Department of Energy
Carlsbad Field Office
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JAN 1 2 2010

Ms. Elizabeth Cotsworth, Director
Office of Radiation and Indoor Air
U. S. Environmental Protection Agency
Washington D.C., 20460

Subject: Response to the Environmental Protection Agency July 16, 2009 and October 19, 2009 Letters on the 2009 Compliance Recertification Application

Dear Ms. Cotsworth:

In response to the Environmental Protection Agency's (EPA) letters of July 16, 2009, and October 19, 2009, the U.S. Department of Energy (DOE) is providing information that answers some the questions included in the enclosures to those letters. DOE determined after review of EPA's letters that the response to many of the items noted in the October 19, 2009 letter required additional analysis or significant effort. In order to allow time for those additional analyses, while at the same time responding to the EPA's requests in a timely manner, DOE is providing responses to some of these issues and questions in this submittal.

This submittal includes four enclosures. Enclosure 1 is a hard copy of the responses. Enclosure 2 (on compact disc) provides references that were not previously submitted with the CRA-2009. Enclosure 3 is a cumulative list of errata that have been identified and corrected up this point. An updated list will be submitted to EPA with future submittals. Enclosure 4 is a table with a summary of comments received, DOE responses in this submittal, responses previously submitted and responses still pending.

If you have any questions, please contact Russ Patterson at 575-234-7457.

Sincerely,

David C. Moody

David C. Moody
Manager

Enclosure(s)
- Responses
- CDs
- Errata
- Tracking Summary Table

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EPA Comment

2-33-2

40 CFR 194.33(c)(2) states: (c) Performance assessments shall document that in analyzing the consequences of drilling events, the Department assumed that... (2) Natural processes will degrade or otherwise affect the capability of boreholes to transmit fluids over the regulatory time frame. Brine extraction wells in the vicinity of WIPP have experienced significant failures and collapse of formations near surface due to creation of cavernous features at depth. Recently, the Energy and Minerals Department Secretary Joanna Prukop directed the Oil Conservation Division to evaluate current rules and regulations governing brine wells, including an internal audit and well inspections. While brine wells are considered in the CRA-2009, it is unclear whether additional analysis was performed to determine whether any unforeseen elements that contributed to recent issues may impact CRA assumptions, and whether these should be further considered as part of the CRA-2009. That is, it is unclear whether these recent phenomenon have been considered, and how, or if, these may affect the transmissivity of formations above the solution collapse. Further, the root cause of these failures should be assessed with respect to well completion practices to determine if factors other than brine extraction (i.e. downward flow of fresh water within a poorly cemented annulus) may have impacted dissolution. Related to this, it is unclear whether the CRA-2009 has assessed injection well integrity for those wells within the 9-township boundary, as no references for this analysis were included in the CRA-2009.

DOE Response

The recent regional brine well collapses occurred after much of the CRA-2009 was prepared and therefore were not discussed or analyzed in the CRA-2009 documentation. The DOE has been evaluating these issues and presents related information in this response. In summary, the DOE believes that these events do not change conclusions or positions presented in previous compliance applications, although current information will be updated to acknowledge these collapse events and discuss their relevance to WIPP screening arguments and decisions. The following presents a more in-depth discussion of the brine well collapses, the likelihood of similar events occurring near the WIPP, and the status of brine and injection wells near the WIPP.

For regulatory purposes, WIPP assessments of compliance must make clear distinctions regarding the regional extent of the area surrounding WIPP. Historically, the greater Delaware basin has been used for the calculation of drilling rate, and the nine-township area surrounding the WIPP has been deemed appropriate for identifying other likely or relevant activities, particularly those that relate to human activities such as drilling and the exploitation of resources. These distinctions are relevant because most resource-related activities are highly dependent upon geology and site-specific characteristics and also because these geologic characteristics may change dramatically in a relatively short distance. For example, the Capitan reef, which identifies the Delaware Basin's northern boundary, is only 7 miles from the WIPP, yet subsurface geology beyond it is quite different than that near the WIPP.

WIPP personnel have been following the investigations undertaken by the New Mexico Oil Conservation Division (OCD) with great interest. In its investigation, the OCD has identified probable common causal factors for the recent collapses. These factors include: 1) operation of brine wells in shallow salt zones, 2) placement of the casing shoe near the top of the salt zone, 3) use of "reverse" circulation[1], and 4) overproduction of brine, thereby creating a large cavern (OCD 2009). These failures have not been attributed to well completion techniques or hardware failures (packer, casing, cement, and/or tubular components). The OCD has identified other brine wells that may be at risk due to the existence of these common factors, and is taking precautionary measures at one well near Carlsbad in which failure may occur.

Currently, the nearest brine solution well is approximately 20 miles from the WIPP (see Figure 2-33-2.1), and its operation poses no risk to the operation of the WIPP. Within the WIPP vicinity (nine-township area surrounding WIPP), there have been no brine wells developed or operated (past or current). As such, the WIPP is not affected in any way by currently operating brine wells. With respect to brine wells that may be established in the future, the DOE has studied the potential effects of solution mining as documented in the Third Set of Responses to EPA's March 19, 1997 request for additional information dated 14 May, 1997 (EPA Docket II-I-31), where it concluded that the effects of solution mining for brine would not affect WIPP performance. In their Compliance Application Review Document (CARD) for Section 194.32.B.1, EPA (1998) concurred with the DOE where it stated that, "...Based upon DOE's supplemental information, the restricted scale of brine extraction, and the distance involved, EPA concluded that while brine extraction (solution mining) occurs, its effects were appropriately screened out from consideration in the PA (due to low consequence)." The screening decision of "low consequence" continues for the CRA-2009. Appendix SCR-2009, FEP H59, "Solution Mining for Other Resources" discusses the potential effects of brine wells on the WIPP and concludes that these wells are screened out of performance assessment calculations on the basis of low consequence to the disposal system.

Additional to the conclusion of low consequence, there are two regulatory justifications that preclude consideration of solution mining at the WIPP. First, because brine wells

[1] Reverse circulation is an injection method which injects fresh water down the casing/tubing annulus and removes saturated brine via the tubing. Because the fresh water contacts the salt at the top of the cavity, the solution cavity grows in an inverted cone shape, reducing the structural integrity of the roof.

have not been developed near the WIPP site in the past or current time frames, the Future States Assumption provided in Section 194.25 would exclude such activities in performance assessment. Second, the EPA's own criteria place limits on the nature and scope of future human activities that relate to drilling. As stated by the EPA (1998) in their CARD for 194.32.B.1, "...The Agency finds that the impact of solution mining on the PA does not need to be analyzed for boreholes drilled in the future as specified in Section 194.33(d)."[2] As a matter of practice, the WIPP project has screened speculative future processes such as this on low consequence, when a low consequence argument can be made. The low consequence arguments used in screening this FEP augments the regulatory exclusions that could be applied.

With regard to the consequences to formations above a solution collapse, the DOE believes that any effects caused by brine extraction at or near the WIPP are considered to be represented by the mining scenario in performance assessment. In their Supplementary Information to 40 CFR 194, EPA requires that performance assessments incorporate mining by significantly varying the hydraulic transmissivity within the overlying rock units (EPA 1996). This is because the most significant effect of total removal of an ore body is understood to be subsidence and disruption of the overlying rocks. The effects of subsidence due to brine extraction are therefore accounted for within the mining scenario in performance assessment.

With respect to evaluating the integrity of injection wells within the vicinity of the WIPP, no such information was presented in the CRA-2009. The DOE has since gathered data on well configurations for the 55 wells currently permitted as injection wells within the nine-township area surrounding the WIPP (WRES 2009). WRES (2009) shows that all 55 of these injection wells are cased through the salt section to preclude dissolution of the salt should tubing and/or packer failure occur. Additionally, 53 of these have at least one other casing and/or cement barrier to further isolate the salt from any potential tubing or packer leak. A representation of the wellbore configuration typical of most of these saltwater disposal wells is presented in Figure 2-33-2.2. It should also be recognized that salt water disposal wells such as these differ from brine solution wells in that the injected fluid is already near saturation and therefore would dissolve the salt very slowly should the necessary wellbore failures occur such that pressurized fluid were to be in communication with the Salado formation. Therefore collapse events such as those that have recently occurred in brine solution wells are not expected to occur in the salt water disposal or injection wells in the vicinity of WIPP.

In summary, the recent brine well collapses are not sufficiently near the WIPP to impact repository performance. Additionally, within the WIPP vicinity (nine-township area

[2] 40 CFR 194.33 (d) states: "With respect to future drilling events, performance assessments need not analyze the effects of techniques used for resource recovery subsequent to the drilling of the borehole."

surrounding WIPP), there have been no brine wells developed or operated (past or current). The DOE believes that these events do not change current screening arguments or decisions, that current performance assessment models appropriately address uncertain future human-initiated events, and that current positions are consistent with regulatory guidance and criteria.[3] The DOE believes that it is important to monitor, analyze, and document the impacts of developing issues such as these recent brine well collapses, and will update compliance documentation as appropriate at each recertification cycle.

[3] The Future States Assumption of 40 CFR 194.25(a) states that the DOE shall, "...assume that characteristics of the future remain what they are at the time the compliance application is prepared provided that such characteristics are not related to hydrogeologic, geologic or climatic conditions." Therefore, because drilling for resources and conventional potash mining are currently occurring near the WIPP, the DOE assumes these activities will continue in the future and represents them in performance as appropriate. Alternatively, future human events such as solution mining have not been included in performance assessment because such activities have not occurred (nor presently occur) in the vicinity near WIPP.

