Independent Assessment of the Radiological Release Event at the Waste Isolation Pilot Plant (WIPP) Repository in New Mexico, USA

June 6-9, 2016

APHL Seminar on "Hot Topics in Radioanalytical Response"-
A Real World Perspective

Carlsbad Environmental Monitoring and Research Center

Outlines

- **The Waste Isolation Pilot Plant (WIPP)**
- **Independent Monitoring and WIPP**
- **February 14, 2014, radiation release event at the WIPP**
- **Environmental Monitoring following the event.**
- **Source term**
- **Environmental Release**
- **Conclusion**

WIPP: a Working Repository

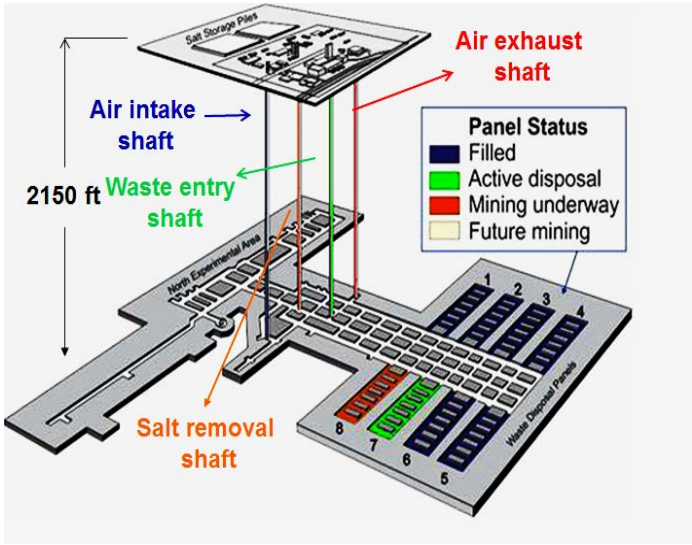
The worlds first licensed geological repository for transuranic (TRU) waste [Intermediate-Level Long-Lived Waste by IAEA definition].

Located in southeast New Mexico about 26 miles east of Carlsbad.

Operated ~15 years by U. S. Department of Energy (DOE).

TRU waste is contaminated with man-made radioactive elements that are heavier than uranium (Z>92).

>100 nCi/g (>3700 Bq/g or ~1ppm) of alpha emitting isotopes with t½ > 20 years.



WIPP layout

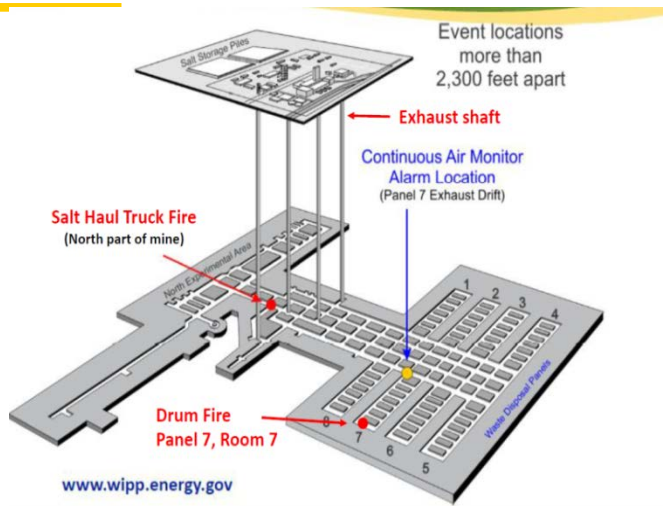
CEMRC: Independent Environmental Monitoring

- Created in 1991 to conduct an independent environmental monitoring program of the WIPP
- Funded Primarily by the Department of Energy (DOE) through a grant (NOT a contract) that respects CEMRC independence
  - Current funding level $3m per year (~80% of total funding for CEMRC)
  - CEMRC monitoring and other work includes:
    - WIPP Underground Exhaust Air
    - Ambient Air
    - Drinking Water
    - Soil
    - Surface Water & Sediment
    - Whole Body Counting for Area Residents age 13+
    - R&D on monitoring methods and technologies

Incidents at WIPP

February 5, 2014 Haul Truck Fire

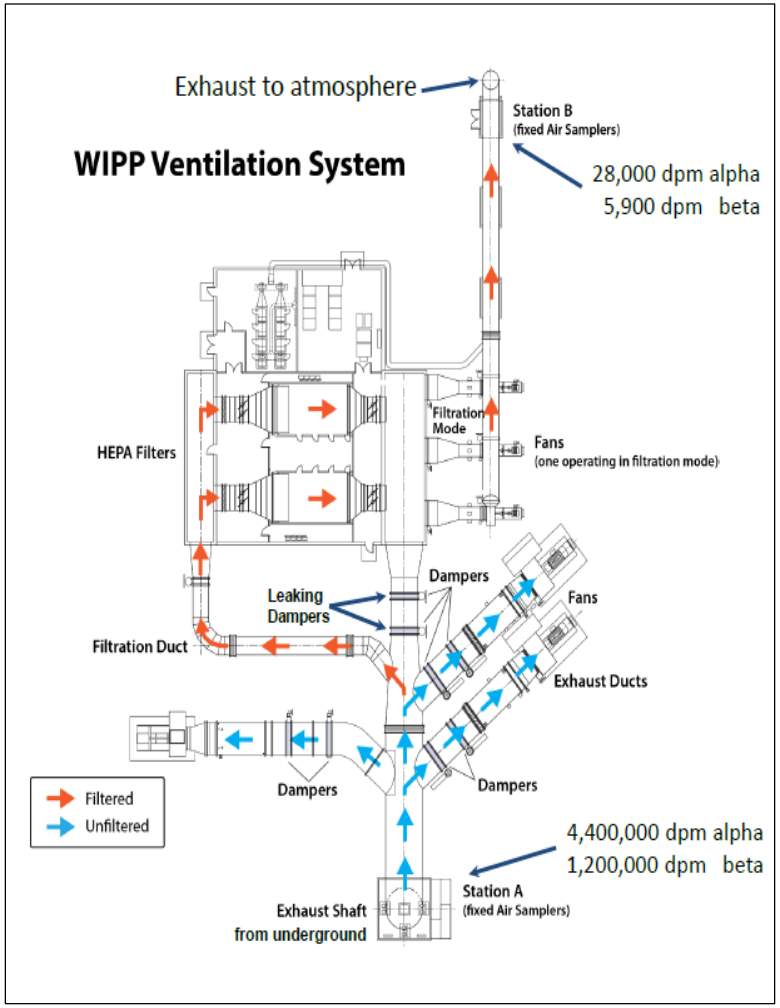
Figure ES-1: EIMCO Haul Truck 74-U-006B after Fire

