



Isolation of Waste from Non-Waste Regions in the SDI WIPP Configuration

Chris Camphouse

Sandia National Laboratories

October 18, 2011



SDI Approach

- SDI results compared to current baseline (PABC-2009)
- Scenarios considering drilling intrusions outside of the waste area were not part of the PABC-2009
- Scenarios considering drilling intrusions outside of the waste area were not part of the SDI impact assessment

Questions:

- What could be released by a drilling intrusion outside of the waste area?
- Do changes (resulting from drilling intrusions, etc) in non-waste areas have a meaningful impact on waste areas?



Release Mechanisms

There are four direct release mechanisms considered in WIPP PA.

- Cuttings and Cavings
 - Releases resulting from solid waste material being extracted to the ground surface during drilling intrusion
- Spallings
 - Solid waste material released to the ground surface during drilling intrusion due to high pressure in the intruded panel
 - Requires sufficient pressure in the intruded panel (≥ 10 MPa)
- Direct Brine Releases (DBRs)
 - Releases to the ground surface of waste material that has been dissolved in brine
 - Requires sufficient pressure (≥ 8 MPa) and brine saturation ($>$ sampled residual brine saturation value) at the time of intrusion
- Culebra transport releases
 - Release through the Culebra, and across the Land Withdrawal Boundary, of waste dissolved in brine
 - Inconsequential release component in the PABC-2009



What Could Happen?

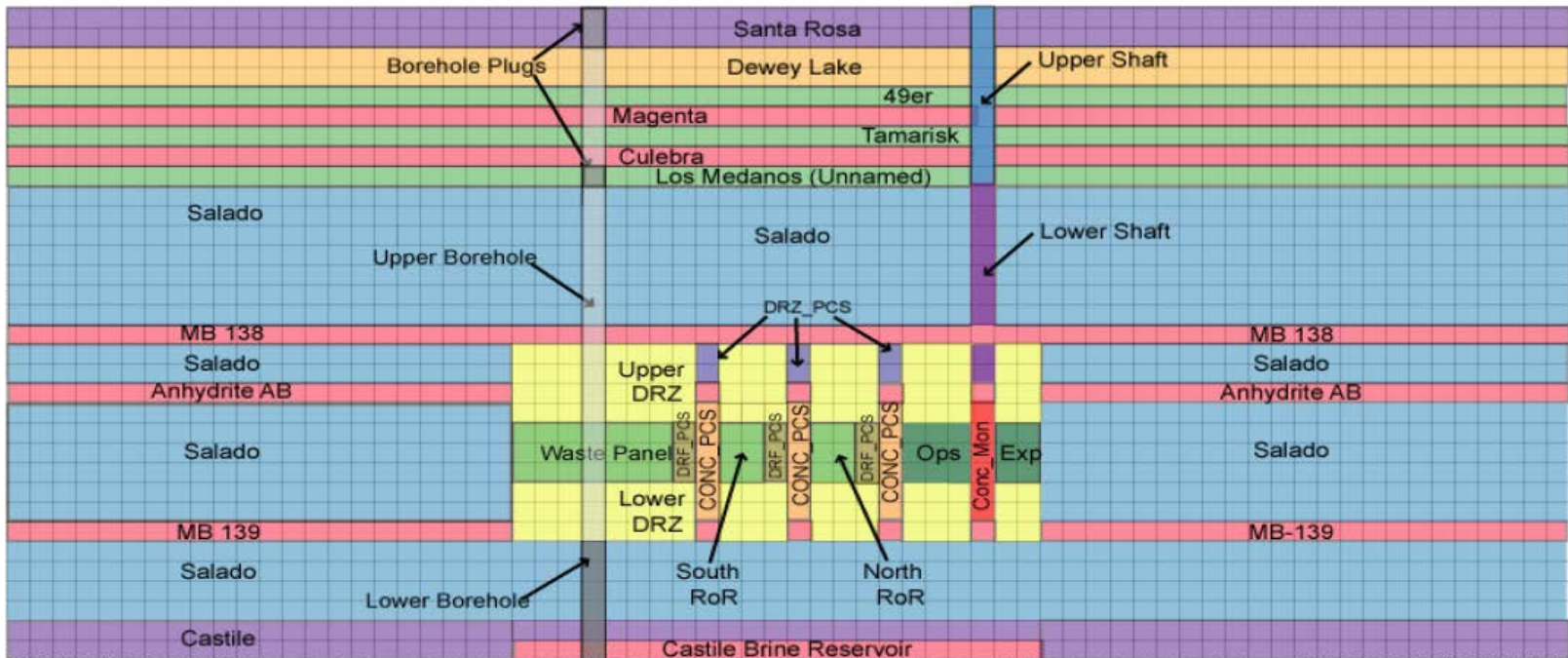
By definition, solid waste is not emplaced in non-waste repository regions.

