RDX in Groundwater Overview

for the

Northern New Mexico Citizens' Advisory Board

Los Alamos National Laboratory
Tim Goering

July 8, 2015

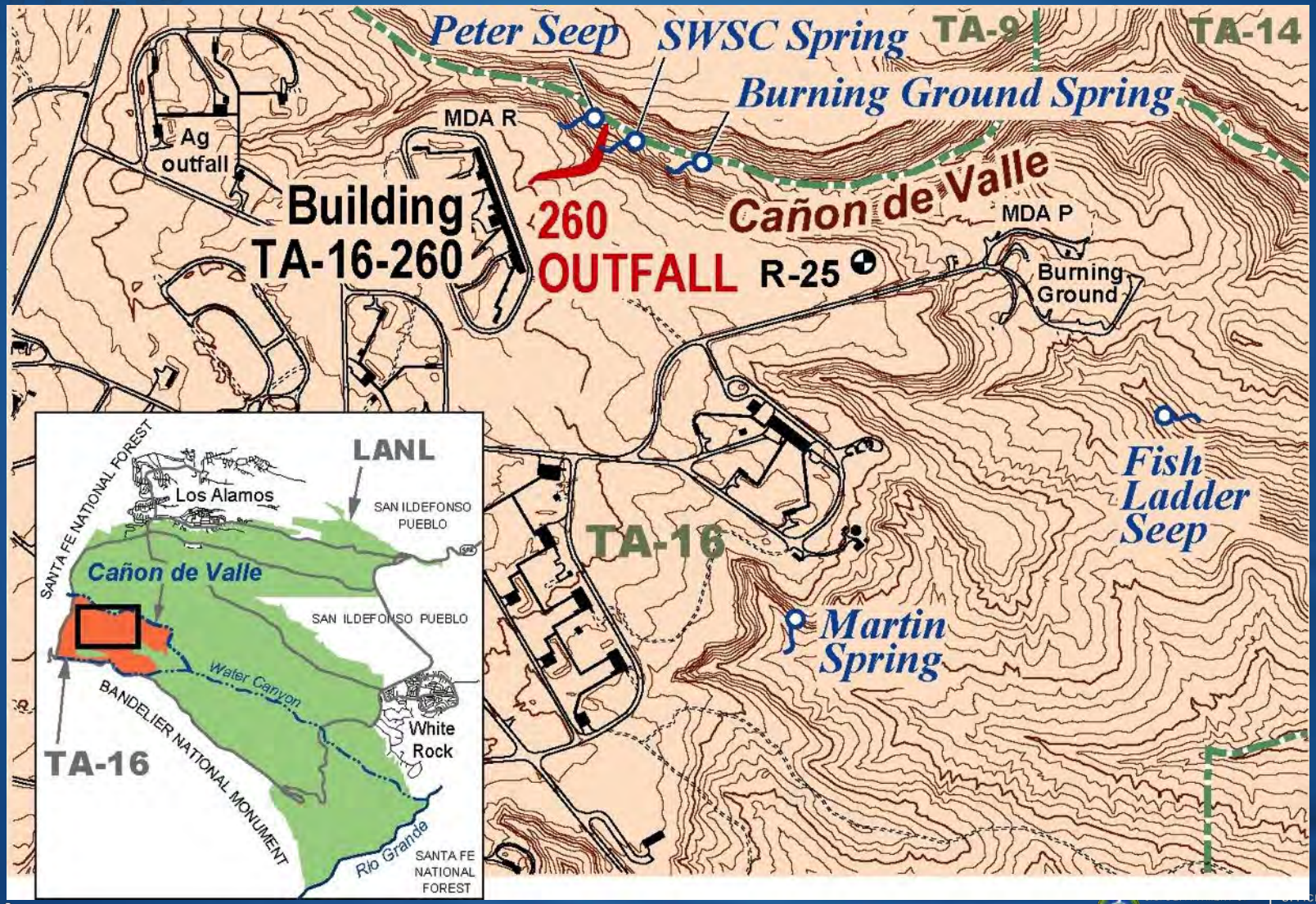
LA-UR-15-24943

Presentation Overview

- History, location and background
- Nature and extent of RDX contamination
- Recent and ongoing characterization activities
- Plans
- Questions