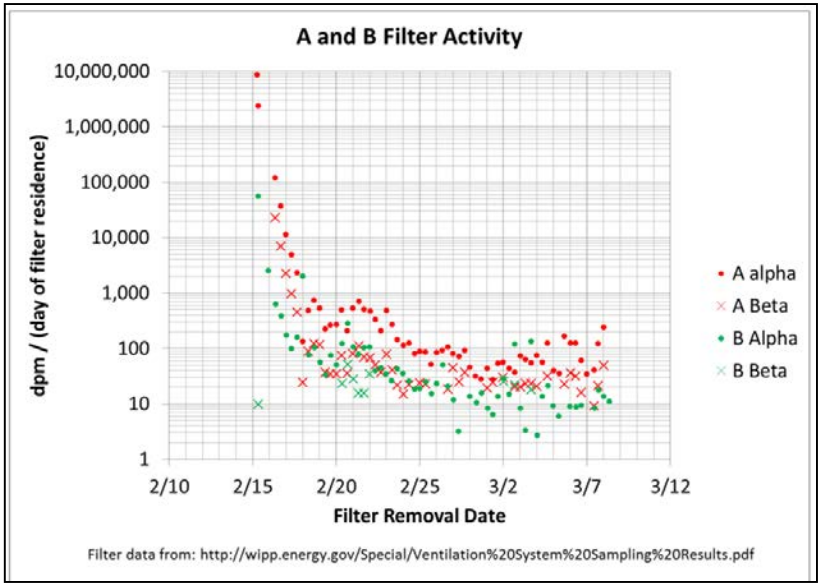


February 14, Radiation Release

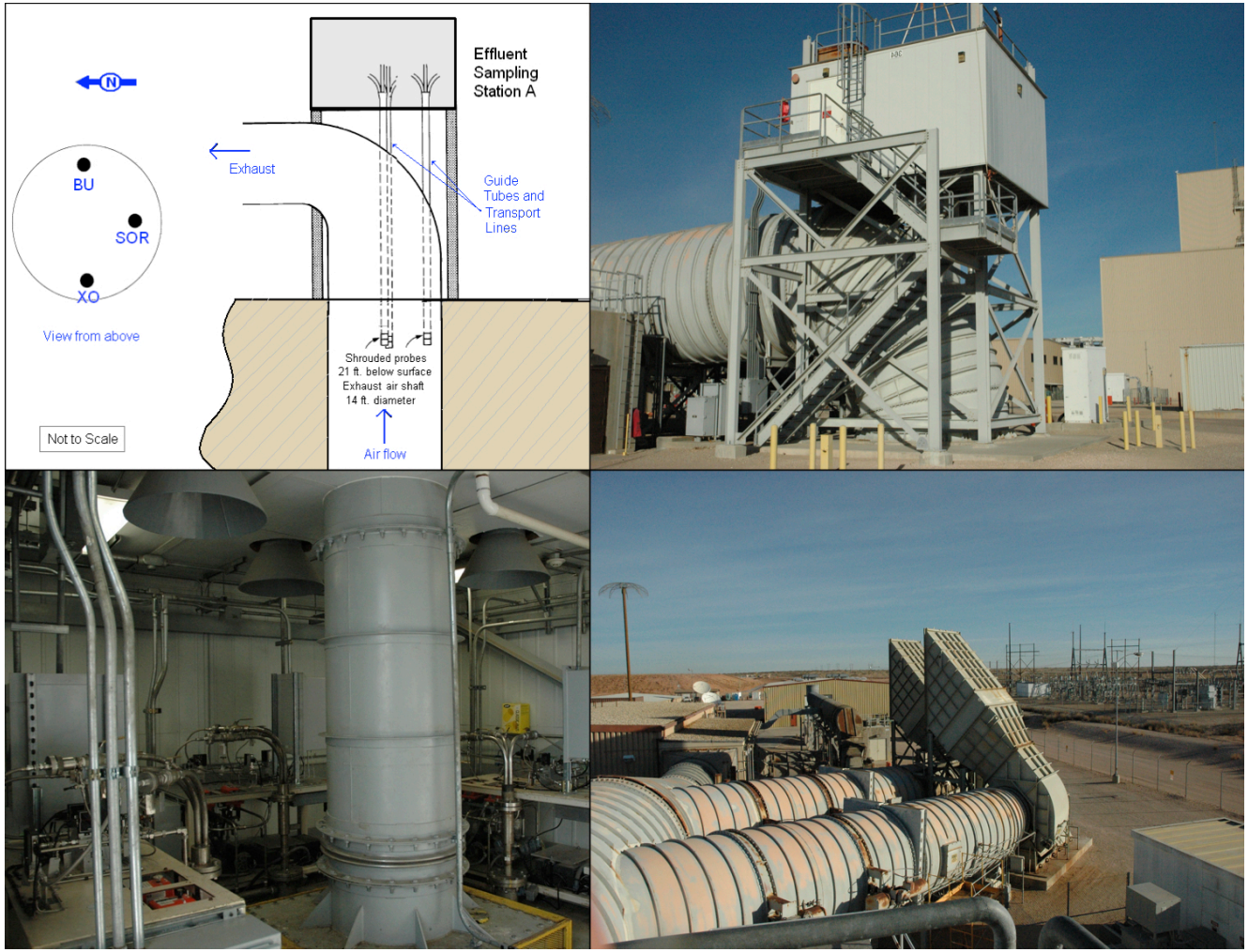
LANL, 68660 Drum with a lifted lid

Filtration bypass allowed some (minor) Release of Contamination

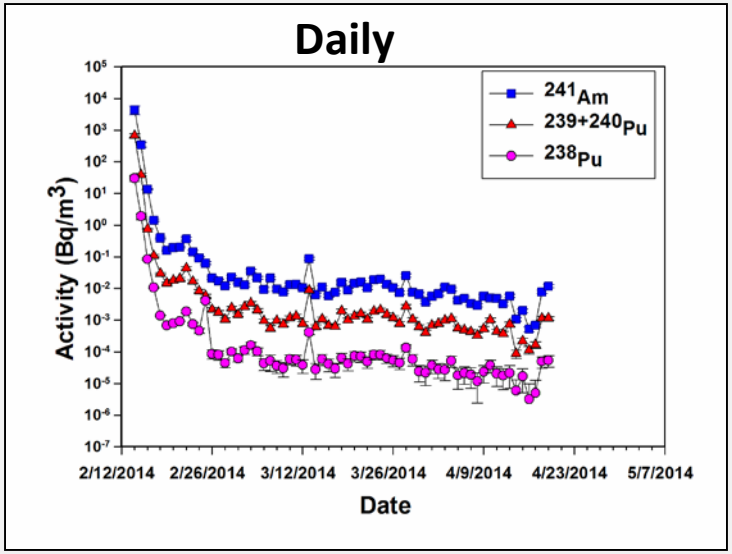


