Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

April 10, 2025

Mr. Tom Peake, Director
Center for Waste Management and Regulations
William Jefferson Clinton Building, West
1301 Constitution Ave NW, Mail Code 6608T
Washington, D.C. 20004

Subject: Response 7 to U.S. Environmental Protection Agency's Questions on the Replacement Panels Planned Change Request

References: 1) EPA letter from Tom Peake to Michael Gerle, dated September 27, 2024; Subject: Seventh Set of Questions on the Replacement Panels Planned Change Request

2) EPA letter from Tom Peake to Michael Gerle, dated April 17, 2024; Subject: First Set of Questions on the Replacement Panels Planned Change Request

Dear Mr. Peake:

Enclosed is the U.S. Department of Energy (DOE) response to the U.S. Environmental Protection Agency's (EPA) questions on the Replacement Panels Planned Change Request (RPPCR) received in the above reference letters. In this communication, the DOE is responding to five of the EPA's questions, including the sub-questions.

This submittal includes the two enclosures listed below:

- Enclosure 1 provides the DOE's responses to five of the EPA's technical questions and comments on the RPPCR.
- Enclosure 2 is a status report of the DOE's responses to the EPA questions on the RPPCR. The report shows the status of all EPA technical questions and comments received to date.

The DOE will continue to submit phased responses to the EPA to ensure questions are answered as promptly as possible. Below are the five responses provided in Enclosure 1.

EPA Letter Date	EPA Question Number	EPA Question Description
September 27, 2024	RPPCR7-BrineRes-1 through 4	Requests related to brine volume estimates made using the two-domain model
April 17, 2024	RPPCR1-DATA0.FM6-7	Lead-Carbonate Aqueous Speciation

If you have any questions, please contact Dr. Anderson Ward, Compliance Certification Manager, CBFO Environmental Regulatory Compliance Division. Dr. Ward can be reached at (575) 988-5414.

Sincerely,

MICHAEL GERLE

Digitally signed by MICHAEL GERLE
Date: 2025.04.10 12:49:36 -06'00'

Michael Gerle, Director
Environmental Regulatory
Compliance Division
Carlsbad Field Office

Enclosures (2)

cc: w/enclosures

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Enclosure 1

Department of Energy Response 7
to EPA's Questions on the RPPCR

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Requests related to brine volume estimates made using the two domain model

A summary of Castile reservoir brine volumes in Table 1 shows that both the maximum and minimum values have varied considerably through the years. Through several steps, Gross and Gjerapic (2022) adequately verified the use of Karasaki's (1987) two domain model for re-evaluating the maximum Castile reservoir brine volume's implementation in WIPP PA and calibrated it using the results of Popielak et al.'s (1983) WIPP-12 field tests. However, Gross and Gjerapic's (2022) sensitivity studies addressed only reservoir thickness and initial conditions. They omitted uncertainty in the equilibrium reservoir pressure and did not provide an explanation for the incomplete match with test results at the end of the long-term WIPP-12 shut-in Test #3 (see Figure 12 from Gross and Gjerapic, 2022). The Agency has the following questions.

Table 1. EPA Summary of various Castile Brine Reservoir volumes

Source	*Minimum (m^3)*	*Maximum (m^3)*
Popielak et al (1983)	*2.7×10^5*	*1.4×10^7*
DOE CCA PA (1996)	*3.2×10^4*	*1.6×10^5*
EPA PAVT (1998)	*3.4×10^6*	*1.7×10^7*
DOE CRA19 PA (2019)	*4.0×10^6*	*2.0×10^7*
Gross & Gjerapic (2022)	*3.61×10^6*	*5.90×10^6*
Docherty (2023)	*1.18×10^6*	*5.90×10^6*

RPPCR7-BrineRes-1: acceptance of calibration curves after ~400 hours

Please justify the acceptance of the calibrated curves in Figure 12 of Gross and Gjerapic (2022) when the field data after about 400 hours show a significantly different behavior.

