

Modeling the Underground Ventilation System at the Waste Isolation Pilot Plant to Ensure Proper Ventilation Alignment

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Mine Ventilation Services, a business unit of SRK Consulting, (U.S.), Inc.

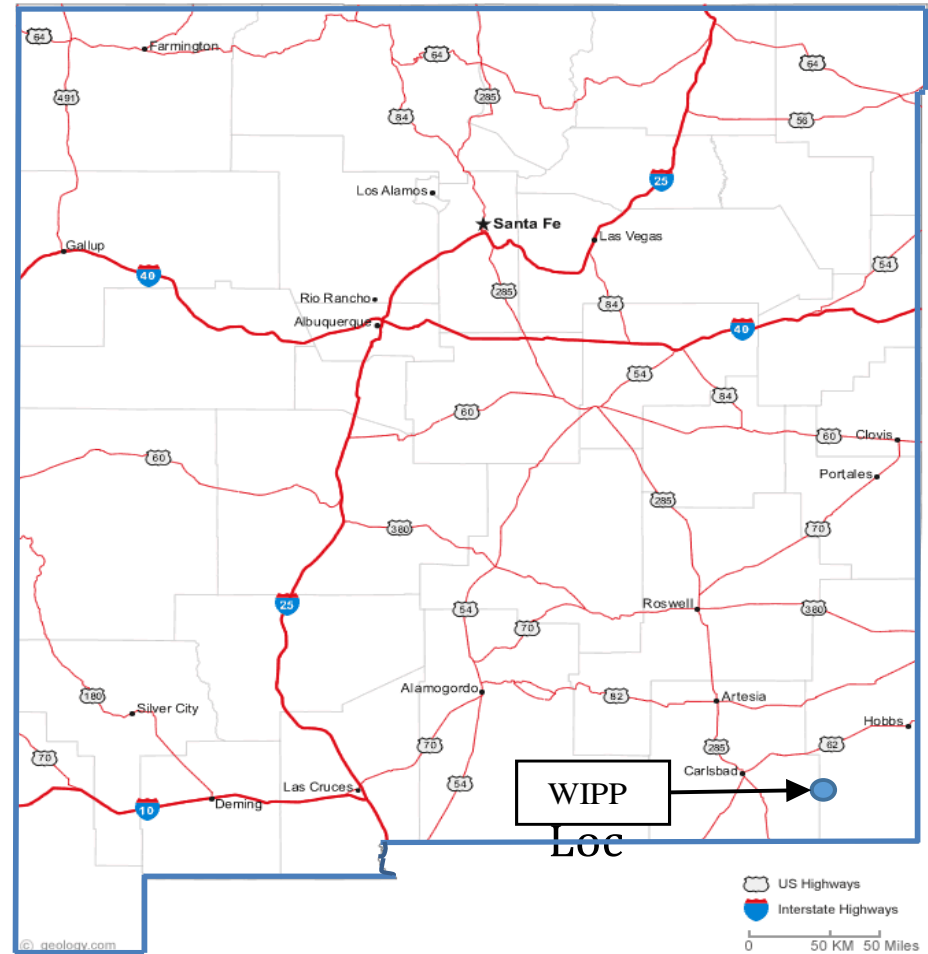
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Introduction

