

ATTACHMENT G
CLOSURE PLAN

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ATTACHMENT G

CLOSURE PLAN

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ATTACHMENT G

CLOSURE PLAN

Introduction

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

The hazardous waste management units (**HWMUs**) addressed in this Closure Plan include the aboveground HWMU in the WHB, the parking area HWMU, and Panels 1 through 8, each consisting of seven rooms. In addition, this Closure Plan includes Panels 9 and 10 which are the main north-south entries in the underground, a portion of which may be used for waste disposal.

This plan was submitted to the New Mexico Environment Department (**NMED**) ~~and the U.S. Environmental Protection Agency (EPA)~~ in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(13)). Closure at the panel level will include the construction of barriers that will contribute to limiting to limit the emission of hazardous waste constituents from the panel into the mine ventilation air stream below levels that meet environmental performance standards⁴ ~~and to mitigate the impacts of methane buildup and deflagration that may be postulated for some closed panels~~. The Post-Closure Plan (Permit Attachment H) includes the implementation of institutional controls to limit access and groundwater monitoring to assess disposal system performance. Until final closure is complete and has been certified in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.115), a copy of the approved Closure Plan and all approved revisions will be on file at the WIPP facility and will be available to the Secretary of

⁴~~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 the NMED or the U.S. Environmental Protection Agency (EPA) Region VI Administrator upon
2 request.

3 G-1 Closure Plan

4 This Closure Plan is prepared in accordance with the requirements of 20.4.1.500 NMAC
5 (incorporating 40 CFR §264 Subparts G, I, and X), Closure and Post-Closure, Use and
6 Management of Containers, and Miscellaneous Units. The WIPP underground HWDUs,
7 ~~including Panels 1 through 8 shown~~ on Figure G-1, will be closed under this Closure Plan permit
8 to meet the performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). The
9 WIPP surface facilities, including Waste Handling Building Container Storage Unit and the
10 Parking Area Container Storage Unit, will be closed in accordance with 20.4.1.500 NMAC
11 (incorporating 40 CFR §264.178). The Permittees may perform partial closure of the WHB and
12 PAU HWMUs prior to final facility closure and certification. For final facility closure, this plan also
13 includes closure ~~of future waste disposal areas including Panels 9 and 10 and closure~~ and
14 sealing of the facility shafts in accordance with 20.4.1.500 NMAC (incorporating 40 CFR
15 §264.601).

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

23 For the purposes of this Closure Plan, final facility closure is defined as closure that will occur
24 when all waste disposal areas are filled or when the WIPP achieves its capacity of 6.2 million
25 cubic feet (ft³) (175,564 cubic meters (m³)) of TRU waste. At final facility closure, the surface
26 container storage areas will be closed, and equipment that can be decontaminated and used at
27 other facilities will be cleaned and sent off site. Equipment that cannot be decontaminated plus
28 any derived waste resulting from decontamination will be placed in the last open underground
29 HWDU. ~~Stockpiled salt may be placed in the underground; it may be used as the core material
30 for the berm component of the permanent marker system; or it must be otherwise disposed of in
31 accordance with Sections 2 and 3 of the Minerals Act of 1947 (30 U.S.C. §§602 and 603).~~ In
32 addition, shafts and boreholes which lie within the WIPP Site Boundary and penetrate the
33 Salado Formation (Salado) will be plugged and sealed, and surface and subsurface facilities
34 and equipment will be decontaminated and removed. Final facility closure will be completed to
35 demonstrate compliance with the Closure Performance Standards contained in 20.4.1.500
36 NMAC (incorporating 40 CFR §264.111, 178, and 601).

37 In the event the Permittees fail to obtain an extension of the hazardous waste permit in
38 accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.51) or fail to obtain a new
39 permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.10(h)), the Permittees
40 will seek a modification to this Closure Plan in accordance with 20.4.1.900 NMAC (incorporating
41 40 CFR §270.42) to accommodate a contingency closure. Under contingency closure, storage
42 units will undergo clean closure in accordance with 20.4.1.500 NMAC (incorporating 40 CFR
43 §264.178); waste handling equipment, shafts, and haulage ways will be inspected for hazardous
44 waste residues (using, among other techniques, radiological surveys to indicate potential
45 hazardous waste releases as described in Permit Attachment G3) and decontaminated as

1 necessary; and underground HWDUs that contain radioactive mixed waste will be closed in
2 accordance with the panel closure design described in this Closure Plan. Final facility closure,
3 however, will be redefined and ~~a request for~~ a time extension for final closure will be requested.
4 A copy of this Closure Plan will be maintained by the Permittees at the WIPP facility and at the
5 U.S. Department of Energy (DOE) Carlsbad Field Office. The primary contact person at the
6 WIPP facility is:

7 Manager, Carlsbad Field Office
8 U.S. Department of Energy
9 Waste Isolation Pilot Plant
10 P. O. Box 3090
11 Carlsbad, New Mexico 88221-3090
12 (575) 234-7300

13 G-1a Closure Performance Standard

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

19 G-1a(1) Container Storage Units

20 Final or partial closure of the permitted container storage units (the Waste Handling Building
21 Unit and Parking Area Unit) will be accomplished by removing all waste and waste residues.
22 Indication of waste contamination will be based, among other techniques, on the use of
23 radiological surveys as described in Permit Attachment G3. Radiological surveys use very
24 sensitive radiation detection equipment to indicate if there has been a potential release of TRU
25 mixed waste, including hazardous waste components, from a container. This allows the
26 Permittees to indicate potential releases that are not detectable from visible evidence such as
27 stains or discoloration. Visual inspection and operating records will also be used to identify
28 areas where decontamination is necessary. Contaminated surfaces will be decontaminated until
29 radioactivity is below ~~DOE-established radiological protection limits~~~~free release limits~~². Once
30 surfaces are determined to be free of radioactive waste constituents, they will be tested for
31 hazardous waste contamination. These surface decontamination activities will ensure the
32 removal of waste residues to levels protective of human health and the environment. The facility
33 is expected to require no decontamination at closure because any waste spilled or released
34 during operations will be contained and removed immediately. Solid waste management units
35 listed in Attachment K, Table K-4 will be subject to closure. ~~In the event portions of these units
36 which require decontamination cannot be decontaminated, these portions will be removed and
37 the resultant wastes will be managed as appropriately.~~

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

²The 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 G-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 35 year
10 operational and facility closure period ~~and to withstand any flammable gas deflagration that may~~
11 ~~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 100 years.
21 Other components become effective more slowly, but provide permanent isolation of the waste.
22 The final shaft seal design is specified in Permit Attachment 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 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 30 years after final facility closure. The post-closure care period may be shortened
8 or lengthened at the discretion of the regulatory agency based on evidence that human health
9 and the environment are being protected or that they are at risk. During the post-closure period,
10 the WIPP shall be maintained in a manner that complies with the environmental performance
11 standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). Post-closure activities are
12 described in Permit Attachment H.

13 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 60 days prior to the date
23 on which closure activities are scheduled to begin.

24 G-1c Maximum Waste Inventory

25 The WIPP will receive no more than 6.2 million ft³ (175,564 m³) of TRU mixed waste, which may
26 include up to 250,000 ft³ (7,079 m³) of remote-handled (**RH**) TRU mixed waste. Excavations are
27 mined as permitted when needed during operations to maintain a reserve of disposal areas. The
28 amount of waste placed in each room is limited by structural and physical considerations of
29 equipment and design. Waste volumes include waste received from off-site generator locations
30 as well as derived waste from disposal and decontamination operations. The maximum volume
31 of TRU mixed waste in a disposal panel is established in Permit Part 4, Table 4.1.1. For closure
32 planning purposes, a maximum achievable volume of 685,100 ft³ (19,400 m³) of TRU mixed
33 waste per panel is used. This equates to 662,150 ft³ (18,750 m³) of contact-handled (**CH**) TRU
34 mixed waste and 22,950 ft³ (650 m³) of RH TRU mixed waste per panel.

35 The maximum extent of operations during the term of this permit is expected to be Panels 1
36 through ~~108~~ as shown on Figure G-1, the WHB Container Storage Unit, and the Parking Area
37 Container Storage Unit. Note that panels 9 and 10 are not authorized for waste
38 emplacementscheduled for excavation only under this permit. If other waste management units
39 are permitted during the Disposal Phase, this Closure Plan will be revised to include the
40 additional waste management units. At any given time during disposal operations, it is possible
41 that multiple rooms may be receiving TRU mixed waste for disposal at the same time.

