U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

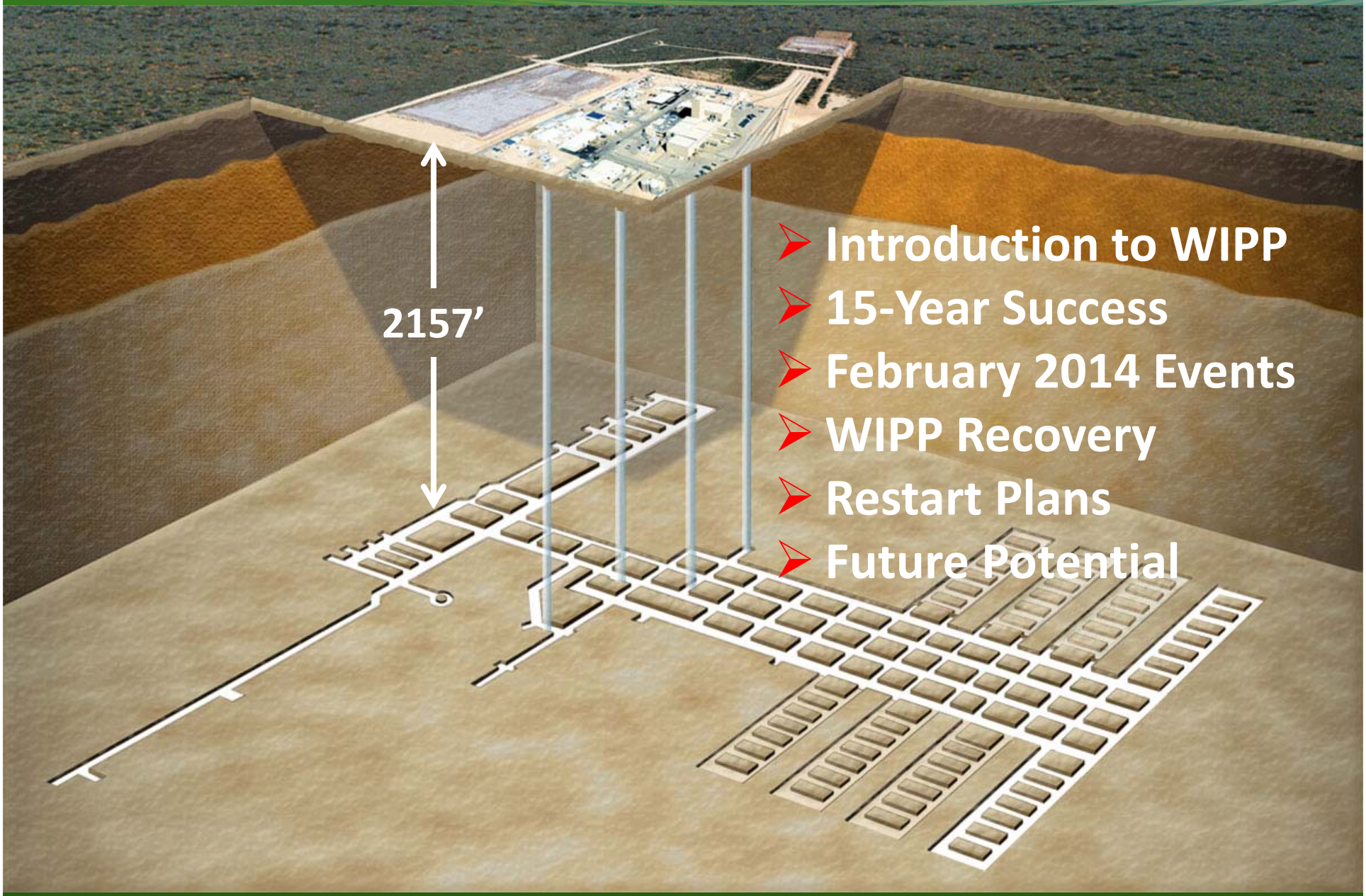
Status and Plans

Geologic Isolation of Radioactive Wastes from America's Nuclear Defense Programs

Nuclear Materials Management and Safeguards System
New Orleans, May 10, 2016

Roger Nelson, USDOE
Carlsbad Field Office

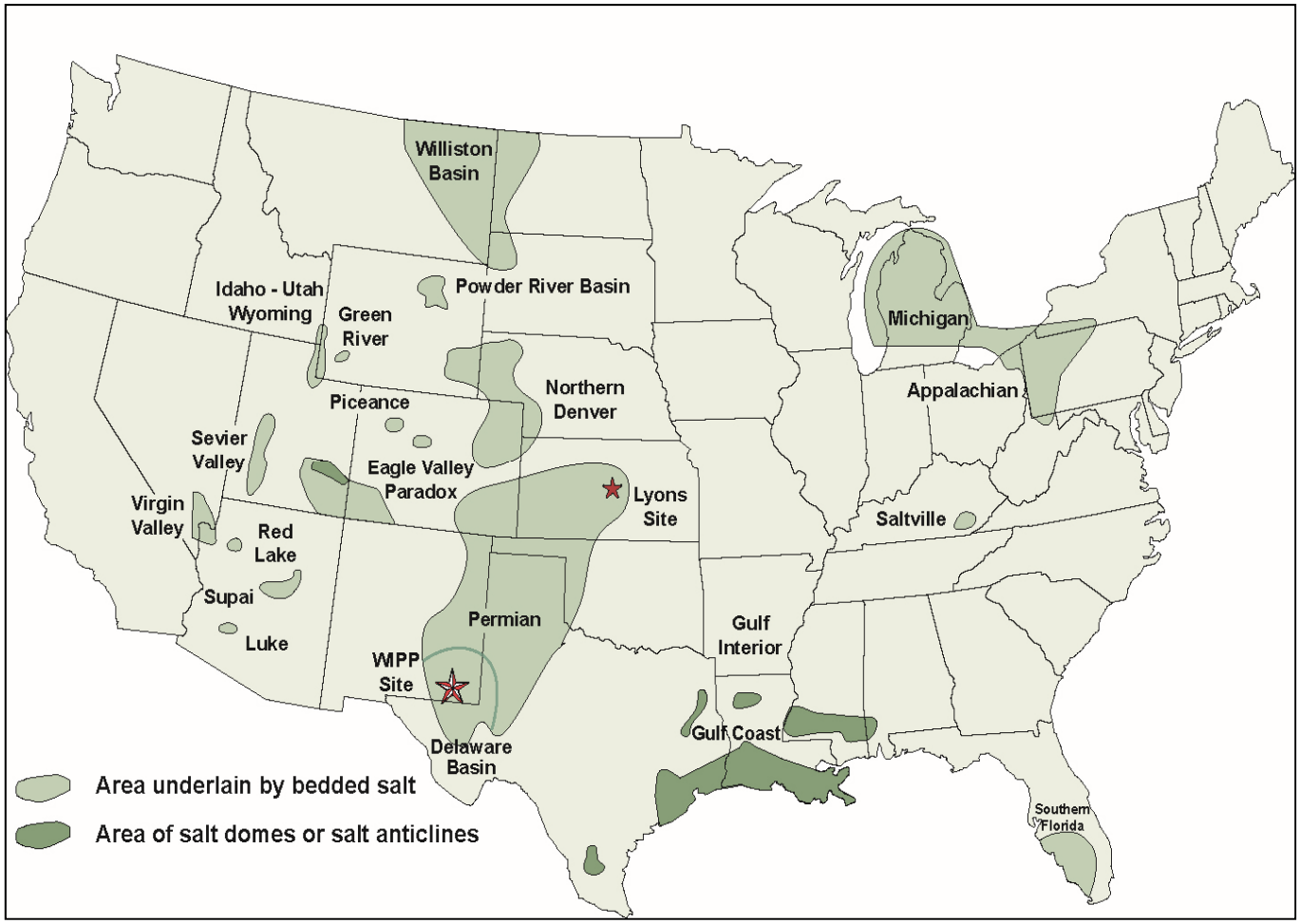
Outline



- Introduction to WIPP
- 15-Year Success
- February 2014 Events
- WIPP Recovery
- Restart Plans
- Future Potential

Salt is the reason for WIPP's location

"Salt at great depth 'flows.' It will encapsulate waste and isolate it from the surface for eons."



- **NAS 1957 Recommendation**
- **Stable geology (~250 million years)**
- **Lack of water**
- **Easy to mine**
- **Self-healing fractures**
- **Salt "creep" will encapsulate the waste**
- **High thermal conductivity**

"The great advantage is that no water can pass through salt. Fractures are self healing…."

