

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 New Mexico Administrative Code (**NMAC**) (incorporating Title 40 of the Code of Federal Regulations (**CFR**) §270.10(h)). Consequently, this Closure Plan describes several types of closures. The first type is panel closure, which involves constructing closures for 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**) Container Storage Unit (**WHB Unit**), the Parking Area Container Storage Unit (**PAU**), or Permit-related surface equipment, structures and contaminated soils. The third type of closure is final facility closure at the end of the Disposal Phase, which will entail “clean” closure of remaining surface storage units and construction of shaft seal systems for each shaft. 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 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 WHB Unit, the PAU, and Panels 1 through 8, Panel 11, and Panel 12, each consisting of seven rooms. In addition, this Closure Plan includes closures for Panels 9 and 10.

This plan was submitted to the New Mexico Environment Department (**NMED**) 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 the emission of hazardous waste constituents from the panel into the mine ventilation air stream below levels that meet environmental performance standards. 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 approved revisions will be on file at the WIPP facility and will be available to the Secretary of the NMED in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.112(a)(2)) upon request.

This Closure Plan uses the terms Disposal Phase, facility closure period, and post-closure care period. The Disposal Phase began with the first waste emplacement in March 1999 and extends until the expiration of the Permit term, **unless a timely Renewal Application has been submitted and the requirements of Permit Part 1, Section 1.7.3 have been met**, or when the HWDUs have received the final volume of waste as specified in Permit Part 4, Table 4.1.1. The facility closure period is the 10-year period that begins once the final waste has been emplaced in the underground. The post-closure care period extends for 30-years after completion of facility closure period.

1 G-1 Closure Plan

2 This Closure Plan is prepared in accordance with the requirements of 20.4.1.500 NMAC
3 (incorporating 40 CFR Part 264, Subparts G, I, and X), Closure and Post-Closure, Use and
4 Management of Containers, and Miscellaneous Units. The WIPP underground HWDUs, shown
5 on Figure M-43, will be closed under this Closure Plan to meet the performance standards in
6 20.4.1.500 NMAC (incorporating 40 CFR §264.601). The WIPP surface facilities, including the
7 WHB Unit and the PAU, will be closed in accordance with 20.4.1.500 NMAC (incorporating 40
8 CFR §264.178). The Permittees may perform partial closure of the WHB Unit, PAU HWMUs, or
9 Permit-related surface equipment, structures and contaminated soils prior to final facility closure
10 and certification. For final facility closure, this plan also includes closure and sealing of the
11 facility shafts in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

12 Following completion of waste emplacement in each underground HWDU, the HWDU will be
13 closed. The Permittees will notify the NMED of the closure of each underground HWDU as
14 specified in the schedule in Figure M-61. For the purpose of this Closure Plan, panel closure is
15 defined as the process of rendering underground HWDUs in the repository inactive and closed
16 according to the facility Closure Plan. The Post-Closure Plan (Permit Attachment H) addresses
17 requirements for future monitoring that are deemed necessary for the post-closure period, prior
18 to final facility closure.

19 For the purposes of this Closure Plan, final facility closure is defined as closure that will occur
20 when permitted HWDUs are filled or have achieved their maximum capacities as outlined in
21 Permit Part 4, Table 4.1.1, or when the WIPP facility achieves its capacity of 6.2 million cubic
22 feet (ft³) (175,564 cubic meters (m³)) of Land Withdrawal Act (**LWA**)TRU waste volume. At final
23 facility closure, the surface container storage areas will be closed. Equipment that cannot be
24 decontaminated plus any derived waste resulting from decontamination will be placed in the last
25 open underground HWDU. In addition, shafts and boreholes which lie within the WIPP Site
26 Boundary and penetrate the Salado Formation (**Salado**) will be plugged and sealed, and
27 surface and subsurface facilities and equipment will be decontaminated, if necessary, and
28 removed and dispositioned appropriately or, alternatively, disposed in the last open
29 underground HWDU as derived waste. The requirements in Permit Part 2, Section 2.3.3.4,
30 *Chemical Incompatibility*, apply to surface and subsurface facilities and equipment to be
31 disposed upon final facility closure. Final facility closure will be completed to demonstrate
32 compliance with the Closure Performance Standards contained in 20.4.1.500 NMAC
33 (incorporating 40 CFR §264.111, 178, and 601).

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

1 Closure Plan will be maintained by the Permittees at the WIPP facility and at the U.S.
2 Department of Energy (**DOE**) Carlsbad Field Office. The primary contact person at the WIPP
3 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) 243-4432

10 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 G-1a(1) Container Storage Units

17 Final or partial closure of the permitted container storage units (the WHB Unit and PAU) will be
18 accomplished by removing waste and waste residues. Indication of waste contamination will be
19 based, among other techniques, on the use of radiological surveys as described in Permit
20 Attachment G3. Radiological surveys use very sensitive radiation detection equipment to
21 indicate if there has been a potential release of TRU mixed waste, including hazardous waste
22 components, from a container. This allows the Permittees to indicate potential releases that are
23 not detectable from visible evidence such as stains or discoloration. Visual inspection and
24 operating records will also be used to identify areas where decontamination is necessary.
25 Contaminated surfaces will be decontaminated until radioactivity is below DOE-established
26 radiological protection limits¹. Once surfaces are determined to be free of radioactive waste
27 constituents, they will be sampled for hazardous waste contamination. Hazardous waste
28 decontamination, if needed, will be conducted in accordance with the requirements of the Permit
29 and the standards in 20.4.1.500 NMAC (incorporating 40 CFR Part 264). These surface
30 decontamination activities will ensure the removal of waste residues to levels protective of
31 human health and the environment. **The facility may require decontamination during the
32 Disposal Phase and at closure because of releases in February 2014 or subsequent releases
33 for which immediate removal is not possible.** Solid waste management units listed in Attachment
34 K, Table K-4 will be subject to closure.

