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Area 2 – What do we know?

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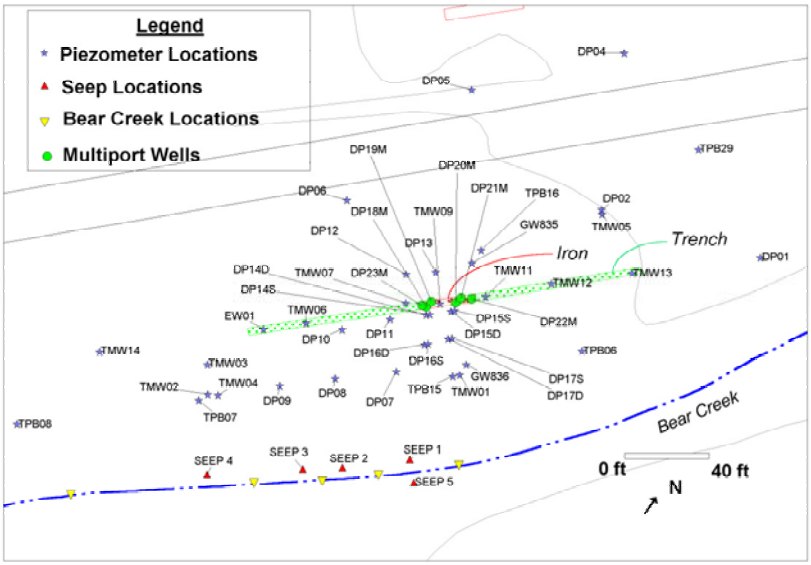
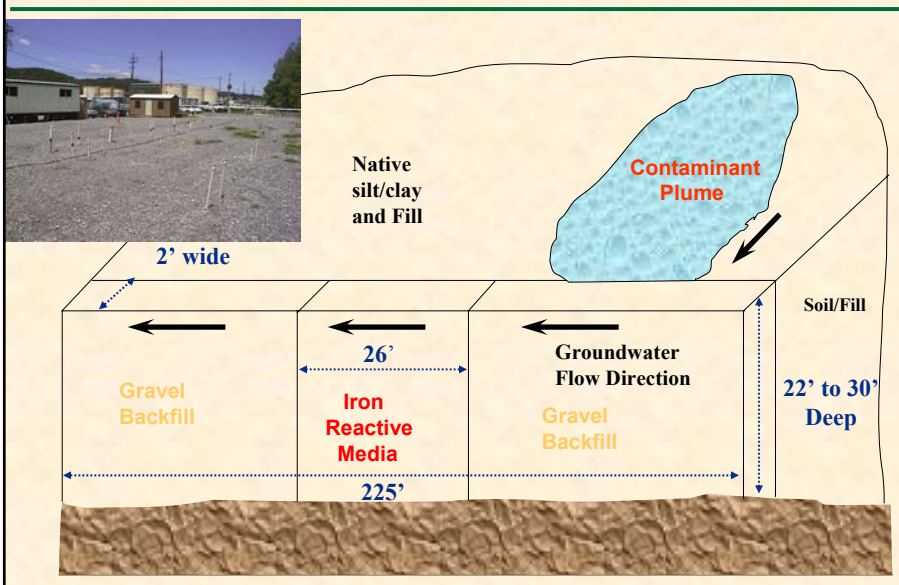
Presentation Outline