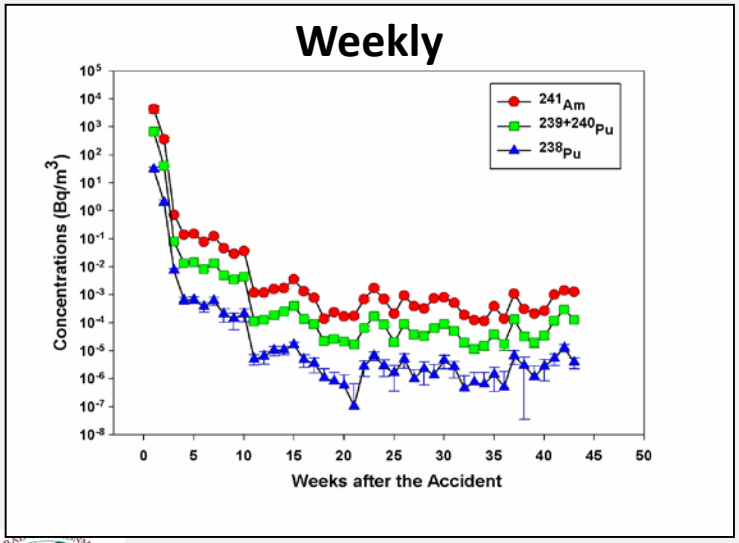


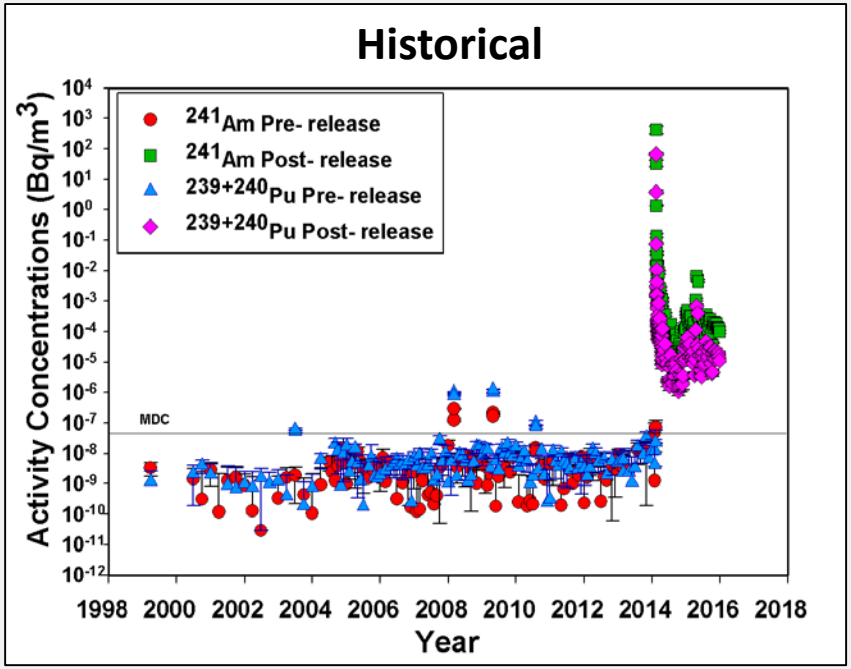
WIPP Underground Air Sampling Station A (Pre-Filtration)



Station A (Pre-Filtration)







WIPP Underground Air Sampling Station B (No- or Post-Filtration)

