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SANDIA NATIONAL LABORATORIES
WASTE ISOLATION PILOT PLANT

ANALYSIS REPORT FOR THE REASSESSMENT OF FEATURES, EVENTS, AND PROCESSES FOR THE 2024 COMPLIANCE RECERTIFICATION APPLICATION

REVISION 0

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LIST OF ACRONYMS

AP	ANALYSIS PLAN
AR	ANALYSIS REPORT
CARD	COMPLIANCE RECERTIFICATION APPLICATION REVIEW DOCUMENT
CCA	COMPLIANCE CERTIFICATION APPLICATION
CFR	CODE OF FEDERAL REGULATIONS
CRA	COMPLIANCE RECERTIFICATION APPLICATION
DOE	U.S. DEPARTMENT OF ENERGY
DP	DISTURBED PERFORMANCE
DRZ	DISTURBED ROCK ZONE
EP	EVENT AND PROCESS
EPA	U.S. ENVIRONMENTAL PROTECTION AGENCY
ERMS	ELECTRONIC RECORD MANAGEMENT SYSTEM
FEP	FEATURE, EVENT, AND PROCESS
H	HUMAN-INITIATED
HCN	HISTORIC, CURRENT, AND NEAR-FUTURE
IB	INSIDE BOUNDARY
N	NATURAL
OB	OUTSIDE BOUNDARY
PA	PERFORMANCE ASSESSMENT
PI	PRINCIPAL INVESTIGATOR
SNL	SANDIA NATIONAL LABORATORIES
SO-C	SCREENED-OUT CONSEQUENCE
SO-P	SCREENED-OUT PROBABILITY
TRU	TRANSURANIC
TSD	TECHNICAL SUPPORT DOCUMENT
UP	UNDISTURBED PERFORMANCE
W	WASTE AND REPOSITORY-INDUCED
WIPP	WASTE ISOLATION PILOT PLANT

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Executive Summary

This Analysis Report (AR) summarizes the results of the reassessment of the Waste Isolation Pilot Plant (WIPP) Features, Events and Processes (FEPs) baseline as conducted according to Analysis Plan (AP) – 199. This reassessment was intended to result in an updated Appendix SCR to accompany the U.S. Department of Energy's (DOE's) Compliance Recertification Application – 2024 (CRA – 2024). However, the DOE is now planning to delay the submission of the CRA – 2024 until November of 2026. Nonetheless, the reassessment of FEPs is a significant improvement and update of the FEPs baseline as presented in the CRA – 2019. Therefore, the results of this reassessment will be the basis for Appendix SCR to be submitted with the CRA – 2026.

The results of this reassessment of FEPs identify 245 FEPs currently in the WIPP FEPs baseline. This number of FEPs remains unchanged from Appendix SCR – 2019. However, of these 245 FEPs, 147 have been updated with new information. Additionally, three of these FEPs have had screening decisions changed from that reported in Appendix SCR – 2019, however none of these changes result in additional FEPs being included in performance assessment (PA) calculations.

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1.0 INTRODUCTION

The Waste Isolation Pilot Plant (WIPP), located in southeastern New Mexico, has been developed by the U.S. Department of Energy (DOE) for the geologic (deep underground) disposal of transuranic (TRU) waste. Containment of TRU waste at the WIPP is regulated by the U.S. Environmental Protection Agency (EPA) according to the regulations set forth in Title 40 of the Code of Federal Regulations (CFR), Part 191 (U.S. EPA 1993).

The DOE demonstrates compliance with the containment requirements according to the Certification Criteria in Title 40 CFR Part 194 (U.S. EPA 1996) by means of performance assessment (PA) calculations performed by Sandia National Laboratories (SNL). WIPP PA calculations estimate the probability and consequence of potential radionuclide releases from the repository to the accessible environment for a regulatory period of 10,000 years after facility closure. The models used in PA are maintained and updated with new information as part of an ongoing process. Improved information regarding important WIPP features, events, and processes (FEPs) may result in refinements and modifications to PA models and the parameters used in them. Planned changes to the repository and/or the components therein also result in updates to WIPP PA models.

PA calculations were included in the 1996 Compliance Certification Application (CCA) (U.S. DOE 1996). The EPA certified that the WIPP met the regulatory containment requirements and the facility was approved for disposal of transuranic waste in May 1998 (U.S. EPA 1998). Subsequent Compliance Recertification Application (CRA) submittals including the CRA-2004, CRA-2009, CRA-2014, and CRA-2019 have included PA calculations. With each of these regulatory submittals, the WIPP FEPs baseline has been reviewed and updated. Each FEPs baseline has been documented in Appendices submitted with each CRA (Appendix SCR-2004, Appendix SCR-2009, Appendix SCR-2014, and Appendix SCR-2019).

