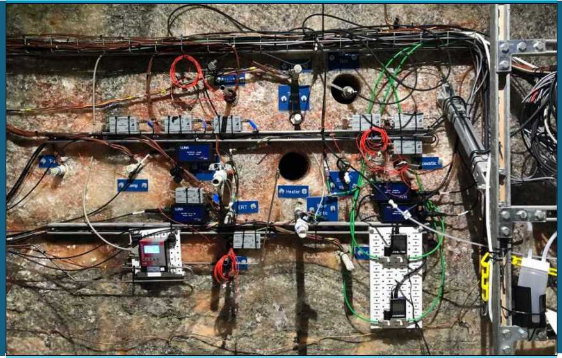
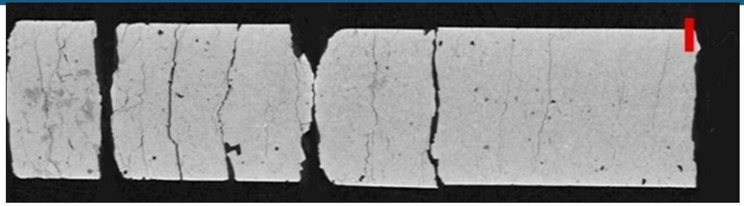
SAND2020-8188PE

Bedded vs. Domal Salt: WIPP Potash Mining Scenario





Kristopher L. Kuhlman

Sandia National Laboratories

Salt Scenarios Workshop, August 12, 2020

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SAND2019-XXXXX PE

Bedded vs. Domal Salt

Bedded salt is laterally more uniform than domal

- Easier regional groundwater modeling of "layercake" stratigraphy
- GRS/SNL collaboration (2015-2018) on Corbet & Knupp (1996) model

Bedded and domal salt have similar mechanical properties

Stratigraphy effects on excavations

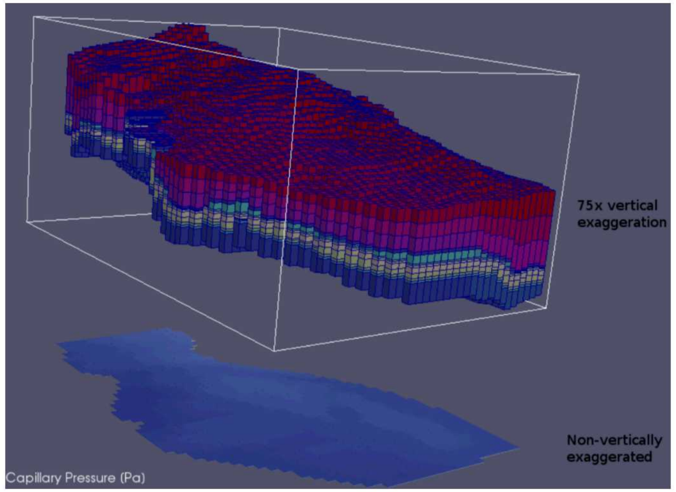
- Laterally continuous thin layers in bedded salt are weaknesses planes
- Must be cognizant of any weaknesses in roof beams of mine (rockbolts)

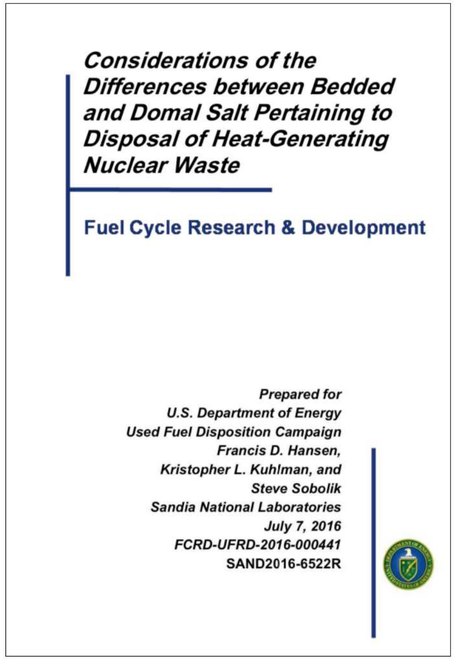
Bedded salt has higher water content than domal salt

- ~1 vol-% vs. 0.1 vol-% brine
- Non-salt layers can contain significant brine (i.e., clay, anhydrite)
- Disseminated clay is main source of water in bedded salt

