

ATTACHMENT 1 G
CLOSURE PLAN

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ATTACHMENT ~~1~~ G

CLOSURE PLAN

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1 **ATTACHMENT ~~J~~ G**

2 **CLOSURE PLAN**

3 Introduction

4 This Permit Attachment contains the Closure Plan that describes the activities necessary to
5 close the Waste Isolation Pilot Plant (**WIPP**) individual units and facility. Since the current plans
6 for operations extend over several decades, the Permittees will periodically reapply for an
7 operating permit in accordance with ~~Title 20 of the New Mexico Administrative Code, Chapter 4,~~
8 ~~Part 1 (20.4.1 NMAC), Subpart 900 (20.4.1.900 NMAC)~~ (incorporating 40 CFR §270.10(h)).
9 Consequently, this Closure Plan describes several types of closures. The first type is panel
10 closure, which involves constructing closures in each of the underground hazardous waste
11 disposal units (**HWDUs**) after they are filled. The second type is partial closure, which can be
12 less than the entire facility and therefore less than an entire unit as described herein for the
13 Waste Handling Building (**WHB**) Unit and the Parking Area Unit (**PAU**). The third type of closure
14 is final facility closure at the end of the Disposal Phase, which will entail “clean” closure of all
15 remaining surface storage units and construction of the four shaft seal systems. Finally, in the
16 event a new permit is not issued prior to expiration of an existing permit, a modification to this
17 Closure Plan will be sought to perform contingency closure. Contingency closure defers the final
18 closure of waste management facilities such as the Waste Handling Building Container Storage
19 Unit (**WHB Unit**), the conveyances, the shafts, and the haulage ways because these will be
20 needed to continue operations with non-mixed Transuranic (**TRU**) waste.

21 The hazardous waste management units (**HWMUs**) addressed in this Closure Plan include the
22 aboveground HWMU in the WHB, the parking area HWMU, and Panels 1 through ~~7~~ 8, each
23 consisting of seven rooms.

24 This plan was submitted to the New Mexico Environment Department (**NMED**) and the U.S.
25 Environmental Protection Agency (**EPA**) in accordance with 20.4.1.900 NMAC (incorporating 40
26 CFR §270.14(b)(13)). Closure at the panel level will include the construction of barriers to limit
27 the emission of hazardous waste constituents from the panel into the mine ventilation air stream
28 below levels that meet environmental performance standards¹ and to mitigate the impacts of
29 methane buildup and deflagration that may be postulated for some closed panels. The Post-
30 Closure Plan (Permit Attachment ~~J~~ H) includes the implementation of institutional controls to
31 limit access and groundwater monitoring to assess disposal system performance. Until final
32 closure is complete and has been certified in accordance with 20.4.1.500 NMAC (incorporating
33 40 CFR §264.115), a copy of the approved Closure Plan and all approved revisions will be on
34 file at the WIPP facility and will be available to the Secretary of the NMED or the EPA Region VI
35 Administrator upon request.

¹ The mechanism for air emissions prior to closure is different than the mechanism after closure. Prior to closure, volatile organic compounds (VOC) will diffuse through drum filters based on the concentration gradient between the disposal room and the drum headspace. These VOCs are swept away by the ventilation system, thereby maintaining a concentration gradient that is assumed to be constant. Hence, the VOCs in the ventilation stream are a function of the number of containers only. After closure, the panel air will reach an equilibrium concentration with the drum headspace and no more diffusion will occur. The only mechanism for release into the mine ventilation system is due to pressure that builds up in the closed panel. This pressure arises from the creep closure mechanism that is reducing the volume of the rooms and from the postulated generation of gas as the result of microbial degradation of organic matter in the waste. Consequently, the emissions after panel closure are a direct function of pressurization processes and rates within the panel.

1 | IG-1 Closure Plan

2 | This Closure Plan is prepared in accordance with the requirements of 20.4.1.500 NMAC
3 | (incorporating 40 CFR §264 Subparts G, I, and X), Closure and Post-Closure, Use and
4 | Management of Containers, and Miscellaneous Units. The WIPP underground HWDUs,
5 | including Panels 1 through ~~7~~ 8 on Figure ~~1~~ G-1, will be closed under this permit to meet the
6 | performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). The WIPP
7 | surface facilities, including Waste Handling Building Container Storage Unit and the Parking
8 | Area Container Storage Unit, will be closed in accordance with 20.4.1.500 NMAC (incorporating
9 | 40 CFR §264.178). The Permittees may perform partial closure of the WHB and PAU HWMUs
10 | prior to final facility closure and certification. For final facility closure, this plan also includes
11 | closure of future waste disposal areas including Panels ~~8 through 9~~ and 10 and closure and
12 | sealing of the facility shafts in accordance with 20.4.1.500 NMAC (incorporating 40 CFR
13 | §264.601).

14 | Following completion of waste emplacement in each underground HWDU, the HWDU will be
15 | closed. The Permittees will notify the NMED of the closure of each underground HWDU as
16 | specified in the schedule in Figure ~~1~~ G-2. For the purpose of this Closure Plan, panel closure is
17 | defined as the process of rendering underground HWDUs in the repository inactive and closed
18 | according to the facility Closure Plan. The Post-Closure Plan (Permit Attachment ~~J~~ H)
19 | addresses requirements for future monitoring that are deemed necessary for the post-closure
20 | period, including monitoring closed panels prior to final facility closure.

21 | For the purposes of this Closure Plan, final facility closure is defined as closure that will occur
22 | when all waste disposal areas are filled or when the WIPP achieves its capacity of 6.2 million
23 | cubic feet (ft³) (175, ~~600564~~ cubic meters (m³)) of TRU waste. At final facility closure, the surface
24 | container storage areas will be closed, and equipment that can be decontaminated and used at
25 | other facilities will be cleaned and sent off site. Equipment that cannot be decontaminated plus
26 | any derived waste resulting from decontamination will be placed in the last open underground
27 | HWDU. Stockpiled salt may be placed in the underground; it may be used as the core material
28 | for the berm component of the permanent marker system; or it must be otherwise disposed of in
29 | accordance with Sections 2 and 3 of the Minerals Act of 1947 (30 U.S.C. §§602 and 603). In
30 | addition, shafts and boreholes which lie within the WIPP Site Boundary and penetrate the
31 | Salado will be plugged and sealed, and surface and subsurface facilities and equipment will be
32 | decontaminated and removed. Final facility closure will be completed to demonstrate
33 | compliance with the Closure Performance Standards contained in 20.4.1.500 NMAC
34 | (incorporating 40 CFR §264.111, 178, and 601).

35 | In the event the Permittees fail to obtain an extension of the hazardous waste permit in
36 | accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.51) or fail to obtain a new
37 | permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.10(h)), the Permittees
38 | will seek a modification to this Closure Plan in accordance with 20.4.1.900 NMAC (incorporating
39 | 40 CFR §270.42) to accommodate a contingency closure. Under contingency closure, storage
40 | units will undergo clean closure in accordance with 20.4.1.500 NMAC (incorporating 40 CFR
41 | §264.178); waste handling equipment, shafts, and haulage ways will be inspected for hazardous
42 | waste residues (using, among other techniques, radiological surveys to indicate potential
43 | hazardous waste releases as described in Permit Attachment ~~1~~ G3) and decontaminated as
44 | necessary; and underground HWDUs that contain radioactive mixed waste will be closed in
45 | accordance with the panel closure design described in this Closure Plan. Final facility closure,
46 | however, will be redefined and a request for a time extension for final closure will be requested.

1 A copy of this Closure Plan will be maintained by the Permittees at the WIPP facility and at the
2 **U.S.** Department of Energy (**DOE**) Carlsbad Field Office. The primary contact person at the
3 WIPP facility is:

4 Manager, Carlsbad Field Office
5 U.S. Department of Energy
6 Waste Isolation Pilot Plant
7 P. O. Box 3090
8 Carlsbad, New Mexico 88221-3090
9 (575) 234-7300

10 ~~I~~G-1a Closure Performance Standard

11 The closure performance standard specified in 20.4.1.500 NMAC (incorporating 40 CFR
12 §264.111), states that the closure shall be performed in a manner that minimizes the need for
13 further maintenance; that minimizes, controls, or eliminates the escape of hazardous waste; and
14 that conforms to the closure requirements of §264.178 and §264.601. These standards are
15 discussed in the following paragraphs.

16 ~~I~~G-1a(1) Container Storage Units

17 Final or partial closure of the permitted container storage units (the Waste Handling Building
18 Unit and Parking Area Unit) will be accomplished by removing all waste and waste residues.
19 Indication of waste contamination will be based, among other techniques, on the use of
20 radiological surveys as described in Permit Attachment ~~I~~G3. Radiological surveys use very
21 sensitive radiation detection equipment to indicate if there has been a potential release of TRU
22 mixed waste, including hazardous waste components, from a container. This allows the
23 Permittees to indicate potential releases that are not detectable from visible evidence such as
24 stains or discoloration. Visual inspection and operating records will also be used to identify
25 areas where decontamination is necessary. Contaminated surfaces will be decontaminated until
26 radioactivity is below free release limits². Once surfaces are determined to be free of radioactive
27 waste constituents, they will be tested for hazardous waste contamination. These surface
28 decontamination activities will ensure the removal of waste residues to levels protective of
29 human health and the environment. The facility is expected to require no decontamination at
30 closure because any waste spilled or released during operations will be contained and removed
31 immediately. Solid waste management units associated described in Permit ~~Module VII Part 8~~
32 will be subject to closure. In the event portions of these units which require decontamination
33 cannot be decontaminated, these portions will be removed and the resultant wastes will be
34 managed as appropriately.

35 Once the container storage units are decontaminated and certified by the Permittees to be
36 clean, no further maintenance is required. The facilities and equipment in these units will be
37 reused for other purposes as needed.

² The free release criteria for items, equipment, and areas is < 20 dpm/100 cm² for alpha radioactivity and < 200 dpm/100 cm² for beta-gamma radioactivity.

1 IG-1a(2) Miscellaneous Unit

2 Post-closure migration of hazardous waste or hazardous waste constituents to ground or
3 surface waters or to the atmosphere, above levels that will harm human health or the
4 environment, will not occur due to facility engineering and the geological isolation of the unit.
5 The engineering aspects of closure are centered on the use of panel closures on each of the
6 underground HWDUs and final facility seals placed in the shafts. The design of the panel
7 closure system is based on the criteria that the closure system for closed underground HWDUs
8 will prevent migration of hazardous waste constituents in the air pathway in concentrations
9 above health-based levels beyond the WIPP land withdrawal boundary during the ~~thirty-five (35)~~
10 year operational and facility closure period and to withstand any flammable gas deflagration that
11 may occur prior to final facility closure.