35 Once the container storage units are certified by the Permittees to be clean, no further
36 maintenance is required. The facilities and equipment in these units will be available for other
37 purposes. If portions of the facilities or equipment in these units, which require decontamination,
38 cannot be decontaminated, these portions will be removed, and the resultant wastes will be
39 managed consistent with radiological control procedures pursuant to 10 CFR Part 835.

¹ Title 10 CFR Part 835.

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 Disposal
10 Phase and facility closure period.

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

16 Shaft seals are designed to provide effective barriers to the inward migration of groundwater
17 and the outward migration of gas and contaminated brine over two discrete time periods.
18 Several components become effective immediately and are expected to function for 100 years.
19 Other components become effective more slowly but provide permanent isolation of the waste.
20 The final shaft seal design is specified in Permit Attachment G2.

21 The facility will be finally closed to minimize the need for continued maintenance. Protection of
22 human health and the environment includes, but is not limited to:

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

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

39 If, during panel or final facility closure activities, unexpected events require modification of this
40 Closure Plan to demonstrate compliance with closure performance standards, a Closure Plan

1 amendment will be submitted in accordance with 20.4.1.900 NMAC (incorporating 40 CFR
2 §270.42).

3 G-1a(3) Post-Closure Care

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

11 G-1b Requirements

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

20 The Permittees will notify the Secretary of the NMED in writing at least 60 days prior to the date
21 on which closure activities are scheduled to begin.

22 G-1c Maximum Waste Inventory

23 The maximum waste inventory (maximum capacity) for the permitted HWDUs is established in
24 Permit Part 4, Table 4.1.1. During the Disposal Phase, and in accordance with the LWA, the
25 WIPP facility will receive no more than 6.2 million ft³ (175,564 m³) of LWA TRU waste volume,
26 which may include up to 250,000 ft³ (7,079 m³) of remote-handled (**RH**) TRU 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. Transuranic mixed waste volumes include waste
30 received from off-site generator locations as well as derived waste from disposal and
31 decontamination operations. For closure planning purposes, a maximum achievable volume of
32 TRU mixed waste per HWDU is listed in Permit Part 4, Table 4.1.1.

33 The maximum extent of operations during the term of this permit includes Panels 1 through 8
34 and Panels 10 through 12; the WHB Unit; and the PAU. Note that Panel 9 will not be used for
35 TRU mixed waste disposal and Panel 10 is not authorized for waste emplacement under this
36 permit. If other waste management units are permitted during the Disposal Phase, this Closure
37 Plan will be revised to include the additional waste management units. The design basis for a
38 panel assumes that it takes about 30 months to fill the HWDU and initiate panel closure (DOE,
39 1997). However, it is anticipated that Panel 7, Panel 8, and Panel 10 (if authorized in the future
40 for TRU mixed waste disposal) will take longer than 30 months to fill due to the reduction in
41 available ventilation capability, ground conditions in Panel 10 and associated remediation
42 efforts, and radiological contamination in Panel 10. These assumptions have been used in

1 preparing the closure schedule in Table G-1. At any given time during disposal operations, it is
2 possible that multiple rooms may be receiving TRU mixed waste for disposal at the same time.
3 Underground HWDUs in which disposal has been completed (i.e., in which CH and RH TRU
4 mixed waste emplacement activities have ceased) will undergo panel closure.

5 G-1d Schedule for Closure

6 For the purpose of establishing a schedule for closure, the final waste disposal will mark the end
7 of the Disposal Phase and will occur when the Permit term expires, **unless a timely Renewal**
8 **Application has been submitted and the requirements of Permit Part 1, Section 1.7.3 have been**
9 **met**, or the permitted HWDUs are filled or have achieved their maximum capacities as outlined
10 in Permit Part 4, Table 4.1.1, within the capacity limit of 6.2 million cubic feet (ft³) (175,564 cubic
11 meters (m³)) of LWA TRU waste volume. The Permittees also assume closure will take 10
12 years. The Disposal Phase may be extended or shortened, within the authorized capacities and
13 Permit term, depending on a number of factors, including the rate of waste approved for
14 shipment to the WIPP facility and the schedules of TRU mixed waste generator sites, and future
15 decommissioning activities.

16 G-1d(1) Schedule for Panel Closure

17 The anticipated schedule for the closure of the underground HWDUs is shown in Figure M-61.
18 Underground HWDUs should be ready for closure according to the schedule in Table G-1.
19 Table G-1 shows actual dates for completed activities and future dates based on the facility
20 design parameters discussed in Section G-1c. These future dates are estimates for planning
21 and permitting purposes. Actual dates may vary depending on the availability of waste from the
22 generator sites.