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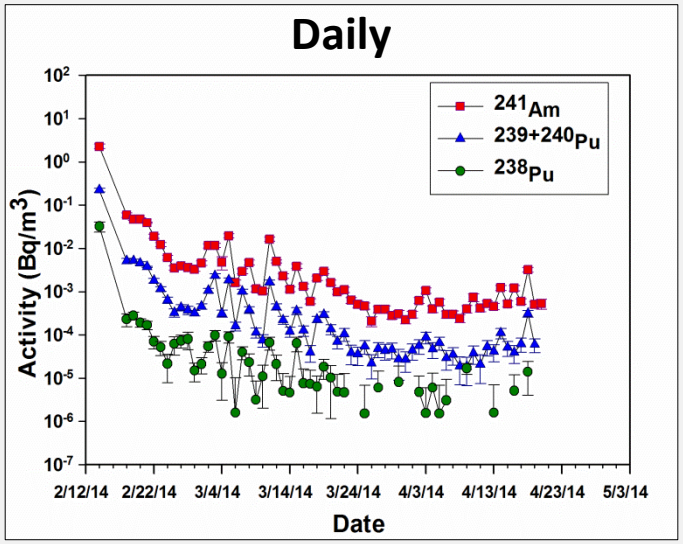
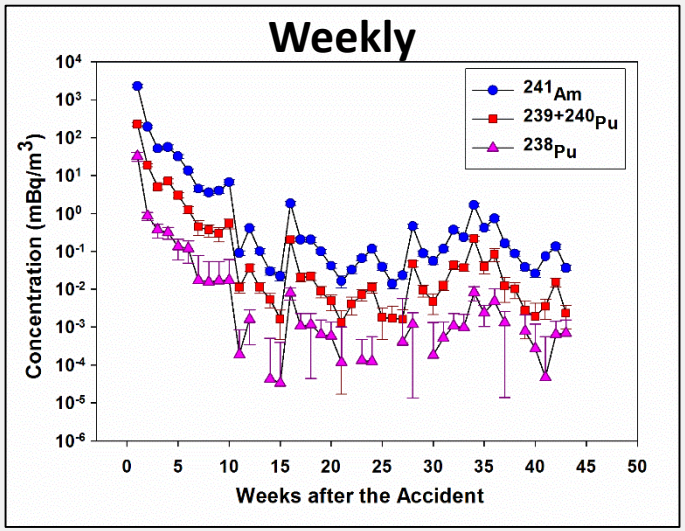
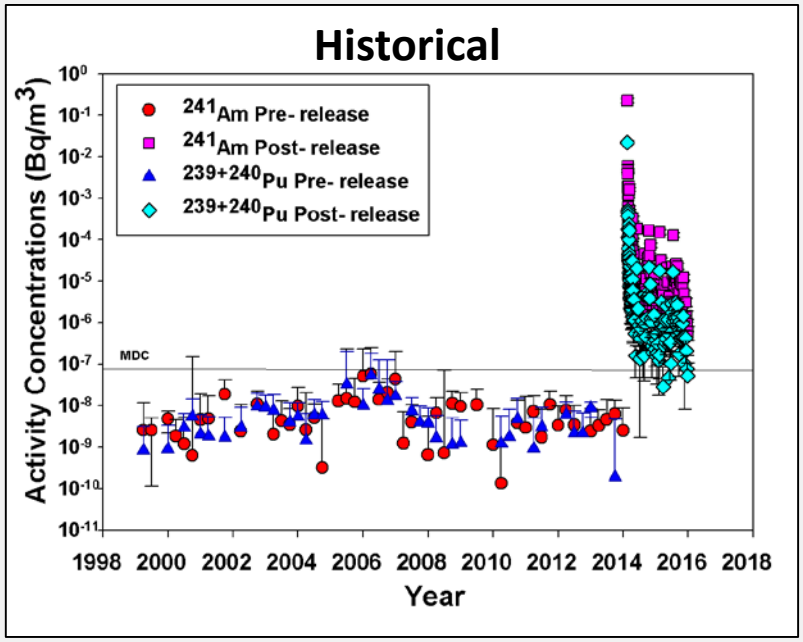




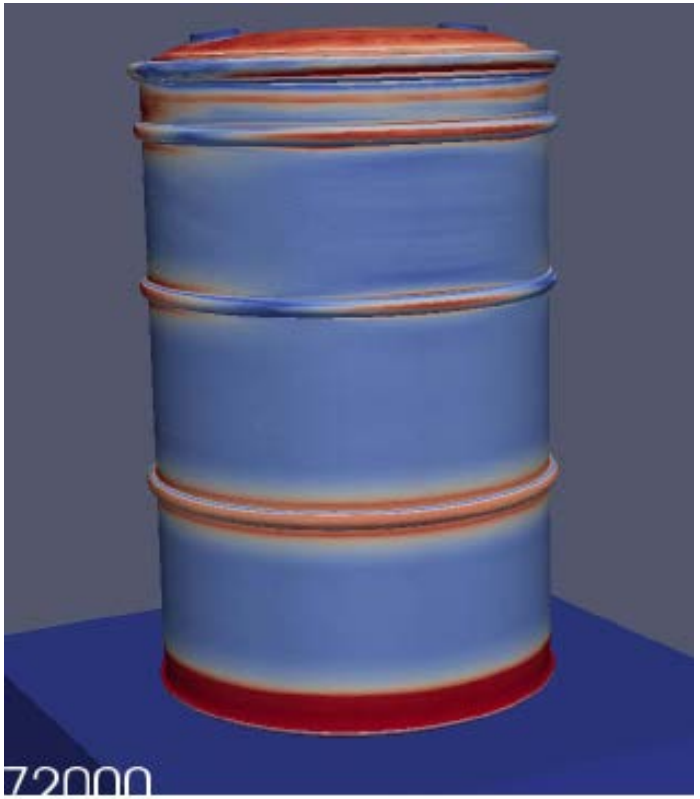


Radiological Inventory of the Breached Drum

The total radiological inventory in the drum was estimated to be around <u>6 to 11 Ci</u>

The radiological constituents in the drum include: ^{241}Am, ^{243}Am, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu.

It is estimated that about 70 % of the drum inventory released into the WIPP underground.