> *The calibrated curves in Gross and Gjerapic's match to Popielak et al.'s (1983) WIPP long-term pressure buildup curve (see Gross and Gjerapic 2022, Figure 12) increasingly deviate from the measured field pressures beginning at a recovery time of about 400 hours. These field data appear to have been ignored except for the final pressure measurement of 162 psig. It is not clear why the calibrated curves were found to be acceptable in view of this large departure from the field data.*

DOE Response

The calibrated curves in Figure 12 of Gross and Gjerapic (2022) were derived using data collected over the first several hundred hours after the gas cap was removed. These data are considered more reliable because they are less likely to be affected by gas generation, skin effects, and wellhead volume. This conclusion is supported by the observations of Popielak et al. (1983), who noted in Section 3.2.2 that:

"With an expanding gas cap, wellhead pressures will rise at a faster rate than reservoir pressures because as a gas cap expands, the gas pressure must rise to compensate for the pressure exerted by the displaced brine. Even if the reservoir pressure is static, the gas pressure in an expanding gas cap will continue to rise."

Popielak et al. (1983) reported relatively stable readings for approximately 400 hours after the gas cap was removed from the wellhead on March 7, 1983. The calibrated curves are based on data collected between 10 and 700 hours after shut-in, and from 6700 and 7060 hours after venting the gas cap.

RPPCR7-BrineRes-2: causes of field pressure peak and decline in long-term shut-in test

Please explain the probable cause or causes of the field pressure peak at about 170 psig, the subsequent decline to between 150 and 160 psig, and the rationale for apparently ignoring this higher pressure when estimating reservoir volume.

With reference to Figure 12, the field pressure peaks at about 170 psig after about 4,000 hours of recovery time and then declines without explanation and apparently before the effects of the gas cap were identified and the gas was vented. This decline suggests a possible leak developing in the wellbore or perhaps at the wellhead that could have affected pressures measured after the gas cap was vented. A peak recovery pressure of 170 psig would be indicative of a much larger brine reservoir.

DOE Response

The EPA's observation that data from 4000 to about 6700 hours might have been affected by gas leaks is one possible explanation for the decline in pressure. However, the decline in pressure from about 4000 to 6700 hours could be also due to a reduction in temperature or to an equipment malfunction. Popielak et al. (1983) reported having to replace the pressure gauge at approximately 6630 hours (March 5, 1983). This gauge was used to record pressures from about 1700 hours (August 12, 1982) to 6630 hours. Recognizing that well pressures above 162 psig are likely due to the presence of gas and that previously recorded leaks have not been associated with measurable losses of brine from the system, the maximum pressure of 162 psig reported from March 7 to March 23, 1983 (> two weeks) was adopted for calibration. Although a recovery pressure of 170 psig could be indicative of a reservoir, as much as 20 percent larger than predicted by Gross and Gjerapic (2022), it is not very likely. However, 170 psig appears to be a reasonable upper bound for the brine reservoir calibration based on the available data and reported measurement procedures. In this context, however, the well pressure of 170 psig should be viewed as a tail-end of possible values that is extremely unlikely to be exceeded.

RPPCR7-BrineRes-3: uncertainties and the 162 psig as final reservoir equilibrium pressure

Popielak et al.'s (1983) adoption of 162 psig as the final reservoir equilibrium pressure does not appear to adequately account for uncertainty. Please justify use of this value by Gross and Gjerapic (2022) in calculating maximum reservoir brine volume without considering multiple sources of uncertainty that could provide a reasonable basis for higher equilibrium pressures and larger reservoir brine volumes.

> *Popielak et al.'s (1983, p. H-53) identification of 162 psig as the final equilibrium shut-in pressure for the WIPP-12 brine reservoir occurred at a time when several disruptive events were occurring that potentially affected the pressure measurements and increased their uncertainty.*

- *As illustrated in Gross and Gjerapic (2022, Figures 12 and 13), the wellhead pressure had been declining for about 1500 hours from a peak of 170 psig to a low of between 150 and 160 psig when a gas cap formed that abruptly increased the wellhead pressure to 175 psig in about 960 hours (40 days). When the gas was vented, the pressure dropped to ~142 psig and then quickly stabilized at 162 psig for about 380 hours (16 days) when another gas cap started to form. Given the pressure oscillations occurring before and after the 16-day stabilization period, the uncertainty in assuming that 162 psig represented long-term equilibrium conditions should be evaluated.*