23 In the schedule in Figure M-61, notification of intent to close occurs 30 days before placing the
24 final waste in an HWDU. Once an HWDU is full, the Permittees will initially block ventilation
25 through the HWDU as described in Permit Attachment A2, Section A2-2a(3) "Subsurface
26 Structures," and then will assess the closure area for ground conditions and contamination so
27 that a definitive schedule and closure location can be determined. If as the result of this
28 assessment the Permittees determine that a panel closure cannot be emplaced in accordance
29 with the schedule in this Closure Plan, a modification will be submitted requesting an extension
30 to the time for closure.

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

32 If, as is currently projected, the WIPP facility is dismantled at closure, surface facilities (except
33 the hot cell portion of the WHB, which will remain as an artifact of the Permanent Marker
34 System [PMS]) will be disassembled and either salvaged or disposed in accordance with
35 applicable standards. Subsurface facilities and equipment will be disassembled and disposed or
36 salvaged to the extent practicable based on underground mining practice. In addition, asphalt
37 and crushed caliche that was used for paving will be removed, and the area will be recontoured
38 and revegetated in accordance with a land management plan. A detailed closure schedule will
39 be submitted in writing to the Secretary of the NMED, along with the notification of closure.
40 Throughout the closure period, necessary steps will be taken to prevent threats to human health
41 and the environment in compliance with applicable Resource Conservation and Recovery Act
42 (RCRA) permit requirements. Figure M-62 presents an estimate of a final facility closure
43 schedule.

1 The schedule for final facility closure is considered to be a best estimate because closure of the
2 facility is driven by policies and practices established for the decontamination, if necessary, and
3 decommissioning of radioactively contaminated facilities. These required activities include
4 extensive radiological contamination surveys and hazardous constituent surveys using, among
5 other techniques, radiological surveys to indicate potential hazardous waste releases. Both
6 types of surveys will be performed at the areas of the WIPP site where hazardous waste were
7 managed, as appropriate. These surveys, along with historical radiological survey records, will
8 provide the basis for determining the disposition of structures, equipment, and components (i.e.,
9 disposal or decontamination for release off-site). Specifications will be developed for each
10 structure to be removed. A cost benefit analysis may be needed to evaluate decontamination
11 options if extensive decontamination is necessary. Individual equipment surveys, structure
12 surveys, and debris surveys may be required prior to disposition. Size-reduction techniques may
13 be required to dispose of mixed or radioactive waste at the WIPP site. Current DOE policy
14 requires the preparation of a final decontamination and decommissioning (**D&D**) plan
15 immediately prior to final facility closure. In this way, the specific conditions of the facility at the
16 time D&D is initiated will be addressed. Section G-1e(2) provides a more detailed discussion of
17 final facility closure activities.

18 Figure M-62 shows the schedule for the final facility closure consisting of decontamination, as
19 needed, of the TRU waste-handling equipment, and of the aboveground equipment and
20 facilities, including closure of surface HWMUs; decontamination of the shaft and haulage ways
21 (if needed); disposal of decontamination derived wastes in the last open underground HWDU;
22 and subsequent closure of this underground HWDU. Subsequent activities will include
23 installation of repository shaft seals.

24 A schedule for final facility closure, showing anticipated durations for final facility closure
25 activities, is shown in Table G-2. This schedule is based on notification of the intent to close as
26 the initial activity, 60 days prior to the final facility closure start date. Schedule details for panel
27 closures are shown on Table G-1.

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

29 As indicated by the closure schedule presented in Figure M-62, the activities necessary to
30 perform facility closure of the WIPP facility may require more than 180 days to complete
31 because of additional stringent requirements for managing radioactive materials. Therefore, the
32 Permit provides an extension of the 180-day final closure requirement in accordance with
33 20.4.1.500 NMAC (incorporating 40 CFR §264.113). During the extended closure period, the
34 Permittees will continue to demonstrate compliance with applicable permit requirements and will
35 take the steps necessary to prevent threats to human health and the environment as a result of
36 TRU mixed waste management at the WIPP facility including all of the applicable measures in
37 Permit Part 2.10, *Preparedness and Prevention*.

38 In addition, according to the schedules in Figure M-62, the final derived wastes that are
39 generated as the result of decontamination activities will not be disposed of for 16 months after
40 the initiation of final facility closure. In accordance with 20.4.1.500 NMAC (incorporating 40 CFR
41 §264.113(a)), the Permit provides an extension of the 90-day limit to dispose of final derived
42 waste resulting from the closure process. This provision is necessitated by the fact that the
43 radioactive nature of the derived waste makes placement in the WIPP repository the best
44 disposition, and the removal of these wastes will, by necessity, take longer than 90 days in
45 accordance with the closure schedules. During this extended period of time, the Permittees will

1 take the steps necessary to prevent threats to human health and the environment, including
2 compliance with applicable permit requirements. These steps include the applicable
3 preparedness and prevention measures in Permit Part 2, Section 2.10, *Preparedness and*
4 *Prevention*.

