PERFORMANCE ASSESSMENT

What is Performance Assessment?

Performance Assessment (PA) is an analysis that uses a series of models and computer calculations to estimate cumulative releases of radionuclides from the Waste Isolation Pilot Plant (WIPP) to the accessible environment over a 10,000-year period. The WIPP PA assesses whether WIPP will meet the radionuclide release limits specified by 40 CFR § 191.13 for 10,000 years after repository closure. The release limits are based on the amount of radionuclides the U.S. Environmental Protection Agency (EPA) has determined can be released from the repository without being detrimental to human health or the environment. EPA compares the results from PA with the release limits as part of the basis for its WIPP recertification decision.

What are the major steps in performing a PA?

PA is designed to answer three primary questions about the WIPP site:

1) What features, events and processes (FEPs) could be important for repository performance over the next 10,000 years?
2) How likely are these FEPs?
3) What are the consequences of these FEPs?

To answer these questions, PA

1) Identifies FEPs that might affect the disposal system
2) Examines the effects of these FEPs on the performance of the disposal system
3) Estimates the cumulative releases of radionuclides to the accessible environment, including the uncertainties associated with all significant processes and events

Analysis of FEPs

A systematic approach is used to identify, compile, and screen a comprehensive list of FEPs that may be relevant to disposal system performance. The FEPs include both natural and man-made processes and events. FEPs that are not significant for disposal system performance are excluded from the PA based on low consequence, low probability, or regulatory specifications (i.e, if they exclude a process or event). FEPs that cannot be excluded are retained and used in the PA. In some cases, a FEP that is beneficial to repository performance (i.e., impedes radionuclide release) has been excluded from PA if its implementation would introduce an unnecessary level of complexity.

Consequences of undisturbed and disturbed performance

The FEPs retained in the PA provide the basis for the models and computer codes that predict long-term performance of an undisturbed or disturbed repository. Undisturbed performance includes the predicted behavior of the disposal system, assuming it is not disrupted by human intrusion or the occurrence of unlikely natural events. Disturbed performance includes the predicted behavior of the disposal system in response to human intrusion or other disruptive actions, including drilling, fluid injection, secondary oil recovery methods (water flooding), disposal of natural brines, excavation mining, solution mining and future development of leases.

PA calculates the consequences for undisturbed and disturbed performance by modeling the physical attributes of the repository, including site geology, site hydrology, the waste form, and its engineered features, in a manner that captures the long-term behavior of the disposal system.

How has PA changed since the initial compliance decision, the 2004 recertification decision and now?

The PA used in the initial compliance certification decision incorporated all the information available at that time. For the 2004 recertification decision, the models and parameters were updated to include the most current information. More information has become available since the 2004 recertification decision; hence, there are some changes in the PA for the CRA-2009. These changes include improvements to parameters and computer codes, as well as corrections to parameters and input files. However, the results of the PA show essentially no change in compliance, with projected

releases less than one tenth of the EPA limits. The same calculation methodologies and conceptual models used in the 2004 recertification decision are used for the CRA-2009 PA.

PA results for CRA-2009

The results of the PA predict the amount and likelihood of cumulative releases of radionuclides to the accessible environment over a 10,000-year period. The accessible environment includes the ground surface, atmosphere, surface water and the subsurface boundary defined by all points lying directly below the boundary of the WIPP controlled area. The results of the WIPP PA are expressed as complementary cumulative distribution functions (CCDFs) that define the probability that the releases from the repository will exceed a given level. A CCDF is required by EPA's regulations and provides a convenient comparison of the PA results with the regulatory release limits from 40 CFR 191.13(a).

Figure 1 shows that the total release calculated for the disturbed repository for CRA-2009 lies to the left of the release limits (i.e., comparing the solid blue curve to the dashed black lines). This demonstrates that the predicted performance of the repository is almost a factor of 10 below the regulatory limits for cumulative radionuclide release. Figure 1 also shows the contributions to total normalized release from the four major release pathways: cuttings and cavings, direct brine release, spallings and through the Culebra aquifer. These four pathways can only occur for disturbed performance, with a drilling intrusion into the repository. Cuttings and cavings and direct brine release are the dominant pathways causing total release, as can be seen in Figure 1. For the undisturbed repository (not shown in Figure 1), there is zero cumulative release of radionuclides to the accessible environment over 10,000 years.

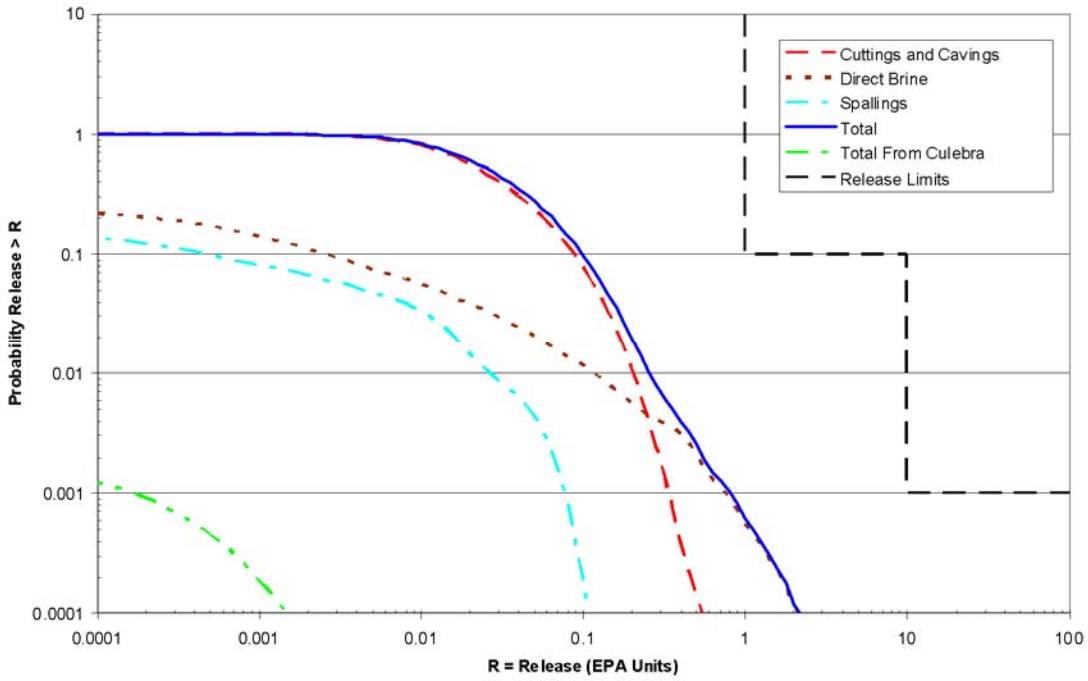

Figure 1. Mean complementary cumulative distribution functions of four disturbed pathways and of total releases in Replicate 2 of the PA for CRA-2009.

For Further Information

Sections 194.23, Models and Computer Codes, 194.25, Future States Assumptions, 194.31, Application of Release Limits, 194.32, Scope of Performance Assessments, 194.33 Consideration of Drilling Events in Performance Assessments, and 194.34, Results of Performance Assessments, provide additional information on PA for CRA-2009. Appendices MASS, PA, and SCR provide detailed descriptions of the modeling assumptions, computational methods, and FEP screening justifications for the CRA-2009 PA.