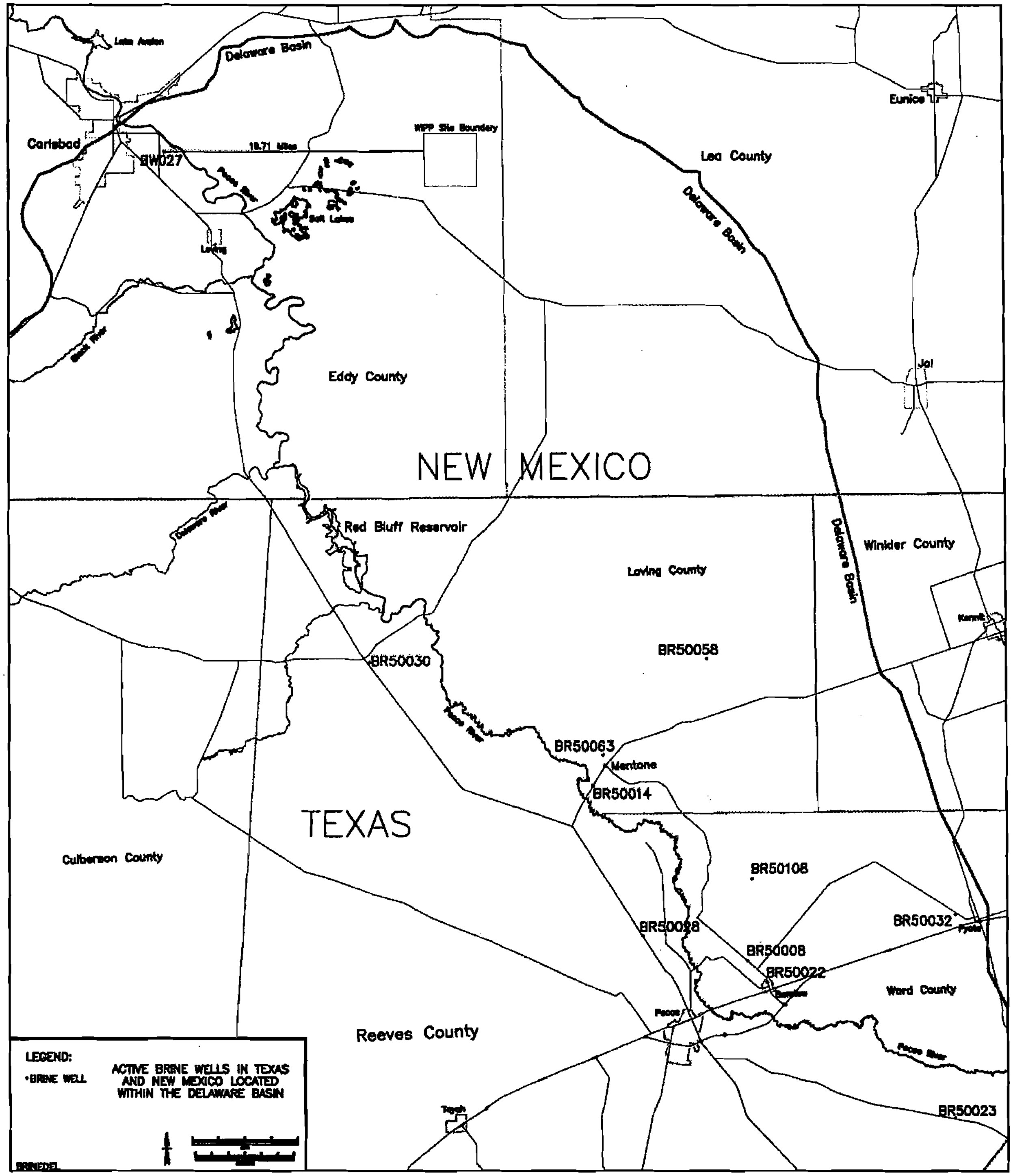

Figure 2-33-2.1 Active Brine Wells in Texas and New Mexico Within the Delaware Basin

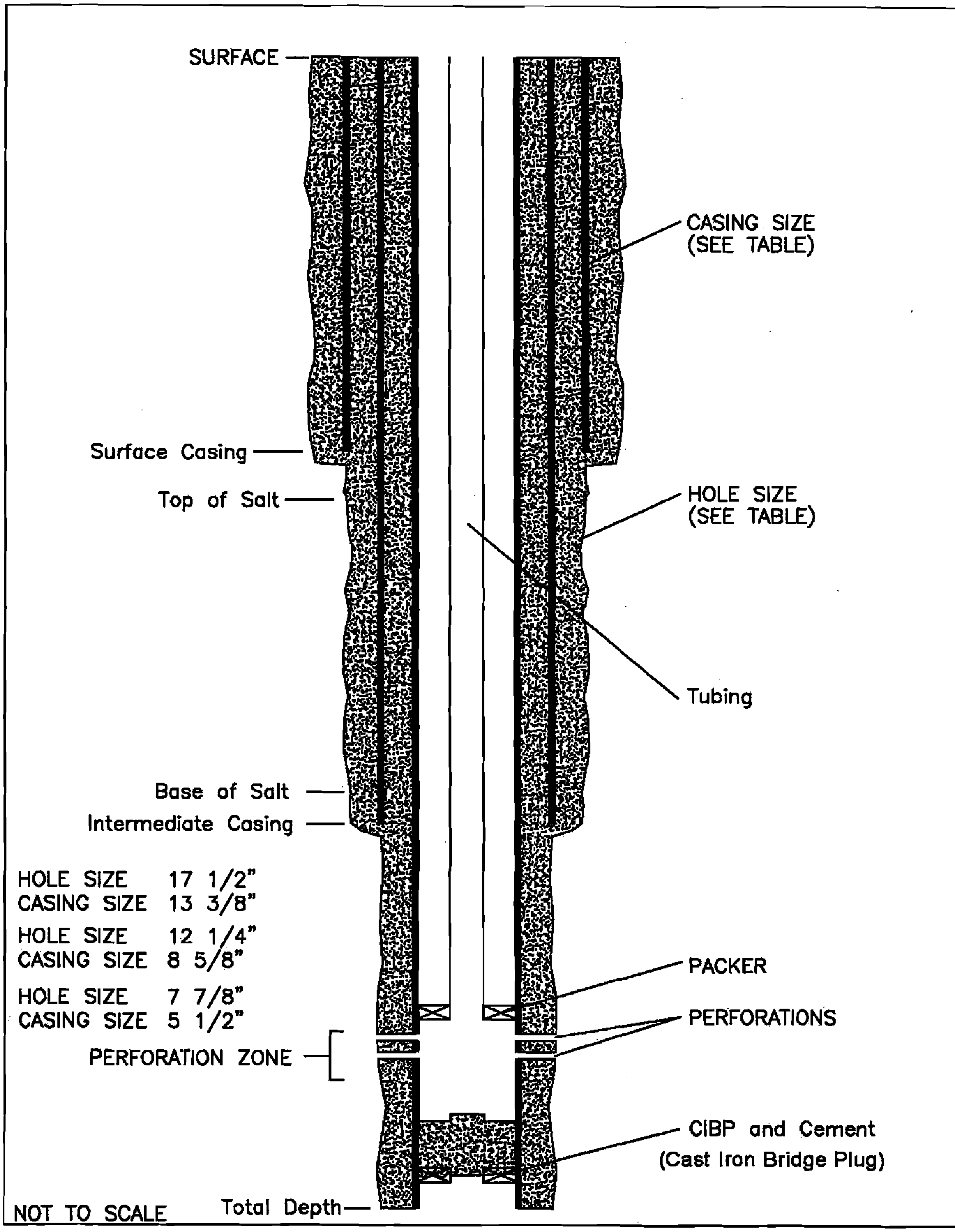

Figure 2-33-2.2 Typical Injection Well Design

DOE References

Environmental Protection Agency (EPA) 1996. Title 40 Code of Federal Regulation Part 194, February 9, 1996. Supplemental Information. Federal Register Volume 61, No. 28. pp. 5224-5245. Washington D.C.

Oil Conservation Division (OCD) 2009. Brine Well Collapse Evaluation Report, June 18, 2009. New Mexico Energy, Minerals and Natural Resources Department. OCD. Santa Fe, NM.

Washington Regulatory and Environmental Services (WRES) 2009. Injection Well Design and Operation in the Nine Township Area. October 15, 2009. Delaware Basin Drilling Surveillance Program. ERMS 552225. Carlsbad, NM.

EPA Comment

2-33-3

Dakota Salts, LLC, is a Denver based company that has proposed the use of Deep Salt Caverns for storage of compressed air generated by windfarms. Dakota Salts currently has eight salt caverns in North Dakota and, according to their website, is "...prepared to enter the regulatory and permitting stage and is working with the North Dakota Industrial Commission and North Dakota Department of Mineral Resources to establish the State's first regulatory control project" for storage of compressed air that would be released through windfarm operations during periods of low wind generation. The CRA-2009, including the DBMR[1], does not address whether there are any known plans to use existing salt or potash mines for this purpose.