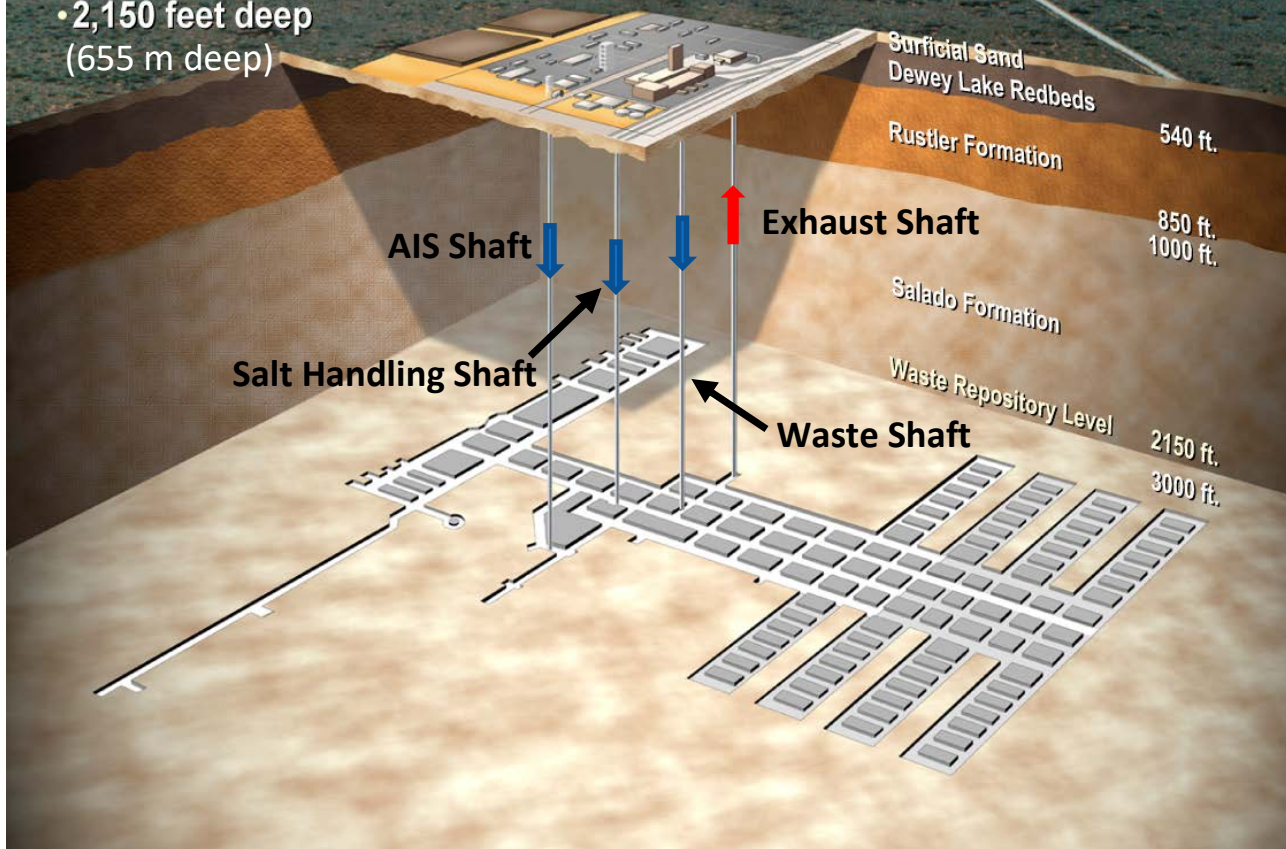
- DOE facility for permanent disposal of transuranic waste.
- Located in Southeastern New Mexico.
- The nation's only deep geologic repository for nuclear waste.
- Located approximately 35 miles east of Carlsbad



Waste Isolation Pilot Plant

Environmentally Safe Nuclear Waste Disposal

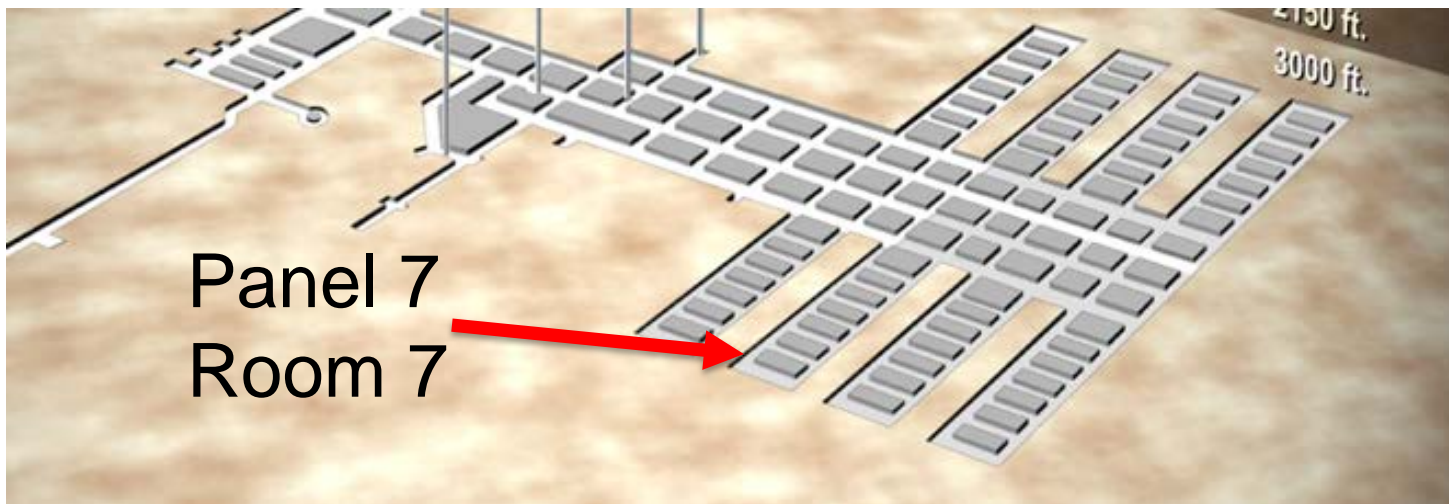
- U.S. Department of Energy facility
- Designed for permanent disposal of transuranic radioactive waste
- 2,150 feet deep (655 m deep)