Location of TA-16 at LANL

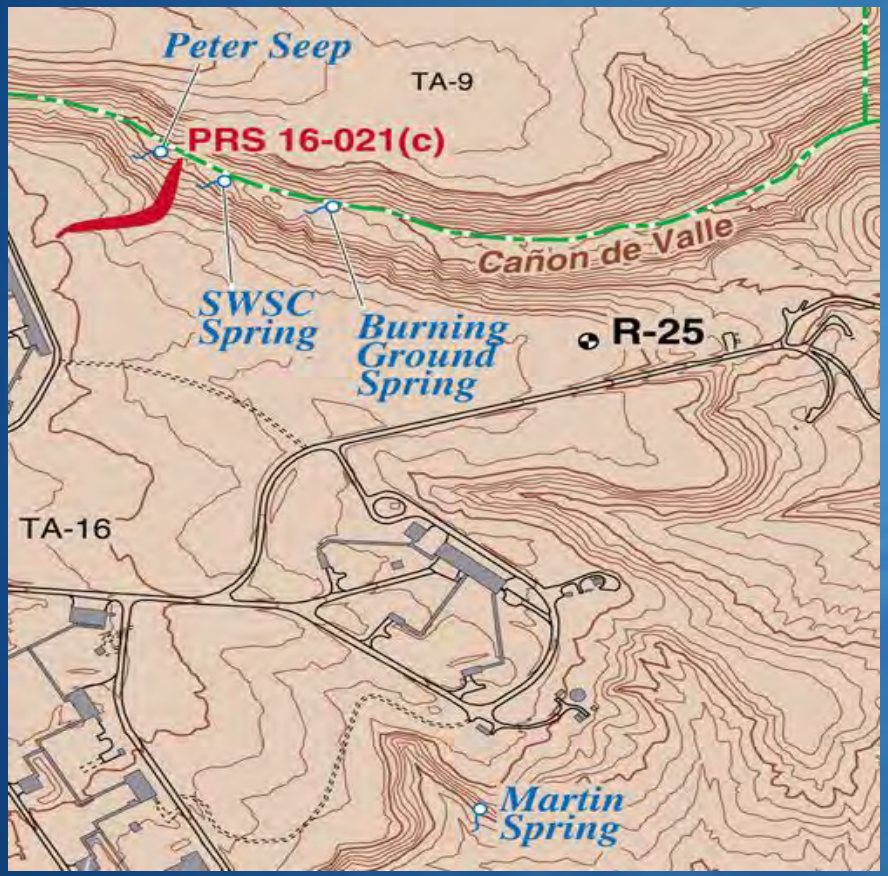
Location of 260 Outfall at TA-16



Background

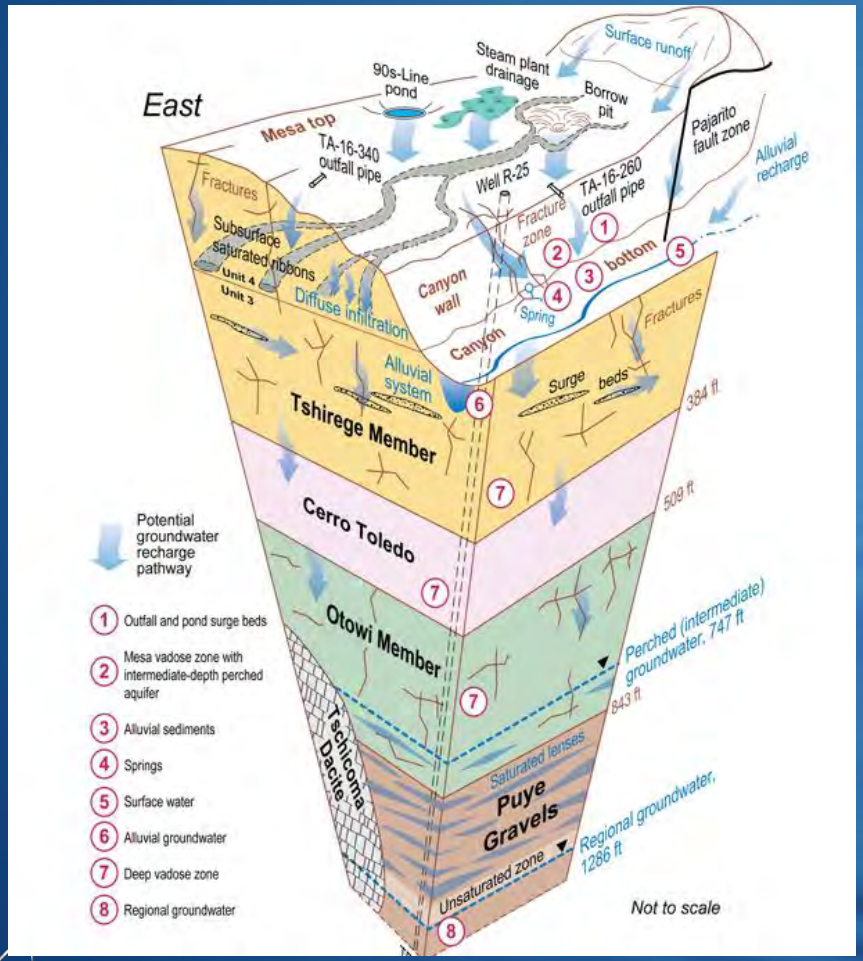
- Source of RDX (HE) contamination is machining of high explosives compounds
- HE wash water was released through the 260 outfall from 1951 to 1996
- 1500 cu yds of soil were cleaned up in the outfall area in 2009-2010
- Contamination remains in groundwater beyond outfall cleanup area
- Preliminary estimates of RDX inventory in groundwater range from hundreds to thousands of kg

TA-16-260 Site Background (cont.)



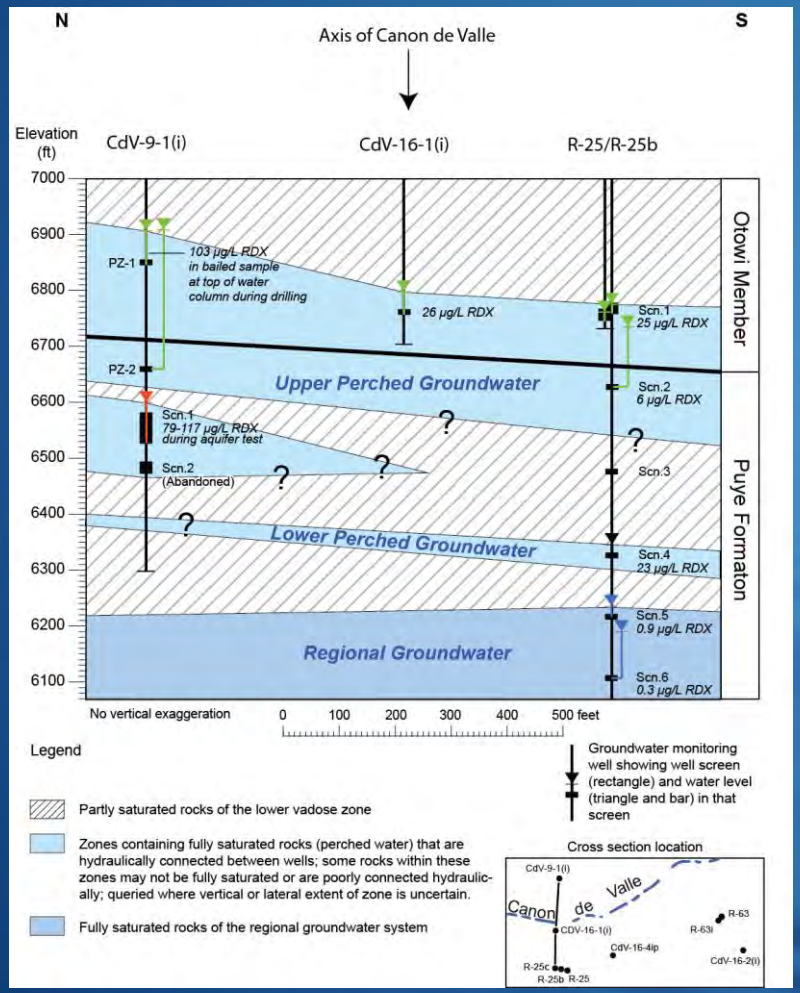
- Nearby springs, seeps, surface water, alluvial and perched-intermediate groundwater in Cañon de Valle and Martin Canyon are contaminated with high explosives (e.g. RDX, HMX, TNT) and metals (e.g. barium).
- Regional groundwater at several wells is contaminated with low concentrations of RDX (below EPA risk-based screening level of 7 ppb)
- This contamination is primarily from TA-16-260 outfall
- Cañon de Valle is a nesting area for Mexican spotted owl

Conceptual Model



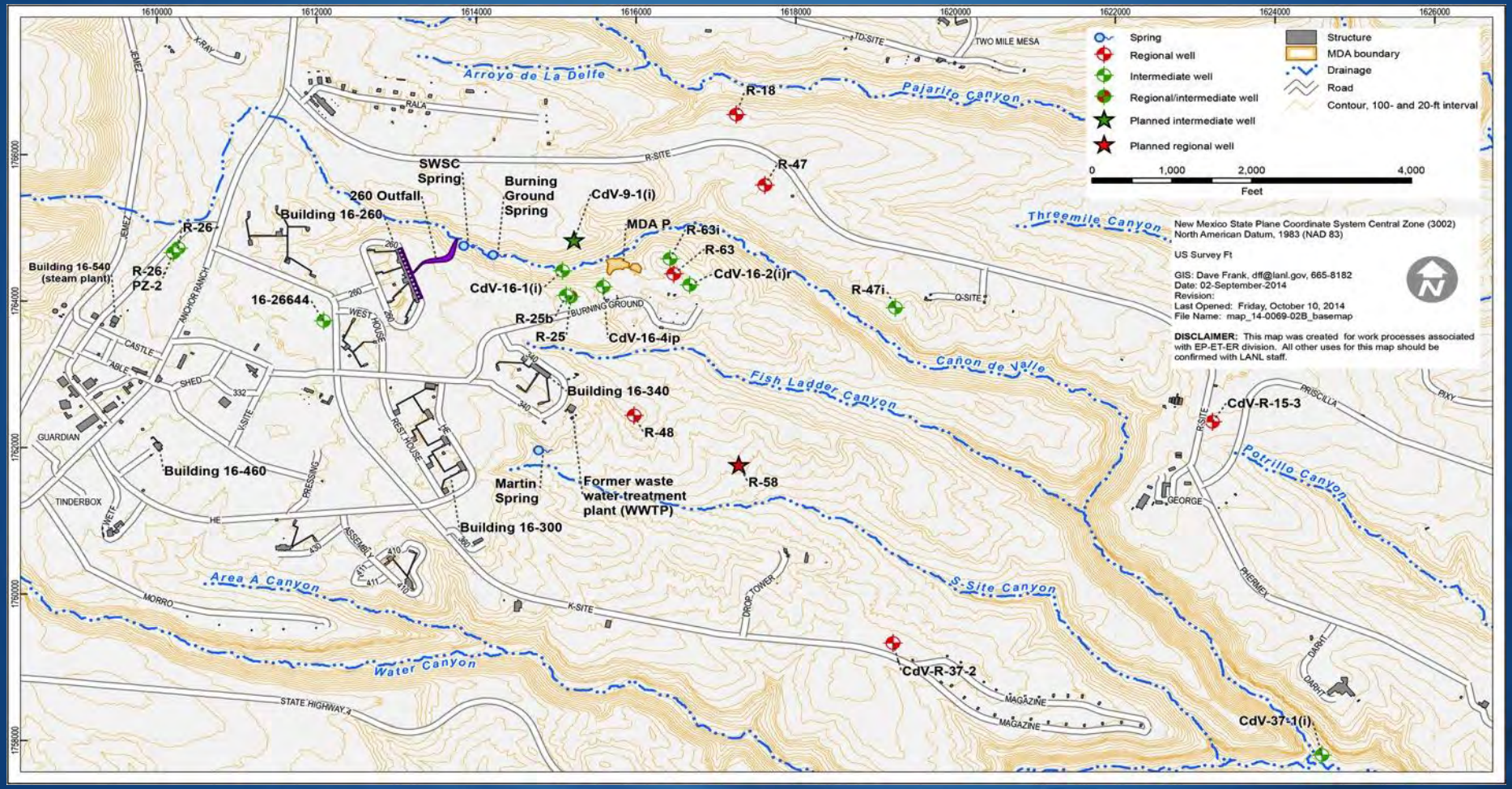
- Conceptual model used to define pathways for risk assessments, to pick monitoring points
- Vadose zone transport characterized by complex pathways
- Alluvial system contaminated from recharge from contaminated springs