EPA References

U.S. Department of Energy (DOE). 2007. Delaware Basin Monitoring Annual Report. DOE/WIPP 07-2308. Carlsbad, NM: Carlsbad Field Office

DOE Response

Due to the speculative nature of trying to predict future human activities, the Future States Assumption provided in 40 CFR §194.25 states that performance assessments should, "...assume that characteristics of the future remain what they are at the time the compliance application is prepared..." Since salt caverns are not currently used within the vicinity of the WIPP (or the greater Delaware Basin) for compressed air storage, they have not been included in WIPP performance scenarios. Currently, there are no windfarms in the New Mexico portion of the Delaware Basin. Consequently, there are no known plans to use salt caverns for the storage of compressed air generated by windfarms at this time. Based on the DOE's wind resource map (see Figure 2-33-3.1) the area in the vicinity of the WIPP is listed as "marginal," rendering the development of wind resources near WIPP in the future questionable. It is acknowledged, however, that the economics of the future may be such that activities that are not profitable today may become more attractive in the future. WIPP monitoring programs will continue to monitor human activities to keep abreast of any technological advances used in current resource-related activities and to identify the initiation of new activities not previously employed or attempted in the WIPP vicinity.

[1] DMBR – Delaware Basin Monitoring Annual Report (DOE 2007)

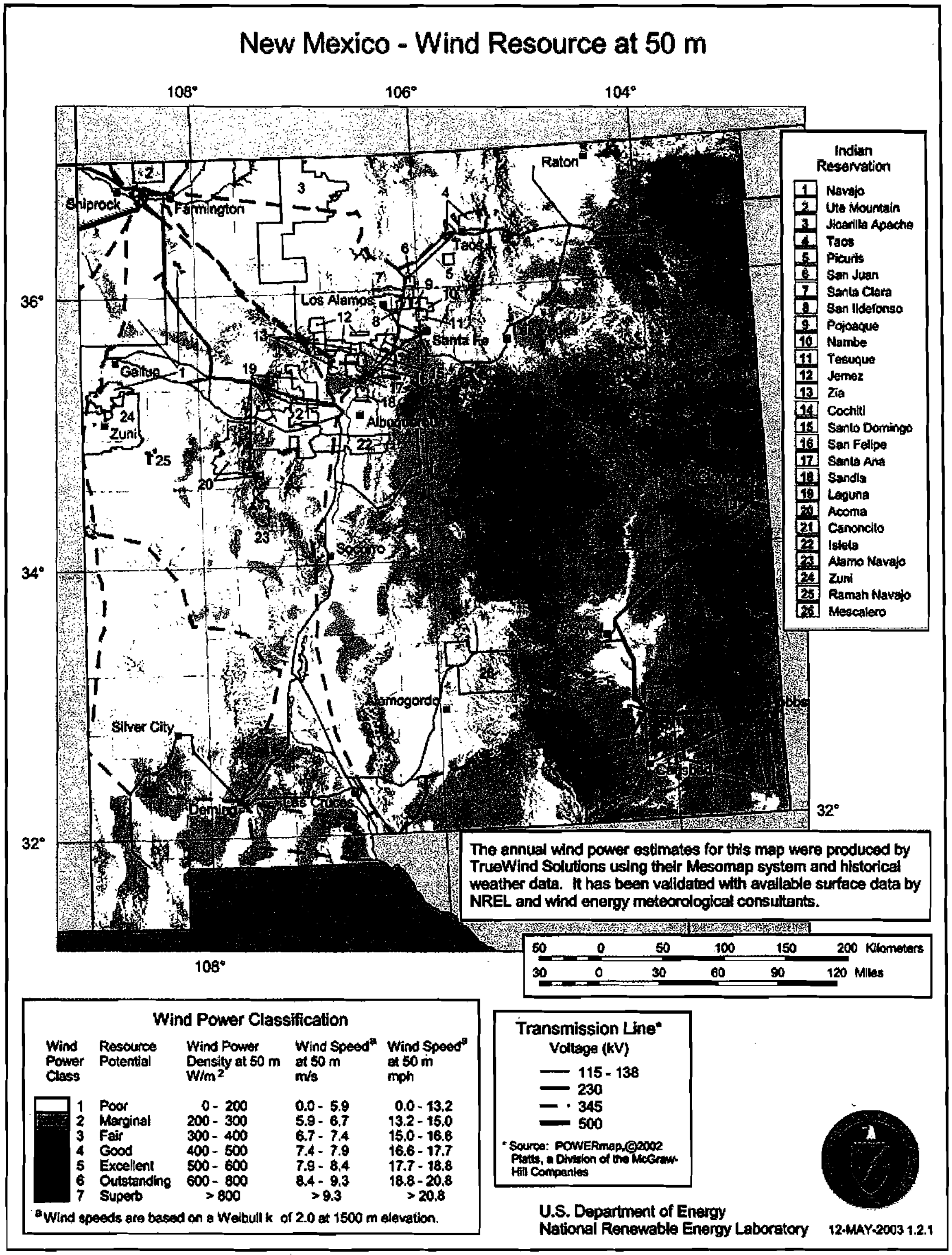

Figure 2-33-3.1 New Mexico Wind Resources Map

DOE References

DOE Energy Efficiency & Renewable Energy Website. 2009. Wind and Hydropower Technologies Program. Wind Resource Map at http://www.windpoweringamerica.gov Retrieved November 2, 2009.

EPA Comment

2-33-4

Carbon sequestration is being assessed on a nationwide basis, including the Permian Basin (http://www.southwestcarbonpartnership.org/). The Southwest Regional Partnership (SWP), was selected by the U.S. Department of Energy and its National Energy Technology Laboratory (NETL) as one of the seven regional partnerships charged with evaluating available technologies to capture and to reduce the emissions intensity of greenhouse gases in the southwest region through a process known as carbon sequestration. The project includes several different analyses such as CO_2 coalbed sequestration, saline aquifer CO_2 sequestration (i.e. injection into saline water-bearing formations), and terrestrial/biotic sequestration. New Mexico was included in the SWP evaluations, as the state contains several highly saline water-bearing intervals that may offer sequestration opportunities. While elements of CO_2 sequestration are addressed in different HI [human intrusion] scenarios, CO_2 sequestration is not specifically identified in the human intrusion analysis.

DOE Response

It is correct that CO_2 sequestration is not represented in performance assessment. The following discusses the regulatory and technical bases for the content of WIPP performance scenarios as they relate to future human activities, both inside and outside the WIPP boundary. The WIPP performance assessment includes both disturbed and undisturbed performance scenarios. Disturbed performance scenarios include the effects of inadvertent, intermittent human intrusion by exploratory drilling for resources, and include the effects of a "direct hit" of waste by the drill bit. This is consistent with the WIPP Certification Criteria at 40 CFR 194.33 (a)(1), where it states, "Inadvertent and intermittent intrusion by drilling for resources ... ... is the most severe human intrusion scenario." Also, 40 CFR 194.33 (d) limits the scope of drilling activities in these scenarios where it states: "With respect to future drilling events, performance assessments need not analyze the effects of techniques used for resource recovery subsequent to the drilling of the borehole." Therefore, WIPP Human Intrusion scenarios do not include the direct effects of carbon dioxide (CO_2) sequestration (neither saline nor terrestrial).

However, the effects of injection activities *outside* the WIPP boundary are not excluded from WIPP analyses by the explicit regulatory exemption provided in 40 CFR 194.33 (d). That is, while they may not be included explicitly in a *direct* intrusion scenario, such activities may warrant consideration indirectly through analyses of human activities outside the WIPP boundary. Such events are identified through the WIPP features, events, and processes (FEPs) identification and screening process detailed in Appendix SCR-2009. For example, human-initiated events that relate to injection near the WIPP are FEP H27, "Liquid Waste Disposal – Outside the WIPP Boundary (OB);" and FEP H28 "Enhanced Oil and Gas Production – OB." Both of these activities are currently practiced in the vicinity of WIPP, and therefore cannot be excluded on the grounds of 40 CFR 194.25, "Future States Assumption." As such, the potential effects of these processes were analyzed in Stoelzel and O'Brien (1996) and Stoelzel and Swift (1997) to determine their impact to WIPP performance. These studies analyzed out-of-zone water injection (whether for brine disposal or enhanced oil recovery (EOR)) near the WIPP boundary to determine if the repository would be adversely affected. Because properly functioning injection wells do not result in the migration of fluids beyond the target interval, failures were assumed to occur in the tubing packer, the casing, and cement sheath around the casing. Further, it was assumed that injection pressures above those typically permitted were reached. Even using these worst-case failure modes, the analyses concluded that hypothetical injection failures would not adversely affect WIPP performance. Therefore, FEPs H27 and H28 (liquid waste disposal outside the WIPP boundary and enhanced oil and gas production outside the WIPP boundary) have been excluded from performance assessment calculations due to low consequences to the disposal system. These arguments also hold true if CO_2 were being injected instead of water or brine.

Currently, the WIPP baseline does not include a FEP which specifically addresses CO_2 sequestration, although aspects of this proposed activity are discussed in WIPP FEPs H29, "Hydrocarbon Storage – OB," and H59, "Solution Mining for Other Resources." Appendix SCR-2009, Section SCR-5.2.2.4.6, *Solution Mining for Gas Storage* states that "...No gas storage cavities have been solution mined within the New Mexico portion of the Delaware Basin." No further examination is provided for this activity, due to the Future State Assumption provided at 40 CFR 194.25. Appendix SCR-2009, Section SCR-5.2.2.4.7 *Solution Mining for Disposal* states, "...Solution mining can be used to create a disposal cavity in bedded salt. Such disposal cavities can be used for the disposal of naturally occurring radioactive material or other wastes. No such cavities have been mined or operated within the vicinity of the WIPP." Such disposal would be analogous to a solution cavity being used for the storage or disposal of greenhouse gases. However, because no such activity has occurred or is occurring in the vicinity of WIPP, no further consideration has been given (although the effects are not thought to be significantly different than those represented in the previous analyses of fluid injection).