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

3 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 35 years (25 years for disposal operations and 10 years for closure) is assumed. This
6 operating period may be extended or shortened depending on a number of factors, including the
7 rate of waste approved for shipment to the WIPP facility and the schedules of TRU mixed waste
8 generator sites, and future decommissioning activities.

9 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 G-2. ~~This schedule assumes there will be little contamination within~~
12 ~~the exhaust drift of the panel.~~ Underground HWDUs should be ready for closure according to
13 the schedule in Table G-1. ~~Future~~ ~~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 G-2, notification of intent to close occurs 30 days before placing the
16 final waste in a panel. Once a panel is full, the Permittees will initially block ventilation through
17 the panel as described in Permit Attachment A2, Section A2-2a(3) "Subsurface Structures," and
18 then will assess the closure area for ground conditions and contamination so that a definitive
19 schedule and closure location design can be determined. If as the result of this assessment the
20 Permittees determine that a panel closure cannot be emplaced in accordance with the schedule
21 in this Closure Plan, a modification will be submitted requesting an extension to the time for
22 closure.

23 ~~The Permittees will initially block ventilation through Panel 5 as described in Permit Attachment~~
24 ~~A2, Section A2-2a(3), "Subsurface Structures," once Panel 5 is full. The Permittees will then~~
25 ~~install the explosion-isolation wall portion of the panel closure system that is described in Permit~~
26 ~~Attachment G1, Section 3.3.2, "Explosion and Construction Isolation Walls." Construction of the~~
27 ~~explosion-isolation wall shall be completed within 180 days after the last receipt of waste in~~
28 ~~Panel 5. Final closure of Panels 1 through 6 will be completed as specified in this Permit no~~
29 ~~later than June 30, 2018.~~

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 A2,~~
32 ~~Section A2-2a(3), after waste disposal in each panel has been completed. The Permittees shall~~
33 ~~continue VOC monitoring in such panels until final panel closure. If the measured concentration,~~
34 ~~as confirmed by a second sample, of any VOC in a panel exceeds the 95% action level given in~~
35 ~~Permit Part 4, Table 4.6.3.2, the Permittees will initiate remedial actions as required by Permit~~
36 ~~Part 4, Section 4.6.3.3. Regardless of the outcome of disposal room VOC monitoring, final~~
37 ~~closure of Panels 3 and 4 will be completed as specified in this Permit no later than June 30,~~
38 ~~2018.~~

39 G-1d(2) Schedule for Final Facility Closure

40 The Disposal Phase for the WIPP facility is expected to require a period of 25 years beginning
41 with the first receipt of TRU waste at the WIPP facility and followed by a period ranging from 7
42 to 10 years for decontamination, decommissioning, and final closure. The Disposal Phase may

1 therefore extend until 2024, and the latest expected year of final closure of the WIPP facility
2 (i.e., date of final closure certification) would be 2034. If, as is currently projected, the WIPP
3 facility is dismantled at closure, all surface and subsurface facilities (except the hot cell portion
4 of the WHB, which will remain as an artifact of the Permanent Marker System [PMS]) will be
5 disassembled and either salvaged or disposed in accordance with applicable standards. In
6 addition, asphalt and crushed caliche that was used for paving will be removed, and the area
7 will be recontoured and revegetated in accordance with a land management plan. A detailed
8 closure schedule will be submitted in writing to the Secretary of the NMED, along with the
9 notification of closure. Throughout the closure period, all necessary steps will be taken to
10 prevent threats to human health and the environment in compliance with all applicable
11 Resource Conservation and Recovery Act (RCRA) permit requirements. Figure G-3 presents an
12 estimate of a final facility closure schedule based on 84 months to implement final closure.

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

30 Figure G-3 shows the schedule for the final facility closure consisting of decontamination, as
31 needed, of the TRU waste-handling equipment, and of the aboveground equipment and
32 facilities, including closure of surface HWMUs; decontamination of the shaft and haulage ways;
33 disposal of decontamination derived wastes in the last open underground HWDU; and
34 subsequent closure of this underground HWDU. Subsequent activities will include installation of
35 repository shaft seals.

36 An overall schedule for final facility closure, showing currently scheduled dates for the start and
37 end of final facility closure activities is shown in Table G-2. The dates assume a ~~startup~~
38 date of March 1999 and continued permitting of the WIPP facility until it is filled. ~~Schedule~~
39 ~~details~~ ~~Details~~ for panel closures are shown on Table G-1.

40 G-1d(3) Extension for Closure Time

41 As indicated by the closure schedule presented in Figure G-3, the activities necessary to
42 perform facility closure of the WIPP facility ~~may will~~ require more than 180 days to complete
43 because of additional stringent requirements for managing radioactive materials. Therefore, the
44 Permit provides an extension of the 180-day final closure requirement in accordance with
45 20.4.1.500 NMAC (incorporating 40 CFR §264.113). During the extended closure period, the

1 Permittees will continue to demonstrate compliance with applicable permit requirements and will
2 take ~~all~~ steps necessary to prevent threats to human health and the environment as a result of
3 TRU mixed waste management at the WIPP facility including ~~all of~~ the applicable measures in
4 Permit Part 2.10 (~~Preparedness and Prevention~~ Preparedness and Prevention).

5 In addition, according to the schedules in Figure G-3, the final derived wastes that are
6 generated as the result of decontamination activities will not be disposed of for 16 months after
7 the initiation of final facility closure. In accordance with 20.4.1.500 NMAC (incorporating 40 CFR
8 §264.113(a)), the Permit provides an extension of the 90-day limit to dispose of final derived
9 waste resulting from the closure process. This provision is necessitated by the fact that the
10 radioactive nature of the derived waste makes placement in the WIPP repository the best
11 disposition, and the removal of these wastes will, by necessity, take longer than 90 days in
12 accordance with the closure schedules. During this extended period of time, the Permittees will
13 take ~~all~~ steps necessary to prevent threats to human health and the environment, including
14 compliance with ~~all~~ applicable permit requirements. These steps include ~~all of~~ the applicable
15 preparedness and prevention measures in Permit Part 2.10 (~~Preparedness and~~
16 Prevention) ~~Permit Attachment A~~.

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

22 G-1d(4) Amendment of the Closure Plan

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

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

36 The Permittees will submit a written request for a permit modification with a copy of the
37 amended Closure Plan at least 60 days prior to the proposed change in facility design or
38 operation or within 60 days of the occurrence of an unexpected event that affects the Closure
39 Plan. If the unexpected event occurs during final closure, the permit modification will be
40 requested within 30 days of the occurrence. If the Secretary of the NMED requests a

1 modification of the Closure Plan, a plan modified in accordance with the request will be
2 submitted within 60 days of notification or within 30 days, if the change in facility condition
3 occurs during final closure.

4 G-1e Closure Activities

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

14 G-1e(1) Panel Closure

15 Following completion of waste emplacement in each underground HWDU, ~~disposal-side~~
16 ~~ventilation will be established in the next panel to be used, and the HWDU panel containing the~~
17 ~~waste will be closed. A WIPP Panel Closure (WPC) panel closure system will be emplaced in the~~
18 ~~panel access drifts, in accordance with the design in Permit Attachment G1 and the schedule in~~
19 ~~Figure G-2 and Table G-1. Alternatively, panels may be closed simultaneously by placing panel~~
20 ~~closures in the north-south mains.~~ The panel closure system is designed to meet the following
21 requirements that were established by the DOE for the design to comply with 20.4.1.500 NMAC
22 (incorporating 40 CFR §264.601(a)):

- 23 • the panel closure system shall contribute to meeting the closure performance
24 standards in Permit Part 6, Section 6.10.1 by mitigating the migration of volatile
25 organic compounds (VOCs) from closed panels~~limit the migration of VOCs to the~~
26 ~~compliance point so that compliance is achieved by at least one order of magnitude~~
- 27 • the panel closure system shall consider potential flow of VOCs through the disturbed
28 rock zone (DRZ) in addition to flow through closure components
- 29 • the panel closure system shall perform its intended functions under loads generated by
30 creep closure of the tunnels
- 31 • the panel closure system shall perform its intended function under the conditions of a
32 postulated thermal runaway involving nitrate salt bearing waste~~methane explosion~~
- 33 • the nominal operational life of the closure system is 35 years
- 34 • the panel closure system may require minimal maintenance per 20.4.1.500 NMAC
35 (incorporating 40 CFR 264.111)~~for each individual panel shall not require routine~~
36 ~~maintenance during its operational life~~
- 37 • the panel closure system shall address the expected~~most severe~~ ground conditions
38 ~~expected~~ in the waste disposal area

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

14 The closure performance standard for air emissions from the WIPP facility is one excess cancer
15 death in one million and a hazard index (HI) of 1 for a member of the public living outside the
16 WIPP Site Boundary as specified in Part 6, Section 6.10.1. ~~established in Permit Part 4 and~~
17 ~~Permit Attachment A2.~~ Releases shall be below these limits for the facility to remain in
18 compliance with standards to protect human health and the environment. The ~~following~~ panel
19 closure design has been shown, through analysis, to meet these standards, if emplaced in
20 accordance with the specifications in Permit Attachment G1. Compliance will be demonstrated
21 by the Repository VOC Monitoring Program (RVMP) in Permit Attachment N. Compliance with
22 the standards established for the RVMP constitutes compliance with the closure standards in
23 Permit Part 6, Table 6.10.1.