National Academy of Sciences, 1957

Authorization & Appropriation in 1980

DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Pub. L. 96-164; 93 Stat. 1269)

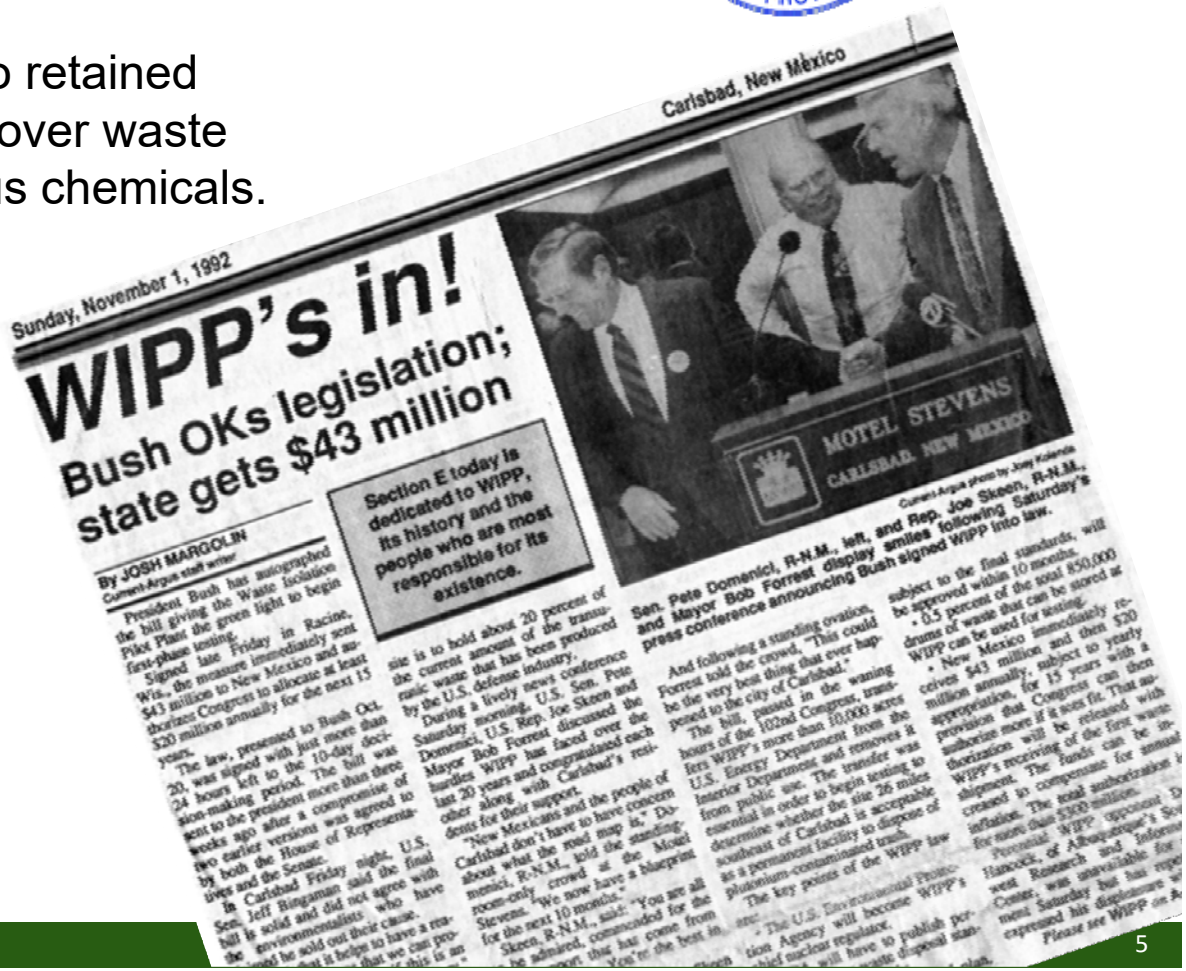
Domenici

R&D facility to demonstrate safe disposal of radioactive waste from U.S. defense activities and programs.

Regulatory Framework

1992 Bush signs the WIPP Land Withdrawal Act into law, designating the Environmental Protection Agency as WIPP's primary regulator for long-term compliance with repository containment standards.

State of New Mexico retained regulatory authority over waste containing hazardous chemicals.



Carlsbad, New Mexico

Sunday, November 1, 1992

WIPP's in!

Bush OKs legislation; state gets $43 million

Section E today is dedicated to WIPP, its history and the people who are most responsible for its existence.

By JOSH MARGOLIN
Current-Argus staff writer

President Bush has autographed the bill giving the Waste Isolation Pilot Plant the green light to begin first-phase testing.

Signed late Friday in Racine, Wis., the measure immediately sent $43 million to New Mexico and authorizes Congress to allocate at least $20 million annually for the next 15 years.

The law, presented to Bush Oct. 20, was signed with just more than 24 hours left to the 10-day decision-making period. The bill was sent to the president more than three weeks ago after a compromise of two earlier versions was agreed to by both the House of Representatives and the Senate.

In Carlsbad Friday night, U.S. Sen. Jeff Bingaman said the final bill is solid and did not agree with the environmentalists who have

site is to hold about 20 percent of the current amount of the transuranic waste that has been produced by the U.S. defense industry.

During a lively news conference Saturday morning, U.S. Sen. Pete Domenici, U.S. Rep. Joe Skeen and Mayor Bob Forrest discussed the hurdles WIPP has faced over the last 20 years and congratulated each other along with Carlsbad's residents for their support.

"New Mexicans and the people of Carlsbad don't have to have concern about what the road map is," Domenici, R-N.M., told the standing-room-only crowd at the Motel Stevens. "We now have a blueprint for the next 10 months."

Skeen, R-N.M., said: "You are all be admired, commended for the

Sen. Pete Domenici, R-N.M., left, and Rep. Joe Skeen, R-N.M., and Mayor Bob Forrest display smiles following Saturday's press conference announcing Bush signed WIPP into law.

Current-Argus photo by Joey Kolenda

And following a standing ovation, Forrest told the crowd, "This could be the very best thing that ever happened to the city of Carlsbad."

The bill, passed in the waning hours of the 102nd Congress, transfers WIPP's more than 10,000 acres U.S. Energy Department from the Interior Department and removes it from public use. The transfer was essential in order to begin testing to determine whether the site 26 miles southeast of Carlsbad is acceptable as a permanent facility to dispose of plutonium-contaminated trash.

The key points of the WIPP law are:

• The U.S. Environmental Protection Agency will become WIPP's chief nuclear regulator.

subject to the final standards, will be approved within 10 months.

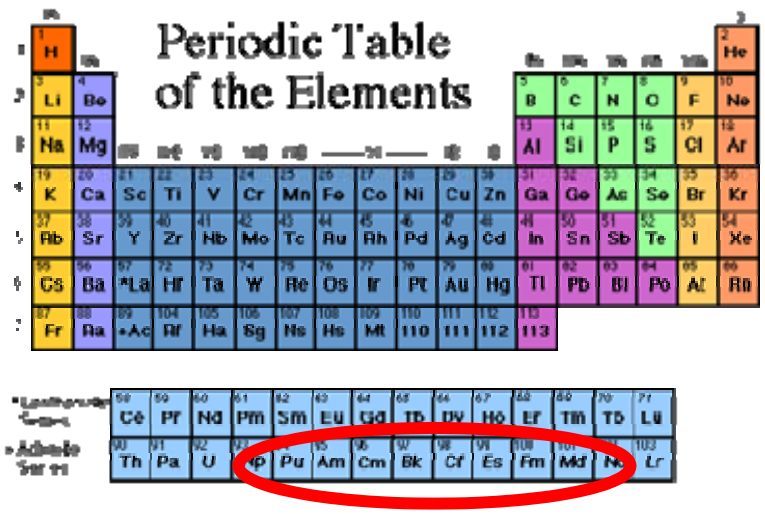
• 0.5 percent of the total 850,000 drums of waste that can be stored at WIPP can be used for testing.

• New Mexico immediately receives $43 million and then $20 million annually, subject to yearly appropriation, for 15 years with a provision that Congress can then authorize more if it sees fit. That authorization will be released with WIPP's receiving of the first waste shipment. The funds can be increased to compensate for annual inflation. The total authorization is for more than $300 million.

Potential WIPP opponent D Hancock, of Albuquerque's Sou west Research and Informa Center, was unavailable for ment Saturday but has repe expressed his displeasure w

Please see WIPP on A

Disposal of "TRU" waste



- Materials contaminated with man-made radioactive elements heavier than uranium
  - Debris: gloves, tools, rags, containers, equipment, machinery, etc.
  - Contaminated soils
  - Homogeneous solids, residues
- > 100 nCi/g (> class "C" commercial):
  - alpha emitting isotopes (~1 ppm Pu)
  - $t_{1/2}$ > 20 years
- Two types of TRU waste
  - Contact-Handled (<200 mrem/hr)
  - Remote-Handled (>2 mSv/hr)
- Legacy inventory ~700,000 drum equivalents

Z > 92 (transuranic) - mostly Plutonium

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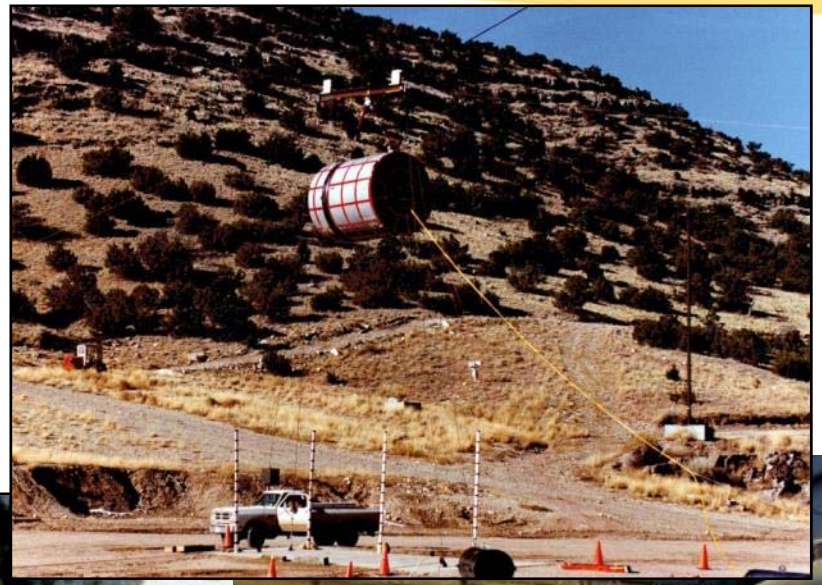
Contact Handled Waste Shipping Container

