Title 40 CFR Part 191
Compliance Certification
Application
for the
Waste Isolation Pilot Plant

Appendix AIC

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Area Office
Carlsbad, New Mexico

-
-
-

1 **THIS PAGE INTENTIONALLY LEFT BLANK**

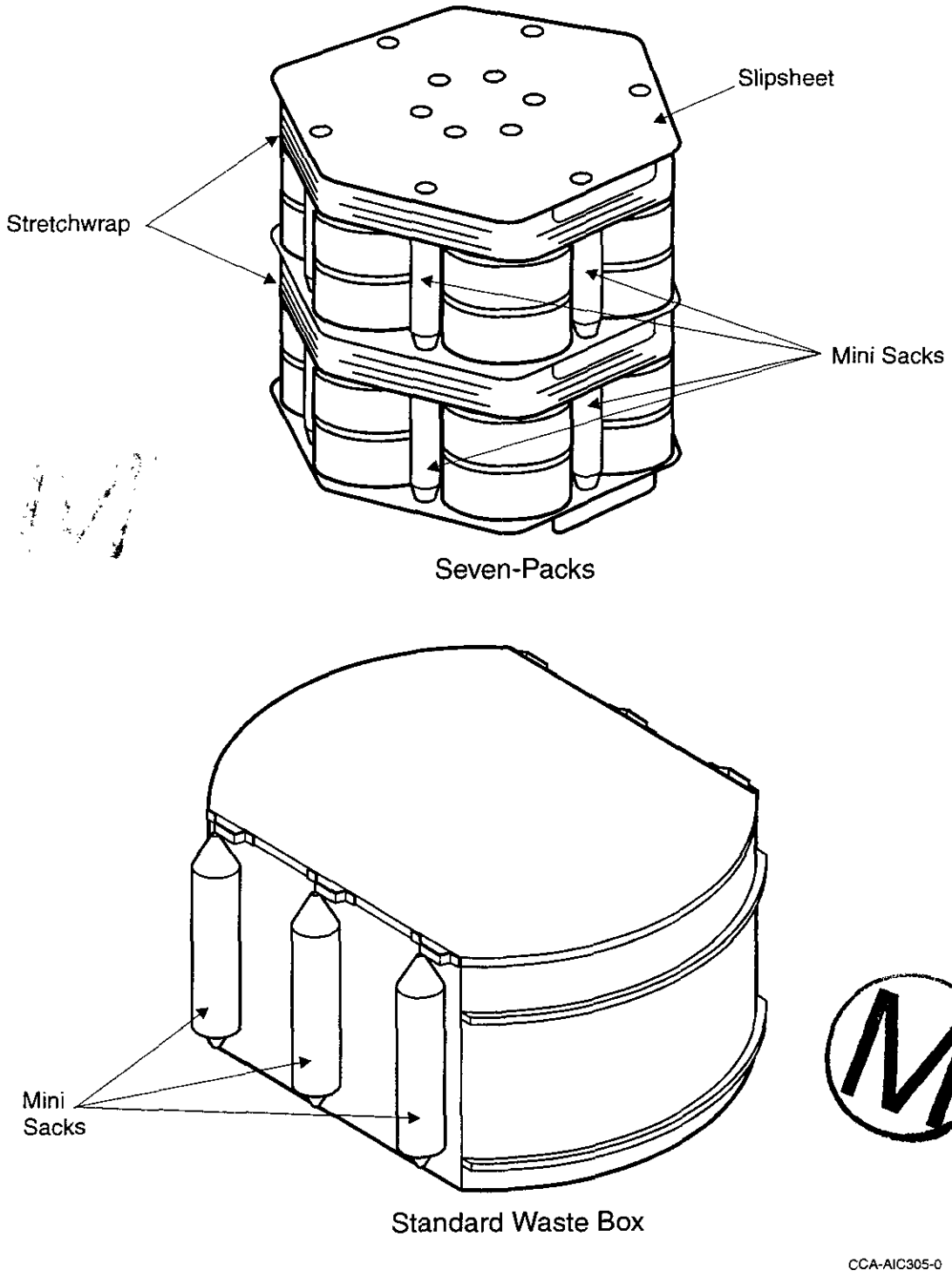

Figure AIC-2. Standard Waste Box and Seven-Pack Configuration

1 THIS PAGE INTENTIONALLY LEFT BLANK

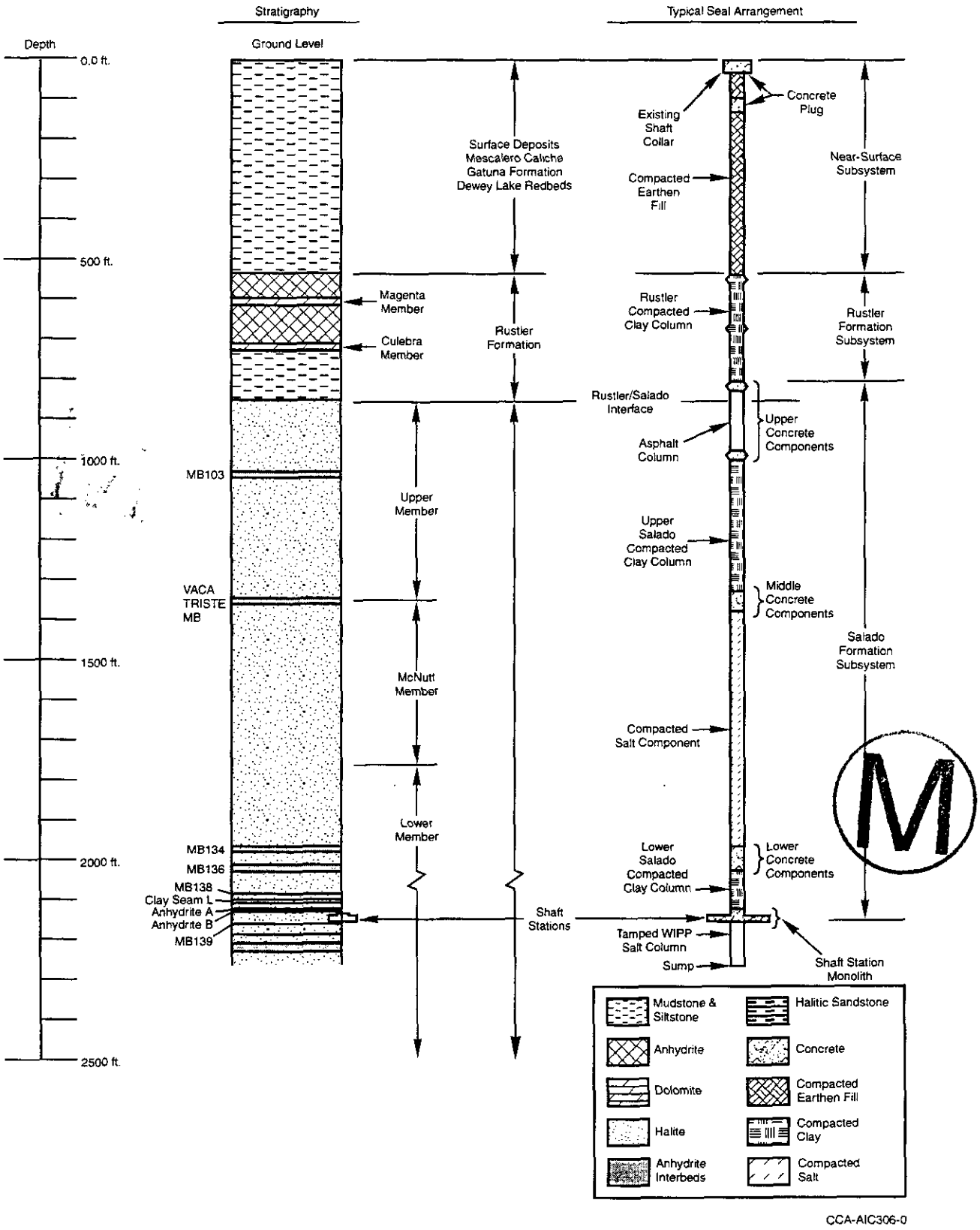

Figure AIC-3. Typical Shaft Sealing System

1 **THIS PAGE INTENTIONALLY LEFT BLANK**

- The test program supporting the permanent marker system will require the construction of a berm section, the erection of test monuments, and the emplacement of test markers, all of which impact the ability to return the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem.

- A posted access barrier will be erected around the repository footprint, also affecting the return of the land disturbed by the WIPP activities to a stable ecological state.

- Elevation benchmarks to support the long-term monitoring program will be located within a grid network on the surface of the withdrawal area.