24 ~~The approved design for the panel closure system calls for a composite panel barrier system~~
25 ~~consisting of a rigid concrete plug with removal of the DRZ, and an explosion isolation wall.~~ The
26 design basis for this closure is such that the migration of hazardous waste constituents from
27 closed panels during the operational and closure period would result in concentrations well
28 below health-based standards. The source term used as the design basis included the average
29 concentrations of VOCs from CH waste containers as measured in headspace gases through
30 November 2010/January 1995. The VOCs are assumed to have been released by diffusion
31 through the container vents and are removed from the closed room by air leakage that occurs
32 due to ventilation-related pressure differentials assumed to be in equilibrium with the air in the
33 panel. Emissions from the closed panel occur at a rate determined by gas generation within the
34 waste and creep closure of the panel.

35 Figures G-4 and G-5 show a diagram of the panel closure design and installation envelopes.
36 Permit Attachment G1 provides the detailed design and the design analysis for the panel
37 closure system. ~~Although the permit application proposed several panel closure design options,~~
38 ~~depending on the gas generated by wastes and the age of the mined openings, the NMED and~~
39 ~~EPA determined that only the most robust design option (D) would be approved. This decision~~
40 ~~does not prevent the Permittees from continuing to collect data on the behavior of the wastes~~

1 ~~and mined openings, or proposing a modification to the Closure Plan in the future, using the~~
2 ~~available data to support a request for reconsideration of one or more of the original design~~
3 ~~options. If a design different from Option D as defined in Permit Attachment G1 is proposed, the~~
4 ~~appropriate permit modification will be sought. The Permittees shall use bulkheads as specified~~
5 ~~in Attachment G1 for the closure of filled panels. A run-of-mine (ROM) salt component will be~~
6 ~~included in the closure for Panel 10.~~

7 G-1e(2) Prerequisite Activities for Panel 6 Final Closure

8 The NMED-approved WIPP Nitrate Salt Bearing Waste Container Isolation Plan (DOE, 2015)
9 provides for performing prerequisite activities associated with ground control, equipment
10 readiness, work control authorization, and ventilation prior to construction of the final closure in
11 Panel 6. These activities are considered closure activities and will be completed in accordance
12 with the WIPP Nitrate Salt Bearing Waste Container Isolation Plan (DOE, 2015).

13 G-1e(32) Decontamination and Decommissioning

14 Decontamination is defined as those activities which are performed to remove contamination
15 from surfaces and equipment that are not intended to be disposed of at the WIPP facility. The
16 policy at the WIPP facility will be to decontaminate as many areas as possible or to fix the
17 contaminants to the surface so they are not easily removable, consistent with
18 ~~radiological~~ radiation protection policy. Decontamination or fixing areis part of ~~all~~ closure
19 activities and areis a necessary activity in the clean closure of the surface container
20 management units. Decontamination or fixing determinations are based upon radiological ~~and~~
21 ~~hazardous constituent~~ surveys.

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

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

- 30 1. Review of operational records for historical information on releases
- 31 2. Visual examination of surface structures for evidence of spills or releases
- 32 3. Performance of site contamination surveys
- 33 4. Decontamination, if necessary, of usable equipment, materials, and structures
34 including surface facilities and areas surrounding the WHB.
- 35 5. Disposal of equipment/materials that cannot be decontaminated but that meet the
36 treatment, storage, and disposal facility waste acceptance criteria (TSDF-WAC) in an
37 underground HWDU
- 38 6. Emplacement of ~~final~~ panel closure system in the last HWDU

- 1 7. Emplacement of shaft seals³
- 2 8. Regrading the surface to approximately original contours
- 3 9. Initiation of active controls

4 This Closure Plan will be amended prior to the initiation of final closure activities to specify the
5 methods to be used.

6 Health and Safety

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

17 G-1e(32)(a) Determine the Extent of Contamination

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

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

36 Radiological and hazardous constituent surveys will be used in determining the presence of
37 hazardous waste and hazardous waste residues in areas where spills or releases have

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 occurred. Radiological surveys are described in Permit Attachment G3. For contamination that
2 is cleaned up, once~~Once~~ cleanup of the radioactivity has been completed, the surface will be
3 sampled for hazardous constituents specified in Permit Attachment B to determine that they,
4 too, have been cleaned up. Sampling and analysis protocols will be consistent with EPA's
5 document SW-846 (EPA, 1996).

6 G-1e(32)(b) Decontamination Activities

7 Once the extent of contamination is known, decontamination or fixing activities will be planned
8 and performed. Radiological control and the control of hazardous waste residues are the
9 primary criteria used in the design of decontamination activities. ~~Radiological~~ ~~Radiation~~ control
10 procedures require that careful planning and execution be used in decontamination activities to
11 prevent the exposure of workers beyond applicable standards and to prevent the further spread
12 of contamination. Careful control of entry, cleanup, and ventilation are vital components of
13 ~~radiological~~ ~~radiation~~ decontamination. The level of care mandated by DOE orders and
14 occupational protection requirements results in closure activities that will exceed the 180 days
15 allowed in 20.4.1.500 NMAC (incorporating 40 CFR §264.113(b)). Decontamination activities
16 are included as item 4 above and are shown on the schedules for contingency closure and final
17 facility closure (Figures G-3 and G-4) as activities D, E, and F. These activities are anticipated
18 to have a duration of 20 months for both contingency closure and for final facility closure. The
19 result of these activities is the clean closure of the surface container management units. Under
20 contingency closure, the other areas that have been decontaminated will not be closed. Instead
21 they will remain in use for continued waste management activities involving non-mixed waste.
22 Under final facility closure, other areas that are decontaminated are eligible for closure.

23 ~~The "Start Clean—Stay Clean" operating philosophy of the WIPP Project will provide for~~
24 ~~minimum need for decontamination. However, the need for decontamination techniques may~~
25 ~~arise.~~

26 Decontamination activities will be coordinated with closure activities so that areas that have
27 been decontaminated will not be recontaminated. All waste resulting from decontamination
28 activities will be surveyed and analyzed for the presence of radioactive contamination and a
29 determination of hazardous constituents specified in Permit Attachment B. The waste will be
30 characterized as hazardous, mixed, or radioactive and will be packaged and handled
31 appropriately. Mixed and radioactive waste ~~may~~ will be classified as TRU mixed waste managed
32 in accordance with the applicable Permit requirements. Derived mixed waste collected during
33 decontamination activities that are generated before repository shafts have been sealed will be
34 emplaced in the facility, if appropriate, or will be managed together with decontamination
35 derived waste collected after the underground is closed. This waste will be classified and
36 shipped off site to an appropriate, permitted facility for treatment, if necessary, and for disposal.

37 Removal of Hazardous Waste Residues

38 Because of the type of waste management activities that will occur at the WIPP facility, waste
39 residues that may be encountered during the operation of the facility and at closure may include
40 derived waste. Derived wastes result from the management of the waste containers or may be
41 collected as part of the closure activities (such as those during which wipes were used to
42 sample the containers and equipment for potential radioactive contamination or those involving
43 solidified decontamination solutions, the handling of equipment designated for disposal, and the
44 handling of residues collected as a result of spill cleanup). Derived wastes collected during the

1 operation and closure of the WIPP facility will be identified and managed as TRU mixed wastes.
2 These wastes will be disposed in the active underground HWDU. Decontamination and
3 decommissioning ~~D&D~~ derived wastes and equipment designated for disposal will be placed in
4 the last underground HWDU panel before closure of that unit.

