Sandia National Laboratories
Albuquerque, New Mexico
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Environmental Restoration Project
Responses to New Mexico Environment Department
NOTICE OF DEFICIENCY
for the
Mixed Waste Landfill: Corrective Measures Study Report, May 2003
EPA ID#: 5890110518
HWB-SNL-01-025

INTRODUCTION

This document responds to a Notice of Deficiency (NOD) received from the State of New Mexico Environment Department (NMED) regarding the Sandia National Laboratories Mixed Waste Landfill (MWL) Corrective Measures Study Report (SNL/NM May 2003). The NOD was issued in a letter from the NMED to the U.S. Department of Energy (DOE) on November 5, 2003 (Martin, November 5, 2003).

This document provides the NMED comments and the DOE/Sandia National Laboratories (SNL) response provided in *italics* on a separate line following "*DOE/SNL Response.*" Responses to general comments begin on page 1. Responses to specific comments begin on page 2.

Additional supporting data for DOE/SNL responses are included as attachments where designated. Attachment A presents figures from the MWL Corrective Measures Study Report that have been revised at the request of the NMED. Attachment B presents tables from the MWL Corrective Measures Study Report that have been revised at the request of the NMED. Revised text in each table is shown in *italics*.

NMED General Comments

The following general comments do not require a response. They are included herein to express the opinions of the New Mexico Environment Department (NMED, or Department) and for the benefit of the administrative record.

1. It is clear from the text of the Mixed Waste Landfill (MWL) Corrective Measures Study (CMS) Report that the U. S. Department of Energy (DOE)/Sandia National Laboratories (SNL) has the view that RCRA cover systems are inferior to evapotranspiration caps (ET caps). The NMED does not share this point of view. In the short term, there is ample evidence that RCRA covers will outperform ET caps. For the long term, there is no compelling evidence that a well-constructed RCRA cap made of modern materials is likely to fail simply because part of it would be constructed of man-made materials or fine-grain soil (clay). Additionally, not all RCRA cap variations contain fine-grain soil barriers.

Regardless, the NMED recognizes that ET caps are adequate for some sites, subject to certain geologic and climatological conditions. Modeling submitted with the ET cap design for the MWL, and modeling done for Kirtland Air Force Base's (KAFB's) Landfills 1, 2, and 8 indicate that ET caps should provide acceptable performance for landfills situated at both SNL and KAFB. The only reason not to install a RCRA cover system is that an ET cap is expected to provide acceptable performance at a lower cost.

2. Regarding the No Further Action (NFA) alternative, the NMED is unlikely to accept the operational cover because of the lack of documentation on its design, expected performance, the materials that it is constructed of, and the lack of construction quality data. Although there is some historical evidence that the operational cover meets corrective action objectives #1, 3, and 4, there are also uncertainties concerning whether this will remain true in the future. Additionally, the lack of construction and design documentation does not provide confidence to the NMED that corrective action objective #2 can be met in the future.

3. Actual monitoring and post-closure care requirements for the MWL will be negotiated later with the NMED, and will depend on the remedy selected by the Department.

4. The NMED reserves all rights with respect to any enforcement authority the Department may have with respect to radionuclides.

NMED Specific Comments

Below are specific comments, most which require a response. Comments not requiring a response are included herein to express the opinions of the NMED and for the benefit of the administrative record.

1. Page 48, 2nd paragraph, Health and Safety -- This paragraph says that excavation and characterization present moderate health and safety concerns, and the risk to site workers is ranked medium. This seems to be inconsistent with the language in the first paragraph of Section 3.2.11.1 (page 47), which states "This alternative poses little exposure risk to site workers, the public, and wildlife". The latter suggests that the risk to site workers should be changed from "medium" to "low". Provide an explanation as to which risk level is correct in the DOE/SNL's opinion.

DOE/SNL Response: Page 48, 2nd paragraph, Health and Safety -- This paragraph refers to MWL Alternative V.e—Future Excavation, which includes hazards from excavation and characterization machinery, heat stress, pressure hazards, noise, and ergonomic work strain. DOE/SNL considers the risk to site workers from construction and characterization hazards as medium. Section 3.2.11.1, page 47, refers to Corrective Action Objective No. 1, radiological dose to site workers, representative members of the public, radon emissions, and radiological dose to wildlife. DOE/SNL believes there is little exposure risk because total radionuclide activity will have decayed to safer levels.

2. Page 48, Section 3.2.11.3, Cost -- The cost for disposal has not been included as it should be. Given that costs are given as present value, the cost today for disposal of waste should have been included. For simplicity, the NMED suggests using the cost for disposal included in the landfill excavation scenario presented in Appendix H, which is in the range of $122,000,000. Provide a disposal cost for this remedial alternative.

DOE/SNL Response: An estimated cost for transportation and disposal of waste for MWL Alternative V.e—Future Excavation is $168,525,120. This estimate is consistent with transportation and disposal costs used for Alternative V.b—Complete Excavation with Off-site Disposal and assumes all soils will be returned to the excavation as backfill. The text in Section 3.2.11.3 has been revised to state, "Direct capital costs for the Future Excavation alternative are $235,603,841. Costs for shipment of waste to an off-site, licensed disposal facility are included."

3. Page 51, Section 4.1, first bullet below 1st paragraph -- Clarify whether institutional controls (ICs) will include monitoring for durations as much as 100 years, given that 30 and 70 year time periods are used elsewhere in the document.

DOE/SNL Response: The actual monitoring and post-closure care requirements for the MWL will be negotiated with the NMED, and will depend on the remedy selected. The 30-, 70- and 100-year time periods used in the document are planning tools. According to NRC 10 CFR 61, 100 years is the longest period of time that active ICs can be relied upon. The 30-year time period used to calculate long-term monitoring costs is based on

a RACER code limitation. The 70-year time period (Table 4-1) is based on a DOE planning horizon for Long-Term Stewardship.

4. Page 61, Section 4.3.4, first paragraph -- see specific comment #2.

DOE/SNL Response: *An estimated cost for transportation and disposal of waste for MWL Alternative V.e—Future Excavation is $168,525,120. This estimate is consistent with transportation and disposal costs used for Alternative V.b—Complete Excavation with Off-site Disposal, and assumes all excavated soils will be returned to the excavation as backfill. See response to Specific Comment No. 2.*

5. Page 62, Section 4.3.4.2, first sentence -- Note that mixed and hazardous waste may require treatment before disposal to meet the land disposal restrictions in 20.4.1.800 NMAC incorporating 40 CFR Part 268. No response is required.

DOE/SNL Response: *Comment acknowledged.*

6. Page 63, Section 4.3.4.4 -- Although excavation may take only an estimated two years, the design and construction of support facilities, which must precede excavation, will likely take several additional years. This is demonstrated in Appendix H for the excavation scenario described in that appendix. Please provide an estimate of the total project duration for the future excavation scenario.

DOE/SNL Response: *The design and construction of support facilities, which precede excavation, will take three to five years. Excavation will require an additional 2 years. Total project duration for the future excavation scenario is estimated to be five to seven years.*

7. Page 63, Section 4.3.4.5, 2nd sentence -- The language in this sentence is poor and implies that there will be no costs for waste disposal for future excavation. Provide clarification.

DOE/SNL Response: *Section 4.3.4.5 has been revised to state the following, " Capital costs for MWL Alternative V.e—Future Excavation are $325,704,159, including waste disposal costs. Because there are no operations and maintenance costs for Alternative V.e, operations and maintenance costs are not included in the estimate."*

8. Page 65, Section 5, first paragraph following the four bullets -- See general comment #2. No response is required.

DOE/SNL Response: *Comment acknowledged.*

9. Page 65, Section 5, 2nd paragraph following the four bullets -- The text states "This selection is based on years of dialogue with the NMED and the public in determining the best approach for closure of the site." Clarify whether the CMS added value to this conclusion.

DOE/SNL Response: The CMS added value to the remedy selection process by verifying (through the formal CMS process) the results of earlier studies by DOE/SNL. These earlier studies identified that NFA with ICs and MWL Alternative III.b —Vegetative Soil Cover were the best alternatives for the MWL (SNL/NM 1996; SNL/NM 1999).

10. Figures 1-3 and 1-4. There is a dashed line in both figures separating the northern and southern halves of the unclassified area. In Figure 1-3, the dashed line presumably represents part of the MWL perimeter according to the legend. In Figure 1-4, it represents a fence. Provide clarification.

DOE/SNL Response: The dashed lines in Figures 1-3 and 1-4 represent MWL fencing. The outermost dashed line represents perimeter fencing. The legend in Figure 1-3 has been revised for clarification. The revised Figure 1-3 and Figure 1-4 are included in Attachment A.

11. Figures 3-1 through 3-7. All of these figures do not include a scale. Resubmit the figures with the appropriate scales included. The addition of an arrow to indicate the north direction on each figure should also be included for the benefit of the public.

DOE/SNL Response: An appropriate scale and a north arrow will be added to Figures 3-1 through 3-7. The revised figures are included in Attachment A.

12. Table 2-1, "NFA" corrective measure, "Comments" block at bottom of table -- See general comment #2. No response is required.

DOE/SNL Response: Comment acknowledged.

13. Table 2-1, "ICs" corrective measure, "Long-term Surveillance and Maintenance" technology description, column on "Responsiveness to Corrective Action Objectives" -- For reasons explained in general comment #2 above, the NMED's opinion is that this column should contain the ranking of "no" instead of "yes". No response is required.

DOE/SNL Response: Comment acknowledged.

14. Table 2-1, "Containment" corrective measure, "Structural Barriers" technology description, column on "Performance" -- the NMED agrees that the long-term performance of this technology can be poor if proper maintenance is not being conducted. The NMED disagrees with the first sentence in the "Comments" block in that structural barriers such as concrete and asphalt can easily meet corrective action objectives #2 and #3, provided that such barriers are well maintained. However, in the case of the MWL, the Department would prefer a remedial alternative that will require as little maintenance as possible. Thus, no response is required.

DOE/SNL Response: Comment acknowledged.

15. Table 2-1, "Containment" corrective measure, "RCRA Subtitle C Cap" technology description, column on "Performance" -- For reasons stated in general comment # 1 above, the NMED believes strongly that the performance of a RCRA cap should be ranked as least as high as an ET cap. Thus, DOE/SNL should consider changing the performance ranking from "Fair" to "Good", and resubmitting this page of Table 2-1.

DOE/SNL Response: DOE/SNL spent a considerable amount of time researching and evaluating the performance of RCRA Subtitle C Caps vs. the performance of Vegetative soil covers and considered changing the performance ranking of a RCRA Subtitle C Cap from "Fair" to "Good". However, based on the body of scientific evidence cited in the literature, DOE/SNL decided that the performance of a RCRA Subtitle C Cap should not be ranked as high as a vegetative soil cover in arid and semi-arid environments of the southwestern U.S.

DOE/SNL agree that the short-term performance of a RCRA Subtitle C Cap is comparable to vegetative soil covers assuming identical construction quality assurance (CQA) and construction quality control (CQC). However, the phrase "short-term" is not defined in the regulations. DOE/SNL believe that the long-term performance of a RCRA Subtitle C Cap is highly questionable and suspect based on the use of synthetic materials and complex, multi-layer designs.

16. Table 2-1, "Containment" corrective measure, "Bio-Intrusion Barrier" technology description -- A bio-intrusion barrier alone would not likely be accepted by the NMED as a remedial alternative. It may be accepted in combination with another technology. No response is required.

DOE/SNL Response: Comment acknowledged.

17. Tables 2-1, technology descriptions for "Complete Excavation" and "Partial Excavation" with either "Above-Ground Retrievable Storage" or "Offsite Disposal", "Comments" blocks for all four cases -- NMED agrees that these technologies are problematic with regard to meeting corrective action objective #1 in the short term. However, these technologies, in the long term, are responsive to corrective action objective #1 (assuming in the cases for partial excavation that this is also true for a technology applied to the unclassified portion of the landfill). Resubmit these pages of Table 2-1 with language stating that objective # 1 will be met in the long term; include also language that corrective objective #1 will not be met in the short term as currently indicated.

DOE/SNL Response: Comment acknowledged. Technology descriptions in Table 2-1 regarding Complete Excavation and Partial Excavation with either Above-Ground Retrievable Storage or Off-Site Disposal have been changed to state, "This technology is not responsive to Corrective Action Objective 1 in the short term; however, it is responsive to Corrective Action Objective 1 in the long term." The revised pages from Table 2-1 are included in Attachment B.

18. Table 2-2, "Long-Term Surveillance and Maintenance" technology column -- the column for "Responsiveness to Corrective Action Objectives" -- For reasons stated in general comment #2, the NMED believes that this column should be changed from "yes" to "no". No response is required.

DOE/SNL Response: Comment acknowledged.

19. Table 2-2, "RCRA Subtitle C Cap" technology column -- the column for "Performance" -- see specific comment #15.

DOE/SNL Response: Comment acknowledged. See response to Specific Comment No. 15.