- *After the gas cap was vented, the wellhead pressure apparently stabilized for about 16 days (about 380 hours) until another gas cap began to develop. Considering the asymptotic nature of approaches to stability in such systems, were 380 hours enough to strongly support a conclusion that equilibrium pressure had been reached in a test that lasted over 7,000 hours?*

- *As illustrated in Gross and Gjerapic (2022, Figures 12 and 13), the deviation of pressure data from the calibrated two-domain model curves, the peaking at 170 psig at about 4,000 hours, and the subsequent decline to between 150 and 160 psig over the next ~1500 hours add additional uncertainty if unexplained. All of this occurred before the gas cap was vented. Did a leak develop in the system? Would 170 psig be a better estimate of the equilibrium pressure?*

- *Ambient temperature variations were reported by Popielak et al. (1983, p. H-14) that caused the wellhead pressure readings to fluctuate, but they considered this effect to have been largely eliminated by insulating the wellhead.*

- *According to Popielak et al. (1983, p. H-14), leaks into the Salado from the uncased, open WIPP-12 borehole could have lowered the buildup pressure by approximately 6 to 7 psi over the long duration buildup period. In considering the importance of anchoring the maximum reservoir volume at a value that is unlikely to be reasonably exceeded, this observation alone would increase the reasonably maximum equilibrium reservoir pressure to 169 psig. EPA considers that this and the other uncertainties described above indicate that an equilibrium pressure of 162 psig may be too low.*

- *Popielak et al. (1983) express some uncertainty in the adoption of 162 psig as the reservoir equilibrium pressure, stating in support of this adoption on p. H-53 that "After more than nine months of recovery, the WIPP-12 reservoir should be near equilibration."*

- *As an example of the sensitivity of reservoir volume to equilibrium pressure, according to Gross and Gjerapic's (2022) Figure 12, increasing the equilibrium pressure by about 5 psig (from 162 to 167 psig) appears to increase the maximum reservoir radius from 3,675 m to 5,000 m. Assuming the same porosity, an increase of 5 psig could increase the maximum reservoir brine volume by a factor of $5000^2/3675^2$ = 1.85. This would increase the estimated maximum brine volume from 5.90 x 10^6 m^3 to 1.09 x 10^7 m^3, which is approaching EPA's PAVT maximum volume of 1.7 x 10^7 m^3.*

DOE Response

The reservoir volumes presented in Figure 12 by Gross and Gjerapic (2022) and the predicted pressure response curves are based on a steady-state pressure of 162 psig at the end of the WIPP-12 testing. Figure 1 shows the evolution of pressure for the WIPP-12 calibration using the maximum WIPP-12 radius (R_{max}) of 3,675 m as well as simulations for the maximum steady-state pressure of 169 psig after completion of flow testing. A steady-state pressure of 169 psi, the maximum pressure after well venting on March 7, 1983, increased the reservoir volume by about 20 percent.