12 Consistent with the definitions in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), the
13 process of panel closure is considered partial closure because it is a process of rendering a part
14 of the repository inactive and closed according to the approved underground HWDU partial
15 closure plan. Panel closure will be complete when the panel closure system is emplaced and
16 operational, when that underground HWDU and related equipment and structures have been
17 decontaminated (if necessary), and when the NMED has been notified of the closure.

18 Shaft seals are designed to provide effective barriers to the inward migration of ground water
19 and the outward migration of gas and contaminated brine over two discrete time periods.
20 Several components become effective immediately and are expected to function for ~~one~~
21 ~~hundred (100)~~ years. Other components become effective more slowly, but provide permanent
22 isolation of the waste. The final shaft seal design is specified in Permit Attachment ~~1~~ G2.

23 The facility will be finally closed (i.e., decontaminated and decommissioned) to minimize the
24 need for continued maintenance. Protection of human health and the environment includes, but
25 is not limited to:

- 26 • Prevention of any releases that may have adverse effects on human health or the
27 environment due to the migration of waste constituents in the groundwater or in the
28 subsurface environment [20.4.1.500 NMAC, incorporating 40 CFR §264.601(a)].
- 29 • Prevention of any releases that may have adverse effects on human health or the
30 environment due to migration of waste constituents in surface water, in wetlands, or on
31 the soil surface [20.4.1.500 NMAC, incorporating 40 CFR §264.601(b)].
- 32 • Prevention of any release that may have adverse effects on human health or the
33 environment due to migration of waste constituents in the air [20.4.1.500 NMAC,
34 incorporating 40 CFR §264.601(c)].

35 As part of final facility closure, surface recontouring and reclamation will establish a stable
36 vegetative cover, and further surface maintenance will not be necessary to protect human
37 health and the environment. Prior to cessation of active controls, monuments will be emplaced
38 to serve as long-term site markers to discourage activities that would penetrate the facility or
39 impair the ability of the salt formation to isolate the waste from the surface environment for at
40 least 10,000 years. The Federal government will maintain administrative responsibility for the
41 repository site in perpetuity and will limit future use of the area.

1 If, during panel or final facility closure activities, unexpected events require modification of this
2 Closure Plan to demonstrate compliance with closure performance standards, a Closure Plan
3 amendment will be submitted in accordance with 20.4.1.900 NMAC (incorporating 40 CFR
4 §270.42).

5 ~~I~~G-1a(3) Post-Closure Care

6 The post-closure care period will begin after completion of the first panel closure and will
7 continue for ~~thirty (30)~~ years after final facility closure. The post-closure care period may be
8 shortened or lengthened at the discretion of the regulatory agency based on evidence that
9 human health and the environment are being protected or that they are at risk. During the post-
10 closure period, the WIPP shall be maintained in a manner that complies with the environmental
11 performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). Post-closure
12 activities are described in Permit Attachment ~~J~~ H.

13 ~~I~~G-1b Requirements

14 The Permit specifies a sequential process for the closure of individual HWMUs at the WIPP.
15 Each underground HWDU will undergo panel closure when waste emplacement in that panel is
16 complete. Following waste emplacement in each underground HWDU, construction-side
17 ventilation will be terminated and waste-disposal-side ventilation will be established in the next
18 underground HWDU to be used, and the underground HWDU containing the waste will be
19 closed. The Permittees will notify the NMED of the closure of each of the underground HWDUs
20 as they are sequentially filled on a HWDU-by-HWDU basis. The HWMUs in the WHB and in the
21 parking area will be closed as part of final facility closure of the WIPP facility.

22 The Permittees will notify the Secretary of the NMED in writing at least ~~sixty (60)~~ days prior to
23 the date on which closure activities are scheduled to begin.

24 ~~I~~G-1c Maximum Waste Inventory

25 The WIPP will receive no more than 6.2 million ft³ (175, ~~600-564~~ m³) of TRU mixed waste, which
26 may include up to 250,000 ft³ (7, ~~989079~~ m³) of remote-handled (RH) TRU mixed waste.
27 Excavations are mined as permitted when needed during operations to maintain a reserve of
28 disposal areas. The amount of waste placed in each room is limited by structural and physical
29 considerations of equipment and design. Waste volumes include waste received from off-site
30 generator locations as well as derived waste from disposal and decontamination operations.
31 The maximum volume of TRU mixed waste in a disposal panel is established in ~~Module IV~~
32 Permit Part 4, Table ~~IV.A.1~~ 4.1.1. For closure planning purposes, a maximum achievable
33 volume of 685,100 ft³ (19,400 m³) of TRU mixed waste per panel is used. This equates to
34 662,150 ft³ (18,750 m³) of contact-handled (CH) TRU mixed waste and 22,950 ft³ (650 m³) of
35 RH TRU mixed waste per panel.

36 The maximum extent of operations during the term of this permit is expected to be Panels 1
37 through ~~7 8~~ as shown on Figure ~~I~~ G-1, the WHB Container Storage Unit, and the Parking Area
38 Container Storage Unit. Note that panels ~~8, 9,~~ and 10 are scheduled for excavation only under
39 the initial term of this permit. If other waste management units are permitted during the Disposal
40 Phase, this Closure Plan will be revised to include the additional waste management units. At
41 any given time during disposal operations, it is possible that multiple rooms may be receiving
42 TRU mixed waste for disposal at the same time. Underground HWDUs in which disposal has

1 | been completed (i.e., in which CH and RH TRU mixed waste emplacement activities have
2 | ceased) will undergo panel closure.

3 | ~~I~~G-1d Schedule for Closure

4 | For the purpose of establishing a schedule for closure, an operating and closure period of no
5 | more than ~~thirty-five (35)~~ years (~~twenty-five (25)~~ years for disposal operations and ~~ten (10)~~ years
6 | for closure) is assumed. This operating period may be extended or shortened depending on a
7 | number of factors, including the rate of waste approved for shipment to the WIPP facility and the
8 | schedules of TRU mixed waste generator sites, and future decommissioning activities.

9 | ~~I~~G-1d(1) Schedule for Panel Closure

10 | The anticipated schedule for the closure of the underground HWDUs known as Panels 3
11 | through 8 is shown in Figure ~~I~~G-2. This schedule assumes there will be little contamination
12 | within the exhaust drift of the panel. Underground HWDUs should be ready for closure
13 | according to the schedule in Table ~~I~~G-1. These dates are estimates for planning and permitting
14 | purposes. Actual dates may vary depending on the availability of waste from the generator sites.

15 | In the schedule in Figure ~~I~~G-2, notification of intent to close occurs ~~thirty (30)~~ days before
16 | placing the final waste in a panel. Once a panel is full, the Permittees will initially block
17 | ventilation through the panel as described in Permit Attachment ~~M~~A2 and then will assess the
18 | closure area for ground conditions and contamination so that a definitive schedule and closure
19 | design can be determined. If as the result of this assessment the Permittees determine that a
20 | panel closure cannot be emplaced in accordance with the schedule in this Closure Plan, a
21 | modification will be submitted requesting an extension to the time for closure.

22 | The Permittees will initially block ventilation through Panel ~~2~~5 as described in Permit
23 | Attachment ~~M~~A2, Section A2-2a(3), "Subsurface Structures," once Panel ~~2~~5 is full ~~to ensure~~
24 | ~~continued protection of human health and the environment~~. The Permittees will then install the
25 | explosion-isolation wall portion of the panel closure system that is described in Permit
26 | Attachment ~~I~~G1, Section 3.3.2, "Explosion- and Construction-Isolation Walls." Construction of
27 | the explosion-isolation wall ~~will not exceed~~ shall be completed within 180 days after the last
28 | receipt of waste in Panel ~~2~~5. Final closure of Panels 1, ~~and 2,~~ and 5 will be completed as
29 | specified in this Permit no later than January 31, 2016.

30 | To ensure continued protection of human health and the environment, the Permittees will
31 | initially block ventilation through Panels 3 ~~through 7~~ as described in Permit Attachment ~~M~~A2,
32 | Section ~~M~~A2-2a(3), after waste disposal in ~~Panel 3 each panel~~ has been completed. The
33 | Permittees shall continue VOC monitoring in ~~Panel 3 such panels~~ until final panel closure. If the
34 | measured concentration, as confirmed by a second sample, of any VOC in ~~Panel 3 a panel~~
35 | exceeds the "95% Action Level" in ~~Module IV Permit Part 4, Table IV.F.3.b 4.6.3.2,~~ the
36 | Permittees will initiate closure of ~~Panel 3 that panel~~ by installing the 12-foot explosion-isolation
37 | wall as described in Section ~~I~~G-1e(1) and submit a Class 1* permit modification request to
38 | extend ~~Panel 3 closure of that panel~~, if necessary. Regardless of the outcome of disposal room
39 | VOC monitoring-, final closure of Panels 3 ~~through 7~~ will be completed as specified in this
40 | Permit no later than January 31, 2016.

1 IG-1d(2) Schedule for Final Facility Closure

2 The Disposal Phase for the WIPP facility is expected to require a period of ~~twenty five (25)~~
3 years beginning with the first receipt of TRU waste at the WIPP facility and followed by a period
4 ranging from ~~seven to ten (7- to 10)~~ years for decontamination, decommissioning, and final
5 closure. ~~Assuming the first waste receipt occurs in July 1998, t~~ The Disposal Phase may
6 ~~therefore~~ extend until ~~2023 2024~~, and ~~so~~ the latest expected year of final closure of the WIPP
7 facility (i.e., date of final closure certification) would be ~~2033 2034~~. If, as is currently projected,
8 the WIPP facility is dismantled at closure, all surface and subsurface facilities (except the hot
9 cell portion of the WHB, which will remain as an artifact of the Permanent Marker System
10 [PMS]) will be disassembled and either salvaged or disposed in accordance with applicable
11 standards. In addition, asphalt and crushed caliche that was used for paving will be removed,
12 and the area will be recontoured and revegetated in accordance with a land management plan.
13 A detailed closure schedule will be submitted in writing to the Secretary of the NMED, along with
14 the notification of closure. Throughout the closure period, all necessary steps will be taken to
15 prevent threats to human health and the environment in compliance with all applicable
16 Resource Conservation and Recovery Act (RCRA) permit requirements. Figure ~~IG-3~~ presents
17 ~~the best an~~ estimate of a final facility closure schedule ~~based on 84 months to implement final~~
18 ~~closure~~.

