

Deployment of a Vadose Zone Monitoring System at the Savannah River Site

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Westinghouse Savannah River Company

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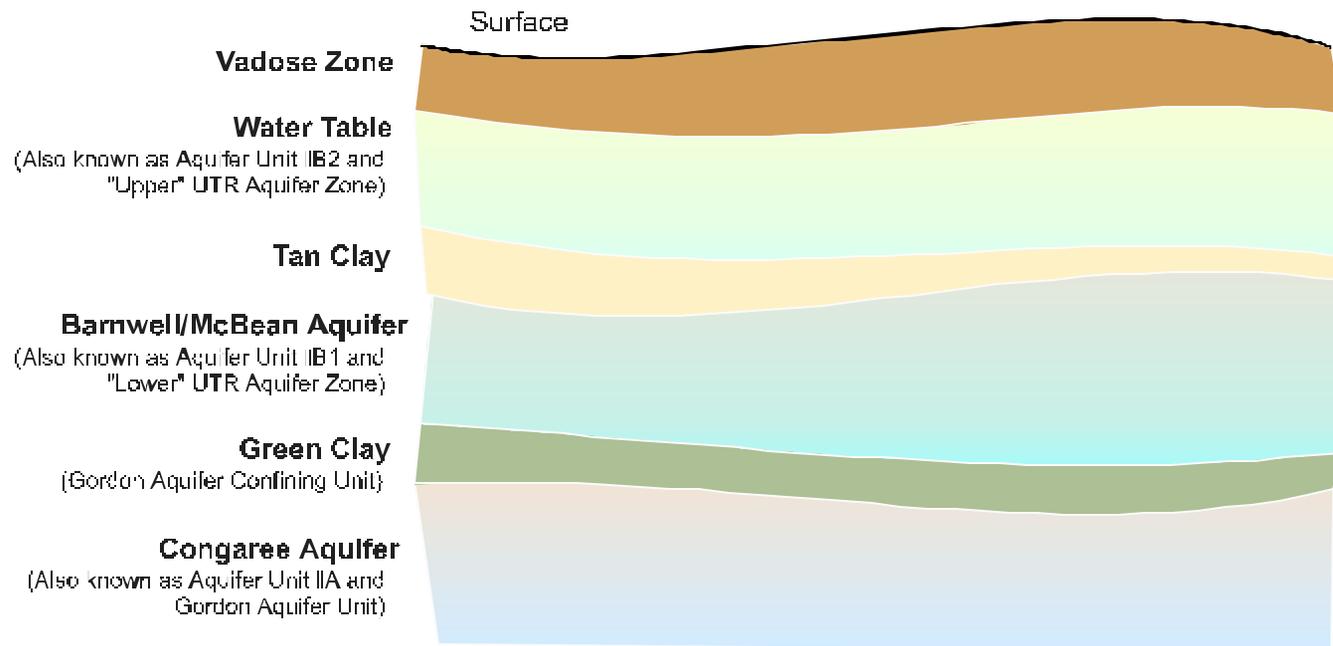
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The SRS Vadose Zone

The vadose zone is defined as the geologic region bounded by the surface of the earth and the water table.



Overall Objective is to Answer the Following Questions:

- **Are Groundwater Resources Being Protected?**
- **Can Performance Assessment (PA) Predictions of Contaminant Transport Be Validated with Actual Field Data?**