A drilling intrusion outside of the waste area will result in:

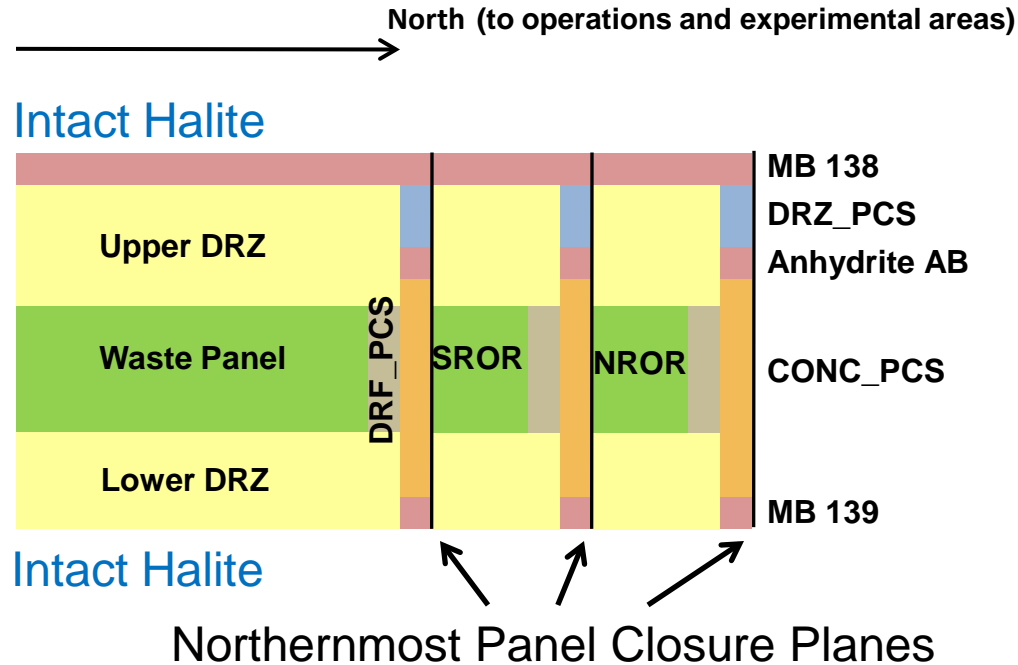
- Negligible Cuttings and Cavings releases (no solid waste emplaced there)
- Negligible Spallings releases (no solid waste emplaced there)
- A possible release of brine to the ground surface (or the Culebra) if pressure and brine saturation are large enough

Panel Closure Locations

Waste panels in the repository are separated from non-waste areas by at least one panel closure. This is also true of the repository representation used in PA.



Waste Area Brine Pathway



For contaminated brine to be released by a drilling intrusion into a non-waste region, it must first migrate northward from the repository region shown above. How much brine travels South-to-North across the three northernmost panel closure planes? How do these amounts compare to those from previous analyses?



Notation

South-to-North brine flow rates out of each northernmost panel closure plane were calculated using SDI BRAGFLO results.