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

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

11 If it becomes necessary to amend the Closure Plan for the WIPP facility, the Permittees will
12 submit a written notification of or request for a permit modification in accordance with 20.4.1.900
13 NMAC (incorporating 40 CFR §270.42). This notification of, or request for, a permit modification
14 will describe any change in operation or facility design that affects the Closure Plan. The written
15 notification of, or request for, a permit modification will include a copy of the amended Closure
16 Plan for approval by the NMED. The Permittees will submit a written notification of, or request
17 for, a permit modification to authorize a change in the approved plan, if:

- 18 • There are changes in operating plans or in the waste management unit facility design
19 that affect the Closure Plan
- 20 • There is a change in the expected year of closure
- 21 • Unexpected events occur during panel or final facility closure that require modification of
22 the approved Closure Plan
- 23 • Changes in State or Federal laws affect the Closure Plan
- 24 • Permittees fail to obtain permits for continued operations as discussed above

25 The Permittees will submit a written request for a permit modification with a copy of the
26 amended Closure Plan at least 60 days prior to the proposed change in facility design or
27 operation or within 60 days of the occurrence of an unexpected event that affects the Closure
28 Plan. If the unexpected event occurs during final closure, the permit modification will be
29 requested within 30 days of the occurrence. If the Secretary of the NMED requests a
30 modification of the Closure Plan, a plan modified in accordance with the request will be
31 submitted within 60 days of notification or within 30 days, if the change in facility condition
32 occurs during final closure.

33 G-1e Closure Activities

34 Closure activities include those instituted for panel closure (i.e., closure of filled underground
35 HWDUs), contingency closure (i.e., closure of surface HWMUs and decontamination of other
36 waste handling areas), and final facility closure (i.e., closure of surface HWMUs, D&D of surface
37 facilities and the areas surrounding the WHB, and placement of repository shaft seals). Panel
38 closure systems will be emplaced to separate areas of the facility and to isolate panels. Permit
39 Attachments G1 and G2 provide panel closure system and shaft seal designs, respectively.

1 Closure activities will meet the applicable quality assurance (**QA**)/quality control (**QC**) program
2 standards in place at the WIPP facility. Facility monitoring procedures in place during operations
3 will remain in place through final closure, as applicable.

4 G-1e(1) Panel Closure

5 Following completion of waste emplacement in each underground HWDU, the HWDU will be
6 closed. A WIPP Panel Closure (**WPC**) will be emplaced in the panel access drifts, in accordance
7 with the design in Permit Attachment G1 and the schedule in Figure M-61 and Table G-1.

8 Alternatively, panels may be closed simultaneously by placing panel closures in the north-south
9 mains (E-300, E-140, W-30, and W-170), as shown in Figure M-43. The panel closure system is
10 designed to meet the following requirements that were established by the DOE for the design to
11 comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)):

- 12 • the panel closure system shall contribute to meeting the closure performance standards
13 in Permit Part 6, Section 6.10.1 by mitigating the migration of volatile organic
14 compounds (**VOCs**) from closed panels
- 15 • the panel closure system shall consider potential flow of VOCs through the disturbed
16 rock zone (**DRZ**) in addition to flow through closure components
- 17 • the panel closure system shall perform its intended functions under loads generated by
18 creep closure of the tunnels
- 19 • the panel closure system shall perform its intended function under the conditions of a
20 postulated thermal runaway involving nitrate salt bearing waste (Golder, 2016)
- 21 • the nominal operational life of the closure system is 35 years, however, the inspection
22 and maintenance, if needed, of accessible bulkheads can continue until the initiation of
23 final facility closure
- 24 • the panel closure system may require minimal maintenance per 20.4.1.500 NMAC
25 (incorporating 40 CFR 264.111)
- 26 • the panel closure system shall address the expected ground conditions in the waste
27 disposal area
- 28 • the panel closure system shall be built of substantial construction and non-combustible
29 material except for flexible flashing used to accommodate salt movement
- 30 • the design and construction shall follow conventional mining practices
- 31 • structural analysis shall use data acquired from the WIPP underground
- 32 • materials shall be compatible with their emplacement environment and function
- 33 • treatment of surfaces in the closure areas shall be considered in the design
- 34 • a QA/QC program shall verify material properties and construction

- 1 • construction of the panel closure system shall consider shaft and underground access
2 and services for materials handling

3 The closure performance standard for air emissions from the WIPP facility is one excess cancer
4 death in one million and a hazard index (**HI**) of 1 for a member of the public living outside the
5 WIPP Site Boundary as specified in Permit Part 6, Section 6.10.1. Releases shall be below
6 these limits for the facility to remain in compliance with standards to protect human health and
7 the environment. The panel closure design has been shown, through analysis, to meet these
8 standards, if emplaced in accordance with the specifications in Permit Attachment G1.

9 Compliance will be demonstrated by the Repository VOC Monitoring Program (**RVMP**) in Permit
10 Attachment N. Compliance with the standards established for the RVMP constitutes compliance
11 with the closure standards in Permit Part 6, Table 6.10.1.

12 The design basis for this closure is such that the migration of hazardous waste constituents
13 from closed panels during the operational and closure period would result in concentrations well
14 below health-based standards. The source term used as the design basis included the average
15 concentrations of VOCs from CH waste containers as measured in headspace gases through
16 November 2010. The VOCs are assumed to have been released by diffusion through the
17 container vents and are removed from the closed room by air leakage that occurs due to
18 ventilation-related pressure differentials.