20. Table 3-1, Alternatives V.a and V.b -- State the reasons why long-term monitoring, maintenance, and access controls will be required for these complete excavation scenarios.

DOE/SNL Response: Long-term monitoring, maintenance, and access controls will not be required for MWL Alternatives V.a and V.b. In addition, long-term monitoring and maintenance will not be required for MWL Alternatives V.c and V.d because exposure and migration risks will have been significantly reduced. However, access controls will be required for MWL Alternatives V.c and V.d. Table 3-1 has been revised accordingly. The revised Table 3-1 is included in Attachment B.

21. Table 3-4, alternatives III.d and III.e -- See general comment #1 above. For the limit migration of contaminants to ground water column, NMED believes that the rankings of "No" should be changed to "Yes", and that the text should explain that the RCRA cap alternatives were not given further evaluation in Chapter 4 because they cost more than ET caps. No response is required.

DOE/SNL Response: Comment acknowledged.

22. Table 3-4, alternatives V.a to V.d -- SNL/DOE should indicate in a footnote in the table that their failure in meeting the corrective action objective of "minimize exposure to workers, the public, and wildlife" is limited to the short-term because of the increased exposure during the excavation phases. In the long-term, these alternatives can meet this corrective action objective. Make this change and resubmit the table.

DOE/SNL Response: A footnote has been added to Table 3-4 for MWL Alternatives V.a to V.d stating, "This alternative's failure in meeting Corrective Action Objective 1 is limited to the short term because of the increased exposure during excavation. In the long term, this alternative meets Corrective Action Objective 1 in minimizing exposure to workers, the public, and wildlife." The revised Table 3-4 is included in Attachment B.

23. Table 3-4, alternative V.e, column for "Worker Health and Safety Risk" -- See specific comment # 1.

DOE/SNL Response: Comment acknowledged. See response to Specific Comment No. 1.

24. Table 4-1, extent of long-term monitoring -- Clarify whether DOE/SNL really intend to monitor ground water for 70 years, or whether this duration of monitoring is just being assumed for the purpose of calculating costs and for suggested post-closure activities. See also general comment #3.

DOE/SNL Response: The actual monitoring and post-closure care requirements for the MWL will be negotiated with the NMED, and will depend on the remedy selected. The 70-year time period (Table 4-1) is based on a DOE planning horizon for Long-Term Stewardship. DOE/SNL intend to monitor groundwater for as long as monitoring is warranted.

25. Table 4-1, Short term reduction in existing risks, future excavation alternative -- The risk assessments assume that the levels of radiological and chemical constituents will be similar to those detected during the RCRA Facility Investigation (RFI). Although the nonradiological risk would be difficult to estimate without further information, the health risk due to chemicals could be much higher than that corresponding to the levels of contaminants detected at the landfill during the RFI. The same applies to radiological constituents, which already show a high level of risk in the future excavation scenario. No response is required.

DOE/SNL Response: Comment acknowledged.

26. Table 4-1, "Cost", "Future Excavation" alternative -- change the table to include disposal costs and resubmit. See specific comment #2.

DOE/SNL Response: MWL Alternative V.e—Future Excavation in Table 4-1 has been revised to include waste disposal costs. Table 4-1 has also been revised to clarify issues raised in Specific comment No. 32 regarding reduction in toxicity, mobility, and volume of waste. The revised Table 4-1 is presented in Attachment B.

27. Table 4-2, "Ecological (Rad) and Transportation and Remediation Injuries and Fatalities" -- include the units of measure and resubmit the table.

DOE/SNL Response: The units for "Ecological Rad" are Rad/day. Injuries and fatalities are unitless. These are total predicted numbers of injuries and fatalities based on the remedial option. The table has been revised and is included in Attachment B.

28. Table 4-3, alternative V.e, under direct costs, include the cost of disposal and correct accordingly the total cost (last column). See specific comment #2.

DOE/SNL Response: Table 4-3, MWL Alternative V.e—Future Excavation has been revised to include the cost of waste disposal. The revised Table 4-3 is included in Attachment B.

29. Appendix B -- For the category of monitoring, for each cost summary report, it is not clear what the costs are for each type of monitoring. Provide clarification.

DOE/SNL Response:
The costs for each type of monitoring are summarized in the attached Table 29a. Additional details on the monitoring costs are included in the Technology Cost Detail reports in Appendix C of the CMS.

30. With regard to the information presented in Chapter 4 (and associated appendices), please provide the following information in table format:

A. For each remedial alternative, indicate the type, frequency, and duration of monitoring assumed for the purposes of calculating costs.

DOE/SNL Response: The type, frequency, and duration of monitoring assumed for each remedial alternative for the purposes of calculating costs are shown in the attached Table 30a. Monitoring at the site may continue for many years; however, because of software limitations, monitoring costs for only 30 years were assumed in the cost estimates, with the exception of MWL Alternative V.e—Future Excavation.

B. Using total costs (directs plus markups), breakout the costs of monitoring, surveillance, and maintenance for each remedial alternative. Escalate the costs for each type of monitoring/surveillance/maintenance for a period of 30 years (or 70 or 100 years) using an average inflation rate of 4% per year (or justify and use another rate). Report also the difference between the escalated costs and their present value.

DOE/SNL Response: The attached *Table 30b breaks out the costs of monitoring and surveillance and maintenance for each remedial alternative. Escalated costs for each type of monitoring, surveillance and maintenance are provided for all alternatives. A 30-year monitoring period is assumed for all alternatives except for MWL Alternative V.e—Future Excavation. Future excavation assumes a monitoring period from 2006 until the hypothetical excavation date (2040).*

Escalation factors are provided by the RACER cost-estimating program, and are the latest Office of Management and Budget Calculation, as published by the Department of Defense Comptroller. Escalation factors vary from year to year. For example, in RACER, the escalation from 2001 to 2002 is 1.0272; from 2002 to 2003 it is 1.0198; and from 2003 to 2004 it is 1.0216. Escalation includes inflation; however, the inflation component of the rates published by the comptroller is not extractable from the RACER program, but may be obtained from the comptroller for the rates published in 2001.

Table 29a. Monitoring costs and details for the various alternatives.

Type of Monitoring	Direct Cost	Markups	Total Cost	Duration	Period	Frequency[1]	Proposed Alternatives	Monitoring Details
Groundwater, Soil, Vegetation, and Air	$864,012	$494,492	$1,358,504	30 years	2007 through 2036	Annually	NFA with Institutional Controls Bio-Intrusion Barrier Vegetative Soil Cover Vegetative Soil Cover with Bio-Intrusion Barrier RCRA Subtitle C Cap RCRA Subtitle C Cap with Bio-Intrusion Barrier Future Excavation	Groundwater may be analyzed for tritium, gross alpha/beta activity, gamma spectroscopy, target analyte list metals, volatile organic compounds, nitrate, major ions, and alkalinity. Soil may be analyzed for tritium and gamma spectroscopy. Vegetation may be analyzed for tritium and gamma spectroscopy. Air may be analyzed for tritium, gamma spectroscopy, and gross alpha/beta.
Long-Term Surveillance and Maintenance	$70,115	$98,629	$168,744	30 years	2007 through 2036	Quarterly	NFA with Institutional Controls Bio-Intrusion Barrier Vegetative Soil Cover Vegetative Soil Cover with Bio-Intrusion Barrier RCRA Subtitle C Cap RCRA Subtitle C Cap with Bio-Intrusion Barrier Future Excavation	Surveillance and maintenance activities may include seeding, mulching, grading, erosion control, signage, and fencing
Vadose Zone Monitoring	$328,260	$261,249	$589,509	30 years	2007 through 2036	Annually	Bio-Intrusion Barrier Vegetative Soil Cover Vegetative Soil Cover with Bio-Intrusion Barrier RCRA Subtitle C Cap RCRA Subtitle C Cap with Bio-Intrusion Barrier Future Excavation	Vadose zone monitoring may consist of Flexible Liner Underground Technologies (FLUTe) and neutron moisture content monitoring. The Vadose FLUTe systems may have 5 access ports, installed at increments of 50 ft to a total depth of 250 ft bgs. The ports may be sampled annually for tritium and volatile organic compounds. Neutron probe access holes may be monitored annually for moisture content. More frequent sampling may be advantageous during the first two years of monitoring to establish baseline vadose zone conditions. These additional costs are not included.

Table 29a. Monitoring costs and details for the various alternatives (con't).

Type of Monitoring	Direct Cost	Markups	Total Cost	Duration	Period	Frequency[1]	Proposed Alternatives	Monitoring Details[1]
Groundwater, Soil, Vegetation, and Air	$115,202	$65,932	$181,134	4 years	2037 through 2040	Annually	Future Excavation	Groundwater may be analyzed for tritium, gross alpha/beta activity, gamma spectroscopy, target analyte list metals, volatile organic compounds, nitrate, major ions, and alkalinity. Soil may be analyzed for tritium and gamma spectroscopy. Vegetation may be analyzed for tritium and gamma spectroscopy. Air may be analyzed for tritium, gamma spectroscopy, and gross alpha/beta.
Long-Term Surveillance and Maintenance	$9,349	$12,964	$22,313	4 years	2037 through 2040	Quarterly	Future Excavation	Surveillance and maintenance activities may include seeding, mulching, grading, erosion control, signage, and fencing
Vadose Zone Monitoring	$43,768	$34,826	$78,594	4 years	2037 through 2040	Annually	Future Excavation	Vadose zone monitoring may consist of Flexible Liner Underground Technologies (FLUTe) and neutron moisture content monitoring. The Vadose FLUTe systems may have 5 access ports, installed at increments of 50 ft to a total depth of 250 ft bgs. The ports may be sampled annually for tritium and volatile organic compounds. Neutron probe access holes may be monitored annually for moisture content.

[1]The actual monitoring and post-closure care requirements for the MWL will be negotiated with the NMED, and will depend on the remedy selected

Table 29a. Monitoring costs and details for the various alternatives (con't).

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Groundwater, Soil, Vegetation, and Air	$115,202	$65,932	$181,134	4 years	2037 through 2040	Annually	Future Excavation	Groundwater may be analyzed for tritium, gross alpha/beta activity, gamma spectroscopy, target analyte list metals, volatile organic compounds, nitrate, major ions, and alkalinity. Soil may be analyzed for tritium and gamma spectroscopy. Vegetation may be analyzed for tritium and gamma spectroscopy. Air may be analyzed for tritium, gamma spectroscopy, and gross alpha/beta.
Long-Term Surveillance and Maintenance	$9,349	$12,964	$22,313	4 years	2037 through 2040	Quarterly	Future Excavation	Surveillance and maintenance activities may include seeding, mulching, grading, erosion control, signage, and fencing
Vadose Zone Monitoring	$43,768	$34,826	$78,594	4 years	2037 through 2040	Annually	Future Excavation	Vadose zone monitoring may consist of Flexible Liner Underground Technologies (FLUTe) and neutron moisture content monitoring. The Vadose FLUTe systems may have 5 access ports, installed at increments of 50 ft to a total depth of 250 ft bgs. The ports may be sampled annually for tritium and volatile organic compounds. Neutron probe access holes may be monitored annually for moisture content.

[1]The actual monitoring and post-closure care requirements for the MWL will be negotiated with the NMED, and will depend on the remedy selected

Table 30a. Type, frequency, and duration of monitoring assumed for the purposes of calculating costs in the MWL CMS.

General Corrective Measure	Alternative	Description	Monitoring Type										Surveillance and Maintenance[6]	
			Groundwater[1]		Soil[2]		Vegetation[3]		Air[4]		Vadose Zone[5]			
			Frequency	Duration	Frequency	Duration	Frequency	Duration	Frequency	Duration	Frequency	Duration	Frequency	Duration
	I.a	NFA with ICs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	None	NA	Quarterly	30 yrs
Containment	III.a	Bio-Intrusion Barrier	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Quarterly	30 yrs
	III.b	Vegetative Soil Cover	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Quarterly	30 yrs
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Quarterly	30 yrs
	III.d	RCRA Subtitle C Cap	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Quarterly	30 yrs
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Annually	30 yrs	Quarterly	30 yrs
Excavation	V.a	Complete Excavation with Aboveground Retrievable Storage	none	NA	none	NA	none	NA	none	NA	none	NA	none	NA
	V.b	Complete Excavation with Off-Site Disposal	none	NA	none	NA	none	NA	none	NA	none	NA	none	NA
	V.c	Partial Excavation with Aboveground Retrievable Storage	none	NA	none	NA	none	NA	none	NA	none	NA	none	NA
	V.d	Partial Excavation with Off-Site Disposal	none	NA	none	NA	none	NA	none	NA	none	NA	none	NA
	V.e	Future Excavation	Annually	Until Excavation[7]	Annually	Until Excavation[7]	Annually	Until Excavation[7]	Annually	Until Excavation[7]	Annually	Until Excavation[7]	Quarterly	Until Excavation[7]

[1]Groundwater samples may be analyzed for tritium, gross alpha/beta, gamma spectroscopy, TAL metals, VOCs, nitrate, major ions, and alkalinity.
[2]Soil samples may be analyzed for tritium and gamma spectroscopy.
[3]Vegetation samples may be analyzed for tritium and gamma spectroscopy.
[4]Air samples may be analyzed for tritium, gamma spectroscopy, and gross alpha/beta.
[5]Vadose zone monitoring may be conducted for moisture content (by neutron logging), tritium, and VOCs.
[6]Surveillance and maintenance activities may include seeding, mulching, grading, erosion control, signage, and fencing.
[7]Assumes a hypothetical excavation date 50 years after closure of the landfill, i.e., 2040.