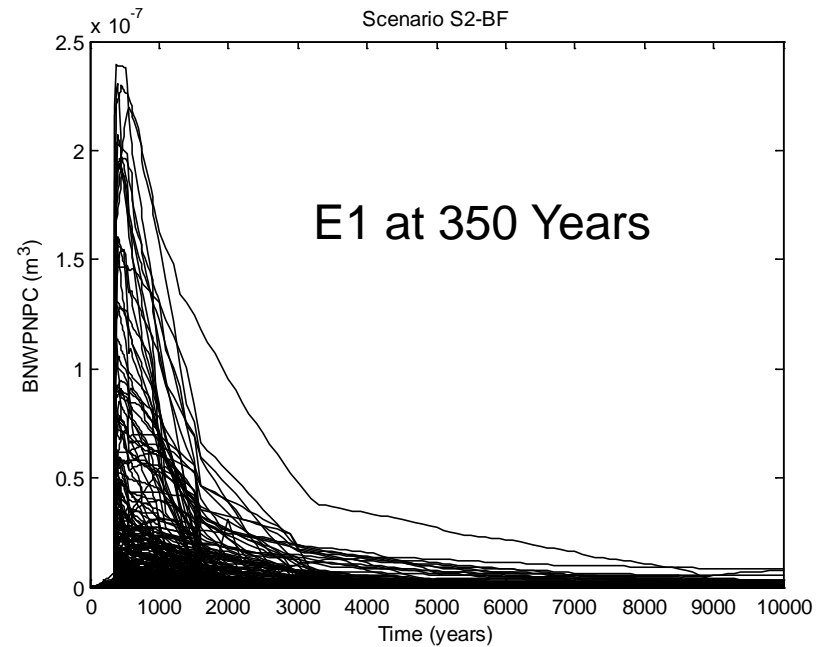
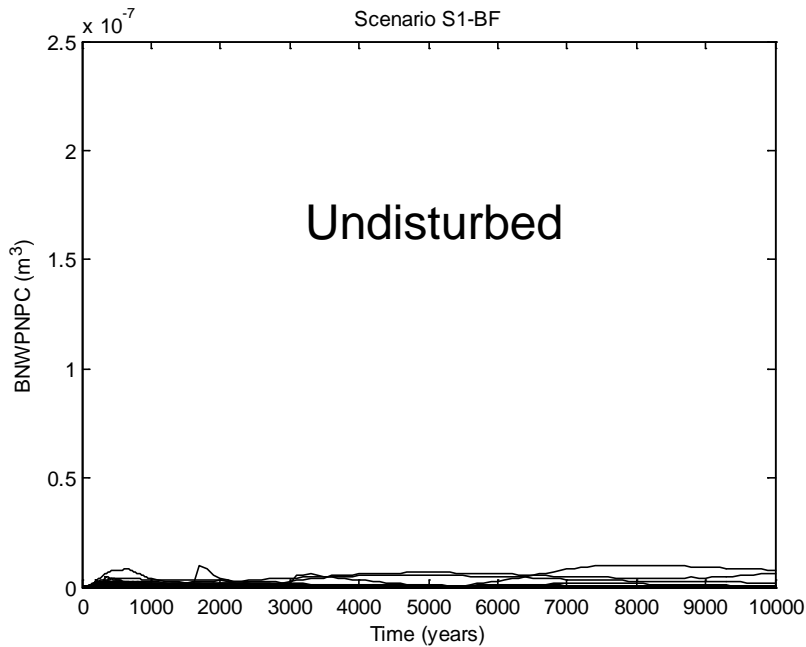
BNWPNPC = Brine from the Waste Panel, north across the panel closure

BNSRNPC = Brine from the South Rest-of-Repository, north across the panel closure

BNNRNPC = Brine from the North Rest-of-Repository, north across the panel closure