19 Diagrams of the panel closure design, the substantial barrier, and installation envelopes are
20 depicted in Permit Attachment G1, Appendix G1-Band Attachment M, Figure M-63 and Figure
21 M-42. Permit Attachment G1 provides the detailed design and the design analysis for the panel
22 closure system. The Permittees shall use bulkheads as specified in Attachment G1 for the
23 closure of filled panels. A run-of-mine (**ROM**) salt component, placed between two bulkheads,
24 was included in the closure for Panel 9 and will be included in the closure for Panel 10. The
25 substantial barrier in Figure M-63 will be installed in Panels 7 and 8.

26 G-1e(2) Decontamination and Decommissioning

27 Decontamination is defined as those activities which are performed to remove contamination
28 from surfaces and equipment that are not intended to be disposed of at the WIPP facility. The
29 policy at the WIPP facility will be to decontaminate as many areas as possible or to fix the
30 contaminants to the surface so they are not easily removable, consistent with radiological
31 protection policy. Decontamination or fixing are part of closure activities and are a necessary
32 activity in the clean closure of the surface container management units. Decontamination or
33 fixing determinations are based upon radiological surveys.

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

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

- 42 1. Review of operational records for historical information on releases

- 1 2. Visual examination of surface structures for evidence of spills or releases
- 2 3. Performance of site contamination surveys
- 3 4. Decontamination, if necessary, of usable equipment, materials, and structures including
- 4 surface facilities and areas surrounding the WHB.
- 5 5. Disposal of equipment/materials that cannot be decontaminated but that meet the
- 6 treatment, storage, and disposal facility waste acceptance criteria (**TSDF-WAC**) in an
- 7 underground HWDU
- 8 6. Emplacement of panel closure system in the last HWDU
- 9 7. Emplacement of shaft seals²
- 10 8. Regrading the surface to approximately original contours
- 11 9. Initiation of active controls

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

14 G-1e(2)(a) Hazards Survey

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

25 G-1e(2)(b) Determine the Extent of Contamination

26 The first activities performed as part of decontamination include those needed to determine the
27 extent of any contamination that needs to be removed or fixed prior to decommissioning a
28 facility. This includes activities 1 to 3 above and, as can be seen by the schedules in Figures M-
29 61 and M-62 (Items B and C), these surveys are anticipated to take 10 months to perform,
30 including obtaining the results of any sample analyses. The process of identifying areas that
31 require decontamination or fixing include three sources of information. First, operating records
32 will be reviewed to determine where contamination has previously been found as the result of
33 historical releases and spills. Even though releases and spills in the above ground storage units
34 will have been cleaned up at the time of occurrence, newer equipment and technology may

² 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 allow further cleaning. Second, surfaces of facilities and structures will be examined visually for
2 evidence of spills or releases. Finally, extensive detailed contamination surveys will be
3 performed to document the level of cleanliness for surface structures and equipment that are
4 subject to decontamination. If equipment or areas are identified as contaminated, the Permittees
5 will notify NMED as specified in Permit Part 1, and a plan and procedure(s) will be developed
6 and implemented to address decontamination-related questions, including:

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

10 Radiological and hazardous constituent surveys will be used in determining the presence of
11 hazardous waste and hazardous waste residues in areas where spills or releases have
12 occurred. Radiological surveys are described in Permit Attachment G3. For contamination that
13 is cleaned up, once cleanup of the radioactivity has been completed, the surface will be
14 sampled for the hazardous constituents associated with the EPA Hazardous Waste Numbers
15 specified in Permit Attachment B to determine that they, too, have been cleaned up. Sampling
16 and analysis protocols will be consistent with EPA's document SW-846 (EPA, 2015).

17 G-1e(2)(c) Decontamination Activities

18 Once the extent of contamination is known, radiological control activities (e.g., decontamination,
19 fixing) will be planned and performed. Consistent with radiological control procedures pursuant
20 to 10 CFR Part 835, decontamination activities will be performed, as necessary. Hazardous
21 waste decontamination, if needed, will be conducted in accordance with the requirements of the
22 Permit and the standards in 20.4.1.500 NMAC (incorporating 40 CFR Part 264). Radiological
23 control and the control of hazardous waste residues are the primary criteria used in the design
24 of decontamination activities. Radiological control procedures require that careful planning and
25 execution be used in decontamination activities to prevent the exposure of workers beyond
26 applicable standards and to prevent the further spread of contamination. Careful control of
27 entry, cleanup, and ventilation are vital components of radiological control activities. The level of
28 care mandated by DOE orders and occupational protection requirements results in closure
29 activities that will exceed the 180 days allowed in 20.4.1.500 NMAC (incorporating 40 CFR
30 §264.113(b)). Decontamination activities are included as item 4 above and are shown on the
31 schedule for final facility closure (Figure M-62) as Activities D, E, and F. These activities are
32 anticipated to have a duration of 20 months for both contingency closure and for final facility
33 closure. The result of these activities is the clean closure of the surface container management
34 units. Under contingency closure, the other areas that have been decontaminated will not be
35 closed. Instead, they will remain in use for continued waste management activities involving
36 non-mixed waste. Under final facility closure, other areas that are decontaminated are eligible
37 for closure.