Complex Stratigraphy



- Perched groundwater found in lower Bandelier Tuff and Puye Formation
- Elevated RDX concentrations show hydraulic connection with recharge from CdV
- Aquifer tests have shown interconnection between wells
- Uncertainty remains about the lateral and vertical extent of these groundwater zones
- Additional cross-hole testing is planned to further evaluate hydraulic connections between zones

TA-16 260 Monitoring Well Network

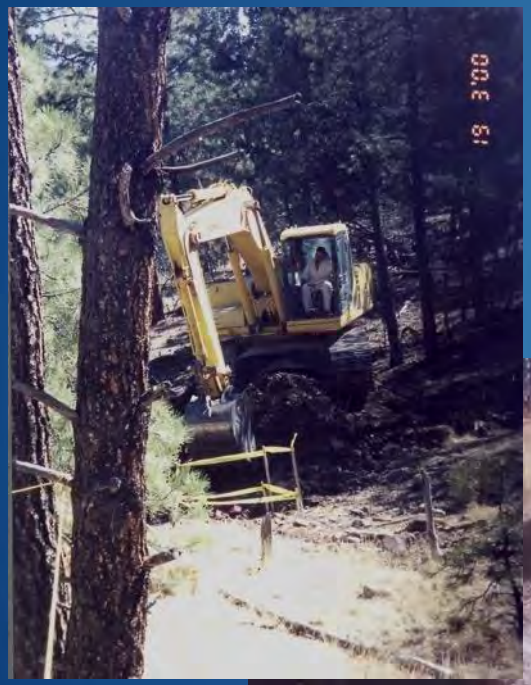


TA-16-260 Regulatory Status

Corrective Measures Evaluation (CME)/Corrective Measures Implementation (CMI) process for 260 Outfall is organized into surface and subsurface actions

- Surface CMI
  - Surface actions relate to soil, springs, surface water, and alluvial groundwater
  - Surface CMI activities implemented 2007 – 2010
- Subsurface CME
  - Subsurface actions relate primarily to perched-intermediate and regional groundwater
  - Current investigations are focused on refining conceptual model and collecting data for revision to subsurface CME

260 Outfall Cleanup



- ~ 1500 cu. yds. of high explosive (HE)-bearing soil were excavated and staged
- > 5% HE soil was blended & excavated robotically
- Soils were screened and rocks were pressure washed to minimize wastes

260 Outfall Interim Measure

- Non-hazardous soil staged in covered piles. Hazardous wastes stored in containers.
- After removals RDX generally < 100 ppm, HMX < 1000 ppm
- Soils were shipped directly to appropriate offsite landfills. Hazardous wastes were treated & disposed of off site.

Installation of spring treatment units and Pilot Permeable Reactive Barrier

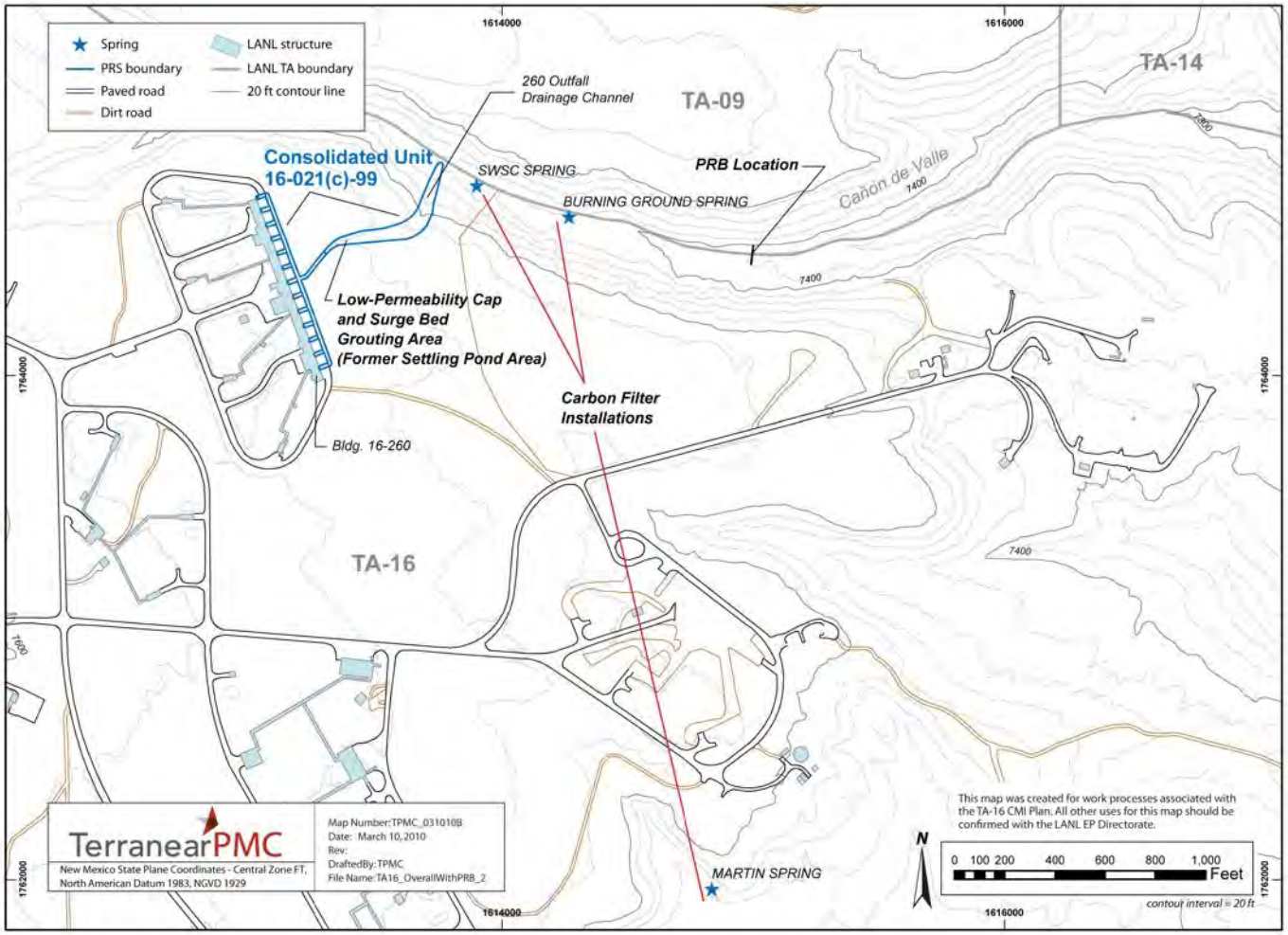
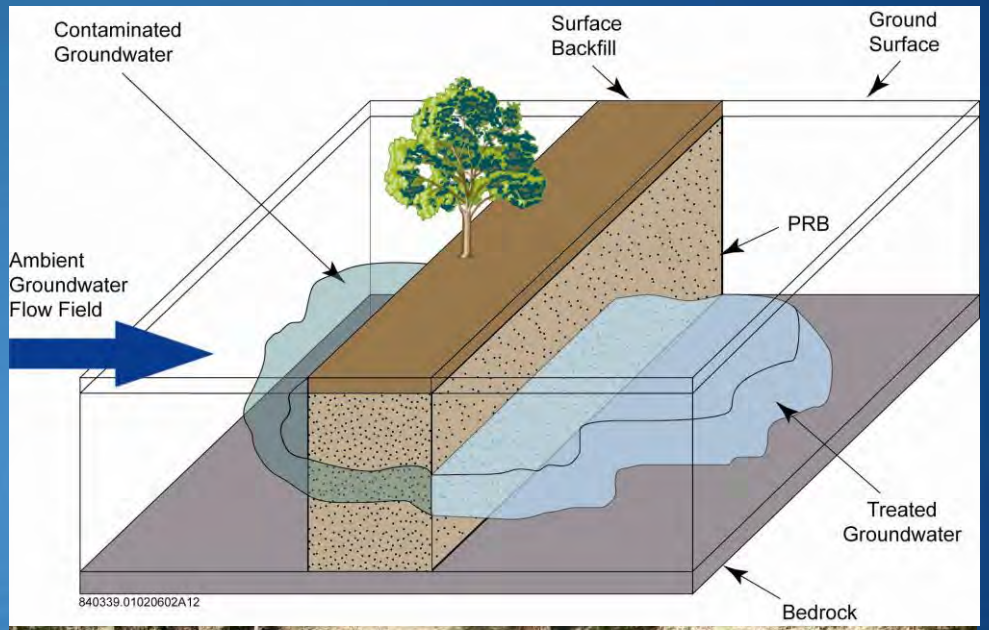