Flow Rates Northward out of the Intruded Waste Panel

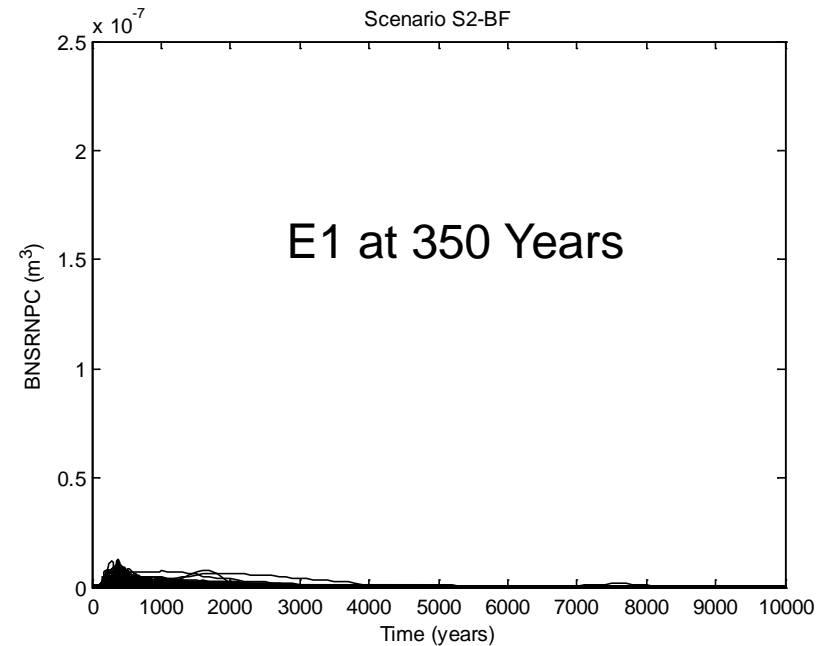
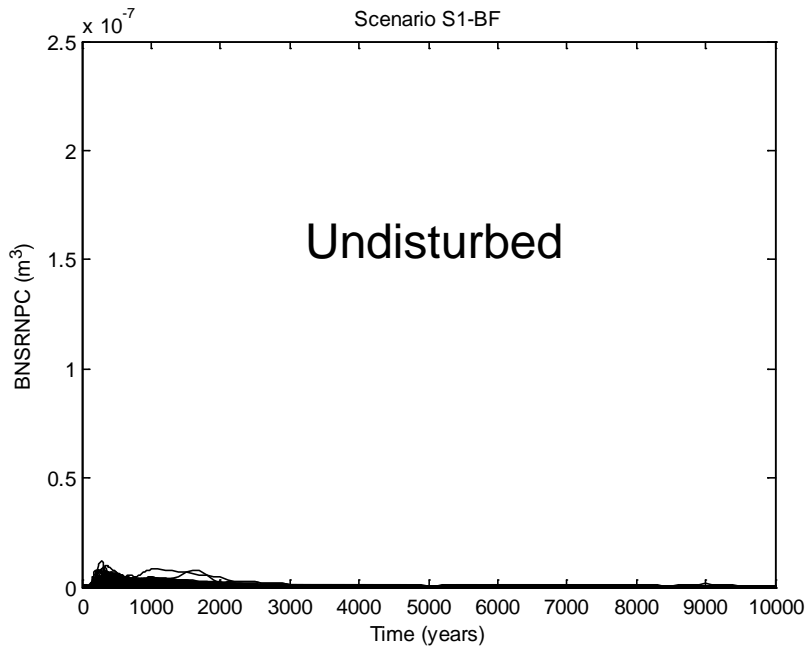
Horsetail Plots Showing all 300 Realizations



Flow rate increases after intrusion compared to undisturbed results, but rates remain extremely small.