- A portion of the mined salt sufficient to support future construction of the berm component of the permanent marker system (see Appendix PIC) will remain on the surface.

- The water supply line to the site will be disconnected. At a future time, a water supply may have to be reestablished to support construction of the permanent marker system. This supply will also be disconnected when construction of the marker system is complete.

- The electrical supply to the site will be removed and isolated at the utility company's substation. Electricity will be required for the future construction of the permanent marker system.

Over the several decades following site restoration, activities supporting the long-term monitoring program and evaluation of the performance of the permanent marker system test program will require occasional access to the site surface area. Construction of the permanent marker system will be a significant effort that will again require the development of water, electrical, and transportation facilities at the site. Both railroad and trucking will be used to transport required materials to the site. This effort is scheduled to last several years.

Upon completion of the permanent marker system, the access control program for the site will be reevaluated and modified as required to address any changes necessitated by the effects of the permanent marker system. At the time that the permanent marker system construction effort is completed, the utilities and railroad spur supporting the site will be removed and the affected terrain returned to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem.

AIC.1 Design Criteria

The access control design criteria applicable to the WIPP active institutional controls after disposal have been developed to meet the definition in 40 CFR § 191.12 for controlling access to the disposal site. In addition to active access controls, the criteria also address scheduling

processes to be implemented upon completion of shaft sealing activities. The decontamination, decommissioning, and restoration of the land is addressed in Appendix D&D of this application and will be described in detail in the *Plan for WIPP Decommissioning*. The *Passive Institutional Controls Conceptual Design Report* (Appendix PIC) addresses postdecommissioning testing activities conducted at the WIPP site. To a limited extent, the restoration of the land to its original condition will be impacted by the testing activities related to the permanent marker system and by the hot cell structure, which will not be removed but will remain as an artifact of the WIPP operating surface activity. The monitoring plan for the detection of substantial and detrimental deviations from expected performance of the disposal system is described in Appendix MON.

Although the LWA establishes a 10,240-acre (4,144-hectare) area for administrative control by the Secretary of Energy in conducting activities associated with the WIPP, the actual disposal area is only approximately 120 acres (48.5 hectares). Access is controlled to ensure that inadvertent intrusion into the disposal area does not occur. Deep or shallow drilling and mining activities are the scenarios requiring consideration as human intrusion events in performance assessment. Drilling techniques in the local area do not normally include slant drilling (see Appendix DEL). In those cases where slant drilling is used, deviation from vertical does not begin until a depth of approximately 4,000 feet (1,200 meters) is attained. This depth is well below the Salado Formation, which extends to approximately 2,800 feet (854 meters) below the surface in the vicinity of the repository. Salt formations do not typically support slant drilling because of the solubility and insufficient consolidation of the salt material (that is, its softness) (Rodriguez and Hughes 1994 and Rodriguez 1996, both in the Bibliography). These technical facts reasonably preclude slant drilling into the repository from outside the area immediately above the repository. In addition, as described in Appendix PIC, the withdrawal boundary is marked with warnings not to drill or conduct mining operations within the 16-square-mile (41-square-kilometer) controlled area. Therefore, it is reasonable not to extend a restrictive access control program to the entire 10,240 acres (4,144 hectares) with the accompanying cost increase and unnecessary resulting prohibition of such uses as grazing, hunting, and other public recreational activities.

The design features developed for the active access controls after disposal are the following:

1. A fence line will be established to control access to the repository footprint area on the surface. A standard four-strand (three barbed and one unbarbed, in accordance with the Bureau of Land Management specifications) wire fence will be erected along the perimeter of the repository surface footprint. To provide access to the repository footprint during construction of the berm (which may be built in multiple sections simultaneously), the fence will have gates placed approximately midway along each of the four sides. The western gate will be 20 feet (6 meters) wide. The remaining three gates will each be 16 feet (4.9 meters) wide. Additional fencing may be needed for remote locations that are used for disposal system monitoring. Such fences will meet the same construction specifications as the repository footprint perimeter fence.

2. Unpaved roadways 16 feet (4.9 meters) wide will be established along the perimeter of the barbed wire fence as well as along the WIPP site boundary. These roadways will be constructed so as to provide ready vehicle access to any point around the fenced perimeter and the site boundary. These roadways will facilitate inspection and maintenance of the fenceline and will allow visual observation of the repository footprint and the site boundary to the extent permitted by the lay of the land. These roadways will connect to the paved south access road. Roads to remote sites will also be constructed and maintained as needed.