19 The schedule for final facility closure is considered to be a best estimate because closure of the
20 facility is driven by policies and practices established for the decontamination, if necessary, and
21 decommissioning of radioactively contaminated facilities. These required activities include
22 extensive radiological contamination surveys and hazardous constituent surveys using, among
23 other techniques, radiological surveys to indicate potential hazardous waste releases. Both
24 types of surveys will be performed at all areas of the WIPP site where hazardous waste were
25 managed. These surveys, along with historical radiological survey records, will provide the basis
26 for release of structures, equipment, and components for disposal or decontamination for
27 release off site. Specifications will be developed for each structure to be removed. A cost benefit
28 analysis will be needed to evaluate decontamination options if extensive decontamination is
29 necessary. Individual equipment surveys, structure surveys, and debris surveys will be required
30 prior to disposition. Size-reduction techniques may be required to dispose of mixed or
31 radioactive waste at the WIPP site. Current DOE policy, as reflected in the WIPP facility Safety
32 Analysis Report (SAR) (DOE 1997), requires the preparation of a final decommissioning and
33 decontamination (D&D) plan immediately prior to final facility closure. In this way, the specific
34 conditions of the facility at the time D&D is initiated will be addressed. Section ~~IG-1e(2)~~
35 provides a more detailed discussion of final facility closure activities.

36 Figure ~~IG-3~~ shows the schedule for the final facility closure consisting of decontamination, as
37 needed, of the TRU waste-handling equipment, and of the aboveground equipment and
38 facilities, including closure of surface HWMUs; decontamination of the shaft and haulage ways;
39 disposal of decontamination derived wastes in the last open underground HWDU; and
40 subsequent closure of this underground HWDU. Subsequent activities will include installation of
41 repository shaft seals.

42 An overall schedule for final facility closure, showing currently scheduled dates for the start and
43 end of final facility closure activities is shown in Table ~~IG-2~~. The dates assume a start up date
44 of March 1999 and ~~hazardous waste permit effective dates of September 1999, September~~
45 ~~2009, and September 2019, continued permitting of the WIPP facility until it is filled~~. Details for
46 panel closures are shown on Table ~~IG-1~~.

1 ~~I~~G-1d(3) Extension for Closure Time

2 As indicated by the closure schedule presented in Figure ~~I~~G-3, the activities necessary to
3 perform facility closure of the WIPP facility will require more than ~~one hundred eighty (180)~~ days
4 to complete because of additional stringent requirements for managing radioactive materials.
5 Therefore, the Permit provides an extension of the 180-day final closure requirement in
6 accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.113). During the extended
7 closure period, the Permittees will continue to demonstrate compliance with applicable permit
8 requirements and will take all steps necessary to prevent threats to human health and the
9 environment as a result of TRU mixed waste management at the WIPP facility including all of
10 the applicable measures in Permit Attachment E-Part 2.10 (Preparedness and Prevention).

11 In addition, according to the schedules in Figure ~~I~~G-3, the final derived wastes that are
12 generated as the result of decontamination activities will not be disposed of for ~~sixteen (16)~~
13 months after the initiation of final facility closure. In accordance with 20.4.1.500 NMAC
14 (incorporating 40 CFR §264.113(a)), the Permit provides an extension of the 90-day limit to
15 dispose of final derived waste resulting from the closure process. This provision is necessitated
16 by the fact that the radioactive nature of the derived waste makes placement in the WIPP the
17 best disposition, and the removal of these wastes will, by necessity, take longer than ~~ninety (90)~~
18 days in accordance with the closure schedules. During this extended period of time, the
19 Permittees will take all steps necessary to prevent threats to human health and the
20 environment, including compliance with all applicable permit requirements. These steps include
21 all of the applicable preparedness and prevention measures in Permit Attachment ~~E~~A.

22 Finally, in the event the hazardous waste permit is not renewed as assumed in the schedule,
23 the Permittees will submit a modification to the Closure Plan to implement a contingency closure
24 that will allow the Permittees to continue to operate for the disposal of non-mixed TRU waste.
25 This modification will include a request for an extension of the time for final facility closure. This
26 modified Closure Plan will be submitted to the NMED for approval.

27 ~~I~~G-1d(4) Amendment of the Closure Plan

28 If it becomes necessary to amend the Closure Plan for the WIPP facility, the Permittees will
29 submit, in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42), a written
30 notification of or request for a permit modification describing any change in operation or facility
31 design that affects the Closure Plan. The written notification or request will include a copy of the
32 amended Closure Plan for approval by the NMED. The Permittees will submit a written
33 notification of or request for a permit modification to authorize a change in the approved plan, if:

- 34 • There are changes in operating plans or in the waste management unit facility design
35 that affect the Closure Plan
- 36 • There is a change in the expected year of closure
- 37 • Unexpected events occur during panel or final facility closure that require modification
38 of the approved Closure Plan
- 39 • Changes in State or Federal laws affect the Closure Plan
- 40 • Permittees fail to obtain permits for continued operations as discussed above

1 The Permittees will submit a written request for a permit modification with a copy of the
2 amended Closure Plan at least ~~sixty (60)~~ days prior to the proposed change in facility design or
3 operation or within ~~sixty (60)~~ days of the occurrence of an unexpected event that affects the
4 Closure Plan. If the unexpected event occurs during final closure, the permit modification will be
5 requested within ~~thirty (30)~~ days of the occurrence. If the Secretary of the NMED requests a
6 modification of the Closure Plan, a plan modified in accordance with the request will be
7 submitted within ~~sixty (60)~~ days of notification or within ~~thirty (30)~~ days, if the change in facility
8 condition occurs during final closure.

9 IG-1e Closure Activities

10 Closure activities include those instituted for panel closure (i.e., closure of filled underground
11 HWDUs), contingency closure (i.e., closure of surface HWMUs and decontamination of other
12 waste handling areas), and final facility closure (i.e., closure of surface HWMUs, D&D of surface
13 facilities and the areas surrounding the WHB, and placement of repository shaft seals). Panel
14 closure systems will be emplaced to separate areas of the facility and to isolate panels. Permit
15 Attachments ~~+G1~~ and ~~+G2~~ provide panel closure system and shaft seal designs. All closure
16 activities will meet the applicable quality assurance (QA)/quality control (QC) program standards
17 in place at the WIPP facility. Facility monitoring procedures in place during operations will
18 remain in place through final closure, as applicable.

19 IG-1e(1) Panel Closure

20 Following completion of waste emplacement in each underground HWDU, disposal-side
21 ventilation will be established in the next panel to be used, and the panel containing the waste
22 will be closed. A panel closure system will be emplaced in the panel access drifts, in
23 accordance with the design in Permit Attachment ~~+G1~~ and the schedule in Figure ~~+G-2~~ and
24 Table ~~+G-1~~. The panel closure system is designed to meet the following requirements that were
25 established by the DOE for the design to comply with 20.4.1.500 NMAC (incorporating 40 CFR
26 §264.601(a)):

- 27 • the panel closure system shall limit the migration of VOCs to the compliance point so
28 that compliance is achieved by at least one order of magnitude
- 29 • the panel closure system shall consider potential flow of VOCs through the disturbed
30 rock zone (DRZ) in addition to flow through closure components
- 31 • the panel closure system shall perform its intended functions under loads generated by
32 creep closure of the tunnels
- 33 • the panel closure system shall perform its intended function under the conditions of a
34 postulated methane explosion
- 35 • the nominal operational life of the closure system is ~~thirty-five (35)~~ years
- 36 • the panel closure system for each individual panel shall not require routine
37 maintenance during its operational life
- 38 • the panel closure system shall address the most severe ground conditions expected in
39 the waste disposal area

- 1 • the design class of the panel closure system shall be IIIb (which means that it is to be
- 2 built to generally accepted national design and construction standards)
- 3 • the design and construction shall follow conventional mining practices
- 4 • structural analysis shall use data acquired from the WIPP underground
- 5 • materials shall be compatible with their emplacement environment and function
- 6 • treatment of surfaces in the closure areas shall be considered in the design
- 7 • thermal cracking of concrete shall be addressed
- 8 • during construction, a QA/QC program shall be established to verify material
- 9 properties and construction practices
- 10 • construction of the panel closure system shall consider shaft and underground access
- 11 and services for materials handling

12 | The performance standard for air emissions from the WIPP facility is established in ~~Module IV~~
13 | Permit Part 4 and Permit Attachment ~~MA~~2. Releases shall be below these limits for the facility
14 | to remain in compliance with standards to protect human health and the environment. The
15 | following panel closure design has been shown, through analysis, to meet these standards, if
16 | emplaced in accordance with the specifications in Permit Attachment ~~I~~G1.

17 | The approved design for the panel closure system calls for a composite panel barrier system
18 | consisting of a rigid concrete plug with removal of the DRZ, and an explosion-isolation wall. The
19 | design basis for this closure is such that the migration of hazardous waste constituents from
20 | closed panels during the operational and closure period would result in concentrations well
21 | below health-based standards. The source term used as the design basis included the average
22 | concentrations of VOCs from CH waste containers as measured in headspace gases through
23 | January 1995. The VOCs are assumed to have been released by diffusion through the
24 | container vents and are assumed to be in equilibrium with the air in the panel. Emissions from
25 | the closed panel occur at a rate determined by gas generation within the waste and creep
26 | closure of the panel.

27 | Figures ~~I~~G-4 and ~~I~~G-5 show a diagram of the panel closure design and installation envelopes.
28 | Permit Attachment ~~I~~G1 provides the detailed design and the design analysis for the panel
29 | closure system. Although the permit application proposed several panel closure design options,
30 | depending on the gas generated by wastes and the age of the mined openings, the NMED and
31 | EPA determined that only the most robust design option (D) would be approved. This decision
32 | does not prevent the Permittees from continuing to collect data on the behavior of the wastes
33 | and mined openings, or proposing a modification to the Closure Plan in the future, using the
34 | available data to support a request for reconsideration of one or more of the original design
35 | options. If a design different from Option D as defined in Permit Attachment ~~I~~G1 is proposed,
36 | the appropriate permit modification will be sought.

1 IG-1e(2) Decontamination and Decommissioning

2 Decontamination is defined as those activities which are performed to remove contamination
3 from surfaces and equipment that are not intended to be disposed of at the WIPP facility. The
4 policy at the WIPP will be to decontaminate as many areas as possible, consistent with radiation
5 protection policy. Decontamination is part of all closure activities and is a necessary activity in
6 the clean closure of the surface container management units. Decontamination determinations
7 are based upon radiological and hazardous constituent surveys.