- Summary of Site Setting
- Groundwater data
- Sediment data
- Microbial data

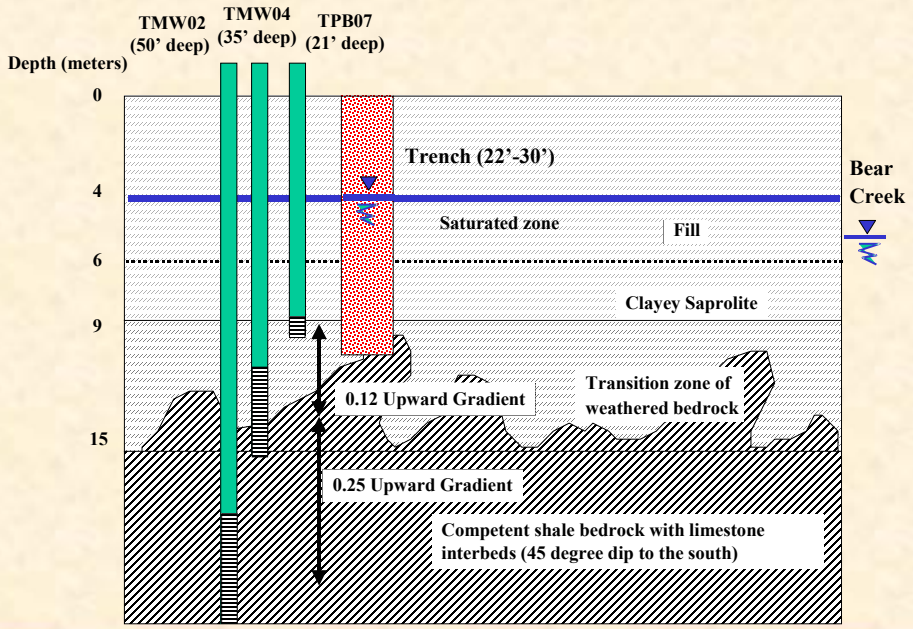
Monitoring locations at Area 2



Pathway 2 - Permeable Reactive Trench



Typical Stratigraphic Section

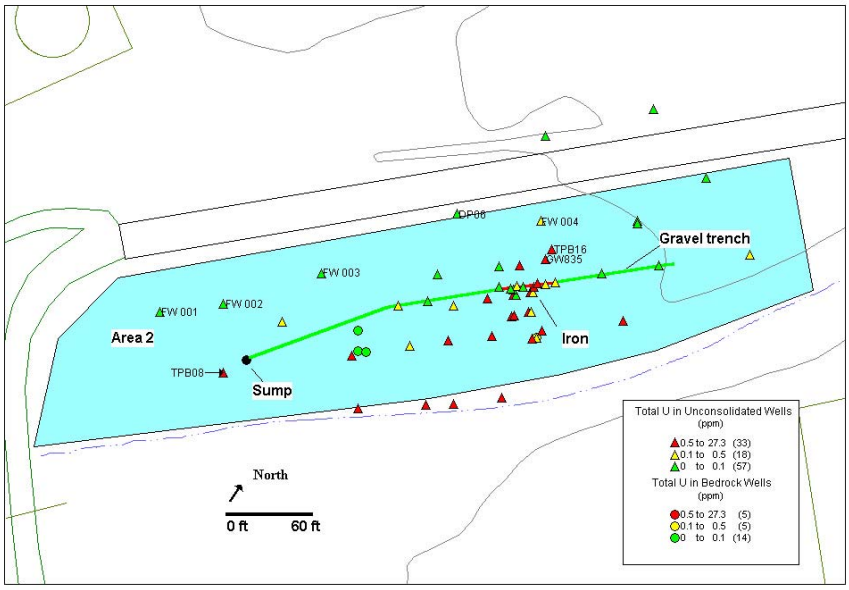


Groundwater Data

- Reactive barrier data from over 40 wells going back 5 years
  - Uranium, cations, anions, DOC, field parameters, some VOC data
  - Water levels (manual and data logger)

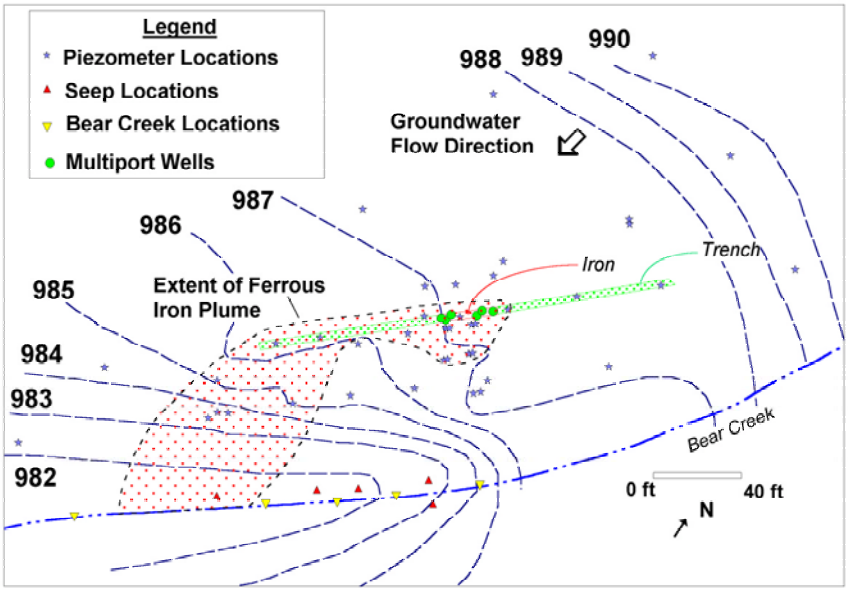
Comparison of Area 3 and Area 2 Groundwater