- Licensed by NRC: 1989
- Extensive testing
- Multiple payload options
- Double containment
- ~3 m^3 capacity
- 12,500 lbs (5700 kg)



Type B

TRUPACT-II

Remote Handled Waste Shipped in Shielded Packages

RH-72B

- Tested to same specifications as CH waste shipping packages
- Also Type B

CNS 10-160B

Shipping Statistics and Routes

22 sites completed

Approximately 11,900 shipments

RH & CH Waste Disposal

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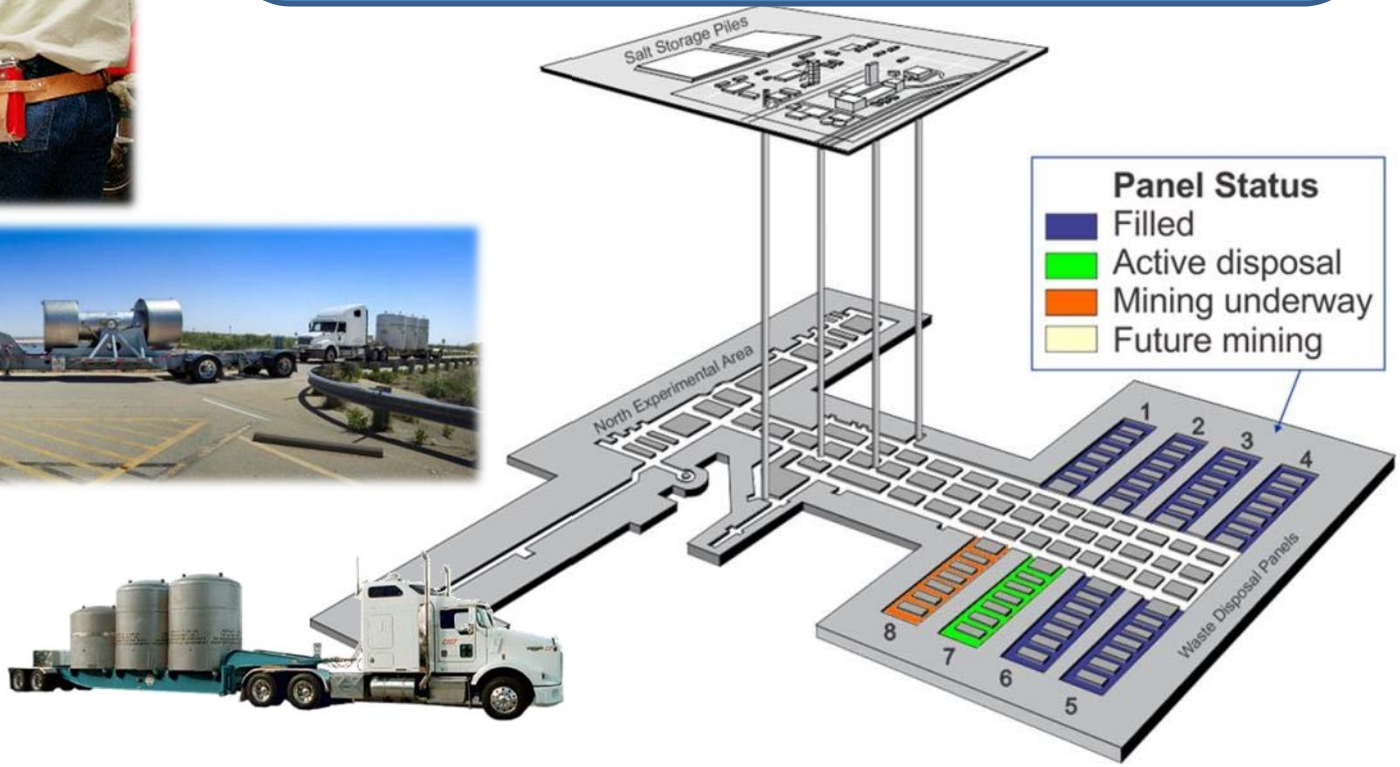
WIPP's 15-year History of Success*

11,894	shipments received
33,000	type B packages unloaded
91,000	cubic meters of TRU waste disposed
14,200,000	loaded miles
24	storage sites cleaned

* Through February 4, 2014



Underground Fire

CARLSBAD CURRENT-ARGUS

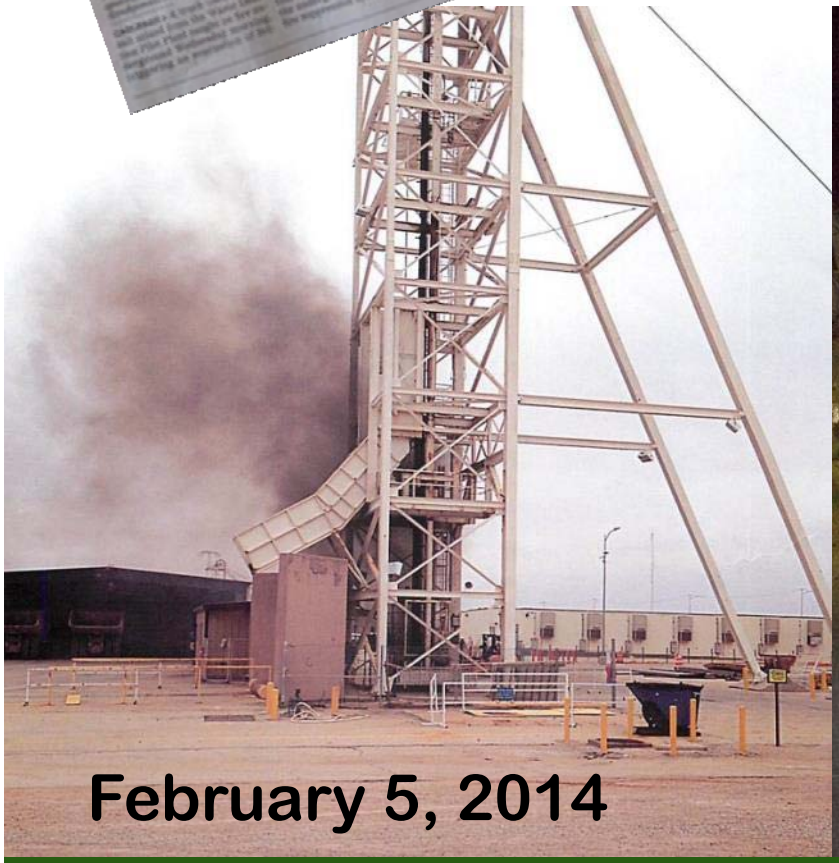
Thursday, February 6, 2014

ACCIDENT

Underground fire shuts WIPP

Several workers treated for smoke inhalation after truck used to haul salt erupts in flames; no nuclear waste in in vicinity of blaze

Formal Type B Accident Investigation Board Appointed by EM-1 and On-Site in by Feb. 10



AIB Report Findings

- Maintenance program was ineffective
- Fire protection program was less than adequate
- Nuclear facility versus mine culture

Hydraulic Leak under Sister Vehicle

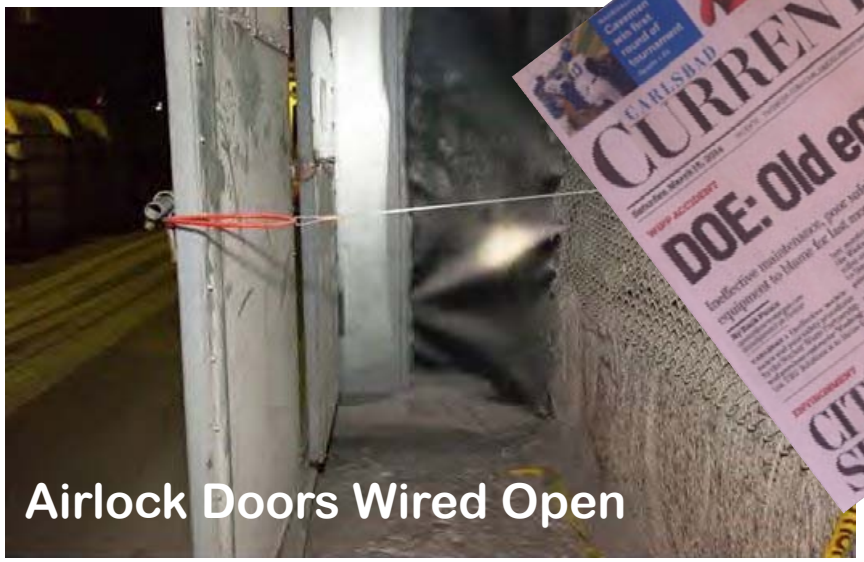
CARLSBAD CURRENT-ARGUS

DOE: Old equipment to blame

Ineffective maintenance's poor safety procedures and outdated equipment to blame for last month's underground fire at WIPP

