TABLES
## Table 2-1
Description and Evaluation of General Corrective Measures

<table>
<thead>
<tr>
<th>Corrective Measure</th>
<th>Technology Description</th>
<th>Responsiveness to Corrective Action Objectives</th>
<th>Implementability</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFA</td>
<td>NFA is a general corrective measure that is carried through the CMS in order to provide a baseline for comparison against remedial action technologies. NFA can be implemented with or without ICs. a) NFA with no ICs b) NFA with ICs</td>
<td>No Yes</td>
<td>Yes</td>
<td>Poor Fair</td>
</tr>
</tbody>
</table>

**Comments**

NFA with no ICs is not responsive to corrective action objectives because it does not minimize exposure to site workers, the public, and wildlife; limit migration of contaminants to groundwater; minimize biological intrusion into buried waste; or prevent or limit human intrusion. NFA with ICs is generally responsive to Corrective Action Objectives 1, 2, 3, and 4. ICs include long-term monitoring, long-term surveillance and maintenance, and long-term access controls. The NFA corrective measure is technically and administratively implementable. The long-term performance of the existing operational cover is unknown due to the lack of documentation regarding design, materials used, and construction quality assurance.

Refer to footnotes at end of table.
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<tr>
<td>ICs</td>
<td>Long-Term Monitoring: This technology would involve the installation of monitoring devices to: 1) detect the presence and extent of moisture and contaminants (e.g., tritium) in the environment; 2) assist in determining the human health and environmental impact of water infiltration and any contaminant releases; and 3) evaluate the performance of site closure measures. Long-term monitoring may include sampling of surface water, soil, soil gas, vegetation, air, and groundwater.</td>
<td>No</td>
<td>Yes</td>
<td>Good</td>
</tr>
</tbody>
</table>

**Comments**

Long-term monitoring alone is not responsive to corrective action objectives because it does not minimize exposure to site workers, the public, and wildlife; limit migration of contaminants to groundwater; minimize biological intrusion into buried waste; or prevent or limit human intrusion. However, when used in conjunction with other technologies, it may increase the overall effectiveness of corrective measures. Long-term monitoring has been employed effectively at the MWL since 1969. Continuation and/or modification of the existing controls is technically and administratively implementable. Monitoring systems have a long industrial record of proven performance. Individual components of the monitoring systems will require periodic upgrades and/or replacement. Additionally, staff must be trained and funded to collect and analyze data for the systems in order to be useful in the long-term. Although monitoring alone does not limit water infiltration or the release and migration of contaminants, it is effective in demonstrating the performance of corrective measures. Monitoring may also detect the failure of a corrective measure and the need for corrective action. Long-term monitoring is retained as an implicit part of all corrective measures alternatives.

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<tr>
<td>ICs</td>
<td>Long-Term Surveillance and Maintenance: These controls would involve routine inspection and maintenance of the site on a regular basis, including seeding and mulching, minor grading to address subsidence and erosion issues, and maintenance of drainage features. The site maintenance program would be commensurate with long-term needs and requirements.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Comments**
Long-term surveillance and maintenance alone are not responsive to Corrective Action Objective 4, but are responsive to Corrective Action Objectives 1, 2 and 3. However, when used in conjunction with other technologies, surveillance and maintenance may increase the overall effectiveness of corrective measures. Surveillance and maintenance have been effectively employed at the MWL since 1959. Continuation and/or modification of the existing controls is technically and administratively implementable. Surveillance and maintenance have a long industrial record of proven performance. Although surveillance and maintenance alone do not limit water infiltration or the release and migration of contaminants, these controls are effective in maintaining the performance of corrective measures. Surveillance may also detect the failure of a corrective measure and the need for corrective action. Long-term surveillance and maintenance are retained as an implicit part of all alternatives.