Salt and Hydrocarbons

- Salt domes are often adjacent to hydrocarbons
- Bedded salt is either stratigraphically above/below hydrocarbons





Considerations of the Differences between Bedded and Domal Salt Pertaining to Disposal of Heat-Generating Nuclear Waste

Fuel Cycle Research & Development

Prepared for
U.S. Department of Energy
Used Fuel Disposition Campaign
Francis D. Hansen,
Kristopher L. Kuhlman, and
Steve Sobolik
Sandia National Laboratories
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WIPP Potash Mining "Scenario" Introduction

Culebra Member of Rustler Formation

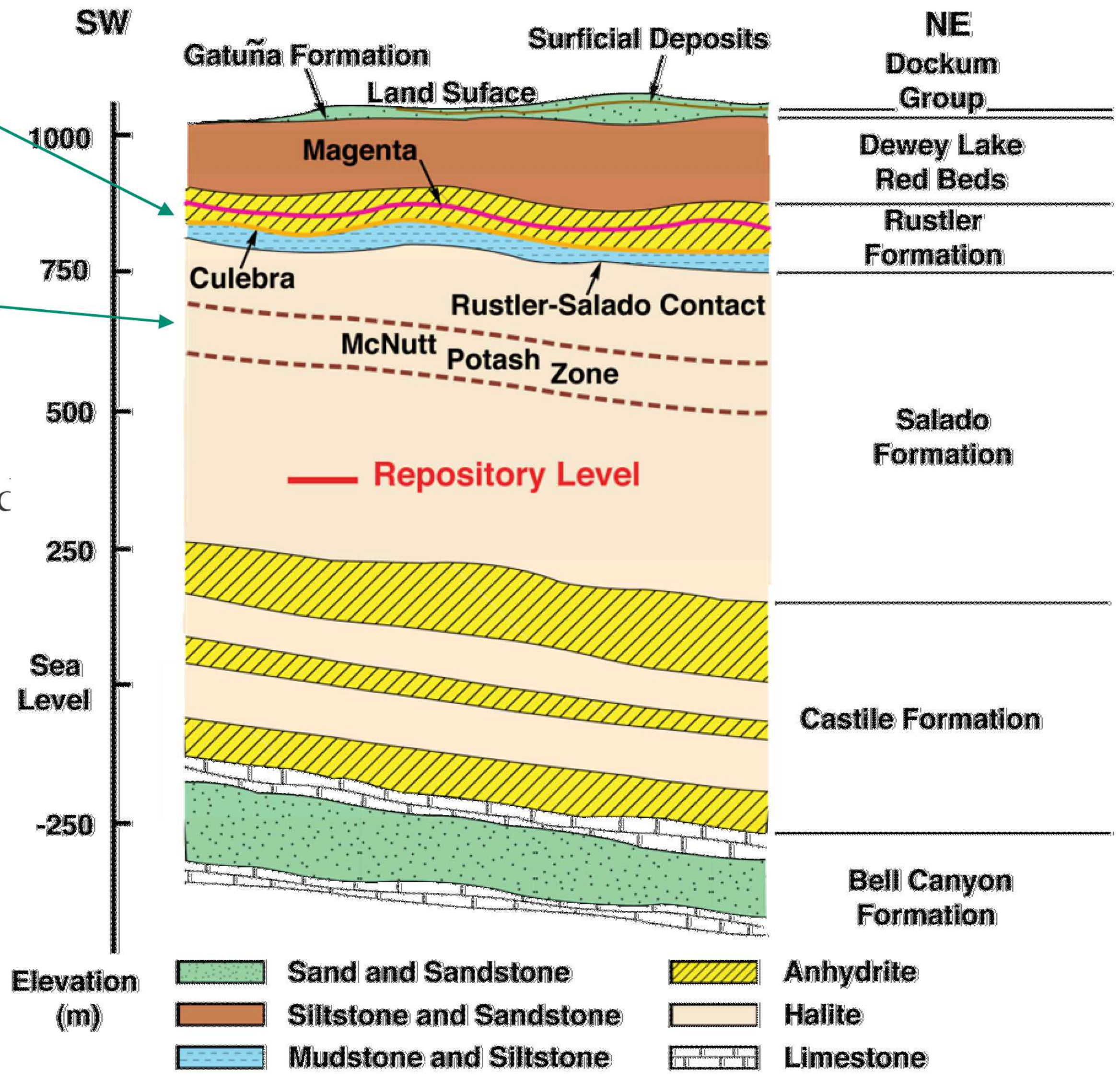
- Stratigraphically above Salado
- Potential offsite pathway via human drilling intrusion

