UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 2 2 2011

Mr. Ed Ziemianski
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U.S. Department of Energy
P.O. Box 3090
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OFFICE OF
AIR AND RADIATION

Dear Mr. Ziemianski:

On August 30 and September 28, 2011 the U.S. Department of Energy (DOE) submitted two Planned Change Requests (PCRs) to the U.S. Environmental Protection Agency for review. The first PCR (DOE/CBFO-11-3478) proposes relocating Waste Panels 9 and 10 to the south of existing Waste Panels 4 and 5, the second PCR (DOE/CBFO-11-3479) proposes replacing the current 'Option D' Panel Closure System (PCS) with an alternative design. Both PCR packages use the Panel Closure Redesign and Repository Reconfiguration (PC3R) Performance Assessment (PA) modeling results and analyses.

As you know, 40 CFR Part 194 specifies in Appendix A, Condition 1 that the Option D Panel Closure be implemented at WIPP. Thus, any change in the panel closure design requires modification to the rule. EPA is reviewing the PC3R PA package to determine if it is sufficient for us to move ahead with a rulemaking and to identify areas that need additional supporting information or modification. The first set of review questions and comments is included in this package, it focuses on changes to the panel closures. Within the next few weeks, EPA will be providing additional questions and comments to DOE related to both the PCS and the repository reconfiguration.

Your timely and considered response to the attached questions and comments, as well as those you will receive over the next few weeks, will allow us to determine whether a rulemaking is feasible prior to DOE's next submission for recertification.

Sincerely,

Alan D. Perrin, Acting Director
Radiation Protection Division

cc: (Electronic Distribution)
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Enclosure: First Set of EPA Questions to DOE
December 22, 2011

1 Parameters Related to Run of Mine (ROM) Panel Closure (PC)

This attachment provides initial questions and comments in EPA's ongoing review of the Panel Closure Redesign and Repository Reconfiguration Performance Assessment (PC3R PA). The focus of these comments are justifications for the parameters and parameter values that are new or have been changed from those in the 2009 Performance Assessment Baseline Calculation (PABC 2009 PA).

The starting points for reviewing each parameter are the descriptions and references provided in the S*ummary Report for the AP-151 (PC3R) Performance Assessment, Rev. 1* (Camphouse et al. 2011, ERMS 555489) and in *Recommendation and Justification of Parameter Values Required for the WIPP Panel Closure Redesign and Repository Reconfiguration Performance Assessment* (Camphouse 2010b, ERMS 554614). The first of these is the principal document describing the PC3R PA and its results, and the second is the principal document describing and justifying the parameters and values that were used.

1.1 Duration of Time Period T1

Parameter Name	PABC 2009 Value	Used in PC3R PA ERMS 555489	Units
Duration of Time Period T1	Not Applicable	100	years

Technical Question 1.1a: Please clarify the justification of the 100 year duration for T1. Different documents have estimated different time periods for run of mine salt to reach steady state porosity. Specifically, the PC3R cites Callahan and DeVries (1991, SAND91-7052), who predict consolidation of ROM salt to a porosity of 0.05 in about 13 years, and Hansen and Thompson (2002, ERMS 523476), who predict consolidation of ROM salt to a higher porosity of 0.10 within 100 years.

Technical Question 1.1b: Please justify the assumption that loosely placed, ROM salt will consolidate to a porosity of 0.05 in 100 years when the cited source Hansen and Thompson (2002) concludes that the salt will consolidate to a porosity of only 0.10 within 100 years.

Technical Question 1.1c: Please justify the use of two time periods to represent consolidation of the ROM salt panel closure material, when additional time periods could provide a more refined representation of salt consolidation over time.

Completeness Question 1.1d: Please identify the effect of the rock bolts installed at WIPP for ground control on the consolidation rate for the ROM salt panel closure material.

EPA Concerns

DOE's justification for adopting 100 years as the time frame for the T1 time period is not clear, especially given the range of values given by different sources.

Hansen and Thompson (2002, p.4) estimated that a reduction of ROM salt porosity from 0.33 to 0.10 would occur within a maximum of 100 years, and indicate that it would take more than 100 years for ROM salt porosity to drop to the target value of 0.05.

Numerical simulations conducted by Callahan and DeVries (1991, Figure 4-2 SAND91-7052) predicted the essentially total reduction in the void volume of a room filled with crushed salt within about 25 years. These predictions do not seem to be supported by the measured closure rates of Panel 1 access drifts used in Hansen and Thompson (2002).

In DOE's proposed 2006 panel closure redesign (which also used 100 feet of loosely placed ROM salt for the panel closure material), a value of 200 years was used for creep closure to reduce the porosity from an initial value of 0.33 (averaged to 0.27 when combined with the porosity of the concrete block explosion wall) to a final value of 0.05 (Vugrin and Dunagan 2006, Table 3 and p. 15 ERMS 543865). No reason is given for reducing the time required to reach a .05 porosity value from 200 years to 100 years in the PC3R PA.

1.2 Panel Closure Porosity

Parameter Name	PABC 2009 Value	Used in PC3R PA ERMS 555489	Units
PCS_T2: POROSITY	0.05 for CONC_PCS	0.05	--

Technical Question 1.2a: Please provide justification that the T2 porosity is an appropriate target value that correlates to the permeability and compressibility values used in the PC3R PA.

