

Headquarters U.S. Air Force

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Demonstrations of PneuLog® **Vertical Profiling in the Vadose Zone**



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January 30, 2001

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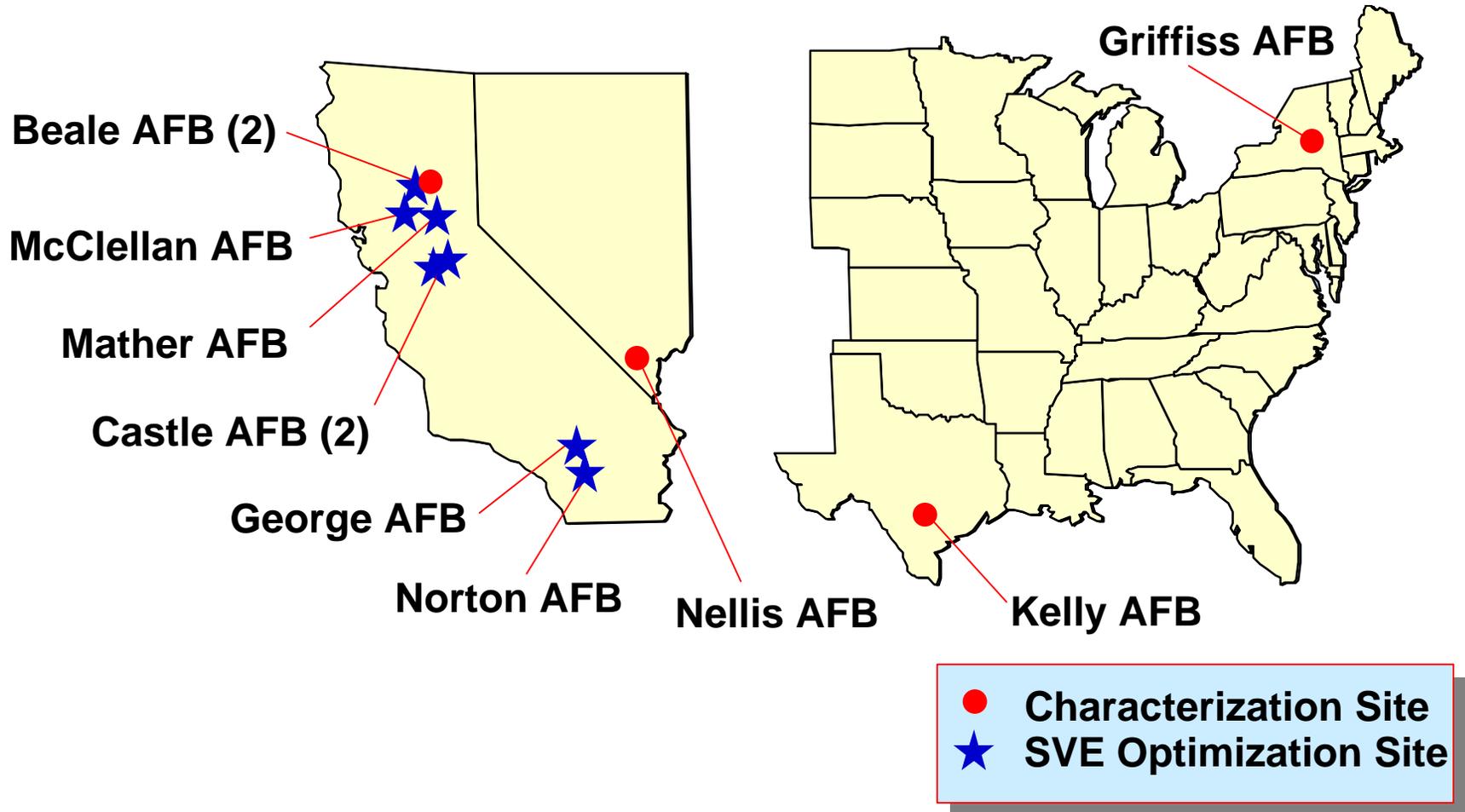
PneuLog[®] Applications

- **Characterization of VOCs in the Vadose Zone**
- **Optimization of Remedial Systems**
(e.g., SVE and Bioventing)
- **Site Closure**

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AFCEE PneuLog Demo Sites





Overview

- **Purpose of the PneuLog Effort**
- **What is PneuLog[®]?**
- **Characterization Demonstration**
- **SVE Optimization Demonstration**
- **Current Status of PneuLog[®]**



Defining the Problem

- **Characterization & remediation are treated as separate slow, costly processes;**
- **Weak conceptual site models do not convince regulators to support remedial decisions; and**
- **Cleanup processes are understood but data are not collected nor evaluated effectively.**



What is PneuLog[®]?



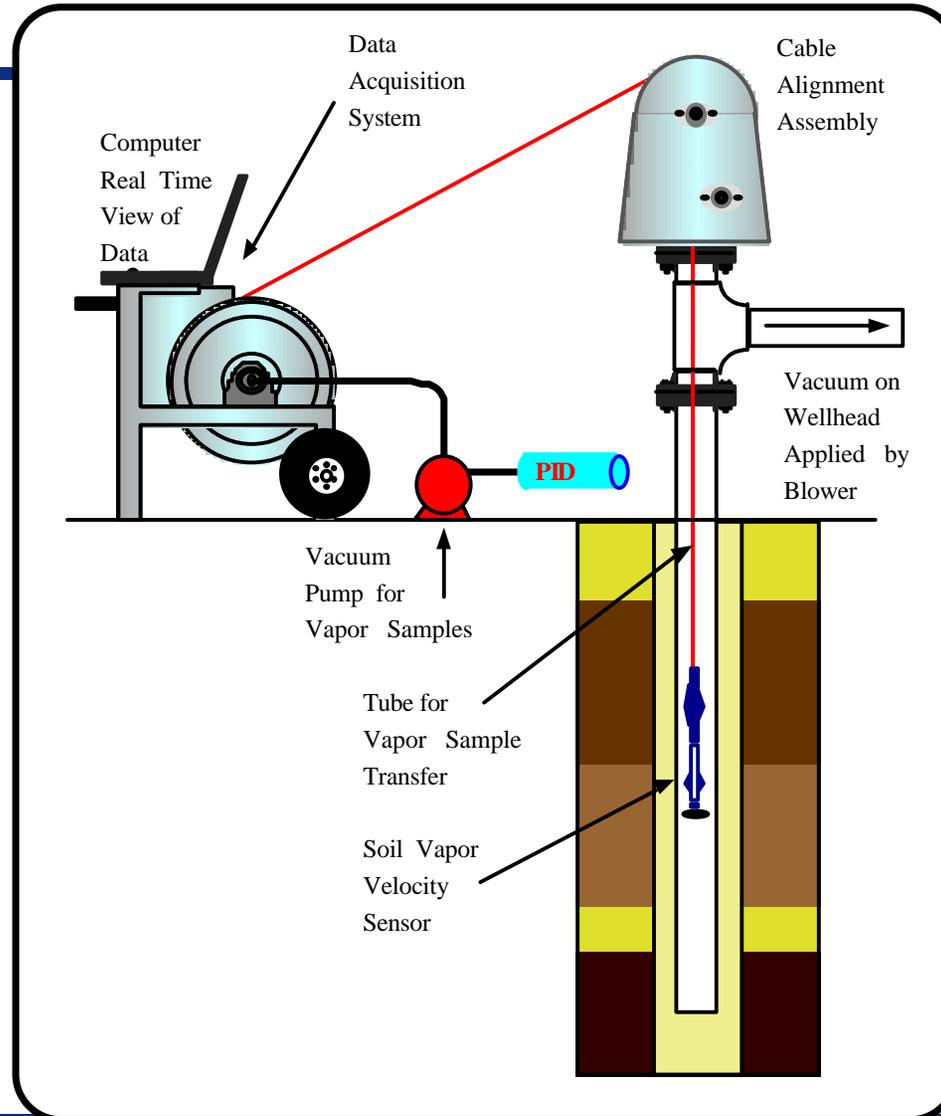
**Diagnostic Tool:
measures contamination
and air permeability in
vadose zone soils during
vapor extraction.**