This analysis report includes a summary of the results of the completed FEPs reassessment as outlined in AP-199 (Kirkes 2022). According to AP-199, each FEP (or group of FEPs if screened jointly) has undergone an evaluation to assure that information in each screening argument is up-to-date and valid. In some cases, new information has resulted in a change in the screening decision for the FEP (or group of FEPs). The detailed update for each FEP is documented in a specific records package established to hold all FEPs evaluated per AP-199[1].

The completion of AP-199 FEPs reassessment was originally intended to be used in support of PA calculations for the CRA-2024. Due to decisions made by the DOE (U.S. DOE 2023) and endorsed by the EPA (U.S. EPA 2023), submittal of the next CRA will not occur until November 2026 and will be aptly named the "CRA-2026." The FEPs reassessment packages that were submitted as a result of the AP-199 review will be utilized to create a new baseline document in the form of Appendix SCR for CRA-2026 (hereafter termed Appendix SCR-2026). Any updates to the current FEPs baseline in the interim between this report and the development of Appendix SCR-2026 will be conducted under Sandia Specific Procedure (SP) 9-4 (Kirkes 2021).

[1] Records package 574936 was established to contain all FEPs assessments conducted per SP 9-4 since March 22, 2021, and the results of FEPs revisions and updates resulting from the AP-199 FEPs reassessment.

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2.0 FEPS REASSESSMENT METHODOLOGY

Upon initiation of this FEPs reassessment, the FEP baseline prepared by SNL for the CRA-2019 PA (U.S. DOE 2019, Appendix SCR-2019) was the most recent baseline that has been reviewed and approved by the Agency (U.S. EPA 2022a). That baseline consisted of 245 FEPs and was divided into three categories: 70 FEPs were related to the external natural environment such as earthquakes (prefix N); 61 FEPs were related to external human-induced conditions such as potash mining (prefix H); and 114 FEPs were related to internal waste and repository conditions such as changes in the waste inventory (prefix W).

The AP-199 FEPs review began with the identification of the principal investigators (PIs) best suited to evaluate the content of screening arguments and decisions for each of the 245 FEPs within the current FEPs baseline. PIs then reviewed the EPA's Technical Support Document (TSD) (EPA 2022b) and Compliance Application Review Document (CARD) (U.S. EPA 2022c) for findings and recommendations in their review of the CRA-2019. Of note, FEPs N71 Microbes, H26 Groundwater Extraction, H31 Natural Borehole Fluid Flow, and W23 Subsidence, were identified by EPA as deserving special attention as part of the review of CRA-2019 (U.S. EPA 2022b). The EPA also noted that many Natural (N) FEPs had not been updated since the original 1996 CCA and should be updated if possible. These FEPs were addressed, and, if available, new information was presented as part of the screening arguments.

All FEPs were updated as appropriate and documented in the official "FEP Update Record" for each FEP (or group of FEPs if screened jointly) and reside in the Sandia WIPP Records Center listed under their own unique electronic record management system (ERMS) number. Each FEP update was reviewed according to Sandia's document review and approval process (NP 6-1; Nielsen (2022)) and submitted into Sandia records package ERMS #574936, according to the requirements of NP 17-1 (Duran 2023).

3.0 FEPS REASSESSMENT RESULTS

SNL's reassessment of FEPs concluded that of the 245 FEPs considered, 98 had not changed and 147 were updated with new information since the CRA-2019 (CRA-2019, Appendix SCR-2019, p. SCR-1). There are a total of 92 FEPs screened in to undisturbed performance (UP) or disturbed performance (DP) scenarios in some way. FEPs that have been screened in have had implementation details added to their description. The updated FEPs include 5 that had their screening decisions changed:

FEP N71 "Microbes" was changed to remove the reference to "UP-for colloidal effects and gas generation". N71 screening decision has been changed to only SO-C. The SO-C screening decision will focus on only naturally-occurring microbes. Gas generation due to microbial degradation is discussed in FEP W44, Degradation of Organic Material.

