

## **Consequence Assessment Review Summary for the February 2014 Radiological Emission Release at the Waste Isolation Pilot Plant**

### **Executive Summary**

In the immediate aftermath of a radioactive release, modeling is used to project the direction of the plume and the amount of potential exposure to the public. The Department of Energy (DOE) refers to this activity as consequence assessment. Shortly after the radiation release incident at the Waste Isolation Pilot Plant (WIPP), DOE conducted consequence assessment to estimate the extent of the release. Based on the source term measured by DOE in the several days after the event, the modeling indicated that the release was very low-level (with an effective dose equivalent [EDE] of < 1 mrem to the nearest population) and was largely confined to the Land Withdrawal Boundary (LWB), limiting exposure to the public. The initial modeling was corroborated by compliance modeling that indicated the release would result in annual exposure well below EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regulatory limit of 10 mrem annual dose to any member of the public. Subsequent environmental samples of air, soil and sediment indicate that levels of radioactivity were also very low, in line with the modeled concentrations and doses.

### **Background**

The process for estimating potential effects of the February 14, 2014 radiation release at the WIPP is consequence assessment, which involves modeling of the release to the environment. DOE began developing consequence assessments on February 15 and updated them periodically until March 10. DOE subsequently did additional modeling and collected air and other environmental samples. The primary radionuclide released was americium-241. Plutonium-239 was a secondary radionuclide detected.

Station B collects effluent air samples downstream from the HEPA filtration system. These samples represent the radioactive materials and associated radiation released into the environment. The HEPA filtration of the mine exhaust prevented the majority of the contamination from reaching the environment; however, leakage within the ventilation system allowed a small amount of mine exhaust to bypass the HEPA filters and be released into the environment.<sup>1</sup> EPA is confident that Station B samples adequately represented the released radioactivity. DOE's data indicate that about 99% of the release occurred within 24 hours, and most of that by 2 p.m. on February 15, 2014.<sup>2</sup>

### **DOE's Consequence Assessment Modeling**

Immediately following the incident, DOE conducted initial consequence assessments to estimate possible doses to workers and the public. The DOE Carlsbad Field Office (CBFO) asked the National

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<sup>1</sup> Department of Energy. *Accident Investigation Report: Phase 1: Radiological Release Event at the Waste Isolation Pilot Plant on February 14, 2014*. Washington, DC: 2014.

[http://energy.gov/sites/prod/files/2014/04/f15/Final%20WIPP%20Rad%20Release%20Phase%201%2004%2022%202014\\_0.pdf](http://energy.gov/sites/prod/files/2014/04/f15/Final%20WIPP%20Rad%20Release%20Phase%201%2004%2022%202014_0.pdf)

<sup>2</sup> U. Department of Energy (DOE). "February 14<sup>th</sup>, contamination release consequence assessment Rev.1" Data file, DOE, 2014. Retrieved from <http://www.wipp.energy.gov/Special/Modeling%20Results.pdf>

Atmospheric Release Advisory Center (NARAC) to model the release using the radioactivity information gathered at the Station B monitoring location and using local meteorological data.

At the beginning of the event the wind was blowing toward the northwest, but shifted to the east on the morning of February 15. The NARAC modeled plume reflects the prevalent wind directions during the release, with the largest part of the release plume modeled as going to the northwest. The NARAC model indicated that both the lower plume concentration of 0.1 mrem dose contour and the larger 1 mrem dose contour stayed within the LWB (these dose contours are described as “isodose” or “equal dose” curves in Figure 1). For comparison, the regulatory NESHAP limit for air emission is 10 mrem annual dose to any member of the public.

### **Compliance Modeling**

In addition to the NARAC modeling, DOE also conducted air emissions modeling using an EPA-approved model, CAP88-PC, to confirm compliance with the NESHAP limit of 10 mrem annual dose. The CAP88-PC modeling projects the highest potential public exposure for the most exposed individual as less than 1 mrem (0.678 mrem) at the fence line in the northwest direction from the WIPP air exhaust shaft. Using the same model and information, EPA staff members were able to recreate DOE’s results<sup>3</sup>. In addition to being below the NESHAPs limits, the findings are also well below the requirements in 40 CFR Part 191, Subpart A, which sets annual dose limits to any member of the public of 25 mrem to the whole body and 75 mrem to any critical organ.

### **Environmental Data Consistent with Modeling**

The low levels of environmental radioactivity projected by modeling are consistent with ambient air sampling data that were collected during and after the event. Table 1 lists the data from DOE’s ambient air sampling<sup>4</sup> around the WIPP in the days immediately following the release (no air filters in the environmental sampling program were above the minimum detectable concentration, or MDC, after a week so the DOE data set is truncated in Table 1). Low but detectable levels of radioactivity were found only at the WIPP Far Field, WIPP East, WIPP South and Smith Ranch locations; this is what would be expected given the plume directions. DOE also did a soil collection transect in March 2014 across the plume path and found no samples with americium or plutonium above detectable levels, save one duplicate for which the companion measurement was below the minimum detection concentration.

