

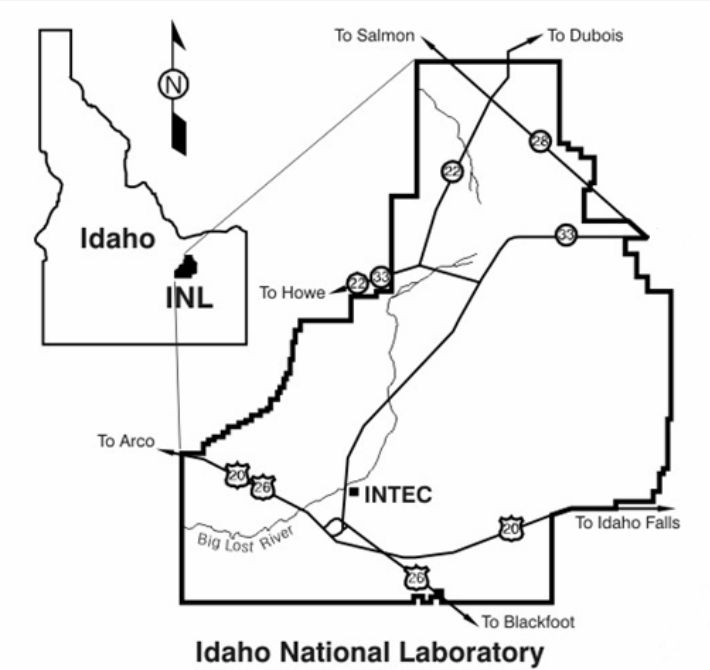
Sr-90 Contamination at INTEC

June 2006

Jeffrey Forbes - CWI



INTEC

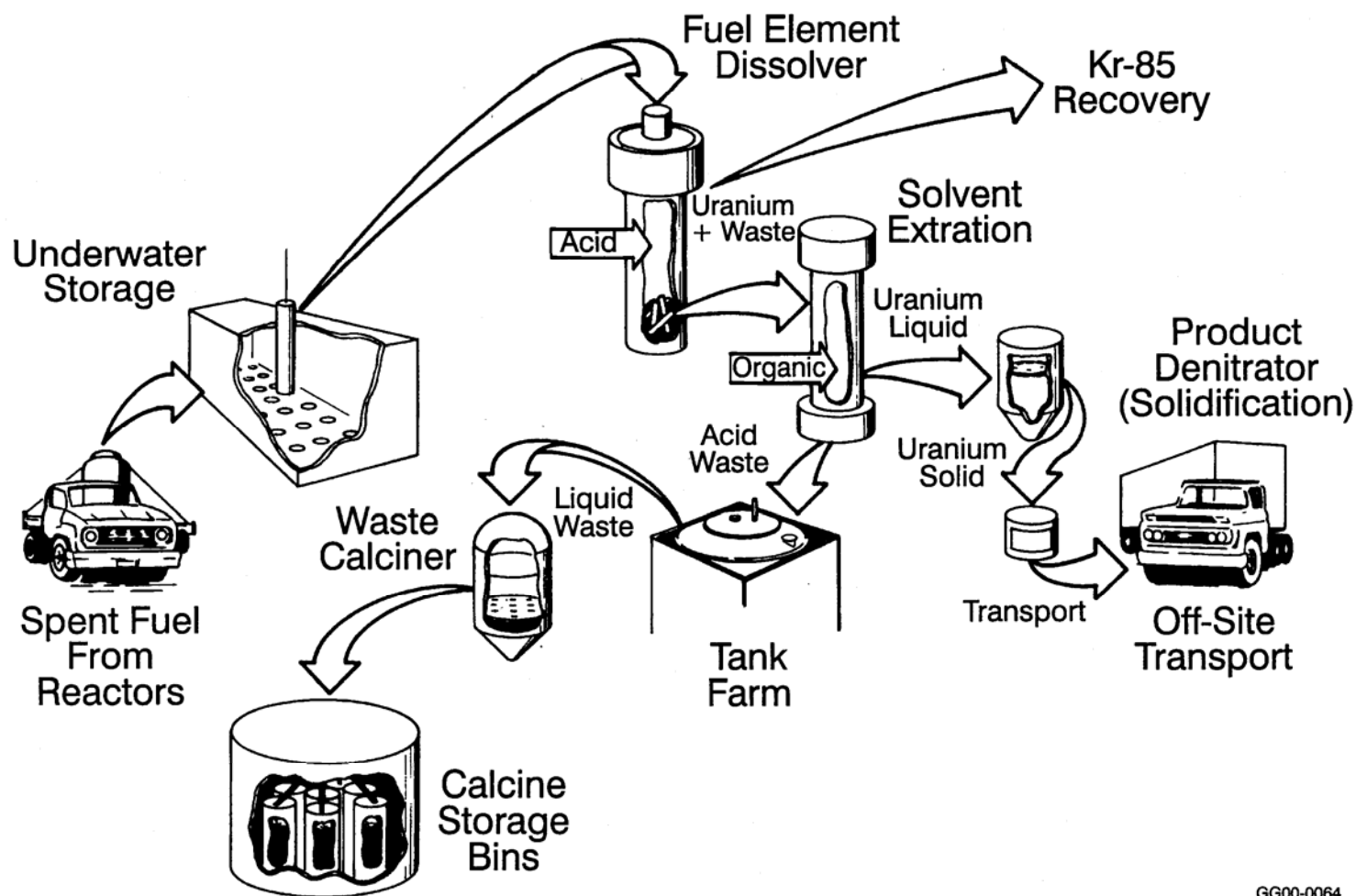


INTEC Historical Information*

(formerly Idaho Chemical Processing Plant)

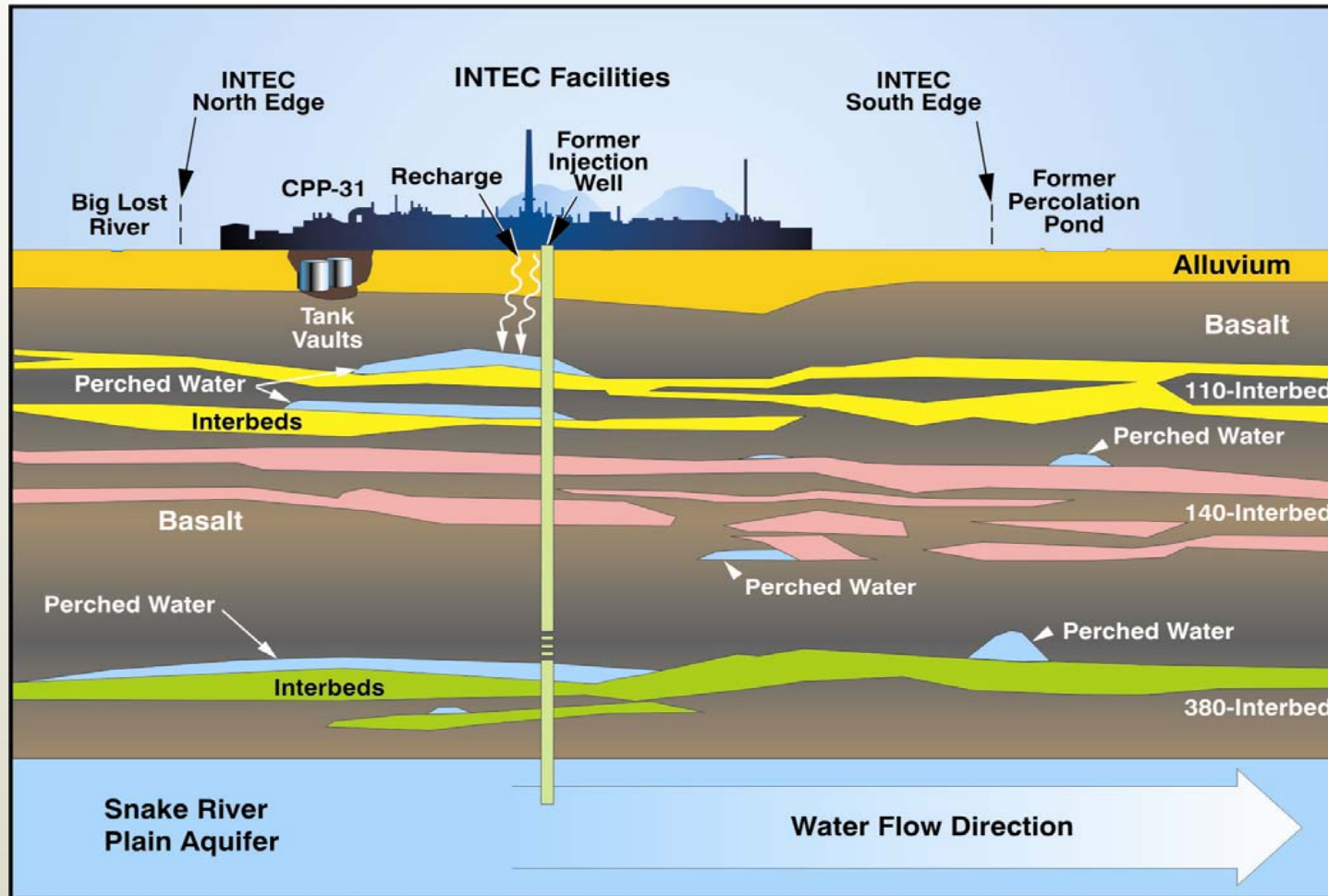
- Reprocessed SNF to recover U-235 from 1953 to 1992
- Total of ~31,000 kg U-235 recovered
- Acidic HLLW stored in 300,000 gal underground stainless steel tanks
- ~8M gal HLLW converted to ~3,800 m³ calcined solids (7-fold volume reduction)
- Calcined solids stored in stainless steel bins
- INTEC was first to:
 - Reprocess highly-enriched SNF and breeder reactor fuels
 - Reprocess zirconium clad fuels (hydrofluoric acid)
 - Reprocess stainless-steel clad fuels (electrolytic)
 - Perform production-scale calcination of HLLW