5 Surface Container Storage Units

6 The procedures employed for waste receipt at the WIPP facility minimize the likelihood for any
7 waste spillage to occur on the surface outside the WHB. TRU mixed waste is shipped to the
8 WIPP facility in approved shipping containers (i.e., Contact-Handled or Remote-Handled
9 Packages) that are not opened until they are inside the WHB. Therefore, it is unlikely that soil in
10 the Parking Area Unit or elsewhere in the vicinity of the WHB will become contaminated with
11 TRU mixed waste constituents as a result of TRU mixed waste management activities. An
12 evaluation of the soils in the vicinity of the WHB will only be necessary if an documented event
13 resulting in a release of hazardous waste has occurred outside the WHB.

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

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

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

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

26 Waste Handling Equipment ~~and~~

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

31 Personnel Decontamination

32 Personal protective equipment (PPE) ~~PPE~~ worn by personnel performing closure activities in
33 areas determined to be contaminated will be disposed of appropriately. Disposable PPE used in
34 such areas will be placed into containers and managed as TRU mixed waste. Non-disposable
35 PPE will be decontaminated, if possible. Non-disposable PPE that cannot be decontaminated
36 will be managed as TRU mixed waste.

37 In accordance with DOE policy, TRU mixed waste PPE will be considered to be contaminated
38 with all of the hazardous waste constituents contained in the containers that have been

1 managed within the unit being closed. Wastes collected as a result of closure activities and that
2 may be contaminated with radioactive and hazardous constituents will be considered TRU
3 mixed wastes. These wastes will be managed as derived wastes, as described in Permit
4 Attachment A2. Such waste, collected as the result of closure of the WIPP facility, will be
5 disposed of in the final open underground HWDU.

6 Cleanup Criteria

7 ~~Radiological Radiation~~ decontamination will be less than or equal to ~~the following levels, or to~~
8 whatever ~~lesser~~ levels that may be established by DOE Order at the time of cleanup:.

9 Contamination Type	Loose⁴	Fixed plus removable
10 alpha contamination (α)	20 dpm/100 cm²	500 dpm/100 cm²
11 beta-gamma contamination (β-γ)	200 dpm/100 cm²	1000 dpm/100 cm²

12 Hazardous waste decontamination will be conducted in accordance with standards in
13 20.4.1.500 NMAC (incorporating 40 CFR §264) or as incorporated into the Permit.

14 Final Contamination Sampling and Quality Assurance

15 Verification samples will be analyzed by an approved laboratory that has been qualified by the
16 DOE according to a written program with strict criteria. The QA requirements of EPA/SW-846,
17 "Test Methods for Evaluating Solid Waste" (EPA, ~~1996~~1986), will be met for hazardous
18 constituent sampling and analyses.

19 Quality Assurance/Quality Control

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

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

⁴The 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 G-1e(32)(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 G-34. 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 16 months after the initiation of closure. Dismantling of
8 the balance of the facility, including those structures and equipment that are not included in the
9 application and are not used for TRU mixed waste management, is anticipated to take an
10 additional 66 months. It should be noted that the placement of D&D waste into the final
11 underground HWDU may, by necessity, involve the placement of uncontainerized bulk materials
12 such as concrete components, building framing, structural members, disassembled or partially
13 disassembled equipment, or containerized materials in non-standard waste boxes. Such
14 placement will only occur if it can be shown that it is protective of human health and the
15 environment and all items are described in an amendment to the Closure Plan. Identification of
16 bulk items is not possible at this time since their size and quantity will depend on the extent of
17 non-removable contamination.

18 G-1e(32)(d) Closure of Open Underground HWDU

19 The closure of the final underground HWDU is shown by Activity H in Figure G-3. This closure
20 will be consistent with the description in Section G-1e(1) and the design in Permit Attachment
21 G1. Detailed closure schedules for underground HWDUs are given in Figure G-2 and Table G-
22 1.

23 G-1e(32)(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 G-6 identifies where three existing boreholes overlie the proximate area of the repository
31 footprint. Of these identified boreholes in Figure G-6, all but ERDA-9 are terminated hundreds of
32 feet above the repository horizon. Only ERDA-9, which is accounted for in long-term
33 performance modeling, is drilled through the repository horizon, near the WIPP excavations.

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

38 Borehole plugging activities have been underway since the 1970s, from the early days of the
39 development of the WIPP facility. Early in the exploratory phase of the project, a number of
40 boreholes were sunk in Lea and Eddy counties. After the WIPP site was situated in its current
41 location, an evaluation of all vertical penetrations was made by Christensen and Peterson
42 (1981).

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

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

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

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

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

28 Once shaft sealing is completed, the Permittees will consider closure complete and will provide
29 the NMED with a certification of such within 60 days.

30 G-1e(32)(f) Final Contouring and Revegetation

31 In the preparation of its Final Environmental Impact Statement (DOE, 1980), the DOE
32 committed to restore the site to as near to its original condition as is practicable. This involves
33 removal of access roads, unneeded utilities, fences, and any other structures built by the DOE
34 to support WIPP operations. Provisions would be left for active post-closure controls of the site
35 and for the installation of long-term markers and monuments for the purpose of permanently
36 marking the location of the repository and waste. Permit Attachment H-1a(1) discusses the
37 active and long-term controls proposed for the WIPP. Installation of borehole seals are
38 anticipated to take 12 months, shaft seals 52 months, and final surface contouring 8 months.

1 G-1e(32)(g) Closure, Monuments, and Records

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

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

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

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

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

25 G-1e(43) Performance of the Closed Facility

26 20.4.1.500 NMAC (incorporating 40 CFR §264.601) requires that a miscellaneous unit be
27 closed in a manner that protects human health and the environment. The RCRA Part B permit
28 application addressed the expected performance of the closed facility during the ~~30~~-30-year
29 post closure period. Groundwater monitoring will provide information on the performance of the
30 closed facility during the post-closure care period, as specified in Section H-1a(2) (Monitoring)
31 of Permit Attachment H.

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

1 G-2 Notices Required for Disposal Facilities

2 G-2a Certification of Closure

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

10 G-2b Survey Plat

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

19

1 References

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TABLES

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**Table 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 5
PANEL 4	1/07*	5/09*	5/09*	8/09* SEE NOTE 5
PANEL 5	3/09*	7/11*	7/11*	11/11* SEE NOTE 5
PANEL 6	3/11*	1/14*	1/14*	6/18* SEE NOTE 5
PANEL 7	9/13*	6/18	7/18	3/19
PANEL 8	6/18	6/20	7/20	3/21
PANEL 9	6/20	1/28	2/28	SEE NOTE 4
PANEL 10	1/28	9/30	10/30	SEE NOTE 4

* Actual month and year

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 ~~the Permit~~~~new permits~~ will be ~~issued in 2009 and 2019~~~~renewed~~.

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

NOTE 3: The point of closure end is defined as 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 40 years so that the preparation for closure may take longer than the time allotted in Figure G-2. If this extension is needed, it will be requested as an amendment to the Closure Plan.

NOTE 5: Installation of the 12-foot explosion-isolation wall for Panels 1, 2, and 5 has been completed. Final closure of Panels 1 through 6 will be completed as specified in this Permit no later than June 30, 2018.