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<tr>
<td>ICs</td>
<td>Long-Term Access Controls: These controls would involve both physical access and administrative controls to prevent or limit human exposure to contaminants. Physical access controls would involve perimeter signage, fencing, monuments, and security patrols. Administrative controls would include land use restrictions.</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
</tr>
</tbody>
</table>

Comments

Long-term access controls alone are not responsive to Corrective Action Objectives 1, 2, and 3, but are responsive to Corrective Action Objective 4. However, when used in conjunction with other technologies, these controls may increase the overall effectiveness of corrective measures. Long-term access controls have been employed effectively at the MWL since 1959. Continuation and/or modification of existing controls is technically and administratively implementable. Long-term access controls have a long industrial record of proven performance. Physical access controls are currently in place at TA-3 and at the MWL. These include perimeter signs, fencing, and security patrols. Signage and fencing will require periodic replacement, and staff must be trained and funded to conduct surveillance and maintenance. Physical access and administrative controls provide an extra degree of protection of human health and are simple to implement. Long-term access controls are retained as an implicit part of all alternatives.

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<td>Responsiveness to Corrective Action Objectives</td>
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<tr>
<td>Containment</td>
<td>Vegetative Soil Cover: This technology would involve the construction of a natural soil cover to limit water infiltration and direct surface water away from the landfill. A diverse community of native plants would be established on the cover to extract water and minimize wind and water erosion. A cover constructed of natural soil will function with minimal maintenance by emulating the natural analogue ecosystem.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Comments**

This technology is directly responsive to Corrective Action Objectives 1, 2, 3, and generally responsive to Corrective Action Objective 4. This technology is technically and administratively implementable and has been effectively demonstrated at existing, low-level radioactive and mixed waste landfills in Nevada and Idaho. Natural soil to construct the cover is readily available at the site. A major advantage of a soil cover is its simplicity of construction. The performance of vegetative covers and their analogues has been studied extensively and recommended for deployment in the arid and semiarid environments of the western United States. Vegetative soil covers are designed to emulate natural analogues that have performed for thousands of years with minimal infiltration.

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<tr>
<td>Containment</td>
<td>Structural Barriers: This technology would involve the construction of a concrete or asphalt barrier over the MWL to minimize water infiltration and limit biological and inadvertent human intrusion into waste disposal cells.</td>
<td>Yes</td>
<td>Yes</td>
<td>Poor</td>
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</tbody>
</table>

Comments  
This technology is directly responsive to Corrective Action Objectives 1 and 4, but is not responsive to Corrective Action Objectives 2 and 3. This technology is technically and administratively implementable and has been demonstrated at existing, low-level radioactive and mixed waste landfills in New Mexico and South Carolina. Materials used for construction of structural barriers are readily available, and structural barriers are simple to construct. Concrete and asphalt barriers are often used for short-term control of vertical water infiltration and to limit biological and human intrusion. The long-term performance of structural barriers is limited by susceptibility to loading, weathering, and cracking, which impairs the structural integrity of the barrier and facilitates the infiltration of water through the barrier into waste disposal cells. IC’s would have to be employed to maintain and eventually replace these types of barriers.

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<tr>
<td>Containment</td>
<td>RCRA Subtitle C Cap: This technology would involve the construction of an engineered cap using natural soil and man-made materials. A cap would consist of layers of soil, compacted clay, and flexible membrane liners. A diverse community of native plants would be established on the cover to extract water and minimize wind and water erosion.</td>
<td>Yes</td>
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</table>

Comments
This technology is directly responsive to Corrective Action Objectives 1 and 3, and is generally responsive to Corrective Action Objectives 2 and 4. This technology is technically and administratively implementable and has been the baseline technology for hazardous and radioactive waste landfills in the United States since 1989. Materials used to construct RCRA Subtitle C caps are readily available. A minor disadvantage of the RCRA Subtitle C caps is their complexity of construction. Greater care is required to ensure the hydraulic integrity of compacted clay and flexible membrane liners. RCRA Subtitle C caps may not perform well in arid and semiarid environments due to potential deterioration of compacted clay and flexible membrane liners.