The DOE believes that the periodic recertification of the WIPP's performance is an opportunity to take into account advances in technology and changes and updates to human activities. Such is the case for CO_2 injection (whether for sequestration or enhanced oil recovery [EOR]). Therefore, CO_2 sequestration is a potential activity that is being monitored in WIPP human activities monitoring. For example, in Appendix SCR-2009, CO_2 sequestration is recognized as an activity that could occur in the future, should political and economic forces merit. In a supporting reference to Appendix SCR-2009, Melzer (2008) evaluates the potential for CO_2 sequestration to be utilized as an EOR technique. Melzer illustrates that while CO_2 flooding is a viable EOR technique in certain reservoirs, the potential to use captured carbon from industrial processes may make CO_2 injection even more attractive in the future. While such techniques are currently not being employed, WIPP monitoring activities will continue to keep abreast of any advancements and project start-ups that may affect the current state of human industrial practices as they pertain to the WIPP vicinity and WIPP performance.

DOE References

Melzer, L.S. 2008. An Assessment of the CO_2-Enhanced Oil Recovery Potential in the Vicinity of the Waste Isolation Pilot Plant (June). ERMS 550502. Midland, TX: Melzer Consulting.

Stoelzel, D.M., and D.G. O'Brien. 1996. The Effects of Salt Water Disposal and Waterflooding on WIPP. Summary Memorandum of Record for NS-7a. ERMS 240837. Albuquerque: Sandia National Laboratories.

Stoelzel, D.M., and P.N. Swift. 1997. Supplementary Analyses of the Effect of Salt Water Disposal and Waterflooding on the WIPP. ERMS 244158. Albuquerque: Sandia National Laboratories.

EPA Comment

2-33-5

In the CRA-2009, DOE changed the maximum time a DBR can occur from 11 days to 4.5 days. The maximum DBR duration is represented in PA by the parameter MAXFLOW and used in the code BRAGFLO. The CRA-2009 states "Kirkes (2007) documents that this change is in keeping with current drilling practices within the Delaware Basin and the previous assumption of 11 days was incorrect. Kirkes and Clayton (2008) document the impacts of reducing the maximum duration of DBR and show that this change has a very minor impact upon performance predictions. Appendix PA-2009, Section PA.9.3 discusses the contribution of DBR to total releases for the CRA-2009 performance calculations. Therefore, DOE continues to comply with 40 CFR §194.33(c)."

Review of Kirkes (above, 2007) raised the following completeness questions:

a. *The South Culebra Bluff Blowout is cited as an inappropriate analogy for a WIPP brine release based on the formation encountered, downhole pressures anticipated, gas content/ignition, etc. The document does not address whether there are analogies elsewhere (e.g. unanticipated brine pockets encountered at relatively shallow depths in salt formations) that are more representative of potential conditions anticipated at the WIPP.*

EPA References

Kirkes, G.R. 2007. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment (Revision 0). ERMS 545988. Carlsbad, NM: Sandia National Laboratories.

Kirkes, R., and D. Clayton. 2008. Impact Analysis of Decreased Duration of Direct Brine Release in WIPP Performance Assessment, Revision 0. (March 10). 2008. ERMS 548313. Carlsbad, NM: Sandia National Laboratories.

DOE Response

While there are limited reported occurrences of brine flows from units above the Delaware Mountain Group, there are no cases of catastrophic well control loss, as in the South Culebra Bluff. As documented in Kirkes (2007), conversations with drillers indicate that occurrences of pressurized brine flows are quite rare in the vicinity of WIPP, and when they do occur, drilling progress is seldom interrupted. In cases when the driller chooses to shut in the well, it is done due to the presence of gas or to determine the presence of gas. If no gas is present, then drilling resumes. Gas kicks[1] are more difficult (and dangerous) to handle because gas entrained in the mud returns lightens the mud column and may threaten well control. Therefore, the majority of drillers surveyed in the analysis state that they would shut in a gas kick, but would let a brine kick flow, once the absence of gas was confirmed (allowing the flow of brine does not slow drilling, casing, and cementing procedures as discussed further in response to comments 2-33-5c and 2-33-5d). Unmitigated flow from the repository to the surface is represented by the DBR scenario.

The DOE believes that the hypothetical scenario posed to the drillers in the survey (Kirkes 2007) accurately represents downhole conditions representative of a pressurized repository. The survey responses effectively reflect how a driller would react to a pressurized brine flow originating from the Salado and represents current practice in the area. The drillers' responses to the hypothetical scenario are consistent with what is documented in EPA's Background Information Document (BID) for 40 CFR 194 where the Cedar Breaks "2" State (API 30-015-27406) intercepted a pressurized brine flow in the McNutt potash zone of the Salado Formation May 1, 1993. New Mexico Oil Conservation Division (OCD) records show that this well was temporarily shut in for four hours, flow rates were determined and the absence of gas was verified. Drilling then continued uninterrupted while brine was allowed to flow until the target depth for the intermediate string was reached (1,555 ft below ground surface). The casing was then set and cemented without interruption. The driller's reaction to this unexpected water flow is very consistent with the answers provided by the drillers interviewed in Kirkes (2007a). While the Cedar Breaks "2" well is outside the Delaware Basin, it does provide a useful analog regarding a driller's reaction to an unexpected pressurized brine flow and is consistent with both the most recent driller's survey and the assumptions used in the current DBR model.

DOE References

Kirkes, G.R. 2007. Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545980. Carlsbad, NM: Sandia National Laboratories.

[1] A "kick" is an entry of water, gas, oil, or other formation fluid into the wellbore during drilling. It occurs because the pressure exerted by the column of drilling fluid is not great enough to overcome the pressure exerted by the fluids in the formation drilled.

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b. *Review of drillers' comments (Memorandum, Document Number 545844) indicates that many drillers have never encountered a situation that would require mitigation of a brine release or blow out at shallow depths in the Delaware Basin. Kirkes (2007) takes this into account by calculating the anticipated time it would take to acquire appropriate materials, but it is unclear whether the actual response time from the crew takes into account this lack of experience. Please indicate whether there are any other considerations short of material availability, that were considered when evaluating this circumstance.*

EPA References

545844 (Kirkes, G.R. 2007). Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545844 (Superseded by ERMS 545980). Carlsbad, NM: Sandia National Laboratories.

Kirkes, G.R. 2007. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment. April 27, 2007. ERMS 545988. Carlsbad, NM. Sandia National Laboratories.

DOE Response

Conservative assumptions (such as maximum repository pressures) were used when developing the hypothetical scenario represented to the drillers in the survey. When evaluating the responses from the drillers, other considerations such as bad weather and conservative travel times were used in the development of the response time. However, while it is correct that most drillers have not encountered a situation similar to the hypothetical scenario presented in the questionnaire in Kirkes (2007a), this should not be interpreted as a lack of knowledge of common well control techniques. All the drillers interviewed were very familiar with kill techniques[1] and state that the primary safety feature on the drilling rig is the blow-out preventer (BOP). All drillers interviewed state that they have BOPs rigged up and that these BOPs are routinely tested. In addition to BOPs, mud additives such as weight agents (barite) are either on site or readily available from local vendors. One driller stated that they *may not yet* have such additives on site while drilling the intermediate section of the borehole, because over-pressurized brine or gas is so rare at such a shallow depth. Therefore, in this case, weight additives would be brought to the site prior to drilling deeper zones where overpressure is more common. Another driller in the survey stated that barite or other additives are always on hand at his rig.

[1] "Kill techniques" are methods used to overcome pressure in a well by use of mud or heavy drilling fluids such that the hydrostatic pressure within the wellbore (as exerted by the drilling fluid) exceeds formation pressure, thus prohibiting formation fluids or gas from entering the wellbore.

The mitigation scenario in the DBR Report (Kirkes 2007b) conservatively assumed that mud weighting additives would not be present on site and therefore would be trucked in after the high pressure zone was encountered. In the case of a high pressure kick that threatens losing control of the well, the BOPs would be activated (closed), thus shutting in the well. During this shut-in period, weight additives could be mixed (if on hand), or dispatched from the nearest vendor if not available on site.

DOE References

Kirkes, G.R. 2007a. Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545980. Carlsbad, NM: Sandia National Laboratories.

Kirkes, G.R. 2007b. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment. April 27, 2007. ERMS 545988. Carlsbad, NM: Sandia National Laboratories.

EPA Comment

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c. *Several drillers (reference 545844) indicated that they may never detect a brine release from the repository given the hypothetical release conditions posed by Kirkes (2007). While this may be improbable under the assumed downhole pressure conditions, the consequences that a lack of release detection would have with respect to release scenarios or performance assessment has not been addressed in the references reviewed or in Kirkes (2007). Please provide this information.*

EPA References

545844 (Kirkes, G.R. 2007). Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545855 (Superseded by ERMS 545980). Carlsbad, NM: Sandia National Laboratories.

Kirkes, G.R. 2007. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment (Revision 0). ERMS 545988. Carlsbad, NM: Sandia National Laboratories

DOE Response

There would be no impacts upon the current DBR modeling assumptions if a driller failed to detect that a brine flow was occurring. In fact, this is precisely what the DBR model assumes. Current DBR conditions are such that a DBR will occur if: 1) repository pressure exceeds 8 megapascals (MPa), and 2) the repository contains sufficient mobile brine. The DBR model then assumes that flow will continue until one of the following occurs: 1) repository pressure drops below 8 MPa, 2) available brine is depleted, or 3) the 4.5 day maximum DBR duration is reached. In the case where the driller does not notice that a flow is occurring, the intermediate section of the borehole would be completed, cased and cemented within three days, according to current practices in the vicinity (Leonard, 1996). Because the minimum duration for DBR has been set at three days, failure to detect is represented by allowing flow while normal drilling, casing, and cementing operations continue (unless one of the limiting assumptions above occurs first). If repository conditions merit, flow may continue, although this is a conservative assumption and ignores the fact that the driller would complete this section of the borehole in three days or less. This three-day minimum duration is based on previous WIPP surveys and information in Section 9.3.1.2 of EPA's Background Information Document (BID) for 40 CFR 194 (EPA 1996).