FEP W8 "Shaft Seal Chemical Composition" was changed from SO-C *Beneficial* to simply SO-C (losing the "beneficial" indication) due to the lack of a clear and defensible beneficial consequence. The limited movement of brine in contact with the lower shaft seal components and resulting minimal impact on pH and is not assumed to provide any benefit.

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FEP W59 "Precipitation of Secondary Minerals" was also changed from SO-C *Beneficial* to SO-C. FEP W59 is not impactful to the concentrations of radionuclides and does not provide a clear beneficial consequence to the performance of the disposal system.

FEP W82 "Suspension of Particles" was changed from DP to screened-out due to low consequence (SO-C). FEP W82 is now classified as SO-C to eliminate inconsistencies within the FEPs baseline. This designation is consistent with the CCA (DOE 1996), and places proper emphasis on dissolved and colloidal actinides as currently implemented in PA.

FEP W111 "Panel Closure Chemical Composition" was changed from SO-C Beneficial to SO-C. FEP W111 does not provide a clear beneficial consequence to the performance of the disposal system.

Table 1 below lists all 245 WIPP FEPs and identifies updates and changes that result from the AP-199 FEPs reassessment.

Table 1. FEPs Reassessment Summary

EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
N1	Stratigraphy	New references to stratigraphic data obtained during drilling of Shaft 5	No	UP – BRAGFLO	580725
N2	Brine Reservoirs	Updated with new references	No	DP – BRAGFLO	580725
N3	Changes in Regional Stress	Updated with new references and information	No	SO-C	580158
N4	Regional Tectonics	Updated with new references and information	No	SO-C	580158
N5	Regional Uplift and Subsidence	Updated with new references and information	No	SO-C	580158
N6	Salt Deformation	Updated with new references	No	SO-P	580343
N7	Diapirism	Updated with new references	No	SO-P	580343
N8	Formation of Fractures	Updated with new references	No	SO-P (Far-field) UP (Repository) – BRAGFLO	580620
N9	Changes in Fracture Properties	Updated with new references	No	SO-C UP (Near Repository) – BRAGFLO	580142
N10	Formation of New Faults	Updated with new references	No	SO-P	580146

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
N11	Fault Movement	Updated with new references	No	SO-P	580146
N12	Seismic Activity	Updated with new references	No	UP – BRAGFLO	580666
N13	Volcanic Activity	No change	No	SO-P	580480
N14	Magmatic Activity	No change	No	SO-C	580553
N15	Metamorphic Activity	No change	No	SO-P	580484
N16	Shallow Dissolution	Updated with new references and information	No	UP – MODFLOW6	580162
N18	Deep Dissolution	Updated with new references	No	SO-P	580166
N20	Breccia Pipes	Updated with new references	No	SO-P	580166
N21	Collapse Breccias	Updated with new references	No	SO-P	580166
N22	Fracture Infills	Updated with new references	No	SO-C – Beneficial	580662
N23	Saturated Groundwater Flow	No change	No	UP – MODFLOW6	580678
N24	Unsaturated Groundwater Flow	No change	No	UP – MODFLOW6	580678
N25	Fracture Flow	No change	No	UP – MODFLOW6	580678
N27	Effects of Preferential Pathways	No change	No	UP – MODFLOW6	580678
N26	Density Effects on Groundwater Flow	Updated to discuss new geometry	No	SO-C – Beneficial	580670
N28	Thermal Effects on Groundwater Flow	Updated with new references	No	SO-C	580674
N29	Saline Intrusion (Hydrogeological Effects)	No change	No	SO-P	580787
N30	Freshwater Intrusion (Hydrogeological Effects)	Updated with new references	No	SO-P	580791
N31	Hydrological Response to Earthquakes	FEP text updated with new information	No	SO-C	580729
N32	Natural Gas Intrusion	Updated with new references and information	No	SO-P	580182
N33	Groundwater Geochemistry	Updated with new references	No	UP – EQ3/6; PANEL; SECOTP2D	580852