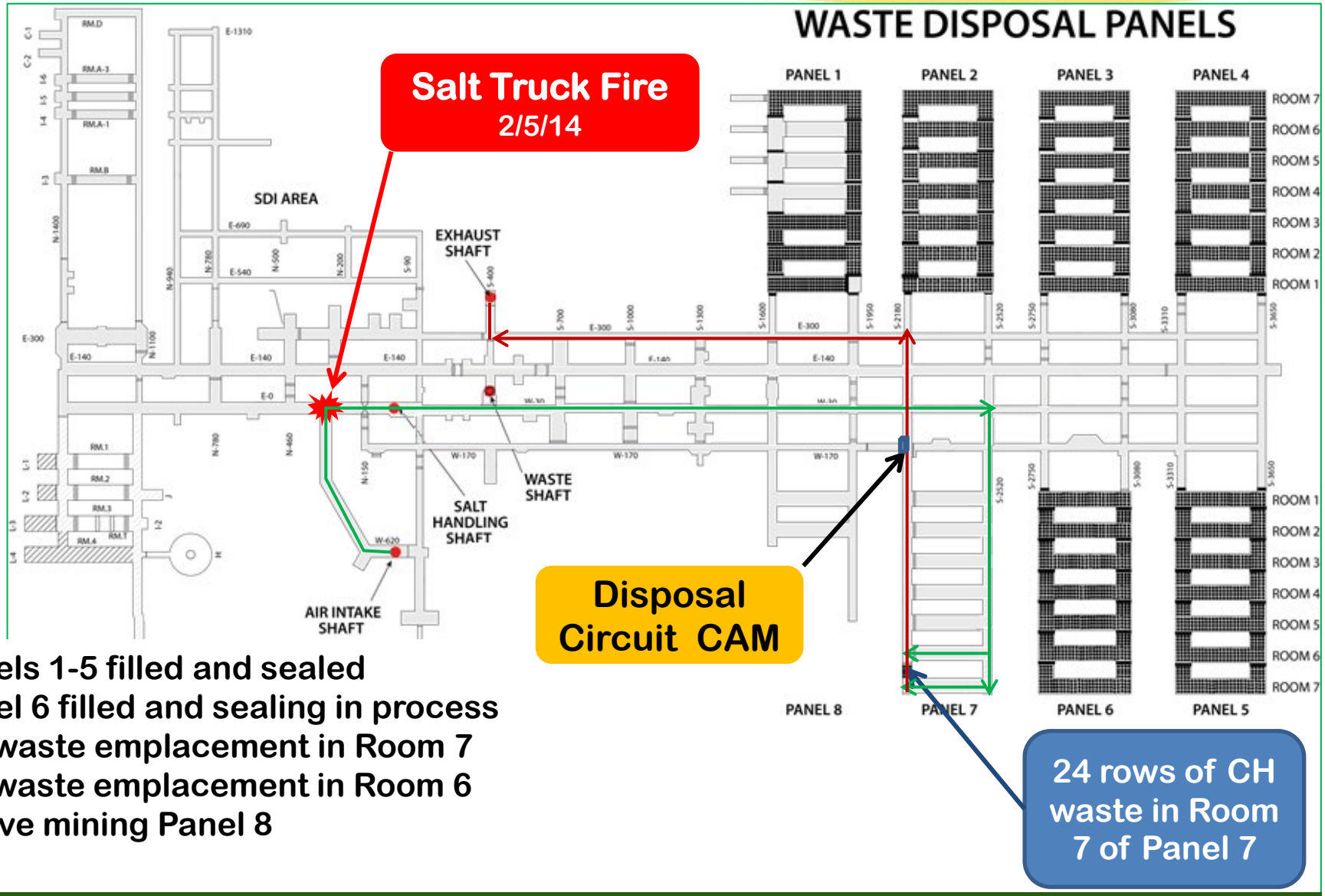
CITY CONSIDERS SINKHOLE OPTIONS

Lack of seat belt use leads


Airlock Doors Wired Open

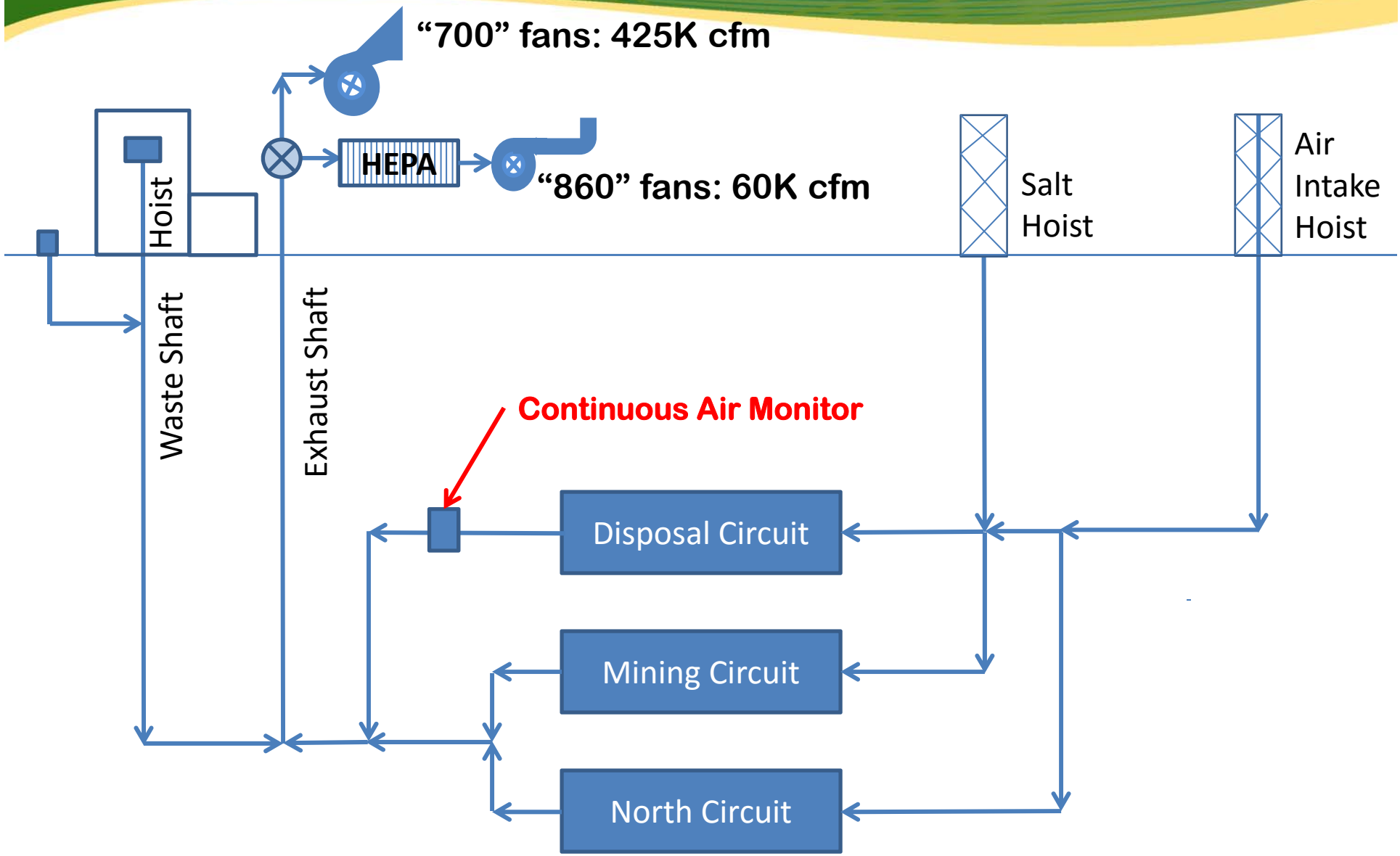
Combustible Loading in U/G

U/G Status February 5, 2014

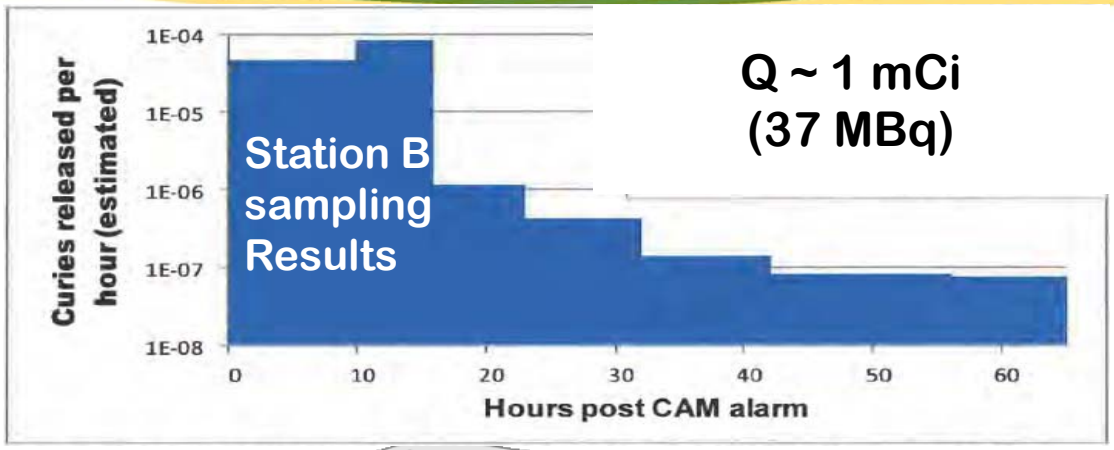


- Panels 1-5 filled and sealed
- Panel 6 filled and sealing in process
- CH waste emplacement in Room 7
- RH waste emplacement in Room 6
- Active mining Panel 8

