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2011 Compliance Monitoring Parameter Program Assessment and Recommendations

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1.0 Introduction

The Department of Energy's (DOE) *Compliance Monitoring Implementation Plan for 40 CFR §191.14(b), Assurance Requirement* (DOE 2005) states that the scientific advisor is responsible for periodically reassessing the Compliance Monitoring program and recommending changes to the DOE. The purpose of this report is to meet this periodic reassessment requirement by reviewing and assessing the information generated by the compliance monitoring program from the last ten years and document recommendations to the monitoring program if determined appropriate. A periodic reassessment of the monitoring program is necessary to ensure that the program continues to meet the Environmental Protection Agency (EPA) requirements for monitoring and realign the program with current programmatic conditions and current performance assessment (PA) assumptions and expectations. This assessment was developed using Sandia National Laboratories specific procedure SP 9-8 (Wagner 2008a).

The compliance monitoring program focused on demonstrating compliance with 40 CFR §191.14(b) (EPA 1993), which states:

Disposal systems shall be monitored after disposal to detect substantial and detrimental deviations from expected performance. This monitoring shall be done with techniques that do not jeopardize the isolation of the wastes and shall be conducted until there are no significant concerns to be addressed by further monitoring.

The "expected performance" was to be determined through PA (in accordance with the compliance criteria at 40 CFR§194.42 (EPA 1996)). In response to this EPA requirement, ten monitoring parameters were identified in an analysis during the original certification process in 1996. This analysis was termed the MONPAR analysis and was included in the WIPP's first Compliance Certification Application (DOE 1996). More detailed information describing the compliance monitoring program is located in the DOE Compliance Monitoring Implementation Plan (DOE 2005) and the 2009 Compliance Recertification Application (CRA-2009) (DOE 2009), Section 42: Monitoring; and Appendix MON: WIPP Monitoring Program.

The periodic reassessment of the compliance monitoring program was completed as follows. The task first listed all relevant COMPs assessment program documents and reviewed them to compile any recommendation relating to potential modification to the monitoring program contained in the documents. These past recommendations identify areas of the monitoring program that may need to be updated and include suggestions to change several of the monitored parameters. The COMPs program compares data for ten compliance monitoring parameters with related PA expectations. This activity is documented in annual COMPs reports starting in 1999. Other documents related to the COMPs program include the Trigger Value (TV) Derivation Report, two assessments of

the monitoring program prior to each WIPP recertification and a draft analysis report from an earlier attempt at reassessing the monitoring program through a MONPAR type analyses after the first recertification. This activity was not completed because of higher DOE priorities for proposed changes during the period between the first and second recertification cycle. The compilation of recommendations from these documents was reviewed and a recommendation for potential changes to the monitoring program was developed. Based on the results of this review, this report recommends a new MONPAR analysis be performed using the same methods and requirements that were originally used to develop the ten original monitoring parameters. This analysis should also use the results of the latest compliance baseline PA (the CRA-2009 Performance Assessment Baseline Calculations (PABC)) and assess the monitoring potential of both sampled and fixed PA parameters to align the monitoring program to current WIPP program conditions. The following discusses the monitoring program documents used in this report. The conclusion of this report contains the final recommendations and potential path forward to achieve these recommendations.

1.1 List of COMPs Programmatic Documents

The following is a list of the documents reviewed for this monitoring program status assessment:

Sandia National Laboratories Annual Compliance Monitoring Parameter Assessment for years 1999 to 2010

- 1999 COMPs Report – (Beauheim et al., 2000a)
- 2000 COMPs Report – (Beauheim et al., 2000b)
- 2001 COMPs Report – (Beauheim et al., 2001)
- 2002 COMPs Report – (Chace et al., 2002)
- 2003 COMPs Report, Revision 1 – (Chace et al., 2004)
- 2004 COMPs Report – (Pfeifle et al., 2005)
- 2005 COMPs Report – (Wagner and Hillesheim 2005)
- 2006 COMPs Report – (Wagner and Hillesheim 2006)
- 2007 COMPs Report – (Wagner and Hillesheim 2008)
- 2008 COMPs Report – (Wagner and Hillesheim 2009)
- 2009 COMPs Report, Revision 1 – (Wagner 2010)
- 2010 COMPs Report – (Wagner and Kuhlman 2010a)