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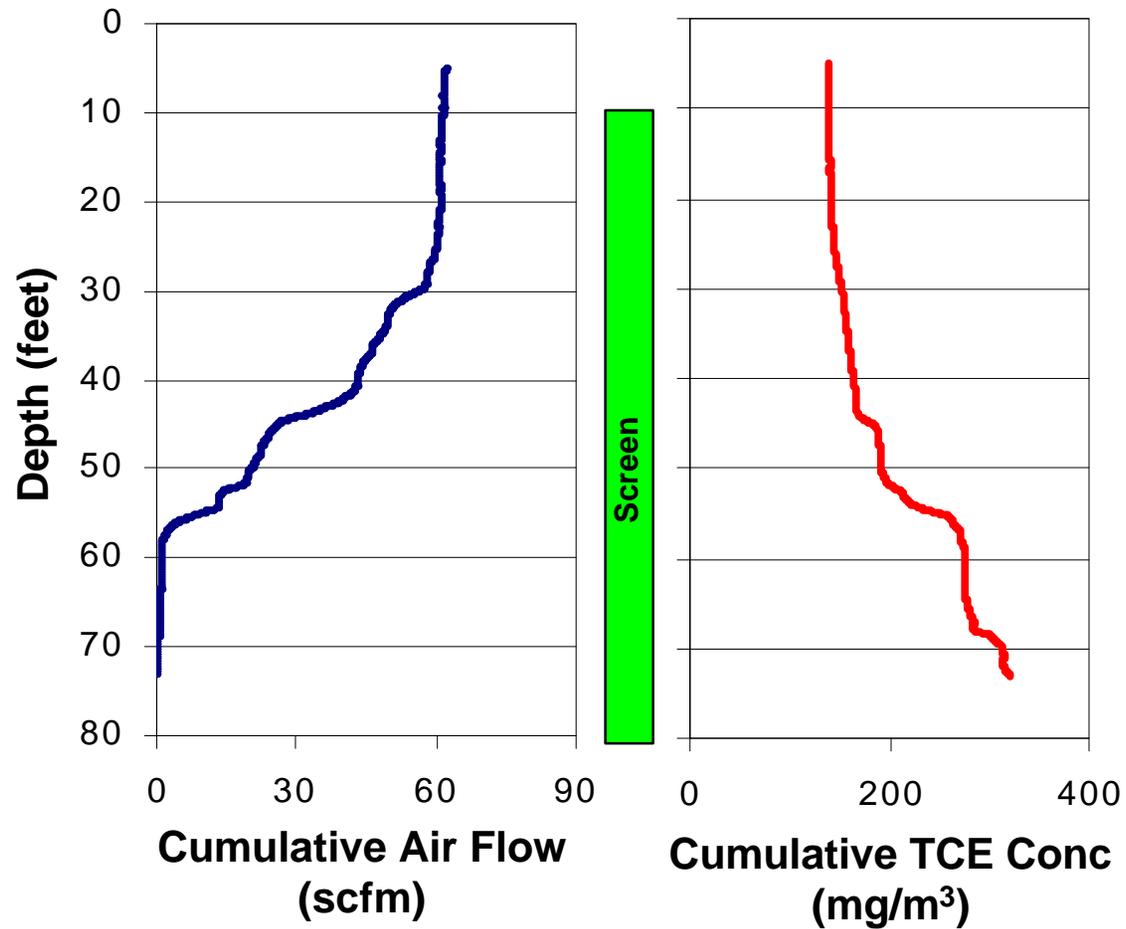
What is PneuLog[®]?