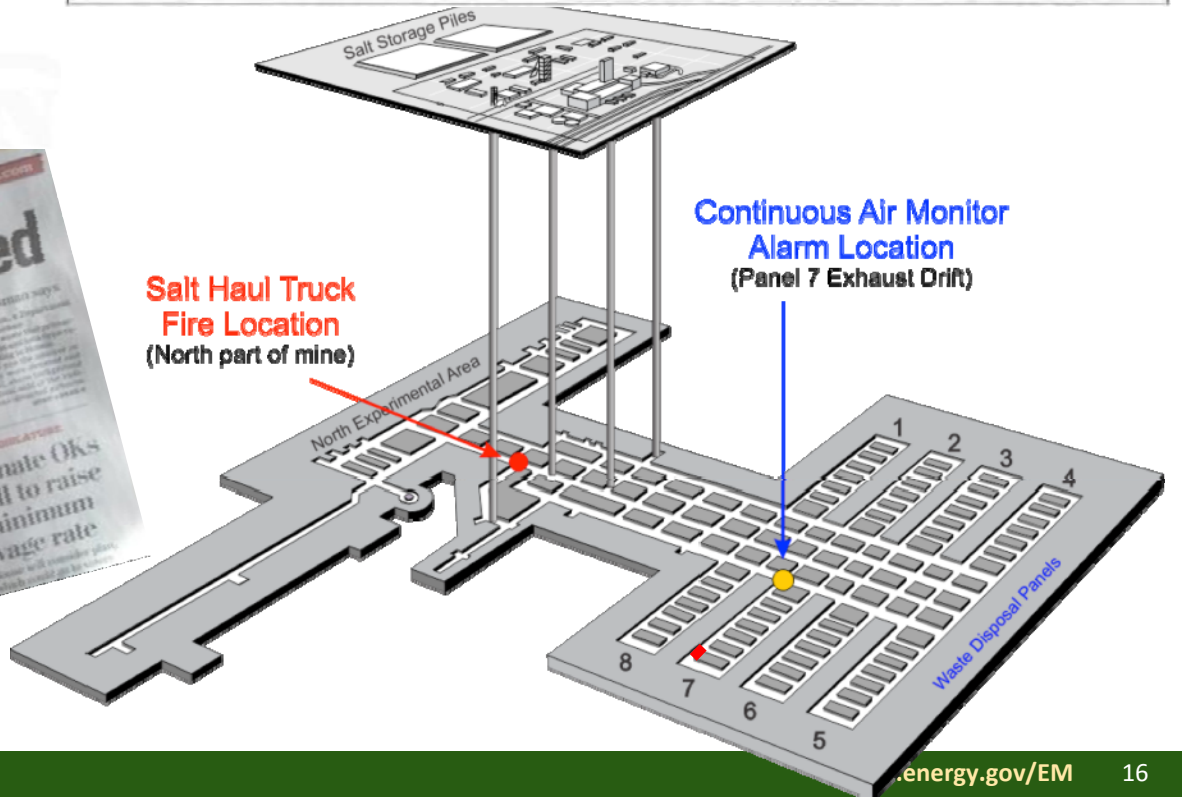
WIPP Mine Ventilation System



February 14th , Radiation Release; HEPA Filtration

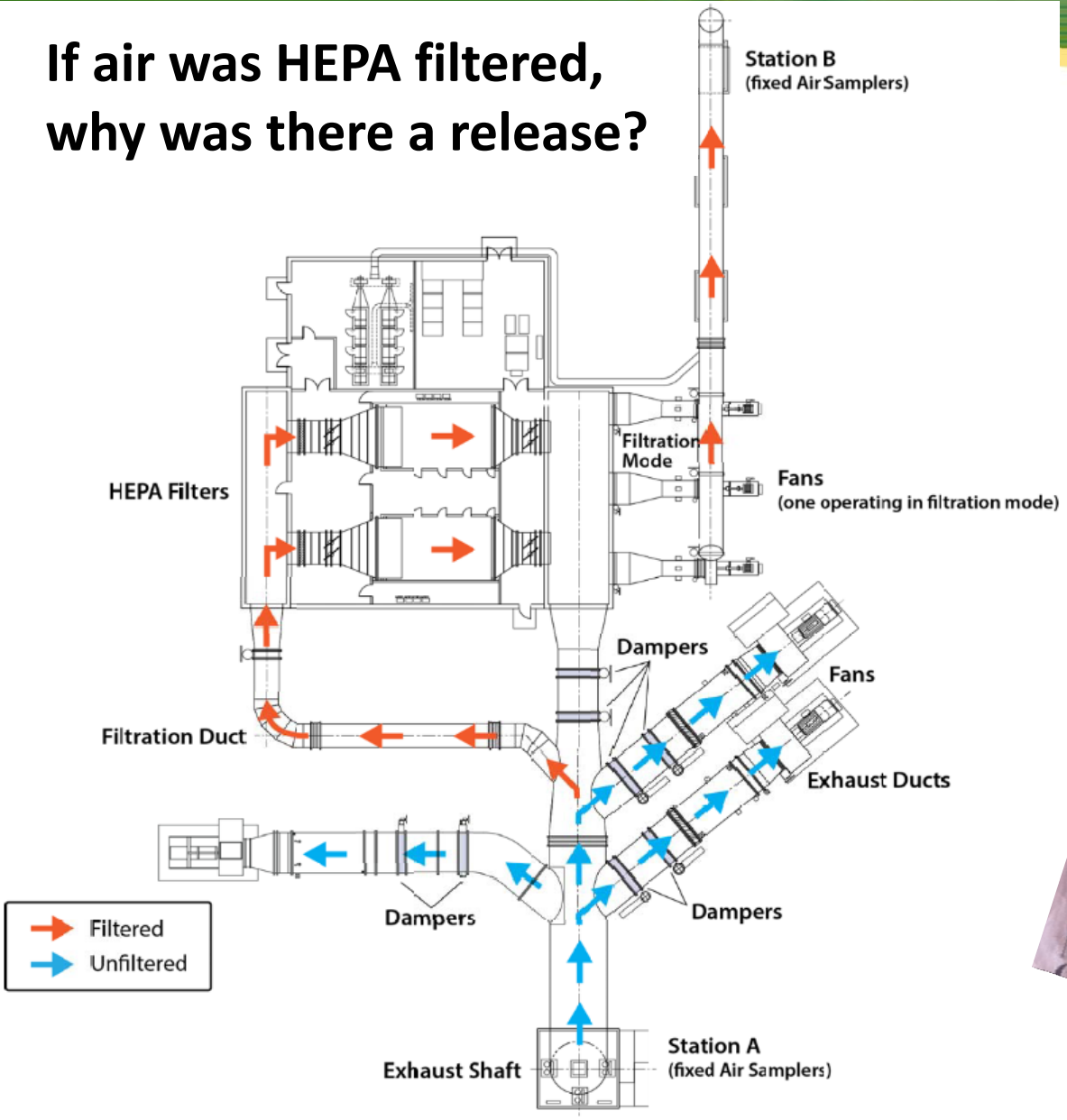


Q ~ 1 mCi (37 MBq)



Surface HEPA Filtration System

If air was HEPA filtered, why was there a release?



Early Entries - Visuals From a Distance

April entries with elevated camera and high intensity light showed broad damage to MgO bags, but no obvious cause could be identified.

Later Entries : Evidence of Heat Event

May 15 Entry

Affected drum from waste stream MIN-02 from LANL

Other MIN-02 containers:

- **WIPP: 55 drums in Panel 7/Room 7**
  WIPP: 453 drums in Panel 6.
- **WCS: 113 drums at Andrews, TX**
- **LANL: 57 drums still at TA-54**

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Project REACH – Complete Visual Survey

ARGUS

currentargus.com

WIPP

Cat litter possibly had role in leak

By Zack Ponce

CARLSBAD • A change in the type of "kitty litter" that's mixed with transuranic waste may be to blame for February's radiation leak at the Waste Isolation Pilot Plant.

A scientist who worked at WIPP until 2010 says he believes a change from non-organic kitty litter to organic litter caused a chemical reaction inside a waste drum, releasing the radioactive isotopes.