McNutt Potash Zone

- Stratigraphically above WIPP repository

Potash mining effects on WIPP via Culebra

- EPA makes us assume all mapped potash will be minec
- Mining creates subsidence/collapse
- Increases permeability of units above collapse
- Changes flow in Culebra



WIPP Potash Mining "Scenario" Rules

EPA-mandated approach to potash-mining effects

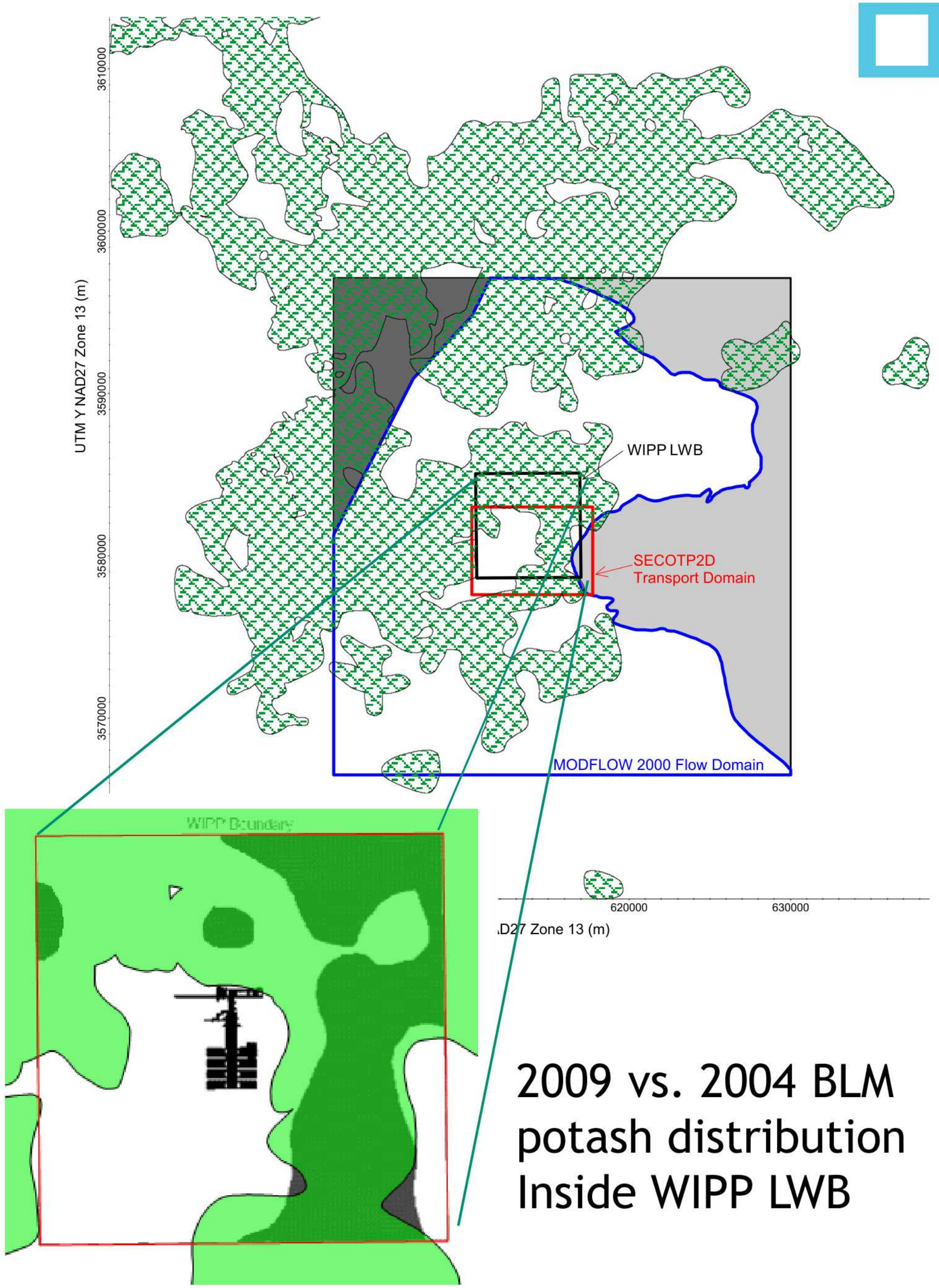
- Use 2008 BLM (Bureau of Land Management) official map of "minable" potash resources
- Assume will be mined
- Assume mined areas will collapse
- Assume collapse effects will propagate up to Culebra
- Assume "angle of draw" effects (affected area grows)
- Multiply permeability by random factor [1, 1000]