3. The fence line will be posted with signs having, as a minimum a legend reading "Danger—Unauthorized Personnel Keep Out" (40 CFR § 264.14[c]) and warning against entering the area without specific permission of the federal government. The signs must be legible from a distance of at least 25 feet (7.6 meters). The size of the visual warning and the spacing of the warning signs will be sufficiently large and close to ensure that one or more of the signs can be seen from any approach prior to an individual actually making contact with the fence line. In no case will the spacing be greater than 300 feet (91.5 meters).

4. The federal government will ensure that periodic inspection and expedited corrective maintenance are conducted on the fence line, its associated warning signs, and the roadway.

5. The federal government will provide for routine periodic patrols and surveillance of the protected area by personnel trained in security surveillance and investigation.

6. A process will be implemented for monitoring and controlling the long-term testing requirements of the permanent marker system and implementing the periodic monitoring requirements of the long-term monitoring system.

7. The federal government will ensure that any necessary modifications to the active controls appropriate for access control and surveillance upon installation of the permanent marker system are provided.

8. The federal government will provide for actions to be taken to address abnormal conditions identified during periodic surveillance and inspections.

9. Reports addressing activities associated with the performance of the active access controls after disposal will be prepared periodically by the federal government for submittal to the appropriate regulatory and legislative authority.

The primary active attribute of access control consists of the routine surveillance patrols of the fence barrier and the repository footprint within that barrier. Periodic monitoring of the parameters associated with repository performance is a secondary active control feature. The

development of a schedule for these activities and implementation of that schedule serves as a tertiary active control. The details of the monitoring program are described in Appendix MON.

AIC.2 Access Controls

40 CFR § 191.12 defines active institutional controls to consist of four elements:

- controlling access to a disposal site by any means other than passive institutional controls,
- performing maintenance operations or remedial actions at a site,
- controlling or cleaning up releases from a site, and
- monitoring parameters related to disposal system performance.

The LWA has removed the WIPP site from public use as a site for mining and other types of mineral resource extraction. Since any type of exploration activity would require authorization, the issuance of approval to intrude upon the repository is precluded by the LWA. The existence of the LWA as law permits meeting the requirements of the first element above by implementing low technology barriers. These barriers include a posted fence and active surveillance at a frequency that denies sufficient time for an individual or organization to intrude into the repository undetected using today's drilling technology. As identified in the design criteria, maintenance and remedial actions at the WIPP site will be conducted by the federal government at the time of implementing the access controls for the site. Those maintenance operations and remedial actions associated with decommissioning and site restoration following final facility closure are discussed in Appendix D&D. The control or cleanup of releases from the site will be conducted as part of the operational program prior to sealing of the shafts. This is necessary to ensure that all radioactive derived waste is disposed of within the repository prior to shaft sealing. There is no credible scenario for the release of radioactive material during the active institutional controls period. Both preclosure and postclosure monitoring of disposal system performance are addressed in Appendix MON.

The federal government has the responsibility to maintain the access controls. Such responsibility includes the maintenance and corrective actions necessary to ensure that the fence and patrol requirements (surveillance) are met for as long as the federal government remains a viable controlling entity. Justification that such control will endure for at least 100 years is supported by the fact that the U.S. government has existed for over 200 years, and in that 200 years, its degree of control over activities affecting the common good has steadily increased. In addition, historical evidence supports that as the human population increases

and technology advances, the need to control the resulting complexities gives rise to society's acceptance of a governing system of laws, regulations, and oversight of activities affecting the common good.

AIC.2.1 Repository Footprint Fencing

Access to an area approximately 2,780 feet by 2,360 feet (875 meters by 720 meters) will be controlled by a four-strand barbed wire fence. A single gate will be included along each side of the fence for access. Around the perimeter of the fence, an unpaved roadway 16 feet (4.9 meters) wide will be cut to allow for patrolling of the perimeter. Figure AIC-4 is an illustration of the fence line in relation to the repository footprint. Patrolling of the perimeter is based upon the need to ensure that no mining or well drilling activity is inadvertently initiated that could threaten the integrity of the repository.