WIPP announced Monday night that photos taken over the weekend showed evidence of various

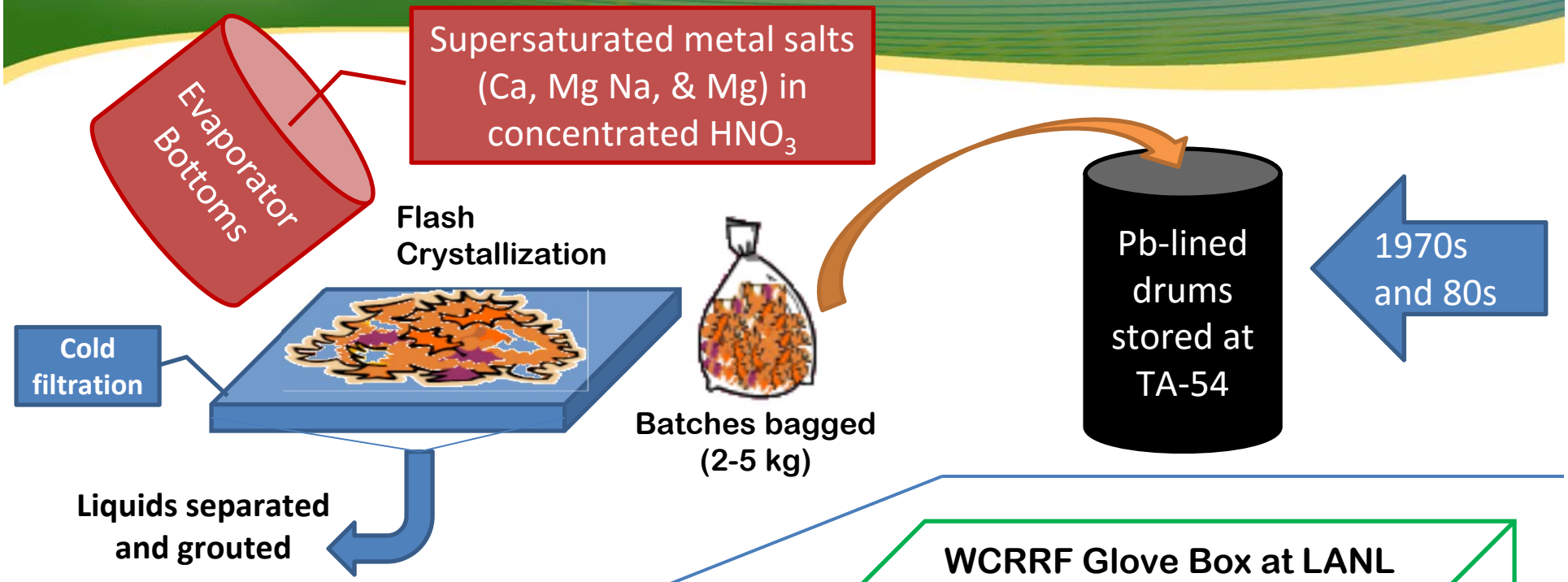
Project REACH Findings:

1. Single drum burst from internal combustion of organic kitty liter (fuel) and metal nitrate salts (oxidizer) – MIN-02

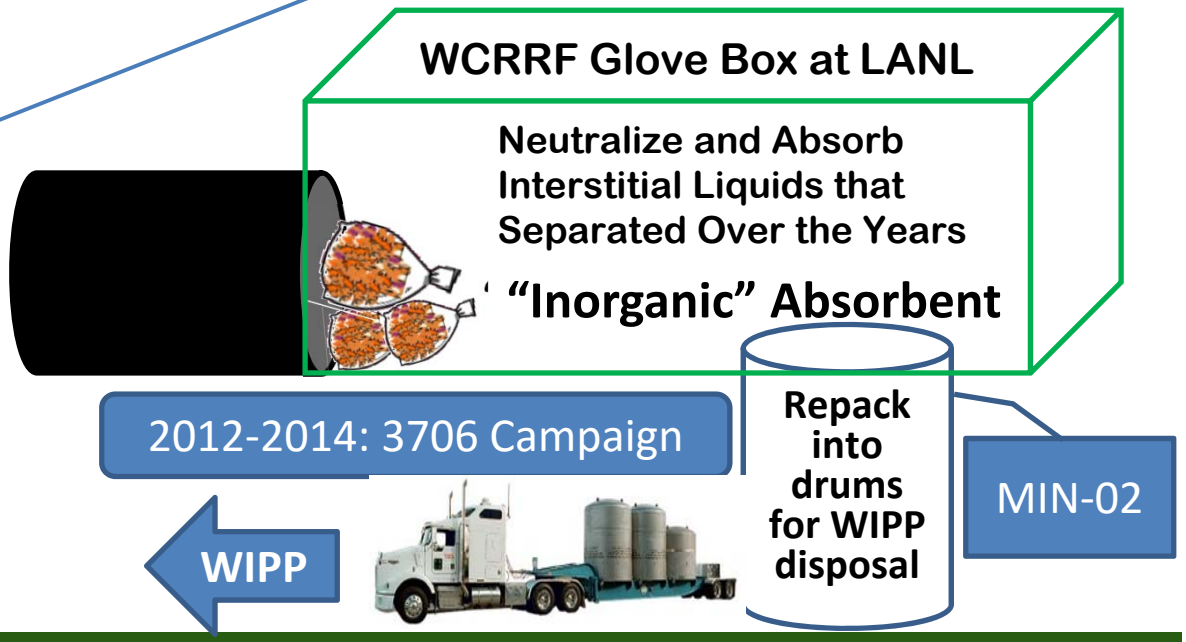
2. Flammable gases ignited adjacent combustibles: PE stretch wrap, PE slip-sheets, polypropylene MgO bag fabric and cardboard stiffeners

3. Combustibles burned across the top tier, spilling powdered MgO, and extinguishing combustion on lower tiers.

Origin of MIN-02



Without adequate review, LANL changed the process to use an organic neutralizer (Triethanolamine) and an organic absorbent (Swheat kitty liter)



AIB Phase 2 Report on Cause of Rad Release

HQ-EM	06	31	37	40													
CBFO	05	11	29	30													
NTP	01	02	04	28													
CCP	07	08	12														
NWP	33	34	35	36													
NA-LA	03	24	26	27													
LANS	09	10	13	14	15	16	17	18	19	20	21	22	23	25	32	38	39

Judgement of Needs Across All Participants

<u>Direct cause:</u> Reaction of incompatible materials in LANL drum 68660 led to thermal runaway, breach of the drum, and release of a portion of the contents into the WIPP underground.

<u>Local root cause</u>: Failure of LANS to understand and effectively implement the Permit and CBFO directed controls. Specifically, LANL's "waste treatment operation" resulted in a noncompliant, ignitable waste form.

<u>Systemic root cause</u>: Los Alamos Field Office (NA-LA) and National Transuranic Program/CBFO failure to ensure that LANL developed and implemented repackaging and treatment procedures that incorporated suitable hazard controls and <u>included a rigorous review and approval process</u>.

Near Term Highest Priority

Install Interim Panel Closures

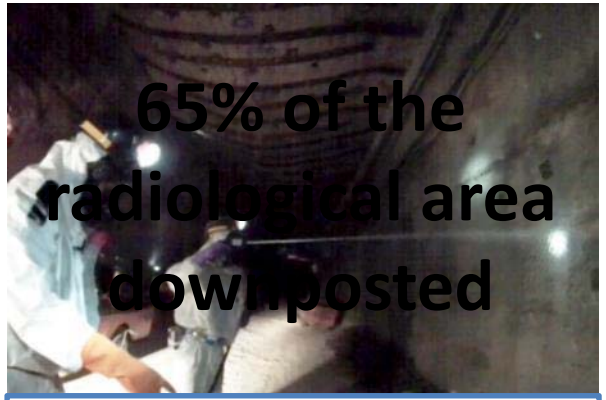
- Room 7, Panel 7
- Panel 6
- Completed 2015

Interim Panel Closures:

- Chain-link + Brattice Cloth
- Anchored in ROM salt at angle of repose
- Metal Bulkhead with HD rubber seals to rock