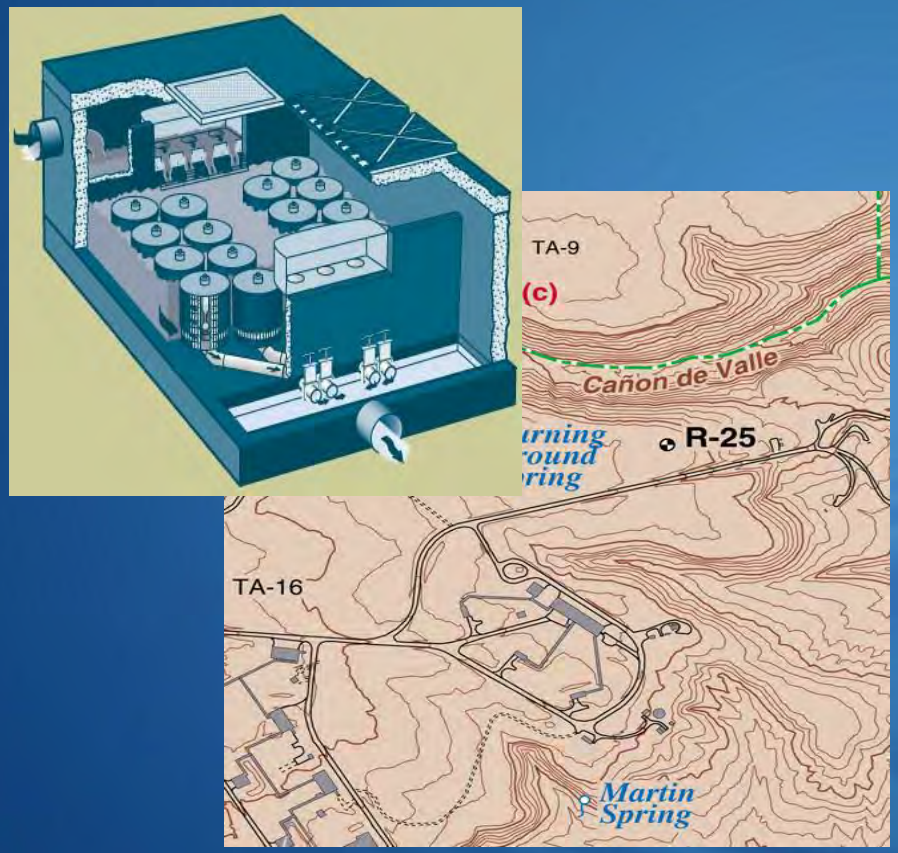
Figure 1.0-2 Location of Consolidated Unit 16-021(c)-99 including 260 Outfall drainage; former settling pond area; SWSC, Burning Ground, and Martin Springs; PRB location; and carbon filter system locations

Permeable Reactive Barrier Pilot

- Mixed performance during pilot implementation phase (2010)
- Los Conchas Fire impacted the watershed above Canon de Valle
- August 21, 2011 flood destroyed the PRB
- Watershed continues to be prone to flooding
- PRB will not likely be reinstalled