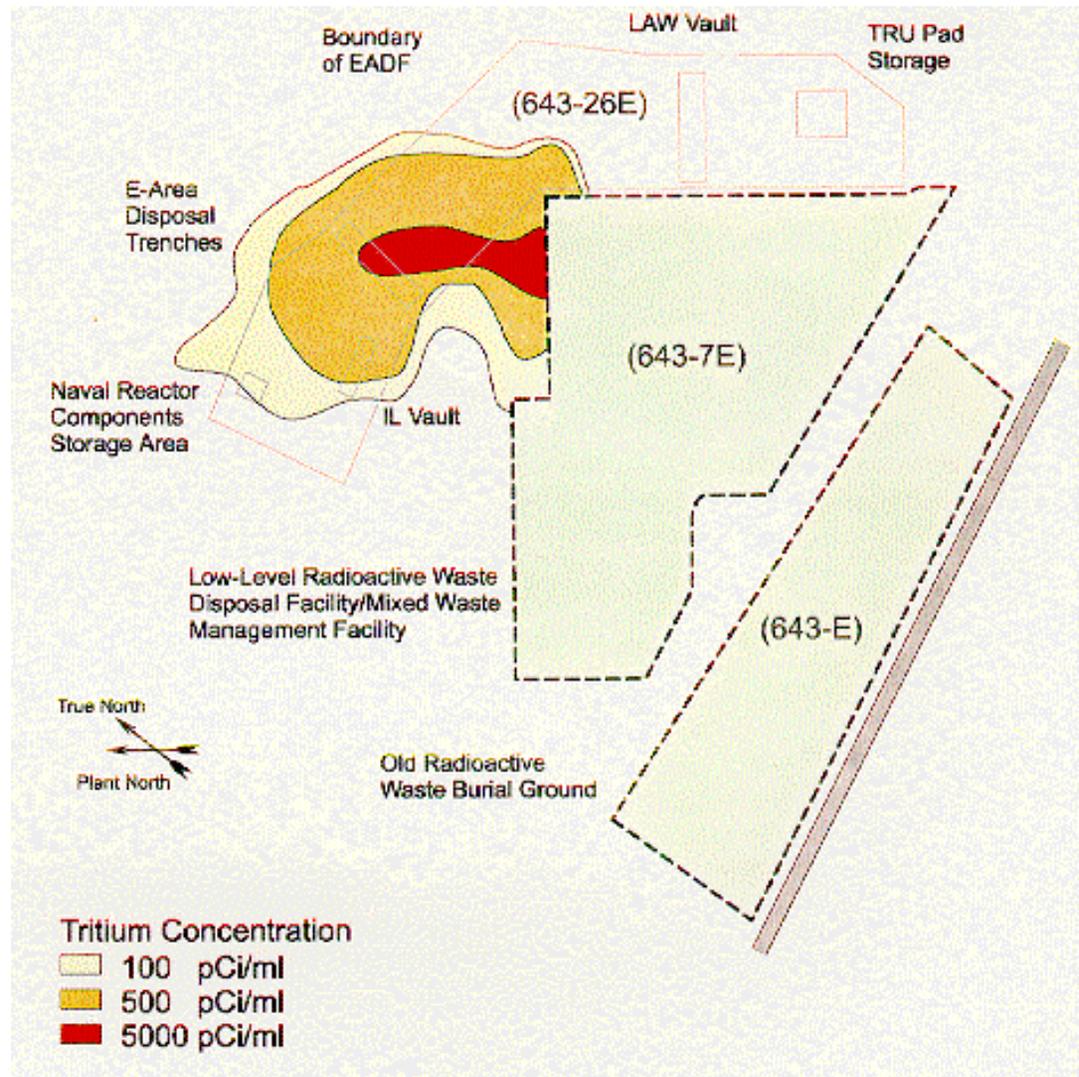
Issue

Traditional groundwater monitoring is not feasible due to existing contamination plumes that have migrated underneath the new low-level radioactive waste disposal units

Solution

Vadose Zone Monitoring

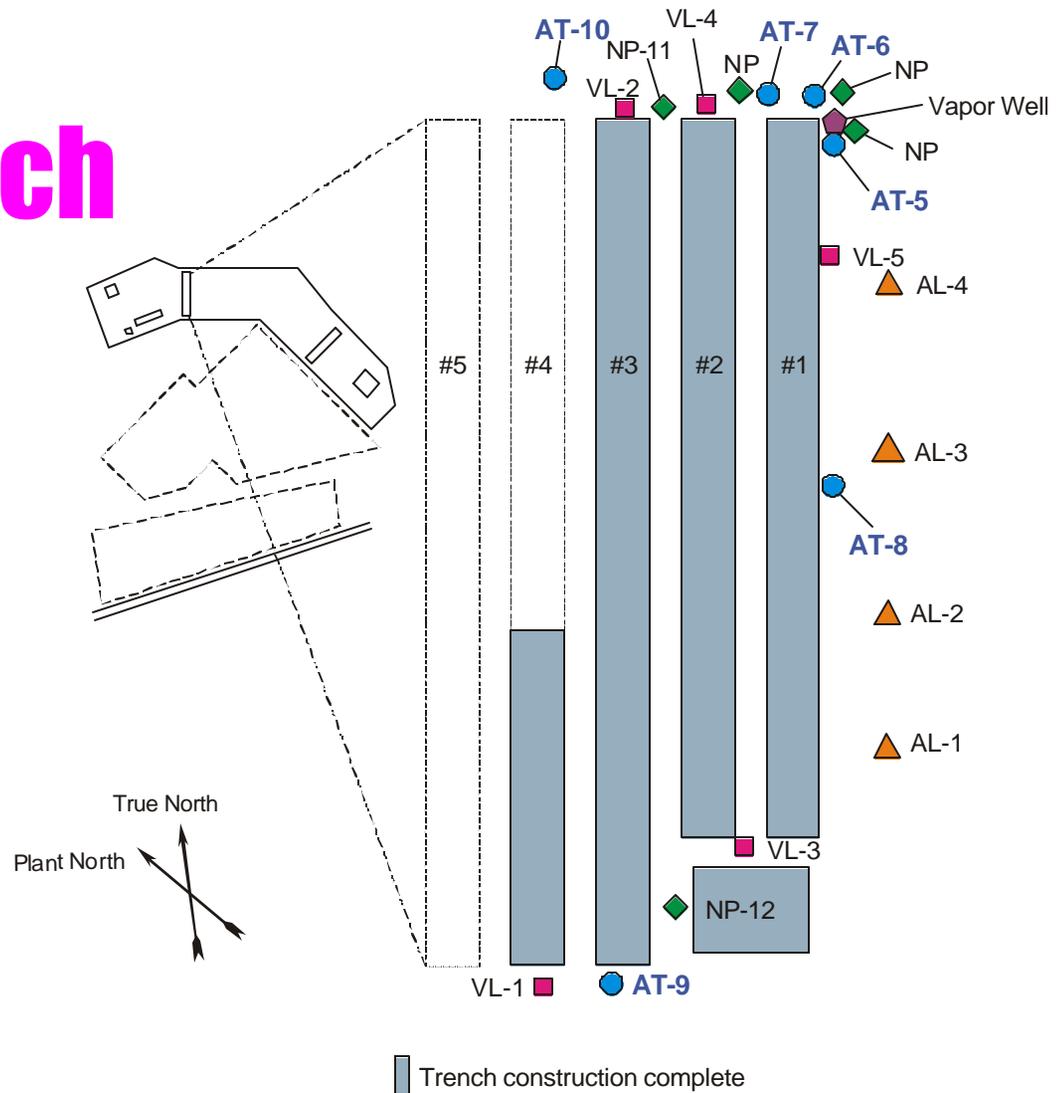
Tritium Plume in the Water Table Aquifer



Summary

- **The SRS Vadose Zone Monitoring Systems (VZMS) is one of the few operating systems in the country successfully monitoring contaminant migration through the ground via 150 instruments in 19 wells**
- **Began Phased deployment in 1999**
- **Lessons learned have been applied to the 2000 & 2001 Programs**