Flow Rates Northward out of the Southern Repository Region

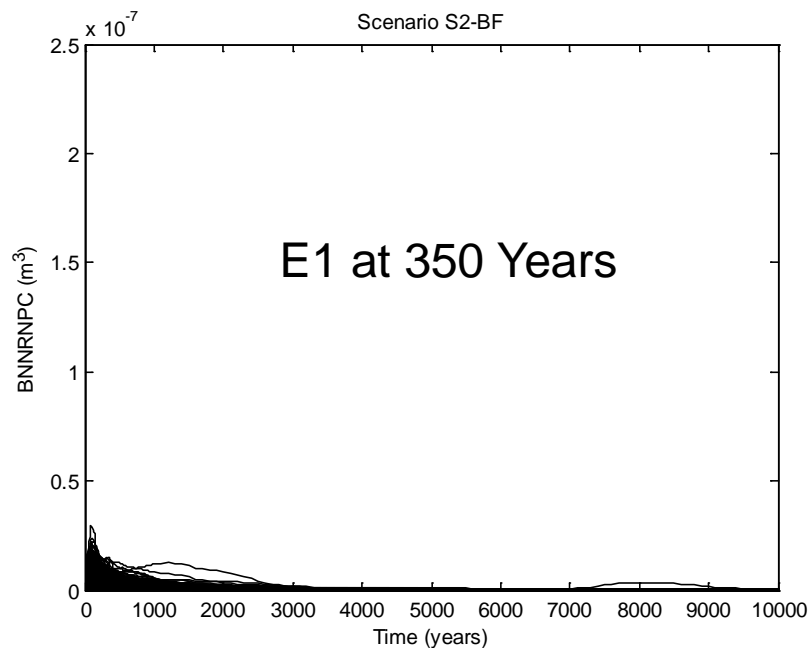
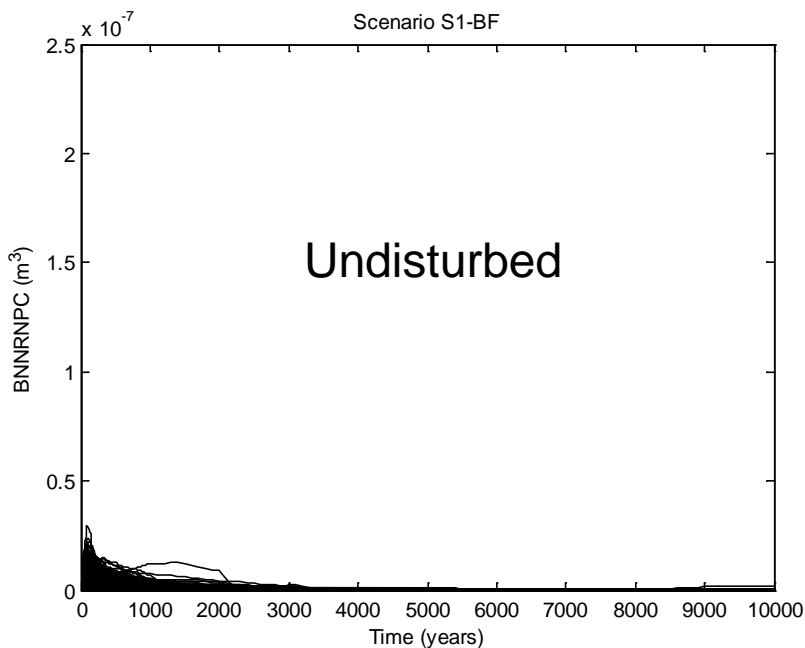
Horsetail Plots Showing all 300 Realizations



Drilling intrusions have essentially no impact on flow rates from the southern repository waste area to the northern repository waste area.