Trigger Values

- Trigger Value Derivation Report, Revision 1 (Beauheim, et al. 2002)
- Trigger Value Derivation Report, Revision 2 (Wagner and Kuhlman 2010b)

Recertification Assessment Documents

- CRA 2004 MONPAR Assessment – (Kirkes and Wagner 2003)
- CRA 2009 MONPAR Assessment – (Wagner 2008b)

MONPAR Type Analysis

- Monitoring Parameter Assessment per 40 CFR §194.42 Using the 2005 Recertification Baseline Performance Assessment Results – Draft¹ (Wagner 2006)

2.0 Document Review Summaries

The reports listed in the previous section were reviewed and all recommendations for change to the compliance monitoring program were summarized. Because these documents span an eleven-year period and two recertifications, many elements of the compliance monitoring program have changed or have been impacted by other programmatic changes. Therefore, the following briefly list each of the documents based on the date it was completed and all recommendation and relevant information relating to the need to make changes to the compliance monitoring program.

1999 COMPs Report – No deviations in expected COMPs results were reported - No modifications to the monitoring program were recommended.

2000 COMPs Report – The COMP Change in Culebra Groundwater Flow exceeded the TV. Several wells had water levels outside the water level ranges used in the Compliance Certification Application (CCA). An investigation into the cause of the water level rises was started – No modifications to the monitoring program were recommended.

2001 COMPs Report – Water levels in several Culebra wells continue to be above the CCA data range. The Drilling Rate COMP is expected to exceed the TV in the next few years. The report noted that work was initiated to revise the PA groundwater model. The TV for the Displacement of Deformation Features COMP was exceeded; the exceedence was noted as having no impact on the performance of the disposal system and most if not all boreholes are expected to eventually exceed the TV - Modification to Displacement of Deformation Features TV was recommended.

TV Derivation Report, Rev. 1 – A minor correction was made to the Drilling Rate TV. A TV for the Culebra Groundwater Composition COMP that was based on parameter ranges used in PA was added. It was recognized that the Drilling Rate TV would be exceeded in one to two years, however a sensitivity analysis concluded that an order of magnitude change in the rate had no consequence on performance. This revision noted that the geotechnical COMPs as well as their associated TVs will likely be revised in the

¹ This draft report was never finished due to a reprioritization of work by the DOE. Conclusions and recommendations in this draft report have been superseded by EPA's recertification of WIPP in 2006, and more recently in 2010.

There are two types of MONPAR analyses; one is used during each recertification process to determine if changes that have occurred over this period significantly impact the validity of the original CCA MONPAR results and the other that reanalyzes the current PA parameters and their sensitivity to repository performance to determine compliance monitoring parameters per 40 CFR 194.42 requirements. This draft report and the CCA MONPAR analysis are the second type.

future to focus on monitoring parameters that relate more directly to compliance and PA issues. No other COMP recommendations were discussed in the revision.

2002 COMPs Report – Culebra work continues. The Waste Activity COMP is expected to change as a result of EPA recertification guidance. The Displacement of Deformation Features TV was exceeded - No modifications to the monitoring program were recommended.

2003 COMPs Report, Rev. 1 – This report was the last report prior to the first CRA being submitted to the EPA. The TV for Displacement of Deformation Features COMP was exceeded. The CRA will include an updated Culebra model - No modifications to the monitoring program were recommended.

CRA 2004 MONPAR Assessment – This report stated that the original conclusion of the MONPAR analysis in the CCA remains unchanged, however ongoing Culebra investigations may identify conditions in the future that would suggest changes be made to the monitoring program – No modifications to the monitoring program were recommended.