### **Conclusion**

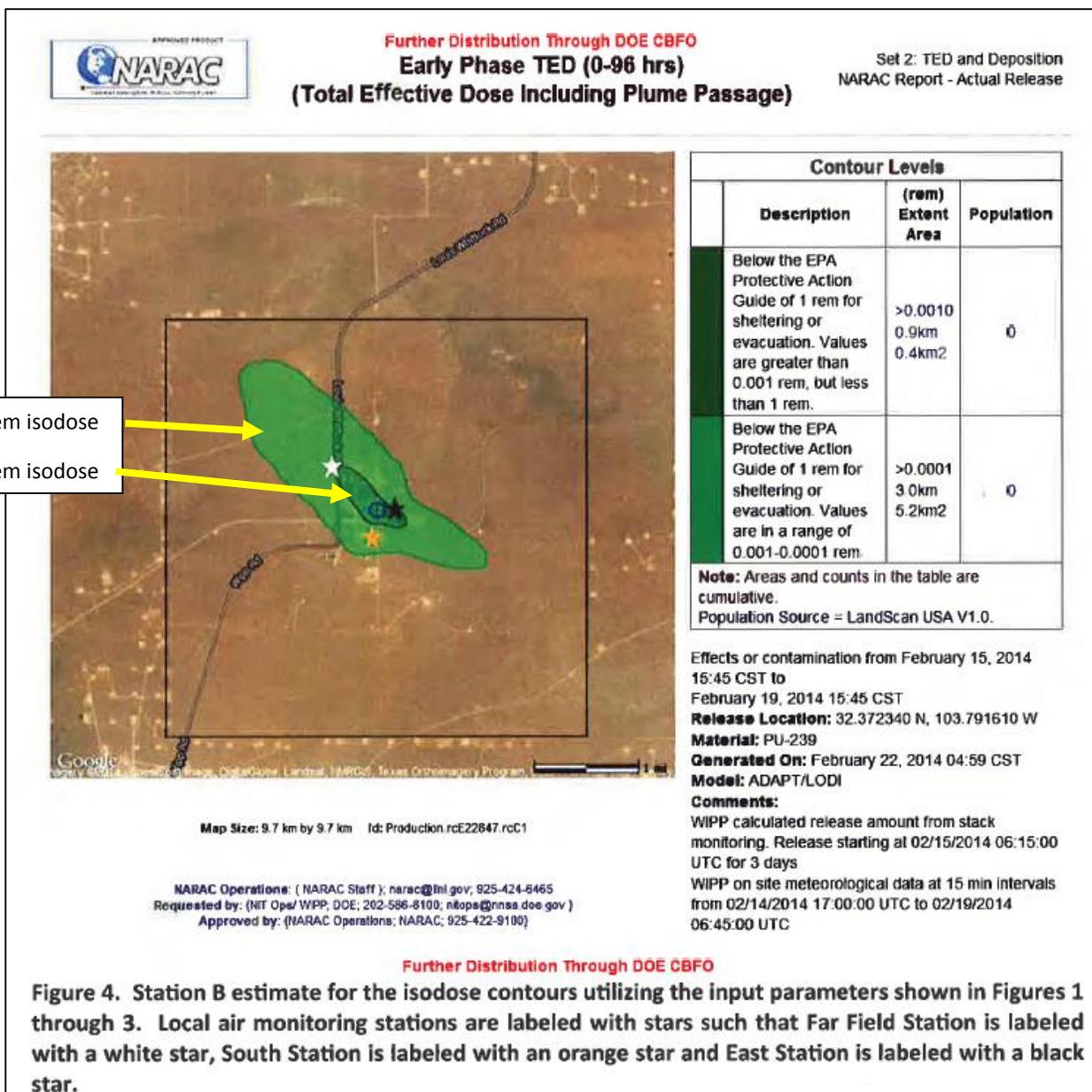
Multiple lines of evidence indicate that the February 14, 2014 incident at the WIPP resulted in very low releases to the environment. Calculations indicate that the releases remain well below EPA’s NESHAP compliance requirement of 10 mrem annual dose limit. The evidence indicates that the release of radioactivity from the WIPP in February 2014 does not represent a public health concern.