Fencing off an area larger than the disposal area footprint would not significantly reduce the risk of inadvertent intrusion but would interfere with cattle grazing established prior to the LWA. The LWA states that the Secretary of Energy can allow grazing to continue where it was established prior to enactment of the LWA. Based upon current drilling technologies, discussions with local well drilling organizations, and observation of well drilling activities in the WIPP vicinity, it typically requires at least two to three days for a driller to set up a deep drilling rig and commence actual drilling operations. Attaining the 2,150-foot (655-meter) depth that would approach the repository horizon takes at least another week to 10 days. Based upon current drilling practices (see Appendix DEL), patrolling the fenced area two to three times weekly would identify any potential drilling activity well before any breach of the repository could occur.

A scenario involving drilling at a location outside the disposal area surface footprint and inadvertently intruding into the disposal area is extremely unlikely. The most economical drilling practice is to drill vertically into the targeted formation. Local slant drilling is conducted only when the desired drill location is not available because of circumstances that the operator cannot overcome. When slant drilling practices are employed, the deviation from a vertical position directly below the drill rig does not commence until approximately 4,000 feet (1,200 meters) below the surface in the local area. Slant drilling within a salt formation is not practical because the salt is water soluble and insufficiently consolidated to support the technique for accurate control of the drill bit (Rodriguez 1996 in the Bibliography). According to the local office of the Bureau of Land Management, local operators and drillers, and oil field consultants, slant drilling in the local area does not begin until the drilling operator has reached a level below the evaporite formations. The lowest evaporite formation in the WIPP vicinity is the Castile Formation, which lies immediately below the Salado, which contains the WIPP repository.

Construction of access control systems using higher technology than described is not required or cost-effective. Likewise, continuous surveillance whether human or electronic is not required or practicable. The staffing levels required to achieve continuous human surveillance

become significant when weighed against the potential threat and alternatives for controlling access. Continuous electronic surveillance also has significant costs of procurement, installation, testing, and maintenance. Electronic systems would require significant maintenance, both operational and corrective, and probably would not relieve the need to make routine patrols to the site. This is especially true of alarmed electronic surveillance in a location populated by a variety of wild and domestic animals that might trigger numerous false alarms. Televised electronic surveillance that combines both human and electronic technology could be incorporated to deter inadvertent human intrusion; however, this method is extremely costly.

AIC.2.2 Surveillance Monitoring

The federal government (initially DOE and/or the Bureau of Land Management) will conduct periodic surveillance of the site and the repository footprint. Unpaved roadways around the WIPP site boundary and around the repository footprint will facilitate such surveillance. Contractual arrangements with a local organization such as the Eddy County Sheriff's Department would provide some distinct advantages. Among the advantages are the following:

- deputies are trained in patrol and surveillance activities,
- deputies are authorized to arrest members of the general public who are found to be violating trespassing laws,
- the liability associated with apprehension, attempted apprehension, or circumstances arising from attempts would remain with the Sheriff's Department, and
- the general area to be patrolled is already a part of the Sheriff's area of responsibility.

Surveillance will consist of drive-by patrolling around the fenced perimeter a minimum of two times per week. In the course of the patrol, particular note will be taken of the fence integrity. In addition, the locked condition of each gate will be checked to ensure that gate integrity is maintained and there is no evidence of tampering. Surveillance will also include visual observation of the entire enclosed area for any signs of human activity. Additionally, surveillance patrols will be conducted around the site boundary's perimeter for signs of unauthorized human activities. A routine summary of each month's surveillance activity will be prepared documenting the date and time of each patrol and any unusual circumstances that may have been observed. This surveillance routine will continue throughout the active controls period and for at least 100 years following the sealing of shafts.

Upon beginning construction of the permanent marker system, a routine presence at the site will once again be established and periodic surveillance will not be necessary. Once the permanent marker system is completed, the active controls program and access control measures will be reevaluated, and changes necessitated by construction of the permanent

