

*Idaho National Engineering and Environmental Laboratory*

# **Integrated Environmental Systems Analysis**

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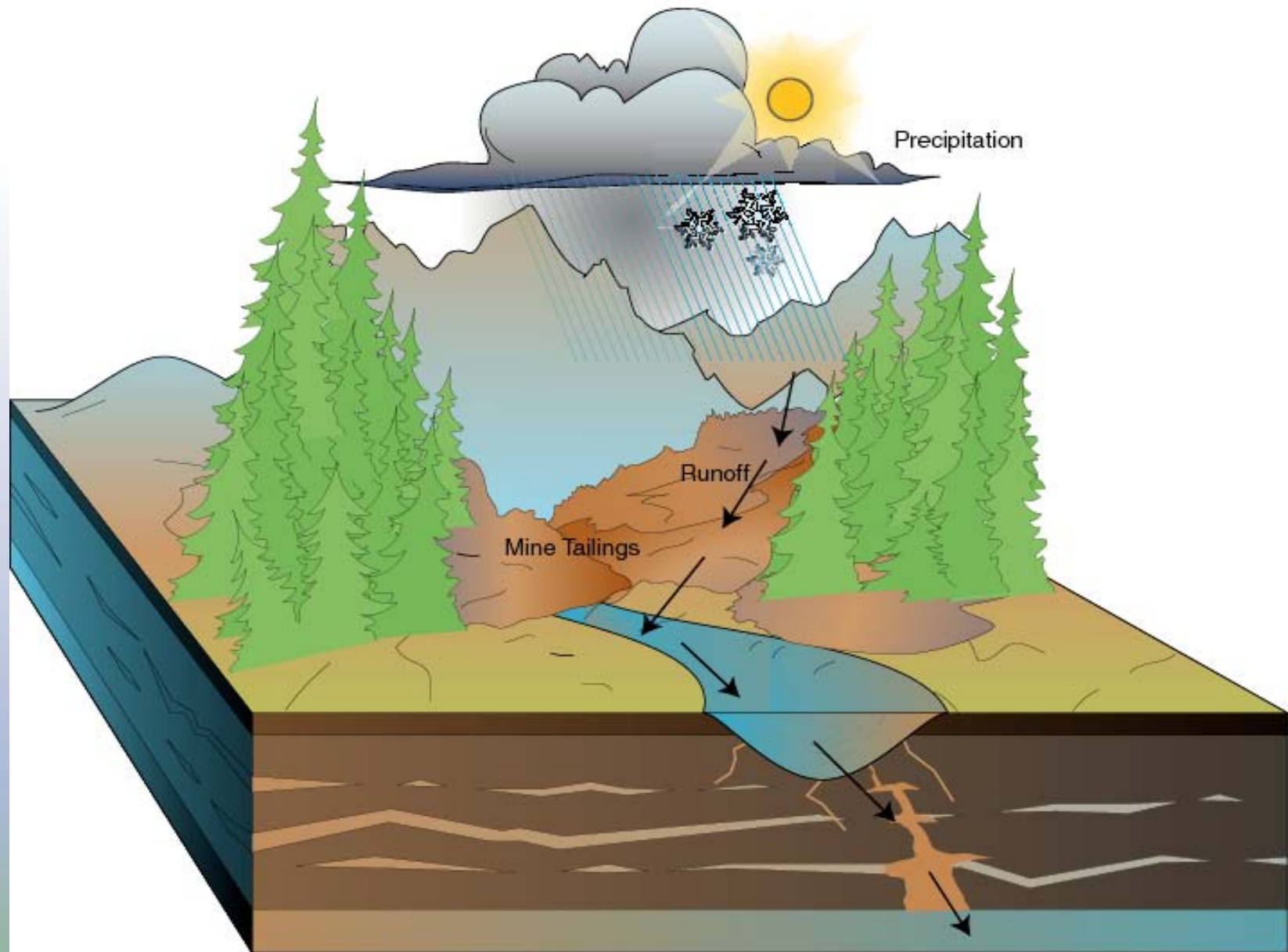
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## ***Brief History***

- *Abandon and active mines continue to be a source of contamination to surface and groundwater sources.*
- *September 2002 - Zinc/Cadmium Symposium in Coeur d'Alene was held to discuss current issues.*
- *Tailings piles continue to be a source of contamination in the tributaries of the Coeur d'Alene River.*



# ***What Options are Available***

- *Do Nothing*
- *Excavate and Remove the Waste*
- *Engineered Covers*
- *Isolating Walls such as Grout Curtains or Sheet Piles*
- *Treat Contaminated Water*
- *Reactive Barriers*
- *Divert the River or Creek*

# ***The INEEL Has Treated Buried Waste And Contaminated Soil and Water***

- *While the INEEL does not have tailings piles, it does have*
  - *Buried waste*
  - *Contaminated surface and subsurface soil*