Radiologic Event

February 14, 2014

- Continuous Air Monitors detect radiation release in Panel 7, Room 7
- Ventilation System is immediately switched to filtration mode (from 260,000 cfm to 60,000 cfm)



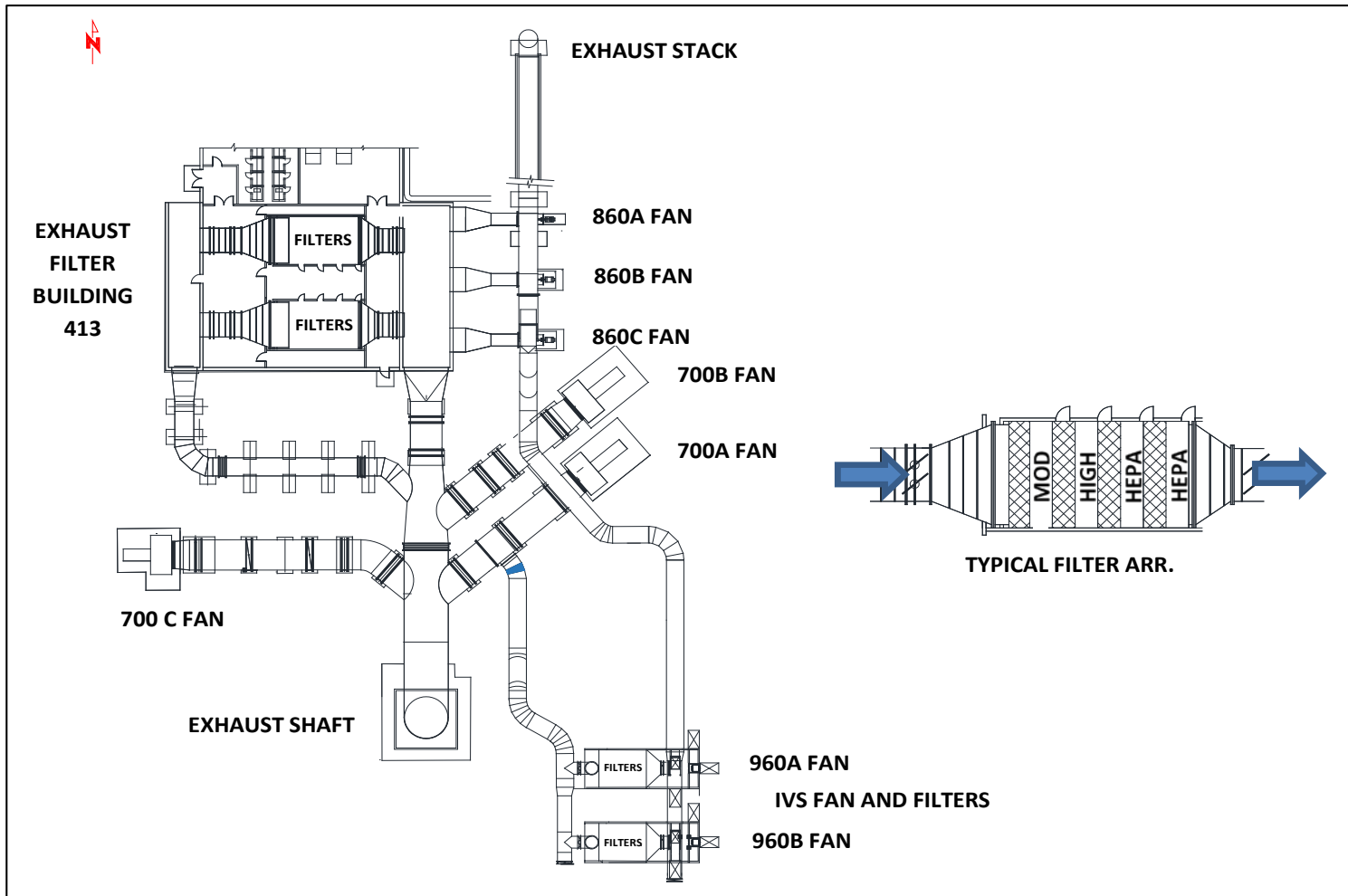
Aftermath and System Changes

- Filtration mode – 60,000 cfm – not enough for emplacement of nuclear waste or mining.
- Need additional airflow and filtration capacity
- Eventually a long term permanent ventilation system
- Short term solution so that waste emplacement can resume – interim ventilation system (IVS)