Two mining scenarios

- Full mining: all potash is mined out
- Partial mining: no mining inside WIPP Land Withdrawal Boundary (LWB)

EPA-mandated approach is conservative

- Much of the potash has already been mined
- Many mine workings have already collapsed
- Not all mine subsidence effects will propagate to surface
- BLM definition of "minable" potash changes with time

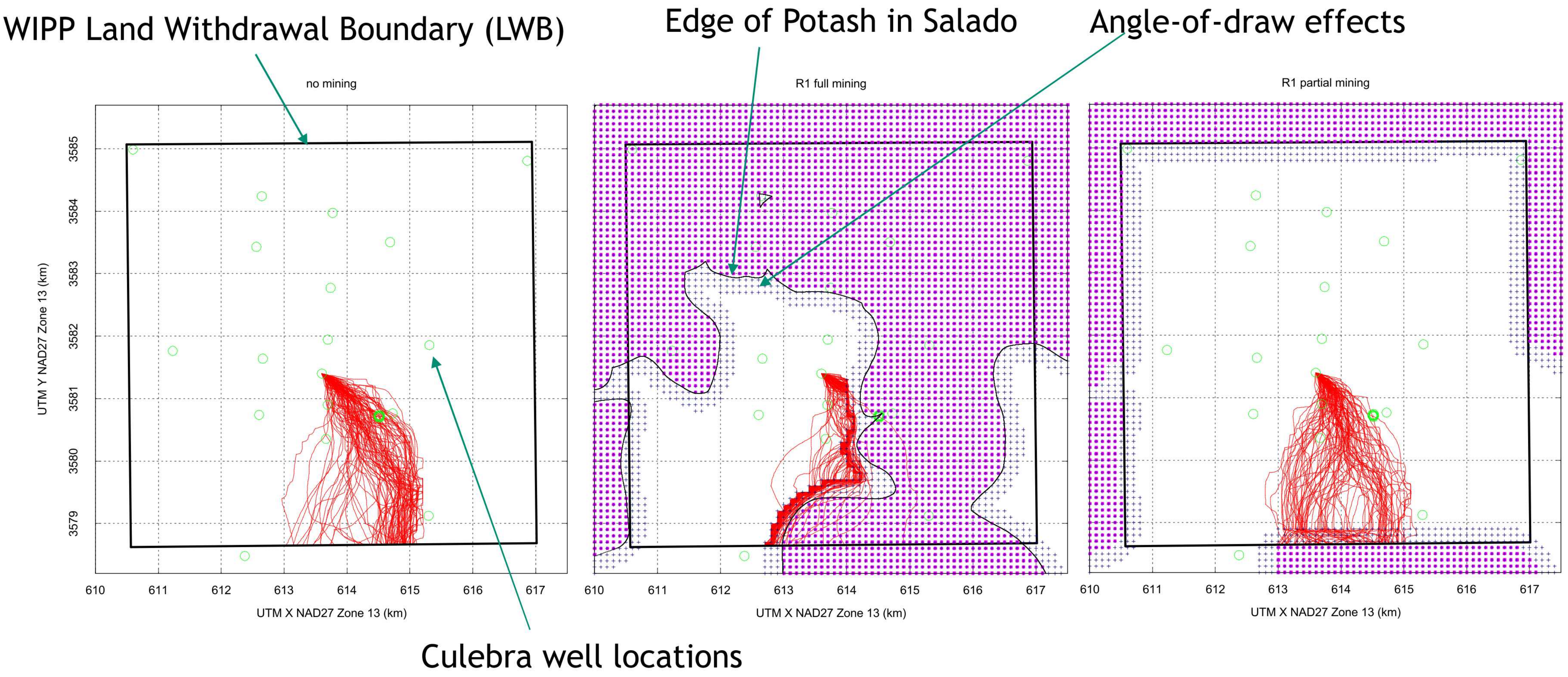