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<tr>
<td>Containment</td>
<td>Bio-Intrusion Barrier: This technology would involve the use of gravel and cobbles (rip rap) or woven wire mesh to limit intrusion by deep-rooted plants and burrowing mammals. A bio-intrusion barrier could be used as a stand-alone technology or in conjunction with a cap or cover. A bio-intrusion barrier constructed of resistant material such as gravel and cobbles may also serve as an effective human intrusion barrier.</td>
<td>Responsive to Corrective Action Objectives: Yes</td>
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</table>

Comments

This technology is directly responsive to Corrective Action Objectives 1, 3, and 4, but is not responsive to Corrective Action Objective 2. The bio-intrusion barrier is technically and administratively implementable. Materials used to construct bio-intrusion barriers are readily available from off-site suppliers. A bio-intrusion barrier can be constructed on the existing landfill surface. An advantage of a bio-intrusion barrier is its simplicity of construction. The performance of wire mesh bio-intrusion barriers has not been established. The short-term performance of rip-rap bio-intrusion barriers within covers has been studied recently in Idaho. The results of field and pilot tests indicate that long-term performance is promising.

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<td></td>
<td>Containment Cells: This technology would involve the use of subsurface horizontal and</td>
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<td>vertical barriers to isolate buried waste from the environment. Grout curtains and</td>
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<td>slurry walls are common applications of subsurface barriers.</td>
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<td>Poor</td>
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<tr>
<td>Comments</td>
<td>This technology is directly responsive to Corrective Action Objectives 1, 3, and 4,</td>
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<td>and is generally responsive to Corrective Action Objective 2. Installation of</td>
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<td>subsurface barriers involves extensive intrusive activity that raises exposure</td>
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<td>concerns for site workers. This technology is technically and administratively</td>
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<td>implementable. Containment cells could be deployed around individual waste disposal</td>
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<td>cells or around and under the landfill as a whole. Grouting may involve directional</td>
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<td>drilling equipment and injection of pressurized fluids. Slurry walls involve</td>
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<td>vertical trenching and backfilling with bentonite or cement mixtures. Performance</td>
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<td>of subsurface barriers is limited by the inability of noninvasive techniques to</td>
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<td>confirm barrier continuity (e.g., the base of the barrier).</td>
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<tr>
<td>Stabilization/In situ Treatment</td>
<td><em>In Situ</em> Vitrification: This technology would involve using an electric current at extremely high temperatures to convert soil and waste to a crystalline mass, which is a chemically stable, leach-resistant, vitreous material. The process destroys and/or removes organic material while retaining heavy metals and radionuclides.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Comments
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4, but is not responsive to Corrective Action Objective 1. *In situ* vitrification increases the risk of exposure to radioactive and hazardous vapors for site workers. This technology is implementable at the MWL but the heterogeneity and size of waste may affect its effectiveness. Vitrification temperatures up to 2,000°C would generate and release radioactive and hazardous vapors to the environment. An off-gas hood and treatment system would be needed to collect and treat these vapors. A volume reduction in the soil matrix of 20 to 50% may occur (e.g., a 20-ft deep melt would create a depression of 4 to 10 ft). Performance is limited by the inability of nonintrusive techniques to confirm complete vitrification. *In situ* vitrification would severely limit future remedial alternatives for the MWL (e.g., wastes may remain at the MWL forever).

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<tr>
<td>Stabilization/In-situ Treatment</td>
<td>In Situ Grouting or Chemical Fixation: This technology would involve either physical stabilization (grouting) or chemical stabilization (fixation) of wastes within waste disposal cells.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Comments
This technology is directly responsive to Corrective Action Objectives 2, 3, and 4, but is not responsive to Corrective Action Objective 1. *In situ* grouting and chemical fixation involves extensive intrusive activity that raises exposure concerns for site workers. This technology is technically and administratively implementable. Stabilization with physical and chemical agents would require direct access to waste disposal cells. This technology requires injection of pressurized fluids directly into waste. Performance of grout or chemical reagents is limited by the directional control of the drilling technology delivering the grout or chemical reagents, the proper viscosity of the fluids, effective mixing, and the inability of nonintrusive techniques to confirm fluid delivery at depth and complete encapsulation and stabilization. *In situ* grouting or chemical fixation would severely limit future remedial alternatives for the MWL (e.g., wastes may remain at the MWL forever).