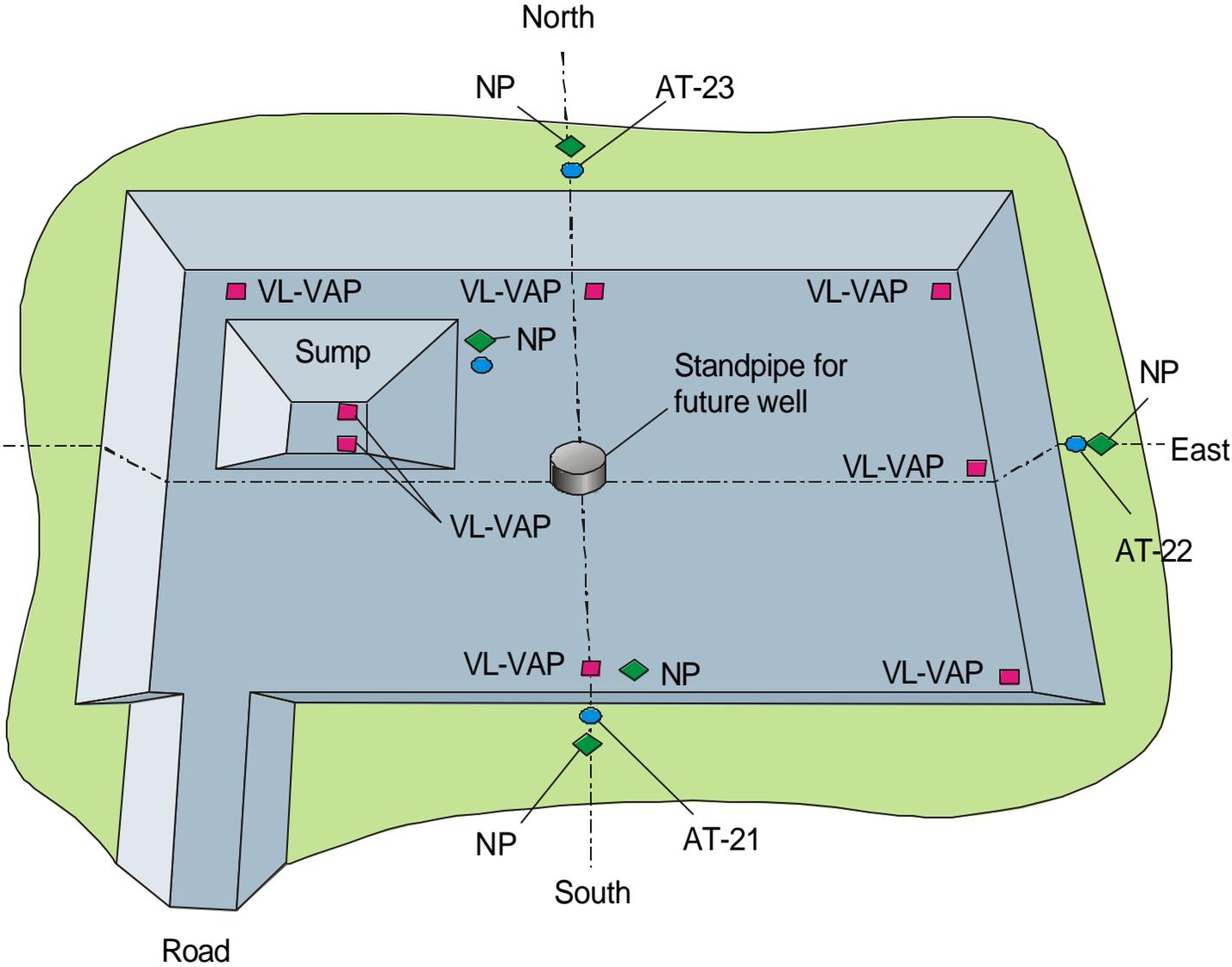
Slit Trench Vadose Zone Wells



Well Types

- Electronic well with advanced tensiometer (AT, New 1999 Deployment) water content reflectometers, lysimeters, data loggers
- Vertical suction lysimeter well
- Angled lysimeter well
- Vapor well (New 2000 Deployment)
- Neutron probe access ports

Future Plans for Engineered Trench

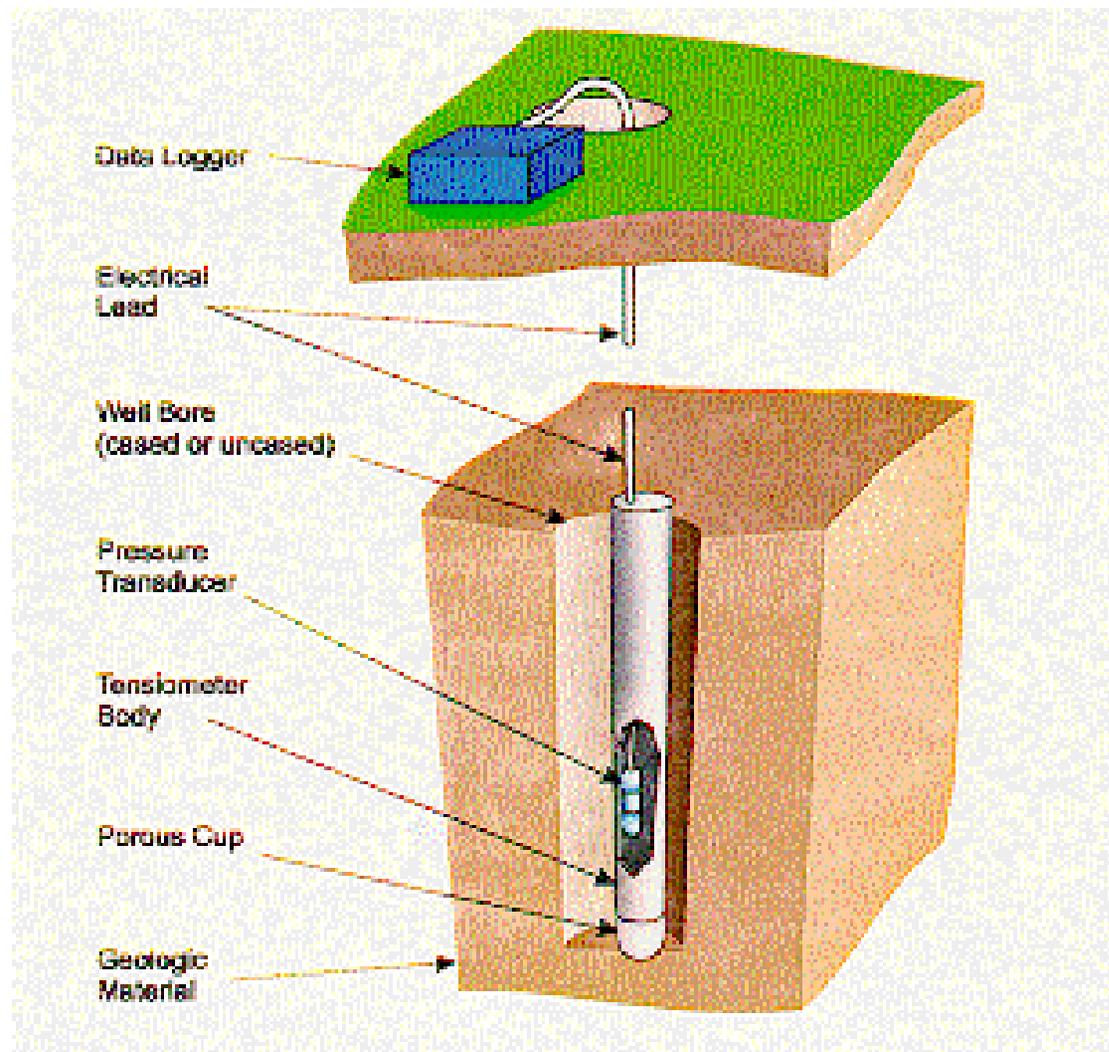


Background:

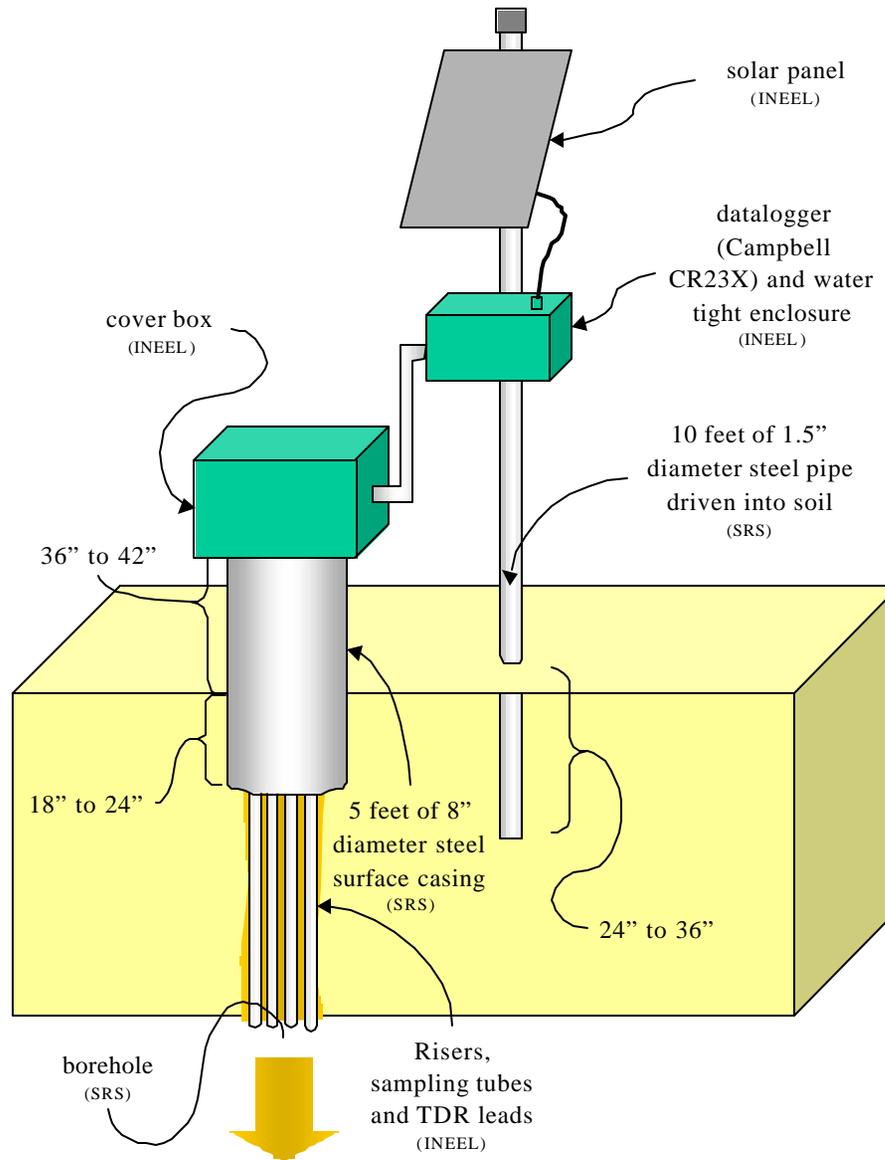
Soil Parameters being Monitored

- **Contaminant Concentration**
- **Soil-Water Tension**
- **Water Content**

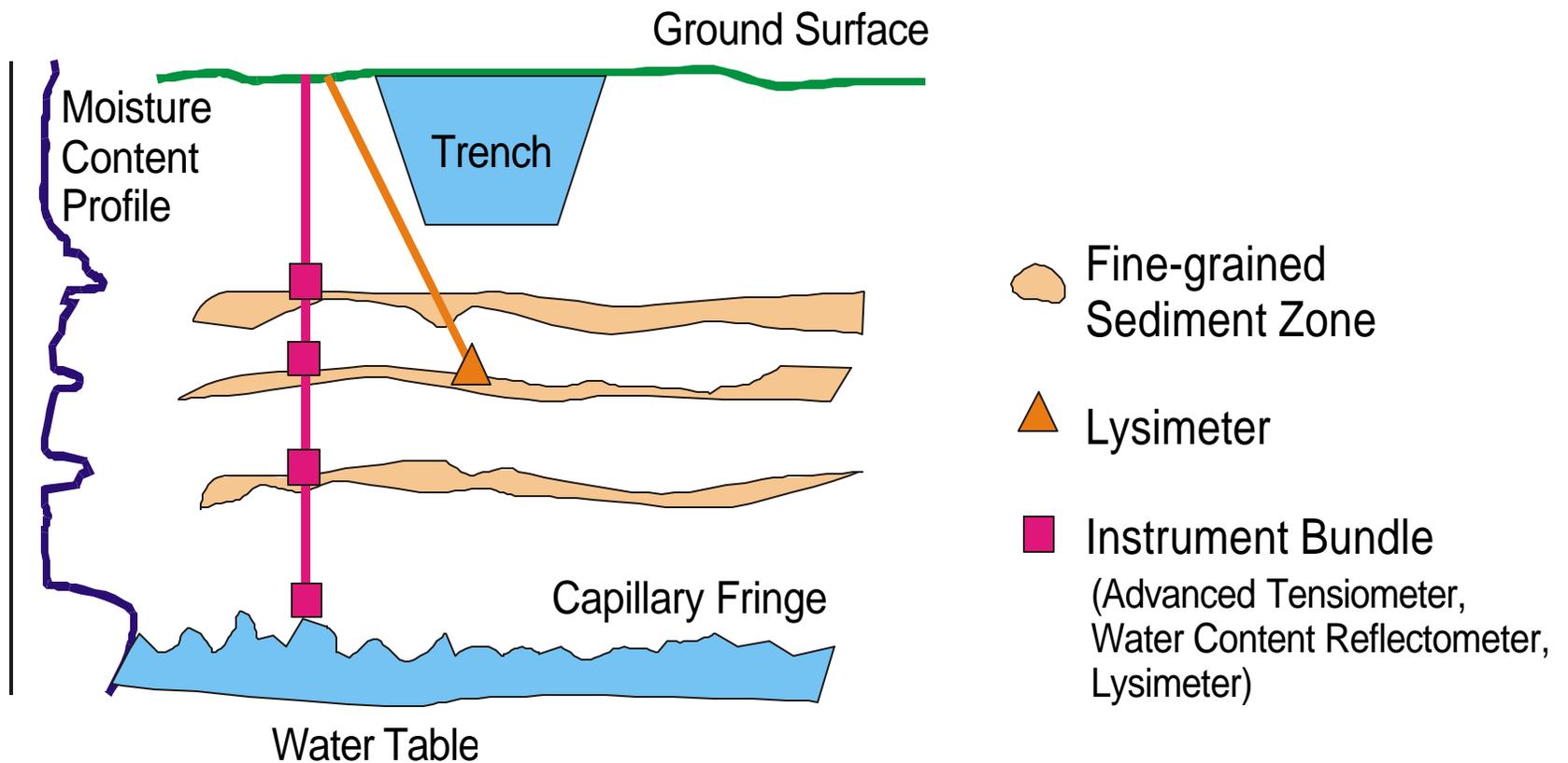
Typical Advanced Tensiometer Installation