Recovery Progress Status

Ground Control



Radiological Risk Reduction

Electrical Restoration

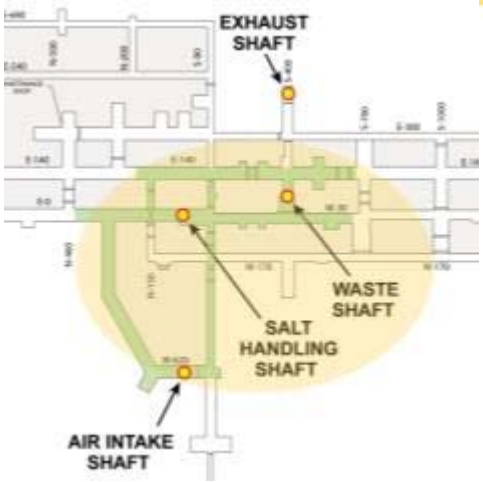
Zone Recovery

AIB/SMP Corrective Actions

DSA Revision

Enhancements to WIPP

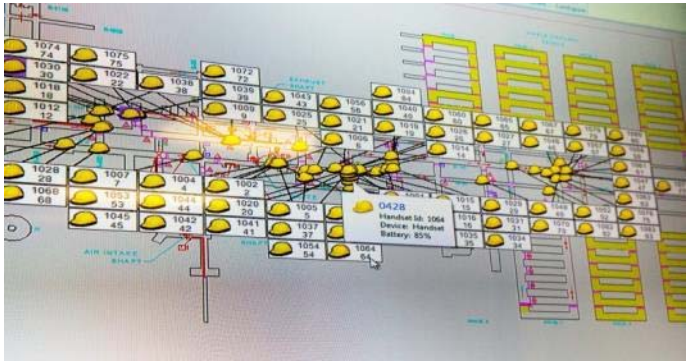
New Emergency Operations Center



Combustible Control Zone

Hybrid Bolting Machine

Vehicle Fire Suppression



Notification System

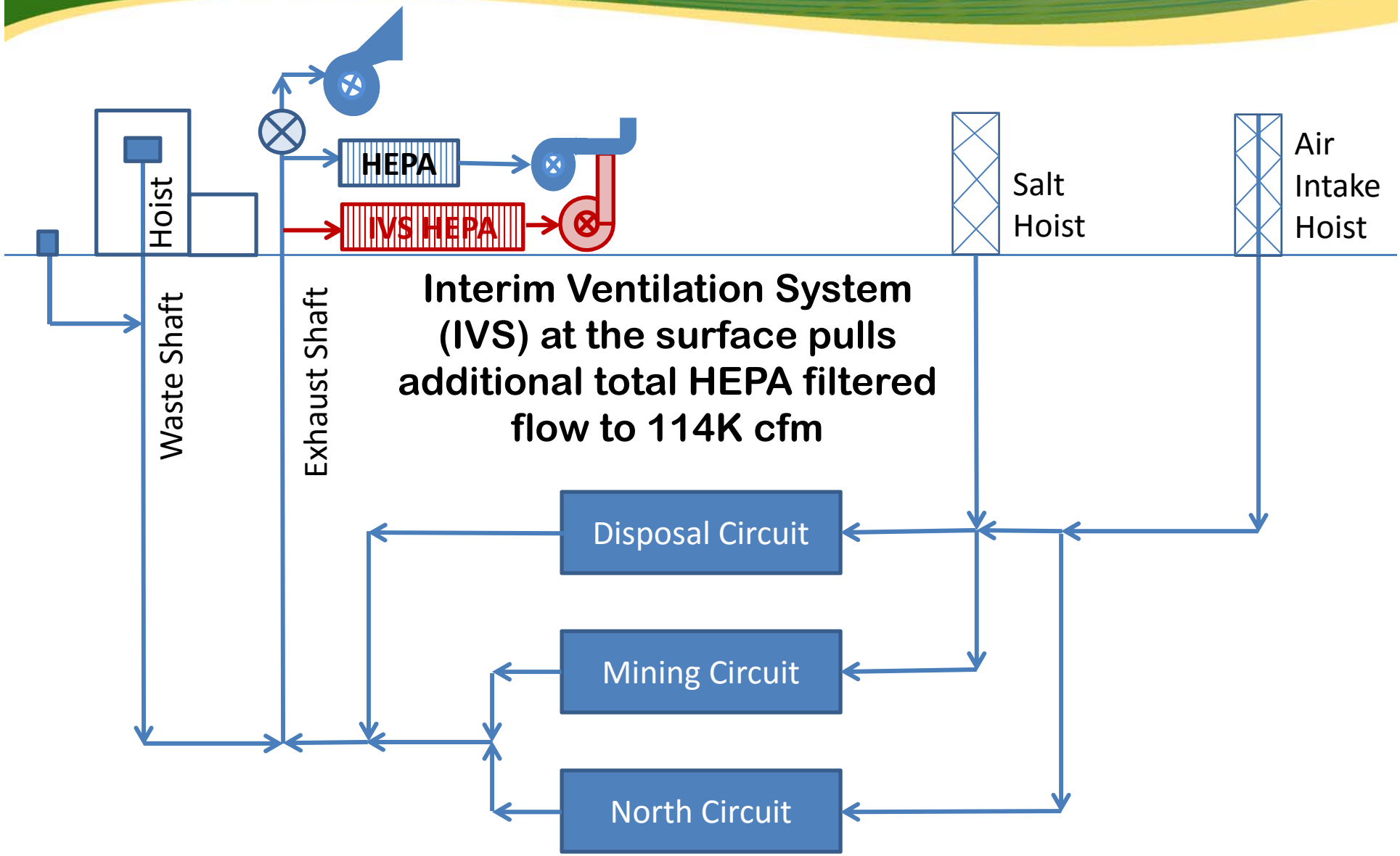
New Equipment

Underground Ventilation

- Interim Ventilation System
  - Operate parallel HEPA filter with existing HEPA
  - Adds 54 Kcfm of filtered airflow for total of 114 Kcfm
- Supplemental Ventilation System
  - U/G fans "push" air up the salt shaft
  - Adds another 66 Kcfm for a total of ~175 Kcfm (mining circuit not filtered)
- Permanent Ventilation System
  - Safety Significant HEPA Filtration w/ Salt De-Duster System At Existing Exhaust Shaft
  - New Exhaust Shaft for Mining Ventilation

Current U/G ventilation under HEPA filtration (60 Kcfm)