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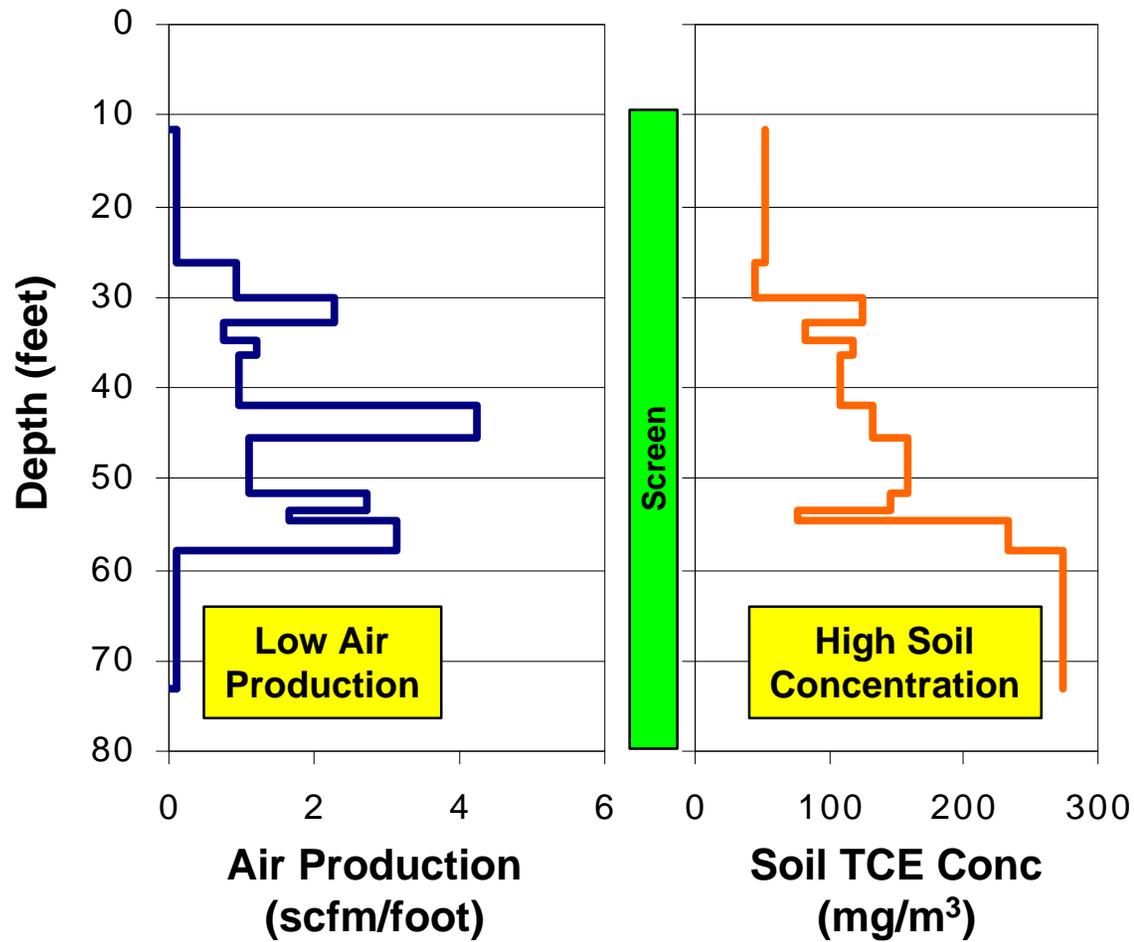
PneuLog Data Collection



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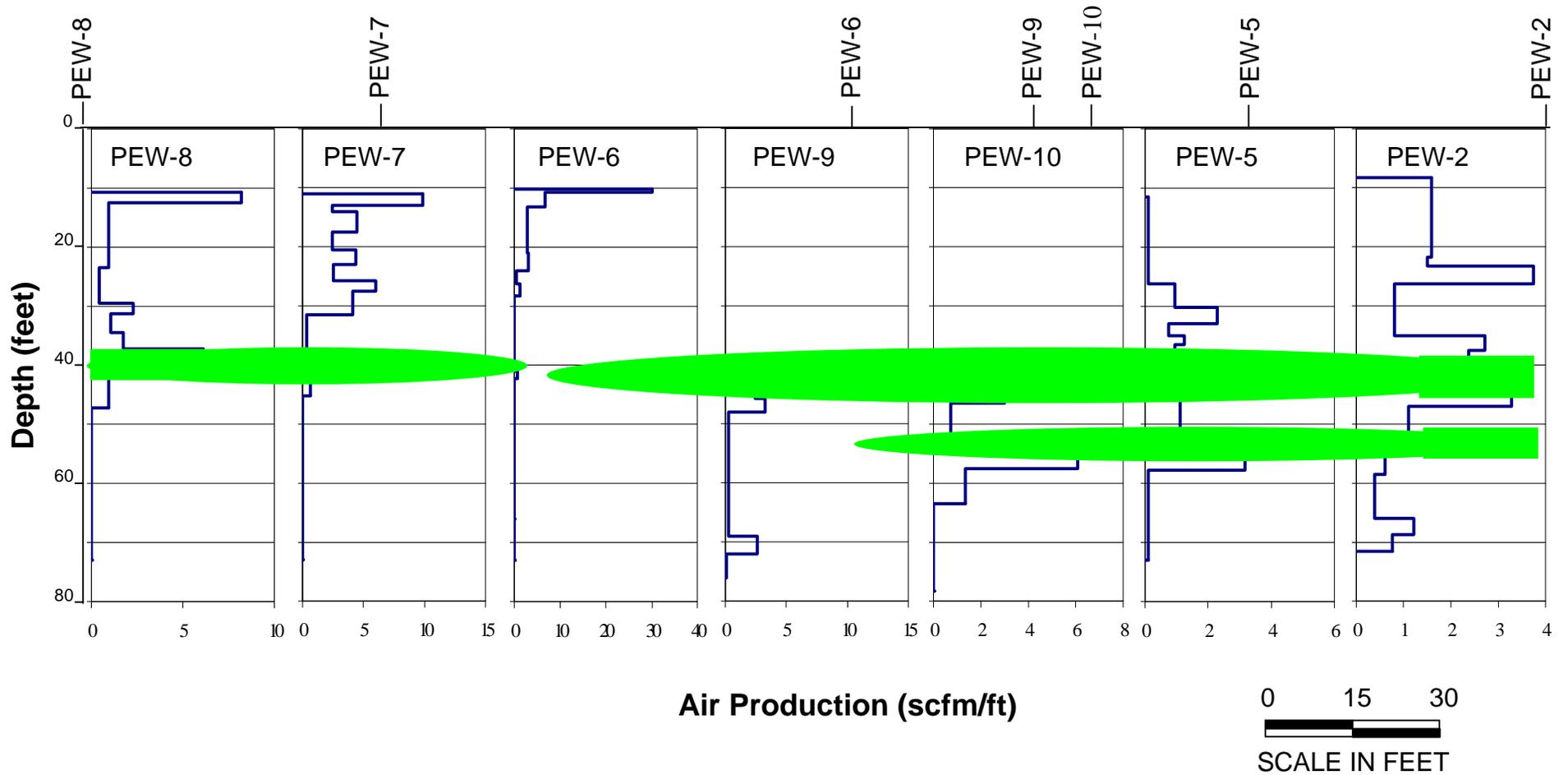