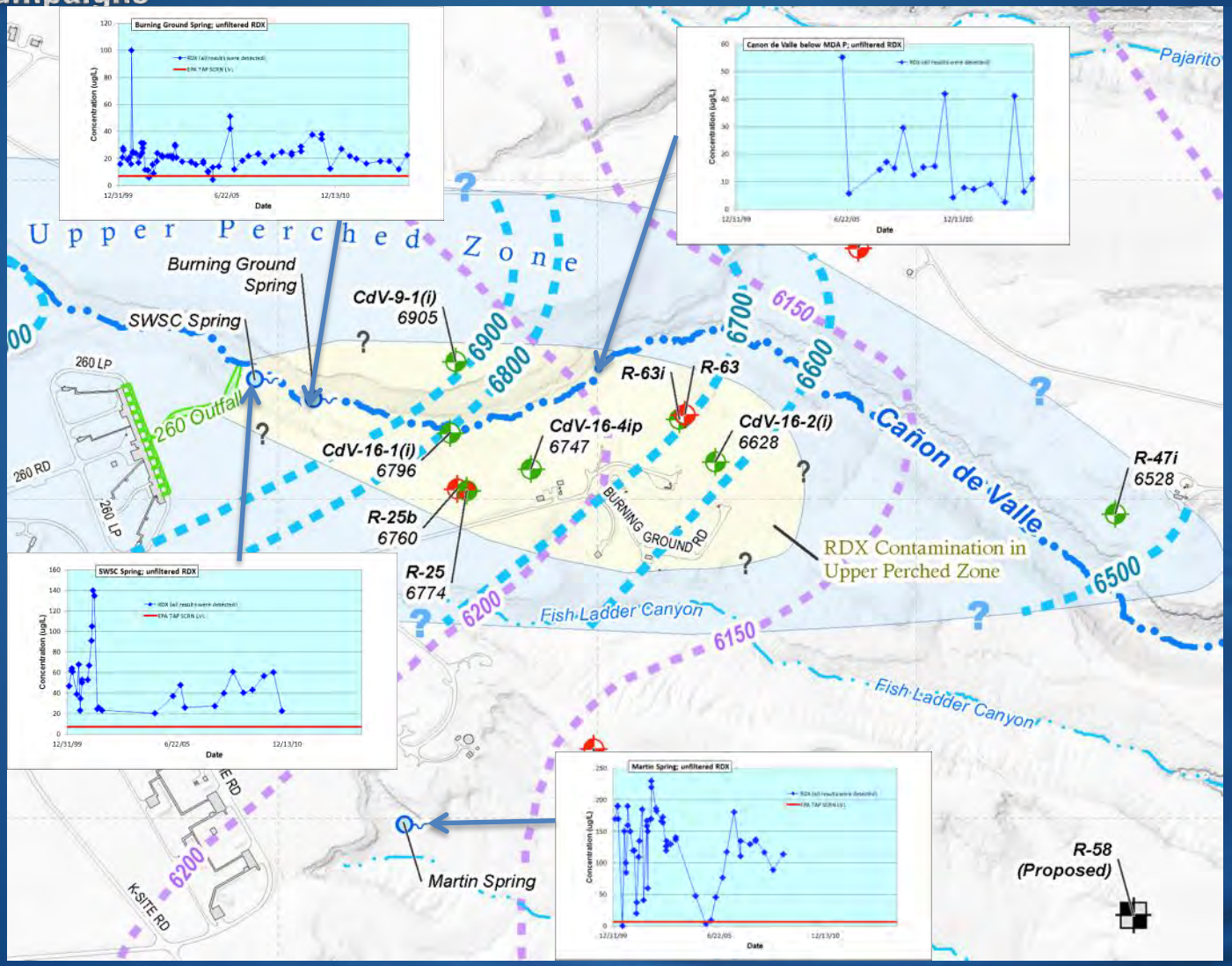


Spring Treatment Units

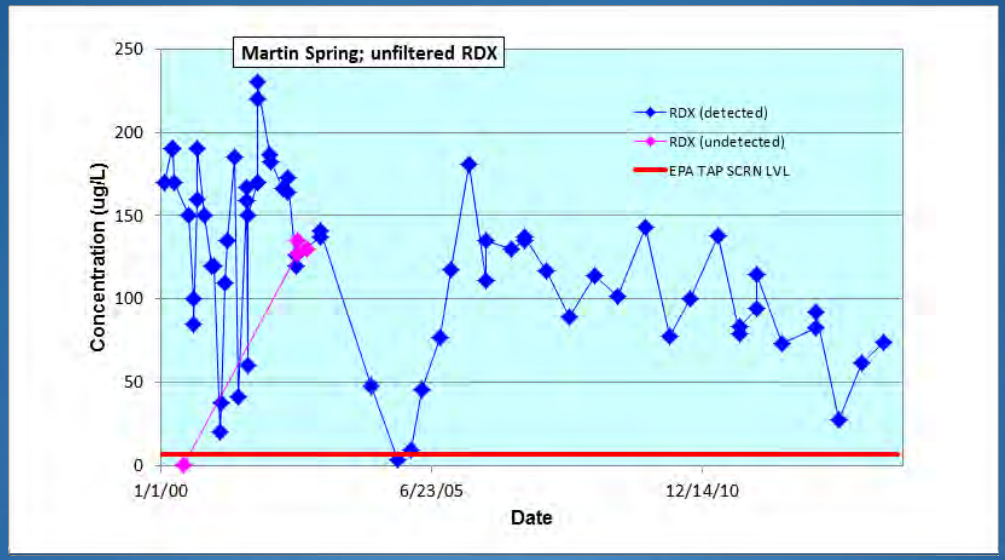


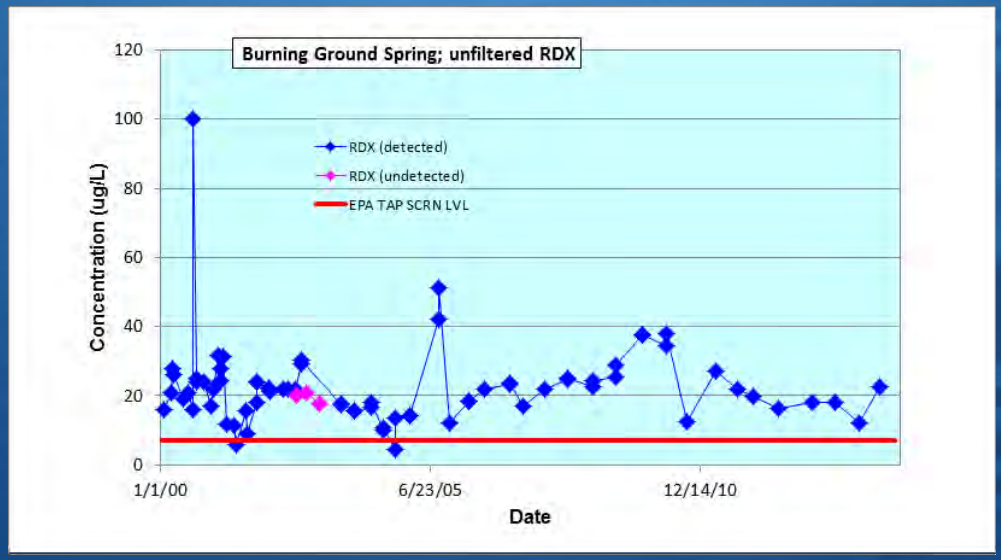
- Remove contaminants from discharge
- Pilot-scale deployment in Martin Spring (2001) to remove high explosives and barium
  - High explosives removed (> 99%), minor breakthrough in late '02
- Units in place at Martin, SWSC, and Burning Ground Springs
- Regulatory challenges for operation of treatment units
- For surface CMI still need to determine need and regulatory approach