NA - Not Applicable

Table 30b. Escalated costs for monitoring and surveillance and maintenance for each of the MWL alternatives.

General Corrective Measure	Alternative	Description	Monitoring Costs[1]			Surveillance and Maintenance Costs[2]		
			Total Cost	Escalated Cost[3,4]	Cost Difference	Total Cost	Escalated Cost[3,4]	Cost Difference
	I.a	NFA with ICs	$1,370,839	$2,099,928	$729,089	$169,825	$260,153	$90,328
Containment	III.a	Bio-Intrusion Barrier	$1,948,013	$2,984,023	$1,036,010	$168,744	$258,501	$89,757
	III.b	Vegetative Soil Cover	$1,948,013	$2,984,023	$1,036,010	$168,744	$258,501	$89,757
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	$1,948,013	$2,984,023	$1,036,010	$168,744	$258,501	$89,757
	III.d	RCRA Subtitle C Cap	$1,948,013	$2,984,023	$1,036,010	$168,744	$258,501	$89,757
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier	$1,948,013	$2,984,023	$1,036,010	$168,744	$258,501	$89,757
Excavation	V.a	Complete Excavation with Aboveground Retrievable Storage	$0	$0	$0	$0	$0	$0
	V.b	Complete Excavation with Off-Site Disposal	$0	$0	$0	$0	$0	$0
	V.c	Partial Excavation with Aboveground Retrievable Storage	$0	$0	$0	$0	$0	$0
	V.d	Partial Excavation with Off-Site Disposal	$0	$0	$0	$0	$0	$0
	V.e	Future Excavation	$2,207,741	$3,501,778	$1,294,037	$191,057	$302,980	$111,923

[1]Monitoring costs are for groundwater monitoring, soil sampling, vegetation sampling, air sampling, and vadose zone monitoring. Monitoring costs do not include the cost of the vadose zone monitoring system, which will cost an estimated $228,457 in current dollars.

[2]Surveillance and maintenance costs include costs for seeding, mulching, grading, erosion control, signage, and fencing.

[3]Escalated costs are based on a 30-year monitoring period for all alternatives except for MWL Alternative V.e--Future Excavation. Escalation for Future Excavation assumes monitoring and surveillance and maintenance will continue until excavation (hypothetically, 50 years after landfill closure, i.e. in 2040).

[4]Escalation factors were provided by the RACER cost estimating program, and are the latest Office of Management and Budget Calculation, as published by the Department of Defense Comptroller.

Table 30c. Cost per square foot of warehouses and support buildings for all remedial alternatives

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.a - Complete Excavation with Aboveground Retrievable Storage - Option A	UnClassified Soil Storage Warehouse 1	High Bay Warehouse	$20,778,390	$29,400,000	569,999	$51.58
	UnClassified Soil Storage Warehouse 2	High Bay Warehouse	$20,778,390	$29,400,000	569,999	$51.58
	UnClassified Soil Storage Warehouse 3	High Bay Warehouse	$20,778,390	$29,400,000	569,999	$51.58
	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Classified Soil Storage Warehouse 2	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$684,704	$927,000	5,286	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.a - Complete Excavation with Aboveground Retrievable Storage - Option B	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$294,423	$398,610	2,273	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.b - Complete Excavation with Off-Site Disposal - Option A	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$294,423	$398,610	2,273	$175.37

Table 30c. Cost per square foot of warehouses and support buildings for all remedial alternatives (Con't)

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.b - Complete Excavation with Off-Site Disposal - Option B	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Unclassified Waste Storage Warehouse	High Bay Warehouse	$21,114,374	$29,875,000	569,999	$52.41
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$294,423	$398,610	2,273	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.c - Partial Excavation with Aboveground Retrievable Storage - Option A	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Classified Soil Storage Warehouse 2	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$294,423	$398,610	2,273	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.c - Partial Excavation with Aboveground Retrievable Storage - Option B	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$198,564	$268,830	1,533	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.d - Partial Excavation with Off-Site Disposal - Option A	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	MWL Storage Facility Office	General Administrative Facility	$95,859	$129,780	740	$175.37

Table 30c. Cost per square foot of warehouses and support buildings for all remedial alternatives (Con't)

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.d - Partial Excavation with Off-Site Disposal - Option B	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	MWL Storage Facility Office	General Administrative Facility	$95,859	$129,780	740	$175.37

	Facility	Model Type	Facility Direct Cost	Facility Total Cost	Area (ft^2)	Total Cost ($/$ft^2$)
Alternative V.e - Future Excavation	Classified Soil Storage Warehouse 1	High Bay Warehouse	$17,563,199	$24,850,000	477,803	$52.01
	Classified Waste Storage Warehouse	High Bay Warehouse	$5,080,123	$7,188,000	103,459	$69.48
	MWL Storage Facility Office	General Administrative Facility	$198,564	$268,830	1,533	$175.37

Note: All costs are in today's dollars.

Table 30d. Costs per mile of roads to be constructed for each remedial alternative.

General Corrective Measure	Alternative	Description	Road Length (Miles)	Total Cost[1] of Roads	Cost per Mile ($)	Cost per Linear Ft ($)
	I.a	NFA with ICs	1.92	$126,211	$65,849	$12.47
Containment[2]	III.a	Bio-Intrusion Barrier	1.92	$122,554	$63,941	$12.11
	III.b	Vegetative Soil Cover	1.92	$122,554	$63,941	$12.11
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	1.92	$122,554	$63,941	$12.11
	III.d	RCRA Subtitle C Cap	1.92	$122,554	$63,941	$12.11
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier	1.92	$122,554	$63,941	$12.11
Excavation[3]	V.a	Complete Excavation with Aboveground Retrievable Storage	3.08	$713,069	$231,550	$43.85
		Complete Excavation with Aboveground Retrievable Storage	1.36	$314,908	$231,550	$43.85
	V.b	Complete Excavation with Off-Site Disposal	1.36	$314,908	$231,550	$43.85
		Complete Excavation with Off-Site Disposal	1.36	$314,908	$231,550	$43.85
	V.c	Partial Excavation with Aboveground Retrievable Storage	1.33	$307,962	$231,550	$43.85
		Partial Excavation with Aboveground Retrievable Storage	1.00	$231,550	$231,550	$43.85
	V.d	Partial Excavation with Off-Site Disposal	0.75	$173,663	$231,550	$43.85
		Partial Excavation with Off-Site Disposal	0.75	$173,663	$231,550	$43.85
	V.e	Future Excavation	1.00	$231,550	$231,550	$43.85

[1]Total cost = direct cost plus markups

[2]Road costs for the NFA and Containment alternatives were determined by RACER, and are for a one-lane crowned dirt road from the MWL south to the clean soil piles located west of the Corrective Action Management Unit.

[3]Road costs for the Excavation alternatives were determined by PACES, and are for a 2-lane crowned asphalt road from the landfill to the va high-bay warehouses.

34. Appendix H, Page J-4, Section 2.3.1, 2nd paragraph, last sentence -- The language in this sentence is unclear. Provide clarification.

DOE/SNL Response: The assumption that the tenth-value (0.1 percent) shielding layers are intact enables the potential exposure rate to the Co-60 sources (estimated to be 28,000 mrem/hr at one-foot distance if unshielded) to be reduced to 28 mrem/hr at one-foot distance, or 1.1 mrem/hr at five-feet distance.

35. Appendix H, Page J-8, Section 2.4.1, last paragraph, 1st sentence -- It seems likely that the planning phase of the project could be reduced to no more than 3 years at most, as many planning tasks can be done simultaneously. Provide justification why this phase should take 5 years.

DOE/SNL Response: As was recently experienced for other SNL corrective measures [i.e., the Technical Area 3 Chemical Waste Landfill (CWL) and the Corrective Action Management Unit (CAMU)], this process, which includes RCRA permitting, can take up to five years to complete, considering all the technical regulations and public requirements and the number of stakeholders involved. It is agreed that planning could be completed in three years; however, the original statement included tasks other than planning. The contracting, facility construction, function testing, process proving and final readiness review could take an additional two years to complete.

36. Appendix H, Pages J-9 (Section 2.4.2, last paragraph) and J-11 (Section 2.4.3, last paragraph) -- The information on these pages suggest that full excavation of the landfill will take nearly 6 years to complete. Under the future excavation scenario presented in the main text, full excavation is estimated to take only two years to complete. Explain this difference in time.

DOE/SNL Response: The estimated two years of excavation cited in the main text is for excavation 50 years in the future, when radiological risks will be greatly reduced. The total estimated duration of six years cited in Appendix H, for near-future excavation, includes 3.5 years for excavation and initial screening of debris from the Unclassified Area and 2.5 years for excavation and initial screening of debris from the Classified Area.

37. Appendix H, Page J-11, Section 2.4.4, Waste Management -- The Department is unlikely to accept a remediation proposal which would include provisions that would allow treatment and disposal to be delayed until the landfill was completely excavated (six years later). Should the Department select an excavation alternative for the landfill, treatment and disposal would be required to commence immediately upon implementation of the corrective measure. No response is required.

DOE/SNL Response: Comment acknowledged. There is a typographical error. Waste management would start concurrently with excavation.

38. Appendix H, Page J-12, 4th paragraph, Treatment -- Be advised that shredding and mixing, and other forms of treatment, require a RCRA permit. No response is required.

DOE/SNL Response: Comment acknowledged.

39. Appendix H, Page J-13, Backfill -- Be advised that an engineered cap may be required for the MWL even if it is excavated, depending on the final state of the landfill. The alternative described in Appendix H assumes that any residual contamination would meet acceptable risk levels without the need for a cap. No response is required.

DOE/SNL Response: Comment acknowledged.

40. Appendix H, Page J-16, Table J-5, "Long-term Reliability and Effectiveness", "Extent of Long-Term Monitoring" -- This part of the table indicates that ground water monitoring was assumed to continue for 30 years. Under the future excavation alternative in the main text, ground water monitoring is not going to be conducted. Explain this difference.

DOE/SNL Response: The main text in Table 4-1 indicates that "No monitoring required after excavation" because it is assumed that risk-based closure of the Mixed Waste Landfill can be obtained and it can be demonstrated that there are no potential remaining impacts to groundwater. Appendix H assumes 30 years of long-term groundwater monitoring due to the presence of excavated contaminated materials without off-site disposal options in storage buildings that are erected at the site.

41. Appendix H, Page J-16, Table J-5, "Reduction in Toxicity, Mobility, and Volume" -- See specific comment #32, and if necessary, correct the table accordingly.

DOE/SNL Response: The referenced table is correct. As per the response to comment No. 32, the estimated volume of excavated contaminated soils (contaminated waste) has the potential to decrease by screening and segregation, as indicated in Appendix H. The estimated volume will also increase, as per the main text in Table 4-1, when considering bank run soils vs. loose excavated soils. Appendix H estimated excavated soil volumes include an expansion factor of 30 percent.

42. Appendix H, Page J-16, Table J-5, "Short-Term Effectiveness" -- See specific comment #25.

DOE/SNL Response: Comment acknowledged. No response required per Specific Comment No. 25.

43. Appendix H, Appendix J-3, Page J.3-9 (and elsewhere) -- justify the purchase of major construction equipment, rather than renting such equipment as some contractors

might do. Additionally, because the equipment is purchased, clarify whether the equipment will have resale value after the project is completed, what any such resale value may be, and whether this is taken into account in the cost estimates.

DOE/SNL Response: The purchase of major construction equipment for a six-year project is cost-effective because typical rental rates for equipment are based on a one- to two-year payback. Thus, a substantial cost savings will be achieved. Purchased equipment used for six years is not expected to have any significant salvage value due to the total number of hours the equipment is expected to be used and its age at the completion of the project. Therefore, no resale value of purchased equipment is included in cost estimates.

44. Appendix H, Appendix J-3, Page J.3-10, assumption #9 -- justify the cost to bring backfill as far as 20 miles from the site when information in the main text states that suitable backfill is readily available next to the landfill. How much does this influence the cost (provide an answer in estimated dollars) when the haul realistically should not exceed perhaps 0.5 mile?

DOE/SNL Response: The justification to bring fill from within 20 miles of the site was based upon the availability of screened stockpiled material and unscreened in situ material at a borrow pit near the former Chemical Waste Landfill. In the event that borrow material is available within 0.5 miles of the Mixed Waste Landfill, an estimated cost savings of $181,224 for backfill costs could be realized.