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
N34	Saline Intrusion (Geochemical Effects)	Updated with new references	No	SO-C	580844
N38	Effects of Dissolution	Updated with new references	No	SO-C	580844
N35	Freshwater Intrusion (Geochemical Effects)	FEP text updated with new information	No	SO-C	580488
N36	Changes in Groundwater Eh	FEP text updated with new information	No	SO-C	580488
N37	Changes in Groundwater pH	FEP text updated with new information	No	SO-C	580488
N39	Physiography	No change	No	UP – MODFLOW6	580624
N40	Impact of a Large Meteorite	No change	No	SO-P	579997
N41	Mechanical Weathering	No change	No	SO-C	580306
N42	Chemical Weathering	No change	No	SO-C	580306
N43	Aeolian Erosion	FEP text updated with new information	No	SO-C	580310
N44	Fluvial Erosion	FEP text updated with new information	No	SO-C	580310
N45	Mass Wasting (Erosion)	FEP text updated with new information	No	SO-C	580310
N46	Aeolian Deposition	No change	No	SO-C	580314
N47	Fluvial Deposition	No change	No	SO-C	580314
N48	Lacustrine Deposition	No change	No	SO-C	580314
N49	Mass Wasting (Deposition)	No change	No	SO-C	580314
N50	Soil Development	Updated with new references	No	SO-C	580472
N51	Stream and River Flow	No change	No	SO-C	579957
N52	Surface Water Bodies	No change	No	SO-C	579961
N53	Groundwater Discharge	Updated with new information	No	UP – MODFLOW6; MWT3D	580848
N54	Groundwater Recharge	Updated with new information	No	UP – MODFLOW6; PEST++; MWT3D	580848
N55	Infiltration	Updated with new information	No	UP – MODFLOW6; MWT3D	580848
N56	Changes in Groundwater	Updated with new references and information	No	UP – PRESECOTP2D	580733

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
	Recharge and Discharge				
N57	Lake Formation	No change	No	SO-C	579965
N58	River Flooding	No change	No	SO-C	579965
N59	Precipitation (e.g., Rainfall)	Updated with new references and climate data	No	UP – PRESECOTP2D	579993
N60	Temperature	Updated with new references and climate data	No	UP – PRESECOTP2D	579993
N61	Climate Change	No change	No	UP – PRESECOTP2D	580351
N62	Glaciation	No change	No	SO-P	579969
N63	Permafrost	No change	No	SO-P	579969
N64	Seas and Oceans	No change	No	SO-C	579973
N65	Estuaries	No change	No	SO-C	579973
N66	Coastal Erosion	No change	No	SO-C	579977
N67	Marine Sediment Transport and Deposition	No change	No	SO-C	579977
N68	Sea Level Changes	No change	No	SO-C	579981
N69	Plants	No change	No	SO-C	579985
N70	Animals	No change	No	SO-C	579985
N71	Microbes	FEP text updated with new information that states this FEP only applies to naturally-occurring microbes	Yes. Removed reference to UP classification for colloidal effects and gas generation, which is discussed in W44 *Degredation of Organic Material.*	SO-C	580541
N72	Natural Ecological Development	No change	No	SO-C	579989
H1	Oil and Gas Exploration	Updated with new drilling rate and references	No	SO-C during the historic, current, and near-future	580218

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
				timeframes (HCN) DP (Future) – CCDFGF	
H2	Potash Exploration	FEP text updated with new information	No	SO-C (HCN) DP (Future) – CCDFGF	580218
H4	Oil and Gas Exploitation	Updated with new drilling rate and references	No	SO-C (HCN) DP (Future) – CCDFGF	580218
H8	Other Resources	FEP text updated with new information	No	SO-C (HCN) DP (Future) – CCDFGF	580218
H9	Enhanced Oil and Gas Recovery	FEP text updated with new information	No	SO-C (HCN) DP (Future) – CCDFGF	580218
H3	Water Resources Exploration	Updated with most recent monitoring information	No	SO-C (HCN) SO-C (Future)	579470
H5	Groundwater Exploitation	Updated with most recent monitoring information	No	SO-C (HCN) SO-C (Future)	579470
H6	Archaeological Investigations	No change	No	Screened-Out, Regulatory (SO-R) (HCN) SO-R (Future)	579716
H7	Geothermal	No change	No	SO-R (HCN) SO-R (Future)	579716
H10	Liquid Waste Disposal	No change	No	SO-R (HCN) SO-R (Future)	579716
H11	Hydrocarbon Storage	No change	No	SO-R (HCN) SO-R (Future)	579716
H12	Deliberate Drilling Intrusion	No change	No	SO-R (HCN) SO-R (Future)	579716
H13	Conventional Underground Potash Mining	No change	No	UP (HCN) DP (Future) – MODFLOW6	580138
H14	Other Resources (Mining For)	No change	No	SO-C (HCN) SO-R (Future)	579644
H15	Tunneling	No change	No	SO-R (HCN) SO-R (Future)	579648
H16	Construction of Underground Facilities (For Example Storage, Disposal, Accommodation)	No change	No	SO-R (HCN) SO-R (Future)	579648
H17	Archaeological Excavations	No change	No	SO-C (HCN) SO-R (Future)	579652
H18	Deliberate Mining Intrusion	No change	No	SO-R (HCN) SO-R (Future)	579656
H19	Explosions for Resource Recovery	No change	No	SO-C (HCN) SO-R (Future)	579660