55-gallons drum

Source Term From Station A-Filter Analysis

Total Estimated Release of Radio-activity to Station A from the WIPP underground

CEMRC analyses:

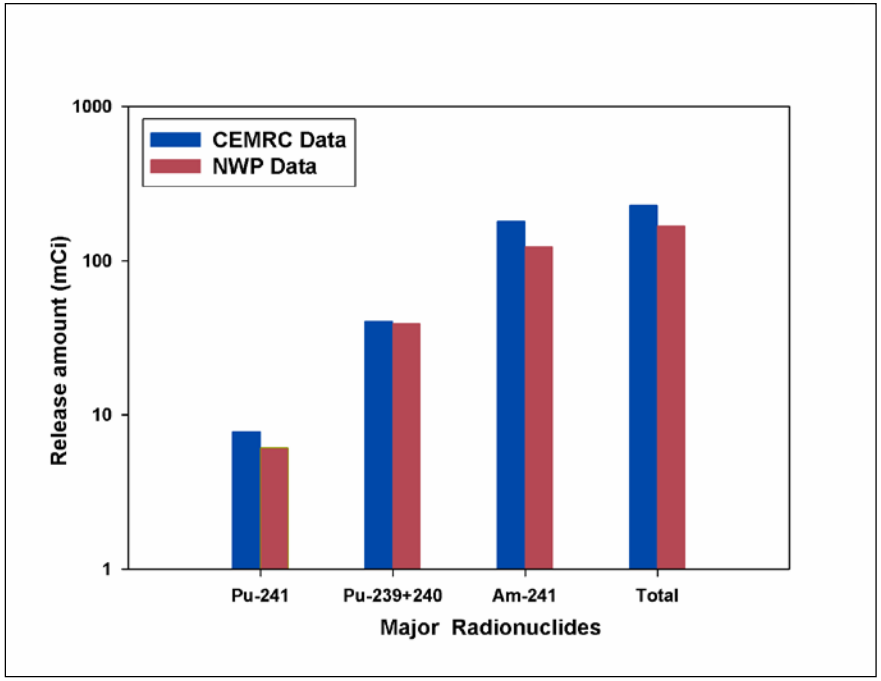
- 180.1 mCi of ^{241}Am and
- 40.3 mCi of $^{239+240}Pu$

Total = (~228 mCi)

Nuclear Waste Partnership LLC (NWP, the WIPP operating contractor) analyses :

- 123.1 mCi of ^{241}Am and
- 39.1 mCi of $^{239+240}Pu$

Total = (~168 mCi).



Source Term From Station B-Filter Analysis

(Total Environmental Release)

CEMRC analyses:

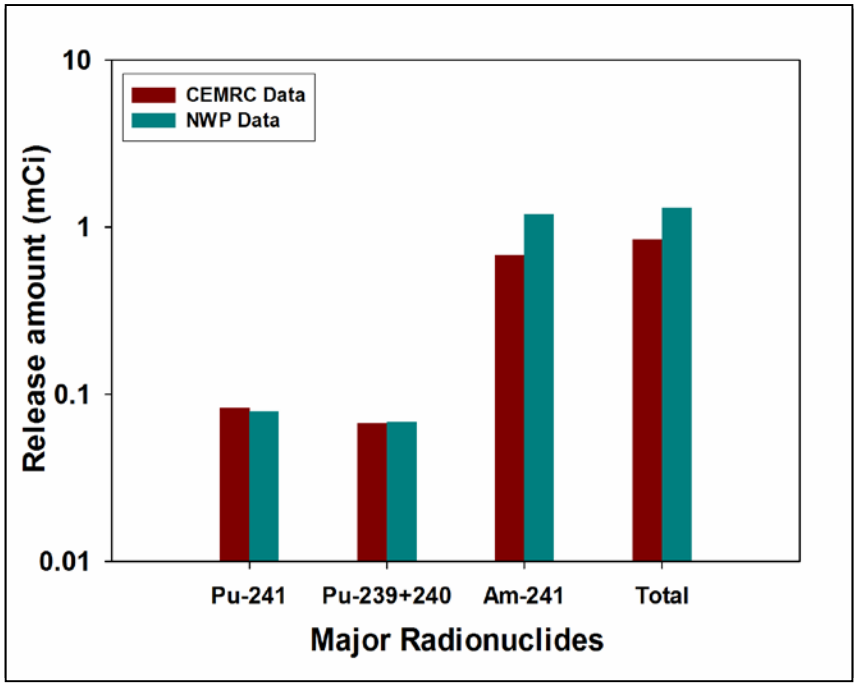
- 0.72 mCi of ^{241}Am and
- 0.067 mCi of $^{239+240}$Pu

Total = (~1 mCi).

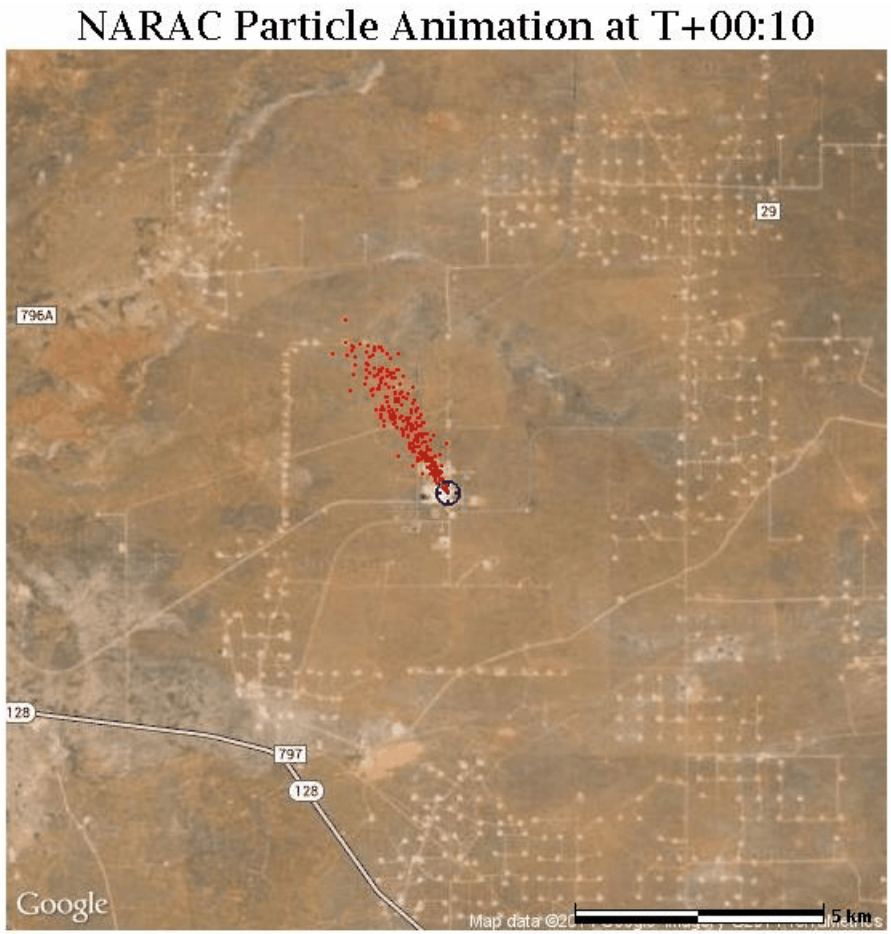
NWP analyses :

- 1.21 mCi of ^{241}Am and
- 0.068 mCi of $^{239+240}$Pu

Total = (~1.3 mCi).