Technical Question 1.2b: How sensitive a parameter is the final porosity of the panel closure? That is, how much would changing the value of PCS_T2: POROSITY (e.g. to 0.01 or 0.075) change calculated results, such as waste area saturation and pressure, that are known to impact performance?

EPA Concerns

DOE's reasoning in selecting the final T2 porosity value of 0.05 is not explicit. Because the assigned porosity of the panel closure at T2 is the value from which the long-term permeability and compressibility of the panel closure are defined, EPA is asking for more information on the parameter's justification and the importance of the specific value used.

1.3 Long-Term Panel Closure Permeability

Parameter Name	PABC 2009 Value	Used in PC3R PA ERMS 555489	Units
PCS_T2:PRMX_LOG PCS_T2:PRMY_LOG PCS_T2:PRMZ_LOG	-17, -20.8, -18.8 for CONC_PCS	-17.6,-22.8,-20.2 Triangular Distribution	$\log(m^2)$

Technical Question 1.3a: Please provide a source for the permeability values assigned to the ROM salt panel seal during time period T2 that provides traceability to original sources.

Technical Question 1.3b: Please justify the assignment of permeabilities to the ROM salt panel seal during time period T2 that represent fully consolidated salt rather than ROM salt consolidated to a porosity of 0.05.

Completeness Question 1.3c: Please provide design and performance information that justifies the stated assumption that the "substantial barrier" will have no impact on panel seal performance during time period T2.

Completeness Question 1.3d: Please justify the unstated assumption that repository gas pressure buildup during time period T2 will not inhibit or reverse consolidation of the ROM salt panel seal, potentially resulting in higher porosities and therefore higher permeabilities than the recommended values.

Completeness Question 1.3e: Please justify the unstated assumption that backpressure reduction through lateral halite movement at the unconstrained ends of the 100-ft panel closure backfill can be ignored during the consolidation process.

EPA Concerns

EPA is looking for clarification on the justification of the long-term panel closure permeability.

A compilation of laboratory-measured permeability values for WIPP crushed salt at various fractional densities was prepared by Hurtado et al. (1997, Table 2-1 SAND97-1287). The most relevant results were taken from Brodsky (1994, SAND93-7058), who measured the permeability of compacted ROM salt at fractional densities near 0.95 (equivalent to a porosity of 0.05) using brine as the fluid rather than gas.

Kelley et al. (1996, p. 1 ERMS 230995) provide a summary of permeability values at various densities. The T2 permeability values recommended by Camphouse (2010b, p. 4)) are most similar to those reported by Kelley et al. (1996, Table 6) for 200-years, which represented full reconsolidation. The values recommended by Camphouse are not identical to any of those presented in the 1996 Kelley report.

The PC3R T2 permeability values are similar to the values for fully reconsolidated crushed salt reported by Kelley et al. (1996) and Hurtado et al. (1997), but not representative of porosities equivalent to 0.05. The T2 permeabilities used to represent ROM salt at a porosity of 0.05 are generally 1.5 to 2 orders of magnitude lower than those reported by Butcher et al. (1991, reported in Hansen and Callahan, 1993), Brodsky (1994), Hurtado et al. (1997, SAND97-1287), and Hansen and Thompson (2002) for compacted salt equivalent to a porosity of 0.05.

1.4 Panel Closure DRZ Permeability

Parameter Name	PABC 2009 Value	Used in PC3R PA ERMS 555489	Units
Long Term T2 Values for the PCS DRZ			
PCS_T2:PRMX_LOG PCS_T2:PRMY_LOG PCS_T2:PRMZ_LOG	-20.7, -18.8, -17.0 for material CONC_PCS	-22.8, -20.2, -17.6 Triangular Distribution	$\log(m^2)$

Technical Question 1.4a: Please justify the assignment of permeability values to the PCS DRZ during time period T2 that appear to represent a fully reconsolidated material, when the ROM salt panel closure itself has not yet fully reconsolidated and stress equilibrium has not yet been achieved.

Completeness Question 1.4b: Please explain why the anhydrite marker beds surrounding the ROM salt panel seal are not treated in the same manner as those within the waste panel DRZ.

EPA Concerns

EPA cannot trace the justification for assigned permeabilities provided by Camphouse (2010, p. 5 ERMS 554614) to supporting documentation. Both the panel closure and the surrounding rock consist of essentially similar material, disturbed Salado halite. The porosity and permeability of the disturbed halite around an ROM salt panel closure will begin to decrease when back pressure from the compacting ROM salt begins to significantly increase.

As noted by Hansen and Callahan (1993, p. 7), laboratory results indicate that little resistance is created by crushed salt during consolidation until fractional densities on the order of 0.90 are achieved. According to Hansen and Thompson (2002, p. 2), a fractional density of 0.90 is equivalent to a porosity of 0.10 and a permeability on the order of 10^{-15} m^2. Full reconsolidation of the PCS DRZ halite would be unlikely to occur until the ROM salt panel closure is itself fully reconsolidated and stress equilibrium is achieved. The T2 permeabilities assigned to the ROM PC, and therefore, also to the T2 PCS DRZ halite, are more closely representative of fully reconsolidated salt at a porosity of about 0.01 than of a partially reconsolidated salt at a porosity of 0.05.