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**Table 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 G-3 and 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 G-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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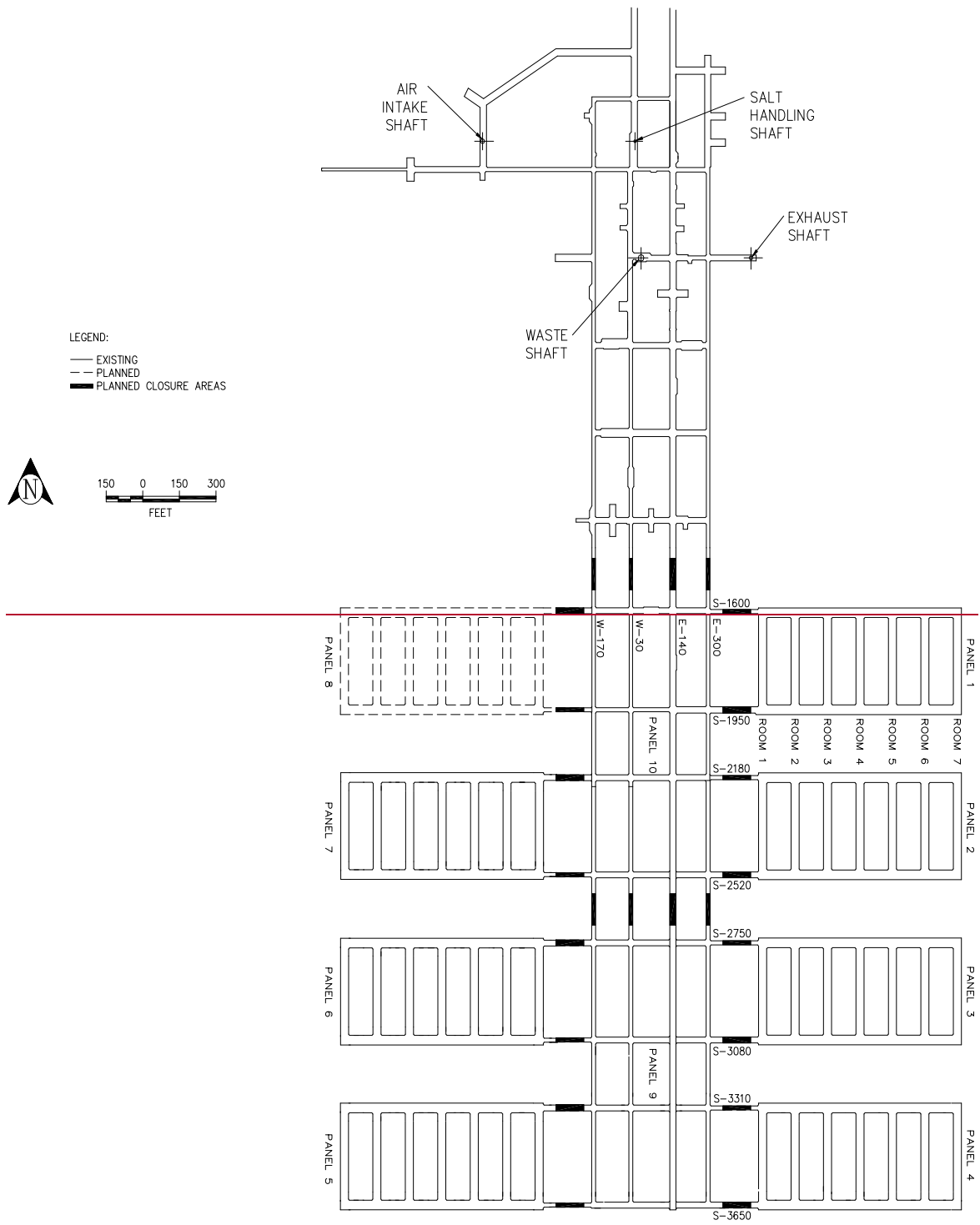
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FIGURES

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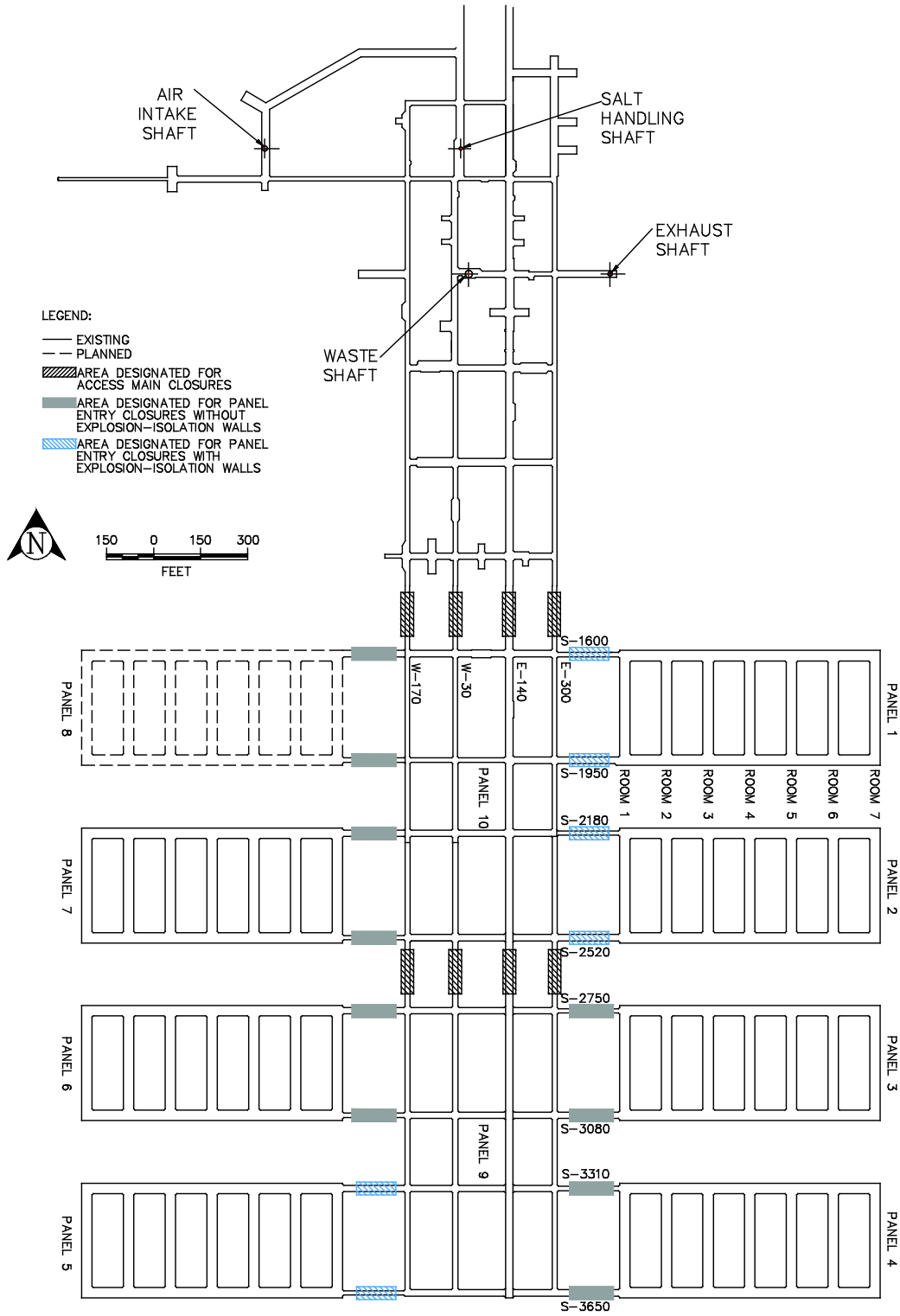


Figure G-1
 Location of Underground HWDUs and Anticipated **WPC** Closure Locations