Type	Analyte	FW024 (Area 3)	TPB16 (Area 2)
ANION	Chloride (mg/L)	265.00	78.15
ANION	Nitrate (mg/L)	8074.00	41.99
ANION	Sulfate (mg/L)	996.83	101.17
CARBON	Inorganic carbon (mg/L)	305.10	60.32
CARBON	Organic carbon, total (mg/L)	73.26	62.56
FLD	Conductivity (uS/cm)	13200.00	799.33
FLD	pH (SU)	3.55	6.49
METAL	Aluminum (mg/L)	540.50	0.62
METAL	Barium (mg/L)	0.24	0.07
METAL	Cadmium (mg/L)	0.45	0.01
METAL	Calcium (mg/L)	930.50	144.87
METAL	Chromium (mg/L)	0.12	ND
METAL	Cobalt (mg/L)	1.36	ND
METAL	Copper (mg/L)	0.86	ND
METAL	Iron (mg/L)	1.76	0.51
METAL	Lead (mg/L)	0.04	ND
METAL	Lithium (mg/L)	3.02	0.01
METAL	Magnesium (mg/L)	173.67	22.62
METAL	Manganese (mg/L)	130.17	0.96
METAL	Nickel (mg/L)	12.65	0.06
METAL	Phosphorus (mg/L)	12.00	0.50
METAL	Potassium (mg/L)	93.75	5.00
METAL	Silicon (mg/L)	28.20	1.48
METAL	Sodium (mg/L)	858.50	18.00
METAL	Strontium (mg/L)	1.59	0.44
METAL	Sulfur (mg/L)	325.00	25.10
METAL	Uranium (mg/L)	45.05	0.88
METAL	Zinc (mg/L)	2.49	0.03
RAD	Technetium-99 (pCi/L)	36956.06	4.69

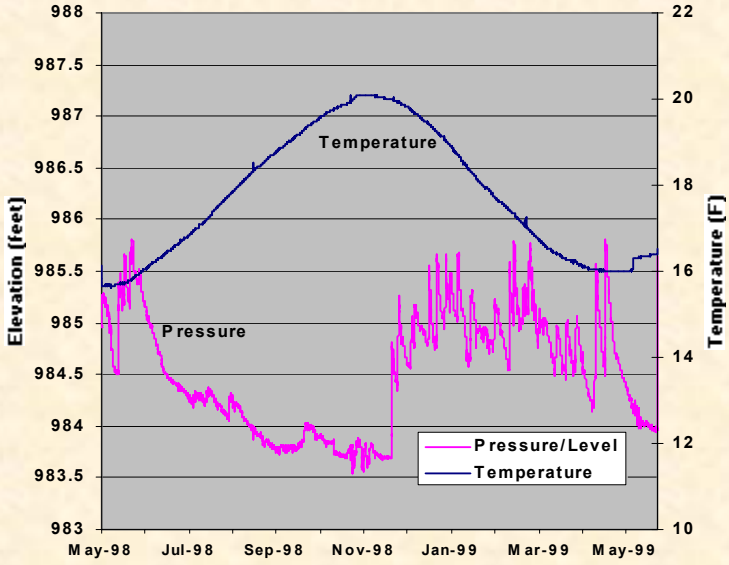


Uranium Concentrations at Area 2

Groundwater Elevations and Ferrous Plume



DP10 Groundwater Elevations



Area 2 Sediment Data

- Limited data from ORNL and LBNL
  - U and metals (XRD and ICP/MS)
  - Sequential extraction of Fe, Al, Mn, Si etc.
  - TOC, TIC, pH, nitrate, nitrite

Area 2 Sediment Data (continued)