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<tr>
<td>**Excavation/Storage/</td>
<td>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.</td>
<td><strong>Responsive to</strong> Corrective Action Objectives</td>
</tr>
<tr>
<td>Treatment/Disposal</td>
<td></td>
<td><strong>Yes</strong></td>
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<td></td>
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<tr>
<td></td>
<td>Comments</td>
<td>This technology is directly responsive to Corrective Action Objectives 2, 3, and 4, but is not responsive to Corrective Action Objective 1. 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.</td>
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<tr>
<td>Excavation/Storage/Treatment/Disposal</td>
<td>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.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Comments

This technology is directly responsive to Corrective Action Objectives 2, 3, and 4, but is not responsive to Corrective Action Objective 1. 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.

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<tr>
<td>Excavation/Storage/Treatment/Disposal</td>
<td>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.</td>
<td>Yes</td>
</tr>
</tbody>
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**Comments**

This technology is directly responsive to Corrective Action Objectives 2, 3, and 4, but is not responsive to Corrective Action Objective 1. 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.

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<td>Yes</td>
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<tr>
<td>**Excavation/</td>
<td>Future Excavation:</td>
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<tr>
<td>Storage/</td>
<td>This technology would</td>
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<td>Treatment/</td>
<td>involve complete</td>
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<td>Disposal</td>
<td>excavation of the MWL</td>
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<td>at some time in the</td>
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<td>future when remote</td>
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<td>handling and/or robotics</td>
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<td>equipment would not be</td>
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<td>and handling of waste</td>
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<td>facility for disposal.</td>
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</tr>
<tr>
<td></td>
<td><strong>Comments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This technology is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>directly responsive to</td>
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</tr>
<tr>
<td></td>
<td>Corrective Action</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Objectives 1, 2, 3, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. This technology is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>technically and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>administratively</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>implementable. Excavation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>would be conducted when</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>total radionuclide</td>
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<tr>
<td></td>
<td>activity has decayed</td>
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<tr>
<td></td>
<td>to safer levels than</td>
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</tr>
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<td></td>
<td>those that currently</td>
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</tr>
<tr>
<td></td>
<td>exist. Fugitive</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>emissions generated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>from excavation activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>may pose health risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to site workers and the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public. Excavation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>would require the</td>
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<tr>
<td></td>
<td>construction of secure,</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>high-bay warehouses to</td>
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</tr>
<tr>
<td></td>
<td>stockpile, process,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>store, and monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>waste prior to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>disposition. Regulations</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>may limit the duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of storage of hazardous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and mixed waste, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pretreatment of waste,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>including demilitarization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of classified waste,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>may be required. It is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>likely that some waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>would need to be shipped</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>off site for treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and disposal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportation of waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to an off-site facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>must be in compliance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with DOT regulations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>As with other radioactive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>waste shipments, such</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>transportation may raise</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public concerns. The</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acceptance of waste by</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>an off-site disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>facility may be limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>by pretreatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>requirements and/or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>facility-specific waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>acceptance criteria.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CMS Corrective Measures Study
°C Degrees Celsius
DOT U.S. Department of Transportation
ft Foot (feet)
IC Institutional Controls

MWL Mixed Waste Landfill
NFA No Further Action
RCRA Resource Conservation and Recovery Act
TA Technical Area
Table 2-2  
Results of Technology Screening for the MWL

