual dose (mrem)	25,000 (fish, Pu-239 53%, Pu-240 30%, Am-241 16%) [3240]	23,000 (fish, Pu-239 60%, Pu-240 30%, Am-241 10%) [3540]	13,000 (fish, Pu-239 53%, Pu-240 35%, Am-241 12%) [3540]
Cattaraugus Creek individual peak annual dose (mrem)	3,300 [3240]	3,000 [3540]	1,700 [3540]
Off-site population peak annual dose (person-rem)	2,000 [3240]	1,800 [3540]	1,000 [3540]
Cumulative off-site population dose over 1000 years (person-rem)	9,800	8,300	5,800

a. For the case where releases are not limited by solubility. Because waste within a trench may be unconsolidated, the erosional collapse scenarios assume that an entire trench would collapse and fall into the creek at one time.

b. Erosional collapse after 1000 years could apply to Alternative III (In-Place Stabilization) or IV (No Action: Monitoring and Maintenance) in the Draft EIS, where global erosion controls last for 1000 years including time after institutional control is lost or where local erosion controls are maintained for 1000 years during post-implementation. Doses are for year of maximum impact; the year of occurrence is provided in brackets.

c. From Ref. 1.

d. See Figure 1 for the trench sections assumed to be exhumed.

e. Pu-238 is the only radionuclide that dominated doses which could be selectively exhumed.

Figure 2. Dose to the On-Premises Agricultural/Residential Intruder - WMA 8, Alternative IV, 0 to 10,000 Years Post Implementation