45. Appendix H, Appendix J-3, Page J.3-15, assumption #3 -- justify why (2) 235 excavators, as many as (3) 950 loaders, and as many as (5) dump trucks are needed for the waste management phase when the landfill would already be excavated under this hypothetical scenario? How much does this influence the cost (provide an answer in estimated dollars)?

DOE/SNL Response: This portion of the scenario deals with waste management. As indicated in this section, waste management activities include segregation, shredding, and packaging of soil and debris. The referenced equipment would be used to perform these activities, which would include movement of stockpiled and processed materials and loading shredders and containers. Estimated cost for this equipment (without markups), as shown in the estimate for Waste Management is:

- *235 Excavators - $ 1,305,503.68*
- *950 Loaders - $ 1,044,670.85*
- *Dump trucks - $ 1,531,687.04*

46. Appendix H, Appendix J-3, Page J.3-17, assumption #5 -- Justify why 8,000 CY of scraped soil is assumed to be disposed of off-site rather than be placed back into the excavation as replaceable soil. How much does this influence the cost (provide an answer in estimated dollars)?

DOE/SNL Response: *As stated, the 8000 cy of soil is expected to be generated from scraped soil and site-generated waste. It is assumed that this material will be low-level radioactive waste and cannot be used for replaceable soils. The estimated cost for off-site disposal of this material is $ 6.48 million.*

47. Appendix H, Appendix J-3, Page J.3-19, bullet #1 -- See specific comment #40.

DOE/SNL Response: *Appendix H assumes 30 years of long-term groundwater monitoring due to the presence of contaminated materials placed in storage buildings that are erected at the site. See response to Specific Comment No. 40.*

48. Appendix I, Section IV, Page I-12, last paragraph of section, third sentence stating "However, due to remedial options, the COC's may vary." -- This statement and the rest of the paragraph would be more clear with some additional explanatory text. Provide further explanation on how constituents of concern were selected.

DOE/SNL Response: *The COC selection criteria are summarized in the previous paragraphs of this section. This includes a background screen for inorganics and all detected organics. The sentence "However, due to remedial options, the COC's may vary." is in reference to depth consideration for potential exposure of the remedial options. The referenced paragraph has been revised with the following; "For NFA with no ICs, maximum concentrations in MWL soils at all depths were evaluated within the risk assessment. For the remaining alternatives (with the exception of future excavation), the maximum concentrations within the upper five feet (0 to 5 ft bgs) were evaluated in the risk assessments due to institutional controls that will remain in place for these alternatives."*

49. Appendix I, Page I-42, Section VI.6.2.2 -- Provide an explanation as to what ICs are implemented for this alternative. Make it clear how these ICs would then cause less risk than that calculated for the "NFA without ICs" alternative (compare Tables 16 and 17). Explain why the list of COC's is different in Tables 16 and 17 (see specific comment #48).

DOE/SNL Response: *The risk summary provided in Section VI.6.2.2 is MWL Alternative 1.a - NFA with ICs. As described in the main text, this includes maintaining long-term monitoring, surveillance and maintenance, and access controls. Therefore, the contamination depth was limited to 0 to 5 feet bgs. Note that for the other NFA with ICs alternatives, additional cover is proposed and the risks are zero due to the lack of potential exposure pathways (i.e., the waste will be greater than 5 feet bgs). For NFA with no ICs, all depths were evaluated and therefore, the COC list is different and leads to greater calculated risk (refer to Section IV for more detail on the COC selection criteria).*

References

Martin, S. (New Mexico Environment Department), letter to K.L Boardman (U.S. Department of Energy) and P.B. Davies (Sandia National Laboratories), "Notice of Deficiency: Mixed Waste Landfill Corrective Measures Study Report, May 2003, Sandia National Laboratories", EPA ID#5890110518, HWB-SNL-01-025, November 5, 2003.

Sandia National Laboratories/New Mexico (SNL/NM), 1996, "Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation, Sandia National Laboratories, Albuquerque, NM". Sandia National Laboratories Dept. 7585: Environmental Restoration for Landfills and Test Areas, Albuquerque, NM 87185. Prepared for the US D.O.E. under contract DE-AC04-94AL85000.

Sandia National Laboratories/New Mexico (SNL/NM), September, 1999, "Deployment of an Alternative Cover and Final Closure of the Mixed Waste Landfill, Sandia National Laboratories, New Mexico", prepared for US DOE by Sandia National Laboratories Environmental Restoration Project, Albuquerque, New Mexico, September 23, 1999.

Sandia National Laboratories/New Mexico (SNL/NM), May, 2003, "Mixed Waste Landfill Corrective Measures Study Final Report, Sandia National Laboratories/New Mexico", prepared for US DOE by Sandia National Laboratories Environmental Restoration Project, Albuquerque, New Mexico, May 2003.

ATTACHMENT A

Revised Figures
From the
Mixed Waste Landfill
Corrective Measures Study

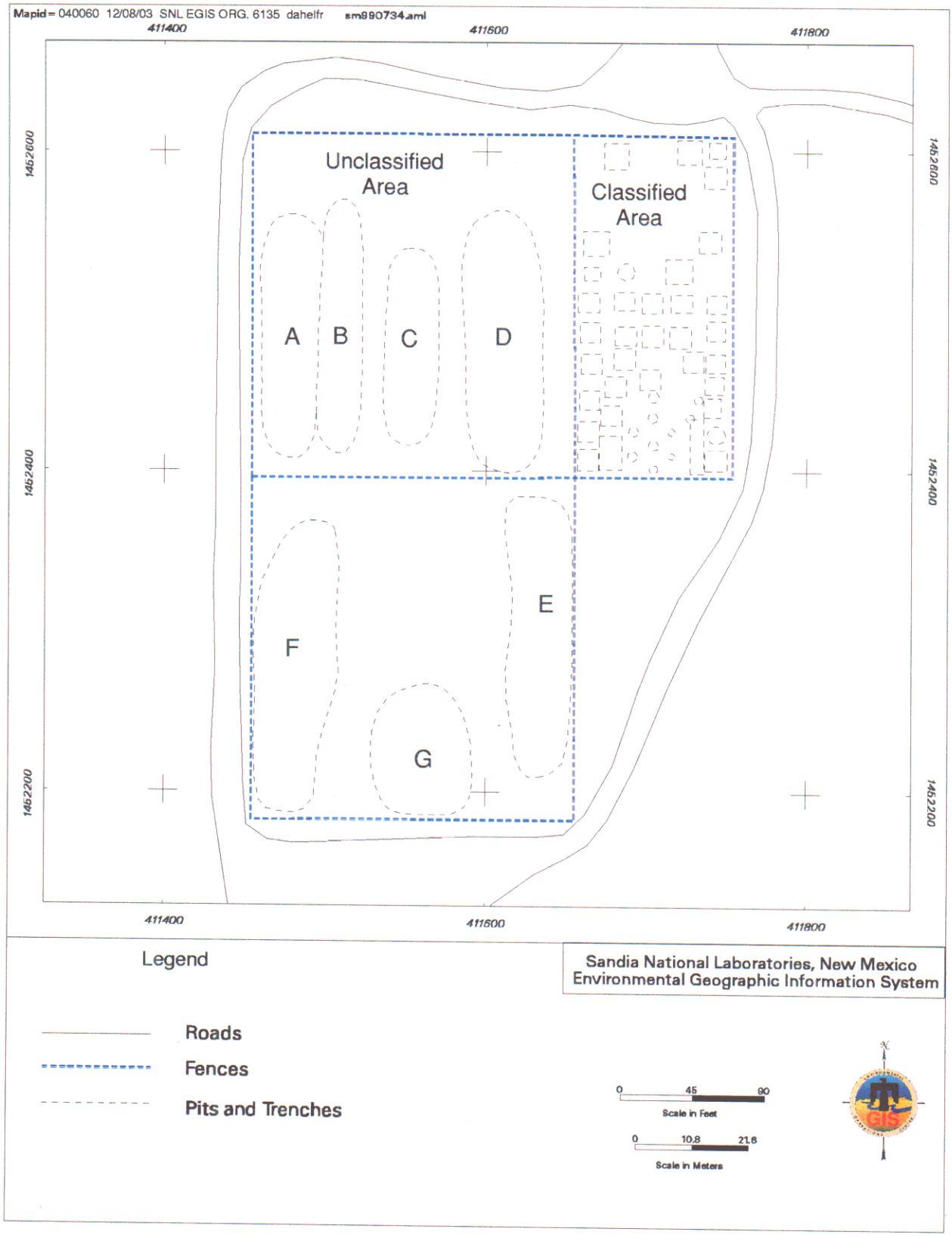


Figure 1-3
Map of the Mixed Waste Landfill

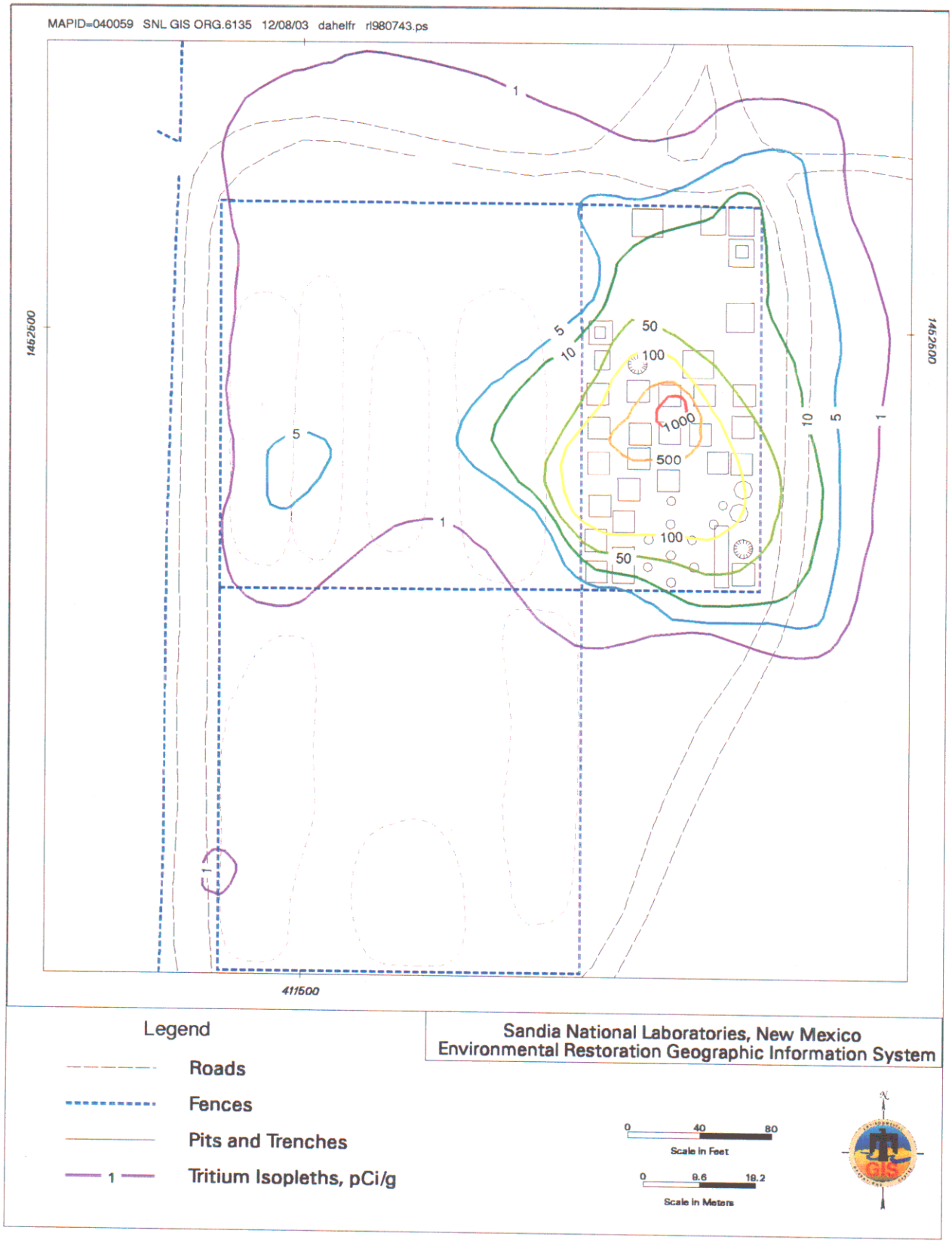


Figure 1-4
Tritium in Surface Soil Soils at the Mixed Waste Landfill (1993 data)