<table>
<thead>
<tr>
<th>Technology</th>
<th>Responsiveness to Corrective Action Objectives* (Yes/No)</th>
<th>Implementabilityb (Yes/No)</th>
<th>Performance (Good, Fair, Poor)</th>
<th>Screening Evaluation (Accepted/Rejected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFA with no ICs</td>
<td>No</td>
<td>Yes</td>
<td>Poor</td>
<td>Rejected</td>
</tr>
<tr>
<td>NFA with ICs</td>
<td>Yes</td>
<td>Yes</td>
<td>Fair</td>
<td>Accepted</td>
</tr>
<tr>
<td>Long-Term Monitoring</td>
<td>No</td>
<td>Yes</td>
<td>Good</td>
<td>NAc</td>
</tr>
<tr>
<td>Long-Term Surveillance and Maintenance</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>NAc</td>
</tr>
<tr>
<td>Long-Term Access Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>NAc</td>
</tr>
<tr>
<td>Vegetative Soil Cover</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>Structural Barriers</td>
<td>Yes</td>
<td>Yes</td>
<td>Poor</td>
<td>Rejected</td>
</tr>
<tr>
<td>RCRA Subtitle C Cap</td>
<td>Yes</td>
<td>Yes</td>
<td>Fair</td>
<td>Accepted</td>
</tr>
<tr>
<td>Bio-Intrusion Barrier</td>
<td>Yes</td>
<td>Yes</td>
<td>Fair</td>
<td>Accepted</td>
</tr>
<tr>
<td>Containment Cells</td>
<td>Yes</td>
<td>Yes</td>
<td>Poor</td>
<td>Rejected</td>
</tr>
<tr>
<td>In Situ Vitrification</td>
<td>Yes</td>
<td>Yes</td>
<td>Poor</td>
<td>Rejected</td>
</tr>
<tr>
<td>In Situ Grouting or Chemical Fixation</td>
<td>Yes</td>
<td>Yes</td>
<td>Poor</td>
<td>Rejected</td>
</tr>
<tr>
<td>Complete Excavation with Aboveground Retrievable Storage</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>Complete Excavation with Off-Site Disposal</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>Partial Excavation with Aboveground Retrievable Storage</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>Partial Excavation with Off-Site Disposal</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>Future Excavation</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

*a* "Yes" implies that the technology is responsive to at least one of the corrective action objectives.

b *"Yes" implies that the technology is technically or administratively implementable.

*ICs are implicit in all proposed corrective measures alternatives.

IC Institutional Controls
MWL Mixed Waste Landfill
NA Not applicable
NFA No Further Action
RCRA Resource Conservation and Recovery Act
## Table 3-1
Development of Corrective Measures Alternatives for the MWL

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

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

<table>
<thead>
<tr>
<th>General Corrective Measure</th>
<th>Alternative</th>
<th>Description</th>
<th>Direct Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I.a</td>
<td>NFA with ICs</td>
<td>$1,082,143</td>
</tr>
<tr>
<td>Containment</td>
<td>III.a</td>
<td>Bio-Intrusion Barrier</td>
<td>$2,201,668</td>
</tr>
<tr>
<td></td>
<td>III.b</td>
<td>Vegetative Soil Cover</td>
<td>$1,953,501</td>
</tr>
<tr>
<td></td>
<td>III.c</td>
<td>Vegetative Soil Cover with Bio-Intrusion Barrier</td>
<td>$2,527,007</td>
</tr>
<tr>
<td></td>
<td>III.d</td>
<td>RCRA Subtitle C Cap</td>
<td>$2,850,872</td>
</tr>
<tr>
<td></td>
<td>III.e</td>
<td>RCRA Subtitle C Cap with Bio-Intrusion Barrier</td>
<td>$3,636,474</td>
</tr>
<tr>
<td></td>
<td>V.a</td>
<td>Complete Excavation with Aboveground Retrievable Storage—Option A</td>
<td>$545,620,660</td>
</tr>
<tr>
<td></td>
<td>V.a</td>
<td>Complete Excavation with Aboveground Retrievable Storage—Option B</td>
<td>$416,018,751</td>
</tr>
<tr>
<td></td>
<td>V.b</td>
<td>Complete Excavation with Off-Site Disposal—Option A</td>
<td>$702,088,516</td>
</tr>
<tr>
<td></td>
<td>V.b</td>
<td>Complete Excavation with Off-Site Disposal—Option B</td>
<td>$579,110,303</td>
</tr>
<tr>
<td></td>
<td>V.c</td>
<td>Partial Excavation with Aboveground Retrievable Storage—Option A</td>
<td>$139,718,215</td>
</tr>
<tr>
<td></td>
<td>V.c</td>
<td>Partial Excavation with Aboveground Retrievable Storage—Option B</td>
<td>$103,569,857</td>
</tr>
<tr>
<td></td>
<td>V.d</td>
<td>Partial Excavation with Off-Site Disposal—Option A</td>
<td>$157,360,724</td>
</tr>
<tr>
<td></td>
<td>V.d</td>
<td>Partial Excavation with Off-Site Disposal—Option B</td>
<td>$116,638,183</td>
</tr>
<tr>
<td></td>
<td>V.e</td>
<td>Future Excavation</td>
<td>$72,512,261a</td>
</tr>
</tbody>
</table>

*Costs for aboveground retrievable storage of waste and/or shipment of waste to an off-site, licensed facility for disposal are not included.