RDX in Springs and Baseflow

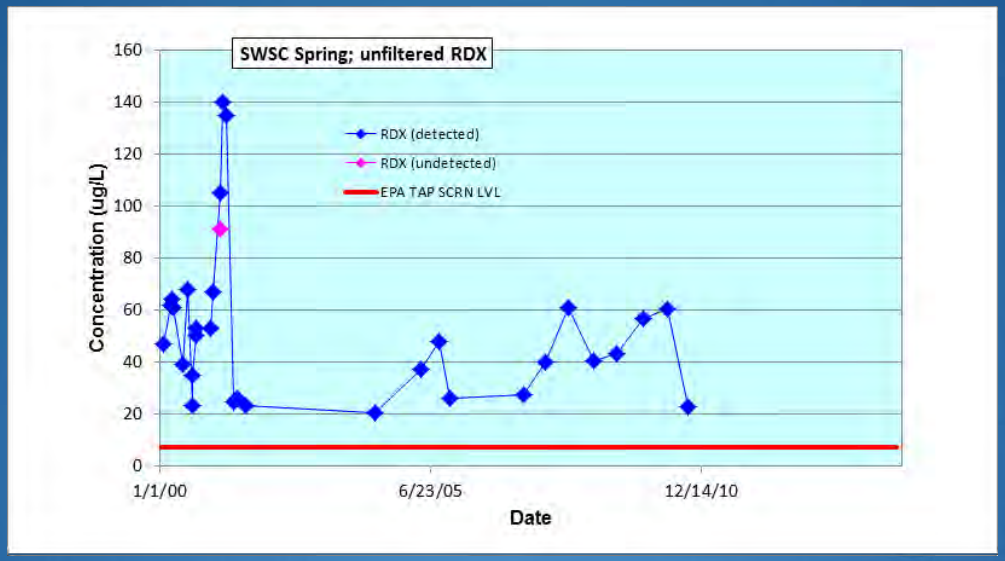


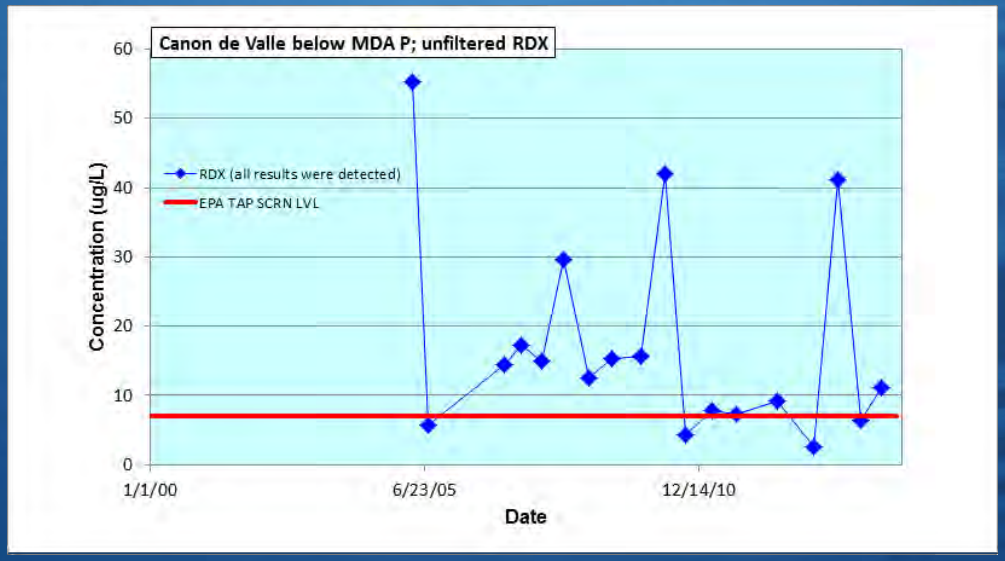
RDX Concentrations in Springs





RDX in SWSC Spring and CdV Baseflow

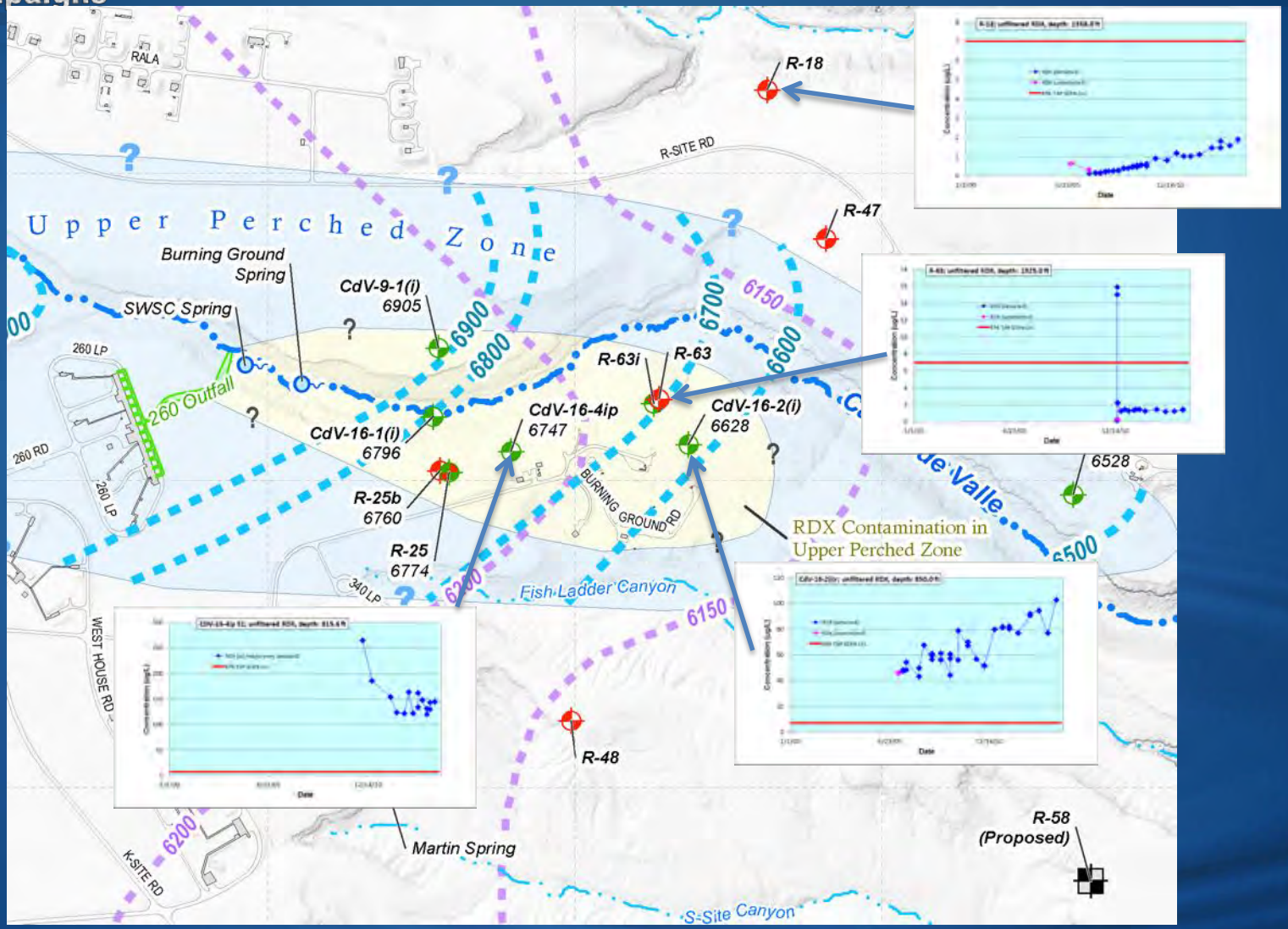




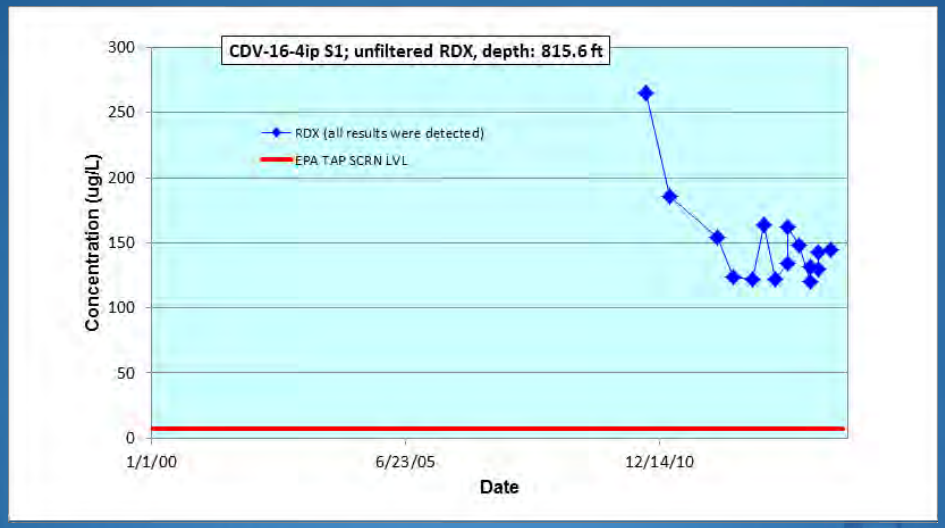
Subsurface CME

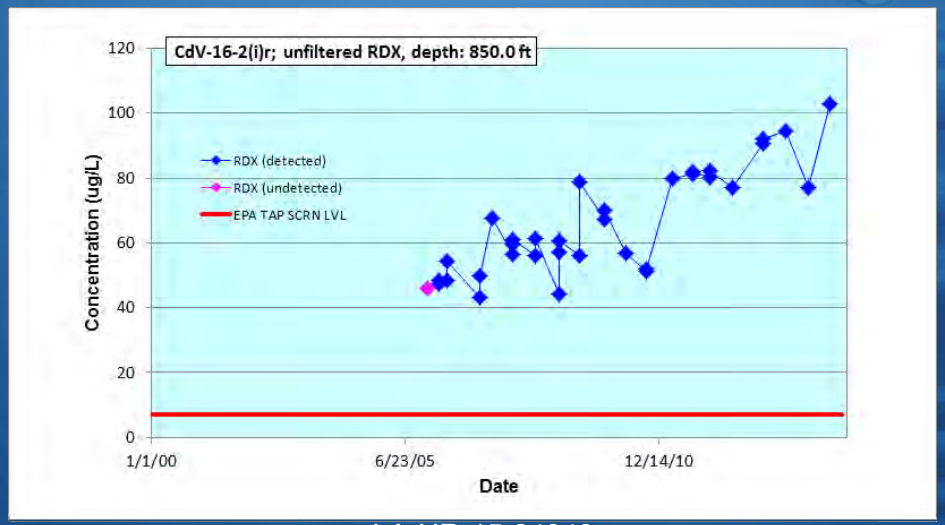
- CME Report for Intermediate and Regional Groundwater issued to NMED in 2007
- NMED issued Notice of Disapproval for CME report in 2008
  - More information needed before remedy selection
- Investigation underway to support CME revision