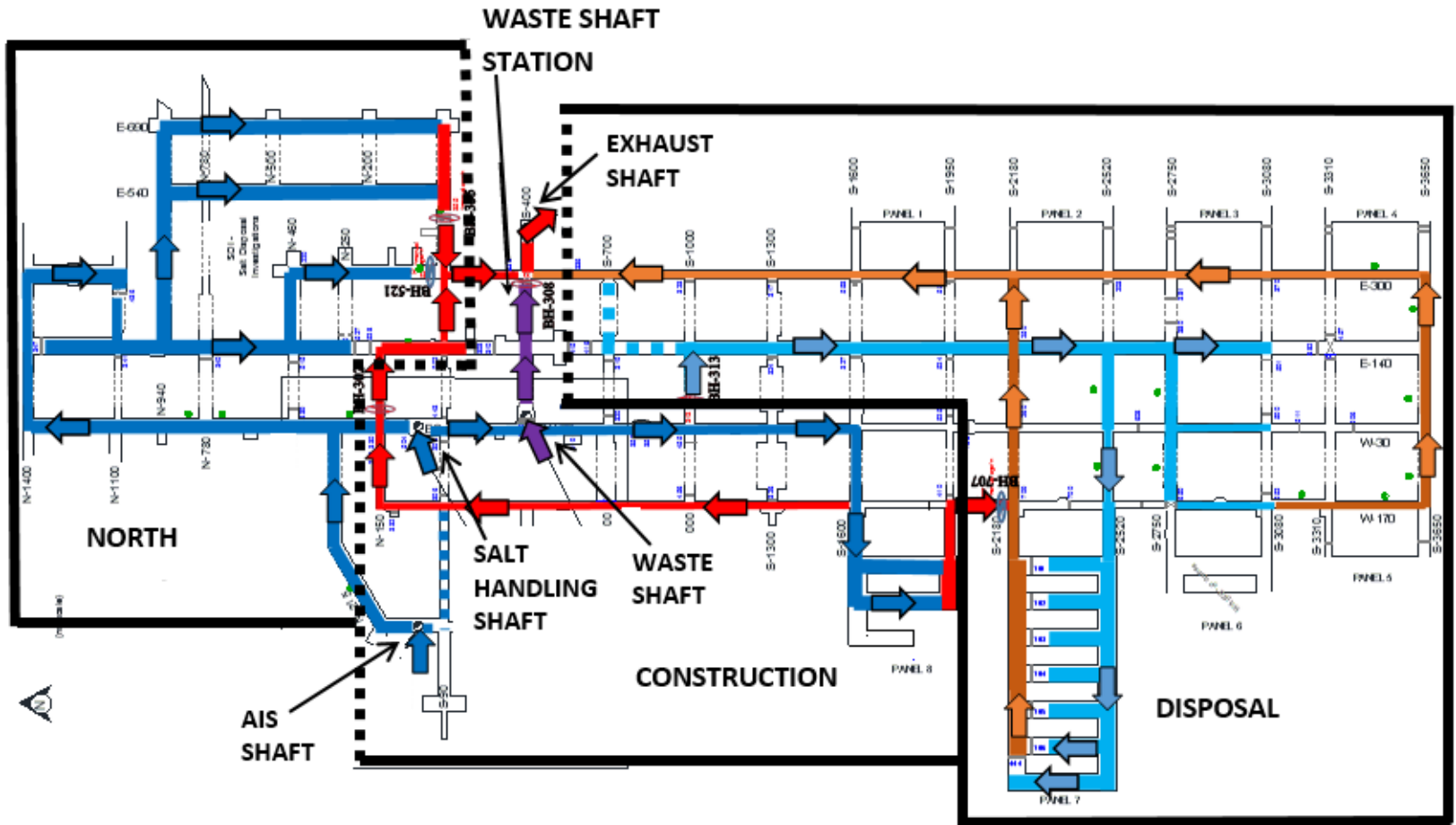
IVS System Settings

- Increase from 60,000 cfm to 114,000 cfm
- Two new filtration fans on surface.
- Criteria for waste emplacement
 - 42,000 cfm in emplacement room
 - 20,000 cfm through BH308
 - DP of at least -0.1 in. w.g. on BH308 (airflow moving towards the Exhaust Shaft)