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

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Cost of Excavation, Characterization, and Transportation</th>
<th>Cost of Aboveground Retrievable Storage Facility and/or Waste Processing Facility</th>
<th>Total Direct Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.a</td>
<td>Complete Excavation with Aboveground Retrievable Storage—Option A</td>
<td>$420,059,569</td>
<td>$125,561,091</td>
<td>$545,620,660</td>
</tr>
<tr>
<td></td>
<td>Complete Excavation with Aboveground Retrievable Storage—Option B</td>
<td>$367,196,113</td>
<td>$48,822,638</td>
<td>$416,018,751</td>
</tr>
<tr>
<td>V.b</td>
<td>Complete Excavation with Off-Site Disposal—Option A</td>
<td>$653,265,878</td>
<td>$48,822,638</td>
<td>$702,088,516</td>
</tr>
<tr>
<td></td>
<td>Complete Excavation with Off-Site Disposal—Option B</td>
<td>$530,287,665</td>
<td>$48,822,638</td>
<td>$579,110,303</td>
</tr>
<tr>
<td>V.c</td>
<td>Partial Excavation with Aboveground Retrievable Storage—Option A</td>
<td>$97,997,927</td>
<td>$41,720,288</td>
<td>$139,718,215</td>
</tr>
<tr>
<td></td>
<td>Partial Excavation with Aboveground Retrievable Storage—Option B</td>
<td>$79,510,583</td>
<td>$24,059,274</td>
<td>$103,569,857</td>
</tr>
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<td>V.d</td>
<td>Partial Excavation with Off-Site Disposal—Option A</td>
<td>$138,479,388</td>
<td>$18,881,336</td>
<td>$157,360,724</td>
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<td>Partial Excavation with Off-Site Disposal—Option B</td>
<td>$97,756,847</td>
<td>$18,881,336</td>
<td>$116,638,183</td>
</tr>
<tr>
<td>V.e</td>
<td>Future Excavation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$48,452,987</td>
<td>$24,059,274</td>
<td>$72,512,261</td>
</tr>
</tbody>
</table>

<sup>a</sup>Costs for aboveground retrievable storage of waste and/or shipment of waste to an off-site, licensed facility for disposal are not included.
### Table 3-4
Summary of Development of Corrective Measures Alternatives for the MWL (Chapter 3.0)

<table>
<thead>
<tr>
<th>General Corrective Measure</th>
<th>Alternative</th>
<th>Description</th>
<th>Effectiveness at Meeting Corrective Action Objectives</th>
<th>Implementability</th>
<th>Evaluation Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimize Exposure to Workers, the Public, and Wildlife</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limit Migration of Contaminants to Groundwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimize Biological Intrusion into Waste</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Prevent or Limit Human Intrusion</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Constructability Concerns</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>Worker Health and Safety Risk</td>
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<td>Maintenance Requirements</td>
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<td>Evaluation Summary</td>
<td></td>
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</tr>
<tr>
<td>General Corrective Measure</td>
<td>Description</td>
<td>Effectiveness</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-------------</td>
<td>------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>I.a</td>
<td>NFA with ICs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Insignificant</td>
</tr>
<tr>
<td>II.a</td>
<td>Bio-Intrusion Barrier</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>II.b</td>
<td>Vegetative Soil Cover</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>II.c</td>
<td>Vegetative Soil Cover with Bio-Intrusion Barrier</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>II.d</td>
<td>RCRA Subtitle C Cap</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>II.e</td>
<td>RCRA Subtitle C Cap with Bio-Intrusion Barrier</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>III.a</td>
<td>Complete Excavation with Aboveground Retrievable Storage</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>III.b</td>
<td>Complete Excavation with Off-Site Disposal</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>III.c</td>
<td>Partial Excavation with Aboveground Retrievable Storage</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>III.d</td>
<td>Partial Excavation with Off-Site Disposal</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>III.e</td>
<td>Future Excavation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