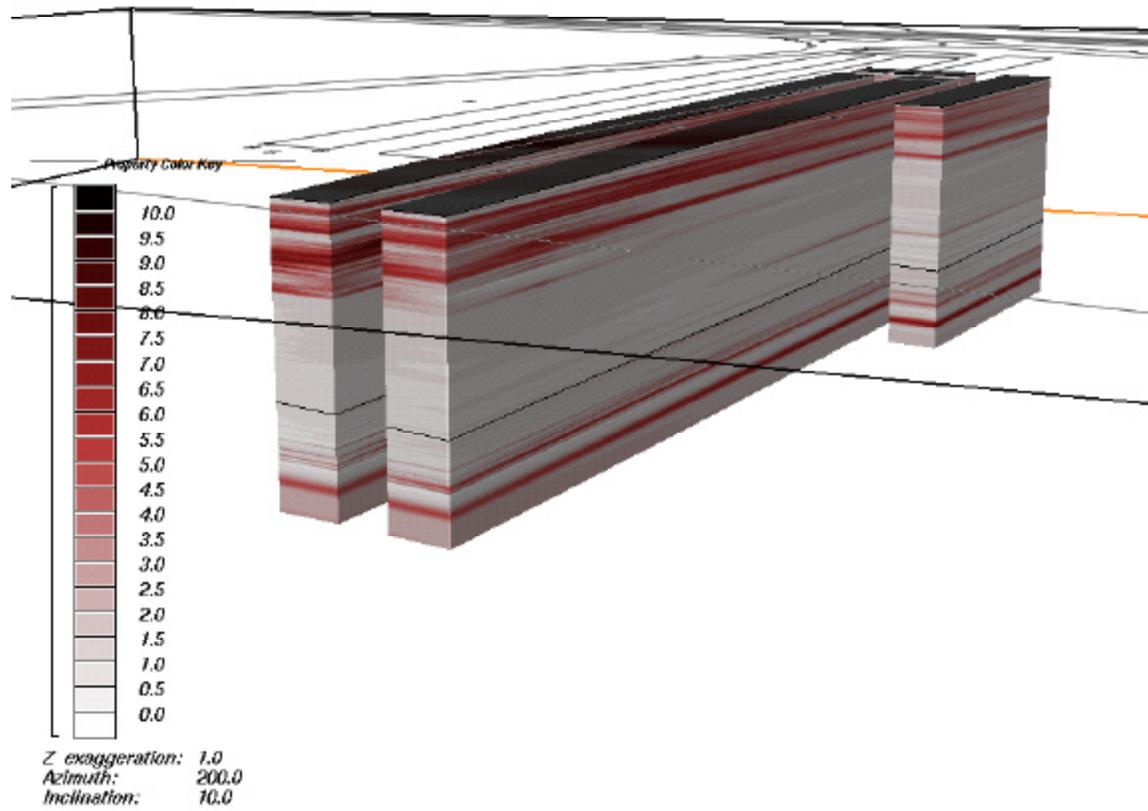
Completion Details for E-Area Advanced Tensiometer (AT) Installation