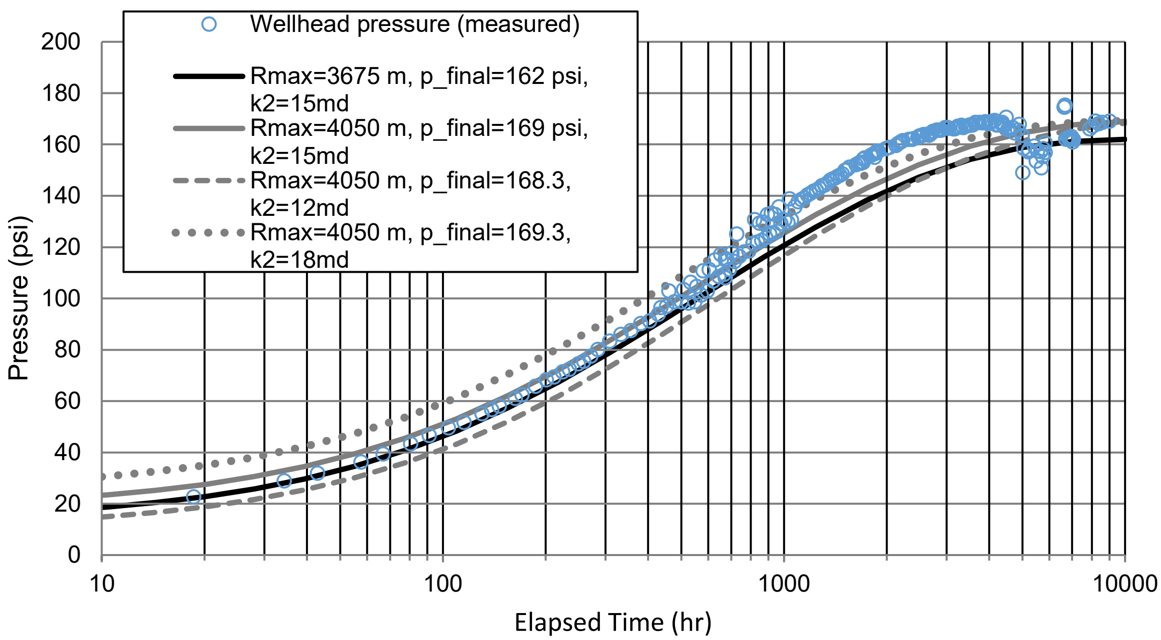

Figure 1. Sensitivity analyses based on the long-term steady-state pressure of 169 psig (R_{max} = 4050m) vs. analyses with the long-term steady-state pressure of 162 psig (R_{max} = 3675 m).

Additional simulations were used to assess the sensitivity of well head pressure to reservoir radius. At R_{max} = 4,050 m, with other calibration parameters remaining the same, the far-field (outer domain) permeability increased by 20 percent relative to those adopted by Gross and Gjerapic (2022) . The resulting WIPP-12 volumes, assuming a porosity of 2.2 percent for the near-field domain and a porosity of 0.7 percent for the far field domain, are summarized in Table 1.

Table 1. Estimated WIPP-12 brine reservoir volumes for the steady-state wellhead pressures of 162 psig (R_{max} = 3675 m) and 169 psig (R_{max} = 4050 m).

Zone	Volume (m^3)	
	R_{max} = 3675 m	R_{max} = 4050 m
Near-Field Domain	5.60×10^5	5.60×10^5
Far-Field Domain	5.34×10^6	6.53×10^6
Total	5.90×10^6	7.09×10^6

Table 1 indicates that a 7 psi increase in steady-state wellhead pressure increases reservoir volume of about 20 percent. While Popielak et al. (1983) state, *"The maximum inflow into the Salado Formation, based on shut-in conditions, was estimated to be 25 bbl/day and this in turn could lower the buildup pressure by approximately 6 to 7 psi over a long-duration buildup period"*, their estimates for the WIPP-12 reservoir volume is based on 162 psi being the most reasonable value. The maximum outflows of 25 bbl/day estimated by Popielak et al. (1983) from data that were likely affected by intermittent leaks and measurement errors render a maximum steady-state pressure of 169 psi unlikely. The maximum WIPP-12 reservoir volume estimated by Gross and Gjerapic (2022) may be viewed as an upper-bound estimate. This is because the analysis neglects the influence of rock creep in the Castile (within the confines of the brine reservoir) and the Salado (from the reservoir level at a depth of about 3,017 feet to the top of the uncased borehole at a depth of 1,002.8 feet, see for example, Black 1982). Popielak et al. (1983) noted, "*…if any portion of the late-time buildup is due to rock creep, the reservoir volume estimate will be too large.*" Rock creep in the upper portions of the Salado is likely to be larger than CCA (DOE 1996) estimate (Reedlunn et al. (2022). Therefore, the upper-bound estimate of Gross and Gjerapic (2022)is likely conservative.

RPPCR7-BrineRes-4: basis for estimate of maximum brine reservoir pore volume

Please justify basing the estimate of the maximum brine reservoir pore volume in Gross and Gjerapic (2022, p. 31) on Popielak et al.'s (1983, p. G-47) average porosity range of 0.4 to 0.7 percent rather than on their total porosity range of 0.1 to 1.0 percent.