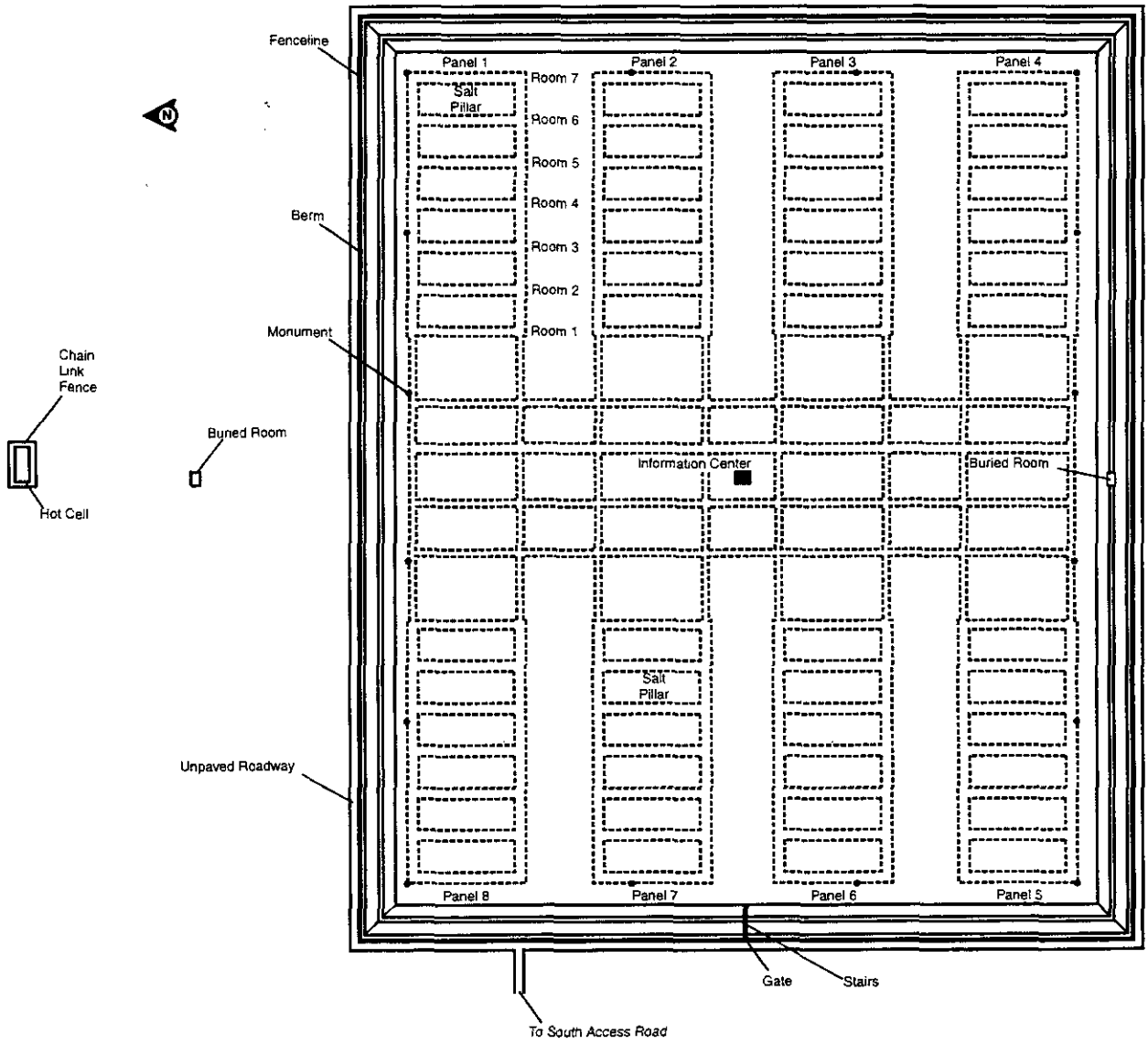

Figure AIC-4. Perimeter Fenceline and Roadway

THIS PAGE INTENTIONALLY LEFT BLANK

marker system will be made and implemented for the remainder of the active controls period. With construction of the permanent marker system, easy visual inspection will not be possible from the perimeter fence because the berm and monuments will restrict vision. However, this will not affect the ability of patrols to properly survey the repository footprint integrity. The berm profile and configuration would require an extensive dismantling effort to create an opening sufficient to permit entrance of drilling equipment. The routine patrols would detect this effort well before intrusion into the repository could occur.

AIC.2.3 Maintenance and Remedial Actions

Anticipated maintenance and remedial action issues during the active controls period are minimal and should encompass such issues as

- fence and road maintenance,
- correction of any damage that occurs due to vandalism,
- response to evidence of potential erection of drilling equipment, and
- response to unauthorized entry into prohibited areas.

The federal government (initially the DOE) will provide maintenance services when the need is identified during routine patrolling activity. Any observed vandalism or unauthorized entry will be investigated and action will be taken as the circumstances warrant.