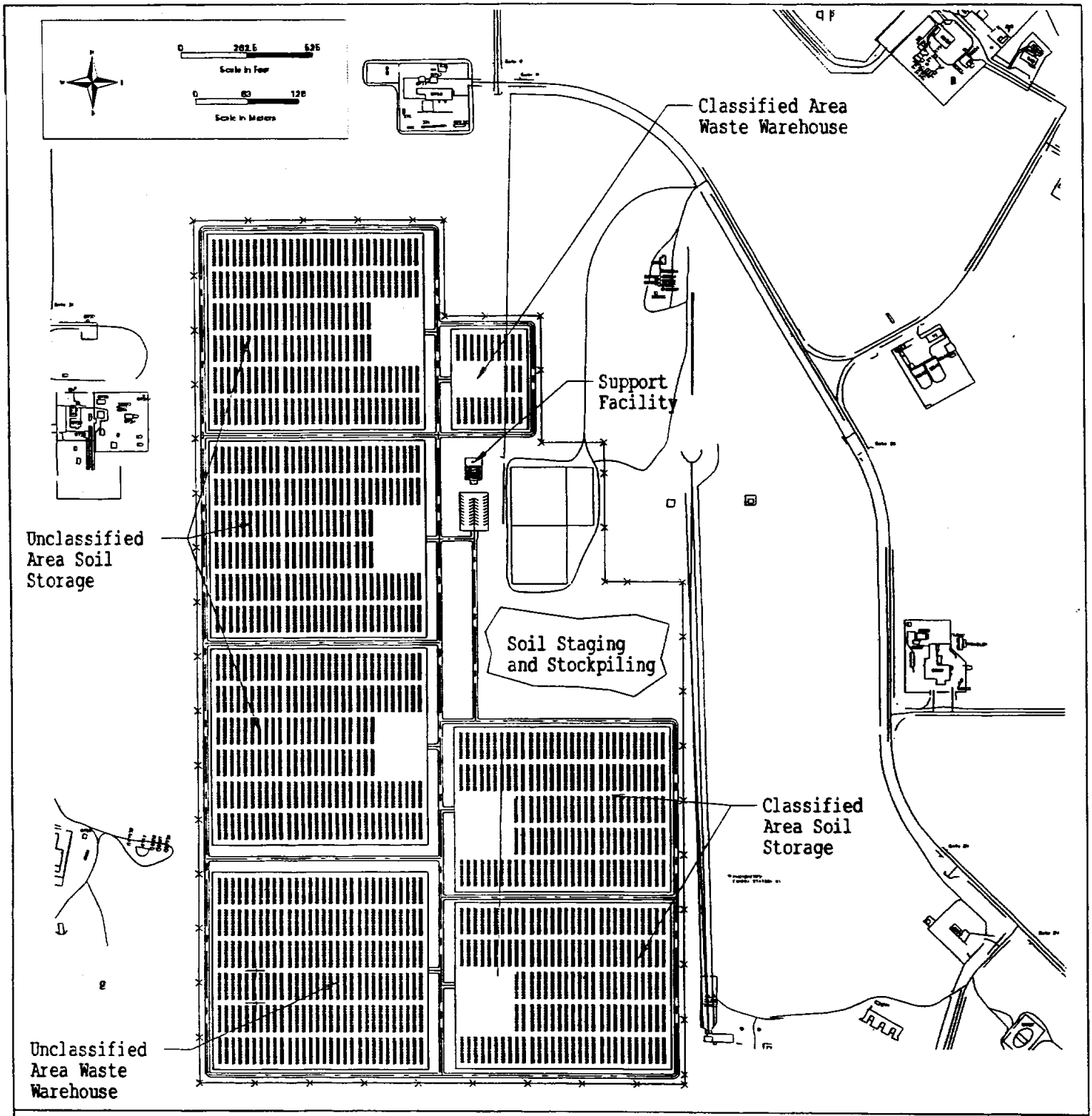
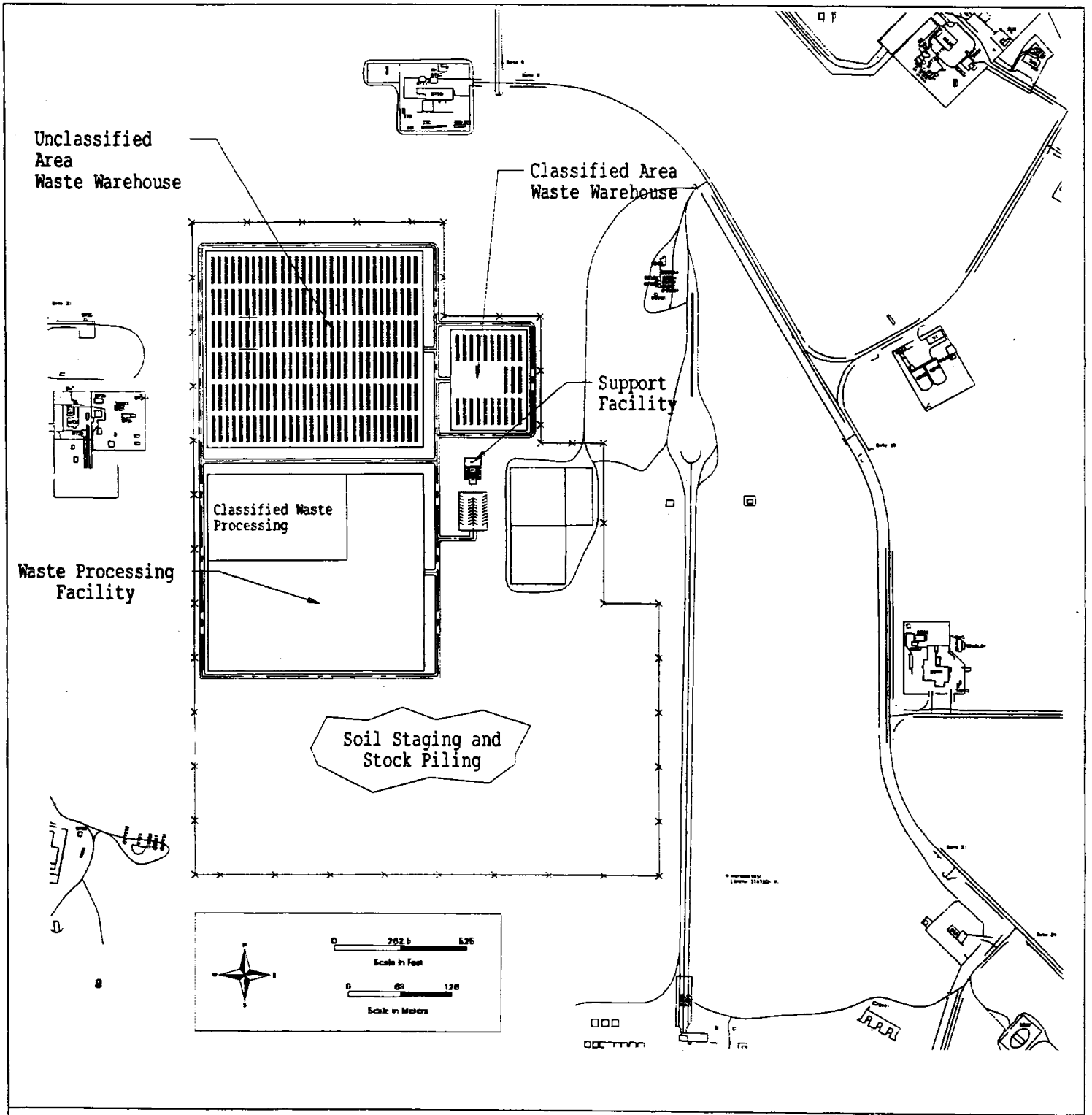


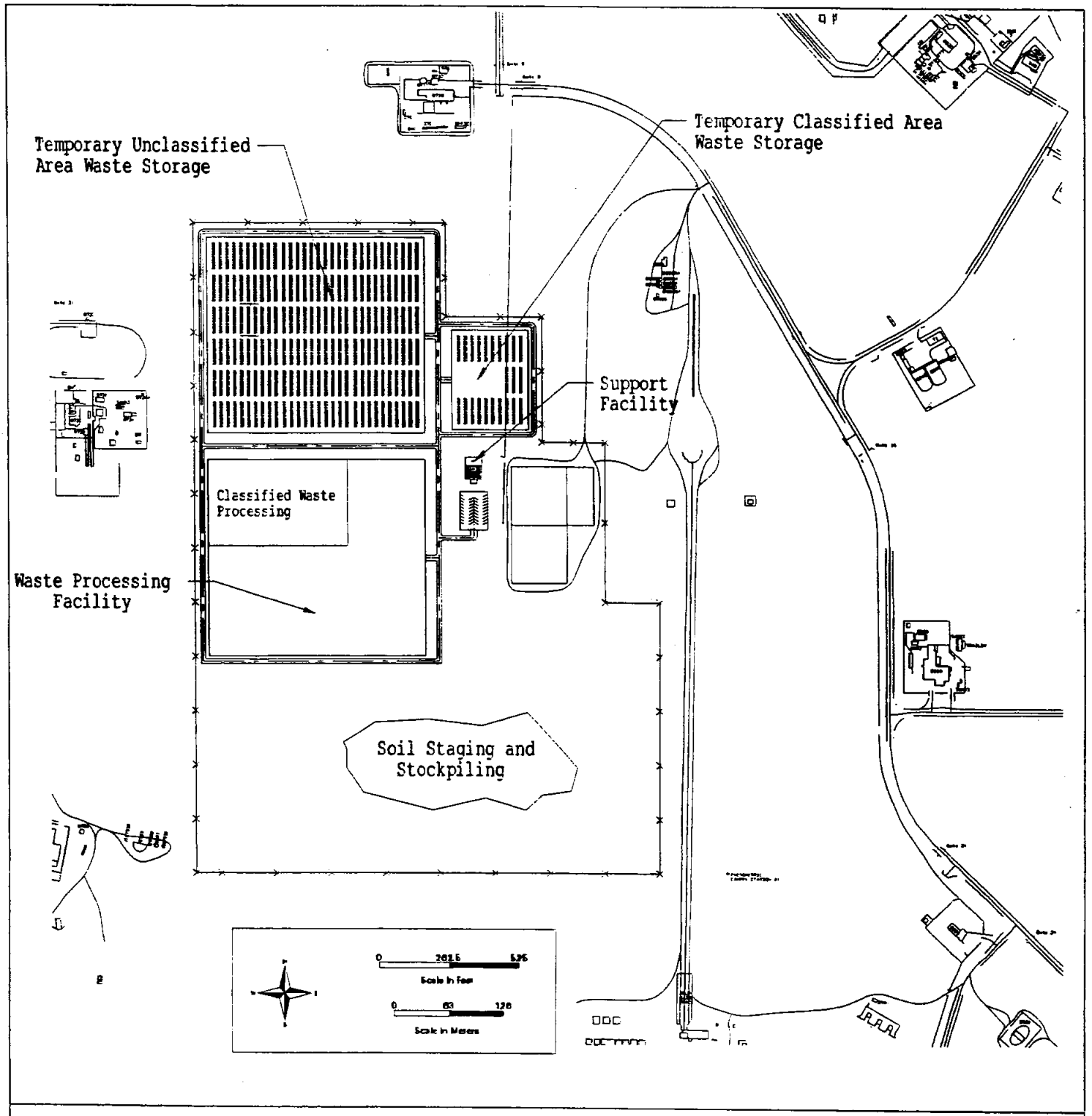
Figure 3-1 Completed Excavation with Aboveground Retrievable Storage



MIXED WASTE LANDFILL
Conceptual Layout
Complete Excavation with
Above-Ground Retrievable Storage and Backfilling

Warehouses: 1,240,400 Square Feet
Support Facility: 5286 Square Feet
Site Area: 80 Acres
Roads: 1.36 Miles