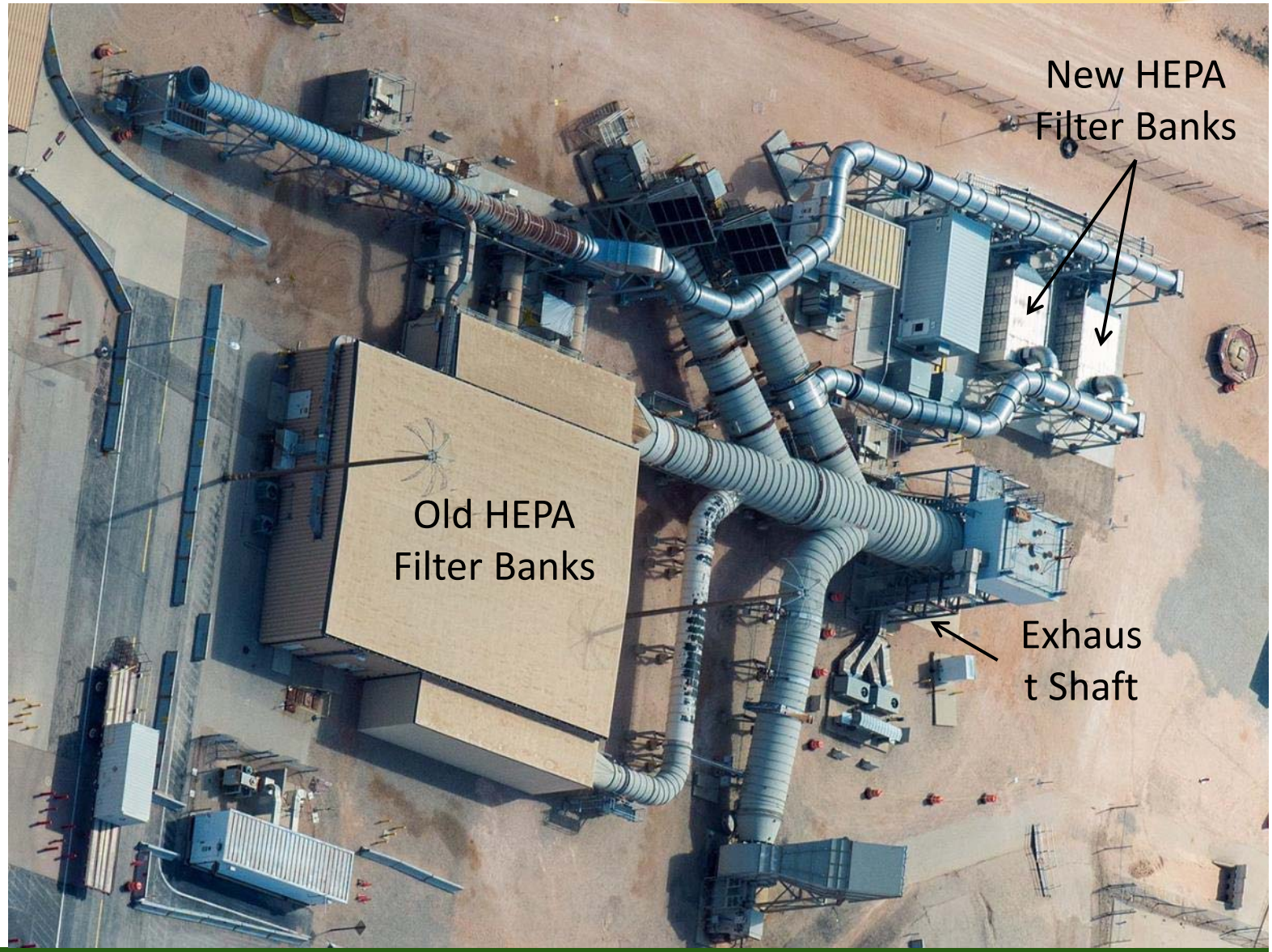
Interim Ventilation System



Interim Ventilation System

Testing Ongoing

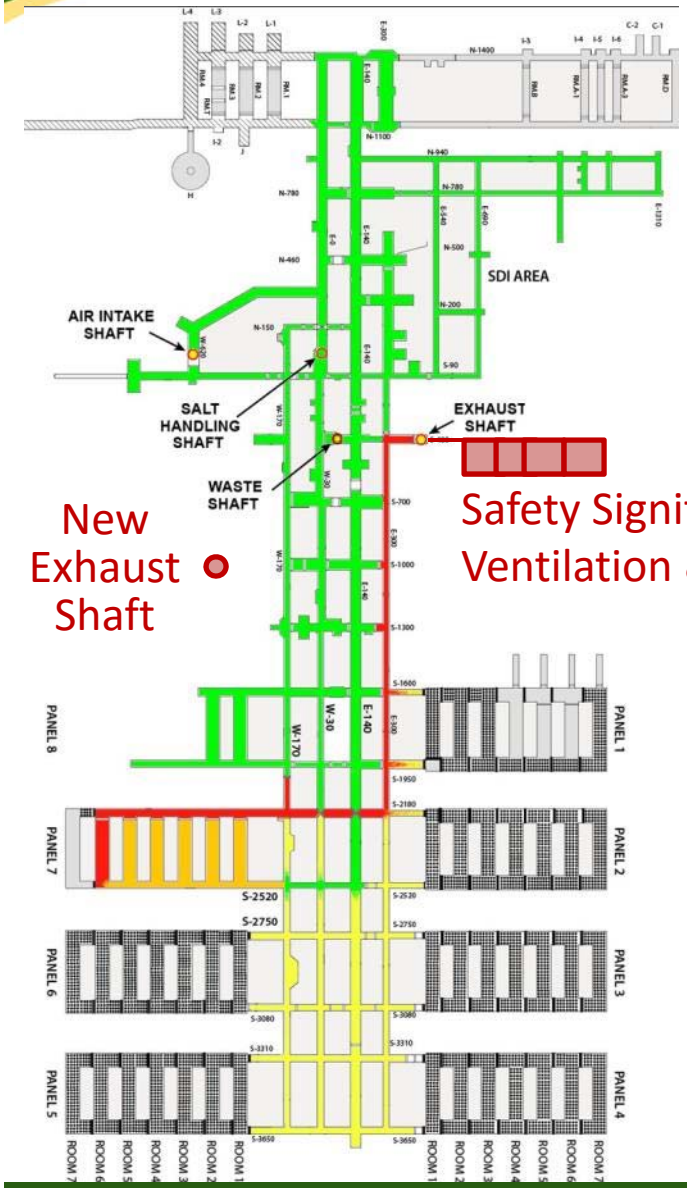
Operations Planned July 2016



Waste Emplacement Operations Resume December 2016

- Contractor and DOE Readiness Reviews and Corrective Actions Begin in June/July
- Priority Waste: Containers Stranded in WHB
- Shipments from Generator Sites ~1-2 Months afterwards
- Emplacement in Contaminated Areas (Panel 7)
- Emplacement Rate (initially) Limited to a Few Shipments/week
- No Remote Handled Canisters

Planning for the Future

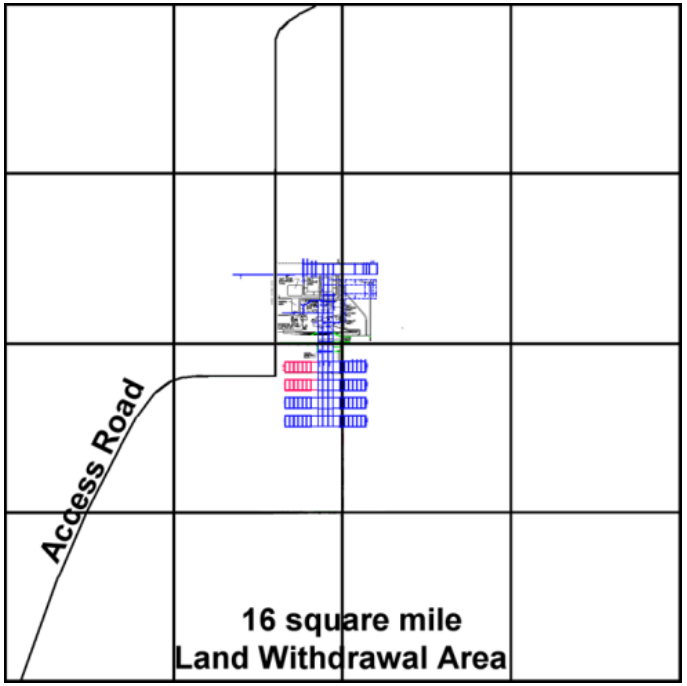


New Exhaust Shaft

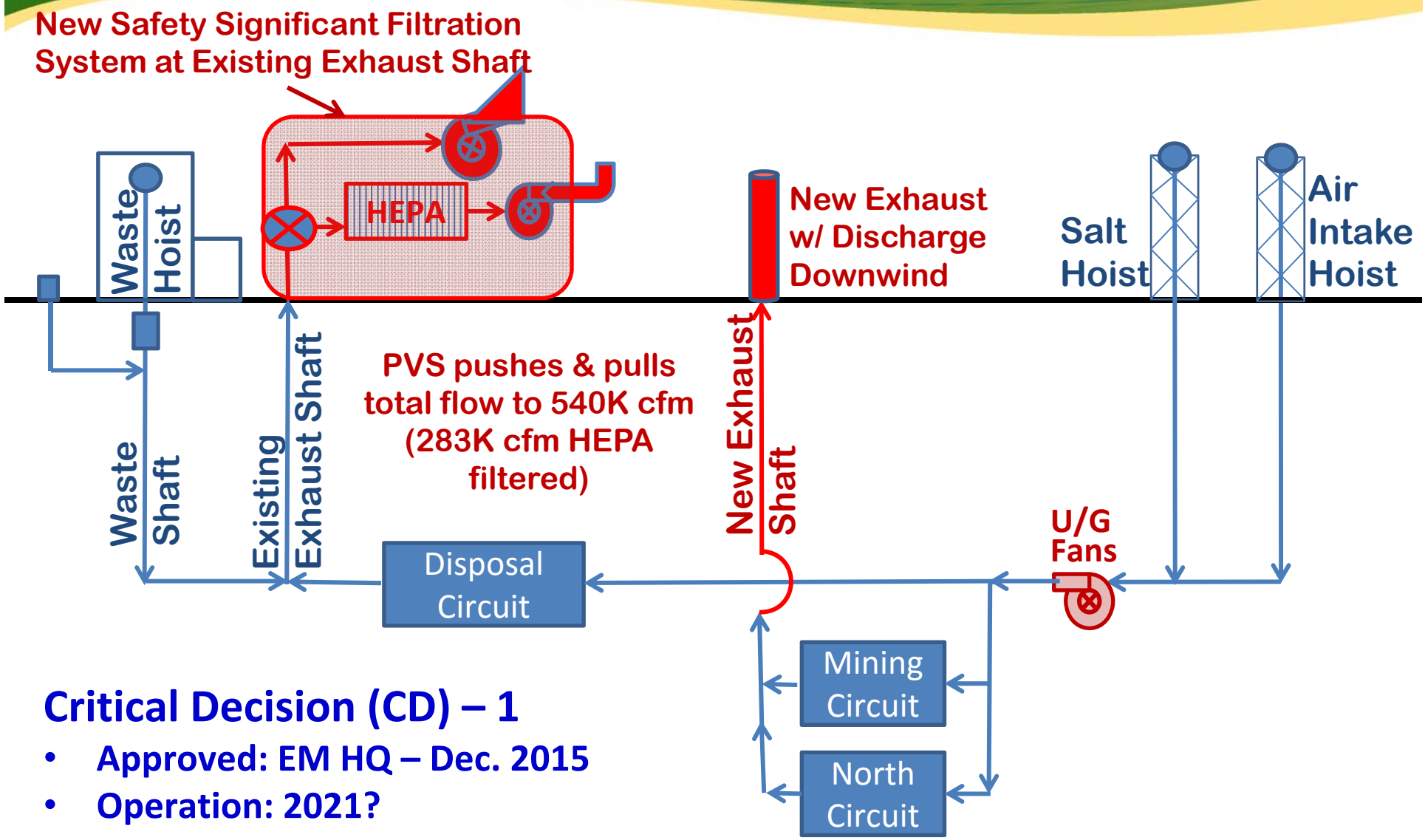
Safety Significant HEPA Ventilation & Filtration System

- Panel 7 Will Take Several Years to Fill
- Panel 8 Availability Before Panel 7 is Filled
- Panel 8 Mining Completion Limited by Ventilation and Salt Dust On HEPA Filters
- New Exhaust Shaft and Filtration Capability Planned No Earlier than 2021
- Footprint U/G Likely to Grow (but not expansion)

Lifecycle Planning to 2050



Permanent Ventilation System (PVS)



Critical Decision (CD) – 1

- Approved: EM HQ – Dec. 2015
- Operation: 2021?

WIPP Will Recover

- The WIPP radioactive release event was serious:
  - It has stopped routine operations for more than two years
  - Recovery efforts are expected to cost approximately $300-$500 million
- The WIPP radiation release event was minor:
  - In terms of environmental contamination or public health
  - In terms of exposures to workers
- The WIPP radiation release event should not have happened:
  - The event revealed weaknesses in the safety systems and safety culture that are being addressed
- A full recovery of the WIPP facility is foreseen:
  - It will take some time
  - WIPP has an important national mission of permanently isolating US defense-related TRU waste from the biosphere

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WIPP
Waste Isolation Pilot Plant
Recovery

Questions?