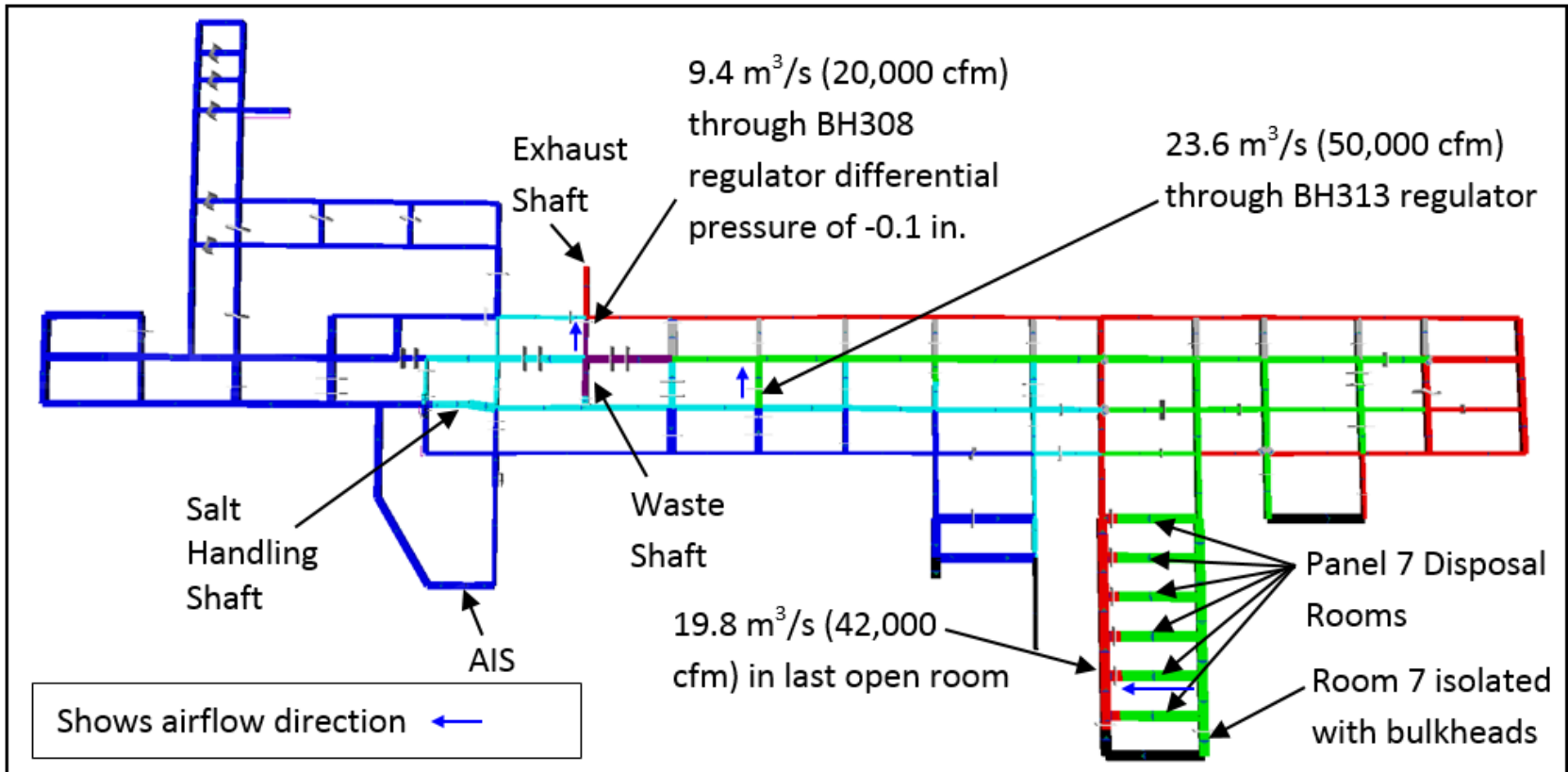
IVS Surface Fans



IVS Underground



IVS Infrastructure Settings



Goal of Study

- Determine if a single differential pressure sensor at BH308 was an adequate measure to validate flow direction in the underground facility to help ensure air from the “clean” uncontaminated side flows to the disposal side with all disposal air exhausting through the surface filtration system.

Outline of Study

- Monitor DP at:
 - BH308 Regulator
 - the Waste Hoist Tower
 - BH313 Regulator
- Monitor flow direction in the Waste Shaft

Parameters Analyzed

- Comprehensive List of Parameters:
 - Varying natural ventilation pressure (NVP)
 - Different combinations of operating fans
 - Varying fan airflow
 - Different regulator and ventilation infrastructure settings
 - Various upset configurations representing sudden control changes or failures.