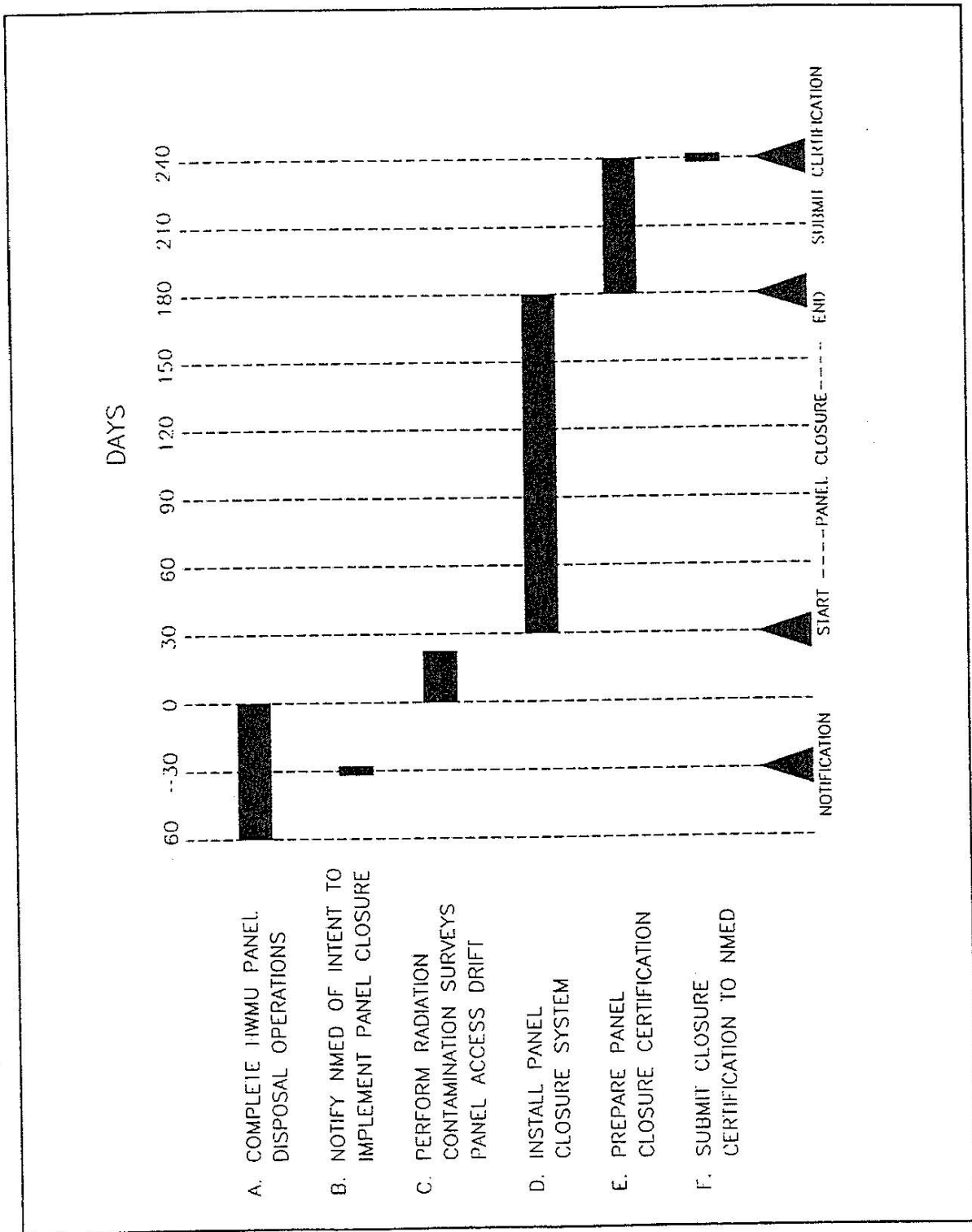


Figure G-2
WIPP Panel Closure Schedule

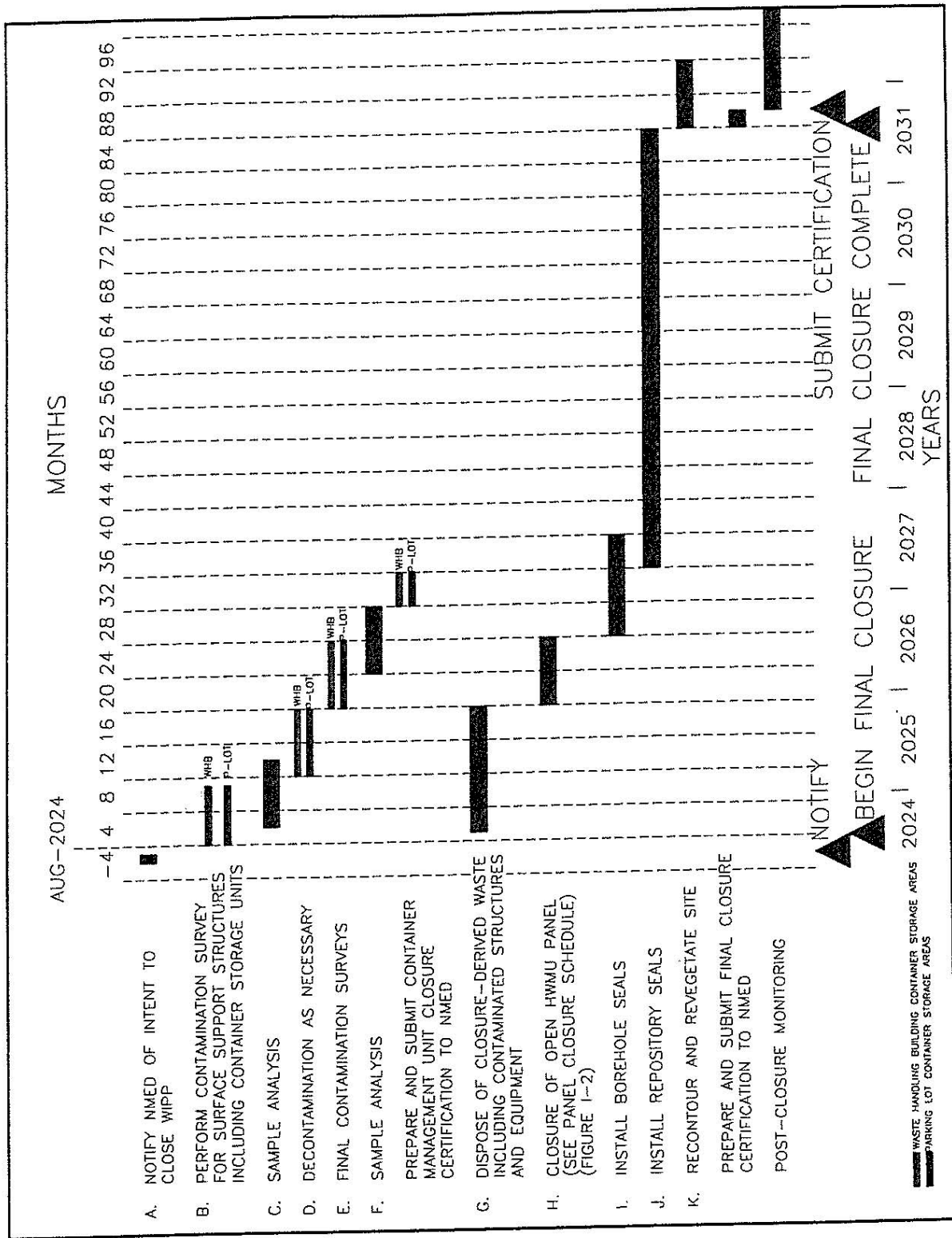
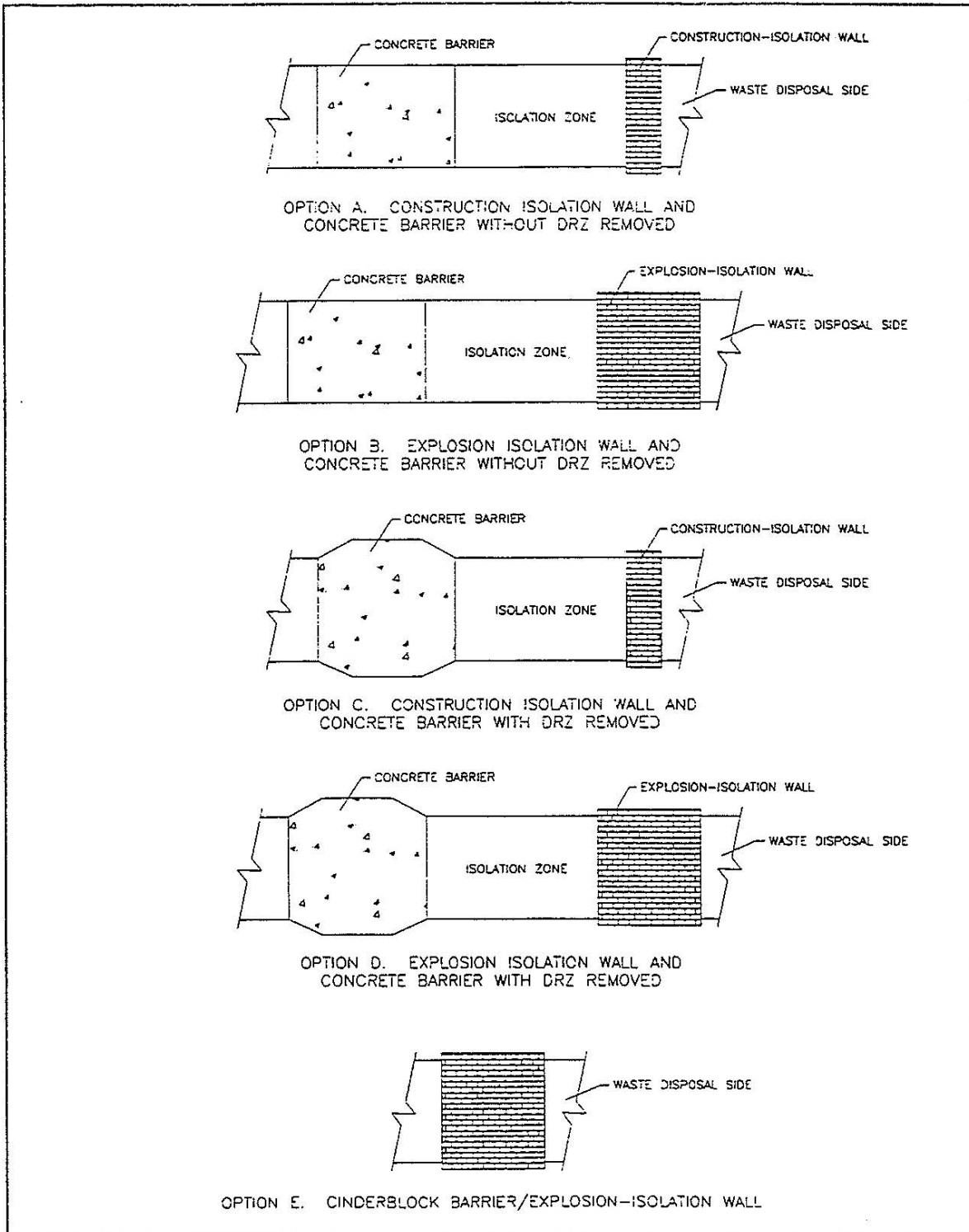