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
H20	Underground Nuclear Device Testing	Updated for clarity. No new information.	No	SO-C (HCN) SO-R (Future)	580005
H21	Drilling Fluid Flow	Updated to screen H21, H22, and H23 together	No	SO-C (HCN) DP (Future) – BRAGFLO	580545
H22	Drilling Fluid Loss	Updated to screen H21, H22, and H23 together	No	SO-C (HCN) DP (Future) – BRAGFLO	580545
H23	Blowouts	Updated to screen H21, H22, and H23 together	No	SO-C (HCN) DP (Future) – BRAGFLO	580545
H24	Drilling-Induced Geochemical Changes	Updated for clarity	No	UP (HCN) DP (Future) – SECOTP2D	580581
H25	Oil and Gas Extraction	FEP text updated with new information	No	SO-C (HCN) SO-R (Future)	580616
H26	Groundwater Extraction	Updated with new references	No	SO-C (HCN) SO-R (Future)	580616
H27	Liquid Waste Disposal–Outside Boundary (OB)	Updated with new references	No	SO-C (HCN) SO-C (Future)	580282
H28	Enhanced Oil and Gas Production–OB	Updated with new references	No	SO-C (HCN) SO-C (Future)	580282
H29	Hydrocarbon Storage–OB	No change	No	SO-C (HCN) SO-C (Future)	580282
H60	Liquid Waste Disposal–Inside Boundary (IB)	No change	No	SO-R (HCN) SO-R (Future)	579712
H61	Enhanced Oil and Gas Production–IB	No change	No	SO-R (HCN) SO-R (Future)	579712
H62	Hydrocarbon Storage–IB	No change	No	SO-R (HCN) SO-R (Future)	579712
H30	Fluid-Injection Induced Geochemical Changes	No change	No	UP (HCN) – SECOTP2D SO-R (Future)	579945
H31	Natural Borehole Fluid Flow	Updated to reflect BRAGFLO corrections for open borehole parameters and to reflect new plugging probabilities.	No	SO-C (HCN) SO-C (Future, holes not penetrating waste panels) DP (Future, holes penetrating panels) – BRAGFLO	579949
H32	Waste-Induced Borehole Flow	Updated to reflect new plugging probabilities.	No	SO-R (HCN) DP (Future) – BRAGFLO	579953
H34	Borehole-Induced Solution and Subsidence	Updated with new references and information	No	SO-C (HCN) SO-C (Future)	580795

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
H35	Borehole-Induced Mineralization	Updated with new references and information	No	SO-C (HCN) SO-C (Future)	580799
H36	Borehole-Induced Geochemical Changes	Updated to reflect new plugging probabilities.	No	UP (HCN) – SECOTP2D: BRAGFLO DP (Future) – SECOTP2D: BRAGFLO SO-C – Beneficial (for units other than the Culebra)	580682
H37	Changes in Groundwater Flow Due to Mining	Updated with new references and mining leases.	No	UP (HCN) – MODFLOW6 DP (Future) – MODFLOW6	579474
H38	Changes in Geochemistry Due to Mining	Argument edited for clarity.	No	SO-C (HCN) SO-R (Future)	579664
H39	Changes in Groundwater Flow Due to Explosions	No change	No	SO-C (HCN) SO-R (Future)	579668
H40	Land Use Changes	FEP text updated with new information	No	SO-R (HCN) SO-R (Future)	579672
H41	Surface Disruptions	FEP text updated with new information	No	UP (HCN) – MODFLOW6 SO-C (Future)	579676
H42	Damming of Streams or Rivers	No change	No	SO-C (HCN) SO-R (Future)	579680
H43	Reservoirs	No change	No	SO-C (HCN) SO-R (Future)	579680
H44	Irrigation	No change	No	SO-C (HCN) SO-R (Future)	579680
H45	Lake Usage	No change	No	SO-R (HCN) SO-R (Future)	579684
H46	Altered Soil or Surface Water Chemistry by Human Activities	No change	No	SO-C (HCN) SO-R (Future)	579688
H47	Greenhouse Gas Effects	No change	No	SO-R (HCN) SO-R (Future)	579682
H48	Acid Rain	No change	No	SO-R (HCN) SO-R (Future)	579682
H49	Damage to the Ozone Layer	No change	No	SO-R (HCN) SO-R (Future)	579682
H50	Coastal Water Use	No change	No	SO-R (HCN) SO-R (Future)	579696
H51	Sea Water Use	No change	No	SO-R (HCN) SO-R (Future)	579696