- Typical metals concentration in contaminated clay layer

COMP_NAME	Result	Units
Antimony	<1.3	mg/kg
Arsenic	5.66	mg/kg
Cadmium	<0.64	mg/kg
Chromium	38.3	mg/kg
Lead	25.2	mg/kg
Nickel	26.3	mg/kg
Selenium	<1.3	mg/kg
Thallium	<0.64	mg/kg
Uranium	303	mg/kg

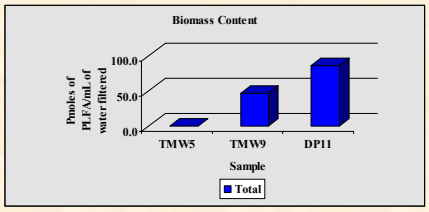
- DOC ranged between 543 ug/g and 2260 mg/kg

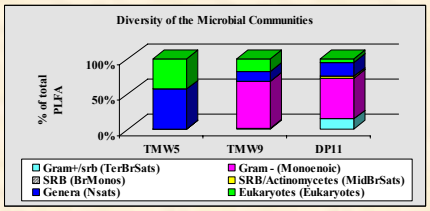
Microbial Data – Limited and associated with barriers

- PLFA – Groundwater and sediment
- DNA – Groundwater and sediment
- Live/Dead cell counts (LBNL)

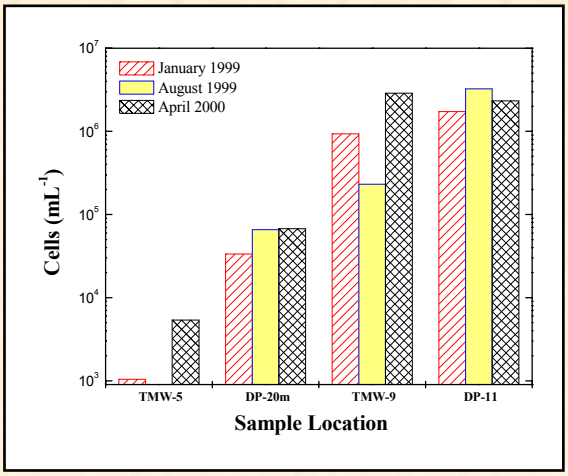
Impact of Guar Gum on Microbial Activity

(Permeable Trench at Pathway 2)

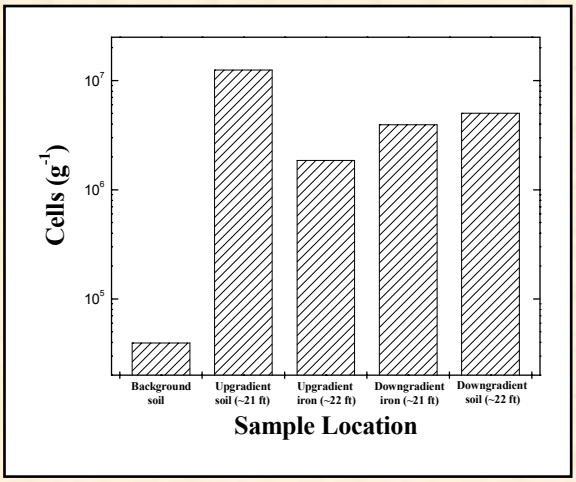




Distribution of microbial populations over time in groundwater



Distribution of microbial populations in solids within the trench



DNA functional group analysis of microorganisms

Microbial populations are presented as the maximum dilution (tenfold incremental) at which they are detected by the DNA PCR analysis. Sulfate-reducing bacteria, denitrifying bacteria, nitrite reductase, and methanogens were determined by the DSR, Heme, Cu, and MCR primers, respectively.

Groundwater

	TMW-5	DP-20m	TMW-9	DP-11
By DNA Analysis				
Sulfite reductase	**nd**[b]	10^2	10^2	10^4
Denitrifying bacteria	**nd**[b]	10	10^3	10^3
Nitrite Reductase	**nd**[b]	nd[b]	10^2	10^4
Methanogens	**nd**[b]	1	nd[b]	10

Core samples

	Background soil	Upgradient soil (~21 ft)	Upgradient iron (~22 ft)	Downgradient iron (~21 ft)	Downgradient soil (~22 ft)
Sulfite reductase	**nd**[a]	10^2	1	1	nd[a]
Denitrifying bacteria	**nd**[a]	1	nd[a]	1	1
Nitrite reductase	**1**	10^2	10	10	10^2
Methanogens	**nd**[a]	10	nd[a]	1	nd[a]