RDX in Regional and Intermediate Groundwater



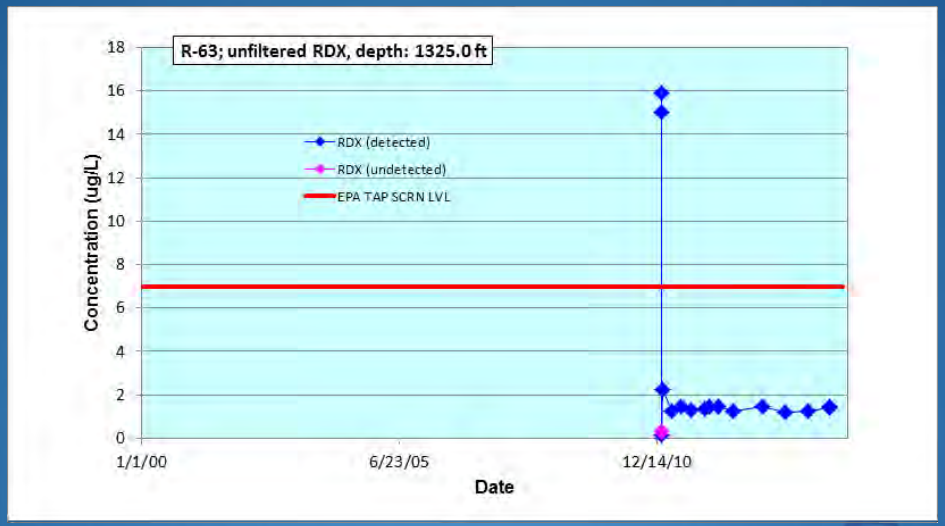
RDX Trends in Intermediate Wells

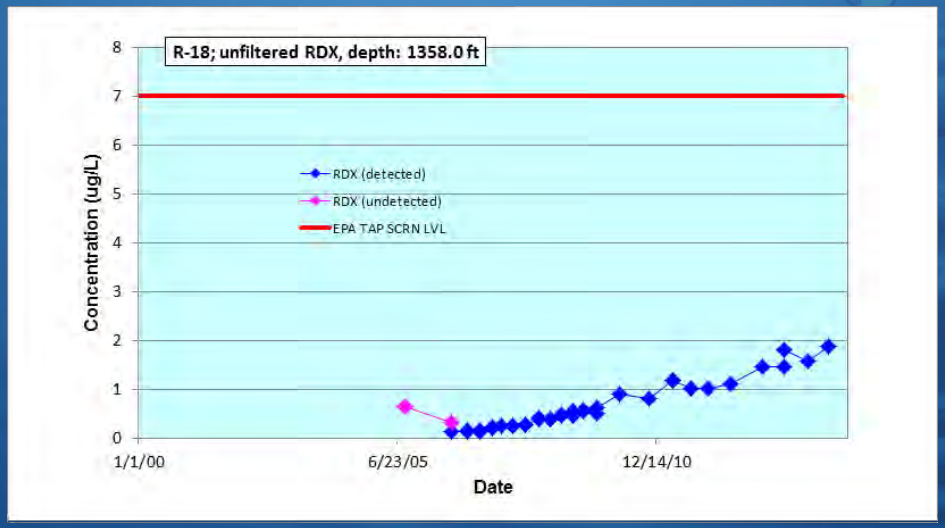




LA-UR-15-24943

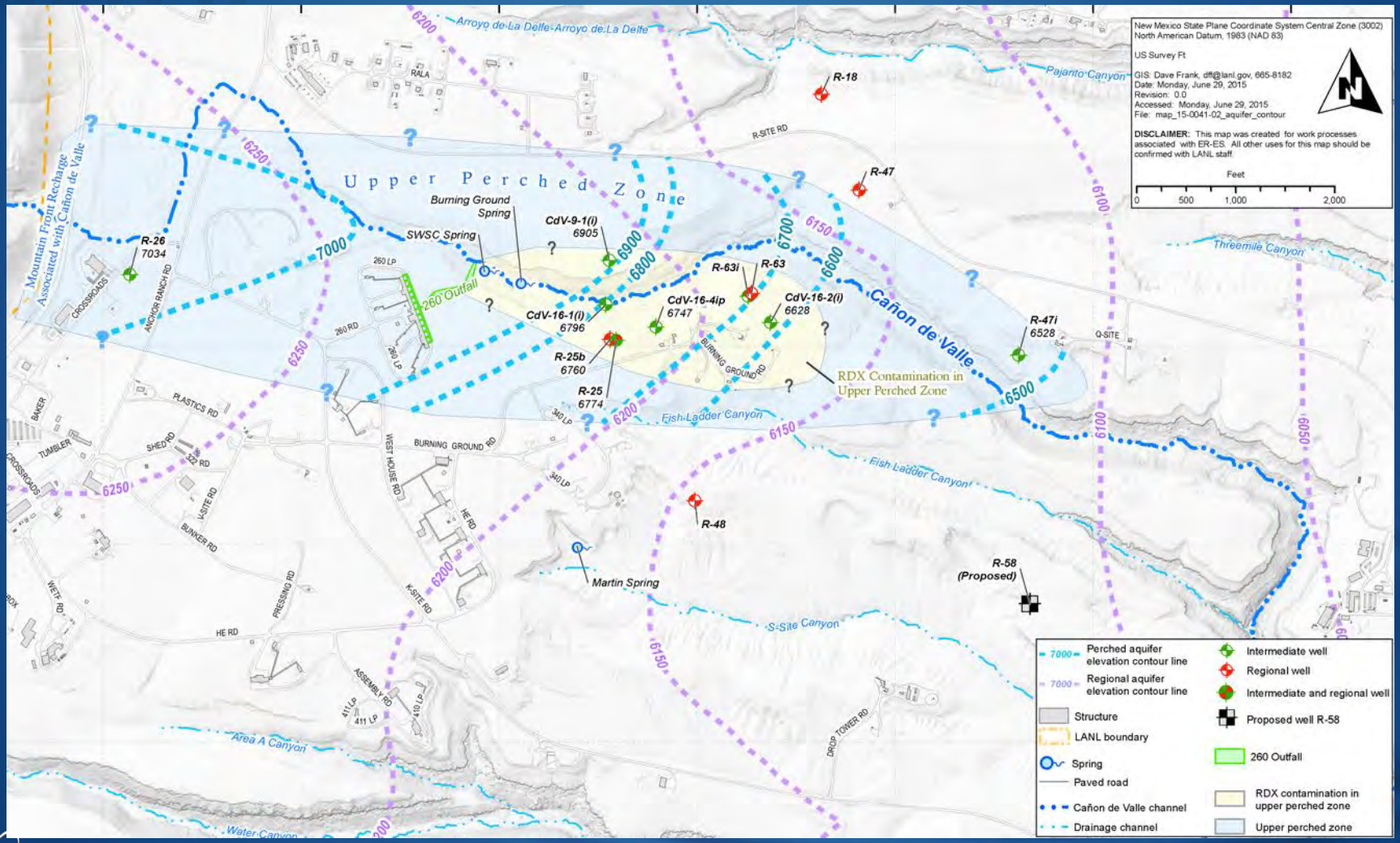
RDX Trends in Regional Wells





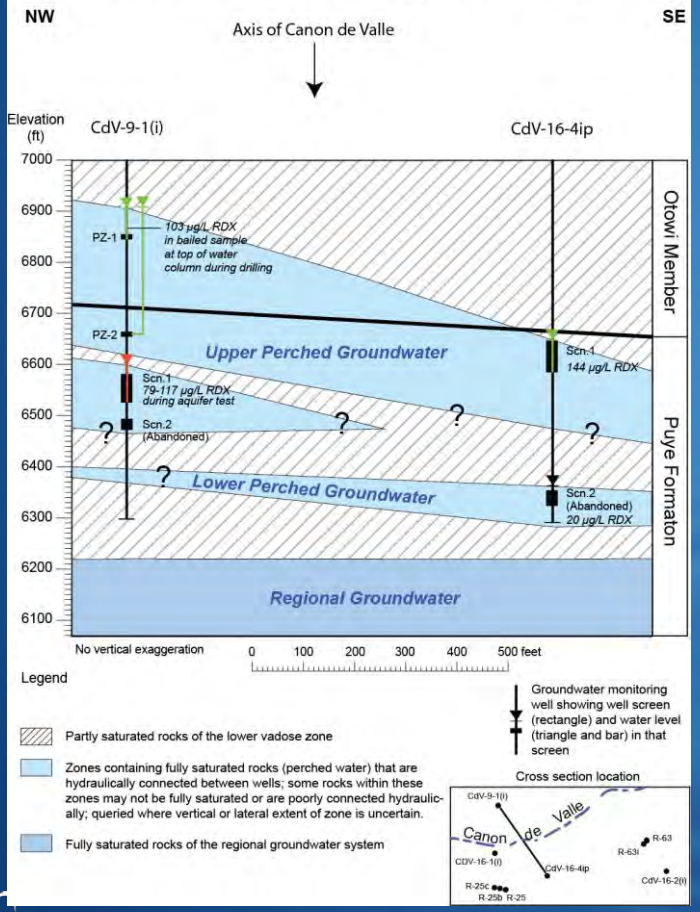
LA-UR-15-24943

Extent of Perched Intermediate Zone

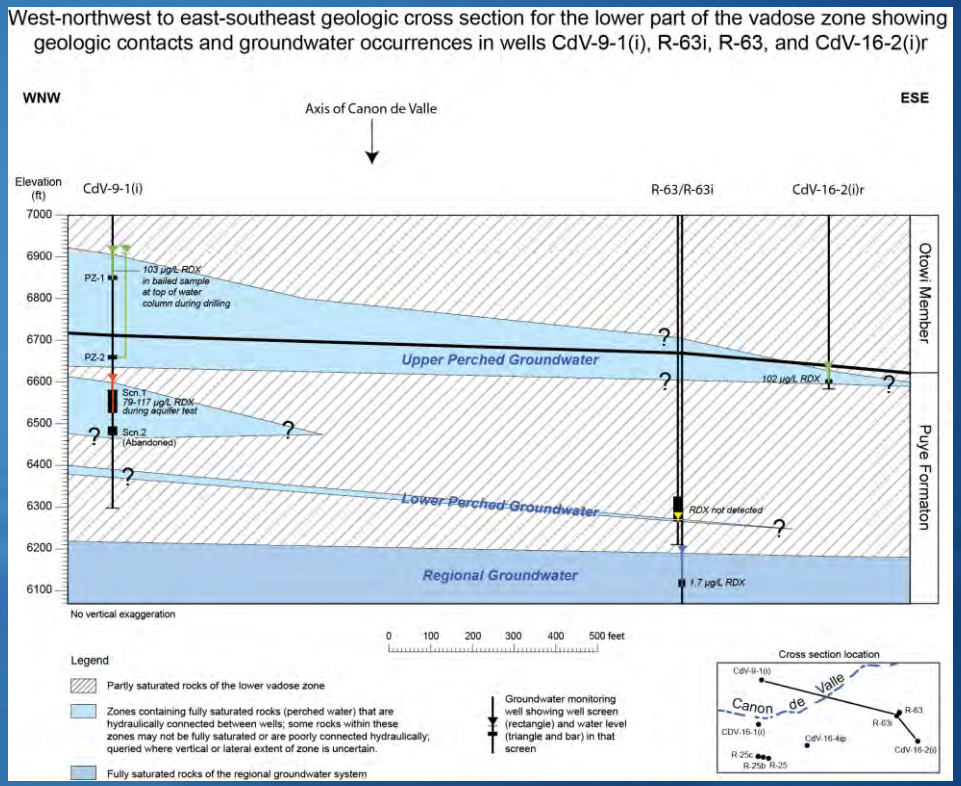


Complex Stratigraphy

Northwest-southeast geologic cross section for the lower part of the vadose zone showing geologic contacts and groundwater occurrences in wells CdV-9-1(i) and CdV-16-4ip.



West-northwest to east-southeast geologic cross section for the lower part of the vadose zone showing geologic contacts and groundwater occurrences in wells CdV-9-1(i), R-63i, R-63, and CdV-16-2(i)r



Recent TA-16 Subsurface Investigation Activities

- Well reconfigurations
  - CdV-R-15-3 and CdV-R-37-2 (Westbay wells) to single-screened wells
  - CdV-16-4ip (dual screened well) reconfigured to single- screened well
- Geophysical study to assess subsurface conditions
  - Results consistent with conceptual model for perched intermediate groundwater
  - Results used to help locate proposed well CdV-9-1(i) north of CdV
- Source removal testing at CdV-16-4ip
  - 60-day aquifer test showed perched zones are hydrologically connected