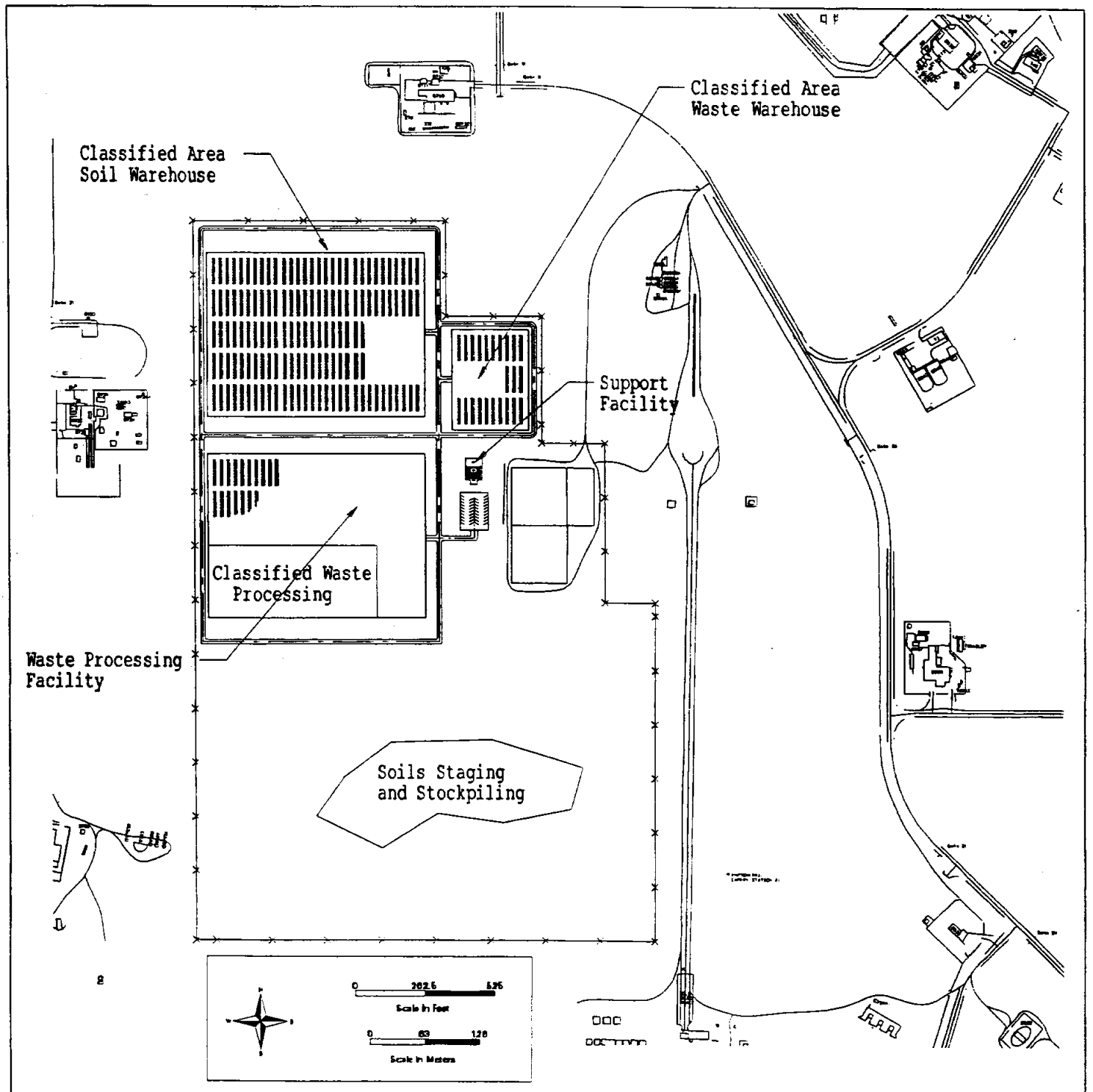
Figure 3-2 Complete Excavation with Aboveground Retrievable Storage and Backfilling



MIXED WASTE LANDFILL
Conceptual Layout
Complete Excavation with Off-Site Disposal
and Waste Processing Facility

Warehouses: 1,240,400 Square Feet
Support Facility: 5286 Square Feet
Site Area: 80 Acres
Roads: 1.36 Miles

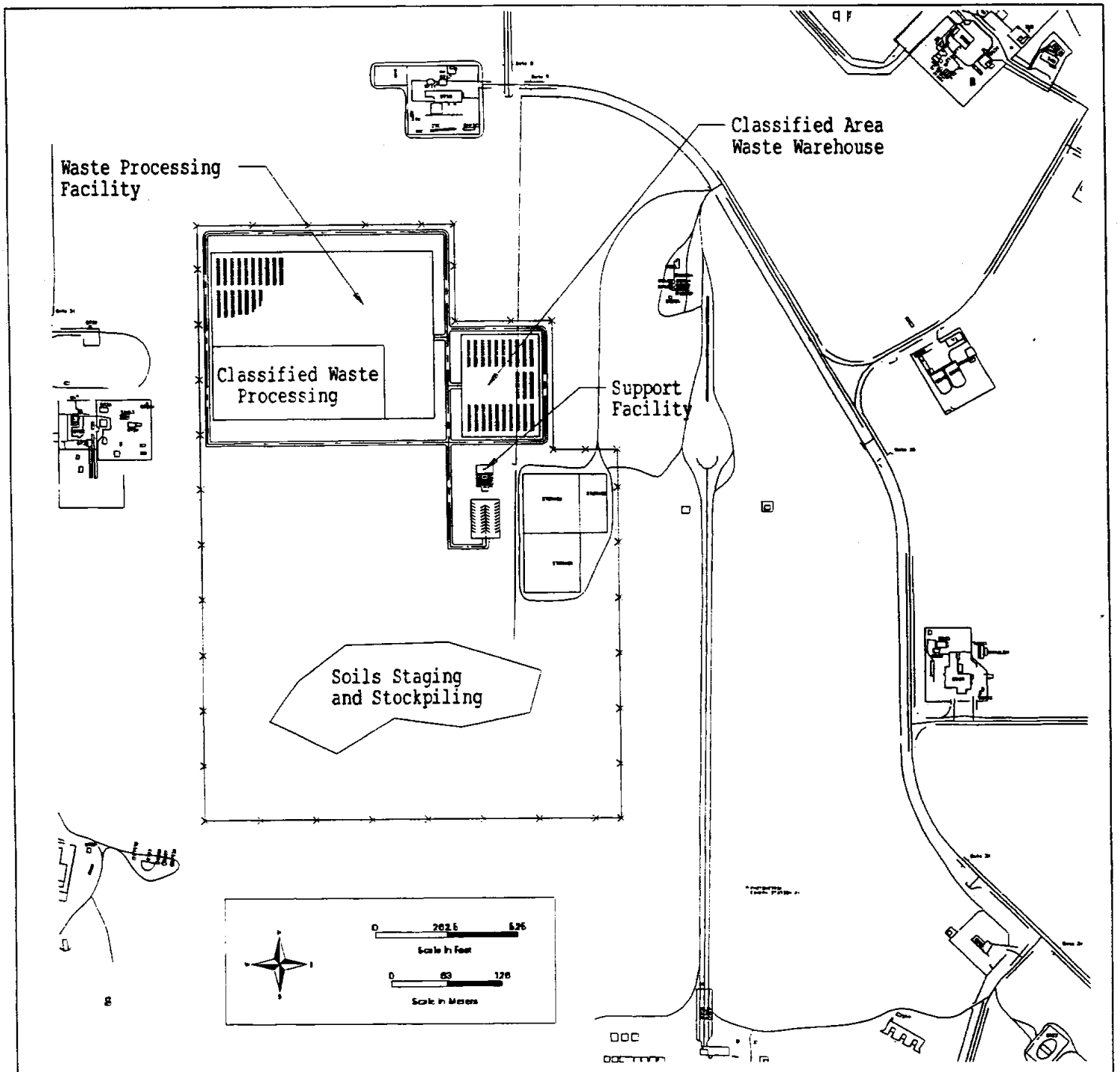
Figure 3-3 Complete Excavation with Offsite Disposal and Backfilling



MIXED WASTE LANDFILL
Conceptual Layout
Partial Excavation Option with Above-Ground Retrievable Storage
of Classified Area Soils and Waste

Warehouses: 1,055,880 Square Feet
Support Facility: 5286 Square Feet
Site Area: 90 Acres
Roads: 1.33 Miles

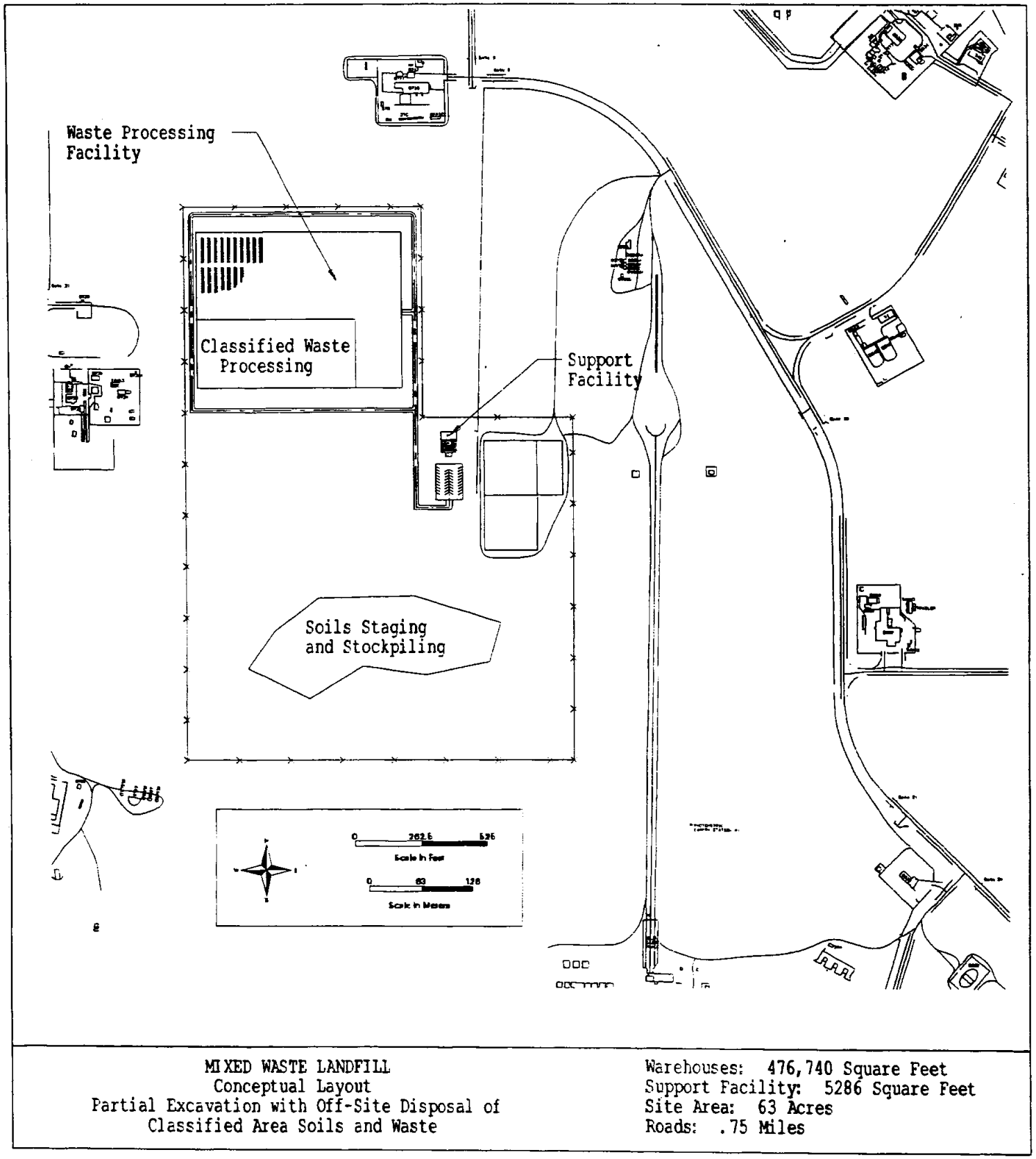
Figure 3-4 Partial Excavation with Aboveground Retrievable Storage



MIXED WASTE LANDFILL
Conceptual Layout
Partial Excavation with Aboveground Retrievable Storage of Classified Area Waste and Backfilling

Warehouses: 579,140 Square Feet
Support Facility: 5286 Square Feet
Site Area: 66.75 Acres
Roads: 1 Mile

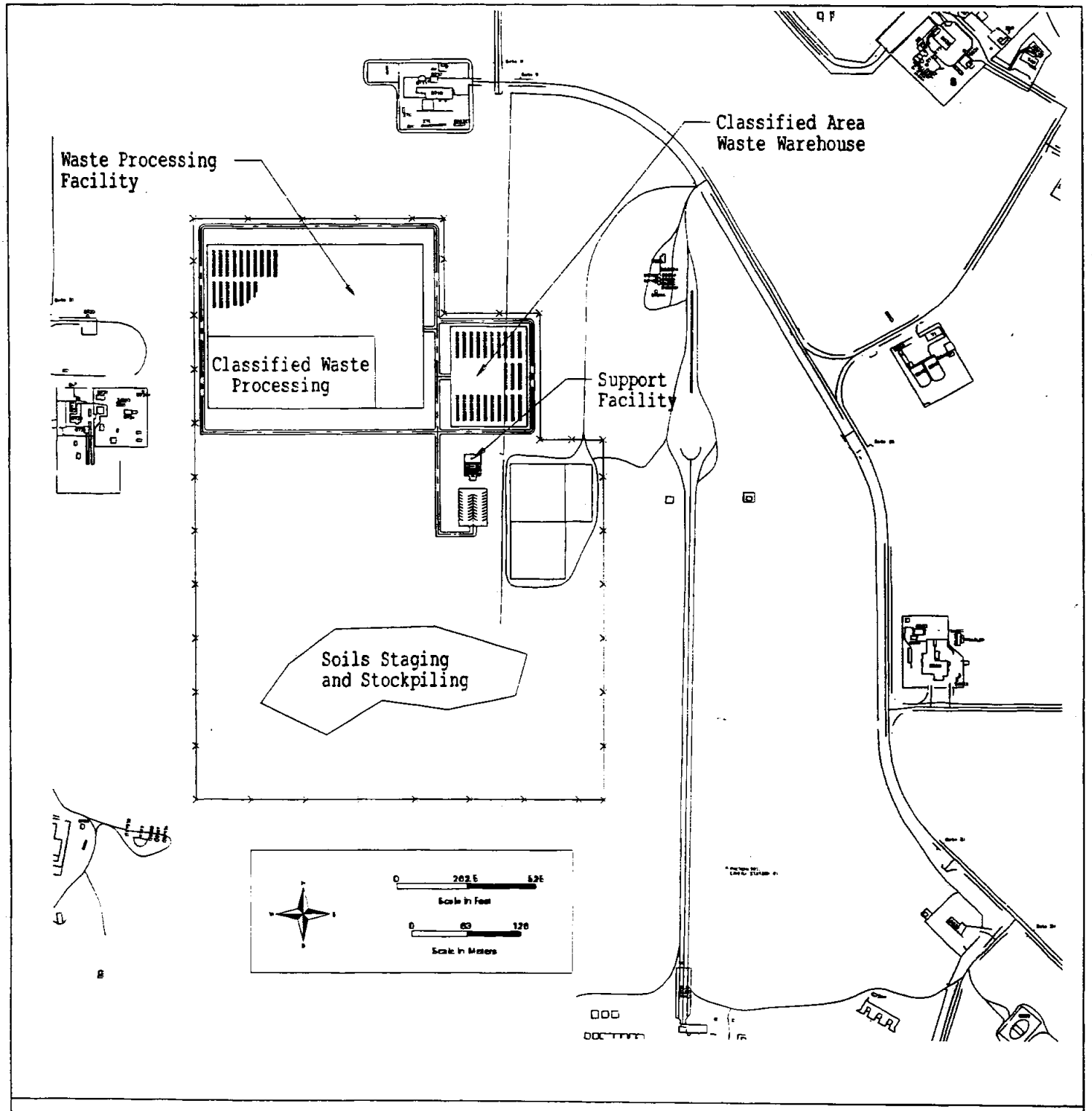
Figure 3-5 Partial Excavation with Aboveground Retrievable Storage and Backfilling