NARAC Particle Dispersion Simulation for First 12 hours of Release from WIPP

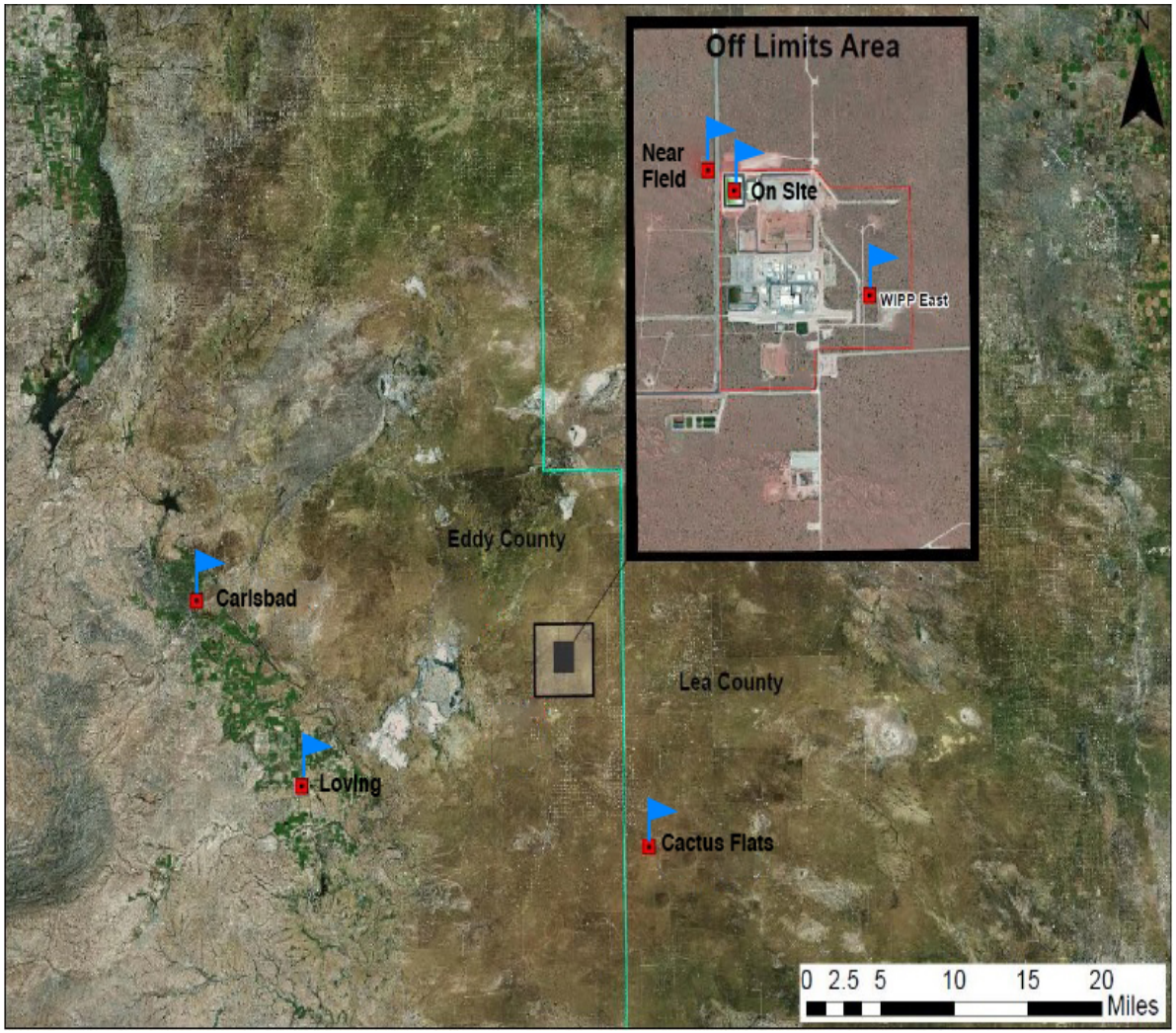


- **Release Start Time: February 14, 2014 23:39 Mountain time.**
- **On-site meteorological data used to update NARAC wind fields.**
- **Significant wind shift occurred around 07:00 Mountain on February 15, during the majority of the release.**

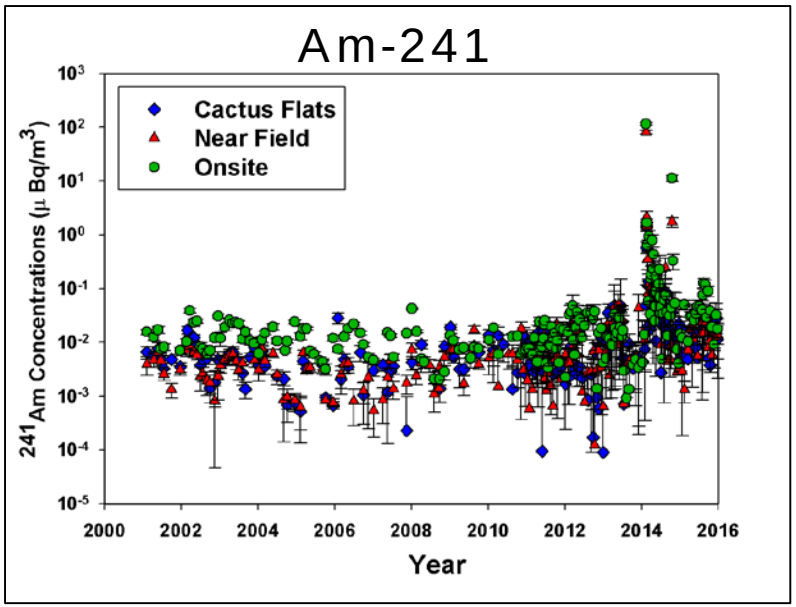
National Atmospheric Release Advisory Center NARAC