  - 473,000 gallons water pumped; 0.6 lb of RDX removed
  - Results indicate long-term pumping at CdV-16-4ip with sole objective of mass removal is not cost-effective
- New monitoring wells
  - Regional well R-47
  - Intermediate well R-63i – limited yield
  - Intermediate well CdV-9-1(i) – elevated RDX concentrations observed during drilling

Plans

- Tracer Test – pending NMED approval
  - Tracers to be introduced in 3 wells at multiple depths, and in Canon de Valle alluvium
  - Intended to resolve uncertainties regarding contaminant flowpaths
  - Study will take several years to complete
- Further aquifer testing of perched intermediate zone – pending NMED approval
  - Cross-hole testing at CdV-9-1(i); CdV-16-4ip; and CdV-16-1(i)
- RDX inventory update
- New well – R-58 to monitor regional aquifer downgradient of Martin Spring area
- Regulatory path forward for spring treatment units

Plans (cont.)

- Groundwater modeling
  - Develop 3-D flow and transport model
- Geologic studies
  - Characterize subsurface contaminant pathways based on orientations of stratigraphic units
  - Characterize the nature of confining beds that serve as perching layers for groundwater
- Bioremediation studies
  - RDX treatability and degradation studies
  - Review of existing RDX degradation data
- Revision to the subsurface CME – date TBD

Questions?