Flow Rates Northward out of the Northern Repository Region

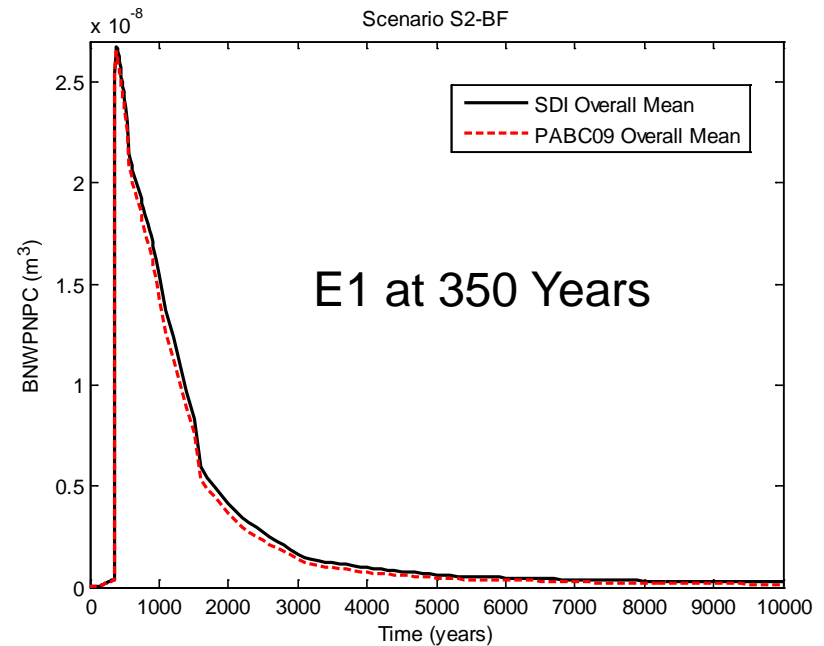
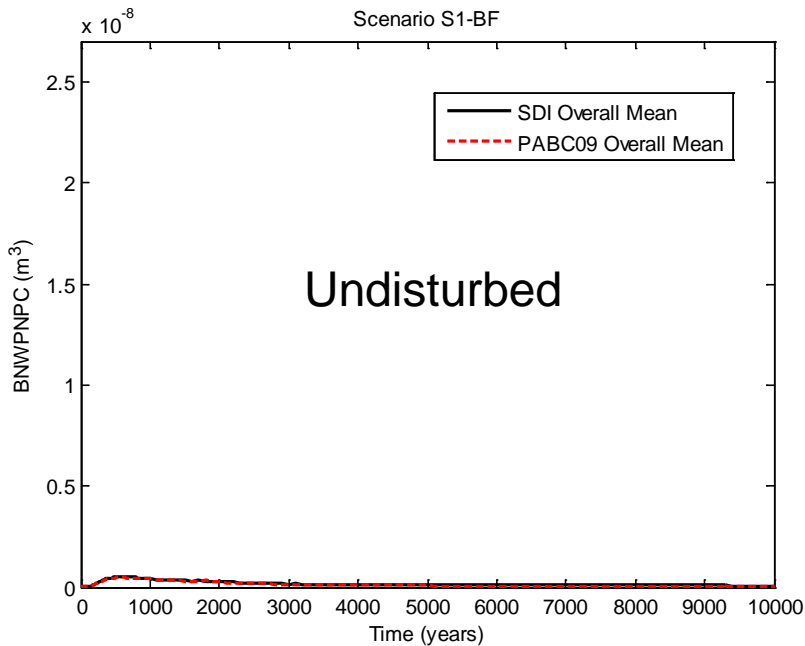
Horsetail Plots Showing all 300 Realizations



Drilling intrusions have essentially no impact on flow rates out of the repository waste area, toward the operations and experimental areas. Panel Closures are very effective at isolating intrusion impacts to the intruded region.