INTEC Process Flow



GG00-0064

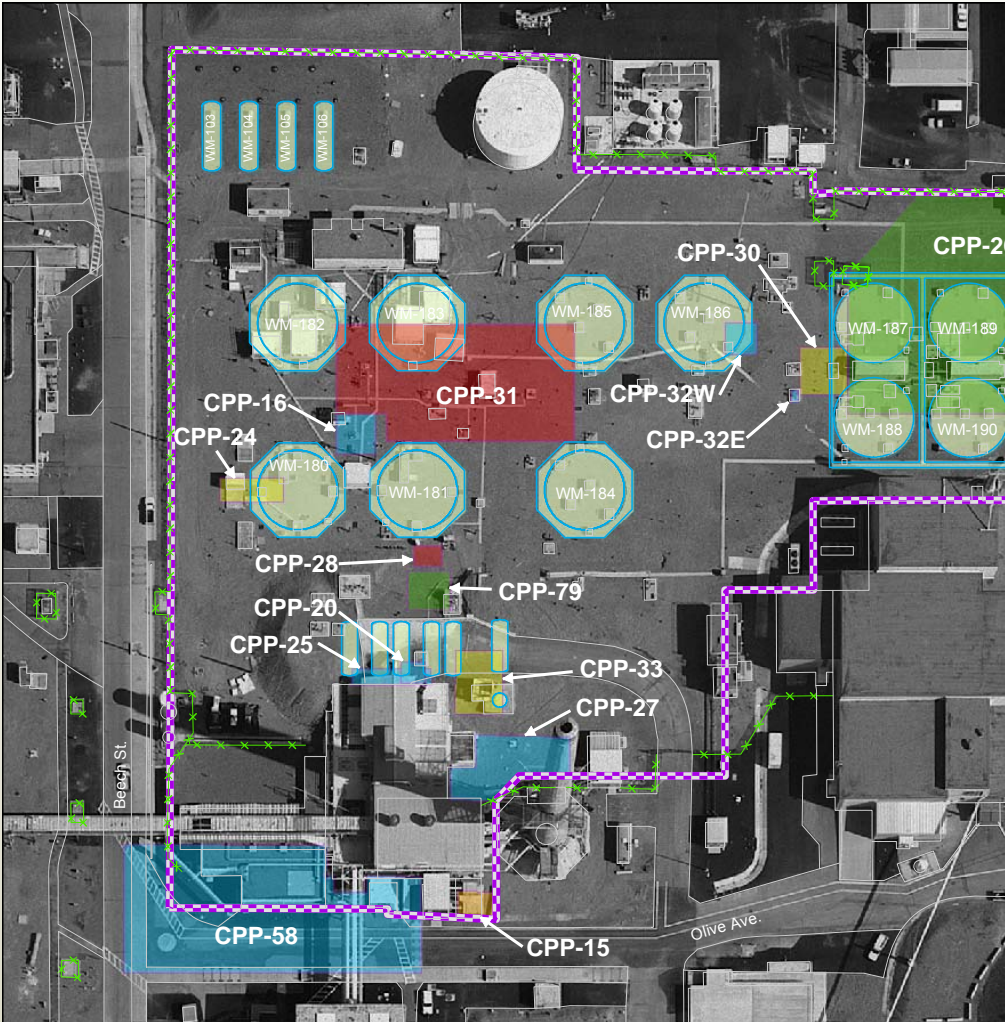
INTEC Subsurface Hydrogeologic Conceptual Model