Seasonal NVP

NVP Condition	AIS Collar	Shaft NVPs Pa (in. w.g.)		
		AIS	SHS	WS
Summer	Covered	-150 (-0.6)	-249 (-1.0)	-150 (-0.6)
Winter	Covered	0.0* (0.0)	+498 (+2.0)	+74 (+0.3)
Summer	Uncovered	-249 (-1.0)	-249 (-1.0)	+150 (+0.6)
Winter	Uncovered	+498 (+2.0)	0.0** (0.0)	+74 (+0.3)

*AIS is covered and will upcast in winter conditions

**SHS will upcast in winter conditions with AIS uncovered

Fan Combinations

- One 960 fan or One 860 Fan at half flow
- Two 960 fans or One 860 Fan
- One 960 fan and One 860 fan
- Two 960 fans and One 860 fan

Variations to Surface Fan Airflow

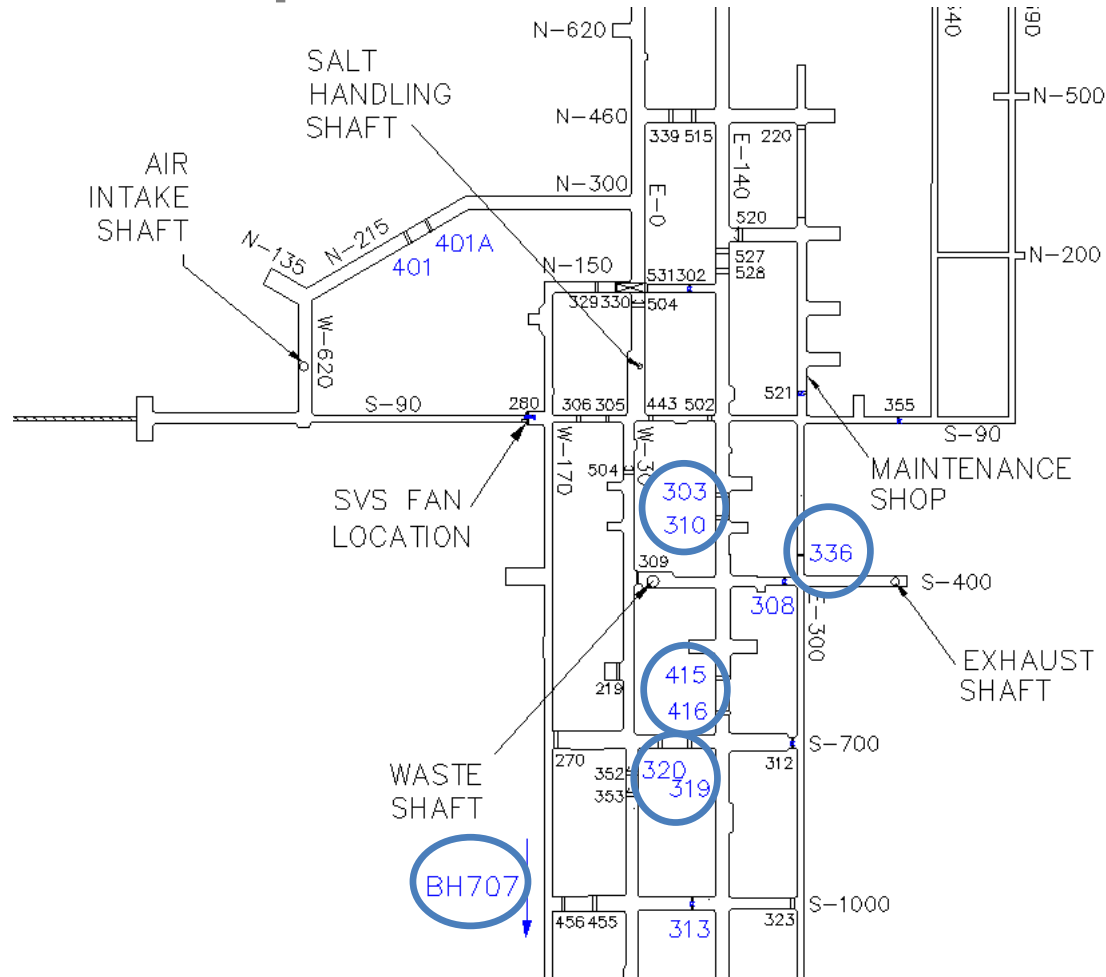
- 860 Fans could vary by +/- 1500 cfm
- 960 Fans could vary by +/- 500 cfm