Comparisons of Flow Rates Northward out of the Intruded Waste Panel

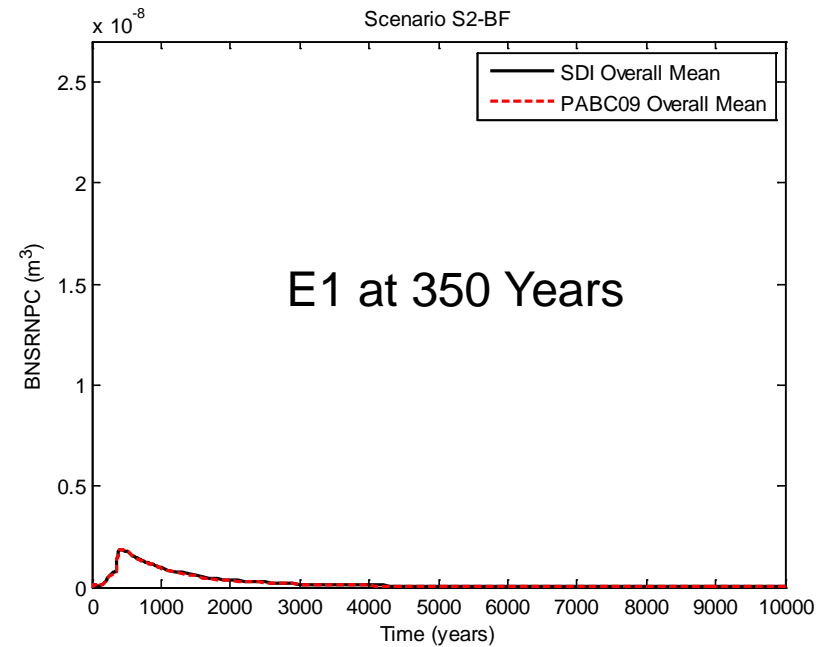
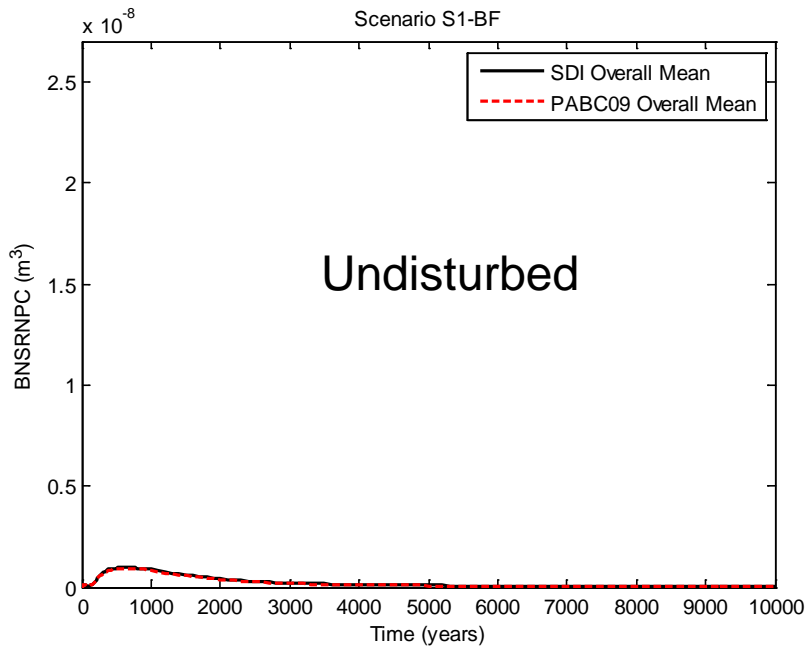
Overall Means Calculated Over all 300 realizations



SDI Overall Means of Flow Rates Northward from the Intruded Panel are Practically Identical to Current Baseline Results.

