
**Title 40 CFR Part 191
Subparts B and C
Compliance Recertification Application 2019
for the
Waste Isolation Pilot Plant**

**Appendix IGP-2019
Individual and Groundwater
Protection Requirements**



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

Carlsbad Field Office
Carlsbad, New Mexico

Compliance Recertification Application 2019
Appendix IGP-2019
Individual and Groundwater
Protection Requirements

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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
gpm	gallons per minute
LWB	Land Withdrawal Boundary
mg/L	milligrams per liter
mrem	millirem
PA	performance assessment
pCi/L	picocuries per liter
TDS	total dissolved solids
USDW	underground source of drinking water
WIPP	Waste Isolation Pilot Plant

Elements and Chemical Compounds

Ra radium
Rn radon
U uranium

IGP-1.0 Introduction

In addition to the qualitative containment performance requirements of 40 CFR 191.13 ([U.S. EPA 1993](#)), the U.S. Department of Energy (DOE) must also comply with two other quantitative performance standards contained in the individual protection requirements (40 CFR 191.15) and groundwater protection requirements (40 CFR 191.24). This appendix describes the DOE's demonstration of Waste Isolation Pilot Plant (WIPP) disposal system compliance with both the individual and groundwater protection requirements.

In performing the compliance assessment for the Compliance Certification Application (CCA) ([U.S. DOE 1996](#)) and all Compliance Recertification Applications (CRAs), the DOE applied a bounding-analysis approach using conservative assumptions that overestimate potential radiation doses and contaminant concentrations. To provide added assurance, the DOE assumed the presence of an underground source of drinking water (USDW) in close proximity to the WIPP Land Withdrawal Boundary (LWB), even though available water quality and quantity data indicate that none exists near the boundary. For the undisturbed scenario, the maximum potential radiation dose to an individual is 0.93 millirem (mrem) per year in the CCA evaluation. This bounding value is well below the individual protection standard [40 CFR 191.15(a)] of 15 mrem as an annual committed effective dose. In addition, the estimated potential maximum combined radium-226 (^{226}Ra) and ^{228}Ra concentration in groundwater is 0.49 picocuries per liter (pCi/L) in the CCA, well below the acceptable standard of 5 pCi/L required by 40 CFR 191.24(a)(1). A complete description and historical basis for these analyses are found in Chapter 8 of the CRA-2004 ([U.S. DOE 2004](#)).

The DOE has deferred submittal of the CRA-2019 Performance Assessment (PA) until after submission of the CRA-2019 (see Executive Summary 2019, Section 1.3). As such, the CRA-2014 ([U.S. DOE 2014](#)) PA continues to be the baseline calculation for the CRA-2019. As directed in 40 CFR 194.15(b), where information remains valid and has been submitted in previous recertification applications, such information may be summarized and referenced. Therefore, this appendix either references or summarizes the associated CRA-2014 information.

As was done for all past CRAs, additional information was gathered for this CRA to confirm the conclusion that there are no USDWs within or at the WIPP accessible boundary, although they do exist some distance away. The CRA-2014 analysis continued to show that the maximum concentration of radionuclides reaching the boundary (zero for this analysis) is projected to be less than the maximum concentration projected in the CCA, which has been used for each recertification as the bounding case for compliance assessment analyses. Based on this and additional information updated for the CRA-2019 evaluation in this appendix, the DOE concludes that the WIPP disposal system continues to comply with the individual and groundwater protection provisions of Part 191 Subparts B and C.

As stated above, the baseline performance assessment calculations contained in the CRA-2014 continue to be the baseline for the CRA-2019. Information that remains unchanged from the CRA-2014, Appendix IGP, include the following:

Appendix IGP-2014 Section IGP-3.3 Comparison with the Limits Found in 40 CFR 141 as they Existed on January 19, 1994

Appendix IGP-2014 Section IGP-3.3.1	Transport Pathway
Appendix IGP-2014 Section IGP-3.3.2	Combined ^{226}Ra and ^{228}Ra
Appendix IGP-2014 Section IGP-3.3.3	Gross Alpha Particle Activity Including ^{226}Ra but Excluding Rn and U
Appendix IGP-2014 Section IGP-3.3.4	Annual Dose Equivalent to the Total Body or Any Internal Organ from the Average Annual Concentration of Beta Particle and Photon Radioactivity from Man-made Radionuclides

IGP-2.0 Criteria for USDW Determination

In evaluating the presence of any USDW, it is necessary to establish criteria for water quality and quantity data from wells in the vicinity of the WIPP disposal system. The criteria must be based on the regulatory definition of a USDW, as provided in 40 CFR 191.22. A USDW is defined in 40 CFR 191.22 to mean an aquifer or its portion that:

- (1) Supplies any public water system; or
- (2) Contains a sufficient quantity of groundwater to supply a public water system; and
 - (i) Currently supplies drinking water for human consumption; or
 - (ii) Contains fewer than 10,000 milligrams of total dissolved solids per liter.

“Public water system” means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. Such term includes:

- (1) Any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and
- (2) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

“Total dissolved solids” means the total dissolved (filterable) solids in water as determined by use of the method specified in 40 CFR Part 136.

“Total dissolved solids” means the total dissolved (filterable) solids in water as determined by use of the method specified in 40 CFR Part 136.

Criteria based on these definitions were developed by the DOE and are used to assess the presence of any USDW near the WIPP disposal system. These criteria are defined in the sections that follow.

IGP-2.1.1 Groundwater Quantity

Since there are no public water systems in the WIPP vicinity, any possible USDW must meet the 40 CFR 191.22(2)(i) or (ii) requirements. Three sub-criteria have been identified by the DOE and applied to these USDW requirements.