Figure G-3
WIPP Facility Final Closure 84-Month Schedule



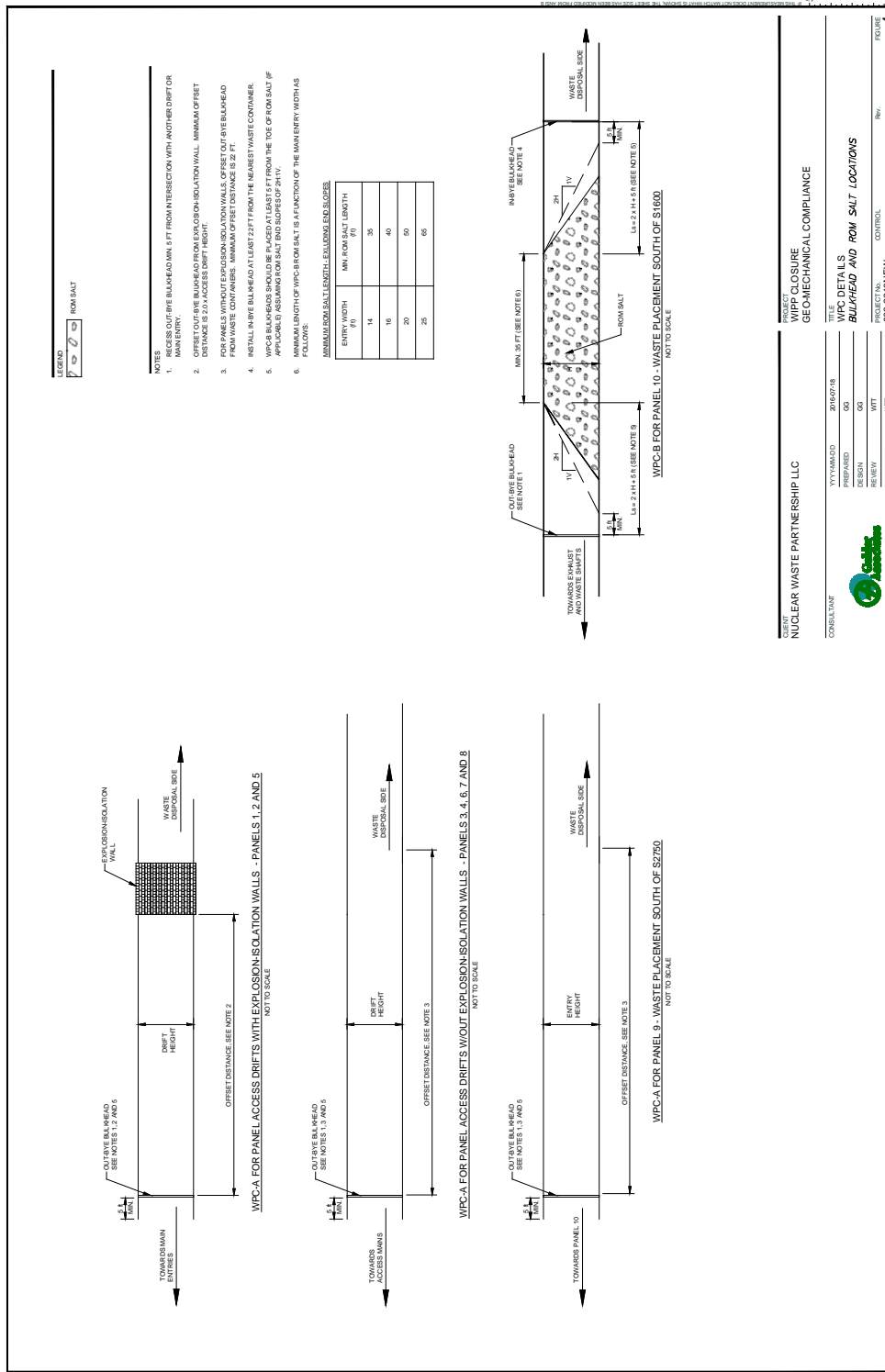
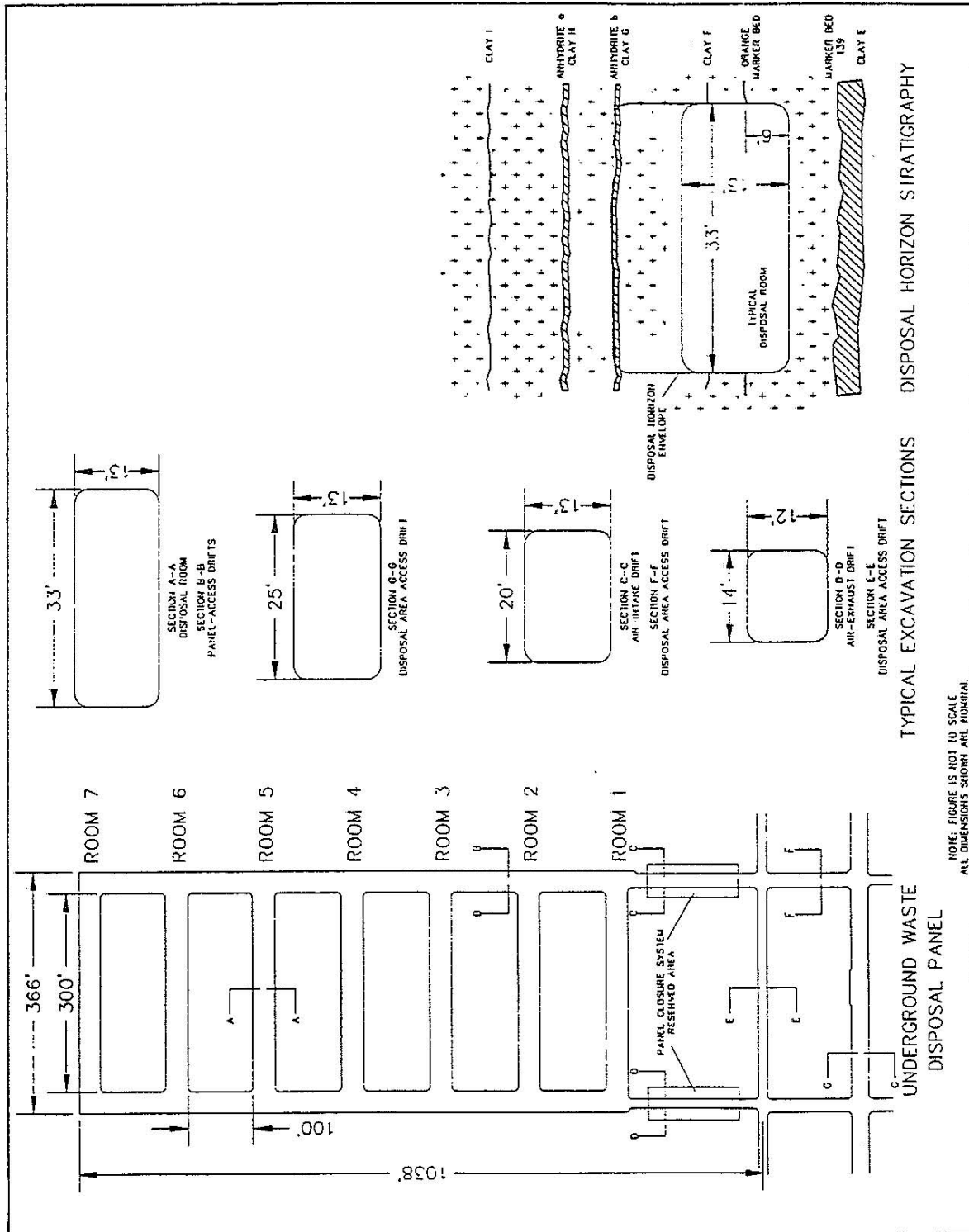