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
H52	Estuarine Water Use	No change	No	SO-R (HCN) SO-R (Future)	579696
H53	Arable Farming	No change	No	SO-C (HCN) SO-R (Future)	579700
H54	Ranching	No change	No	SO-C (HCN) SO-R (Future)	579700
H55	Fish Farming	No change	No	SO-R (HCN) SO-R (Future)	579700
H56	Demographic Change and Urban Development	No change	No	SO-R (HCN) SO-R (Future)	579704
H57	Loss of Records	No change	No	NA (HCN) DP (Future) – CCDFGF	579708
H58	Solution Mining for Potash	No change	No	SO-R (HCN) SO-R (Future)	579925
H59	Solution Mining for Other Resources	Updated with new information regarding brine wells in the region.	No	SO-C (HCN) SO-C (Future)	579929
W1	Disposal Geometry	Updated with additional and replacement panel information.	No	UP – BRAGFLO; PANEL	579326
W2	Waste Inventory	Updated with new inventory data	No	UP – BRAGFLO; PANEL; EQ3/6	579322
W3	Heterogeneity of Waste Forms	Updated with new inventory data	No	DP – CCDFGF; CUTTINGS_S; EPAUNI	579322
W4	Container Form	Updated with new container material masses.	No	SO-C – Beneficial	579937
W34	Container Integrity	Updated to screen W4 and W34 together.	No	SO–C Beneficial	579937
W5	Container Material Inventory	Updated to reflect new inventory data and container variants.	No	UP – BRAGFLO	580577
W6	Shaft Seal Geometry	FEP text updated with new information	No	UP – BRAGFLO	580476
W7	Shaft Seal Physical Properties	FEP text updated with new information	No	UP – BRAGFLO	580476
W109	Panel Closure Geometry	FEP text updated with new information	No	UP – BRAGFLO	580476
W110	Panel Closure Physical Properties	FEP text updated with new information	No	UP – BRAGFLO	580476

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
W8	Shaft Seal Chemical Composition	Screened separately from W111	Changed from SO-C Beneficial to SO-C	SO-C	580214
W9	Backfill Physical Properties	FEP text updated with new information	No	SO–C	580628
W10	Backfill Chemical Composition	No change	No	UP – BRAGFLO; EQ3/6; PANEL	580573
W11	Post-Closure Monitoring	No change	No	SO-C	579318
W12	Radionuclide Decay and In-Growth	No change	No	UP – PANEL; NUTS; SECOTP2D; EPAUNI; and CUTTINGS_S	580492
W13	Heat from Radioactive Decay	FEP text updated with new information	No	SO-C	580496
W14	Nuclear Criticality: Heat	FEP text updated with new information	No	SO-P	580429
W15	Radiological Effects on Waste	Updated to reflect new radionuclide inventory	No	SO-C	580234
W16	Radiological Effects on Containers	Updated to reflect new radionuclide inventory	No	SO-C	580234
W17	Radiological Effects on Shaft Seals	Updated to reflect new radionuclide inventory	No	SO-C	580234
W112	Radiological Effects on Panel Closures	Updated to reflect new radionuclide inventory	No	SO-C	580234
W18	Disturbed Rock Zone (DRZ)	Updated with information on new panels	No	UP – BRAGFLO	580270
W19	Excavation-Induced Changes in Stress	Updated with information on new panels	No	UP – BRAGFLO	580270
W20	Salt Creep	Updated with new references	No	UP – BRAGFLO	580290
W21	Changes in the Stress Field	Updated with new references	No	UP – BRAGFLO	580290
W22	Roof Falls	Updated with information about new panels	No	UP – BRAGFLO	580274
W23	Subsidence	Updated with new references and information	No	SO-C	580840
W24	Large Scale Rock Fracturing	Updated with new references and information	No	SO-P	580840
W25	Disruption Due to Gas Effects	Updated with information on mechanical effects of gas generation	No	UP – BRAGFLO	579544