Gross and Gjerapic (2022, p. 31) calculated the range of far field brine reservoir pore volumes using Popielak et al.'s (1983, p. G-47) representative average porosity range of 0.4 to 0.7 percent rather than the total porosity range of 0.1 to 1.0 percent that Popielak et al. used in their own estimate of maximum and minimum brine volumes (see Popielak et al. 1983, Figure H-19). EPA calculates that using Popielak et al.'s limiting maximum porosity of 1.0 percent instead of their average maximum porosity of 0.7 percent would have increased the estimated maximum reservoir brine volume by 39 percent to 8.2 x 10^6 m^3. Although not directly sampled in WIPP PA, the reservoir porosity effectively has a triangular distribution because if its close association with Castile bulk rock compressibility. Such a distribution was selected in part because the maximum and minimum values can be identified with a reasonable confidence that the true value lies within those bounds. Popielak et al. identified those bounding porosity limits as ranging from 0.1 to 1.0 percent and referred to the porosity range of 0.4 to 0.7 percent as average rather than *limiting values. Given that Gross and Gjerapic (2022, p. i) are proposing a new maximum brine volume, it is not clear why they choose Popielak et al.'s average porosity range rather than their limiting porosity range.*

DOE Response

The porosity range of 0.1 to 1 percent used by Popielak et al. (1983) to estimate the WIPP-12 reservoir volume is based on the assumption of a homogeneous reservoir characterized by a uniform distribution of hydraulic and geomechanical parameters. Therefore, this porosity range is applicable to a brine reservoir with the equivalent uniform properties. The analyses by Popielak et al. (1983) required an increase in the average porosity from the local-scale values to estimate the WIPP-12 reservoir upper-bound volume. Areas with increased local porosity most likely coincide with zones in the Castile that were subjected to higher tensile stresses during deformation and fracturing of anhydrite by the flow of underlying halite (e.g. anticlinal crests) and are not expected to exceed the effective reservoir radius of several hundred meters. Therefore, local-scale porosity may be applicable to the near-field domain, whereas the average porosity is more applicable to the far-field domain in the two-domain reservoir model. Gross and Gjerapic (2022) assumed the near-field permeability value in the two-domain model is governed by the maximum local porosity reported by Popielak et al. (1983). The far-field porosity is likely to be the average fracture porosity when lower permeability and smaller fractures persist over larger areas of the reservoir with an effective radius of several kilometers. Table 2 shows the estimated porosities for the WIPP-12 brine reservoir, which are based on measured pressure responses, geological logs, and a two-domain conceptual model (Popielak et al. (1983). The average porosities are consistent with both the field borehole data and structural calculations using the geometry of anhydrite layers and are considered appropriate for assigning the outer domain porosities in the two-domain model. The porosities in Table 2 indicate the range of fracture porosities at different scales of the model and were used to estimate a realistic upper bound for the WIPP-12 brine reservoir volume.

Table 2. Estimated WIPP-12 brine reservoir porosity for the two-domain model (after Popielak et al. 1983).

	Effective Fracture Porosity		
Zone	**Approx. Min. Avg. Porosity (%)**	**Approx. Max. Avg. Porosity (%)**	**Max. Local Porosity (%)**
Near-Field Domain	0.4	0.7	2.2
Far-Field Domain	0.4	0.7	n/a

RPPCR1-DATA0.FM6-7: Lead-Carbonate Aqueous Speciation

Please provide a review and evaluation of lead-carbonate aqueous speciation data that has been published since Powell et al. (2009) and explain the reason the Pb(CO3)Cl- aqueous species was omitted from the DATA0.FM6 database.

DATA0.FM6 lead-carbonate aqueous species and stability constants were obtained from Powell et al. (2009). More recent investigations have been published that including Easley and Byrne (2011) and Woosley and Millero (2017) 1 that evaluate lead-carbonate aqueous speciation. Both Powell et al. (2009) and Woosley and Millero (2017) 2 included the Pb(CO3)Cl- aqueous species, but this species was not included in DATA0.FM6. Woosley and Millero (2017) 3 determined that this species was important in chloride media, so its inclusion in DATA0.FM6 should be considered.

Easley, R.A., and R.H. Byrne. 2011. The ionic strength dependence of lead (II) carbonate complexation in perchlorate media. Geochimica et Cosmochimica Acta 75:5638-5647.

Powell, K.J., P.L. Brown, R.H. Byrne, T. Gajda, G. Hefter, A.-K. Leuz, S. Sjöberg, and H. Wanner. 2009. Chemical speciation of environmentally significant metals with inorganic ligands. Part 3: The Pb2+, + OH, Cl-, CO32-, SO42-, and PO4- systems (IUPAC Technical Report). Pure and Applied Chemistry 81:2425-2476.