Typical Location of Sensors



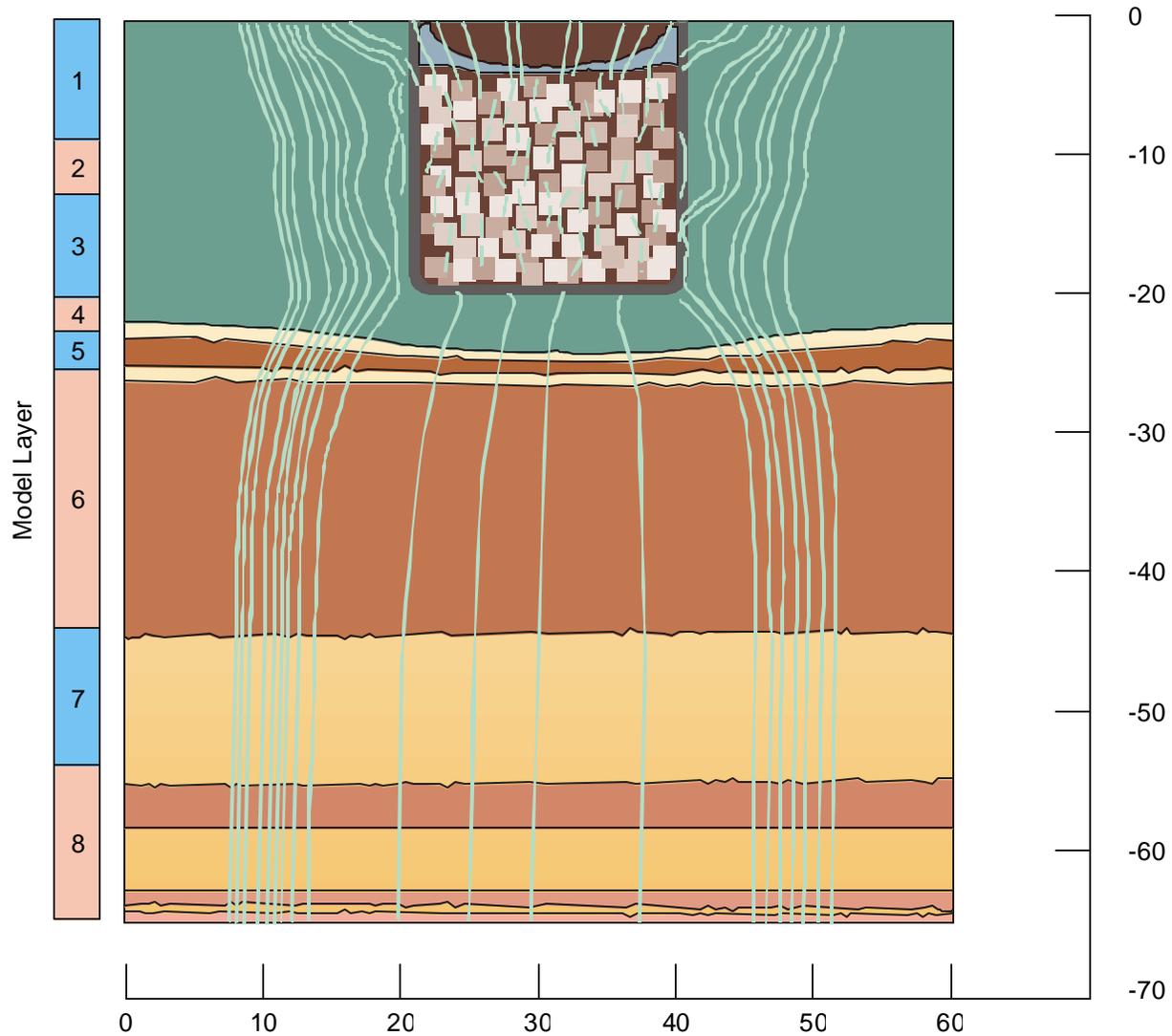
E Vault Trenches Friction Ratio



Lessons Learned

- **Redundant Monitoring**
- **Improved Design via Modeling**
- **High-Performance Monitoring**
- **Pre-Operational Monitoring**
- **Long-Term Monitoring**
- **Improved Installation and Characterization**

Contaminant Transport Modeling



Redundant Monitoring

Instruments	Soil Water Content	Soil Tension	Contaminant Concentration
Primary	Water Content Reflectometer	Advanced Tensiometer	Suction Lysimeter
Secondary	Neutron Probe	Heat Dissipation Sensor	Vapor Well

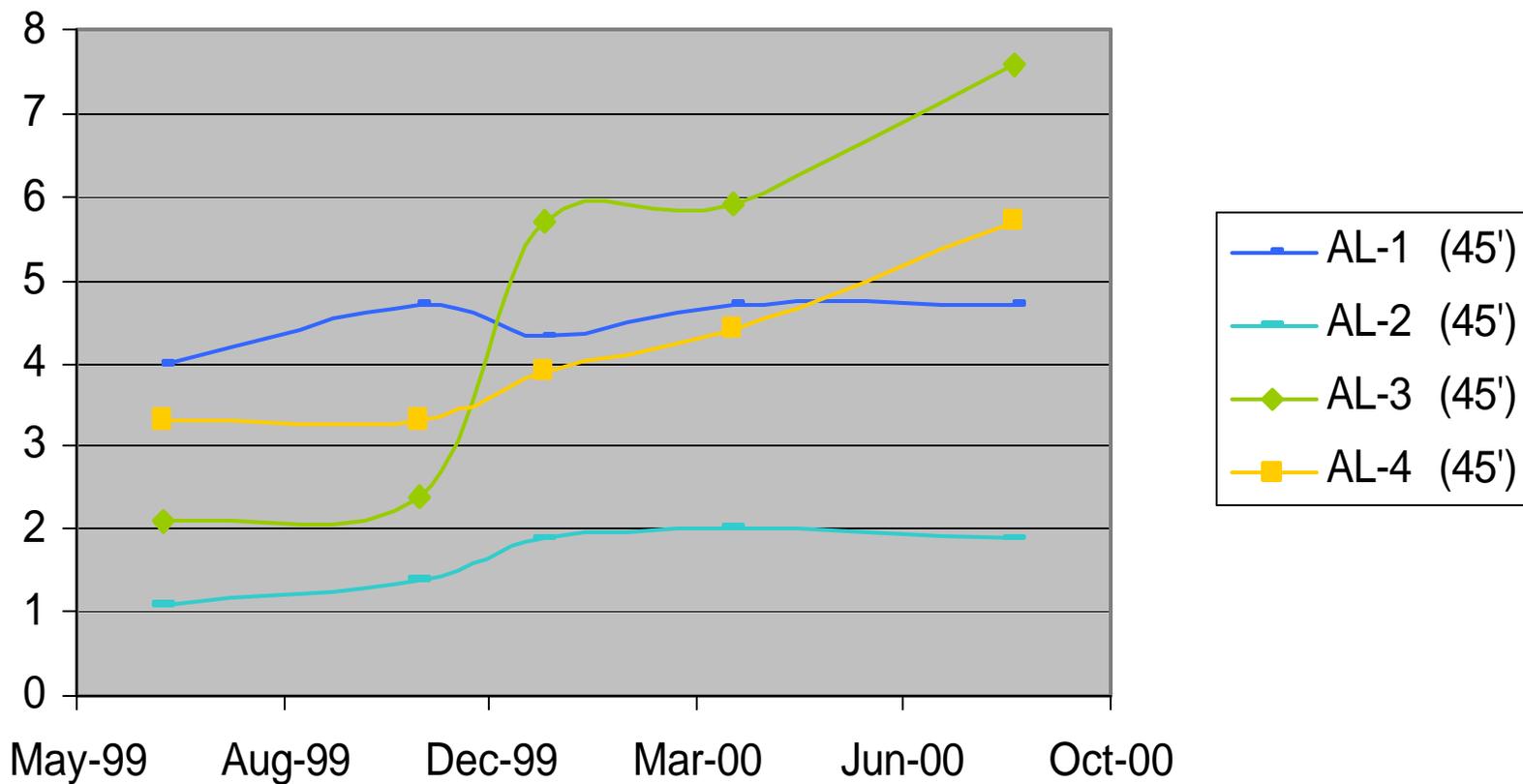
Performance Evaluation

- **How is the Monitoring System performing?**
- **How are the Disposal Units performing?**