Varied Regulator and Infrastructure Settings

- Adjustments to regulators around the Shafts surface and underground.
- Covering/Uncovering the AIS
- Opening and closing doors

Five Upset Conditions

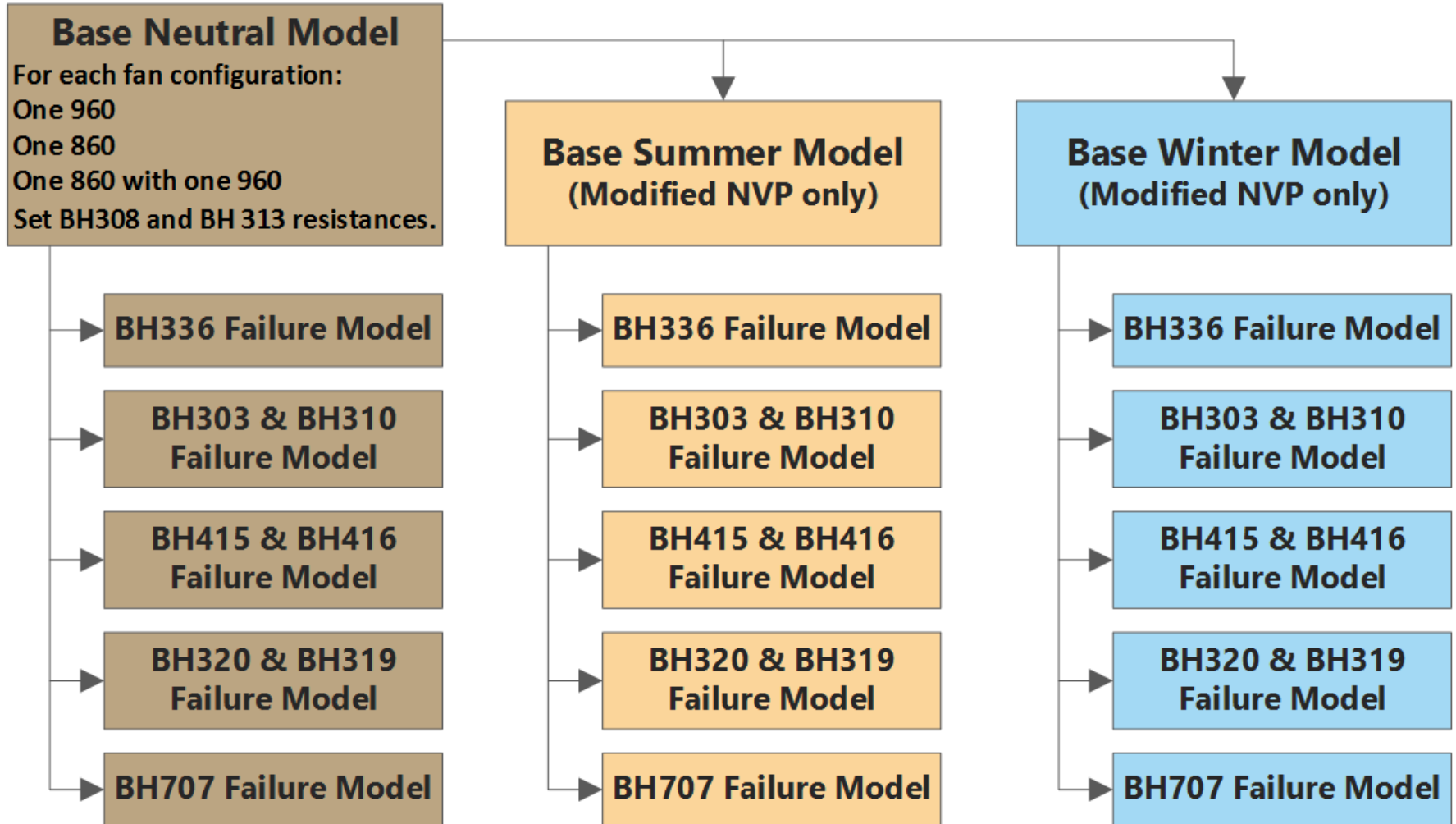
- Study did not include multiple simultaneous failures