DOE References

Environmental Protection Agency (EPA). 1996. Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal

Regulations. Background Information Document for 40 CFR Part 194. EPA 402-R-96-002. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, DC.

Leonard, R.J. 1996. "Commonality of Pressurized Brine Encounters within the Delaware Basin." Memorandum from R. Leonard to M. Marietta. July 31, 1996. ERMS 240850. Carlsbad, NM: Westinghouse Electric Corporation.

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d. *One driller interviewed in reference 545844 indicated that if a brine kick was encountered, he would probably let brine flow to surface without any attempt at mitigation. However, Kirkes (2007) and other references examined do not appear to address the likely duration of unmitigated flow and impact on PA assumptions. Please provide or cite references that address this occurrence.*

EPA References

545844 (Kirkes, G.R. 2007). Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545855 (Superseded by ERMS 545980). Carlsbad, NM: Sandia National Laboratories.

Kirkes, G.R. 2007. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment (Revision 0). ERMS 545988. Carlsbad, NM: Sandia National Laboratories

DOE Response

As stated in the response to EPA question 2-33-5c, there would be no impacts upon the current DBR modeling assumptions if a driller failed to detect that a brine flow was occurring. As identified in Kirkes (2007), not all drillers state that they would react in the same manner to the hypothetical conditions presented in the questionnaire. Reactions vary based on personal experience, training, and other personal factors such as risk aversion, etc. It is clear, however, that most drilling decisions are based on maximizing drilling efficiency and continued progress towards target depth. Some drillers state that only when a fluid flow is sufficient to exceed pit capacity (thus requiring excess brine to be trucked away for disposal), would shutting in the well become necessary. Otherwise stated, only when the flow becomes an obstacle to drilling progress, or presents a safety or environmental concern, would mitigation techniques be sought. Therefore, under these circumstances, the flow would continue until the intermediate interval was drilled, cased, and cemented. These procedures would take no more than three days, which is the minimum duration for direct brine release (Leonard 1996). Therefore, unmitigated flow has no impact on performance assessment assumptions, and is represented by the three-day minimum duration used in performance assessment.

DOE References

Kirkes, G.R. 2007. Documentation of Personal Interviews with WIPP Area Drilling Personnel. April 26, 2007. ERMS 545980. Carlsbad, NM: Sandia National Laboratories.

Leonard, R.J. 1996. "Commonality of Pressurized Brine Encounters within the Delaware Basin." Memorandum from R. Leonard to M. Marietta. July 31, 1996. ERMS 240850. Carlsbad, NM: Westinghouse Electric Corporation.

EPA Comment

2-33-5

e. *Additionally, it is unclear what effect brine shut-in would have with respect to duration of flow and downhole conditions. Please provide references that address the effects that surface shut in (prior to brine kill) would have on downhole conditions below the surface casing, assuming that surface casing is set to approximately 900 ft with the remainder of the hole open. (At that point, intermediate casing would not have been set.)*

DOE Response

If pressures were sufficient to cause the well to be shut-in, flow from the wellbore into the casing (and upwards to the surface) would cease. The following excerpt from Kirkes (2007) provides an explanation of flow and relative downhole pressures:

> "…Should a high pressure kick occur (approaching an SIDPP [Shut-in Drillpipe Pressure] of 1,000 psi), it is standard procedure for the driller to shut-in the well. Such is the case during the "wait and weight" method of well control (Grace, 2003). During this shut-in period, no flow to the surface occurs. Only during the actual kill procedure, when the kill-weight mud is being pumped down the drillpipe, can formation fluids (in this case contaminated brine from the repository) flow to the surface. During the kill procedure, mud returns are regulated through a choke until kill fluids have been circulated down the drill string and back up the drillpipe/casing annulus. Once the kill-weight mud has been circulated completely throughout the well, there should be zero surface pressure on the drillpipe and the drillpipe/casing annulus, indicating zero flow into the wellbore (Grace, 2003). In such a scenario, fluid from the repository could only flow into the wellbore during the kill procedure, and then only at a very slow rate, due to the choking and regulating process used in the kill procedure. This may result in flow to the surface of only one-half hour or less; the period of time it takes to circulate the kill fluid (Grace, 2003). Once the flow has been killed, normal drilling operations would continue until the target depth for the intermediate string is reached. The kill-weight mud would continue to be used throughout the remainder of this interval, thus keeping high pressure formation fluids in place. Finally, when setting the intermediate casing string, the heavy mud would continue to be used until the casing is set and cemented. It is likely that very little flow from the repository would occur, once the kill-weight mud was in circulation."

The point of this observation is that should a driller encounter pressure sufficient to warrant shutting in the well while a kill-weight mud was prepared, the duration of flow to the surface would be *even less* (perhaps significantly less) than if the flow was undetected, and allowed to continue until the intermediate string interval was cased and cemented. That is, when considering real-world drilling techniques (not those used in a hypothetical model), higher pressures do not necessarily result in increased flow or duration. The current DBR model employed in WIPP performance assessment conservatively ignores the fact that a shut-in well does not flow to the surface.

DOE References

Grace, R. D. 2003. "Blowout and Well Control Handbook." Elsevier Science, 2003.

Kirkes, G.R. 2007. Evaluation of the Duration of Direct Brine Release in WIPP Performance Assessment. April 27, 2007. ERMS 545988., Carlsbad, NM: Sandia National Laboratories.

EPA Comment

3-23-9 FEPs (194.23)

EPA supports the systematic approach required by SP 9-4 and believes that it will improve the maintenance, accuracy, and traceability of DOE's FEPs baseline. In reviewing SP 9-4, EPA found discrepancies in the identification of documentation that should be resolved. Section 3.0 of SP 9-4 identifies three QA Records: a FEPs Assessment Analysis Report, a Document Review Comment form per NP 6-1, and a Revised Baseline FEPs List (BFL). The FEPs Assessment Analysis Report appears to be the report documenting the results and recommendations of the baseline FEPs assessment mentioned in Section 2.4.8 of SP 9-4, however, Section 2.4.9 of SP 9-4 states that the PA Manager is to sign the cover sheet for the FEPs Impact Assessment Report. If the FEPs Impact Assessment Report is different from the FEPs Assessment Analysis Report, it should also be included as part of the QA record. If these are the same reports, they should be given the same name. DOE should clarify these different documents when including them in the future.

DOE Response

The EPA is correct in identifying the inconsistency in nomenclature in sections 2.5.9 and 3.0 of Sandia Procedure (SP) 9-4 (Kirkes 2009). The terms, "FEPs Impact Assessment Report" and "FEPs Assessment Analysis Report" are in fact referring (in generic terms) to the unique report generated for each FEP assessment, not a specific FEPs assessment report. In SP 9-4, these terms are used generically, since each FEP assessment is named with a specific title indicating the scope of the assessment (e.g., "Features Events and Processes Assessment for the Panel Closure System Redesign"), however the inconsistency is not appropriate and will be corrected via revision of SP 9-4.

DOE References

Kirkes, G.R. 2009. Activity/Project Specific Procedure SP 9-4, Performing FEPs Baseline Impact Assessments for Planned or Unplanned Changes, Revision 2. August 24, 2009. ERMS 551859.Carlsbad, NM: Sandia National Laboratories.

CRA 2009 ErrataTracking

Error #	Error Description	Correction	Originator	Responsibility	Status	Date of Completion
1	EPA comment 1-C-15 In Appendix SOTERM-2009, Table SOTERM-21, the parameter descriptions for PHUMCIM and PHUMSIM indicate "actinide solubilities are inorganic only (complexes with man-made organic ligands are not important); solubilities were calculated assuming equilibrium with Mg-bearing minerals (brucite and magnesite)." DOE should correct these statements to clarify that organic ligands were considered during calculation of the solubilities used with these proportionality constants for the CRA-2004 PABC, and that the solubilities were calculated assuming equilibrium with brucite and hydromagnesite.	The description for PHUMCIM in Appendix SOTERM-2009, Table SOTERM-21 should be changed to "Proportionality constant for concentration of actinides associated with mobile humic colloids; in Castile brine; actinide solubilities include organics (complexes with man-made organic ligands); solubilities are calculated assuming equilibrium with Mg-bearing minerals (brucite and hydromagnesite)."	EPA	LANL-Reed	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009
2	EPA comment 1-C-15 In Appendix SOTERM-2009, Table SOTERM-21, the parameter descriptions for PHUMCIM and PHUMSIM indicate "actinide solubilities are inorganic only (complexes with man-made organic ligands are not important); solubilities were calculated assuming equilibrium with Mg-bearing minerals (brucite and magnesite)." DOE should correct these statements to clarify that organic ligands were considered during calculation of the solubilities used with these proportionality constants for the CRA-2004 PABC, and that the solubilities were calculated assuming equilibrium with brucite and hydromagnesite.	The description for PHUMSIM in Appendix SOTERM-2009, Table SOTERM-21 should be changed to "Proportionality constant for concentration of actinides associated with mobile humic colloids; in Salado brine; actinide solubilities include organics (complexes with man-made organic ligands); solubilities are calculated assuming equilibrium with Mg-bearing minerals (brucite and hydromagnesite)."	EPA	LANL-Reed	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009