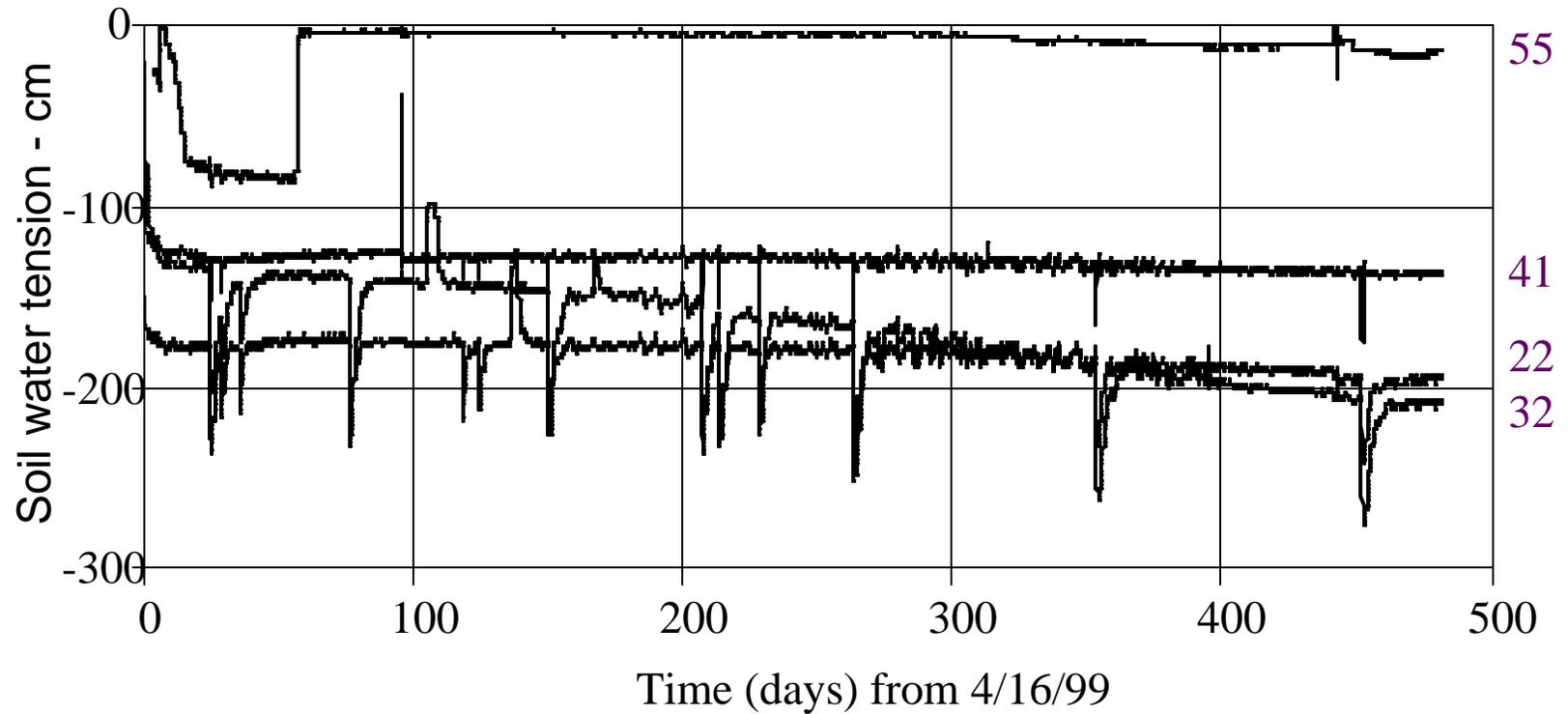
How Is The Monitoring System Performing?

- **The program is a success; monitoring system is successfully collecting data and we are analyzing the data .**
- **Data is reflecting expected soil conditions in humid sub-tropical environment**
- **Data allows tracking of contaminant of concern throughout vadose zone**