- (1) An aquifer or its portion must be capable of producing water at an adequate rate.
- (2) An aquifer or its portion must be capable of producing water for a sufficient duration.

- (3) An aquifer must contain fewer than 10,000 milligrams per liter (mg/L) of total dissolved solids (TDS).

Water-consumption information was evaluated by the DOE to define the first sub-criterion (the ability to produce at an adequate rate). The value to be applied is determined by obtaining the following information:

- (1) The rate, over a 24-hour period, at which water is consumed by 15 service connections
- (2) The rate, over a 24-hour period, at which water is consumed by 25 individuals

To define a USDW, the lower of these two values is assigned by the DOE to the first sub-criterion. Based on calculations presented in the CCA, Appendix USDW, a quantity of 5 gallons per minute (gpm) was assigned as the first sub-criterion.

In updating these calculations for the CRA-2014, more current census data and water consumption data were obtained. Data relating to the sub-criteria rate were again reviewed for the CRA-2019 to ensure new information was consistent with the previous calculations. These data are shown in Table IGP-1.

Table IGP- 1 Per Person Household and Water Consumption Values Evaluated in the CRA-2014 and CRA-2019

Community	Persons Per Household, 2016 ^a (CRA-2019)	Persons Per Household, 2011 ^b (CRA-2014)	Gallons Per Capita Per Day ^c
Artesia	2.29	2.61	393
Carlsbad	2.24	2.51	274
Hobbs	2.76	2.72	218
Lovington	2.83	2.80	235
Roswell	2.42	2.58	242
Average	2.51	2.64	272

Sources: ^a U.S. Bureau of Census 2018; ^b U.S. Census Bureau 2013; ^c Longworth et. al., 2013

As was determined in the CRA-2014, the rate derived based on 15 service connections is approximately twice the rate of that derived from 25 individuals (Appendix IGP-2009 [DOE 2009], Section IGP-3.1.1). This is because 15 service connections with 2.51 persons per household give a rate based on 38 individuals. Therefore, only the rate based on 25 individuals is necessary. Multiplying 272 gallons per capita per day times 25 people and converting to gallons per minute yields a rate of 4.72 gpm. Based on this information, it is concluded that applying the 5-gpm sub-criterion is still valid for a bounding analysis. No change in this sub-criterion is warranted as a result of applying the most current census and water consumption data.

The definition of the second quantity sub-criterion (the acceptable production duration of a well) is more subjective. Because the creation of a public water supply system involves considerable capital expense, it is reasonable to assume that such a water system would not be constructed unless the water source would continue to be available for some time, at least long enough to

recover the capital expense. The Rural Utility Service of the U.S. Department of Agriculture provides loans to fund new rural water supply systems. The loan periods are generally 40 years in duration. Based on this, a duration of 40 years is applied by the DOE to the second quantity sub-criterion. This is the same assumption that has been used since the CCA.

IGP-2.1.2 Groundwater Quality

A criterion of 10,000 mg/L of TDS is specified in 40 CFR 191.22. Any aquifer or its water-producing portion with TDS concentrations below this level is determined to produce water that meets the quality criterion for a USDW. Any aquifer or its water-producing portion with TDS concentrations at or above this level is determined to produce water that does not meet the quality criterion and the regulatory definition of a USDW.

IGP-2.2 Comparison with USDW Determination Criteria

Previous analyses of water quality in the WIPP site characterization and groundwater investigation wells have determined that there are wells with groundwater TDSs below 10,000 mg/L in the WIPP vicinity. The WIPP vicinity is the area where these WIPP wells are located outside of the WIPP LWB. The WIPP LWB is the regulatory compliance point for individual and groundwater protection. Although for conservatism the DOE assumes there is a USDW at the WIPP boundary, analyses of available data concluded that no wells within the WIPP and at the boundary meet the criteria or definition of a USDW. These analyses are documented in Appendix IGP-2009, Section IGP-3.2. For this recertification period, there were no new wells drilled at new locations in the WIPP vicinity, only replacement wells (information on these wells is provided in Appendix HYDRO-2019, Section HYDRO-4.0). As such, there is no new information to assess for a USDW determination. No additional USDW investigations were performed as part of the CRA-2019. Based on this review, no modification of the USDW determinations reported in the CCA, Appendix USDW, is warranted. The DOE continues to conclude that there are no USDWs at the WIPP accessible boundary; however, in the vicinity of the WIPP disposal system, USDWs are present in the Culebra, and potential USDWs are present in the Dewey Lake and the Santa Rosa.

IGP-3.0 Compliance Summary

In performing the compliance assessment, the DOE applied a bounding-analysis approach using assumptions that overestimate potential radiation doses and contaminant concentrations. To provide added assurance, the DOE assumed the presence of a USDW in close proximity to the WIPP LWB, even though available data indicate that none currently exists near the boundary. Using this bounding-analysis approach, the calculated maximum potential radiation dose to an individual determined for the CCA evaluation would be about one-sixteenth of the individual protection standard.

For the CRA-2019, the CRA-2014 evaluation continues to be the baseline. The potential radiation dose would be zero, which is below the CCA bounding value. The potential concentrations of contaminants in the hypothetical USDW and the maximum potential radiation dose to a receptor that drinks from the hypothetical USDW continue to be bounded by the CCA analysis.

This approach also conservatively assumes that all contaminants reaching the accessible environment are directly available to a receptor. The analysis bounds any potential impacts of underground interconnections among bodies of surface water, groundwater, and USDWs.

IGP-4.0 References

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

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