8 Decommissioning is the process of removing equipment, facilities, or surface areas from further
9 use and closing the facility. Decommissioning is part of final facility closure only and will involve
10 the removal of equipment, buildings, closure of the shafts, and establishing active and passive
11 institutional controls for the facility. Passive institutional controls are not included in the Permit.

12 The objective of D&D activities at the WIPP facility is to return the surface to as close to the
13 preconstruction condition as reasonably possible, while protecting the health and safety of the
14 public and the environment. Major activities required to accomplish this objective include, but
15 are not limited to the following:

- 16 1. Review of operational records for historical information on releases
- 17 2. Visual examination of surface structures for evidence of spills or releases
- 18 3. Performance of site contamination surveys
- 19 4. Decontamination, if necessary, of usable equipment, materials, and structures
20 including surface facilities and areas surrounding the WHB.
- 21 5. Disposal of equipment/materials that cannot be decontaminated but that meet the
22 treatment, storage, and disposal facility waste acceptance criteria (**TSDF-WAC**) in an
23 underground HWDU
- 24 6. Emplacement of final panel closure system
- 25 7. Emplacement of shaft seals³
- 26 8. Regrading the surface to approximately original contours
- 27 9. Initiation of active controls

28 This Closure Plan will be amended prior to the initiation of closure activities to specify the
29 methods to be used.

³ For the purposes of planning, the conclusion of shaft sealing is used by the DOE as the end of closure activities and the beginning of the Post-Closure Care Period.

1 Health and Safety

2 Before final closure activities begin, health physics personnel will conduct a hazards survey of
3 the unit(s) being closed. A release of radionuclides could also indicate a release of hazardous
4 constituents. If radionuclides are not detected, sampling for hazardous constituents will still be
5 performed if there is documentation or visible evidence that a spill or release has occurred. The
6 purpose of the hazards survey will be to identify potential contamination concerns that may
7 present hazards to workers during the closure activities and to specify any control measures
8 necessary to reduce worker risk. This survey will provide the information necessary for the
9 health physics personnel to identify worker qualifications, personal protective equipment (**PPE**),
10 safety awareness, work permits, exposure control programs, and emergency coordination that
11 will be required to perform closure related activities.

12 ~~I~~G-1e(2)(a) Determine the Extent of Contamination

13 The first activities performed as part of decontamination include those needed to determine the
14 extent of any contamination that needs to be removed prior to decommissioning a facility. This
15 includes activities 1 to 3 above and, as can be seen by the schedules in Figures ~~I~~G-3 and ~~I~~G-4
16 (Items B and C), these surveys are anticipated to take ~~ten (10)~~ months to perform, including
17 obtaining the results of any sample analyses. The process of identifying areas that require
18 decontamination include three sources of information. First, operating records will be reviewed
19 to determine where contamination has previously been found as the result of historical releases
20 and spills. Even though releases and spills will have been cleaned up at the time of occurrence,
21 newer equipment and technology may allow further cleaning. Second, surfaces of facilities and
22 structures will be examined visually for evidence of spills or releases. Finally, extensive detailed
23 contamination surveys will be performed to document the level of cleanliness for all surface
24 structures and equipment. If equipment or areas are identified as contaminated, the Permittees
25 will notify NMED as specified in Permit ~~Module I~~ Part 1, and a plan and procedure(s) will be
26 developed and implemented to address decontamination-related questions, including:

- 27 • Should the component be decontaminated or disposed of as waste?
- 28 • What is the most cost-effective method of decontaminating the component?
- 29 • Will the decontamination procedures adequately contain the contamination?

30 Radiological and hazardous constituent surveys will be used in determining the presence of
31 hazardous waste and hazardous waste residues in areas where spills or releases have
32 occurred. Radiological surveys are described in Permit Attachment ~~I~~G3. Once cleanup of the
33 radioactivity has been completed, the surface will be sampled for hazardous constituents
34 specified in Permit Attachment ~~Q~~B to determine that they, too, have been cleaned up. Sampling
35 and analysis protocols will be consistent with EPA's document SW-846 (EPA, 1996).

36 ~~I~~G-1e(2)(b) Decontamination Activities

37 Once the extent of contamination is known, decontamination activities will be planned and
38 performed. Radiological control and the control of hazardous waste residues are the primary
39 criteria used in the design of decontamination activities. Radiation control procedures require
40 that careful planning and execution be used in decontamination activities to prevent the
41 exposure of workers beyond applicable standards and to prevent the further spread of
42 contamination. Careful control of entry, cleanup, and ventilation are vital components of
43 radiation decontamination. The level of care mandated by DOE orders and occupational

1 protection requirements results in closure activities that will exceed the ~~one hundred eighty~~
2 ~~(180)~~ days allowed in 20.4.1.500 NMAC (incorporating 40 CFR §264.113(b)). Decontamination
3 activities are included as item 4 above and are shown on the schedules for contingency closure
4 and final facility closure (Figures ~~1 G-3~~ and ~~1 G-4~~) as activities D, E, and F. These activities are
5 anticipated to have a duration of ~~twenty (20)~~ months for both contingency closure and for final
6 facility closure. The result of these activities is the clean closure of the surface container
7 management units. Under contingency closure, the other areas that have been decontaminated
8 will not be closed. Instead they will remain in use for continued waste management activities
9 involving non-mixed waste. Under final facility closure, other areas that are decontaminated are
10 eligible for closure.

11 The “Start Clean—Stay Clean” operating philosophy of the WIPP Project will provide for
12 minimum need for decontamination. However, the need for decontamination techniques may
13 arise.

14 Decontamination activities will be coordinated with closure activities so that areas that have
15 been decontaminated will not be recontaminated. All waste resulting from decontamination
16 activities will be surveyed and analyzed for the presence of radioactive contamination and
17 hazardous constituents specified in Permit Attachment ~~O B~~. The waste will be characterized as
18 hazardous, mixed, or radioactive and will be packaged and handled appropriately. Mixed and
19 radioactive waste will be classified as TRU mixed waste managed in accordance with the
20 applicable Permit requirements. Derived mixed waste collected during decontamination
21 activities that are generated before repository shafts have been sealed will be emplaced in the
22 facility, if appropriate, or will be managed together with decontamination derived waste collected
23 after the underground is closed. This waste will be classified and shipped off site to an
24 appropriate, permitted facility for treatment, if necessary, and for disposal.

25 Removal of Hazardous Waste Residues

26 Because of the type of waste management activities that will occur at the WIPP facility, waste
27 residues that may be encountered during the operation of the facility and at closure may include
28 derived waste. Derived wastes result from the management of the waste containers or may be
29 collected as part of the closure activities (such as those during which wipes were used to
30 sample the containers and equipment for potential radioactive contamination or those involving
31 solidified decontamination solutions, the handling of equipment designated for disposal, and the
32 handling of residues collected as a result of spill cleanup). Derived wastes collected during the
33 operation and closure of the WIPP facility will be identified and managed as TRU mixed wastes.
34 These wastes will be disposed in the active underground HWDU. D&D derived wastes and
35 equipment designated for disposal will be placed in the last underground HWDU panel before
36 closure of that unit.

37 Surface Container Storage Units

38 The procedures employed for waste receipt at the WIPP facility minimize the likelihood for any
39 waste spillage to occur outside the WHB. TRU mixed waste is shipped to the WIPP facility in
40 approved shipping containers (i.e., Contact-Handled or Remote-Handled Packages) that are not
41 opened until they are inside the WHB. Therefore, it is unlikely that soil in the Parking Area Unit
42 or elsewhere in the vicinity of the WHB will become contaminated with TRU mixed waste
43 constituents as a result of TRU mixed waste management activities. An evaluation of the soils in

1 the vicinity of the WHB will only be necessary if a documented event resulting in a release has
2 occurred outside the WHB.

3 The “Start Clean—Stay Clean” operating philosophy of the WIPP Project will minimize the need
4 for decontamination of the WHB during decommissioning and closure. Procedures for opening
5 shipping containers in the WHB limit the opportunity for waste spillage.

6 Should the need for decontamination of the WHB arise, the following methods may be
7 employed, as appropriate, for the hazardous constituent/contaminant type and extent:

- 8 • Chemical cleaning (e.g., water, mild detergent cleanser, and polyvinyl alcohol)
- 9 • Nonchemical cleaning (e.g., sandblasting, grinding, high-pressure water spray,
10 scabblers pistons and needle scalers, ice-blast technology, dry-ice blasting)
- 11 • Removal of contaminated components such as pipe and ductwork

12 Waste generated as a result of WHB decontamination activities will be managed as derived
13 waste in accordance with applicable permit requirements and will be emplaced in the last open
14 underground HWDU for disposal.

15 Waste Handling Equipment and

16 The waste shaft conveyance and associated waste handling equipment will be decontaminated
17 to background or be disposed as derived waste as part of both contingency and final facility
18 closure. Procedures for detection and sampling will be as described above. Equipment cleanup
19 will be as above using chemical or nonchemical techniques.

20 Personnel Decontamination

21 PPE worn by personnel performing closure activities in areas determined to be contaminated
22 will be disposed of appropriately. Disposable PPE used in such areas will be placed into
23 containers and managed as TRU mixed waste. Non-disposable PPE will be decontaminated, if
24 possible. Non-disposable PPE that cannot be decontaminated will be managed as TRU mixed
25 waste.

26 In accordance with DOE policy, TRU mixed waste PPE will be considered to be contaminated
27 with all of the hazardous waste constituents contained in the containers that have been
28 managed within the unit being closed. Wastes collected as a result of closure activities and that
29 may be contaminated with radioactive and hazardous constituents will be considered TRU
30 mixed wastes. These wastes will be managed as derived wastes, as described in Permit
31 Attachment ~~M~~A2. Such waste, collected as the result of closure of the WIPP facility, will be
32 disposed of in the final open underground HWDU.

1 Cleanup Criteria

2 Radiation decontamination will be less than or equal to the following levels, or to whatever
3 lesser levels that may be established by DOE Order at the time of cleanup:

4 <u>Contamination Type</u>	<u>Loose</u> ⁴
5	<u>Fixed plus removable</u>
6 alpha contamination (α)	20 dpm/100 cm ²
7	500 dpm/100 cm ²
8 beta-gamma contamination (β - γ)	200 dpm/100 cm ²
9	1000 dpm/100 cm ²

10 Hazardous waste decontamination will be conducted in accordance with standards in
11 20.4.1.500 NMAC (incorporating 40 CFR §264) or as incorporated into the Permit.

12 Final Contamination Sampling and Quality Assurance

13 Verification samples will be analyzed by an approved laboratory that has been qualified by the
14 DOE according to a written program with strict criteria. The QA requirements of EPA/SW-846,
15 "Test Methods for Evaluating Solid Waste" (EPA, 1986), will be met for hazardous constituent
16 sampling and analyses.