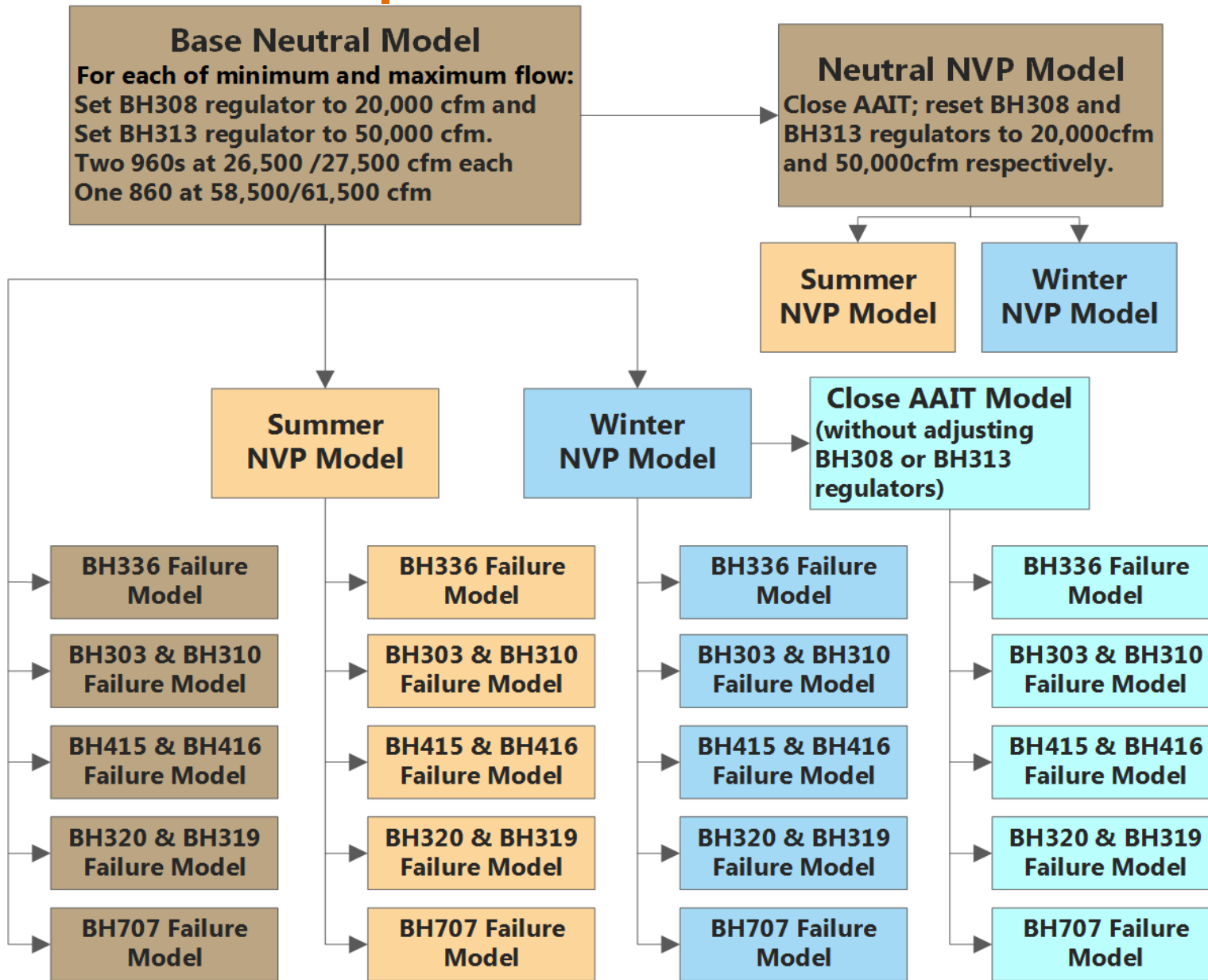
Modeling Study

- The study generated a large amount of data.
- Progression of the study resulted in additional modeling for sensitive variables
- Primary Concern – Contaminated air upcasting the Waste Shaft with the BH308 regulator not in alarm (keep DP above 0.1 in w.g.)
- BH308 in alarm means personnel can react to correct the situation for an upcasting Waste Shaft.

Basic Model Development



Additional
Model
Development



Results

- Some models did result in an upcasting Waste Shaft without an alarm at BH308.
- For these models upcasting air was from the North (clean areas) and not contaminated areas
- Other models show an upcasting Waste Shaft, but BH308 was in alarm.
- No results showed upcasting contaminated air in the Waste Shaft without BH308 in alarm.

Primary Conclusion

- A negative differential pressure (from clean to contaminated) at BH308 confirms that all of the air in the disposal circuit is exhausted up the exhaust shaft regardless of other fans/regulators/door configurations
- This study validated using the BH308 DP sensor as a reliable indicator of acceptable flow distribution at WIPP.

Any Questions?