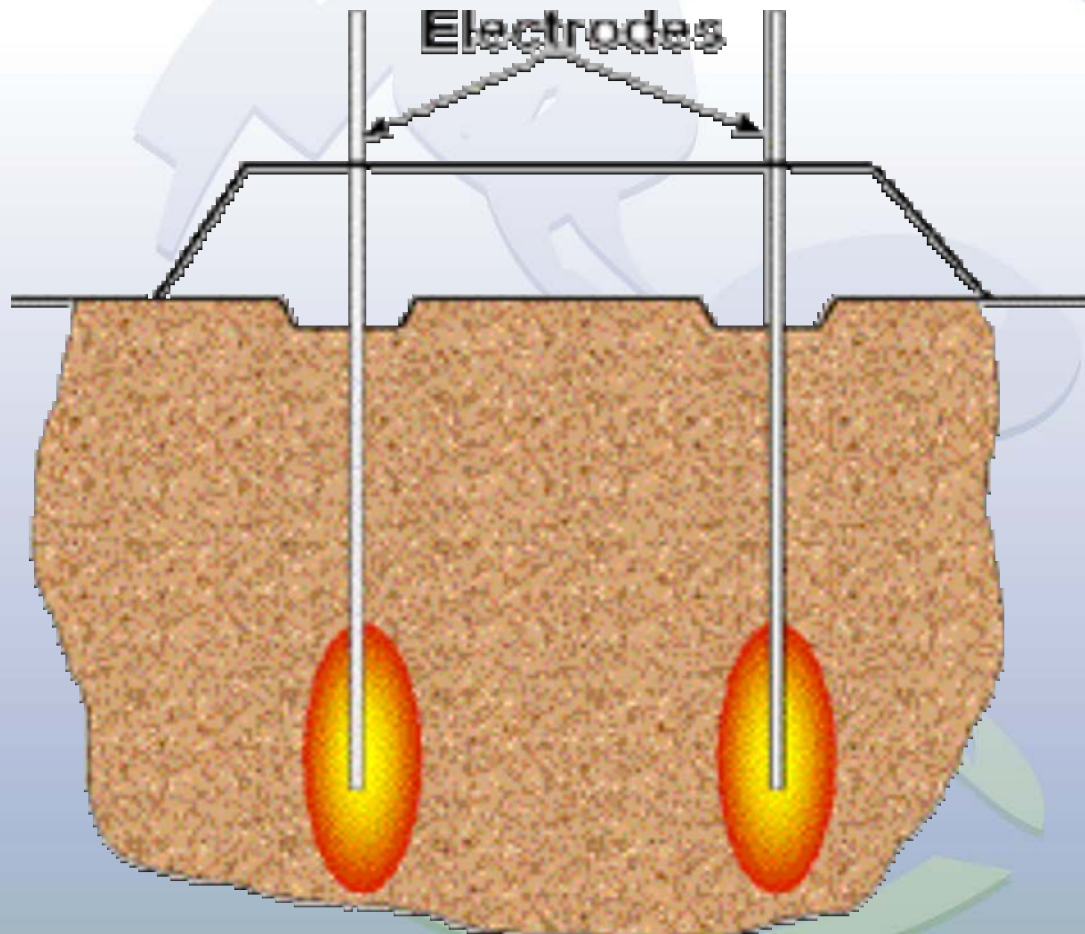
# Construction of Liners and Covers



# *In Situ Jet Grouting*



# ***In Situ Vitrification***





# Results of In Situ Vitrification

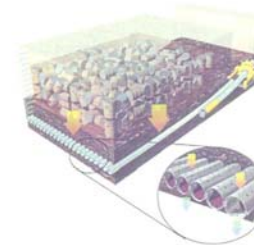
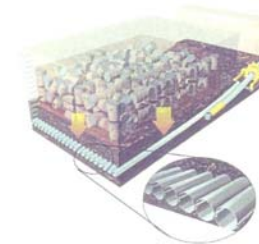


# Specialized Containment

## The Smart Subsurface Barrier System Supports Multiple Environmental Applications

### Impermeable subsurface barrier

The Smart Subsurface Barrier base configuration is impermeable and can be used as an isolation of the zone of concern or as a means to separate groundwater from the zone of concern. This technology provides access for monitoring and verification, and provides the opportunity to perform in situ failure detection and repair.

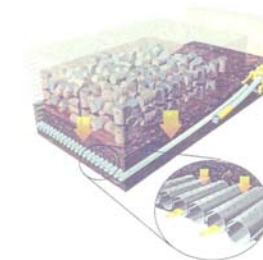


### Permeable subsurface barrier

Casing can be made of semi-permeable material and used for in situ treatment of contamination in groundwater or soil. Due to the unique physical configuration which allows access following installation, reactive components can be replaced periodically, and in situ monitoring instrumentation can be maintained or improved over time.

### Subsurface accumulation barrier

The Smart Subsurface Barrier technology is well suited to a leachate collection application. By constructing casing with permeable walls adjacent to the zone of concern, minerals of interest can be collected in situ and removed from the barrier.