Red dots show horizontal location of all NARAC-simulated airborne particles at all heights for every 10 minutes from beginning of the release

CEMRC-Ambient Air Monitoring



CEMRC-Ambient Air Monitoring

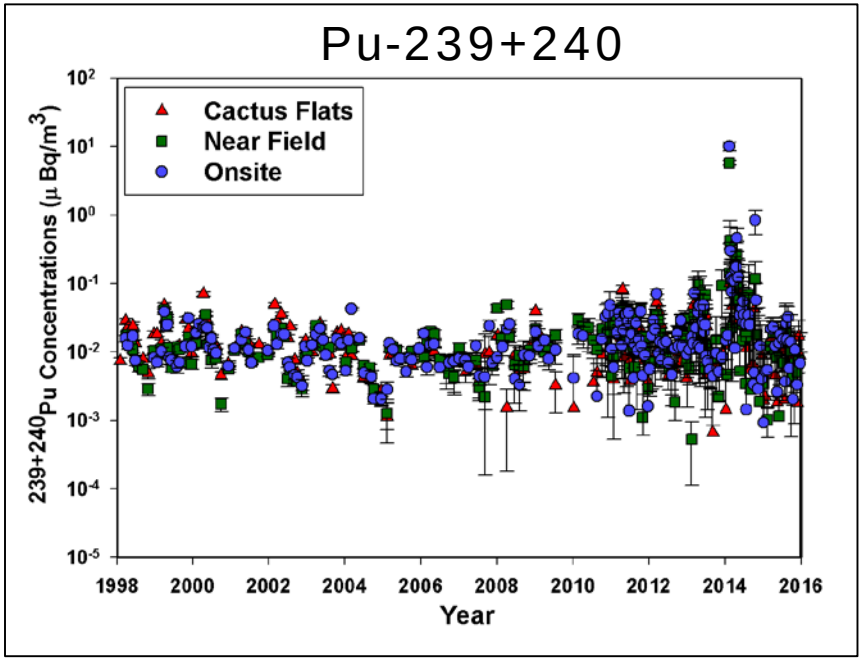


Am-241

115.2 μBq/m³ at Onsite

81.4 μBq/m³ at Near Field

No detection at Cactus Flats



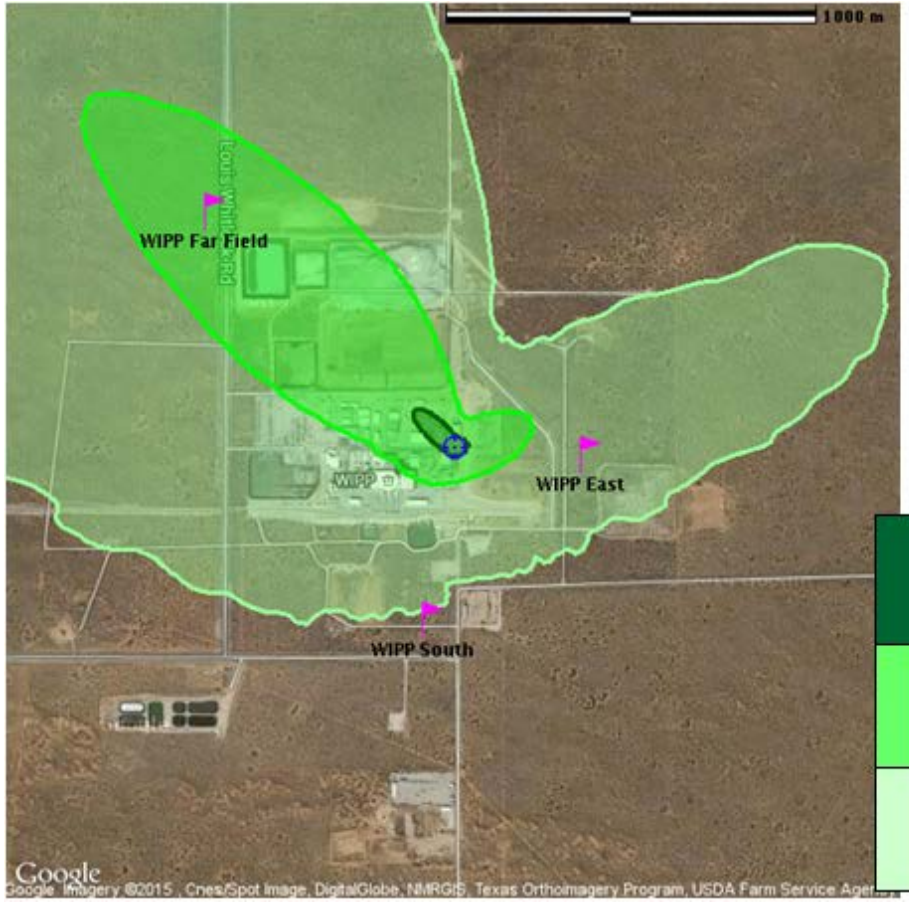
Pu-239+240

10.2 μBq/m³ at Onsite

5.8 μBq/m³ at Near Field

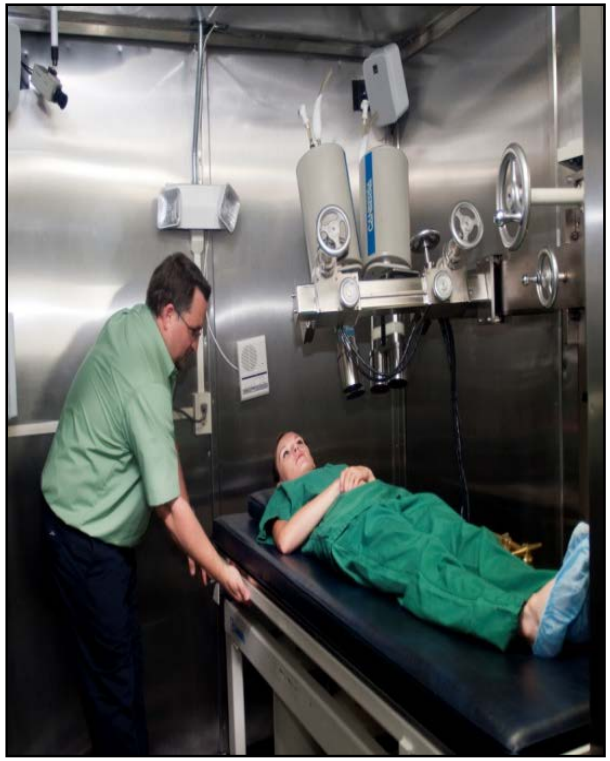
No detection at Cactus Flats

Total Effective Dose (TED) Over 7 Days (close-in view)



Dose (rem) Downwind extent (km) Area (km^2)
>0.01 rem 0.1 km 0.008 km^2
0.001-0.01 rem 1.4 km 0.5 km^2
0.0001-0.001 rem 5.1 km 11.1 km^2

Workers Exposer- Radio-bioassay



Fecal samples: 31

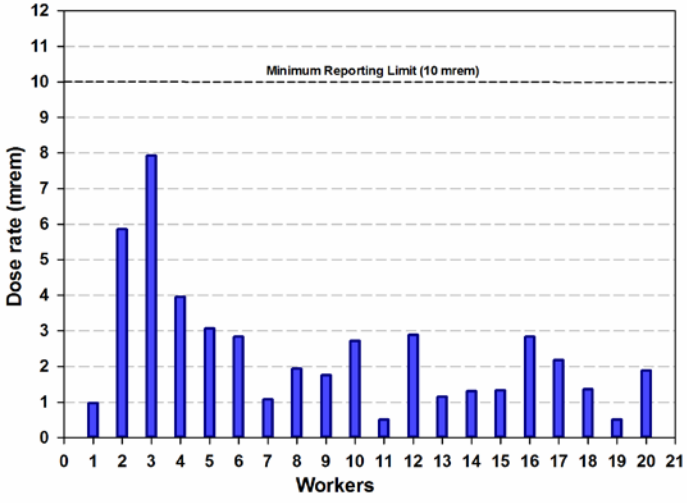
- 21 low-level positive
  - 21 positive for ^{241}Am
  - 7 positive for Pu
- 0.024 Bq (1.45 dpm) was highest total activity in a sample

Urine samples: 140

- 1 low-level ^{241}Am positive

- Between Feb-July, 2014, 144 WIPP workers and 42 local citizens were counted.
- 0.1 nCi MDA for ^{241}Am
- ^{241}Am not detected.

Dose to the Contaminated workers



CEMRC's Role

- **CEMRC communicated all its monitoring results to the public through press releases and by posting on the CEMRC website *www.cemrc.org***
- **Timely dissemination of independently measured and interpreted information following the release event, through local newspaper and Town Hall type meetings, provided the public a key element of trust and transparency**
- **Public access to the monitoring data and their ability to directly participate in CEMRC's whole body counting program provided a sense of security to concerned citizens after the event**