PneuLog Data Interpretation





3-D Data Interpretation

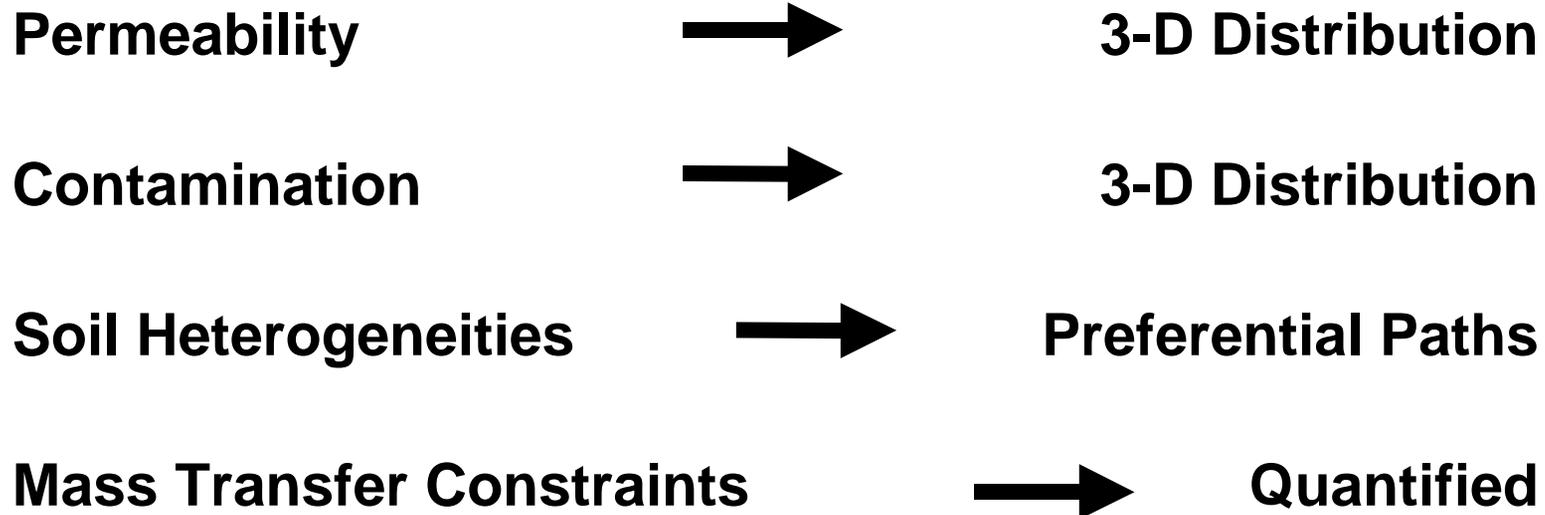


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How Does PneuLog Help?

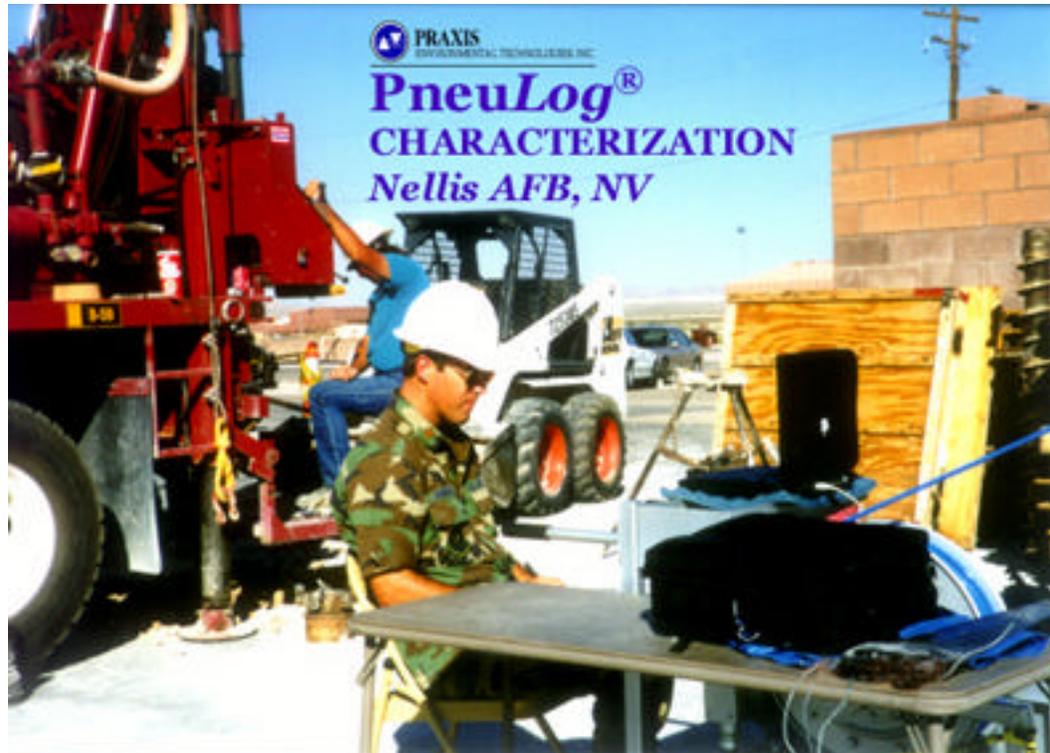
PneuLog provides a quick, cost-effective data set to create a scientific conceptual site model and quantify cleanup:





What is CPR?

SVE combined with PneuLog is a powerful characterization tool (and it removes mass!)



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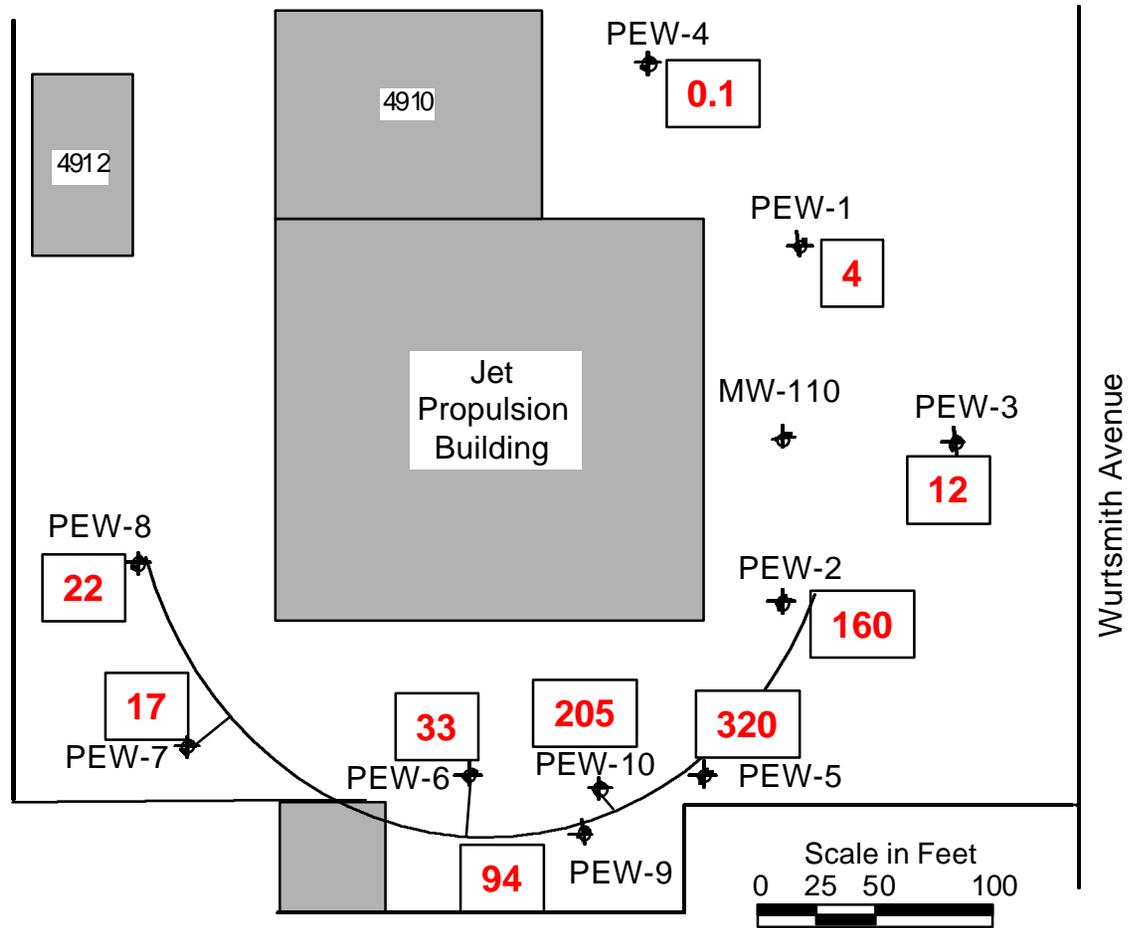