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
W26	Pressurization	Updated with information on mechanical effects of gas generation	No	UP – BRAGFLO	579544
W27	Gas Explosions	FEP text updated with new information	No	UP – BRAGFLO	580298
W28	Nuclear Explosions	Updated with new references and information.	No	SO-P	580604
W29	Thermal Effects on Material Properties	Updated to reflect new inventory information.	No	SO-C	580355
W30	Thermally-Induced Stress Changes	Updated to reflect new inventory information.	No	SO-C	580355
W31	Differing Thermal Expansion of Repository Components	Updated to reflect new inventory information	No	SO-C	580355
W72	Exothermic Reactions	Updated to reflect new inventory information	No	SO-C	580355
W73	Concrete Hydration	Updated to reflect new inventory information	No	SO-C	580355
W32	Consolidation of Waste	Updated disposal room porosity surface	No	UP – BRAGFLO	580359
W36	Consolidation of Shaft Seals	No change	No	UP – BRAGFLO	580359
W37	Mechanical Degradation of Shaft Seals	No change	No	UP – BRAGFLO	580359
W39	Underground Boreholes	No change	No	UP – BRAGFLO	580359
W113	Consolidation of Panel Closures	No change	No	UP – BRAGFLO	580359
W114	Mechanical Degradation of Panel Closures	No change	No	SO-P	580359
W33	Movement of Containers	Updated with new references	No	SO-C	580294
W35	Mechanical Effects of Backfill	Updated with new information and references.	No	SO–C	580608
W40	Brine Inflow	Updated with new formulas and references	No	UP – BRAGFLO	580009
W41	Wicking	Updated with new formulas and references	No	UP – BRAGFLO	580009

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
W42	Fluid Flow Due to Gas Production	Updated with new references	No	UP – BRAGFLO	579330
W43	Convection	Updated with new estimates of heat produced from inventory data	No	SO-C	580302
W44	Degradation of Organic Material	Updated with new information and screened separately from W45 and W48	No	UP – BRAGFLO	580549
W45	Effects of Temperature on Microbial Gas Generation	Updated with new thermal increase calculations and screened separately from W44.	No	UP – BRAGFLO	580512
W48	Effects of Biofilms on Microbial Gas Generation	Updated with new information and screened separately from W44.	No	UP – BRAGFLO	580512
W46	Effects of Pressure on Microbial Gas Generation	Updated with new references and information. Modified to more directly discuss the effects of pressure on gas generation	No	SO-C	580516
W47	Effects of Radiation on Microbial Gas Generation	Updated with new information	No	SO-C	580520
W49	Gases from Metal Corrosion	Updated to reflect new inventory information and address EPA comments	No	UP – BRAGFLO	579466
W51	Chemical Effects of Corrosion	Updated to reflect new inventory information and address EPA comments	No	UP – EQ3/6	579466
W50	Galvanic Coupling (Within the Repository)	Updated with information on lead inventory.	No	SO-C	580278
W52	Radiolysis of Brine	Updated with new references	No	UP – BRAGFLO	579334
W53	Radiolysis of Cellulose	Updated with new information and references	No	SO-C	580318
W54	Helium Gas Production	Updated to reflect new inventory	No	SO-C	580230
W55	Radioactive Gases	Updated to reflect new inventory	No	SO-C	580100
W56	Speciation	Updated with new information and references	No	UP Disposal Rooms; UP Culebra – EQ3/6; SECOTP2D	580524

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
				SO-C elsewhere; SO-C Beneficial – Shaft Seals	
W57	Kinetics of Speciation	No change	No	SO-C	580528
W58	Dissolution of Waste	No change	No	UP – BRAGFLO; PANEL; and NUTS	580585
W59	Precipitation of Secondary Minerals	No change	Changed from SO-C Beneficial to SO-C	SO-C	580585
W60	Kinetics of Precipitation and Dissolution	No change	No	SO-C	580585
W61	Actinide Sorption	Updated with new references	No	UP in the Culebra and Dewey Lake –PANEL; SECOTP2D; SO-C—Beneficial in the disposal room, shaft seals, and other geologic units.	580170
W62	Kinetics of Sorption	Updated with new references	No	UP in the Culebra and Dewey Lake –PANEL; SECOTPD; SO-C—Beneficial in the disposal room, shaft seals, and other geologic units.	580170
W63	Changes in Sorptive Surfaces	Updated with new references	No	UP – PANEL; SECOTPD	580170
W64	Effects of Metal Corrosion	No change	No	UP – EQ3/6	580557
W66	Reduction-Oxidation Kinetics	No change	No	UP – EQ3/6	580557
W65	Reduction-Oxidation Fronts	No change	No	SO-P	580561
W67	Localized Reducing Zones	No change	No	SO-C	580565
W68	Organic Complexation	Updated with new references	No	UP – EQ3/6	580569
W69	Organic Ligands	Updated with new references	No	UP – EQ3/6	580569
W71	Kinetics of Organic Complexation	Updated with new references	No	SO-C	590569
W70	Humic and Fulvic Acids	No change	No	UP – PANEL; SECOTP2D	580500