MIXED WASTE LANDFILL
Conceptual Layout
Partial Excavation with Off-Site Disposal of
Classified Area Soils and Waste

Warehouses: 476,740 Square Feet
Support Facility: 5286 Square Feet
Site Area: 63 Acres
Roads: .75 Miles

Figure 3-6 Partial Excavation with Off-Site Disposal and Backfilling



MIXED WASTE LANDFILL
Conceptual Layout
Future Partial Excavation with Aboveground Retrievable Storage of Classified Area Waste and Backfilling

Warehouses: 579,140 Square Feet
Support Facility: 5286 Square Feet
Site Area: 66.75 Acres
Roads: 1 Mile

Figure 3-7 Future Excavation

ATTACHMENT B

Revised Tables
From the
Mixed Waste Landfill
Corrective Measures Study

Table 2-1 (Continued)
Description and Evaluation of General Corrective Measures

Corrective Measure	Technology Description	Technology Evaluation		
		Responsive to Corrective Action Objectives	Implementability	Performance
Excavation/ Storage/ Treatment/ Disposal	Complete Excavation with Aboveground, Retrievable Storage: This technology would involve complete excavation of the MWL and permanent storage of wastes in an on-site, aboveground, retrievable storage facility. This technology would require on-site capabilities for removal, shielding, handling, characterization, repackaging, transport, and storage of radioactive and mixed waste.	Yes	Yes	Good
Comments				
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4. *This technology is not responsive to Corrective Action Objective 1 in the short term; however, it is responsive to Corrective Action Objective 1 in the long term.* Excavation involves extensive intrusive activity and direct exposure of site workers to radioactive materials. This technology is technically and administratively implementable. Appropriate time, distance, and shielding to protect site workers would require the use of remote handling and/or robotic equipment. Fugitive emissions generated from excavation activities may pose significant health risks to site workers and the public. Excavation and aboveground retrievable storage would require the construction of secure, high-bay warehouses to stockpile, process, store, and monitor waste. Regulations would limit the duration and storage of hazardous and mixed waste, and pretreatment of waste may be required before permanent storage. It is likely that some waste would need to be shipped off site for treatment and disposal.			

Refer to footnotes at end of table.

Table 2-1 (Continued)
Description and Evaluation of General Corrective Measures

Corrective Measure	Technology Description	Technology Evaluation		
		Responsive to Corrective Action Objectives	Implementability	Performance
Excavation/ Storage/ Treatment/ Disposal	Complete Excavation with Off-Site Disposal: This technology would involve complete excavation of the MWL and shipment of wastes to a licensed, off-site facility. This technology would require on-site capabilities for removal, shielding and handling, and temporary on-site facilities for characterization, pretreatment, and repackaging prior to shipment and disposal of the waste.	Yes	Yes	Good
Comments				
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4. *This technology is not responsive to Corrective Action Objective 1 in the short term; however, it is responsive to Corrective Action Objective 1 in the long term.* Excavation involves extensive intrusive activity and direct exposure of site workers to radioactive materials. This technology is technically and administratively implementable. Appropriate time, distance, and shielding to protect site workers would require the use of remote handling and/or robotic equipment. Fugitive emissions generated from excavation activities may pose significant health risks to site workers and the public. Excavation and off-site disposal would require the construction of secure, high-bay warehouses to stockpile, process, package, store, and ship waste. Regulations would limit the duration of storage of hazardous and mixed waste, and pretreatment of waste, including demilitarization of classified waste, may be required before shipment. Transportation of waste to an off-site facility may pose DOT and public health concerns. The acceptance of waste by an off-site disposal facility may be limited by pretreatment requirements and/or facility-specific waste acceptance criteria.			

Refer to footnotes at end of table.

Table 2-1 (Continued)
Description and Evaluation of General Corrective Measures

Corrective Measure	Technology Description	Technology Evaluation		
		Responsive to Corrective Action Objectives	Implementability	Performance
Excavation/ Storage/ Treatment/ Disposal	Partial Excavation with Aboveground Retrievable Storage: This technology would involve excavation of the classified area of the MWL and permanent storage of wastes in an on-site, aboveground, retrievable storage facility. The classified area was selected because it contains various radioactive sources, tritium, uranium, and activation and fission products. This technology would require on-site capabilities for removal, shielding, handling, characterization, repackaging, transport, and storage of radioactive and mixed waste.	Yes	Yes	Good
Comments				
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4. *This technology is not responsive to Corrective Action Objective 1 in the short term; however, it is responsive to Corrective Action Objective 1 in the long term.* Excavation involves extensive intrusive activity and direct exposure of site workers to radioactive materials. This technology is technically and administratively implementable. Appropriate time, distance, and shielding to protect site workers would require the use of remote handling and/or robotic equipment. Fugitive emissions generated from excavation activities may pose significant health risks to site workers and the public. Excavation and aboveground retrievable storage would require the construction of secure, high-bay warehouses to stockpile, process, store, and monitor waste. Regulations would limit the duration of storage of hazardous and mixed waste, and pretreatment of waste would be required before permanent storage. It is likely that some waste would need to be shipped off site for treatment and disposal. The unclassified area of the landfill would require additional technology for remediation such as containment or stabilization.			

Refer to footnotes at end of table.

Table 2-1 (Continued)
Description and Evaluation of General Corrective Measures

Corrective Measure	Technology Description	Technology Evaluation		
		Responsive to Corrective Action Objectives	Implementability	Performance
Excavation/ Storage/ Treatment/ Disposal	Partial Excavation with Off-Site Disposal: This technology would involve excavation of the classified area of the MWL and shipment of wastes to a licensed, off-site facility for disposal. The classified area was selected because it contains radioactive sources, tritium, activation products, and wastes that pose national security concerns. This technology would require on-site capabilities for removal, shielding, handling, and temporary on-site facilities for characterization, pretreatment, and repackaging prior to shipment and disposal of the waste.	Yes	Yes	Good
Comments				
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4. *This technology is not responsive to Corrective Action Objective 1 in the short term; however, it is responsive to Corrective Action Objective 1 in the long term.* Excavation involves extensive intrusive activity and direct exposure of site workers to radioactive materials. This technology is technically and administratively implementable. Appropriate time, distance, and shielding to protect site workers would require the use of remote handling and/or robotic equipment. Fugitive emissions generated from excavation activities may pose significant health risks to site workers and the public. Excavation and off-site disposal would require the construction of secure, high-bay warehouses to stockpile, process, package, store, and ship waste. Regulations would limit the duration of storage of hazardous and mixed waste, and pretreatment, including demilitarization of classified waste, may be required before shipment. Transportation of waste to an off-site facility must be in compliance with DOT regulations. As with other radioactive waste shipments, such transportation may raise public concerns. The acceptance of waste by an off-site disposal facility may be limited by pretreatment requirements and/or facility-specific waste acceptance criteria. The unclassified area of the landfill would require additional technology for remediation such as containment or stabilization.			

Refer to footnotes at end of table.

Table 3-1
Development of Corrective Measures Alternatives for the MWL

General Corrective Measure	Alternative	Description	Technology											
			NFA	Long-Term Monitoring	Long-Term Surveillance & Maintenance	Long-Term Access Controls	Vegetative Soil Cover	RCRA Subtitle C Cap	Bio-Intrusion Barrier	Complete Excavation with Aboveground Retrievable Storage	Complete Excavation with Off-Site Disposal	Partial Excavation with Aboveground Retrievable Storage	Partial Excavation with Off-Site Disposal	Future Excavation
	I.a	NFA with ICs	X	X	X	X								
Containment	III.a	Bio-Intrusion Barrier		X	X	X			X					
	III.b	Vegetative Soil Cover		X	X	X	X							
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier		X	X	X	X		X					
	III.d	RCRA Subtitle C Cap		X	X	X		X						
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier		X	X	X		X	X					
Excavation	V.a	Complete Excavation with Aboveground Retrievable Storage								X				
	V.b	Complete Excavation with Off-Site Disposal									X			
	V.c	Partial Excavation with Aboveground Retrievable Storage				X						X		
	V.d	Partial Excavation with Off-Site Disposal				X							X	
	V.e	Future Excavation		X	X	X								X

IC Institutional Controls
MWL Mixed Waste Landfill
NFA No Further Action
RCRA Resource Conservation and Recovery Act

Table 3-2
Estimated Direct Costs for MWL Corrective Measures Alternatives

General Corrective Measure	Alternative	Description	Direct Cost
	I.a	NFA with ICs	$1,082,143
Containment	III.a	Bio-Intrusion Barrier	$2,201,668
	III.b	Vegetative Soil Cover	$1,953,501
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	$2,527,007
	III.d	RCRA Subtitle C Cap	$2,850,872
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier	$3,636,474
Excavation	V.a	Complete Excavation with Aboveground Retrievable Storage—Option A	$545,620,660
		Complete Excavation with Aboveground Retrievable Storage—Option B	$416,018,751
	V.b	Complete Excavation with Off-Site Disposal—Option A	$702,088,516
		Complete Excavation with Off-Site Disposal—Option B	$579,110,303
	V.c	Partial Excavation with Aboveground Retrievable Storage—Option A	$139,718,215
		Partial Excavation with Aboveground Retrievable Storage—Option B	$103,569,857
	V.d	Partial Excavation with Off-Site Disposal—Option A	$157,360,724
		Partial Excavation with Off-Site Disposal—Option B	$116,638,183
	V.e	Future Excavation	*$211,544,567*

IC Institutional Controls
MWL Mixed Waste Landfill
NFA No Further Action
RCRA Resource Conservation and Recovery Act

Table 3-3
Cost Breakdown for Individual Excavation Alternatives

Alternative	Description	Cost of Excavation, Characterization, and Transportation	Cost of Aboveground Retrievable Storage Facility and/or Waste Processing Facility	Total Direct Cost
V.a	Complete Excavation with Aboveground Retrievable Storage—Option A	$420,059,569	$125,561,091	$545,620,660
	Complete Excavation with Aboveground Retrievable Storage—Option B	$367,196,113	$48,822,638	$416,018,751
V.b	Complete Excavation with Off-Site Disposal—Option A	$653,265,878	$48,822,638	$702,088,516
	Complete Excavation with Off-Site Disposal—Option B	$530,287,665	$48,822,638	$579,110,303
V.c	Partial Excavation with Aboveground Retrievable Storage—Option A	$97,997,927	$41,720,288	$139,718,215
	Partial Excavation with Aboveground Retrievable Storage—Option B	$79,510,583	$24,059,274	$103,569,857
V.d	Partial Excavation with Off-Site Disposal—Option A	$138,479,388	$18,881,336	$157,360,724
	Partial Excavation with Off-Site Disposal—Option B	$97,756,847	$18,881,336	$116,638,183
V.e	Future Excavation	*$211,544,567*	$24,059,274	*$235,603,841*

Table 3-4
Summary of Development of Corrective Measures Alternatives for the MWL (Chapter 3.0)