Site 46, Nellis AFB, NV

- **Installed, sampled and PneuLogged 10 wells proximate to an engine maintenance facility**
- **PneuLog identified preferential flow in a relatively few narrow intervals of caliche**
- **CPR defined the source rapidly and left an optimized SVE system in place**
- **63 pounds of TCE were extracted in 6 weeks; followed by 57 pounds in 5 months**

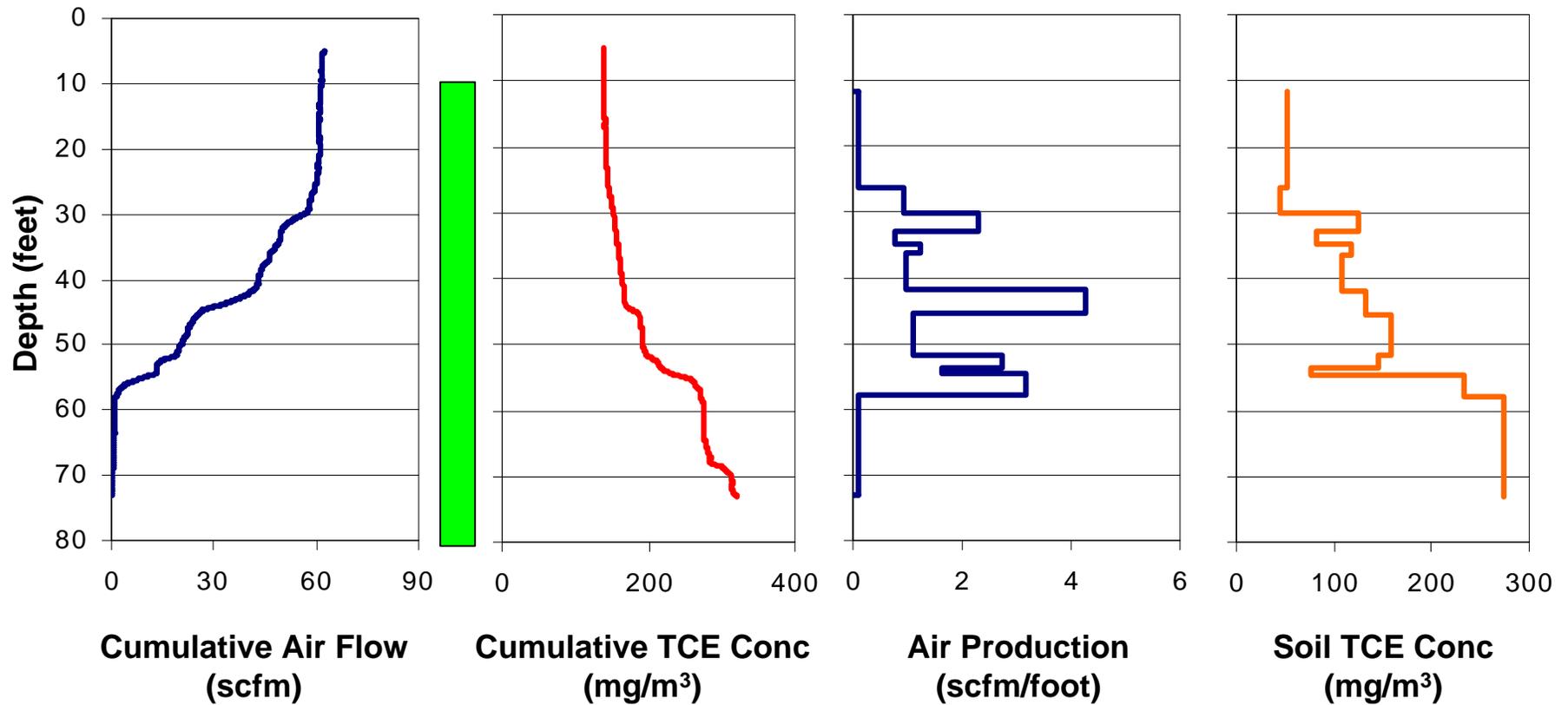


Nellis Site 46 Wells & Initial TCE Concentrations





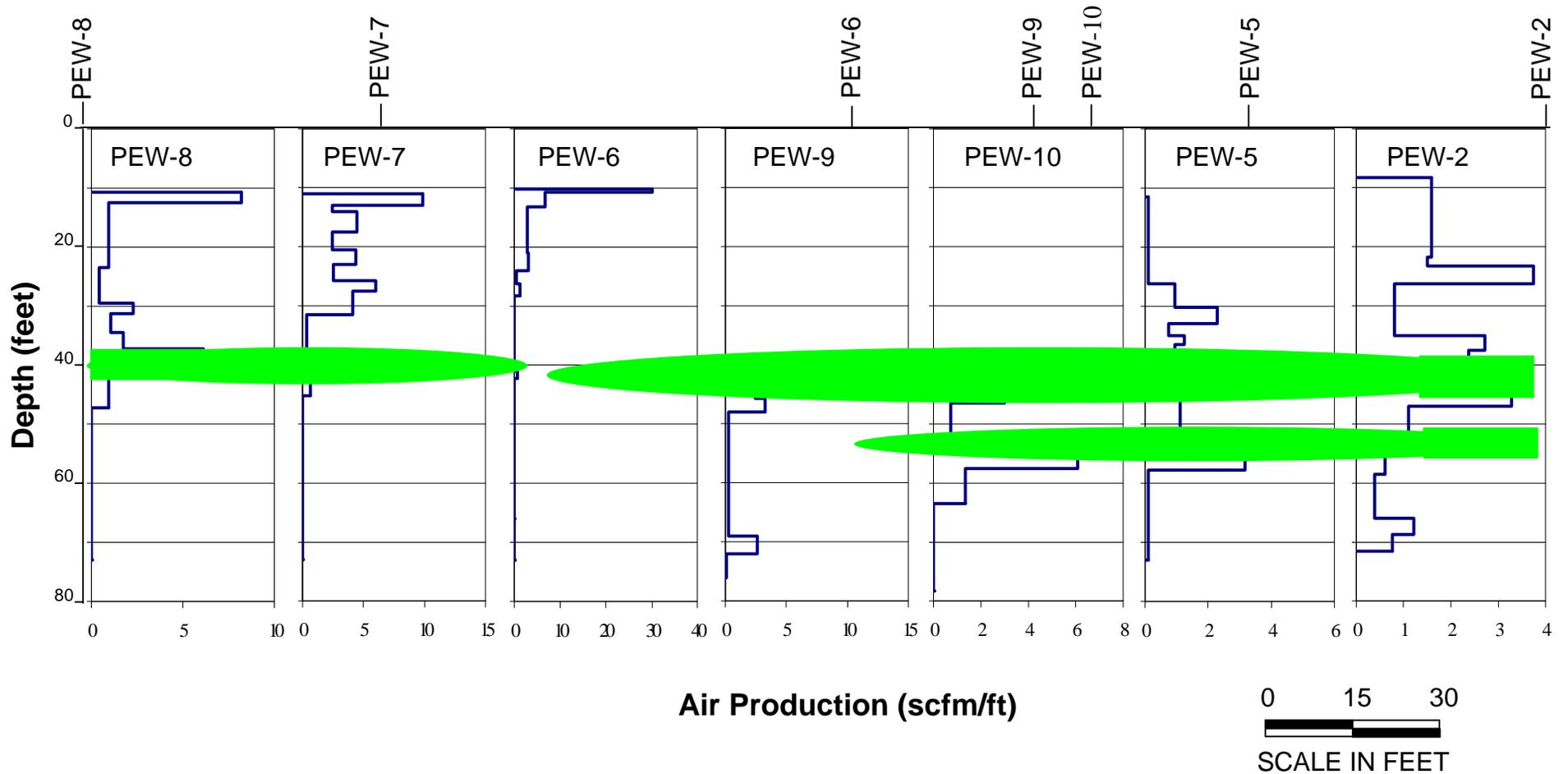
PneuLog Profiles from PEW-5



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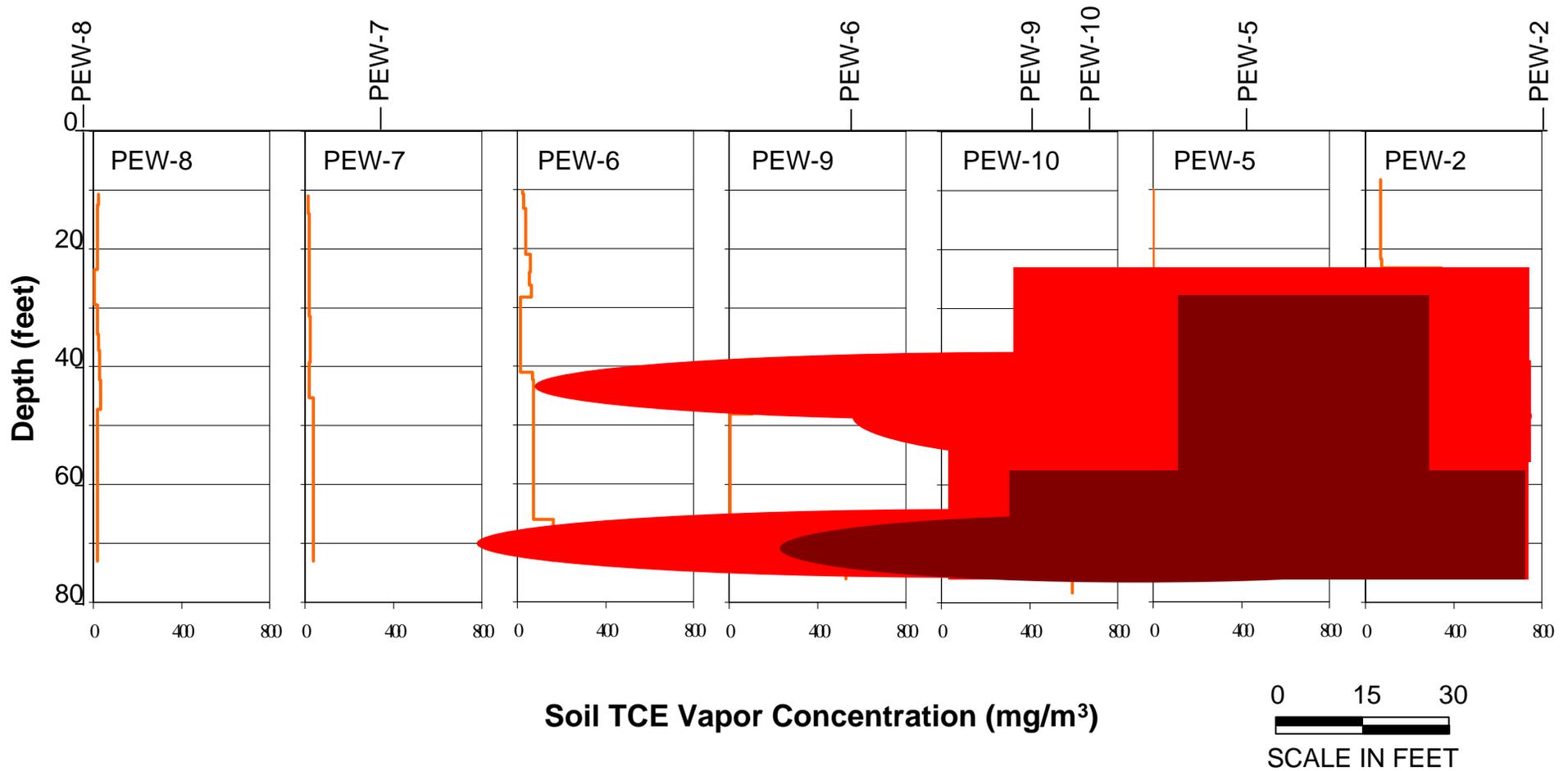
High Permeability Zones