- **CEMRC helped keep community fear down and restored confidence <u>because it is independent.</u>**

FALSE Media Reactions to the WIPP Event

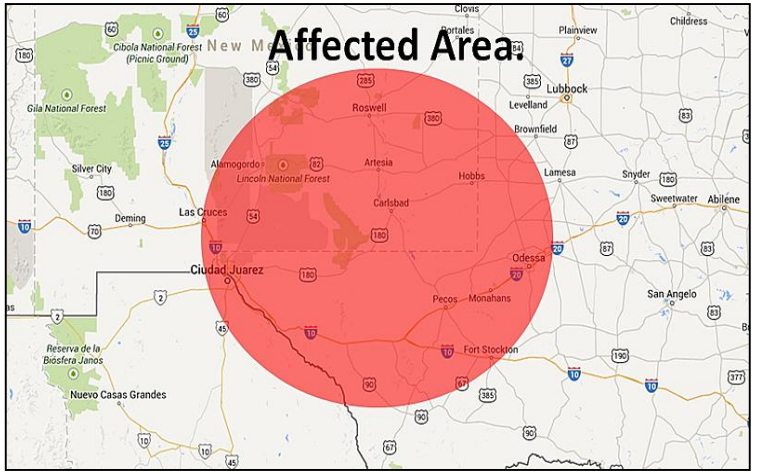
Plume containing cancerous radioactive plutonium isotopes engulfs region" after nuclear event announced by DOE

According to *Seminole Sentinel* –New Mexico and West Texas residents are preparing for evacuation following the "ongoing release of radioactive material"

Cases of lung cancer in the region are expected to skyrocket

Iranian media- Catastrophic Nuclear Event at WIPP Prompts New Mexico Evacuation

Russian media- Russian waste was (illegally) stored in WIPP and an "experiment" conducted in WIPP on Feb. 5 went horrible wrong



Conclusions

- **After almost fifteen years, the first significant airborne radiation was released from WIPP and detected above ground on February 14, 2014.**
- **The concentrations detected in air were very small, localized, and well below any level of public-health or environmental concern.**
- **Independent monitoring and public engagement by CEMRC helped alleviate fears locally and regionally.**
- **The WIPP release incident was newsworthy, but it was not dangerous to any member of the public.**
- **Once recovered, WIPP can once again be a safe permanent disposal solution to the country's Cold War legacy of transuranic nuclear waste.**
- **The CEMRC independent monitoring and communications model ought to be considered as part of any consent-based siting process for new nuclear facilities, especially nuclear waste repositories, elsewhere in the nation and world.**