Comparisons of Flow Rates Northward out of the Southern Repository Region

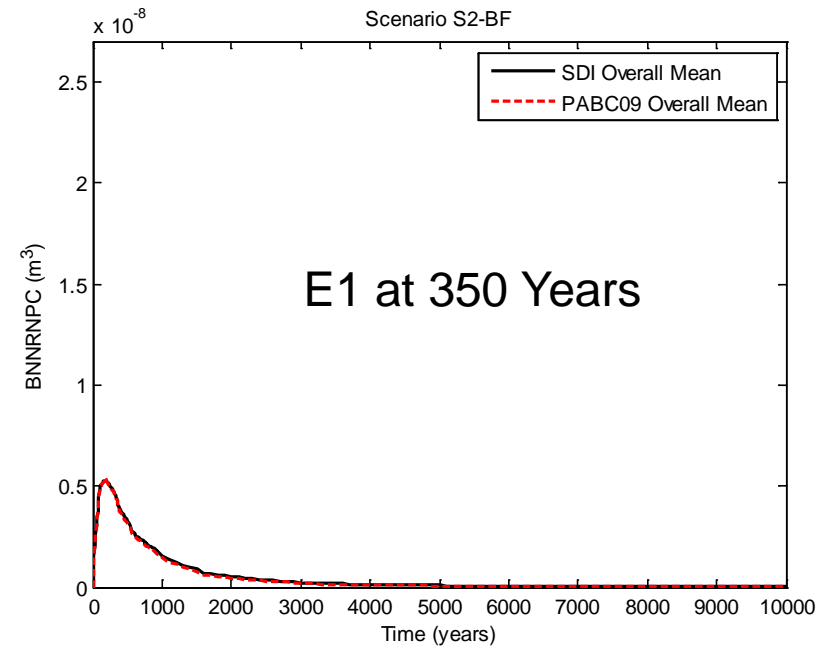
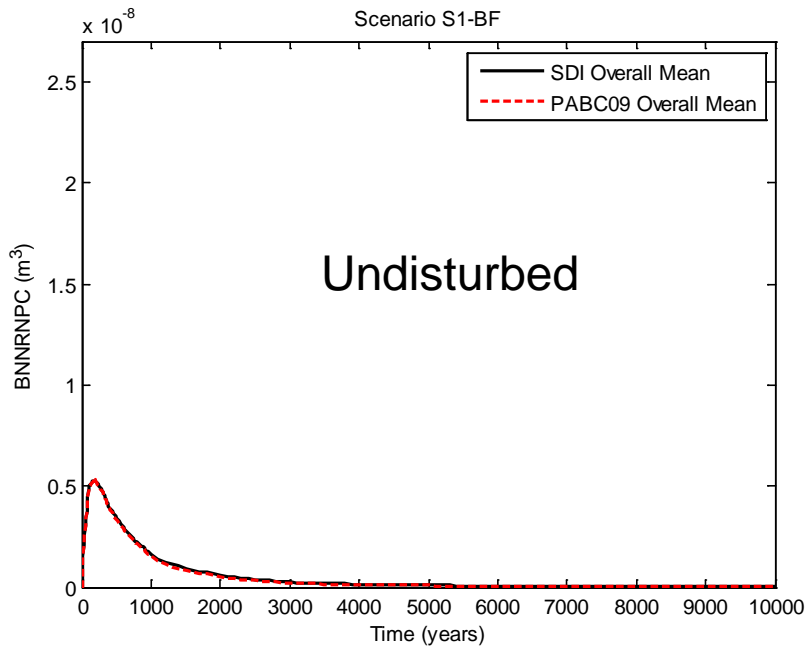
Overall Means Calculated Over all 300 realizations



SDI Overall Means of Flow Rates Northward from the Southern Repository Region are Practically Identical to Current Baseline Results.

Comparisons of Flow Rates Northward out of the Northern Repository Region

Overall Means Calculated Over all 300 realizations



SDI Overall Means of Flow Rates from the Repository Toward the Operations/Experimental Areas are Practically Identical to Current Baseline Results.



Conclusions

- Panel Closures are very effective at isolating intrusion impacts to the intruded region.
- Flow rates northward from waste areas are extremely small for undisturbed and disturbed conditions, and are on the same order for all scenarios.
- A drilling intrusion into the expanded experimental area is of no consequence. The brine present in the operations and experimental regions is unchanged by intrusions in the waste area. It is the same brine as that present in undisturbed conditions.
- SDI brine flow rates northward out of the repository waste area are virtually identical to those found in the current baseline.