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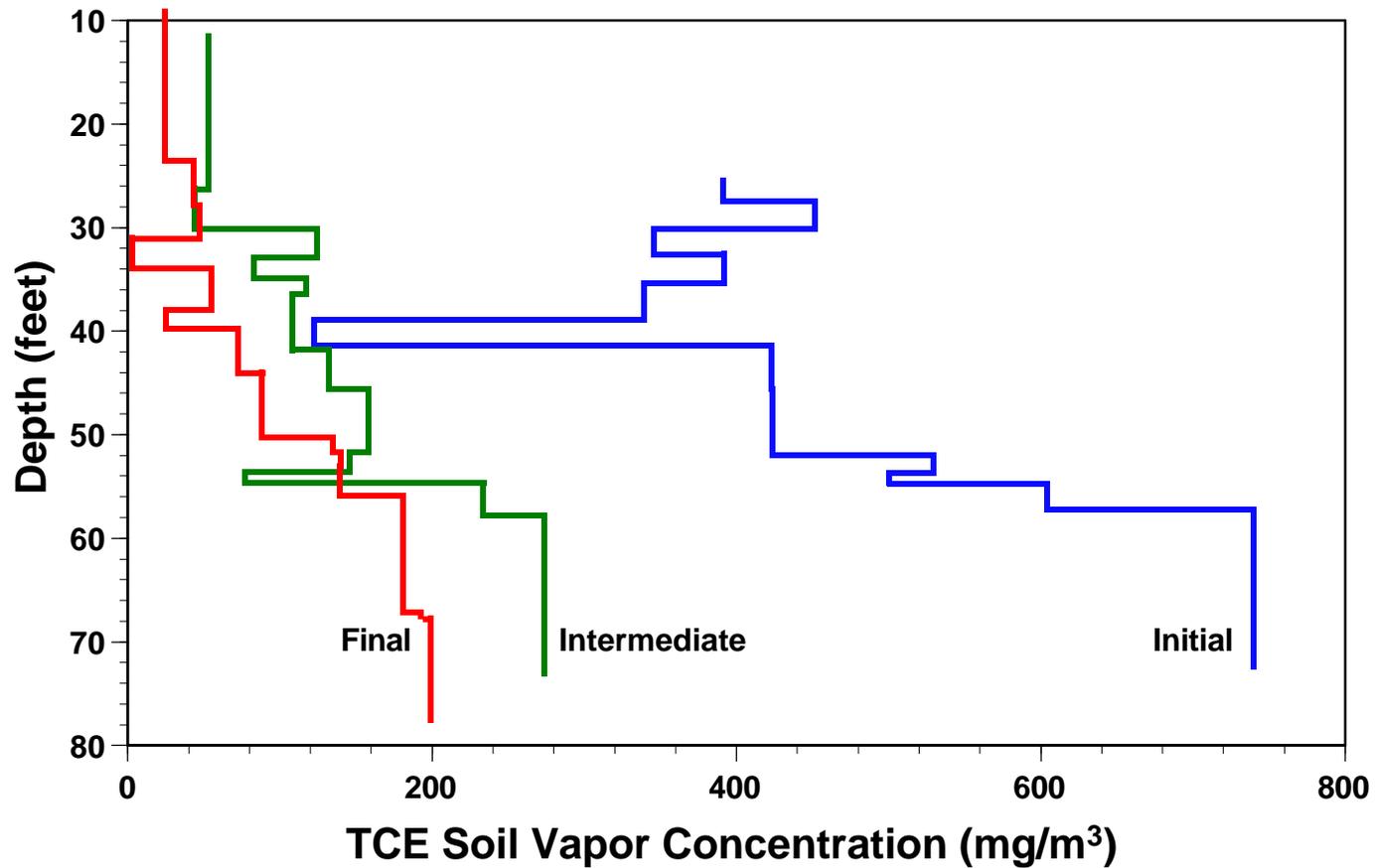
TCE Contaminated Zones



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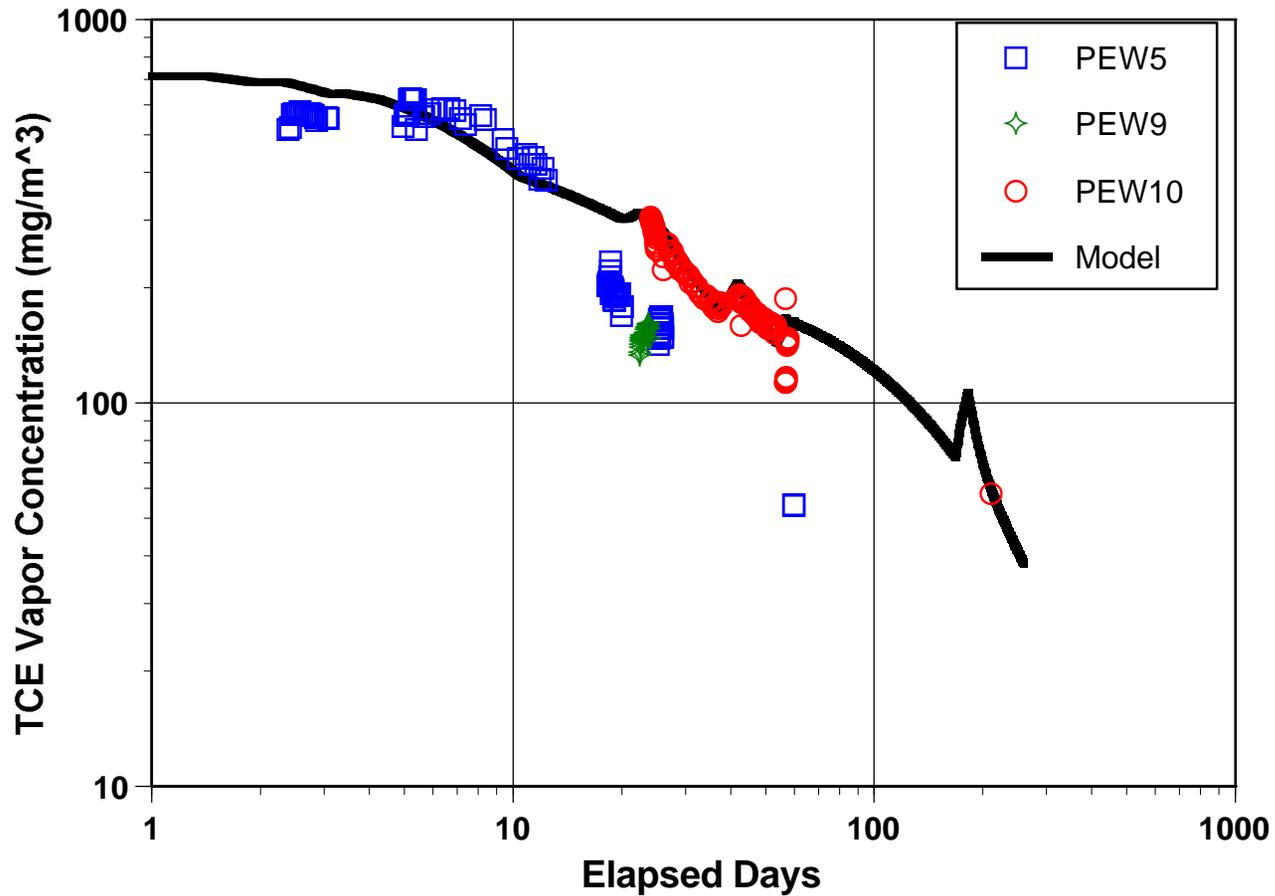
PEW-5 Concentration Profiles