IC: Institutional Controls
MWL: Mixed Waste Landfill
NFA: No Further Action
RCRA: Resource Conservation and Recovery Act
# Table 4-1
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>MWL I.a NFA with ICs</th>
<th>MWL III.b Vegetative Soil Cover</th>
<th>MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier</th>
<th>MWL V.e Future Excavation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long-Term Reliability and Effectiveness</strong></td>
<td>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.</td>
<td>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.</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Extent of Long-Term Monitoring</strong></td>
<td>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.</td>
<td>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.</td>
<td>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.</td>
<td>No monitoring required after excavation.</td>
</tr>
<tr>
<td><strong>Uncertainties Associated with Leaving Waste in Place</strong></td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>NA – No waste left in place.</td>
</tr>
</tbody>
</table>

Refer to footnotes at end of table.
Table 4-1 (Continued)
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>MWL I.a NFA with ICs</th>
<th>MWL III.b Vegetative Soil Cover</th>
<th>MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier</th>
<th>MWL V.e Future Excavation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential for Failure of Alternative</td>
<td>Very Low</td>
<td>Very Low</td>
<td>Very Low</td>
<td>NA – No waste left in place.</td>
</tr>
<tr>
<td>Reduction in Toxicity, Mobility, and Volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in Toxicity</td>
<td>No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.</td>
<td>No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.</td>
<td>No reduction other than natural radioactive decay. Reduction of radiological toxicity can be achieved only by the passage of time.</td>
<td>NA</td>
</tr>
<tr>
<td>Reduction in Volume</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Potential increase in volume</td>
</tr>
<tr>
<td>Short-Term Effectiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rad: TEDE unchanged.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ecorisk unchanged.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Needed to Achieve Reduction in Risk(s)</td>
<td>1 month</td>
<td>4 months</td>
<td>4 months</td>
<td>2 years (excavation only)</td>
</tr>
</tbody>
</table>

Refer to footnotes at end of table.
Table 4-1 (Concluded)
Summary Evaluation of MWL Candidate Corrective Measures Alternatives

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>MWL I.a NFA with ICs</th>
<th>MWL III.b Vegetative Soil Cover</th>
<th>MWL III.c Vegetative Soil Cover with Bio-Intrusion Barrier</th>
<th>MWL V.e Future Excavation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term Risk(S)</td>
<td>Transportation:</td>
<td>Transportation:</td>
<td>Transportation:</td>
<td>Transportation:</td>
</tr>
<tr>
<td>Posed to Site Workers, the Community, and the Environment During Implementation of the Alternative</td>
<td>Injuries: 1.8E-2</td>
<td>Injuries: 4.9E-2</td>
<td>Injuries: 2.5E-1</td>
<td>Injuries: 8.8E-1</td>
</tr>
<tr>
<td></td>
<td>Fatalities: 4.9E-4</td>
<td>Fatalities: 1.3E-3</td>
<td>Fatalities: 6.6E-3</td>
<td>Fatalities: 2.3E-1</td>
</tr>
<tr>
<td></td>
<td>Implementation:</td>
<td>Implementation:</td>
<td>Implementation:</td>
<td>Implementation:</td>
</tr>
<tr>
<td></td>
<td>Injuries: 9.5E-2</td>
<td>Injuries: 2.6E-1</td>
<td>Injuries: 3.2E-1</td>
<td>Injuries: 2.2E+0</td>
</tr>
<tr>
<td></td>
<td>Fatalities: 2.4E-3</td>
<td>Fatalities: 3.2E-3</td>
<td>Fatalities: 3.5E-3</td>
<td>Fatalities: 1.1E-2</td>
</tr>
<tr>
<td>Implementability</td>
<td>Readily available</td>
<td>Readily available</td>
<td>Readily available</td>
<td>Readily available</td>
</tr>
<tr>
<td>Technical and Administrative Difficulties</td>
<td>Air quality</td>
<td>Air quality</td>
<td>Air quality</td>
<td>Digging, rad worker, waste storage, waste treatment, air quality</td>
</tr>
<tr>
<td>Permits and Approvals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital and Operation and Maintenance Costs (Net Present Value)</td>
<td>$1,772,882</td>
</tr>
</tbody>
</table>

*The estimated cost for future excavation does not include costs for waste disposal or operations and maintenance because of the uncertainties associated with future waste disposal and the difficulties in estimating these costs.