Woosley, R.J. and F.J. Millero. 2013. Pitzer model for the speciation of lead chloride and carbonate complexes in natural waters. Marine Chemistry 149:1-7.

DOE Response

Using a reference search tool, "Web of Science", 124 references were found that cite Powell et al. (2009). Search using the following key words, lead, carbonate, complexation, found 242 references.

The references are screened by the titles and abstracts to select references addressing the aqueous speciation of Pb^{+2} - CO_3^{-2}. References immediately excluded are: those for characterization of solid phases, those using others' Pb^{+2} - CO_3^{-2} aqueous speciation models, those investigating adsorption, those including other dissolved metals than Pb^{+2}, those reporting model parameterization with missing informations.

The screening resulted in the same list of references the EPA selected: Easley and Byrne (2011) and Woosley and Millero (2013).

Easley and Byrne (2011) conducted spectroscopic measurements of the Pb^{+2} - CO_3^{-2} aqueous complexes in $NaHCO_3$ - $NaClO_4$ solutions, and determined the formation constants of $PbCO_3$(aq) and $Pb(CO_3)_2^{-2}$. Woosley and Millero (2013) also conducted spectroscopic measurements to determine the formation constant of $PbCO_3$(aq) in NaCl solution.

The formation constants of Easley and Byrne (2011) and Woosley and Millero (2013) are identical to Powell et al. (2009) within the reported errors. The formation constants delineated the measurements of Jang (2022) within the uncertainty associated with the measurements therein, and were included in Data0.fm6 (Jang and Foli, 2023; Domski, 2023).

While the motivation unclear, Powell et al. (2009) statistically derived the formation constant of $PbCO_3Cl^-$ ($10^{6.47\pm0.16}$) using the formation constants of $PbCl_2$(aq) ($10^{2.10\pm0.05}$) and $Pb(CO_3)_2^{-2}$

[1] Correction by DOE: Woosley and Millero (2013)
[2] Correction by DOE: Woosley and Millero (2013)
[3] Correction by DOE: Woosley and Millero (2013)

($10^{10.13\pm0.24}$) at I = 0 that were obtained from sets of experiments independent of each other. In other words, no experiments in the references selected by Powell et al. (2009; Table A2-6, Table A2-8) were conducted in solutions containing both carbonate and chloride simultaneously. The measurements of Easley and Byrne (2011) were made in a chloride-free system.

Woosley and Millero (2013) determined the formation constant of $PbCO_3$(aq) in NaCl solutions. They found difference in the measurements of $PbCO_3$(aq) in NaCl and $NaClO_4$ solutions,[4] and attributed the difference to a new species of interest, $PbCO_3Cl^-$. The value Woosley and Millero (2013) determined for $PbCO_3Cl^-$ using the statistical method of Byrne (1980) is $10^{7.23\pm0.74}$, identical to Powell et al. (2009) ($10^{6.47\pm0.16}$) within the reported uncertainty.

To validate the new species of interest (i.e., $PbCO_3Cl^-$) for the use in Data0.fm6, a prerequisite would be collating measurements of the complexation in solutions containing both CO_3^{-2} (or HCO_3^-) and Cl^-. The measurements need to fulfil the following requirements: Loading(s) of one (or both) ligand(s) should be controlled, and the uncertainty associated with such measurements should be reported. If only the Pb^{+2} - Cl^- and Pb^{+2} - CO_3^{-2} aqueous complexes are sufficient to delineate the measurements within the uncertainty, the inclusion of $PbCO_3Cl^-$ could be considered an overparameterization.

Published papers reporting the measurements of Pb^{+2} - CO_3^{-2} aqueous complexation in systems containing both CO_3^{-2} and Cl^- are scarce, if not zero. Woosley and Millero (2013) is the one that examined the Pb^{+2} - CO_3^{-2} aqueous complexation in the presence of chloride, fulfilling the requirements above. However, Woosley and Millero (2013) acknowledged that the measurements were impacted by large uncertainty.

The DOE decided not to have the $PbCO_3Cl^-$ in Data0.fm6 until experimental evidences of higher credibility are available.