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
W74	Chemical Degradation of Shaft Seals	No change to argument. FEP W115 removed from screening	No	UP – BRAGFLO	580150
W76	Microbial Growth on Concrete	No change to argument. FEP W115 removed from screening	No	UP – BRAGFLO	580150
W75	Chemical Degradation of Backfill	No change	No	SO-C	580154
W111	Panel Closure Chemical Composition	Screened separately from W8	Yes. Changed from SO-C Beneficial to SO-C	SO-C	580222
W115	Chemical Degradation of Panel Closures	No change to argument. Screened separately from W74 and W76	No	SO-P	580033
W77	Solute Transport	Updated for clarity	No	UP – NUTS; SECOTP2D	580092
W78	Colloid Transport	Updated with new references	No	UP – NUTS; SECOTP2D	580504
W79	Colloid Formation and Stability	Updated with new references	No	UP – PANEL	580504
W80	Colloid Filtration	Updated with new references	No	UP – NUTS; SECOTP2D	580504
W81	Colloid Sorption	Updated with new references	No	UP – PANEL	580504
W82	Suspensions of Particles	Updated with arguments for screening out this FEP	Yes. Changed from DP to SO-C	SO-C	580612
W83	Rinse	No change	No	SO-C	580612
W84	Cuttings	No change	No	DP – CUTTINGS_S	580612
W85	Cavings	No change	No	DP – CUTTINGS_S	580612
W86	Spallings	No change	No	DP – DRSPALL	580612
W87	Microbial Transport	Updated with new references	No	UP – PANEL; NUTS	580468
W88	Biofilms	Updated with new references and information	No	SO-C Beneficial	580508
W89	Transport of Radioactive Gases	Updated with new references and information	No	SO-C	580104
W90	Advection	Updated with new references and information	No	UP – NUTS; SECOTP2D	580096

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EPA FEP I.D.	FEP Name	Screening Argument Update	Screening Decision Changed?	Screening Classification and Implementing Code	FEPs Update Record ERMS #
W91	Diffusion	Updated with new information	No	UP – NUTS; SECOTP2D	580013
W92	Matrix Diffusion	Updated with new information	No	UP – NUTS; SECOTP2D	580013
W93	Soret Effect	Updated with new references and information	No	SO-C	580238
W94	Electrochemical Effects	No change	No	SO-C	580226
W95	Galvanic Coupling (Outside the Repository)	No change	No	SO-P	580017
W96	Electrophoresis	No change	No	SO-C	580021
W97	Chemical Gradients	Updated with new references and information	No	SO-C	580174
W98	Osmotic Processes	No change	No	SO-C	580088
W99	Alpha Recoil	No change	No	SO-C	580286
W100	Enhanced Diffusion	No change	No	SO-C	580178
W101	Plant Uptake	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580025
W102	Animal Uptake	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580025
W103	Accumulation in Soils	Updated with new references and information	No	SO-C Beneficial (for section 191.13) SO-C (for section 191.15)	580025
W104	Ingestion	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580029
W105	Inhalation	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580029
W106	Irradiation	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580029
W107	Dermal Sorption	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580029
W108	Injection	Updated with new references and information	No	SO-R (for section 191.13) SO-C (for section 191.15)	580029

4.0 CONCLUSION AND SUMMARY

This reassessment was conducted following the process outlined in AP-199 and provides the new baseline for the next iteration of Appendix SCR (presumed to be Appendix SCR-2026). Principal investigators have reviewed each FEP as represented in Appendix SCR-2019 and addressed comments from EPA that were submitted in their response to the CRA-2019. Screened-in FEPs have been modified to include implementation details that describe how the FEP is implemented

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in PA. Documentation of the reassessments for all 245 FEPs have been submitted to the Sandia records center. The new FEPs baseline presented by this analysis report may be augmented by future SP 9-4 assessments that occur leading up to the CRA-2026 development and submittal.

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