38 The operating philosophy of the WIPP Project, which is described as "Start Clean – Stay Clean,"
39 was intended to provide for minimum need for decontamination at closure. Decontamination
40 during the Disposal Phase and at closure may be needed because of releases in February
41 2014. However, the need for decontamination techniques may arise. Decontamination activities
42 are managed consistent with radiological control procedures pursuant to 10 CFR Part 835,
43 which includes the as-low-as-reasonably-achievable (**ALARA**) principle. The ALARA principle is
44 an approach/philosophy to radiation protection to manage and control exposures (both

1 individual and collective) to the work force and to the general public to as low as is reasonable,
2 taking into account social, technical, economic, practical, and public policy considerations. It is
3 assumed that the process of localized surface decontamination will remove the hazardous
4 waste constituents along with the radioactive waste constituents.

5 Decontamination activities will be coordinated with closure activities so that areas that have
6 been decontaminated will not be recontaminated. Waste resulting from decontamination
7 activities will be surveyed and analyzed for the presence of radioactive contamination and a
8 determination of the hazardous constituents associated with the EPA Hazardous Waste
9 Numbers specified in Part A of the Permit Application. The waste will be characterized as non-
10 radioactive/non-hazardous, hazardous, mixed, or radioactive and will be packaged and handled
11 appropriately. Mixed and radioactive waste, classified as TRU mixed waste, will be managed in
12 accordance with the applicable Permit requirements. Derived mixed waste collected during
13 decontamination activities that are generated before repository shafts have been sealed will be
14 emplaced in the facility, if appropriate, or will be managed together with decontamination
15 derived waste collected after the underground is closed. This waste will be classified and
16 shipped off site to an appropriate, permitted facility for treatment, if necessary, and for disposal.

17 Removal of Hazardous Waste Residues

18 Because of the type of waste management activities that will occur at the WIPP facility, waste
19 residues that may be encountered during the operation of the facility and at closure may include
20 derived waste. Derived wastes result from the management of the waste containers or may be
21 collected as part of the closure activities (such as those during which wipes were used to
22 sample the containers and equipment for potential radioactive contamination or those involving
23 solidified decontamination solutions, the handling of equipment designated for disposal, and the
24 handling of residues collected as a result of spill cleanup). Derived wastes collected during the
25 operation and closure of the WIPP facility will be identified and managed as TRU mixed wastes.
26 These wastes will be disposed in an active underground HWDU. Decontamination and
27 decommissioning derived wastes and equipment designated for disposal will be placed in an
28 underground HWDU before closure of that unit.

29 Surface Container Storage Units

30 The procedures employed for waste receipt at the WIPP facility minimize the likelihood for any
31 waste spillage to occur on the surface outside the WHB. TRU mixed waste is shipped to the
32 WIPP facility in approved shipping containers (i.e., CH or RH Packages) that are not opened
33 until they are inside the WHB. Therefore, it is unlikely that soil in the Parking Area Unit or
34 elsewhere in the vicinity of the WHB will become contaminated with TRU mixed waste
35 constituents as a result of TRU mixed waste management activities. An evaluation of the soils in
36 the vicinity of the WHB will only be necessary if an event resulting in a release of hazardous
37 waste has occurred outside the WHB.

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

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

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

7 Waste generated as a result of WHB decontamination activities will be managed as derived
8 waste in accordance with applicable Permit requirements and will be emplaced in the last open
9 underground HWDU for disposal.

10 Contaminated Underground Equipment

11 The Waste Shaft conveyance, associated waste handling equipment, and underground support
12 equipment (e.g., mining equipment, carts) that has become contaminated with hazardous waste
13 constituents associated with TRU mixed waste will be decontaminated or characterized and
14 disposed (i.e., disposed of as derived waste) as part of both contingency and final facility
15 closure. Procedures for detection and sampling will be as described above. Equipment cleanup
16 will be as above using chemical or nonchemical techniques.

17 Personnel Decontamination

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

23 In accordance with DOE policy, TRU mixed waste PPE will be considered to be contaminated
24 with all of the hazardous waste constituents contained in the containers that have been
25 managed within the unit being closed. Wastes collected as a result of closure activities and that
26 may be contaminated with radioactive and hazardous constituents will be considered TRU
27 mixed wastes. These wastes will be managed as derived wastes and disposed of in the final
28 open underground HWDU, as described in Permit Attachment A2. Such waste, collected as the
29 result of closure of the WIPP facility, will be disposed of in the final open underground HWDU.
30 The requirements in Permit Part 2, Section 2.3.3.4, *Chemical Incompatibility*, apply to the
31 derived wastes to be disposed upon final facility closure.

32 Cleanup Criteria

33 Radiological decontamination will be managed consistent with radiological control procedures,
34 or to whatever levels that may be established by DOE³ at the time of cleanup.

³ Title 10 CFR Part 835

1 Hazardous waste decontamination will be conducted in accordance with standards in
2 20.4.1.500 NMAC (incorporating 40 CFR Part 264) or as incorporated into the Permit.

3 Final Contamination Sampling and Quality Assurance

4 Verification samples will be analyzed by a laboratory that has been qualified by the DOE
5 according to a written program with strict criteria. The QA requirements of EPA/SW-846, "Test
6 Methods for Evaluating Solid Waste" (EPA, 2015), will be met for hazardous constituent
7 sampling and analyses.