The DOE obtained measurements of Pb^{+2} solubility in carbonate and chloride solutions (Jang et al., 2021). The measurements will be analyzed in a memo by 2025-09-30 to illustrate the dominance of $Pb(CO_3)Cl^-$. The new species may be included in the TDB if it is required, in addition to the Pb^{+2} - CO_3^{-2} and Pb^{+2} - Cl^- complexes in Data0.fm6, to delineate the measurements of Jang et al. (2021).

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Enclosure 2

Department of Energy Response 7

Status Report of DOE Responses To EPA Questions on the RPPCR

Status Report of DOE Responses to EPA questions on the RPPCR			
EPA Comment Number	**EPA Request Description**	**EPA Request Letter Date**	**DOE Response**
RPPCR1-References-1	Document Request	April 17, 2024	Response 1
RPPCR2-General-1	Dimensions of replaced area and new panels	April 24, 2024	Response 1
RPPCR1-PROPMIC-1	Pu(III) PROPMIC and CAPMIC values	April 17, 2024	Response 2
RPPCR2-12 PanelAnalyses	12 Panel Analyses	April 24, 2024	Response 2
RPPCR3-Closure-1	Closure of rooms with new design	May 10, 2024	Response 2
RPPCR1-Inventory-1	Waste Characteristics	April 17, 2024	Response 2
RPPCR1-DTAT0.FM6-1	Documentation for Hydromagnesite5424 Solubility	April 17, 2024	Response 2
RPPCR2-DATA0.FM6-4	Omitted Pitzer interaction parameters	April 24, 2024	Response 2
RPPCR-Inventory-2	Breakdown of Emplaced and Temporary Storage CH and RH Waste Volumes by Waste Generator Site	April 17, 2024	Response 3
RPPCR2-DATA0.FM6-1: a-c	$Am(OH)_3(am)$ verification calculations at low ionic strength	April 24, 2024	Response 3
RPPCR2-DATA0.FM6-2: a-c	$Am(OH)_3(am)$ verification calculations at high ionic strength	April 24, 2024	Response 3
RPPCR2-DATA0.FM6-3	$AmOHCO_3(c)$ verification calculations	April 24, 2024	Response 3
RPPCR1-DATA0.FM6-2: a-c	XRD Examination of Post-Test Solids	April 17, 2024	Response 3
RPPCR1-DATA0.FM6-3: a-b	WIPP Test Plans Cited in DATA0.FM6 Documentation	April 17, 2024	Response 3
RPPCR1-DATA0.FM6-4	$FeEDTA^{2-}$ Stability Constant	April 17, 2024	Response 3
RPPCR1-DATA0.FM6-5	$FeCitrate^{-}$ Stability Constant	April 17, 2024	Response 3
RPPCR1-DATA0.FM6-9	Cerussite Solubility	April 17, 2024	Response 3

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EPA Comment Number	**EPA Request Description**	**EPA Request Letter Date**	**DOE Response**
RPPCR1-OXCUTOFF-1: a-b	Sensitivity study using OXCUTOFF parameter	April 17, 2024	Response 4
RPPCR4-Corrosion-1	Steel Packaging and Waste Iron-Based Metals/Alloys Surface Area Recalculation	June 27, 2024	Response 4
RPPCR4-Corrosion-2	Recalculation of Ds	June 27, 2024	Response 4
RPPCR1-DATA0.FM6-6	Cotunnite Solubility	April 17, 2024	Response 4
RPPCR1-DATA0.FM6-8: a-b	Hydrocerussite Solubility	April 17, 2024	Response 4
RPPCR3-BRAGFLO-1	Follow up on BRAGFLO convergence	May 10, 2024	Response 4
RPPCR1-DBMAR-1: a-d	Questions related to the DBMAR	April 17, 2024	Response 5
RPPCR5-12PanelAnalyses-1	N/A	August 12, 2024	Response 5
RPPCR5-12PanelAnalyses-2	N/A	August 12, 2024	Response 5
RPPCR5-12PanelAnalyses-3	N/A	August 12, 2024	Response 5
RPPCR5-12PanelAnalyses-4	N/A	August 12, 2024	Response 5
RPPCR5-12PanelAnalyses-5	N/A	August 12, 2024	Response 5
RPPCR5-12PanelAnalyses-6	Effects of 12-Panel vs. 19-Panel Minimum Brine Volumes on Actinide Solubilities and Repository Releases	August 12, 2024	Response 5
RPPCR1-EM-1: a-e	Questions about the EM survey	April 17, 2024	Response 6
RPPCR3-Mineralogy-1	Detailed mineralogy of new panels	May 10, 2024	Response 6