2004 COMPs Report – The Drilling Rate TV was exceeded as expected. The Displacement of Deformation Features TV was exceeded. An analysis for EPA demonstrated no impact to compliance when the drilling rate is doubled – A modification to the drilling rate TV was recommended.

2005 COMPs Report – Work to reassess compliance monitoring program to 40 CFR §194.42 requirements was noted. The TVs for Drilling Rate and Displacement of Deformation Features COMPs were exceeded. A reassessment of the COMPs program was recommended to account for the new PA baseline – No modifications to the monitoring program were recommended.

2006 COMPs Report – This was the first COMPs report after the EPA recertification which also resulted in a new PABC baseline. The TVs for the Drilling Rate and the Displacement of Deformation Features COMP were exceeded. The next COMPs report was expected to be derived under a new 40 CFR §194.42 monitoring assessment – The new baseline was noted as not being significantly different than the original certification such that no modifications to the monitoring program were recommended.

2007 COMPs Report – Work to reassess the compliance monitoring program was noted. The TVs for the Drilling Rate and Displacement of Deformation Features were exceeded. It was noted that modifications to the monitoring program may be needed should the results of the ongoing reassessment recommend modification; any modification to this program would likely require EPA approval – No modifications to the monitoring program were recommended.

MONPAR type analysis entitled: *Monitoring Parameter Assessment per 40 CFR §194.42 Using the 2005 Recertification Baseline Performance Assessment Results* – A draft analysis under AP-126 (Wagner 2005) was performed. The draft report reanalyzed the PA parameters similar to the approach used to develop the original ten COMPs. Unlike the original MONPAR analysis in the CCA, this analysis included both fixed and sampled PA parameters. The analysis was completed, however the report was not finalized due to DOE priorities prior to the second recertification. The draft recommended changes to the COMPs program are shown in the table below.

Table 1 MONPAR Draft Recommendations for COMPs Parameter Changes

Parameter Description	Related Parameter Name or Related Models	Related PA Code or Assumptions	Type F=Fixed S=Sampled 194 = listed in 40CFR §194.42 COMP=Existing COMP
Borehole Diameter	DIAMOD	CUTTINGS DRSPALL	F
Drill Collar Diameter	COLDIA	CUTTINGS DRSPALL	F
Drill Pipe Diameter	PIPED	DRSPALL	F
Drill Collar Length	L1	DRSPALL	F
Borehole Plugging Configuration	ONEPLUG TWOPLUG THREEPLUG	CCDFGF	F
Drilling Rate	LAMBDAD	CCDFGF	F COMP
Drill String Angular Velocity	DOMEGA	CUTTINGS	S
Change in Culebra Groundwater Flow	Flow and Transport	Data used to generate T Fields	194 COMP
Change in Culebra Groundwater Composition	Flow and Transport	Data verifies groundwater stability assumptions	194 COMP
Subsidence	NA	Long-term Monitoring Parameter	COMP

Note: Work on the reassessment of the COMPs program to 40 CFR §194.42 requirements was stopped before it was completed. The parameter analysis was completed and a draft report was sent to SNL records prior to the formal review process being completed, therefore the draft does not meet WIPP quality assurance requirements and the recommended changes to the monitoring program contained in the draft report cannot be used for compliance-related decisions per NP 9-1 (Chavez 2009). The draft analyses records are contained in record

package ERMS 548367. Work was stopped because other changes pending EPA approval were given a higher priority by the DOE. Any change to the monitoring program would not have been presented to EPA for approval before the upcoming recertification cycle. The next recertification would run another PA and the monitoring analysis would likely need to be repeated using the latest PA results. Since the original monitoring parameters were developed through an EPA approved process documented in the CCA as attachment MONPAR to Appendix MON, the monitoring program meets the basic EPA monitoring requirements. However, the results of this draft analysis suggest that changes could be made to enhance the performance of the monitoring program by accounting for the current understanding of repository performance.