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Extracted TCE History



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Nellis Site 46 Optimized SVE



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CPR Benefits

- **Delineates the source area**
- **Defines vertical distribution of contaminant**
- **Defines vertical distribution of soil type**
- **Initiates optimized remediation**



Yields a scientific conceptual site model to validate design, operation and closure



SVE Optimization Demos

Optimization project demonstrated PneuLog for **rapid** SVE performance assessments & corrections at 7 sites



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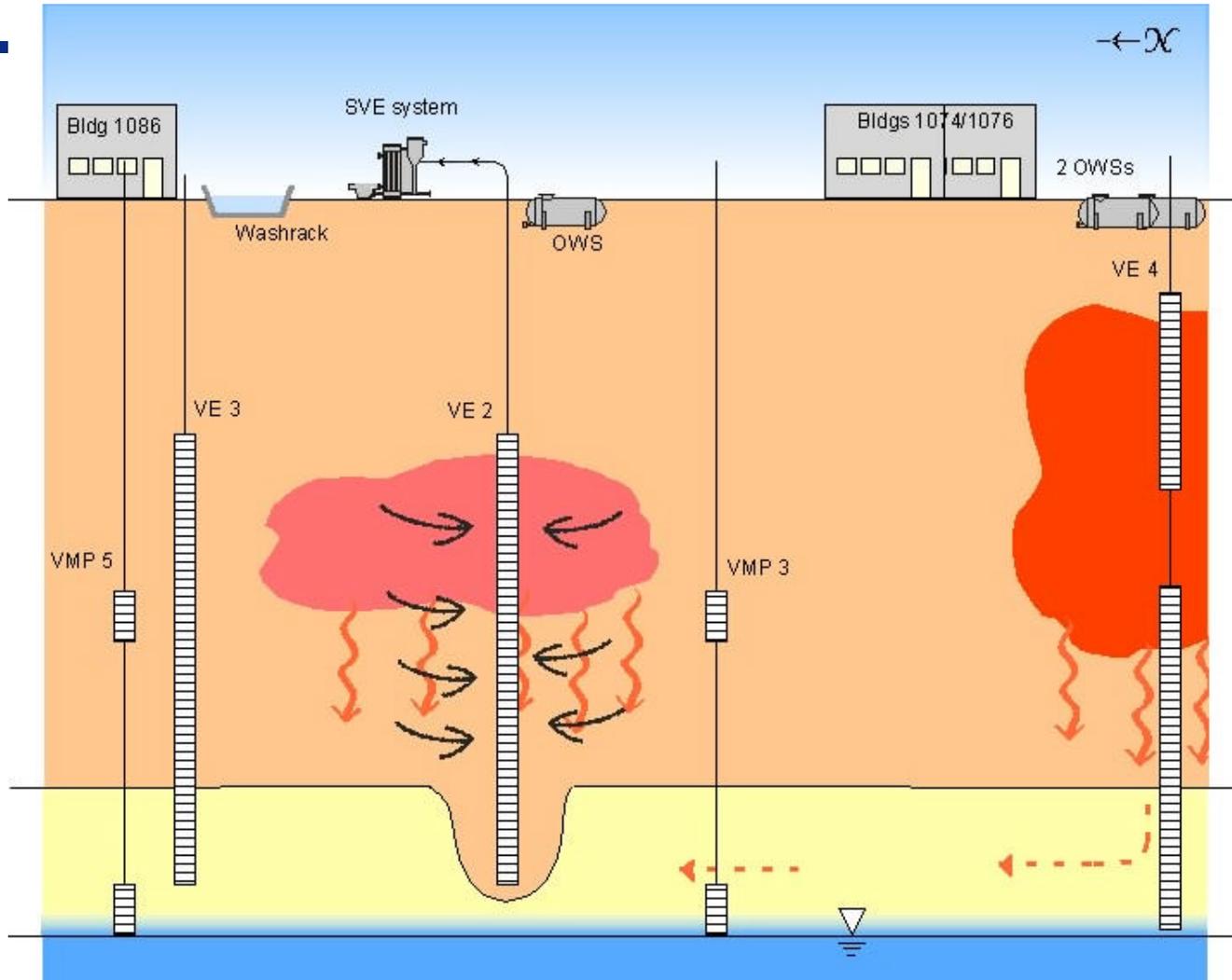
Site 32, Beale AFB, CA

- **SVE system operating on two wells (TCE)**
- **PneuLogged 2 wells, installed 2 wells**
- **PneuLog and extraction tests identified multiple TCE sources**
- **Previous system had stagnation zone in source**
- **Previous system pulling contaminants from distant sources**
- **Optimized extraction strategy was provided: cut flow in half and use only one well**



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Beale Site 32



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SVE Optimization Lessons Learned

- **Source areas often missed (4 out of 7 sites)**
- **Extraction wells often inappropriately placed & operated**
- **Stagnation zones are not adequately addressed**
- **Provisions for mid-term corrections are highly recommended**
- **Start small SVE and grow system, if necessary**
- **Premature closure reports are costly & counter-productive**



PneuLog Status Report

- **Several sites going to closure using PneuLog data**
- **Major, multi-faceted effort at Castle Airport ongoing**
- **Deployment in private sector growing**
- **EPA supporting public domain air flow software**
- **Army Corps supporting rebound guidance**
- **VLEACH alternative is near commercialization**
- **AFCEE vertical profiling study complete**
- **PneuLog is popular with regulators**
- **Big contractors interested but need more exposure to improved approaches**



Typical PneuLog[®] Costs

- **Fieldwork is \$2,000 to \$2,500 per day depending on depth and sampling frequency**
- **2 to 4 wells logged per day**
- **Off-site vapor analyses ~\$300 per sample**
- **Mob / Demob**
- **Reporting varies with level of analysis**
- **Recent 10-well, 1-week effort was < \$25k**