Status Report of DOE Responses to EPA questions on the RPPCR			
EPA Comment Number	**EPA Request Description**	**EPA Request Letter Date**	**DOE Response**
RPPCR7-BrineRes-5	further description and explanation of revised geometric representation of Castile brine reservoir in BRAGFLO	September 27, 2024	Response 6
RPPCR7-BrineRes-6	difference in BRAGFLO grid representation between Docherty (2023) and RPPCR PA (DOE, 2024)	September 27, 2024	Response 6
RPPCR7-BrineRes-1	acceptance of calibration curves after ~400 hours	September 27, 2024	Response 7
RPPCR7-BrineRes-2	causes of field pressure peak and decline in long-term shut-in test	September 27, 2024	Response 7
RPPCR7-BrineRes-3	uncertainties and the 162 psig as final reservoir equilibrium pressure	September 27, 2024	Response 7
RPPCR7-BrineRes-4	basis for estimate of maximum brine reservoir pore volume	September 27, 2024	Response 7
RPPCR1-DATA0.FM6-7	Lead-Carbonate Aqueous Speciation	April 17, 2024	Response 7
RPPCR6-Bhperm-1:	PRB granules as surrogates for corroded borehole casing Please provide justification that include relevant experiments, data, and literature citations	September 5, 2024	In progress
RPPCR6-Bhperm-2:	discrepancy in upper bound permeability for degraded steel casing	September 5, 2024	In progress
RPPCR6-Bhperm-3:	PRB column test conditions	September 5, 2024	In progress
RPPCR6-Bhperm-4:	scatter and uncertainty in experimental results of Moraci et al. (2016)	September 5, 2024	In progress
RPPCR6-Bhperm-5:	relevance of Moraci et al. column tests to WIPP conditions	September 5, 2024	In progress
RPPCR6-Bhperm-6:	PRB corrosion test results and Thompson model	September 5, 2024	In progress
RPPCR6-Bhperm-7:	PRB degredation and incomplete degredation	September 5, 2024	In progress
RPPCR6-Bhperm-8:	concrete grout degrading to silt-like powders	September 5, 2024	In progress

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EPA Comment Number	**EPA Request Description**	**EPA Request Letter Date**	**DOE Response**
RPPCR6-Bhperm-9:	uncertainty in predicted permeability of Hazen equation	September 5, 2024	In progress
RPPCR6-Bhperm-10:	coarser grained materials in degredation debris and permeability	September 5, 2024	In progress
RPPCR6-Bhperm-11:	relevance of microannuli permeability laboratory results	September 5, 2024	In progress
RPPCR6-Bhperm-12:	relevance of continuity calculation	September 5, 2024	In progress
RPPCR6-Bhperm-13:	description and significance of maximum creep volume loss	September 5, 2024	In progress
RPPCR6-Bhperm-14:	uncertainty associated with predicted permeability using Kozeny-Carman relationship	September 5, 2024	In progress
RPPCR6-Bhperm-15:	explanation and timeline of conceptual model for surface hole, upper salt section, and lower salt section	September 5, 2024	In progress
RPPCR6-Bhperm-16:	sample calculations using Kozeny-Carman method	September 5, 2024	In progress
RPPCR6-Bhperm-17:	applicability of Kozeny-Carman model for fine-grained borehole degredation debris	September 5, 2024	In progress
RPPCR6-Bhperm-18:	initial permeability of degraded borehole debris used in creep closure analysis	September 5, 2024	In progress
RPPCR6-Bhperm-19:	effect of backpressure buildup on reductions in permeability in updated modeling	September 5, 2024	In progress
RPPCR6-Bhperm-20:	uncertainty regarding borehole debris fully consolidating to 10^{-15} m^2 permeability at repository depth	September 5, 2024	In progress
The in-progress responses listed above will be provided in the DOE's next response package.			
End of Status Report			