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**Title 40 CFR Part 191  
Subparts B and C  
Compliance Recertification Application 2019  
for the  
Waste Isolation Pilot Plant  
Consideration of Drilling Events in  
Performance Assessments  
(40 CFR 194.33)**



**United States Department of Energy  
Waste Isolation Pilot Plant**

Carlsbad Field Office  
Carlsbad, New Mexico

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**Compliance Recertification Application 2019**  
**Consideration of Drilling Events in**  
**Performance Assessments**  
**(40 CFR 194.33)**

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### **Acronyms and Abbreviations**

CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CRA	Compliance Recertification Application
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
PA	Performance Assessment
WIPP	Waste Isolation Pilot Plant

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## **33.0 Consideration of Drilling Events in Performance Assessments (40 CFR 194.33)**

### **33.1 Requirements**

#### § 194.33 Consideration of Drilling Events in Performance Assessments

- (a) Performance assessments shall examine deep drilling and shallow drilling that may potentially affect the disposal system during the regulatory time frame.
- (b) The following assumptions and process shall be used in assessing the likelihood and consequences of drilling events, and the results of such process shall be documented in any compliance application:
- (1) Inadvertent and intermittent intrusion by drilling for resources (other than those resources provided by the waste in the disposal system or engineered barriers designed to isolate such waste) is the most severe human intrusion scenario.
  - (2) In performance assessments, drilling events shall be assumed to occur in the Delaware Basin at random intervals in time and space during the regulatory time frame.
  - (3) The frequency of deep drilling shall be calculated in the following manner:
    - (i) Identify deep drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared
    - (ii) The total rate of deep drilling shall be the sum of the rates of deep drilling for each resource.
  - (4) The frequency of shallow drilling shall be calculated in the following manner:
    - (i) Identify shallow drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared.
    - (ii) The total rate of shallow drilling shall be the sum of the rates of shallow drilling for each resource.
    - (iii) In considering the historical rate of all shallow drilling, the Department may, if justified, consider only the historical rate of shallow drilling for resources of similar type and quality to those in the controlled area.
- (c) Performance assessments shall document that in analyzing the consequences of drilling events, the Department assumed that:
- (1) Future drilling practices and technology will remain consistent with practices in the Delaware Basin at the time a compliance application is prepared. Such future drilling practices shall include, but shall not be limited to: the types and amounts of drilling fluids; borehole depths, diameters, and seals; and the fraction of such boreholes that are sealed by humans.
  - (2) Natural processes will degrade or otherwise affect the capability of boreholes to transmit fluids over the regulatory time frame.
- (d) 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.

### **33.2 Background**

Title 40 CFR 194.33 ([U.S. EPA 1996](#)) requires the U.S. Department of Energy (DOE) to make assumptions about future deep and shallow drilling in the Delaware Basin and the vicinity of the

Waste Isolation Pilot Plant (WIPP). These assumptions pertain to the timing and duration of drilling, frequency of drilling, drilling practices and technology, and the effects of natural processes on boreholes.

Drilling currently, and in the near future within the Delaware Basin will most likely be for oil and gas exploration/exploitation, which constitutes a deep drilling event. Deep drilling for other resources may occur in the future as well, but does not currently occur within the Delaware Basin and as such, is not considered for future events. As postulated by the U.S. Environmental Protection Agency (EPA) when formulating their long-term disposal standards, current deep drilling rates for petroleum resources serve as a suitable surrogate for future drilling for other resources that are not currently known or desired. Shallow drilling may occur for other resources (e.g., water), but has been screened out of Performance Assessment (PA) analyses due to lack of consequence on the disposal system. Drilling is incorporated in PA as a single event or combinations of events based upon different scenarios. Deep drilling rates and related activities directly affect the cumulative potential for radionuclide releases to the surface or to subsurface geologic units around the WIPP.

Information and data from previous compliance certification and recertification applications that form the basis of past DOE compliance positions and past EPA decision documents are found in the 2014 Compliance Recertification Application (CRA-2014) ([U.S. DOE 2014](#)).

### **33.3 Changes or New Information Since the CRA-2014**

There are three changes in the CRA-2019 that relate to the consideration of drilling in PA. First, the probability that a drilling intrusion into the repository will also intercept pressurized brine beneath the repository has been updated as required by the EPA in their recertification decision ([U.S. EPA 2017a](#)). Second, the drilling rate is updated based on drilling activities in the Delaware Basin since the CRA-2014 in accordance with 40 CFR 194.33(b)(3). Third, the plugging types and ratios of use in the WIPP area have been updated based on data collected by the ongoing Delaware Basin Drilling Surveillance Program. Other than these three parametric changes, the implementation of drilling events within PA has not changed.

The following sections describe how these three parameter changes relate to the demonstration of compliance with the provisions of 40 CFR 194.33.

#### **33.3.1 Probability of Encountering Pressurized Brine**

As mentioned above, in their most recent recertification decision for the WIPP, the EPA has specified a methodology for deriving the parameter distribution to be used in PA that represents the probability of encountering pressurized brine while inadvertently drilling through the WIPP repository. This PA parameter is referred to as PBRINE. Details regarding the justification and derivation of the PBRINE parameter are provided by the EPA in their Technical Support Document for the Probability of Encountering Pressured Brine ([U.S. EPA 2017b](#)). EPA states in their recertification decision that the EPA-derived distribution is to be considered as the baseline distribution for future PAs.