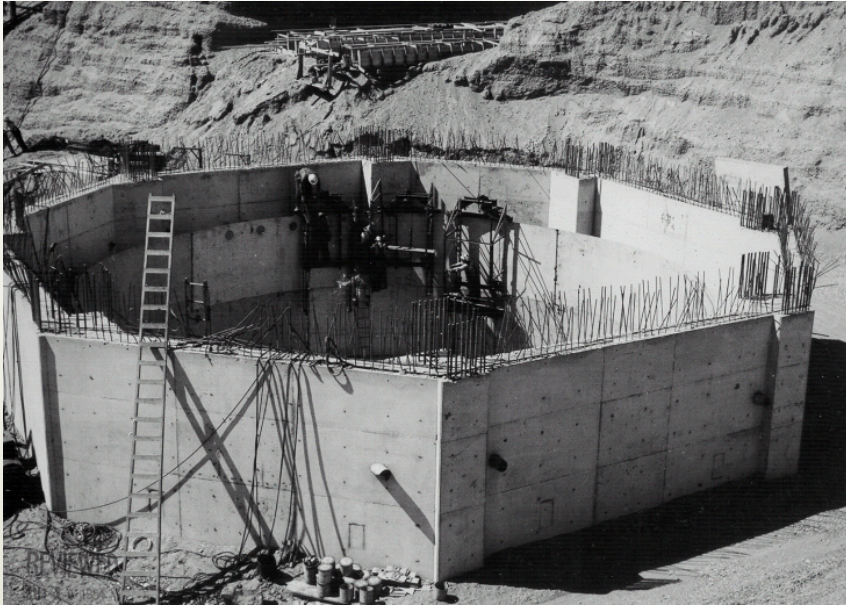
Former Injection Well History

- 1951: Injection well installed (Depth = 600 ft; water level = 450 ft)
- 1953 - 1984: Received ~1 MGD (average) ICPP service wastewater
- Primary radionuclides sent to injection well:
 - Tritium (~21,300 Ci, or 96% of total activity)
 - Cs-137 (20 Ci)
 - Sr-90 (16 Ci)
 - Tc-99 (~12 Ci estimate)
 - I-129 (<1 Ci)
- 1984: Taken out of routine service (Percolation Ponds in service)
- 1989: Injection well plugged and abandoned by pressure grouting

Tank Farm Historical Release Sites

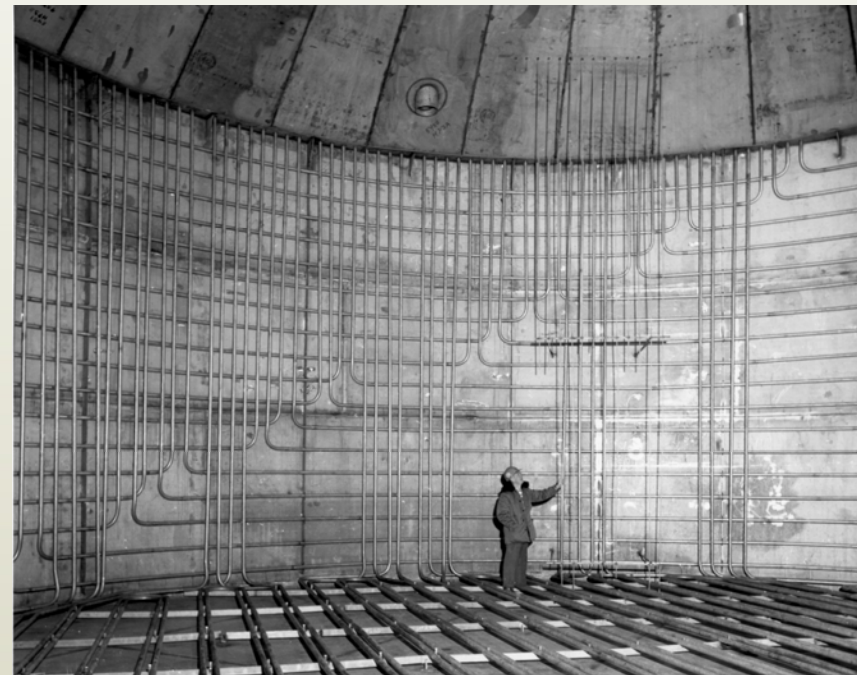


Tank Farm Underground Tank Construction



Construction of monolithic octagonal vault for 300,000 gal underground tank.