3	EPA comment 1-C-18 In Appendix MgO-2009, Section 4.2.2, DOE claims that hydromagnesite will completely convert to magnesite during the 10,000 year WIPP regulatory time period. However, DOE's evaluation of the likely conversion of hydromagnesite to magnesite ignores information about this issue presented in SCA (2008). As part of a thorough evaluation of the likely conversion rate for hydromagnesite to magnesite, SCA (2008) cited data from Vance et al. (1992) that showed hydromagnesite can persist for as long as 6,200 years. In addition, DOE does not consider that slow CPR degradation will result in continuous brucite carbonation during the 10,000-year regulatory period, rather than hydromagnesite formation that occurs only for a short time following repository closure. Consequently, even if hydromagnesite formed in the repository converts to magnesite within a few thousand years, hydromagnesite is likely to remain in the repository and would be likely to influence carbon dioxide fugacity for the entire 10,000-year regulatory period. DOE should revise this discussion to show that hydromagnesite is likely to be present in the backfill throughout the WIPP regulatory period.	The following statement should be added at the end of Subsection 4.2.2 of Appendix MgO 2009 to clarify the text in this subsection: "Based on the evidence discussed above, the DOE concludes that it is still unclear whether hydromagnesite will persist or convert to magnesite during the 10,000-year WIPP regulatory period. However, the EPA has specified that the brucite-hydromagnesite (5424) reaction be used to buffer the CO2 fugacity for compliance-related actinide-solubility calculations since the CCA PAVT (Trovato, 1997; U.S. EPA, 1998)."	EPA	SNL-Brush	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009

4	EPA comment 1-C-19 In Appendix MgO-2009, Section 5.1, DOE states that the actinide solubilities in WIPP brines calculated for the CRA-2004 PA and CRA-2004 PABC differed because of "changes in the thermodynamic databases for the An(III), An(IV), and An(V) models." The thermodynamic database for the An(IV) model changed between these two PA calculations when the chemical potential (μ0/RT) for Th(OH)4(aq) was revised. On the other hand, the An(III) and An(V) solubility results changed because of a recalculation of ligand concentrations. EPA was not informed of any changes to the thermodynamic data for the An(III) and An(V) oxidation states. DOE should either correct this statement or document the revised thermodynamic data.	The statement that, "The An(III), An(IV), and An(V) solubilities predicted for the CRA-2004 PA and PABC calculations are different for both brines because of changes in the thermodynamic databases for the An(III), An(IV), and An(V) models between these calculations" (U.S. DOE, 2009, Appendix MgO, Subsection 5.1, p. MgO-32), is incorrect. It should state, "The An(III) solubilities predicted for the CRA-2004 PA and PABC calculations are different for both brines because of an increase in the concentration of EDTA (compare Brush and Xiong, 2005, Table 4, columns labeled "CRA-2004 PA" and "PABC"). The An(IV), solubilities predicted for the CRA-2004 PA and PABC calculations are different for both brines because of changes in the thermodynamic database for An(IV). The An(V) solubilities predicted for the CRA-2004 PA and PABC calculations are different for both brines because of the inclusion of the solubility-limiting phase whewellite (Ca oxalate·2H2O) in the FMT database, which decreased the dissolved oxalate concentration despite an increase in the concentration of oxalate prior to precipitation of whewellite (compare Brush and Xiong, 2005, Table 4, columns labeled "CRA-2004 PA" and "PABC").	EPA	SNL-Brush	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009

5	EPA comment 1-C-20 In the discussion of MgO uncertainties (Appendix MgO-2009, Section 6.2.4.4), DOE does not include the uncertainties associated with the chemical composition of the cellulose, plastics, and rubber in the WIPP inventory. DOE should acknowledge this uncertainty in the discussion.	The following statement should be added at the end of the first paragraph of Subsection 6.2.4.4.1 of Appendix MgO-2009, "Vugrin et al. (2006) did not include uncertainties associated with the chemical compositions of the CPR materials in the WIPP inventory. However, the DOE acknowledges that there are uncertainties associated with the chemical compositions of these materials."	EPA	SNL-Brush	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009
6	EPA comment 1-C-21 Appendix PA-2009, Table PA-10 does not include units for the concentrations, which should be moles/L	The units moles/L should be added to Appendix PA-2009, Table PA-10.	EPA	SNL-Clayton	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009
7	EPA comment 1-C-22 Appendix PA-2009, Section 4.9 includes a statement that releases are controlled almost entirely by direct releases to the surface as cuttings, cavings, and spallings. DOE should correct this statement to include cuttings, cavings, and direct brine release, as explained in Appendix PA-2009, Section 9.0.	In Appendix PA-2009, Section 4.9, page PA-162, line 2, the phrase "cuttings, cavings, and spallings" should be changed to "cuttings, cavings, and direct brine releases".	EPA	SNL-Clayton	Revised text included in 1st Response Submittal to the EPA	Submitted to EPA in 1st Response Aug 24, 2009
8	EPA Comment 1-C-10 Chemistry Issues In Appendix SOTERM-2009, Section 4.4, DOE states that the chemical potential (μo/RT) for Th(OH)4(s) was changed in the FMT database since the CRA-2004 PA. However, only the chemical potential for Th(OH)4(aq) changed between the CRA-2004 PA and the CRA-2004 PABC (Xiong et al. 2005). DOE should correct this statement	The DOE agrees with this comment – this is a typographical error in the text. The text will be corrected to read Th(OH)4 (aq). Note that this is correctly stated in Figure SOTERM-17 and Equation SOTERM. 48.	EPA	LANL-Reed	Revised text included in 2nd Response Submittal to the EPA	Submitted to EPA in 2nd Response Oct, 2009

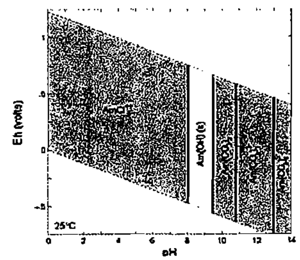
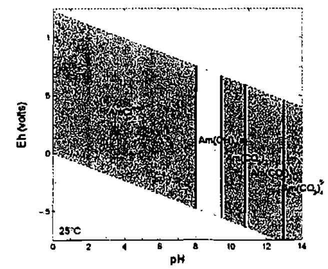
9	EPA Comment 1-C-11 In Appendix SOTERM-2009, Section 4.4, DOE should explain what is meant by their statement that, "The effects of hydromagnesite and calcite precipitation were added..." to the FMT database for the CRA-2004 PABC, because hydromagnesite and calcite thermodynamic data have been included in the database at least since the CCA PAVT. In addition, SOTERM-4.4 states that the version of the code used was FMT_050405.CHEMDAT, which is the database version, not the code. DOE should correct this misstatement.	The EPA is correct in their statement that hydromagnesite and calcite precipitation were included in the FMT calculations at least since the time of the CCA PAVT. The second bullet in SOTERM-2009, Section 4.4 should be replaced with, "The dimensionless standard chemical potential for whewellite ($CaC_2O_4 \cdot H_2O$) was added to the database (Xiong 2004)." The first sentence in SOTERM-2009, Section 4.4 should read, "The version of the database used with the FMT code for the CRA-2004 PABC was FMT_050405.CHEMDAT (Xiong 2005)." These corrections will be added to the errata list for Appendix SOTERM-2009.	EPA	LANL-Reed	Revised text included in 2nd Response Submittal to the EPA	Submitted to EPA in 2nd Response Oct, 2009
10	EPA Comment 1-C-17 Chemistry Issues – Proper Reference for Brush (2005) in Section 2.3.2 In Appendix SOTERM-2009, Section 2.3.2, Brush et al. (2006) is cited as part of the documentation for the CRA-2004 PABC, but this report was prepared after the CRA-2004 PABC. DOE should replace it with the correct reference (Brush 2005).	The DOE agrees with this comment. Brush 2005 is the correct reference. This will be added to the errata list for Appendix SOTERM-2009.	EPA	LANL-Reed	Included in 2nd Response Submittal to the EPA	Submitted to EPA in 2nd Response Oct, 2009

11	EPA Comment 1-23-5 Chemistry Issues – Inconsistencies in pH in SOTERM In Appendix SOTERM-2009, Section 3.3.2 and SOTERM-2009, Section 3.6.2, DOE states that the pcH of the WIPP brines is expected to be approximately 8.7 or 8.5. Based on FMT modeling performed for the CRA-2004 PABC, however, the pcH of GWB and ERDA-6 are expected to be 9.39 and 9.64, respectively. The pcH values cited by DOE seem to reflect the pH values of 8.69 and 8.94. DOE should correct the cited pcH values and reinterpret the solubility data in light of the correct values.	1) Change the following in Appendix SOTERM Section 3.3.2: "At the expected pCH+ in the WIPP (~8.7), the measured uranium solubility was between 10-7 M and 10-6 M." To: "At the expected pCH+ in the WIPP (~9.5), the measured uranium solubility was between 10-7 M and 10-6 M." 2) Change the following in Appendix SOTERM Section 3.6.2: "The WIPP-relevant data summarized in this report support current PA calculations performed with the use of the Pitzer model (U.S. Department of Energy 2004, Appendix PA, Attachment SOTERM) for the values of 3 × 10-7 M and 1.7 × 10-7 M in GWB and ERDA-6, respectively, at pCH+~8.5." To: "The WIPP-relevant data summarized in this report support current PA calculations performed with the use of the Pitzer model (U.S. Department of Energy 2004, Appendix PA, Attachment SOTERM) for the values of 3 × 10-7 M and 1.7 × 10-7 M in GWB and ERDA-6, respectively, at pCH+~9.5."	EPA	LANL-Reed	Included in 3rd Response Submittal to the EPA	Submitted to EPA in 3rd Response Nov 2009