8 Quality Assurance/Quality Control

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

15 Field blanks and duplicate samples will be collected in the field to determine potential errors
16 introduced in the data from sample collection and handling activities. To determine the potential
17 for cross-contamination, rinsate blanks (consisting of rinsate from decontaminated sampling
18 equipment) will be collected and analyzed in accordance with applicable EPA guidance.
19 Acceptance criteria for QA/QC hazardous constituent sample analyses will adhere to the most
20 recent version of EPA SW-846 or other applicable EPA guidance.

21 G-1e(2)(d) Dismantling

22 G-1e(2)(d)(1) Dismantling During Final Closure

23 Final facility closure will include dismantling of structures on the surface and in the underground.
24 These are items 6 and 7 above and are represented as Activity G in the final facility closure
25 schedule in Figure M-62. During dismantling, priority will be given to contaminated structures
26 and equipment that cannot be decontaminated to assure these are properly disposed of in the
27 remaining open underground HWDU in a timely manner. All such facilities and equipment are
28 expected to be removed and disposed of 16 months after the initiation of closure. Dismantling of
29 the balance of the facility, including those structures and equipment that are not included in the
30 application and are not used for TRU mixed waste management, is anticipated to take an
31 additional 66 months. The placement of D&D waste into the final underground HWDU may, by
32 necessity, involve the placement of uncontainerized bulk materials such as concrete
33 components, building framing, structural members, disassembled or partially disassembled
34 equipment, or containerized materials in non-standard waste boxes. Such placement will only
35 occur if it can be shown that it is protective of human health and the environment and will be
36 described in an amendment to the Closure Plan. Identification of bulk items is not possible at
37 this time since their size and quantity will depend on the extent of non-removable contamination.

38 G-1e(2)(d)(2) Dismantling of Permit-Related Surface Equipment, Structures, and
39 Contaminated Soils During Partial Closure

1 Partial closure may include dismantling of Permit-related structures and/or equipment and
2 removal of contaminated soils on the surface prior to final closure. During dismantling, priority
3 will be given to structures and equipment contaminated with hazardous waste or hazardous
4 waste constituents that cannot be decontaminated due to the presence of radioactivity to ensure
5 these are properly disposed of at the WIPP facility or at another designated disposal facility in a
6 timely manner. It should be noted that the placement of D&D waste into a WIPP HWDU may, by
7 necessity, involve the placement of uncontainerized bulk materials such as concrete
8 components, building framing, structural members, disassembled or partially disassembled
9 equipment, or containerized materials in non-standard waste boxes. Such placement will only
10 occur if it can be shown that it is protective of human health and the environment and items are
11 described in the operating record. Identification of bulk items is not possible at this time since
12 their size and quantity will depend on the extent of non-removable contamination. The
13 requirements in Permit Part 2, Section 2.3.3.4, Chemical Incompatibility, apply to these items to
14 be disposed upon final facility closure.

15 G-1e(2)(e) Closure of Open Underground HWDU

16 The closure of the final underground HWDU is shown by Activity H in Figure M-62. This closure
17 will be consistent with the description in Section G-1e(1) and the design in Permit Attachment
18 G1. Detailed closure schedules for underground HWDUs are given in Figure M-61 and Table G-
19 1.

20 G-1e(2)(f) Final Facility Closure

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

27 Figure M-43 identifies where three existing boreholes overlie the proximate area of the
28 repository footprint. Of these identified boreholes in Figure M-43, all but ERDA-9 are terminated
29 hundreds of feet above the repository horizon. Only ERDA-9, which is accounted for in long-
30 term performance modeling, is drilled through the repository horizon, near the WIPP facility
31 excavations.

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

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

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

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

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

- 15 • Near-surface: to prevent subsidence at and around the shafts
- 16 • Rustler Formation: to prevent subsidence at and around the shafts and to ensure
17 compliance with federal and New Mexico groundwater protection requirements
- 18 • Salado: to prevent transporting hazardous waste constituents beyond the point of
19 compliance specified in Permit Part 5

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

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

27 G-1e(2)(g) Final Contouring and Revegetation

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

37 G-1e(2)(h) Closure, Monuments, and Records

38 A record of the WIPP facility shall be listed in the public domain in accordance with the
39 requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.116). Active access controls will
40 be employed for at least the first 100 years after final facility closure. In addition, a passive

1 control system consisting of monuments or markers will be erected at the site to inform future
2 generations of the location of the WIPP repository (see “Permanent Marker Conceptual Design
3 Report” [DOE, 1996]).

4 This Permit requires only a 30-year post-closure period. This is the maximum post-closure time
5 frame allowed in an initial Permit for any facility, as specified in 20.4.1.500 NMAC (incorporating
6 40 CFR §264.117(a)). The Secretary of the NMED may shorten or extend the post-closure care
7 period at any time in the future prior to completion of the original post-closure period (30 years
8 after the completion of construction of the shaft seals). The Permanent Marker Conceptual
9 Design Report and other provisions during the first 100 years after closure are addressed under
10 another federal regulatory program.