### 33.3.2 Drilling Rates used in PA

The method for determining the deep drilling rate for the WIPP PA has not changed for the CRA-2019. However, the drilling rate for the CRA-2019 has been updated. Derivation of the drilling rate used in PA is found in the Delaware Basin Monitoring Report for 2017 ([U.S. DOE 2017](#)). For the CRA-2019, the drilling rate is 93.4 boreholes/km<sup>2</sup>, an increase from the previous value of 67.3 boreholes/km<sup>2</sup> for the CRA-2014.

As with all previous compliance applications, shallow drilling continues to be screened out of PA calculations because of low consequence. The DOE collects data on shallow wells drilled within the Delaware Basin ([U.S. DOE 2017](#)). However, since such wells are not included in performance analyses, the derivation of the shallow drilling rate has not been done for this CRA.

### 33.3.3 Borehole Plugging Techniques and Frequency

The Delaware Basin Monitoring Report for 2017 (U.S. DOE 2017) states that drilling practices that are relevant to WIPP intrusion models have not changed since previous reports. Borehole diameters, depths, and plugging methods have not changed since the last recertification. However, the plug placement, types, and frequencies have changed slightly since the CRA-2014 due to what is considered a normal progression in plugging and abandonment activities. Borehole plugs in the vicinity of WIPP are conceptualized into six “types” and the frequencies of use are updated annually. Table 33-1 below shows the historical changes in these plug types since the Compliance Certification Application (CCA). Of particular interest to WIPP performance is the use of the solid continuous cement plug spanning across the Salado and Castile formations (the Type VI plug), as this plug type is the most effective in isolating the repository from any upward brine migration (see Section 6.4.7.2 of the CCA for an explanation of long-term releases following a drilling intrusion) ([U.S. DOE 1996](#)). As shown in Table 9 of the Delaware Basin Monitoring Report ([U.S. DOE 2017](#)), the percentage of boreholes that are plugged through the entire salt section has increased to 8.8 percent, an increase of 4.8 percent from that used in the CRA-2014. This increase in the frequency of this type (VI) of plug has been expected and will continue to increase in the future as more wells near WIPP are plugged according to applicable regulations (i.e., R-111-P) ([State of New Mexico 1988](#)). The lower frequency for this type of plug in the early years of WIPP operation is because the oil production near WIPP was in the early stages of its life-cycle. As oil production continues, it is expected that this frequency will increase as more wells are depleted and plugged according to the applicable regulations. An explanation of how the various plugs are implemented in performance assessment is provided in Section 6.4.7.2 of the CCA ([U.S. DOE 1996](#)).

**Table 33.1 Plug Type and Frequency in WIPP Compliance Applications**

Type	CCA	CRA-2004	CRA-2009	CRA-2014	CRA-2019
I	32.5%	34.1%	30.5%	26.9%	21.7%
II	20.0%	17.7%	19.5%	20.1%	24.3%
III	34.0%	32.6%	33.0%	29.9%	23.8%
IV	10.0%	11.2%	12.1%	16.5%	17.9%
V	1.5%	2.9%	3.0%	2.6%	3.5%
VI	2.0%	1.5%	1.9%	4.0%	8.8%

### **33.3.4 Summary of Compliance with 40 CFR 194.33**

The DOE incorporates drilling events into evaluations of repository performance. No changes have been made regarding the implementation of these events within performance scenarios. Three parameter changes have been made as described above which are considered a routine and appropriate update of new information since the CRA-2014. Therefore, the DOE continues to comply with 40 CFR 194.33.

### **33.4 References**

(\*Indicates a reference that has not been previously submitted.)

State of New Mexico, Oil Conservation Division, Energy, Minerals, and Natural Resources Department. 1988. Order R-111-P, Potash Areas of Eddy and Lea Counties, NM. Case 9316, Revision to Order R-111-P. April 21, 1988. Santa Fe, NM.

U.S. Department of Energy (DOE). 1996. Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant (October). 21 vols. Carlsbad, NM: Carlsbad Area Office. DOE/CAO 1996-2184.

U.S. Department of Energy (DOE). 2014. Title 40 CFR Part 191 Subparts B and C. Compliance Recertification Application for the Waste Isolation Pilot Plant (March). Carlsbad, NM: Carlsbad Field Office. DOE/WIPP 2014-3503.\*

U.S. Department of Energy (DOE). 2017. Delaware Basin Monitoring Annual Report. (September 2017) Carlsbad, NM: Carlsbad Field Office. DOE/WIPP-17-2308.\*

U.S. Environmental Protection Agency (EPA). 1996. 40 CFR Part 194: Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Final Rule. Federal Register, vol. 61 (February 9, 1996). 5223–5245.

U.S. Environmental Protection Agency (EPA). 2017a. Criteria for the Certification and Recertification of Waste Isolation Pilot Plant's Compliance with Disposal Regulations: Recertification Decision. Federal Register, vol. 82 (July 19, 2017). 33106-33122.\*

U.S. Environmental Protection Agency (EPA). 2017b. Technical Support Document for the Probability of Encountering Castile Brine Beneath the WIPP Waste Panels Using the TDEM Block Method. June 2017. Washington, DC: Office of Radiation and Indoor Air. \*