12	EPA Comment 1-C-8 Chemistry Issues – Issue of pH in microbial and non-microbial vectors The fourth paragraph of Appendix SOTERM-2009, Section 2.3.2 states: "the expected pH, when little or no carbonate is present, is 8.69 in GWB brine and 8.94 for ERDA-6 brine. In both cases, this pH is established/buffered by the brucite dissolution reaction. The presence of microbial activity will potentially contribute significant amounts of carbon dioxide and leads to a model-predicted pH of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively. DOE also states that the ERDA-6 pH is 9.02 in the text immediately following equation SOTERM.4. These statements appear to confuse the results of FMT modeling for the CRA-2004 PABC and the CRA-2004 PA. The pH values of 8.69 and 8.94 for GWB and ERDA-6 brine, respectively, were obtained for microbial vectors with organic ligands for the CRA-2004 PABC. The pH values of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively, were obtained for microbial vectors with organic ligands for the CRA-2004 PA. DOE should clarify this statement, in light of the fact that all vectors for the PABC were assumed to include microbial degradation of cellulose or cellulose, plastics, and rubber	In Section 2.3.2, Page 10, line 12-16 of Appendix SOTERM change: "Under these repository-relevant conditions, the expected pH, when little or no carbonate is present, is 8.69 in GWB brine and 8.94 for ERDA-6 brine. In both cases, this pH is established/buffered by the brucite dissolution reaction. The presence of microbial activity will potentially contribute significant amounts of carbon dioxide and leads to a model-predicted pH of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively." To: "Under these repository-relevant conditions, the model-predicted pH is 8.69 in GWB brine and 8.94 for ERDA-6 brine. In both cases, this pH is established/buffered by the brucite dissolution reaction."	EPA	LANL-Reed	Included in 3rd Response Submittal to the EPA	Submitted to EPA in 3rd Response Nov 2009

		And on page 10, line 36 to page 11 line 2 change: "Consideration of the possibility of high CO2 levels leads to a calculated pH of 8.69 and 9.02 for GWB and ERDA-6 brine, respectively. This is a relatively small change in the predicted pH with no change predicted in GWB brine and only a 0.08 pH shift in ERDA-6 brine. These values of f_{CO2} and pH were used in the actinide speciation and solubility calculations for all CRA-2004 PABC vectors (Brush 2005)." To: "This value of f_{CO2} and a pH of 8.69 and 8.94 for GWB and ERDA-6 brine, respectively, were used in the actinide speciation and solubility calculations for all CRA-2004 PABC vectors (Brush 2005)."				

13	EPA Comment 1-C-12 Chemistry Issues – Stability and likelihood of Pu(III) in Brine In the caption for Appendix SOTERM-2009, Figure SOTERM-11, DOE states that the Eh-pH diagram demonstrates that Pu(IV) species would be stable at near-neutral pH. However, at the reducing conditions expected in the repository (near the lower stability limit for water), Pu(III) species appear to be the most stable (PuCO3+ and Pu(CO3)2-). DOE should explain this apparent discrepancy.	In Appendix SOTERM, page 51, figure legend for Figure 11, change: "Speciation Diagram for Plutonium in Carbonated Low-Ionic-Strength Groundwater (Based on Data Presented in Runde et al. 2002). This Illustrates the Expected Lower Solubility of Reduced Pu, Shows Pu(IV) Rather Than Pu(III) Species at Near-Neutral pH, and Suggests That the Dominant Pu Species in the pH 8-9 Range are Hydrolytic Species with Lesser Contributions From Carbonate." To: "Speciation Diagram for Plutonium in Carbonated Low-Ionic-Strength Groundwater (Based on Data Presented in Runde et al. 2002). This Illustrates the Expected Lower Solubility of Reduced Pu(III) and Pu(IV), and Suggests That the Dominant Pu Species in the pH 8-9 Range are Hydrolytic Species with Lesser Contributions From Carbonate."	EPA	LANL-Reed	Included in 3rd Response Submittal to the EPA	Submitted to EPA in 3rd Response Nov 2009

14	EPA Comment 1-C-13 Chemistry Issues – Data request for Figure SOTERM-16 and error in Figure DOE should provide the carbonate concentration, total americium concentration, and assumed ionic strength for generation of Appendix SOTERM-2009, Figure SOTERM-16. In addition, DOE should correct a typographical error in the figure, where the subscript "3" was omitted from Am(OH)3(s).	The specifics used to generate Figure SOTERM-16 are discussed in more detail in reference Richmann et al. (2008) provided to the EPA. The concentrations used in generating this Figure are the predicted solubility of III actinides in the CRA-2004 PABC for reacted GWB brine. The DOE agrees that the "3" was inadvertently omitted from Am(OH)3(s) in Figure SOTERM-16. In Appendix SOTERM, page 72, Figure SOTERM-16, change:  To:  	EPA	LANL-Reed	Included in 3rd Response Submittal to the EPA	Submitted to EPA in 3rd Response Nov 2009

15	EPA Comment 1-C-14 Chemistry Issues – Inconsistencies in Description of Organic Ligand Effects DOE states in Appendix SOTERM-2009, Section 4.6 that organic ligands do not significantly affect actinide solubilities, despite data presented in Appendix SOTERM-2009, Table SOTERM-19 showing that ligands increased the calculated +III actinide solubilities by factors of 1.71 (GWB) and 3.32 (ERDA-6) and +V actinide solubilities by factors of 1.50 (GWB) and 1.53 (ERDA-6). This statement is also at odds with the assertion in SOTERM-3.7 that EDTA and citrate could potentially affect actinide solubilities in WIPP brines. DOE should correct this statement, especially in light of the data indicating that ligand concentrations in the inventory have increased significantly since the CRA-2004 PABC.	In Appendix SOTERM, Section 4.6, page 79, line 27 change: "The FMT calculations (Brush 2005) demonstrate that the solubility of the III and IV actinides was not significantly enhanced by complexation with acetate, citrate, EDTA, and oxalate at their maximum potential concentrations (Table SOTERM-19)". To: "The FMT calculations (Brush 2005) demonstrate that the solubility of the III and IV actinides are only slightly affected by organic complexation (Table SOTERM-19). The solubility of the III actinides was increased by a factor of 1.7 in GWB and 3.3 in ERDA-6 brine. In both brines the solubility of the IV actinides was decreased by organic complexation. The overall effect of these changes on the release of actinides is not considered significant."	EPA	LANL-Reed	Included in 3rd Response Submittal to the EPA	Submitted to EPA in 3rd Response Nov 2009

EPA Comment	Included in this Submittal	Previously Submitted	Pending
Comments Received May 21, 2009			
1-G-1 Stakeholder-Water Flow Model Concerns - ext from the Citizens for Alternatives to Radioactive Dumping (CARD) news release on March 25, 2009, raises questions...		✓	
1-G-2 Shielded Containers - The shielded container planned change request has been an ongoing activity that was not completed before the CRA-2009 was received by EPA.		✓	
1-G-3 Inventory- As outlined in the Executive Summary of DOE/TRU-2008-3379, Rev. 1 (ATWIR 2007), DOE has proposed that ATWIR 2008 be used as the inventory source...		✓	
1-23-1 New Compliant Performance Assessment - EPA believes it is necessary to perform a new performance assessment to capture changes since the last recertification...		✓	
1-23-2 Chemistry PA - References from Appendix SOTERM-2009: - References from Appendix SOTERM-2009: Borkowski...; Lucchini...; Reed...; Richmann...		✓	
1-23-3 Chemistry PA- DOE summarizes thermodynamic data for the +111, +IV, and +V actinides that have become available since the CRA-2004 PABC in Appendix SOTERM...		✓	
1-23-4 Chemistry PA- AP-137 (Clayton 2008), includes the statement on pages 17 and 18 that the ligand concentrations were expected to increase from the 2004 to 2007 inventories.		✓	
1-23-5 Chemistry PA- In Appendix SOTERM-2009, Section 3.3.2 and SOTERM-2009, Section 3.6.2, DOE states that the pcH of the WIPP brines is expected to be approximately 8.7...		✓	
1-23-6 Chemistry PA- DOE reports uranium (VI) solubility experiments in the absence of carbonate and ligands (Appendix SOTERM-2009, Section 3.3.2).			
1-23-6 a. If the experimental results in GWB are extrapolated to pcH 9.64, the Nd (III) solubility could be approximately two orders of magnitude greater (~4 x 10-5 M) than the value...		✓	
1-23-6 b. -Given the evidence that borate complexation appears to affect the +111 and +VI actinide solubilities, DOE should address whether the +IV actinide solubilities...		✓	