The impacts of programmatic changes that occurred between each recertification are assessed during the recertification process (CRA 2004 MONPAR Assessment and CRA 2009 MONPAR Assessment). These reports look at the changes that have occurred over each recertification period and determine if they significantly impact the conclusions of the original CCA MONPAR analysis. These reports do not reevaluate the PA parameters to identify the appropriate monitoring parameters as is done to meet 40 CFR 194.42 requirements (e.g., the CCA MONPAR analysis).

CRA 2009 MONPAR Assessment – The assessment report noted that the original conclusions of the MONPAR analysis in the CCA remain unchanged. However, if a new PA is requested by the EPA during their review of the recertification application, the current repository performance monitoring parameters will be assessed to ensure the conclusions are consistent with the latest PA baseline results (per the intent of SP 9-8 (Wagner 2008a) and the requirements of 40 CFR §194.42 (EPA 1996)).

2008 COMPs Report – Work to reassess the compliance monitoring program was noted in the report. The TVs for the Drilling Rate and Displacement of Deformation Features were exceeded. It was noted that modifications to monitoring program may be needed should the results of the ongoing reassessment recommend modification; any modification to this program would likely require EPA approval – No modifications to the monitoring program were recommended.

2009 COMPs Report Rev. 1 – This is the first COMPs report after the second CRA was submitted to EPA. Work to reassess the compliance monitoring program was noted. The TV for Drilling Rate and Displacement of Deformation Features was exceeded. It was noted that modification to the monitoring program may be needed should the results of the ongoing reassessment recommend modification; any modification to this program would likely require EPA approval – No modifications to the monitoring program were recommended.

2010 COMPs Report – This is the first report after the second EPA recertification decision. This report includes a new change in the Change in Culebra Groundwater Flow COMP derivation and TV that was implemented due to a new Culebra groundwater model. The new derivation is the same as that used for the WIPP Hazardous Waste Facilities Permit monitoring requirement for change in groundwater flow. This COMPs report states that a revision to the TV report will capture needed changes to the TVs (see next entry).

TV Derivation Report, Rev. 2 – The Drilling Rate, Extent of Deformation and Displacement of Deformation Features TVs were deleted. The TV for Change in Culebra Groundwater Flow COMP was changed to use travel time instead of a range of water levels for each well. The groundwater conceptual model was changed and no longer used a range of freshwater heads as input to PA. The Waste Activity TV evaluation period was changed to annually (more frequent). This revision of the TV report identified several COMPs that were not directly related to current PA parameters or PA modeling assumptions. Such parameters may no longer be considered important indicators of repository performance.

3.0 Assessment of Recommendations

The DOE *Compliance Monitoring Implementation Plan for 40 CFR §191.14(b), Assurance Requirement* (DOE 2005) requires periodic evaluation of the monitoring program. More than ten years of data have been generated by the program and five different PAs have been run for the compliance applications since the original MONPAR analysis was used to identify the ten COMPs used in the currently implemented compliance monitoring program. Review of the compliance monitoring documents generated over the past eleven years leads to the conclusion that information gained over this period and the evolution of the WIPP PA necessitates reevaluation of the compliance monitoring program to 40 CFR §194.42 requirements. There are two conditions that justify this conclusion. First, an analysis similar to the CCA MONPAR analysis which used results from the first recertification was not completed but suggested changes to the COMPs program, specifically identifying new drilling-related PA parameters that could be used as COMPs and recommendations to discontinue some geotechnical parameters. It is likely a new analysis using the latest PA baseline would also recommend similar changes to the COMPs program. Second, the Trigger Value Derivation Report revisions point out specific COMPs that are monitored that are either not related to specific PA elements or are related to PA elements that are no longer considered important indicators of repository performance. These conditions suggest that changes could be made to the COMPs program to better align the monitoring program with current PA expectations and thus increase the program's ability to detect substantial and detrimental deviations from expected performance. Therefore, it is recommended that a new MONPAR analysis be performed using the latest baseline PA information and the results used to identify important monitoring indicators. The results should be used to modify the current list of COMPs to realign the monitoring program to current PA results and expectations.

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