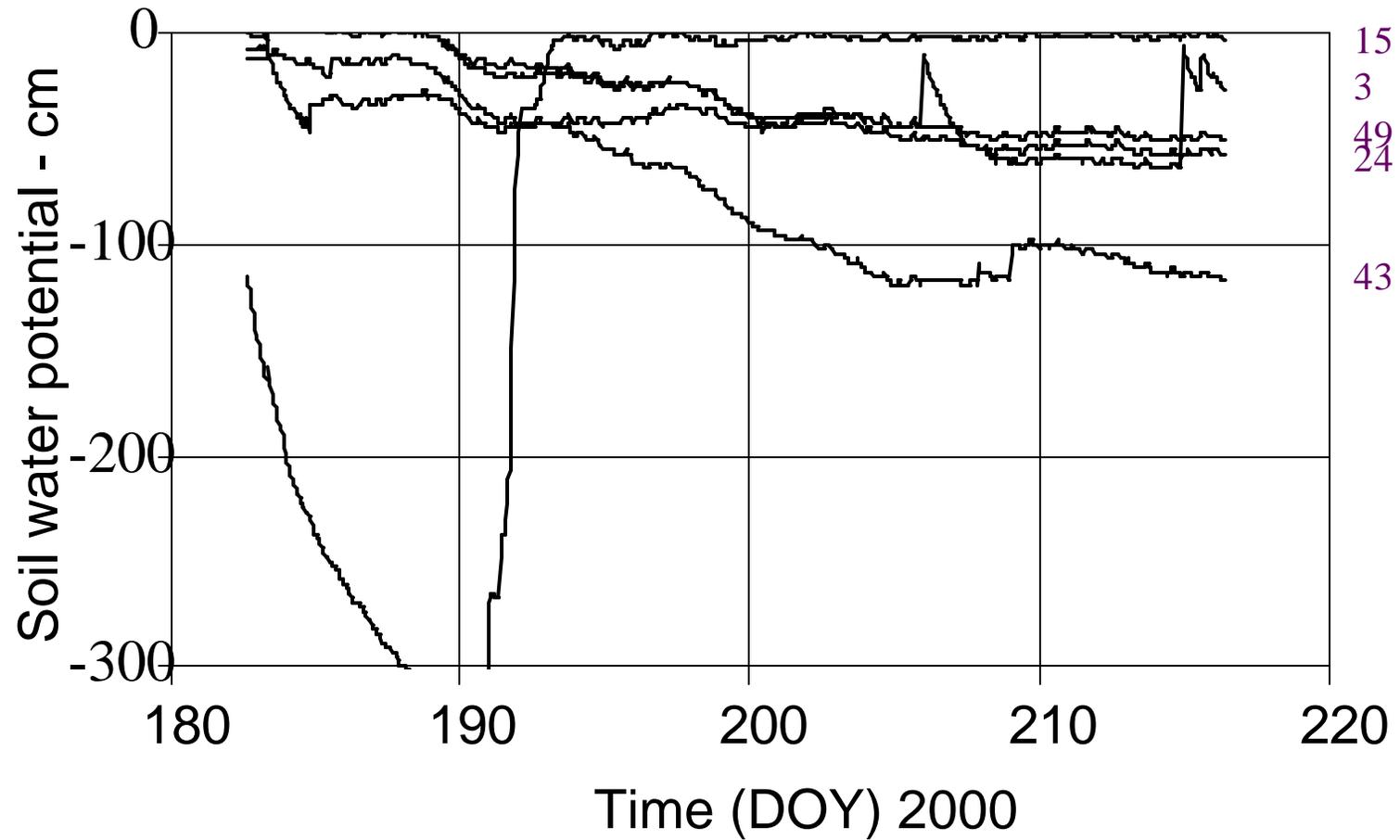
Tritium Concentrations (pCi/ml) for Angled Wells



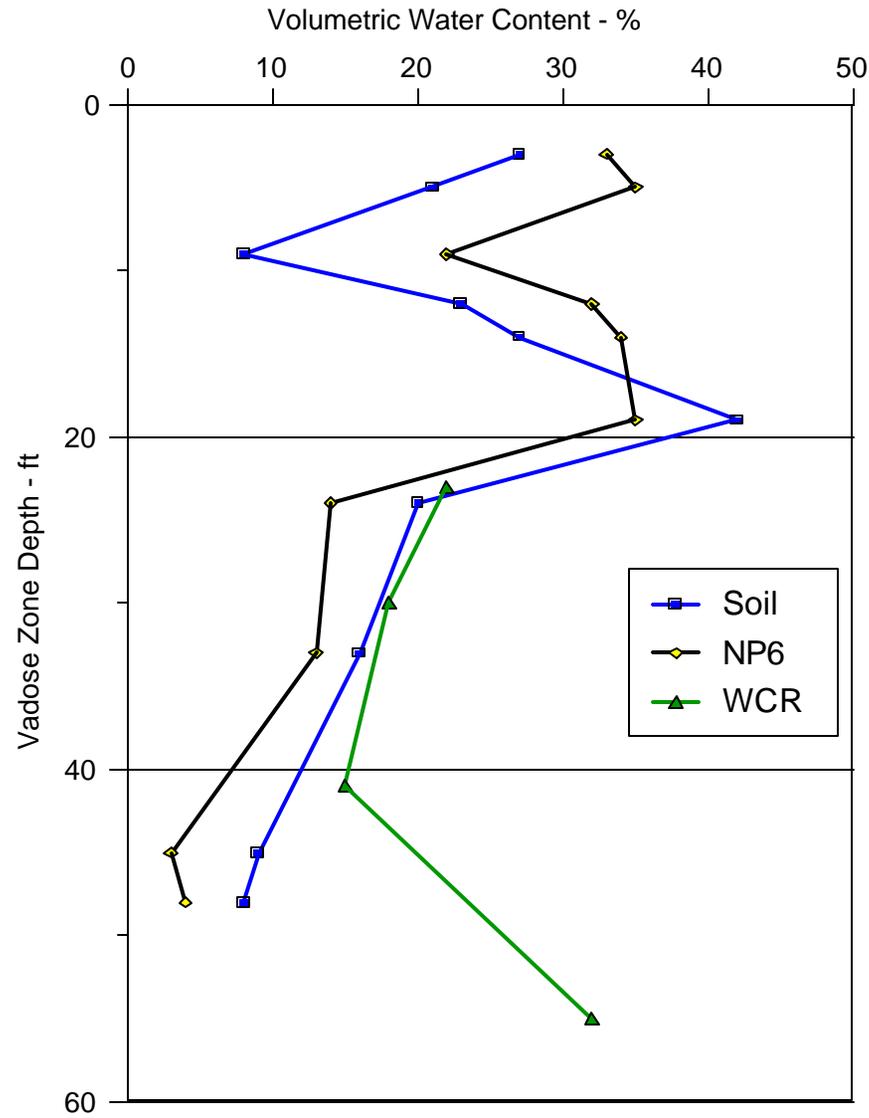
Advanced Tensiometer Data:AT-5



MegaTrench Well AT-23



Comparison of Water Content Data



How are the Disposal Units Performing?

- **The SRS Vadose Zone Monitoring System is confirming that the disposal units are in conformance to the PA and DOE Order**
- **VZMS data indicated CoC migration data is less than the DWS at the compliance point (100 meter well)**
- **Results are validating the PA**

Conclusions: Benefits of the VZMS

Benefits of the SRS VZMS are:

- Assess impact of disposal unit to groundwater**
- Validate actual contaminant migration is less than PA predictions**
- Take preventative measures**
- Save up to \$3 Million annually due to increased trench disposal**
- Identify source and pathway of contaminant migration**

Conclusions: Limitations of the Technology

- **Continue to evaluate vadose zone technologies; How long will they last? How long between calibrations?**
- **Optimize monitoring combinations**
- **Continue to evaluate results and compare to PA**