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<sup>3</sup> See EPA’s Confirmatory Dose Calculations of the Department of Energy’s Use of CAP88-PC for the February 2014 Radiological Emission Release at the Waste Isolation Pilot Plant [EPA Air Docket A-98-49, Item II-B1-32; August 2014]

<sup>4</sup> Vincent, Oba of the Department of Energy, email message to Tom Peake of the Environmental Protection Agency, June 16, 2014. Subject: WIPP Information for call today.

**Figure 1. Initial estimate of radiation dose.** The figure identifies the plume calculated by the NARAC for the period February 14-21, 2014. Note that the 0.1 mrem and 1.0 isodose (equal dose) modeled areas remain within the Land Withdrawal Boundary (LWB). Adapted from DOE’s February 14<sup>th</sup> Contamination Release Consequence Assessment Revision 1, Figure 4<sup>5</sup>.



<sup>5</sup> Department of Energy (DOE). “February 14<sup>th</sup>, contamination release consequence assessment Rev.1” Data file, DOE, 2014. Retrieved from <http://www.wipp.energy.gov/Special/Modeling%20Results.pdf>

**Table 1. DOE's Ambient Air Filter Analyses from On and Around the WIPP Site in the Days Immediately Following the Incident.** The DOE data set below is truncated because no air filters in the environmental sampling program were above the minimum detectable concentration (MDC) after a week. Note that only four sampling locations had measurements above the MDC. The WIPP Far Field location and the Smith Ranch are located in the northwest direction of Figure 1 in the direction of the largest release.

### Environmental Monitoring & Hydrology Airborne Particulates Sampling

Location	Sample ID Number	Sample Date	ISOLO Spectrum Analyzer	WIPP Labs Gross $\alpha$ DPM	WIPP Labs Radiochemistry			WIPP Labs Radiochemistry		
			Gross $\alpha$ $\beta$ Preliminary/Final DPM		Am-241 (dpm/sample)	Pu-238 (dpm/sample)	Pu-239/240 (dpm/sample)	Am-241 (Bq/m <sup>3</sup> )	Pu-238 (Bq/m <sup>3</sup> )	Pu-239/240 (Bq/m <sup>3</sup> )
WIPP Far Field (WFF)*	AL-WFF-20140212-1.1	02/15/2014	36	---	4.88E+01	Below MDC	3.67E+00	1.58E-02	N/A	1.19E-03
WIPP Far Field (WFF)	AL-WFF-20140219-1.1	02/18/2014	2.4	---	2.70E-01	Below MDC	Below MDC	1.85E-05	N/A	N/A
WIPP East (WEE)*	AL-WEE-20140212-1.1	02/17/2014	7.29/4.4	---	5.73E-01	Below MDC	Below MDC	4.57E-05	N/A	N/A
WIPP South (WSS)*	AL-WSS-20140212-1.1	02/17/2014	7.47/3.7	---	1.41E-01	Below MDC	Below MDC	1.13E-05	N/A	N/A
Mills Ranch (MLR)*	AL-MLR-20140212-1.1	02/18/2014	2.7	---	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Smith Ranch (SMR)*	AL-SMR-20140212-1.1	02/18/2014	4.2	---	2.44E-01	Below MDC	Below MDC	1.50E-05	N/A	N/A
Carlsbad (CBD)*	AL-CBD-20140212-1.1	02/18/2014	1.6	---	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Southeast Control (SEC)*	AL-SEC-20140212-1.2	02/18/2014	1.3	---	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Southeast Control (SEC) co-located sample*	AL-SEC-20140212-2.2	02/18/2014	1.5	---	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
WIPP Far Field (WFF)	AL-WFF-20140219-1.1	02/26/2014	---	1.89	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
WIPP East (WEE)	AL-WEE-20140219-1.1	02/26/2014	---	2.48	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
WIPP South (WSS)	AL-WSS-20140219-1.1	02/26/2014	---	2.23	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Mills Ranch (MLR)	AL-MLR-20140219-1.1	02/26/2014	---	2.57	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Carlsbad (CBD)	AL-CBD-20140219-1.1	02/26/2014	---	2.23	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A
Smith Ranch (SMR)	AL-SMR-20140219-1.1	02/26/2014	---	1.12	Below MDC	Below MDC	Below MDC	N/A	N/A	N/A

\* Filter volumes based on an adjusted filter installation date. This date was changed from the actual filter installation date to the date of the release which occurred at 23:30 hours on 2/14/14. Note: Minimum detectable concentration (MDC) corresponds to the lowest concentration measurement that can be detected by the laboratory instrumentation. MDC ranges are: MDC Am-241 (dpm/sample): 1.89E-02 to 5.05E-01; MDC Pu-238 (dpm/sample): 1.89E-02 to 1.57E+01; MDC Pu-239/240 (dpm/sample): 1.70E-02 to 5.94E-0