2009 vs. 2004 BLM potash distribution Inside WIPP LWB

WIPP Potash Mining "Scenario" Particle Tracking

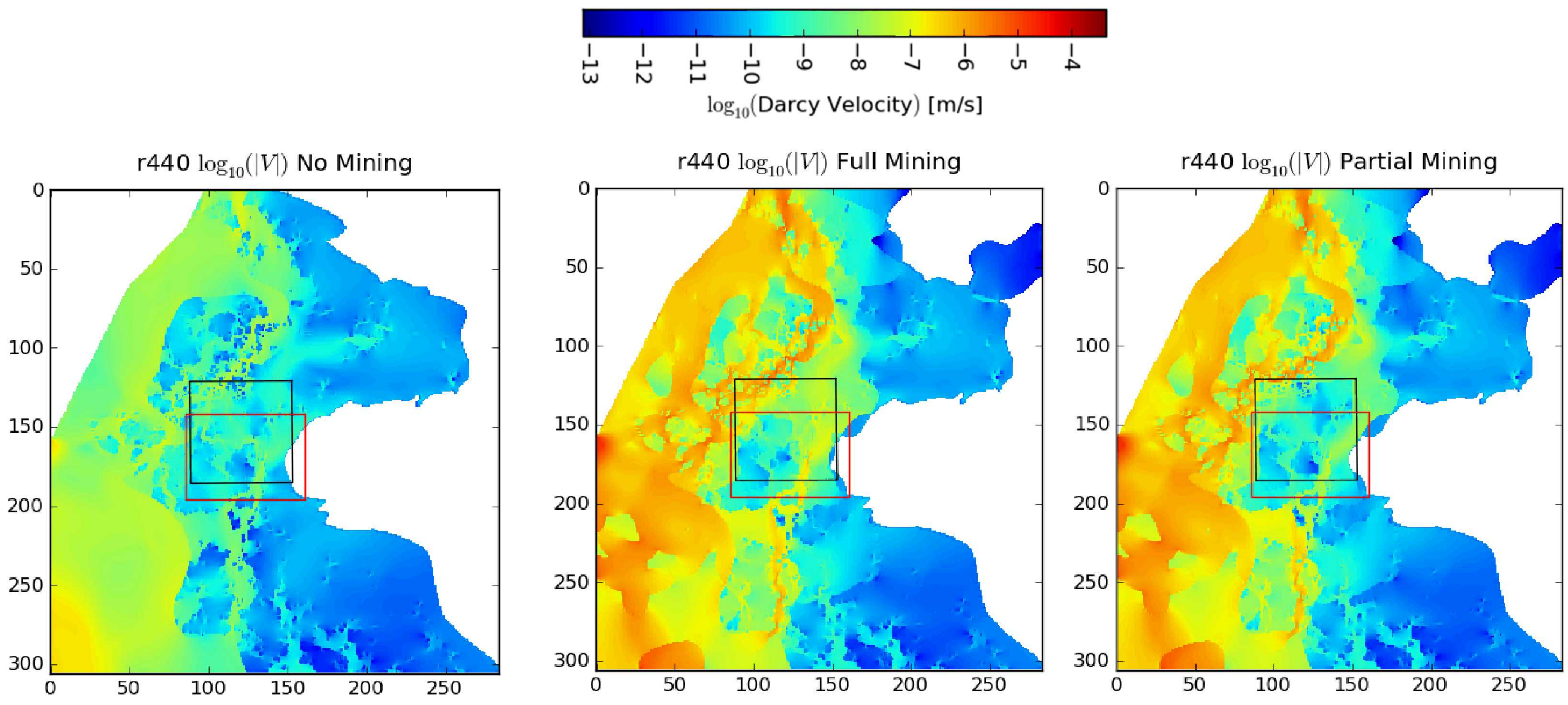
Effects of Potash Mining on Culebra Transport

- Visualized with particle tracks (1 track for each Culebra permeability realization, 300 realizations)



WIPP Potash Mining "Scenario" Flow Fields

Effects of Potash Mining on Culebra Transport: Darcy velocity magnitude (single realization)