AIC.2.4 Control and Clean-up of Releases

The *Plan for WIPP Decommissioning* (as required by the LWA) will describe how the DOE intends to decontaminate and dismantle the surface structures. The decontamination process and disposal of the derived radioactive waste will be completed prior to sealing the shafts and final facility closure. With the location of the WIPP repository at 2,150 feet (655 meters) below the surface and with panels closed and shafts sealed, the potential for releases of radioactive material following the sealing of the shafts is precluded. There will be no credible pathway for releases from the repository other than human intrusion. Routine patrols in accordance with access control requirements will preclude human intrusion into the repository.

AIC.2.5 Monitoring Disposal System Performance

Subsidence monitoring is one of three monitoring programs that are expected to be conducted throughout the active institutional controls period (see Appendix SMP). The other programs are groundwater surveillance and drilling practice observation (Appendices GWMP and DMP). If, upon analysis of monitoring data, disposal system performance deviates from what

is expected, other techniques also described in the long-term monitoring plan may be used to assist in acquiring more information regarding performance.

Performance assessment sensitivity analyses have identified important repository performance parameters (see Appendix MON). Those important parameters that lend themselves to current monitoring technologies without compromising the integrity of the disposal system were considered as candidates for preclosure and postclosure monitoring.

AIC.3 Periodic Activity Controls

With the advent of decommissioning the WIPP and returning the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem, continuous occupancy of the site for operational and security purposes will cease. However, during the active controls period after disposal (at least 100 years) there will be an ongoing need to carry out periodic activities associated with the long-term monitoring program and evaluations of the performance of permanent marker system features under long-term testing. To ensure that these periodic activities are implemented and that their results are included in periodic reports to the appropriate regulatory and legislative authorities, the essential elements of the process for controlling these activities have been identified. The process will be managed from the appropriate DOE office. The essential elements of the process include the following:

- development of detailed individual activities supporting the long-term monitoring plan;

- development of detailed individual activities supporting the evaluation of performance of permanent marker system features;

- development of the individual steps and identification of responsible personnel required for the drafting, review, commenting, and approval of reports to the appropriate regulatory authority;

- development of the individual steps and identification of responsible organizations or personnel required for the drafting, review, commenting, and approval of reports to the appropriate legislative authority;

- identification of the requirements defined from the above actions in a detailed schedule covering a period of at least 10 years;

- review of the approved schedule at least quarterly during the first two years following completion of land restoration and implementation of active institutional controls; and

- semiannual reviews of the schedule including updating and progress reporting to the DOE to be documented until such time as the federal government ceases active control of the site.

For long-term repository performance monitoring, a detailed subsidence survey will be conducted upon completion of land restoration. That survey will include, at a minimum, the 54 elevation benchmarks currently monitored. Once every 10 years, an additional detailed subsidence survey will be taken and analyzed for indications of unexpected repository performance. The long-term monitoring plan describes in detail additional technologies to be used to further evaluate repository performance should any unanticipated subsidence data be developed. These additional technologies may include

- seismic reflection and refraction surveys,
- gravitational surveys,
- electromagnetic conductivity surveys,
- resistivity surveys, and
- ground-penetrating radar surveys.

Currently, none of these technologies is developed to the degree of providing irrefutable evidence of the condition of the sealed repository. However, over the next few decades while waste is being emplaced in the repository, the technologies will likely advance significantly. It is also possible that images available using today's technologies will improve to a point where resolution of images of the repository acquired from grade level will be of sufficient quality to make some assessments of repository performance. Updating the 10-year schedule every six months to one year will ensure that this infrequent requirement is not lost.

To optimize the final design of the permanent marker system, testing of various materials and berm configurations over a long period of time is a prudent and logical course of action. The detailed activities supporting the testing required to evaluate various aspects of the planned permanent marker system design will be included in the schedule managed during the active institutional controls period. Periodic reports will also be managed by the scheduling activity during the active controls period.

Because of the relatively simple technology utilized in providing access control to the repository footprint and the hot cell, the range of potential abnormal occurrences is quite limited. Primarily, the abnormal occurrences will involve damage to the fencelines or roadway through vandalism, weather effects, and aging of the materials. The federal government is responsible for corrective action to repair these effects. Considering the properties for which access control is being provided, there is no need to provide continuous

surveillance. However, arrangements will be made to increase vehicular patrols of the site to daily patrols until repairs are made, if the damage is of a suspicious nature. If not, no increase in patrol activity will be required.