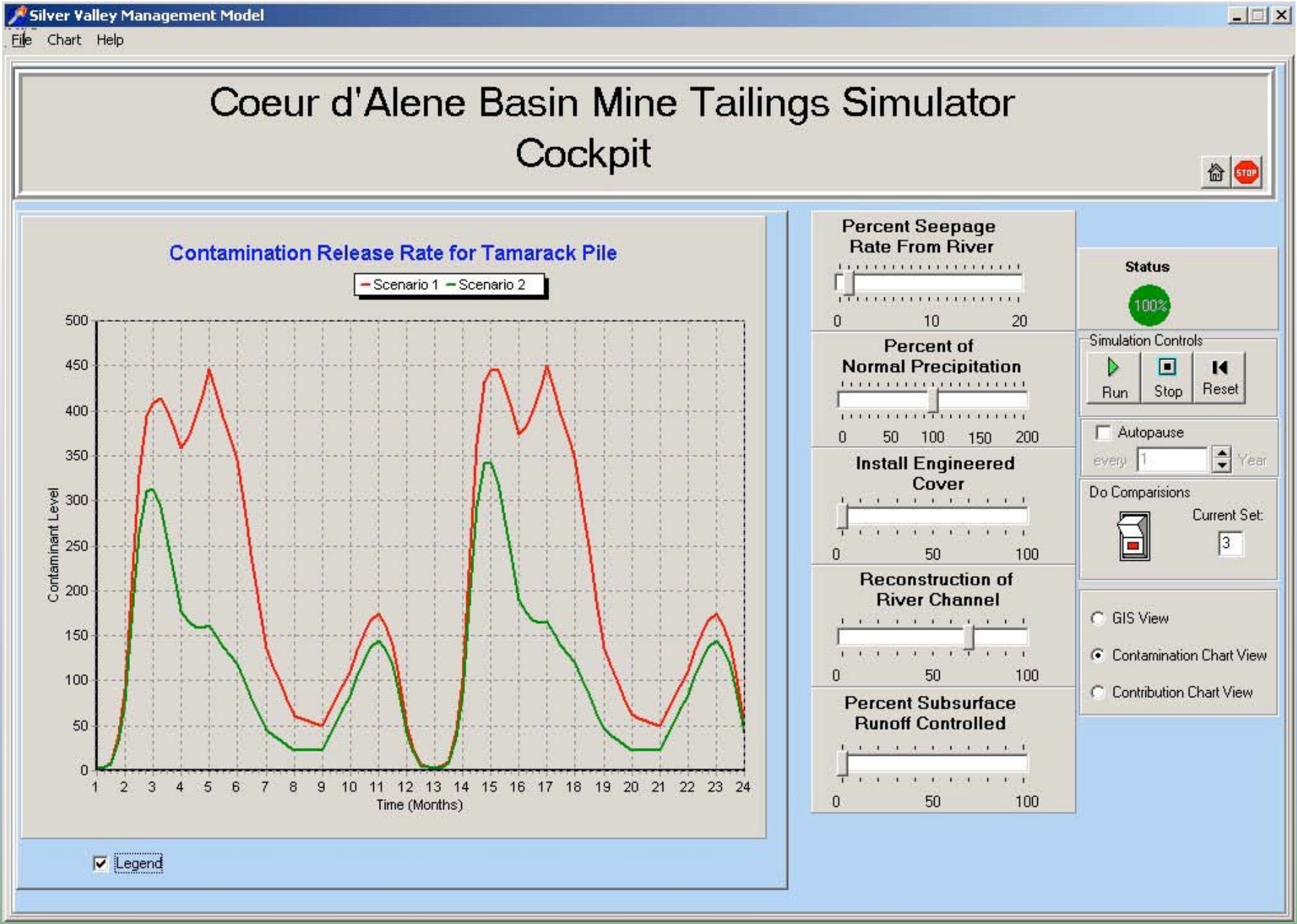


# ***What Type of Barrier is Appropriate***

- *The INEEL has developed a Systems Dynamic Approach*
- *Identify the source of contamination (tailings pile)*
- *Collect and enter site-specific information into the system*
  - *Stream flow*
  - *Precipitation*
  - *Evapo-transpiration (ET)*
  - *Groundwater flow*
  - *Runoff*
- *Identify remedial alternatives and the level of treatment that the alternative affords (0-100% contaminant removal)*
- *Test alternatives in the model*
- *Implement technologies*
- *Verify results*

# ***Input for Tailings Pile Simulation***

- *Weather data obtained for Wallace, ID from NOAA*
- *Stream flow data for Canyon Creek, ID obtained from USGS*
- *ET estimates obtained from the Kimberly, Idaho Experiment Station*
- *A 14 Acre tailings pile selected as an initial test location*
- *About 1000 ft of river frontage*
- *An assumed 500 yards of hillsides on either side of the pile contribute to runoff*



# Conclusions

- *Computer modeling can aid in planning remedial actions for mine tailings piles*
- *This approach involves diverting water away from tailings piles, rather than treating the water after it becomes contaminated*
- *The INEEL has the tools and technical ability to assist with remedial design*
- *The next step is to obtain site-specific data for a specific tailings pile*