General Corrective Measure	Alternative	Description	Effectiveness at Meeting Corrective Action Objectives				Implementability			Evaluation Summary
			Minimize Exposure to Workers, the Public, and Wildlife	Limit Migration of Contaminants to Groundwater	Minimize Biological Intrusion into Waste	Prevent or Limit Human Intrusion	Constructability Concerns	Worker Health and Safety Risk	Maintenance Requirements	
	I.a	NFA with ICs	Yes	Yes	Yes	Yes	Insignificant	Low	Minimal	Suitable
Containment	III.a	Bio-Intrusion Barrier	Yes	No	Yes	Yes	Minimal	Low	Minimal	Unsuitable
	III.b	Vegetative Soil Cover	Yes	Yes	Yes	Yes	Minimal	Low	Minimal	Suitable
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	Yes	Yes	Yes	Yes	Minimal	Low	Minimal	Suitable
	III.d	RCRA Subtitle C Cap	Yes	No	Yes	Yes	Moderate	Low	Moderate	Unsuitable
	III.e	RCRA Subtitle C Cap with Bio-Intrusion Barrier	Yes	No	Yes	Yes	Moderate	Low	Moderate	Unsuitable
Excavation	V.a	Complete Excavation with Aboveground Retrievable Storage	No[a]	Yes	Yes	Yes	Significant	High	Moderate	Unsuitable
	V.b	Complete Excavation with Off-Site Disposal	No[a]	Yes	Yes	Yes	Significant	High	Moderate	Unsuitable
	V.c	Partial Excavation with Aboveground Retrievable Storage	No[a]	Yes	Yes	Yes	Significant	High	Moderate	Unsuitable
	V.d	Partial Excavation with Off-Site Disposal	No[a]	Yes	Yes	Yes	Significant	High	Moderate	Unsuitable
	V.e	Future Excavation	Yes	Yes	Yes	Yes	Significant	Medium	Moderate	Suitable

IC Institutional Controls
MWL Mixed Waste Landfill
NFA No Further Action
RCRA Resource Conservation and Recovery Act

[a]. *This alternative's failure in meeting Corrective Action Objective 1 is limited to the short term because of the increased exposure during excavation. In the long term, this alternative meets Corrective Action Objective 1 in minimizing exposure to workers, the public, and wildlife.*

Table 4-1
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

Evaluation Criteria	MWL I.a NFA with ICs	MWL III.b Vegetative Soil Cover	MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier	MWL V.e Future Excavation
Long-Term Reliability and Effectiveness				
Magnitude of Remaining Risk(s) after Implementation of the Alternative	Nonrad: HI = 0.00; excess cancer risk = 1E-9; risk below NMED guidelines. Rad: TEDE = 3.3E-1 mrem/yr; excess cancer risk = 2.2E-6; below EPA guidelines. Ecorisk less than NMED guidelines. Risk would decrease with time due to radioactive decay. Risk would increase if erosion or intrusion occurs should ICs be relinquished.	Nonrad: HI = 0.00; excess cancer risk ≈ 0.00; risk below NMED guidelines. Rad: TEDE = 2.4E-5 mrem/yr; excess cancer risk = 3.4E-10; below EPA guidelines. Ecorisk less than NMED guidelines. Risk would decrease with time due to radioactive decay. Risk would increase if erosion or intrusion occurs should ICs be relinquished.	Nonrad: HI = 0.00; excess cancer risk ≈ 0.00; risk below NMED guidelines. Rad: TEDE = 2.4E-5 mrem/yr; excess cancer risk = 3.4E-10; below EPA guidelines. Ecorisk less than NMED guidelines. Risk would decrease with time due to radioactive decay. Risk would increase if erosion or intrusion occurs should ICs be relinquished.	Nonrad: HI = 0.00; excess cancer risk ≈ 0.00; risk below NMED guidelines. Rad: TEDE = 0.00 mrem/yr; excess cancer risk = 0; below EPA guidelines. Ecorisk approximately 0. Risk approaches 0 assuming COCs are removed to background screening levels.
Extent of Long-Term Monitoring	Minimum of 70 years. The operational cover will be monitored and maintained to prevent ponding and intrusion of deep-rooted plants and promote surface runoff and growth of native vegetation. ICs will include environmental monitoring, site surveillance and maintenance, access controls, and groundwater and tritium monitoring.	Minimum of 70 years. The vegetative soil cover will be monitored and maintained to prevent ponding and intrusion of deep-rooted plants and promote surface runoff and growth of native vegetation. ICs will include environmental monitoring, site surveillance and maintenance, access controls, and groundwater and tritium monitoring.	Minimum of 70 years. The vegetative cover with bio-intrusion barrier will be monitored and maintained to prevent ponding and intrusion of deep-rooted plants and promote surface runoff and growth of native vegetation. ICs will include environmental monitoring, site surveillance and maintenance, access controls, and groundwater and tritium monitoring.	No monitoring required after excavation.
Uncertainties Associated with Leaving Waste in Place	Low	Low	Low	NA – No waste left in place.

Refer to footnotes at end of table.

Table 4-1 (Continued)
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

Evaluation Criteria	MWL I.a NFA with ICs	MWL III.b Vegetative Soil Cover	MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier	MWL V.e Future Excavation
Potential for Failure of Alternative	Very Low	Very Low	Very Low	NA – No waste left in place.
Reduction in Toxicity, Mobility, and Volume				
Reduction in Toxicity	No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.	No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.	No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.	*Relative to the landfill, toxicity will be reduced. Relative to the waste, no reduction other than natural radioactive decay.*
Reduction in Mobility	Minimal bio-intrusion, human access, and inadvertent human intrusion protection.	Minimized by limiting water infiltration, bio-intrusion, human access, and inadvertent human intrusion.	Minimized by limiting water infiltration, bio-intrusion, human access, and inadvertent human intrusion.	Eliminated by removal of waste from landfill disposal cells.
Reduction in Volume	None	None	None	Potential increase in volume
Short-Term Effectiveness				
Short-Term Reduction in Existing Risk(s)	Nonrad: Incremental HI = 0.07. Incremental excess cancer risk = 3.31E-6. Risk below NMED guidelines. Rad: TEDE unchanged. Ecorisk unchanged.	Nonrad: Incremental HI = 0.07. Incremental excess cancer risk = 3.31E-6. Risk below NMED guidelines. Rad: TEDE reduced by 3.3E-1 mrem/yr; excess cancer risk reduced by 2.2E-6. Ecorisk reduced.	Nonrad: Incremental HI = 0.07. Incremental excess cancer risk = 3.31E-6. Risk below NMED guidelines Rad: TEDE reduced by 3.3E-1 mrem/yr; excess cancer risk reduced by 2.2E-6. Ecorisk reduced.	Nonrad: None (assumes maximum concentrations reported during characterization). Risk below NMED guidelines. Rad: TEDE increased by 3.23E+3 mrem/yr; excess cancer risk increased by 3.7E-2. Ecorisk unchanged.
Time Needed to Achieve Reduction in Risk(s)	1 month	4 months	4 months	2 years (excavation only)

Refer to footnotes at end of table.

Table 4-1 (Concluded)
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

Evaluation Criteria	MWL I.a NFA with ICs	MWL III.b Vegetative Soil Cover	MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier	MWL V.e Future Excavation
Short-Term Risk(S) Posed to Site Workers, the Community, and the Environment During Implementation of the Alternative	Transportation: Injuries: 1.8E-2 Fatalities: 4.9E-4 Implementation: Injuries: 9.5E-2 Fatalities: 2.4E-3	Transportation: Injuries: 4.9E-2 Fatalities: 1.3E-3 Implementation: Injuries: 2.6E-1 Fatalities: 3.2E-3	Transportation: Injuries: 2.5E-1 Fatalities: 6.6E-3 Implementation: Injuries: 3.2E-1 Fatalities: 3.5E-3	Transportation: Injuries: 8.8E-1 Fatalities: 2.3E-1 Implementation: Injuries: 2.2E+0 Fatalities: 1.1E-2
Implementability				
Availability of Materials, Equipment, and Contractors	Readily available	Readily available	Readily available	Readily available
Technical and Administrative Difficulties	None. Addition of soil presents minimal concerns.	None. Addition of compacted fill presents minimal concerns.	None. Addition of compacted fill and the barrier present moderate concerns.	Significant. Excavation and characterization activities present significant concerns.
Permits and Approvals	Air quality	Air quality	Air quality	Digging, rad worker, waste storage, waste treatment, air quality
Cost				
Capital and Operation and Maintenance Costs (Net Present Value)	$1,772,882	$4,335,274	$7,096,859	*$325,704,159*

COC	Contaminant of concern.
Ecorisk	Ecological risk
EPA	U.S. Environmental Protection Agency
HI	Hazard Index
IC	Institutional Controls
mrem/yr	Millirem(s) per year
MWL	Mixed Waste Landfill
NA	Not applicable
NFA	No Further Action
NMED	New Mexico Environment Department
Rad	Radiological
TEDE	Total Effective Dose Equivalent

Table 4-2
Summary of the MWL CMS Alternatives Risk Results

Alternatives	Human Health (IND)		Ecological		Transportation and Remediation *Total Predicted* Injuries and Fatalities			
					Transportation		Implementation	
	Nonrad	Rad	Nonrad	Rad *(rad/day)*	Injuries	Fatalities	Injuries	Fatalities
MWL Risk Baseline—NFA with No ICs	HI = 0.07 CR = 3E-6	TEDE = 3.3E-1 mrem/yr CR = 2.2E-6	No HQ exceedence after uncertainty addressed	Mouse = 1.6E-3 Owl = 1.6E-3	No Transportation Risk		No Remediation Risk	
MWL–Ia. NFA with ICs	HI = 0.00 CR = 1E-9	TEDE = 3.3E-1 mrem/yr CR = 2.2E-6	No HQ exceedence after uncertainty addressed	Mouse = 1.6E-3 Owl = 1.6E-3	0.018	0.00049	0.095	0.0024
MWL–IIIb. Vegetative Soil Cover	HI = 0.00 CR ≈ 0.00	TEDE = 2.4E-5 mrem/yr CR = 3.4E-10	HQ ≈ 0.00	HI ≈ 0.00	0.049	0.0013	0.26	0.0032
MWL–IIIc. Vegetative Soil Cover with Bio-Intrusion Barrier	HI = 0.00 CR ≈ 0.00	TEDE = 2.4E-5 mrem/yr CR = 3.4E-10	HQ ≈ 0.00	HI ≈ 0.00	0.25	0.0066	0.32	0.0035
MWL–V.e Future Excavation	HI = 0.07 CR = 3E-6	TEDE = 3.23E3 mrem/yr CR = 3.7E-2	HQ ≈ 0.00	HI ≈ 0.00	0.88	0.023	2.22	0.011

CMS	Corrective Measures Study
CR	Cancer Risk
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Controls
IND	Industrial
mrem/yr	Millirem(s) per year
MWL	Mixed Waste Landfill
NFA	No Further Action
Rad	Radiological
TEDE	Total Effective Dose Equivalent

Table 4-3
Detailed Cost Breakdowns for Candidate Corrective Measures Alternatives, Including Capital Costs, Operation and Maintenance Costs, Administrative Costs, and Escalation

General Corrective Measure	Alternative	Description	Cost Component	Cost Breakdown		
				Direct Cost[a]	Markups[b]	Total Cost
NFA	I.a	NFA with ICs	Capital Cost[c]	$1,082,143	$690,739	$1,772,882
			Operations & Maintenance[d]	$0	$0	$0
			Total Cost[e] (Net Present Value)	NA	NA	$1,772,882
Containment	III.b	Vegetative Soil Cover	Capital Cost[c]	$1,953,501	$1,525,040	$3,478,541
			Operations & Maintenance[d]	$309,301	$547,432	$856,733
			Total Cost[e] (Net Present Value)	NA	NA	$4,335,274
	III.c	Vegetative Soil Cover with Bio-Intrusion Barrier	Capital Cost[c]	$2,527,007	$1,959,816	$4,486,823
			Operations & Maintenance[d]	$849,300	$1,760,736	$2,610,036
			Total Cost[e] (Net Present Value)	NA	NA	$7,096,859
Excavation	V.e	Future Excavation	Capital Cost[c]	$235,603,841	$ 90,100,318	$325,704,159
			Operations & Maintenance[d]	$0	$0	$0
			Total Cost[e] (Net Present Value)	NA	NA	$106,209,085

[a]Direct costs include material, labor, and equipment used to implement the alternative.
[b]Markups are all costs other than direct costs that do not contribute to the alternative, and include SNL/NM's administrative costs (loads) and contingency allowances.
[c]Capital costs include construction and installation costs, equipment costs, and indirect costs such as engineering costs, legal fees, permitting fees, and startup and shakedown costs.
[d]Operation and maintenance costs are estimated for 30 years only, and include operating labor and materials costs, maintenance labor and materials costs, replacement costs, utilities, monitoring and reporting costs, administrative costs, and indirect costs.
[e]Total costs are based upon net present value, and do not include escalation.

IC Institutional Controls
NA Not applicable
NFA No Further Action
SNL/NM Sandia National Laboratories/New Mexico