Abnormal occurrences associated with the environmental monitoring activities will be investigated. As described above, the postdecommissioning environmental monitoring program will include both radiological and nonradiological monitoring for the first two years following land restoration and then only radiological monitoring thereafter. Because of the reduced activity to support the WIPP after disposal, it is probably more cost effective for the DOE to contract for the periodic sampling and analyses than to maintain a Carlsbad staff for that purpose. Within the contractual arrangements, immediate notification by the contractor to the DOE Albuquerque Operations Office in the event of an abnormal occurrence will be a requirement. Appropriate guidelines for action to mitigate the effects of abnormal occurrences related to environmental monitoring will include

- verification of analytical results,
- increased frequency of sampling and analyses,
- determination of cause,
- investigation of additional geographical and/or parameter monitoring areas that might be affected, and
- timely communication to the press regarding any potential adverse impacts and mitigating actions to be taken.

The action guidelines for abnormal occurrences associated with subsidence are the same as those proposed for the environmental monitoring program.

AIC.4 Quality Assurance

The quality assurance and quality control discipline will be applied to the procurement of materials for and the erection of the fencelines enclosing the repository footprint and the hot cell. In particular, quality control inspection of the placement and tensioning of the barbed wire and chain link fabric should be applied and utilized to provide reasonable assurance that the fencing structures will function over an extended period of years without significant maintenance.

Quality assurance and quality control will also be applied to the sampling and analyses supporting the environmental monitoring program and the long-term monitoring plan. DOE contractors collecting samples and laboratories conducting analyses should be qualified in

accordance with guidelines prescribed in the most current edition of the *Quality Assurance Program Document* (see Appendix QAPD of this application) at the time that the contracts are awarded.

REFERENCES

EPA (U.S. Environmental Protection Agency). 1993. 40 CFR Part 191 Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste; Final Rule. *Federal Register*, Vol. 58, No. 242, pp. 66398-66416, December 20, 1993. Office of Radiation and Indoor Air, Washington, D.C. WPO 39133.

U.S. Congress. 1992. Waste Isolation Pilot Plant Land Withdrawal Act. Public Law 102-579, 106 Stat. 4777, October 1992. 102nd Congress, Washington, D.C. WPO 39015.

Westinghouse Electric Corporation (WEC). 1996. *WIPP Radiological Control Manual*, WP12-5. Westinghouse Electric Corporation, Waste Isolation Division, Carlsbad, NM.

BIBLIOGRAPHY

Bechtold, S. L. 1995. *National Archives and Records Administration (NARA) Bulletin No. 95-7.* September 8, 1995.

DOE (U.S. Department of Energy). 1991. *Resource Conservation and Recovery Act Part B Permit Application*, DOE/WIPP 91-005. Prepared for the Department of Energy by Westinghouse Electric Corporation, Waste Isolation Division, Carlsbad, NM.

DOE (U.S. Department of Energy). 1995. *Conceptual Decontamination and Decommissioning Plan for the Waste Isolation Pilot Plant*, DOE/WIPP 95-2072. January 1995.

DOE (U.S. Department of Energy). 1995. *Permanent Marker Conceptual Design Report*, Draft. March 1995. U.S. Department of Energy, Carlsbad, NM.

DOE (U.S. Department of Energy). 1995. *Long-Term Monitoring Design Concept Description,* Draft. March 1995. U.S. Department of Energy, Carlsbad, NM.

DOE (U.S. Department of Energy). 1996. *Quality Assurance Program Document*, DOE/CA0-94-1012. Rev. 1. April 1996.

EPA (U.S. Environmental Protection Agency). 1985. 40 CFR Part 191: Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste; Final Rule. *Federal Register*, Vol. 50, No. 182, pp. 38066–38089, September 19, 1985. Office of Radiation and Air, Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1994. 40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart X Miscellaneous Units. *Federal Register*, July 1, 1994. Washington, DC.

Jensen, M. 1993. *Conservation and Retrieval of Information - Elements of a Strategy to Inform Future Societies about Nuclear Waste Repositories.* Final Report of the Nordic Nuclear Safety Research Project KAN-1.3. August 1993.

Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Department of Interior, July 19, 1994.

Rodriguez, R.J., telephone conference with Rodney Vogle, Vogle Horizontal Drilling, Inc. June 7, 1996.

Rodriguez, R.J. and Hughes, D. L. Meeting with Michael White, Santa Fe Energy Resources, Inc. June 29, 1994.

THIS PAGE INTENTIONALLY LEFT BLANK