17 Quality Assurance/Quality Control

18 Because decisions about closure activities may be based, in part, on analyses of samples of
19 potentially contaminated surfaces and media, a program to ensure reliability of analytical data is
20 essential. Data reliability will be ensured by following a QA/QC program that mandates
21 adequate precision and accuracy of laboratory analyses. Field documentation will be used to
22 document the conditions under which each sample is collected. The documented QA/QC
23 program in place at the WIPP facility will meet applicable RCRA QA requirements.

24 Field blanks and duplicate samples will be collected in the field to determine potential errors
25 introduced in the data from sample collection and handling activities. To determine the potential
26 for cross-contamination, rinsate blanks (consisting of rinsate from decontaminated sampling
27 equipment) will be collected and analyzed. At least one rinsate blank will be collected for every
28 20 field samples. Duplicate samples will be collected at a frequency of one duplicate sample for
29 every ten field samples. In no case will less than one rinsate blank or duplicate sample be
30 collected for a field-sampling effort. These blank and duplicate samples will be identified and
31 treated as separate samples. Acceptance criteria for QA/QC hazardous constituent sample
32 analyses will adhere to the most recent version of EPA SW-846 or other applicable EPA
33 guidance.

⁴ The unit "dpm" stands for "disintegration per minute" and is the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

1 | IG-1e(2)(c) Dismantling

2 | Final facility closure will include dismantling of structures on the surface and in the underground.
3 | These are items 6 and 7 above and are represented as Activity G in the final facility closure
4 | schedule in Figure IG-4. During dismantling, priority will be given to contaminated structures
5 | and equipment that cannot be decontaminated to assure these are properly disposed of in the
6 | remaining open underground HWDU in a timely manner. All such facilities and equipment are
7 | expected to be removed and disposed of sixteen (16) months after the initiation of closure.
8 | Dismantling of the balance of the facility, including those structures and equipment that are not
9 | included in the application and are not used for TRU mixed waste management, is anticipated to
10 | take an additional sixty-six (66) months. It should be noted that the placement of D&D waste
11 | into the final underground HWDU may, by necessity, involve the placement of uncontainerized
12 | bulk materials such as concrete components, building framing, structural members,
13 | disassembled or partially disassembled equipment, or containerized materials in non-standard
14 | waste boxes. Such placement will only occur if it can be shown that it is protective of human
15 | health and the environment and all items are described in an amendment to the Closure Plan.
16 | Identification of bulk items is not possible at this time since their size and quantity will depend on
17 | the extent of non-removable contamination.

18 | IG-1e(2)(d) Closure of Open Underground HWDU

19 | The closure of the final underground HWDU is shown by Activity H in Figure IG-3. This closure
20 | will be consistent with the description in Section IG-1e(1) and the design in Permit Attachment
21 | IG-1. Detailed closure schedules for underground HWDUs are given in Figure IG-2 and Table
22 | IG-1.

23 | IG-1e(2)(e) Final Facility Closure

24 | Final facility closure includes several activities designed to assure both the short-term isolation
25 | of the waste and the long-term integrity of the disposal system. These include the placement of
26 | plugs in boreholes that penetrate the salt and the placement of the repository sealing system. In
27 | addition, the surface will be returned to as near its original condition as practicable, and will be
28 | readied for the construction of markers and monuments that will provide permanent marking of
29 | the repository location and contents.

30 | Figure IG-6 identifies where ten-three existing boreholes overlie the proximate area of the
31 | repository footprint. Of these identified boreholes in Figure IG-6, all but ERDA-9 are terminated
32 | hundreds of feet above the repository horizon. Only ERDA-9, which is accounted for in long-
33 | term performance modeling, is drilled through the repository horizon, near the WIPP
34 | excavations.

35 | To mitigate the potential for migration beyond the repository horizon, the DOE has specified that
36 | borehole seals be designed to limit the volume of water that could be introduced to the
37 | repository from the overlying water-bearing zones and to limit the volume of contaminated brine
38 | released from the repository to the surface or water-bearing zones.

39 | Borehole plugging activities have been underway since the 1970s, from the early days of the
40 | development of the WIPP facility. Early in the exploratory phase of the project, a number of
41 | boreholes were sunk in Lea and Eddy counties. After the WIPP site was situated in its current

1 location, an evaluation of all vertical penetrations was made by Christensen and Peterson
2 (1981).

3 As an initial criterion, any borehole that connects a fluid-producing zone with the repository
4 horizon becomes a plugging candidate.

5 Grout plugging procedures are routinely performed in standard oil-field operations; however,
6 quantitative measurements of plug performance are rarely obtained. The Bell Canyon Test
7 reported by Christensen and Peterson (1981) was a field test demonstration of the use of
8 cementitious plugging materials and modification of existing industrial emplacement techniques
9 to suit repository plugging requirements. Cement emplacement technology was found to be
10 “generally adequate to satisfy repository plugging requirements.” Christensen and Peterson
11 (1981) also report “that grouts can be effective in sealing boreholes, if proper care is exercised
12 in matching physical properties of the local rock with grout mixtures. Further, the reduction in
13 fluid flow provided by even limited length plugs is far in excess of that required by bounding
14 safety assessments for the WIPP.” The governing regulations for plugging and/or abandonment
15 of boreholes are summarized in Table ~~4~~ G-3.

16 The proposed repository sealing system design will prevent water from entering the repository
17 and will prevent gases or brines from migrating out of the repository. The proposed design
18 includes the following subsystems and associated principal functions:

- 19 • Near-surface: to prevent subsidence at and around the shafts
- 20 • Rustler Formation: to prevent subsidence at and around the shafts and to ensure
21 compliance with Federal and State of New Mexico groundwater protection
22 requirements
- 23 • Salado Formation: to prevent transporting hazardous waste constituents beyond the
24 point of compliance specified in Permit ~~Module V Part 5~~

25 The repository sealing system will consist of natural and engineered barriers within the WIPP
26 repository that will withstand forces expected to be present because of rock creep, hydraulic
27 pressure, and probable collapses in the repository and will meet the closure requirements of
28 20.4.1.500 NMAC (incorporating 40 CFR §264.601 and §264.111). Permit Attachment ~~4~~ G2
29 presents the final repository sealing system design.

30 Once shaft sealing is completed, the Permittees will consider closure complete and will provide
31 the NMED with a certification of such within ~~sixty (60)~~ days.

32 ~~4~~ G-1e(2)(f) Final Contouring and Revegetation

33 In the preparation of its Final Environmental Impact Statement (DOE, 1980), the DOE
34 committed to restore the site to as near to its original condition as is practicable. This involves
35 removal of access roads, unneeded utilities, fences, and any other structures built by the DOE
36 to support WIPP operations. Provisions would be left for active post-closure controls of the site
37 and for the installation of long-term markers and monuments for the purpose of permanently
38 marking the location of the repository and waste. Permit Attachment ~~4~~ H-1a(1) discusses the
39 active and long-term controls proposed for the WIPP. Installation of borehole seals are

1 anticipated to take ~~twelve (12)~~ months, shaft seals ~~fifty-two (52)~~ months, and final surface
2 contouring ~~eight (8)~~ months.

3 ~~I~~G-1e(2)(g) Closure, Monuments, and Records

4 A record of the WIPP Project shall be listed in the public domain in accordance with the
5 requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.116). Active access controls will
6 be employed for at least the first ~~one hundred (100)~~ years after final facility closure. In addition,
7 a passive control system consisting of monuments or markers will be erected at the site to
8 inform future generations of the location of the WIPP repository (see "Permanent Marker
9 Conceptual Design Report" [DOE, 1995b]).

10 This Permit requires only a ~~thirty (30)~~ year post-closure period. This is the maximum post-
11 closure time frame allowed in an initial Permit for any facility, as specified in 20.4.1.500 NMAC
12 (incorporating 40 CFR §264.117(a)). The Secretary of the NMED may shorten or extend the
13 post-closure care period at any time in the future prior to completion of the original post-closure
14 period (30 years after the completion of construction of the shaft seals). The Permanent Marker
15 Conceptual Design Report and other provisions during the first 100 years after closure are
16 addressed under another Federal regulatory program.

17 Closure of the WIPP facility will contribute to the following:

- 18 • Prevention of the intrusion of fluids into the repository by sealing the shafts
- 19 • Prevention of human intrusion after closure
- 20 • Minimization of future physical and environmental surveillance

21 Detailed records shall be filed with local, State, and Federal government agencies to ensure that
22 the location of the WIPP facility is easily determined and that appropriate notifications and
23 restrictions are given to anyone who applies to drill in the area. This information, together with
24 land survey data, will be on record with the U.S. Geological Survey and other agencies. The
25 Federal government will maintain permanent administrative authority over those aspects of land
26 management assigned by law. Details of post-closure activities are in Permit Attachment ~~J~~H.

27 ~~I~~G-1e(3) Performance of the Closed Facility

28 20.4.1.500 NMAC (incorporating 40 CFR §264.601) requires that a miscellaneous unit be
29 closed in a manner that protects human health and the environment. The RCRA Part B permit
30 application addressed the expected performance of the closed facility during the ~~thirty (30)~~ year
31 post closure period. Groundwater monitoring will provide information on the performance of the
32 closed facility during the post-closure care period, as specified in Section ~~J~~H-1a(2) (Monitoring)
33 of Permit Attachment ~~J~~H.

34 The principal barriers to the movement of hazardous constituents from the facility or the
35 movement of waters into the facility are the halite of the Salado Formation (natural barrier) and
36 the repository seals (engineered barrier). Data and calculations that support this discussion
37 were presented in the permit application. The majority of the calculations performed for the
38 repository are focused on long-term performance and making predictions of performance over
39 10,000 years. In the short term, the repository is reaching a steady state configuration where the
40 hypothetical brine inflow rate is affected by the increasing pressure in the repository due to gas
41 generation and creep closure. These three phenomena are related in the numerical modeling

1 performed to support the permit application. The modeling parameters, assumptions and
2 methodology were described in detail in the permit application.

3 ~~I~~G-2 Notices Required for Disposal Facilities

4 ~~I~~G-2a Certification of Closure

5 Within ~~sixty~~ (60) days after completion of closure activities for a HWMU (i.e., for each storage
6 unit and each disposal unit), the Permittees will submit to the Secretary of the NMED a
7 certification that the unit (and, after completion of final closure, the facility) has been closed in
8 accordance with the specifications of this Closure Plan. The certification will be signed by the
9 Permittees and by an independent New Mexico registered professional engineer.
10 Documentation supporting the independent registered engineer's certification will be furnished
11 to the Secretary of the NMED with the certification.