EPA Comment	Included in this Submittal	Previously Submitted	Pending
1-23-6 c. -The current actinide solubility conceptual model includes the assumption that "The important ions in WIPP brines are H+, Na+, K+, Mg2+, OH-, CL-, CO32-, SO42-and Ca2+.		✓	
1-C-1 Chemistry Issues- DOE states that the characterization data for the Martin Marietta MgO has been obtained from a single lot (SL2980076) of this material (Appendix MgO-2009...		✓	
1-C-2 Chemistry Issues- The reactivity test used for MgO material acceptance was developed in 1997. At that time, the MgO used as backfill had a lower reactivity, but was...		✓	
1-C-3 Chemistry Issues- Appendix PA-2009, Section 7.1.1 attributes slower changes in repository pressure after 2,000 years to cessation of room closure, slowing of brine inflow...		✓	
1-C-4 Chemistry Issues- Appendix MASS-2009 and Appendix SOTERM-2009 do not address the current assumption that plastic and rubber degradation (if occurring)...		✓	
1-C-5 Chemistry Issues- It is stated in Appendix PA-2009, Section 2.3.1, that water is neither created nor consumed by microbial reactions.		✓	
1-C-6 Chemistry Issues- DOE should provide justification for the statement in Appendix SOTERM-2009, Section 3.7 that "Of the four organic chelating agents considered, only citrate...		✓	
1-C-7 Chemistry Issues- Appendix SOTERM-2009, Table SOTERM-l, provides an incomplete list of the current chemistry model assumptions.		✓	
1-C-8 Chemistry Issues- The fourth paragraph of Appendix SOTERM-2009, Section 2.3.2 states: "the expected pH, when little or no carbonate is present, is 8.69 in GWB brine and...		✓	
1-C-9 Chemistry Issues- DOE states that carbonate complexation of Nd(III) is unimportant at conditions expected in WIPP brines (Appendix SOTERM-2009, Section 3.6.2).		✓	
1-C-10 Chemistry Issues- n Appendix SOTERM-2009, Section 4.4, DOE states that the chemical potential (μo/RT) for Th(OH)4(s) was changed in the FMT database since the...		✓	
1-C-11 Chemistry Issues- In Appendix SOTERM-2009, Section 4.4, DOE should explain what is meant by their statement that, "The effects of hydromagnesite and calcite...		✓	

EPA Comment	Included in this Submittal	Previously Submitted	Pending
1-C-12 Chemistry Issues- n the caption for Appendix SOTERM-2009, Figure SOTERM-11, DOE states that the Eh-pH diagram demonstrates that Pu(IV) species would be...		✓	
1-C-13 Chemistry Issues- DOE should provide the carbonate concentration, total americium concentration, and assumed ionic strength for generation of Appendix SOTERM-2009...		✓	
1-C-14 Chemistry Issues- DOE states in Appendix SOTERM-2009, Section 4.6 that organic ligands do not significantly affect actinide solubilities, despite data presented in Appendix...		✓	
1-C-15 Chemistry Issues- n Appendix SOTERM-2009, Table SOTERM-21, the parameter descriptions for PHUMCIM and PHUMSIM indicate "actinide solubilities are inorganic only...		✓	
1-C-16 Chemistry Issues- In Appendix SOTERM-2009, Section 2.4.1.1, DOE cites "degradation of solubilizing organic ligands, leading to lower actinide solubility" as a possible...		✓	
1-C-17 Chemistry Issues - In Appendix SOTERM-2009, Section 2.3.2, Brush et al. (2006) is cited as part of the documentation for the CRA-2004 PABC, but this report was...		✓	
1-C-18 Chemistry Issues - In Appendix MgO-2009, Section 4.2.2, DOE claims that hydromagnesite will completely convert to magnesite during the 10,000 year WIPP regulatory time...		✓	
1-C-19 Chemistry Issues - In Appendix MgO-2009, Section 5.1, DOE states that the actinide solubilities in WIPP brines calculated for the CRA-2004 PA and CRA-2004 PABC		✓	
1-C-20 Chemistry Issues - In the discussion of MgO uncertainties (Appendix MgO-2009, Section 6.2.4.4), DOE does not include the uncertainties associated with the...		✓	
1-C-21 Chemistry Issues- Appendix PA-2009, Table PA-10 does not include units for the concentrations, which should be moles/L.		✓	
1-C-22 Chemistry Issues - Appendix PA-2009, Section 4.9 includes a statement that releases are controlled almost entirely by direct releases to the surface as cuttings, cavings...		✓	
1-C-23 Chemistry Issues - To facilitate EPA's technical review, DOE should provide EPA with copies of all FMT input and output files used to update the actinide solubility uncertainty...		✓	

EPA Comment	Included in this Submittal	Previously Submitted	Pending
Comments Received July 16, 2009			
2-G-4 Inventory-Quality Assurance Sign-offs - While reviewing some of the quality assurance documents used by the LANL-CO inventory team to develop, manipulate and...		✓	
CARD 2009 Recertification Comments (as noted in the 1st completeness letter) The group, Citizens Against Radioactive Dumping (CARD), has submitted a report entitled, "Proof of Rapid Rainwater Recharge at the WIPP Site,		✓	
2-15-CARD-l page 1, last line- CARD states, "This is why the proponents of WIPP deny the existence of karst at the WIPP site. They argue, in effect, that WIPP is a karst-free island...		✓	
2-15-CARD-2 page 2, first line- CARD states, "The supposed reliability of the Rustler Formation as a barrier to the migration of contaminated water hangs upon a postulated...		✓	
2-15-CARD-3 page 2, third paragraph- CARD states, "Proof of rainwater recharge at the WIPP site would constitute proof that WIPP is part of the regional karstland of the Pecos River...		✓	
2-15-CARD-4 page 3, third paragraph- CARD states, "This is the very definition of karst. Simply stated, if rainwater recharge does reach the Culebra dolomite, the Culebra is not a...		✓	
2-15-CARD-5 page 4, paragraph 2-CARD states, "But the point to remember is this: none of this rainwater recharge is supposed to be happening. This invalidates the groundwater...		✓	
2-15-CARD-6 page 14 last line-CARD states, "This strongly suggests that the water table will continue to rise at the WIPP site. Thus the Culebra is not in hydraulic steady state, as...		✓	
2-15-CARD-7 page 30, first paragraph-CARD states, "If groundwater is supposed to be flowing from north to south, as DOE contends, how then did dissolved halite appear in these...		✓	
2-15-CARD-8 page 36, 6th paragraph-CARD states in conclusion, Proof of rapid rainwater recharge at the WIPP site renders invalid the hydrologic model of the Culebra by which...		✓	
2-C-24 Inventory-Chemistry - The PA team requested data on the cement inventory as documented in PAIR 2008 (Crawford et al 2009, Section 3.1). The scaled mass of cement was...		✓	

EPA Comment	Included in this Submittal	Previously Submitted	Pending
2-23-7 Adequacy of Minimum Brine Calculations for Actinide Solubility Determinations The minimum brine volume is the volume of brine needed for a direct brine release (DBR) to...		✓	
2-33-1 Please provide the following reference... RL. Resources, Monthly Injection & Saltwater Report for ...		✓	
2-33-2 40 CFR 194.33(c)(2) states: (c) Performance assessments shall document that in analyzing the consequences of drilling events, the Department assumed that. ..(2) Natural...	✓		
2-33-3 Dakota Salts, LLC, is a Denver based company that has proposed the use of Deep Salt Caverns for storage of compressed air generated by wind farms. Dakota Salts...	✓		
2-33-4 Carbon sequestration is being assessed on a nationwide basis, including the Permian Basin (http://www.southwestcarbonpartnership.org). The Southwest...	✓		
2-33-5 In CRA-2009, DOE changed the maximum time a DBR can occur from 11 days to 4.5 days. The maximum DBR duration is represented in PA by the parameter MAXFLOW...	✓		
2-33-5 a. The South Culebra Bluff Blowout is cited as an inappropriate analogy for a WIPP brine release based on the formation encountered, downhole pressures anticipated...	✓		
2-33-5 b. Review of drillers' comments (Memorandum, Document Number 545844) indicates that many drillers have never encountered a situation that would require mitigation of...	✓		
2-33-5 c. Several drillers (reference 545844) indicated that they may never detect a brine release from the repository given the hypothetical release conditions posed by Kirkes (2007)	✓		
2-33-5 d. One driller interviewed in reference 545844 indicated that if a brine kick was encountered, he would probably let brine flow to surface without any attempt at mitigation...	✓		
2-33-5 e. Additionally, it is unclear what effect brine shut-in would have with respect to duration of flow and downhole conditions. Please provide references that address the effects..	✓		
Comments Received October 19, 2009			

EPA Comment	Included in this Submittal	Previously Submitted	Pending
3-24-1 Inventory (194.24) Table 5-4 of PAIR 2008 provides without comment a comparison of waste material parameters used in the PABC and PABC09 (the 2009 PABC).			✓
3-C-25 Chemistry (C) Issues The Kd values used to model matrix actinide sorption during transport through the Culebra were based on the consideration of experimental data...			✓
3-23-8 FEPs (194.23) The screening argument for FEP W45 is combined with that for FEPs W44 (Degradation of Organic Material) and W48 (Effects of Biofilms on Microbial Gas Generation),...			✓
3-23-9 EPA supports the systematic approach required by SP 9-4 and believes that it will improve the maintenance, accuracy, and traceability of DOE's FEPs baseline. In reviewing SP 9-4,...	✓		
3-23-10 Parameters (194.23) The focus of EPA's review of the CRA09 input files was on changes that occurred since the PABC 2004. Identified changes involving hard-coded numerical inputs included...			✓
3-23-11 Appendix PA-2009 states in Section PA-4.2.2, Initial Conditions, last paragraph, that the initial waste disposal area pressure is 1.01325 x 10^5 Pa, rather than the value of ...			✓
3-23-12 Computer Codes A number of secondary computer codes are used to support CRA-2009. Please provide QA documentation for these codes that demonstrate they are reasonably qualified for use in PA.			✓