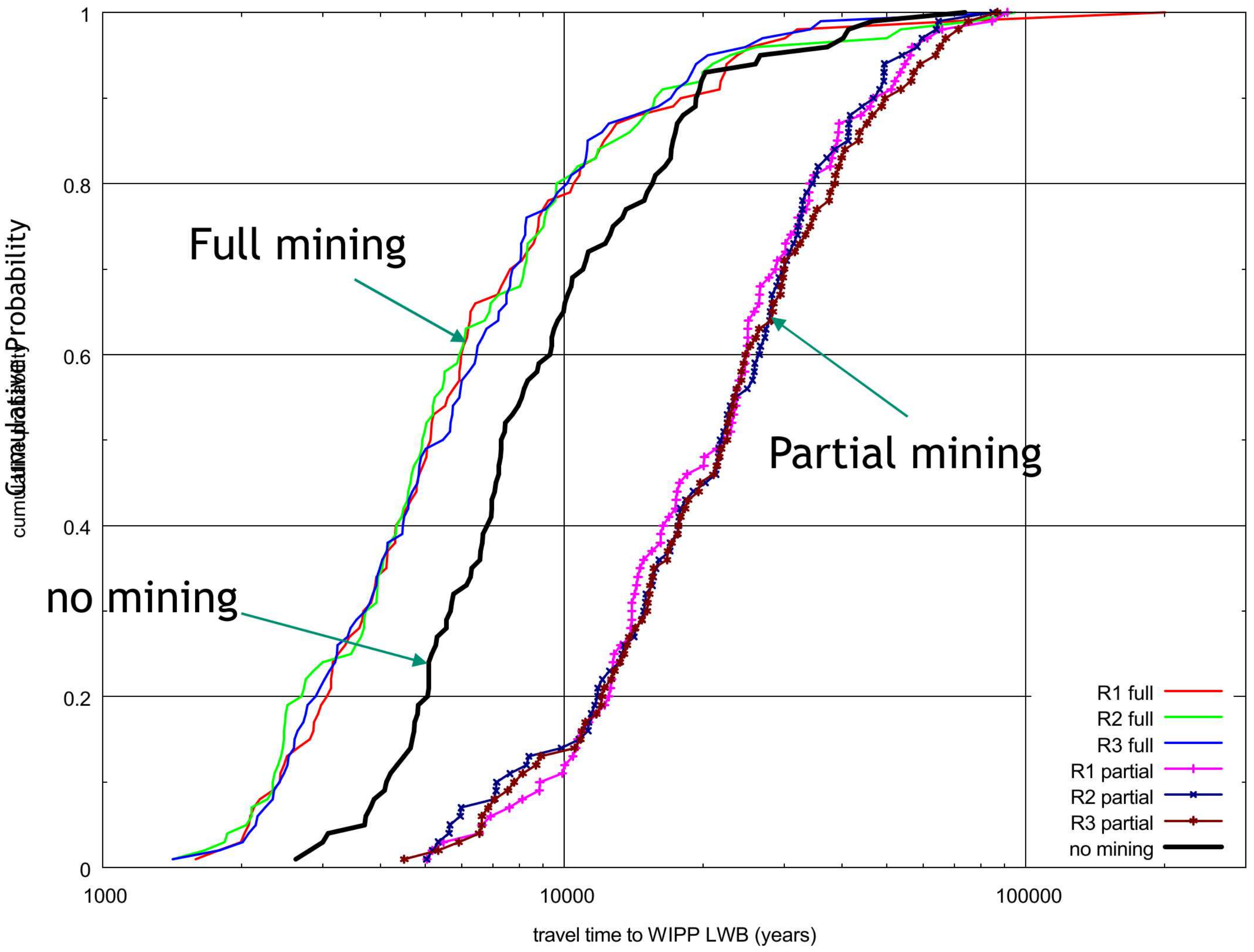
"unmined" condition

Fastest transport

Slowest transport
(flow goes "around" WIPP)

WIPP Potash Mining "Scenario" Overall Effect

Particle track times to WIPP Land Withdrawal Boundary (no retardation or dispersion)



WIPP Potash Mining "Scenario" Summary

Effects of potash mining on WIPP

- Requires release to Culebra through human intrusion
- EPA-mandated impacts of mining on Culebra permeability
- Impact of mining modifications on Culebra releases
  - Full mining speeds up transport to compliance boundary
  - Partial mining slows down transport to compliance boundary
- Performance assessment is comprised of samples from full/partial mining cases

References:

WIPP Compliance Recertification Application 2014, Appendix TFIELD

- https://www.wipp.energy.gov/library/CRA/CRA-2014.html

Corbet, T.F. & P.M. Knupp, 1996. *The Role of Regional Groundwater Flow in the Hydrogeology of the Culebra Member of the Rustler Formation at the Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico*. SAND-96-2133. Sandia National Labs., Albuquerque, NM.

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