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

- 12 • Prevention of the intrusion of fluids into the repository by sealing the shafts
- 13 • Prevention of human intrusion after closure
- 14 • Minimization of future physical and environmental surveillance

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

21 G-1e(3) Performance of the Closed Facility

22 20.4.1.500 NMAC (incorporating 40 CFR §264.601) requires that a miscellaneous unit be
23 closed in a manner that protects human health and the environment. The RCRA Part B permit
24 application addressed the expected performance of the closed facility during the 30-year post
25 closure period. Groundwater monitoring will provide information on the performance of the
26 closed facility during the post-closure care period, as specified in Permit Attachment H, Section
27 H-1a(2) (Monitoring).

28 The principal barriers to the movement of hazardous constituents from the facility or the
29 movement of waters into the facility are the halite of the Salado (natural barrier) and the
30 repository seals (engineered barrier). Data and calculations that support this discussion are
31 presented in Renewal Application Addendum N1 (DOE, 2020). The majority of the calculations
32 performed for the repository are focused on long-term performance and making predictions of
33 performance over the first 300-years of the 10,000-year performance assessment. In the short
34 term (300 years), the repository is reaching a steady state configuration where the hypothetical
35 brine inflow rate is affected by the increasing pressure in the repository due to gas generation
36 and creep closure. These three phenomena are related in the numerical modeling performed to
37 support the permit application. The modeling parameters, assumptions and methodology are
38 described in detail in Renewal Application Addendum N1 (DOE, 2020).

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.

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 Golder Associates Inc. (Golder), 2016, Design Report – WIPP Panel Closure report number
10 0632213 R1 Rev 1, Lakewood, Colorado, October 2016.

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

13 U.S. Department of Energy, 1997, Resource Conservation and Recovery Act Part B Permit
14 Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Revision 6.5, 1997,
15 Chapters D and I.

16 U.S. Department of Energy, 1996, "Passive Institutional Controls Conceptual Design Report,"
17 from Appendix PIC of the Compliance Certification Application, DOE/CAO 1996-2184, U.S.
18 Department of Energy, Carlsbad, NM.

19 U.S. Department of Energy, 2020, WIPP Hazardous Waste Facility Permit Renewal Application,
20 Carlsbad, New Mexico, March 2020.

21 U.S. Environmental Protection Agency, 2015, "Test Methods for Evaluating Solid Waste," SW-
22 846, U.S. Environmental Protection Agency, Washington, D.C.

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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 ^a	Closure End ^b
PANEL 1	3/99*	3/03*	3/03*	5/20*
PANEL 2	3/03*	10/05*	10/05*	5/20*
PANEL 3	4/05*	2/07*	2/07*	8/19*
PANEL 4	1/07*	5/09*	5/09*	8/19*
PANEL 5	3/09*	7/11*	7/11*	8/19*
PANEL 6	3/11*	1/14*	1/14*	8/19*
PANEL 7	9/13*	5/22	6/22	12/22
PANEL 8	5/22	8/25	9/25	3/26
PANEL 9**	N/A	N/A	N/A	N/A
PANEL 10	8/25	9/30	10/30	3/31
PANEL 11	8/25	7/28	8/28	2/29
PANEL 12	7/28	6/31	7/31	1/32

* Actual month and year

** Panel 9 was not used for TRU mixed waste disposal. Panels 3, 4, 5 and 6 were closed by placing closures in Panel 9 in the north-south mains (E-300, E-140, W-30 and W-170), as shown in Figure G-1, pursuant to Section G-1e(1).

^a The point of closure start is defined as 60 days following notification to the NMED of closure.

^b The point of closure end is defined as 180 days following placement of final waste in the panel.

NOTE: For the purposes of preparing the closure schedule, the "Operations Start" date for each additional HWDU is the same as the "Operations End" date of the immediately prior HWDU. The "Operations End" date for each additional HWDU is 30 months after the "Operations Start" date. The "Closure Start" date for each additional HWDU is 1 month after the "Operations End" date. The "Closure End" date for each additional HWDU is 6 months after the "Operations End" date. N/A--Not Applicable

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**Table G-2
 Anticipated Overall Schedule for Final Facility Closure Activities**

Activity	Final Facility Closure Durations	
	Start Month	Duration
Notify NMED of Intent to Close WIPP (or to Implement Contingency Closure)	Month -2	N/A
Perform Contamination Surveys in both Surface Storage Areas	Month 0	6 Months
Sample Analysis	Month 2	8 Months
Decontamination as Necessary of both Surface Storage Areas	Month 8	8 Months
Final Contamination Surveys of both Surface Storage Areas	Month 16	8 Months
Sample Analysis	Month 20	8 Months
Prepare and Submit Container Management Unit Closure Certification	Month 28	4 Months
Dispose of Closure-Derived Waste and Equipment*	Month 2	14 Months
Closure of Open Underground HWDU panel	Month 16	8 Months
Install Borehole Seals	Month 24	12 Months
Install Repository Seals	Month 32	52 Months
Recontour and Revegetate	Month 84	8 Months
Prepare and Submit Final (Contingency) Closure Certification	Month 84	2 Months
Post-closure Monitoring	Month 86	Up to 30 Years

N/A--Not Applicable

Refer to Figure M-62 and Permit Attachment G1, Appendix G1-B for precise activity titles.

*The requirements in Permit Part 2, Section 2.3.3.4, *Chemical Incompatibility*, apply to the equipment to be abandoned upon final facility closure.

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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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