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>
<thead>
<tr>
<th>Alternatives</th>
<th>Human Health (IND)</th>
<th>Ecological</th>
<th>Transportation and Remediation Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonrad</td>
<td>Rad</td>
<td>Nonrad</td>
</tr>
<tr>
<td>MWL Risk</td>
<td>HI = 0.07</td>
<td>CR = 3E-6</td>
<td>TEDE = 3.3E-1 mrem/yr CR = 2.2E-6</td>
</tr>
<tr>
<td>Baseline—NFA with No ICs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWL–Ia. NFA with ICs</td>
<td>HI = 0.00</td>
<td>CR = 1E-9</td>
<td>TEDE = 3.3E-1 mrem/yr CR = 2.2E-6</td>
</tr>
<tr>
<td>Vegetative Soil Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWL–Illb. Vegetative Soil Cover</td>
<td>HI = 0.00</td>
<td>CR ~ 0.00</td>
<td>TEDE = 2.4E-5 mrem/yr CR = 3.4E-10</td>
</tr>
<tr>
<td>with Bio-Intrusion Barrier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWL–Illc. Vegetative Soil Cover</td>
<td>HI = 0.00</td>
<td>CR ~ 0.00</td>
<td>TEDE = 2.4E-5 mrem/yr CR = 3.4E-10</td>
</tr>
<tr>
<td>with Bio-Intrusion Barrier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWL–V.e Future Excavation</td>
<td>HI = 0.07</td>
<td>CR = 3E-6</td>
<td>TEDE = 3.23E3 mrem/yr CR = 3.7E-2</td>
</tr>
</tbody>
</table>

**Table 4-2**

**Summary of the MWL CMS Alternatives Risk Results**

- **HI** Hazard Index
- **CR** Cancer Risk
- **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

<table>
<thead>
<tr>
<th>General Corrective Measure</th>
<th>Alternative</th>
<th>Description</th>
<th>Cost Component</th>
<th>Direct Costᵃ</th>
<th>Markupsᵇ</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFA I.a</td>
<td>NFA with ICs</td>
<td></td>
<td>Capital Costᶜ</td>
<td>$1,082,143</td>
<td>$690,739</td>
<td>$1,772,882</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operations &amp; Maintenanceᵈ</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Costᵃ (Net Present Value)</td>
<td>NA</td>
<td>NA</td>
<td>$1,772,882</td>
</tr>
<tr>
<td>Containment II.b</td>
<td>Vegetative Soil Cover</td>
<td></td>
<td>Capital Costᶜ</td>
<td>$1,953,501</td>
<td>$1,525,040</td>
<td>$3,478,541</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operations &amp; Maintenanceᵈ</td>
<td>$309,301</td>
<td>$547,432</td>
<td>$856,733</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Costᵃ (Net Present Value)</td>
<td>NA</td>
<td>NA</td>
<td>$4,335,274</td>
</tr>
<tr>
<td>III.c Vegetative Soil Cover with Bio-Intrusion Barrier</td>
<td></td>
<td>Capital Costᶜ</td>
<td>$2,527,007</td>
<td>$1,959,816</td>
<td>$4,486,823</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operations &amp; Maintenanceᵈ</td>
<td>$849,300</td>
<td>$1,760,736</td>
<td>$2,610,036</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Costᵃ (Net Present Value)</td>
<td>NA</td>
<td>NA</td>
<td>$7,096,859</td>
</tr>
<tr>
<td>Excavation IV.e Future Excavation</td>
<td></td>
<td>Capital Costᶜ</td>
<td>$72,512,261</td>
<td>$33,696,824</td>
<td>$106,209,085</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operations &amp; Maintenanceᵈ</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Costᵃ (Net Present Value)</td>
<td>NA</td>
<td>NA</td>
<td>$106,209,085</td>
</tr>
</tbody>
</table>

ᵃDirect costs include material, labor, and equipment used to implement the alternative.
ᵇMarkups 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.
ᶜCapital costs include construction and installation costs, equipment costs, and indirect costs such as engineering costs, legal fees, permitting fees, and startup and shakedown costs.
ᵈOperation 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.
ᵉTotal 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