Figure G-4
Bulkhead and ROM Salt Locations Design of a Panel Closure System



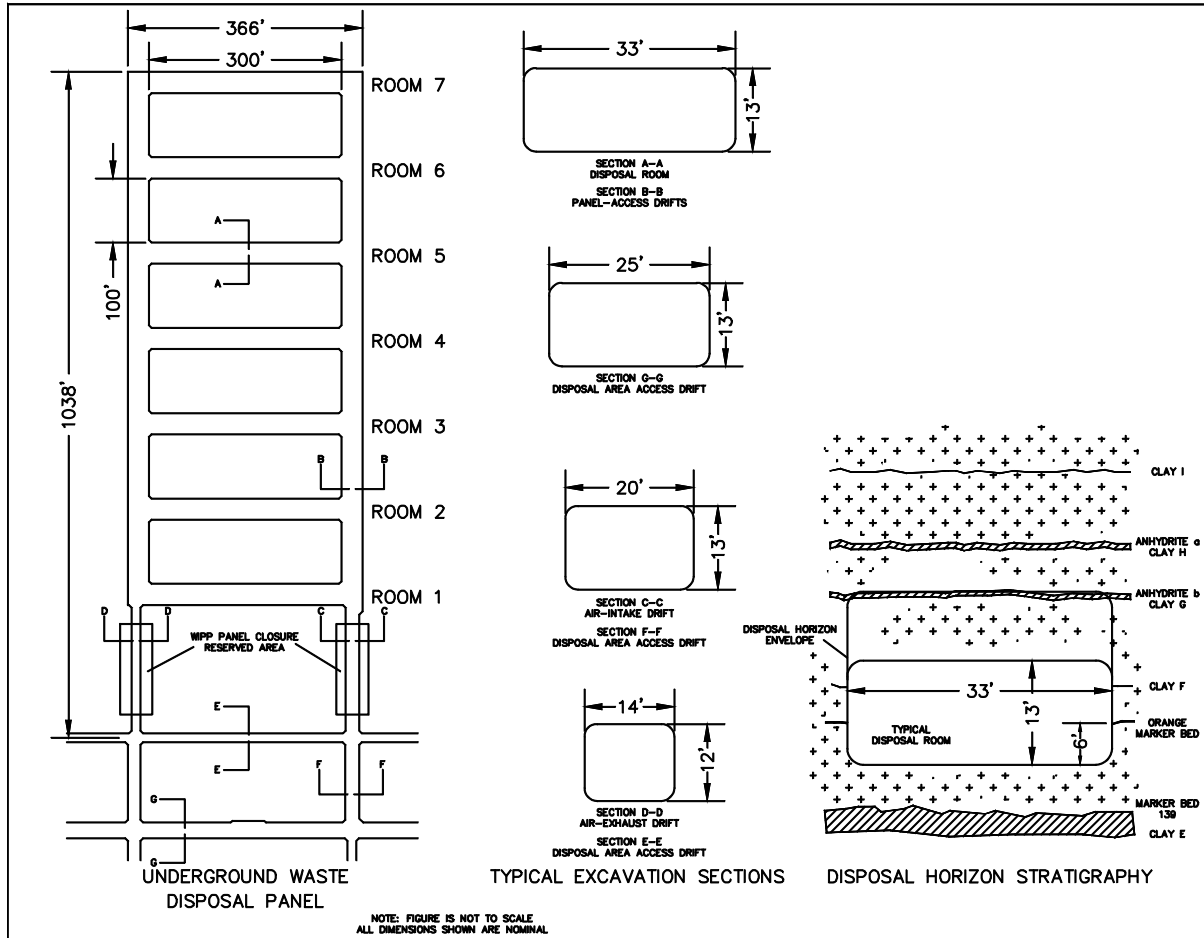


Figure G-5
 Typical Disposal Panel

Waste Isolation Pilot Plant
Draft Hazardous Waste Permit
 February 2018 ~~January 2016~~



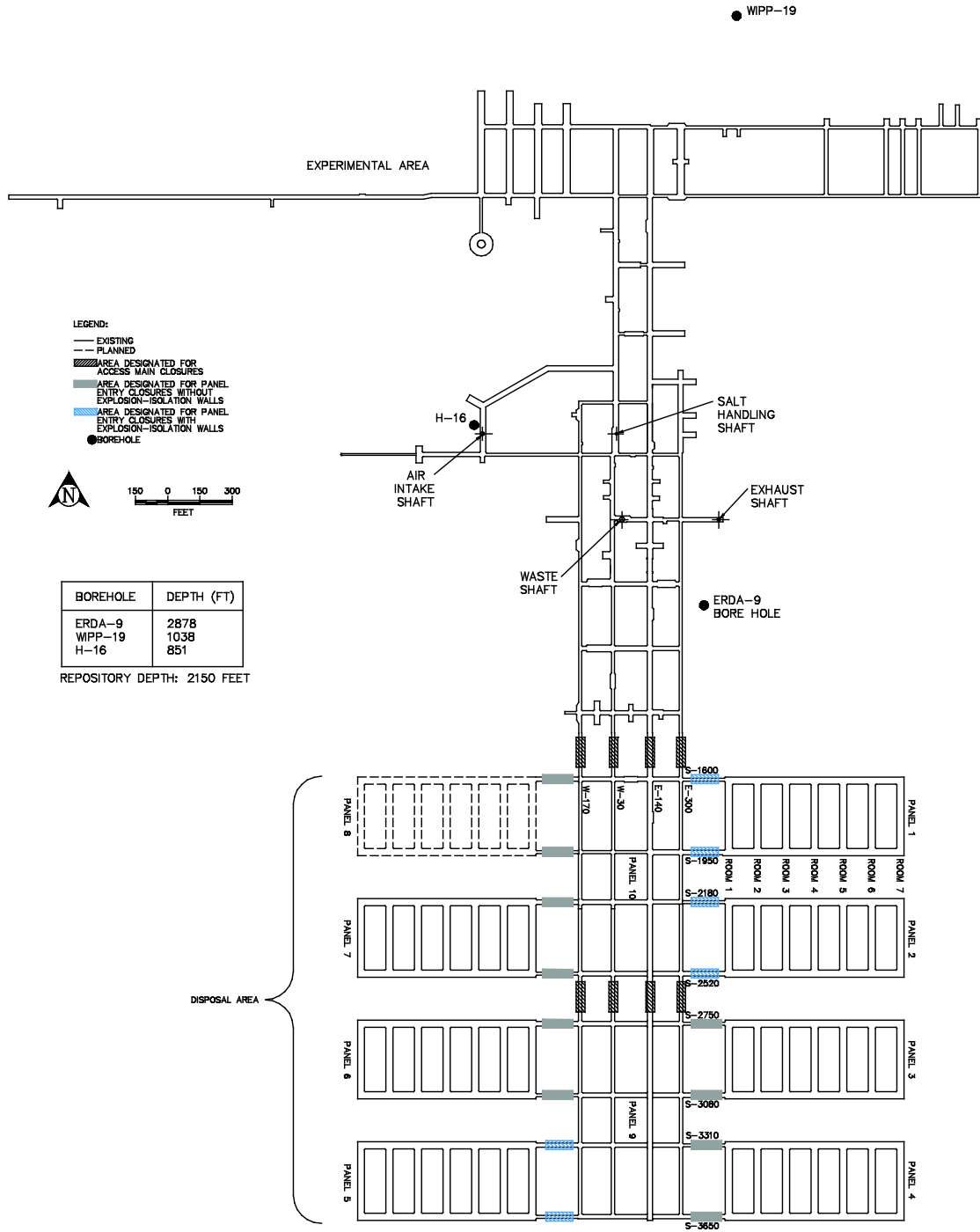


Figure G-6
 Approximate Locations of Boreholes in Relation to the WIPP Underground