12 ~~I~~G-2b Survey Plat

13 Within ~~sixty~~ (60) days of completion of closure activities for each underground HWDU, and no
14 later than the submission of the certification of closure of each underground HWDU, the
15 Permittees will submit to the Secretary of the NMED a survey plat indicating the location and
16 dimensions of hazardous waste disposal units with respect to permanently surveyed
17 benchmarks. The plat will be prepared and certified by a professional land surveyor and will
18 contain a prominently displayed note that states the Permittees' obligation to restrict disturbance
19 of the hazardous waste disposal unit. In addition, the land records in the Eddy County
20 Courthouse, Carlsbad, New Mexico, will be updated through filing of the final survey plats.

1 References

2 Christensen, C. L., and Peterson, E. W. 1981. "Field-Test Programs of Borehole Plugs in
3 Southeastern New Mexico." In *The Technology of High-Level Nuclear Waste Disposal*
4 *Advances in the Science and Engineering of the Management of High-Level Nuclear Wastes*, P.
5 L. Hofman and J. J. Breslin, eds., SAND79-1634C, DOE/TIC-4621, Vol. 1, pp. 354–369.
6 Technical Information Center of the U.S. Department of Energy, Oak Ridge, TN.

7 DOE, see U.S. Department of Energy

8 EPA, see U.S. Environmental Protection Agency

9 U.S. Department of Energy, 1980, "Final Environmental Impact Statement, Waste Isolation Pilot
10 Plant," DOE/EIS 0026, U.S. Department of Energy, Washington, D.C.

11 U.S. Department of Energy, 1995b, "Permanent Marker Conceptual Design Report," from
12 Appendix PMR of the *Draft Compliance Certification Application*, Draft-DOE/CAO-2056, U.S.
13 Department of Energy, Carlsbad, NM.

14 U.S. Department of Energy, 1997, "WIPP Safety Analysis Report," DOE/WIPP-95-2065,
15 Revision 1, U.S. Department of Energy, Carlsbad, NM.

16 U.S. Environmental Protection Agency, 1996, "Test Methods for Evaluating Solid Waste," SW-
17 846, U.S. Environmental Protection Agency, Washington, D.C.

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TABLES

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**Table I-G-1
 Anticipated Earliest Closure Dates for the Underground HWDUs**

HWDU	OPERATIONS START	OPERATIONS END	CLOSURE START	CLOSURE END
PANEL 1	3/99*	3/03*	3/03*	7/03* SEE NOTE 5
PANEL 2	3/03*	10/05*	10/05*	3/06* SEE NOTE 5
PANEL 3	4/05*	2/07*	2/07*	2/07* SEE NOTE 6
PANEL 4	1/07*	5/09*	5/09*	8/09* SEE NOTE 6
PANEL 5	3/09*	1/11	2/11	8/11 SEE NOTE 6 5
PANEL 6	1/11	1/13	2/13	8/13 SEE NOTE 6
PANEL 7	1/13	1/15	2/15	8/15 SEE NOTE 6
PANEL 8	1/15	1/17	2/17	8/17
PANEL 9	1/17	1/28	2/28	SEE NOTE 4
PANEL 10	1/28	9/30	10/30	SEE NOTE 4

* Actual date

NOTE 1: Only Panels 1 to 4 will be closed under the initial term of this permit. Closure schedules for Panels 5 through 10 are projected assuming new permits will be issued in 2009 and 2019.

NOTE 2: The point of closure start is defined as ~~sixty (60)~~ days following notification to the NMED of closure.

NOTE 3: The point of closure end is defined as ~~one hundred eighty (180)~~ days following placement of final waste in the panel.

NOTE 4: The time to close these areas may be extended depending on the nature and extent of the disturbed rock zone. The excavations that constitute these panels will have been opened for as many as ~~forty (40)~~ years so that the preparation for closure may take longer than the time allotted in Figure I-G-2. If this extension is needed, it will be requested as an amendment to the Closure Plan.

NOTE 5: ~~The anticipated closure end date for Panels 1 and 2 is for installation of the 12-foot explosion-isolation wall for Panels 1, 2, and 5 must be completed by the closure end date.~~ Final closure of Panels 1, ~~and 2, and 5~~ will be completed as specified in this Permit no later than January 31, 2016.

NOTE 6: ~~The anticipated closure end date for Panels 3 through 7 is for initially blocking ventilation through the filled panel.~~ Final closure of Panels 3, ~~and 4 through 7~~ will be completed as specified in this Permit no later than January 31, 2016.

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**Table I-G-2
 Anticipated Overall Schedule for Closure Activities**

ACTIVITY	FINAL FACILITY CLOSURE	
	START	STOP
Notify NMED of Intent to Close WIPP (or to Implement Contingency Closure)	October 2030	N/A
Perform Contamination Surveys in both Surface Storage Areas	October 2030	April 2031
Sample Analysis	December 2030	July 2031
Decontamination as Necessary of both Surface Storage Areas	June 2031	January 2032
Final Contamination Surveys of both Surface Storage Areas	February 2032	September 2032
Sample Analysis	June 2032	January 2033
Prepare and Submit Container Management Unit Closure Certification	February 2033	May 2033
Dispose of Closure-Derived Waste	November 2030	January 2032
Closure of Open Underground HWDU panel	February 2032 [*]	September 2032
Install Borehole Seals	October 2032	September 2033
Install Repository Seals	June 2033	September 2037
Recontour and Revegetate	October 2037	May 2038
Prepare and Submit Final (Contingency) Closure Certification	October 2037	May 2038
Post-closure Monitoring	July 2038	N/A

N/A--Not Applicable

Refer to Figures I-G-3 and I-G-4 for precise activity titles.

*This assumes the final waste is placed in this unit in January 2032 and notification of closure for this HWDU is submitted to the NMED in December 2031.

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**Table 1G-3
 Governing Regulations for Borehole Abandonment**

Federal or State Land	Type of Well or Borehole	Governing Regulation	Summary of Requirements
Both	Groundwater Surveillance	State and Federal regulation in effect at time of abandonment	Monitor wells no longer in use shall be plugged in such a manner as to preclude migration of surface runoff or groundwater along the length of the well. Where possible, this shall be accomplished by removing the well casing and pumping expanding cement from the bottom to the top of the well. If the casing cannot be removed, the casing shall be ripped or perforated along its entire length if possible, and grouted. Filling with bentonite pellets from the bottom to the top is an acceptable alternative to pressure grouting.
Federal	Oil and Gas Wells	43 CFR Part 3160, §§ 3162.3-4	The operator shall promptly plug and abandon, in accordance with a plan first approved in writing or prescribed by the authorized officer.
Federal	Potash	43 CFR Part 3590, § 3593.1	(b) Surface boreholes for development or holes for prospecting shall be abandoned to the satisfaction of the authorizing officer by cementing and/or casing or by other methods approved in advance by the authorized officer. The holes shall also be abandoned in a manner to protect the surface and not endanger any present or future underground operation, any deposit of oil, gas, or other mineral substances, or any aquifer.
State	Oil and Gas Well Outside the Oil-Potash Area	State of New Mexico, Oil Conservation Division, Rule 202 (eff. 3-1-91)	<p>B. Plugging</p> <p>(1) Prior to abandonment, the well shall be plugged in a manner to permanently confine all oil, gas, and water in the separate strata where they were originally found. This can be accomplished by using mud-laden fluid, cement, and plugs singly or in combination as approved by the Division on the notice of intention to plug.</p> <p>(2) The exact location of plugged and abandoned wells shall be marked by the operator with a steel marker not less than four inches (4") in diameter, set in cement, and extending at least four feet (4') above mean ground level. The metal of the marker shall be permanently engraved, welded, or stamped with the operator name, lease name, and well number and location, including unit letter, section, township, and range.</p>
State	Oil and Gas Wells Inside the Oil-Potash Area	State of New Mexico, Oil Conservation Division, Order No. R-111-P (eff. 4-21-88)	<p>F. Plugging and Abandonment of Wells</p> <p>(1) All existing and future wells that are drilled within the potash area, shall be plugged in accordance with the general rules established by the Division. A solid cement plug shall be provided through the salt section and any water-bearing horizon to prevent liquids or gases from entering the hole above or below the salt selection.</p> <p>It shall have suitable proportions—but no greater than three (3) percent of calcium chloride by weight—of cement considered to be the desired mixture when possible.</p>

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FIGURES

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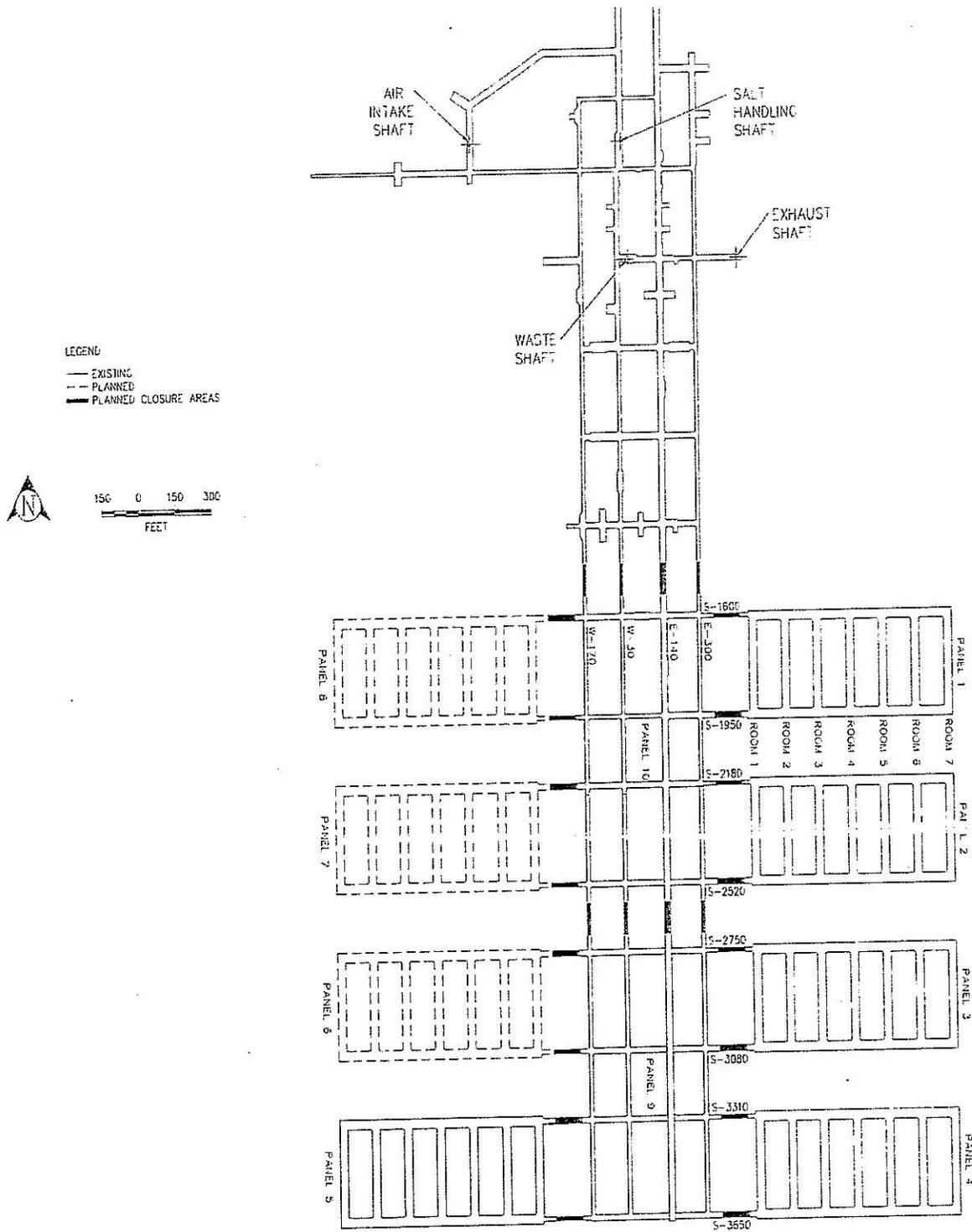


Figure 1G-1
 Location of Underground HWDUs and Anticipated Closure Locations

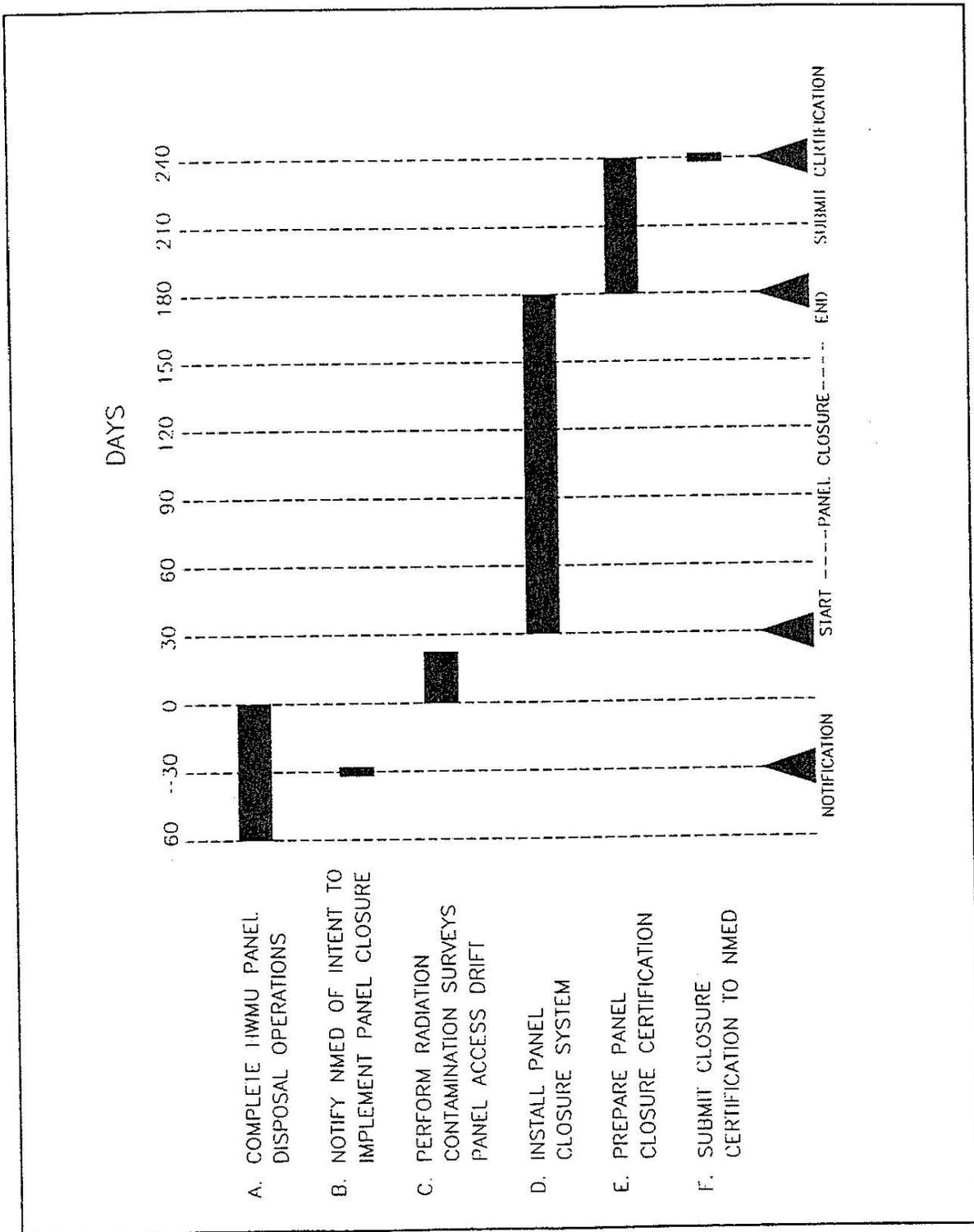


Figure G-2
 WIPP Panel Closure Schedule

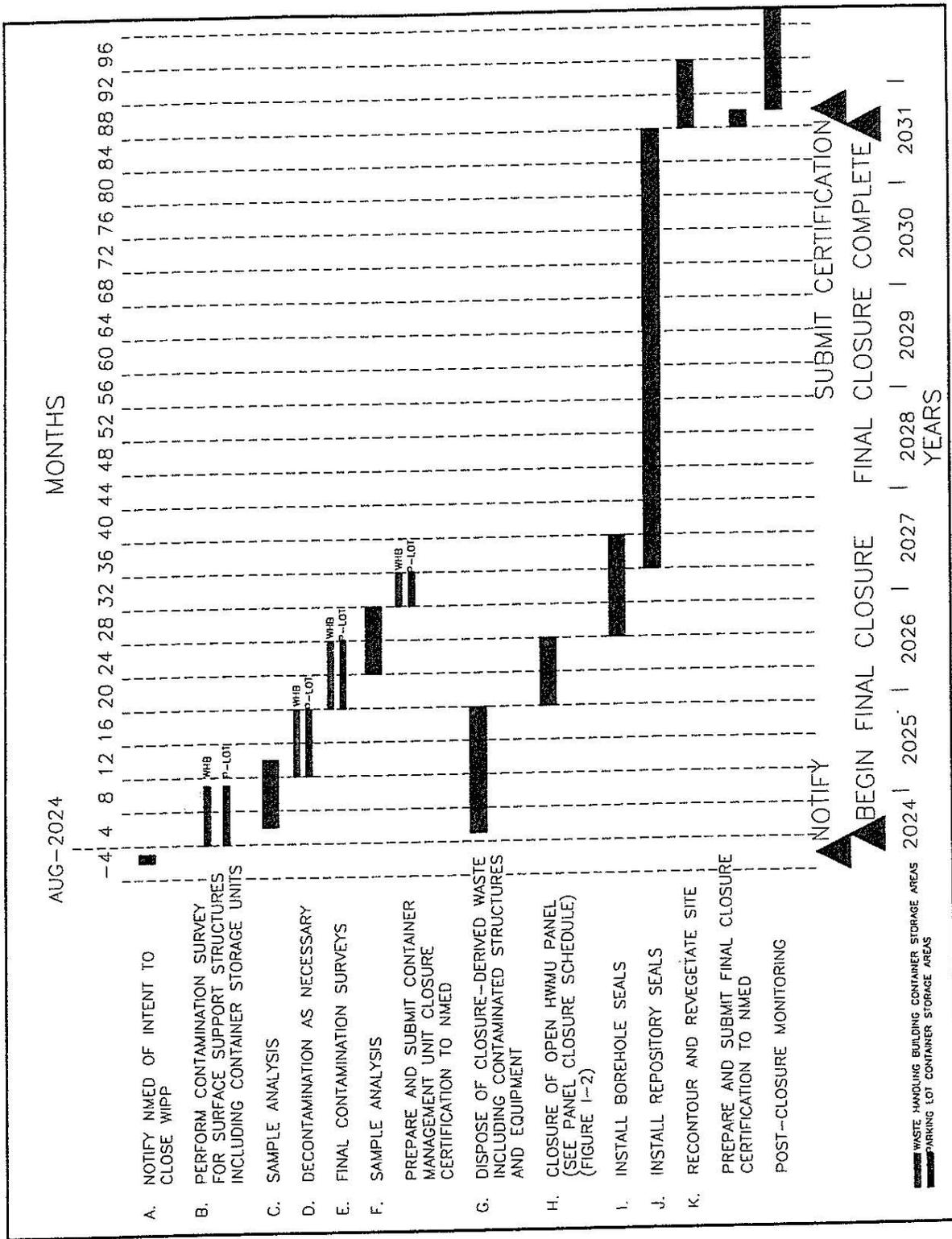


Figure G-3
 WIPP Facility Final Closure 84-Month Schedule

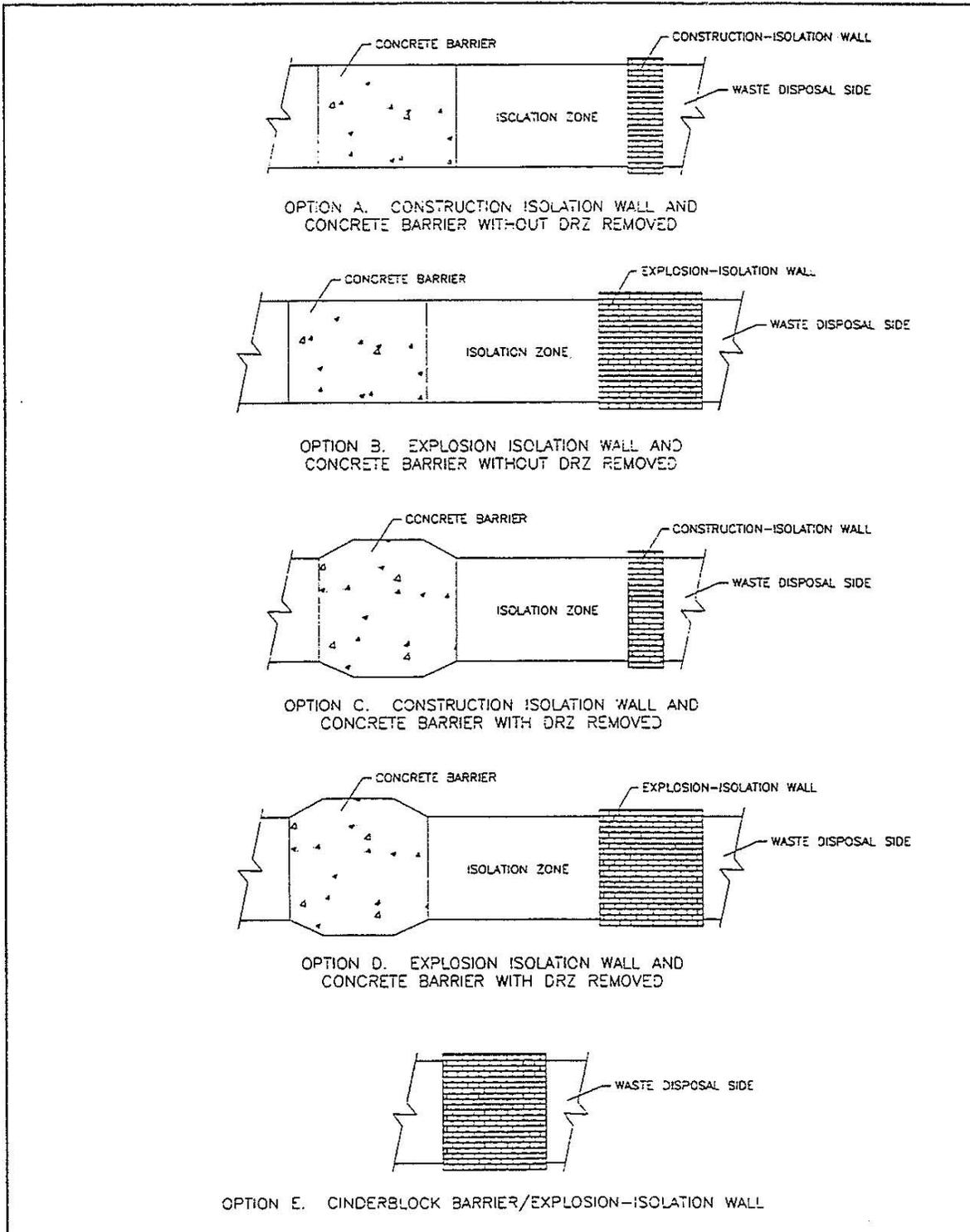


Figure 1G-4
Design of a Panel Closure System

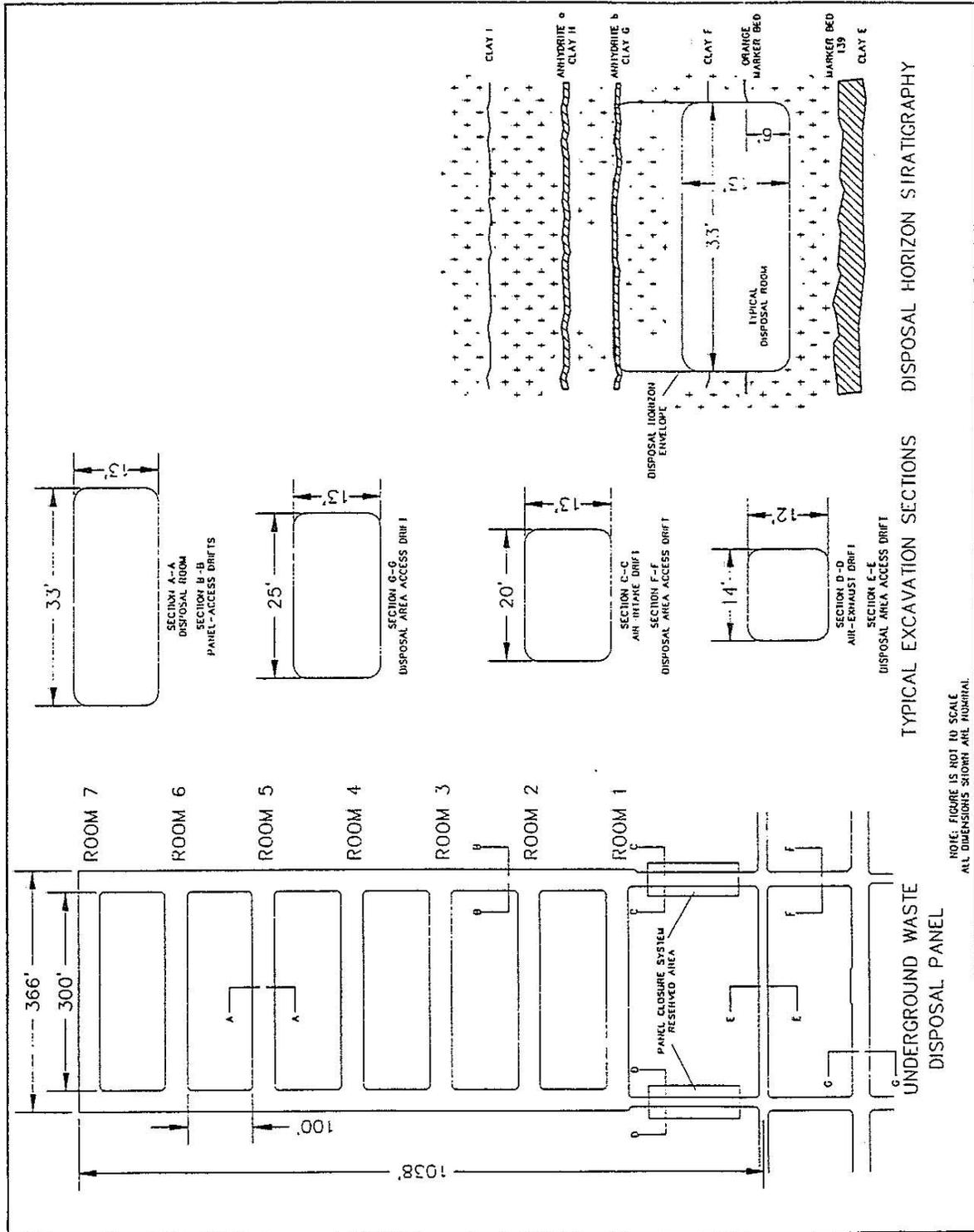


Figure 4G-5
 Typical Disposal Panel

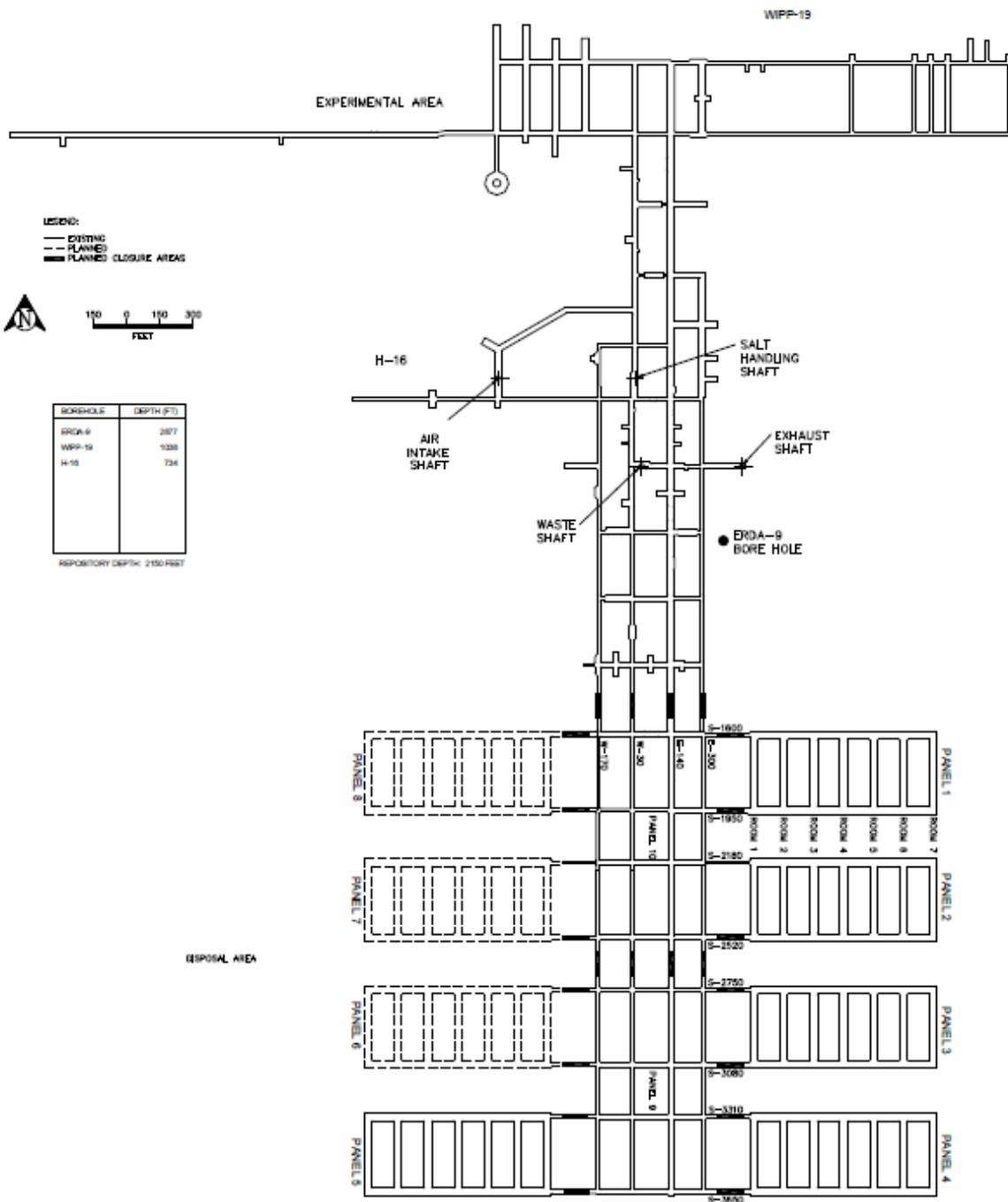


Figure 1-G-6
Approximate Locations of Boreholes in Relation to the WIPP Underground