Interior of typical 300,000-gal stainless steel tank showing cooling coils

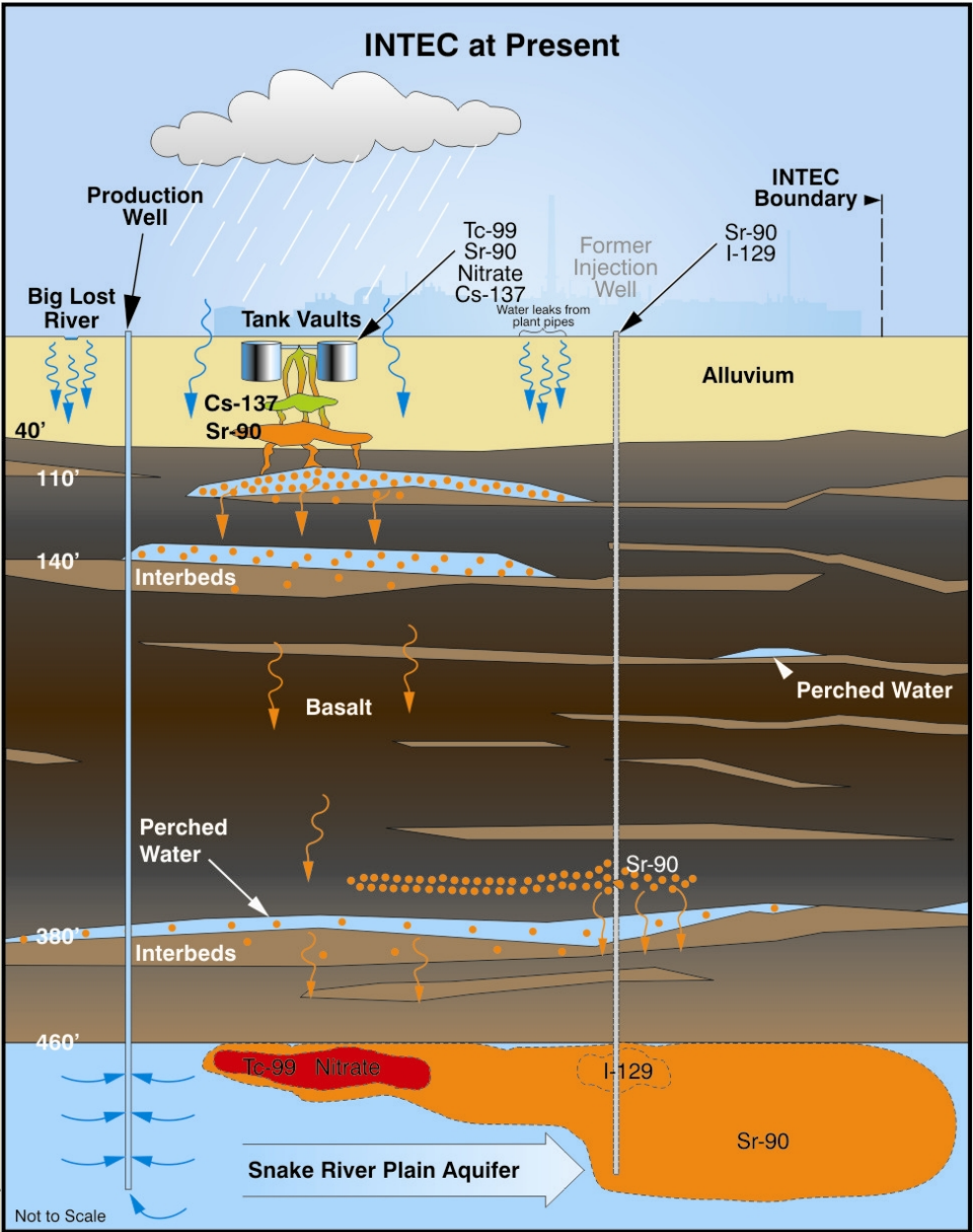


OU 3-14 COC Source Term Summary

Radionuclide	Tank Farm Soil Releases (Ci)	Former Injection Well (Ci)	Former Percolation Ponds (Ci)	Other Soil Releases	Other Liquid Releases	Total (Ci)
Tritium	9.7	20,100	999	0	378	21,487
Sr-90	18,100	24.3	0.30	918	309	19,352
Tc-99	3.6	11.9	1.1	0.09	0	17
I-129	0.001	0.86	0.08	0	0	0.94
U-234	0.14	0.14	0.04	0.14	0	0.45
Np-237	0.03	1.1	0	0.13	0	1.23
Pu-239	6.9	0.014	0.001	1.1	0	8.0
Pu-240	1.07	0.007	0.001	0.12	0	1.2

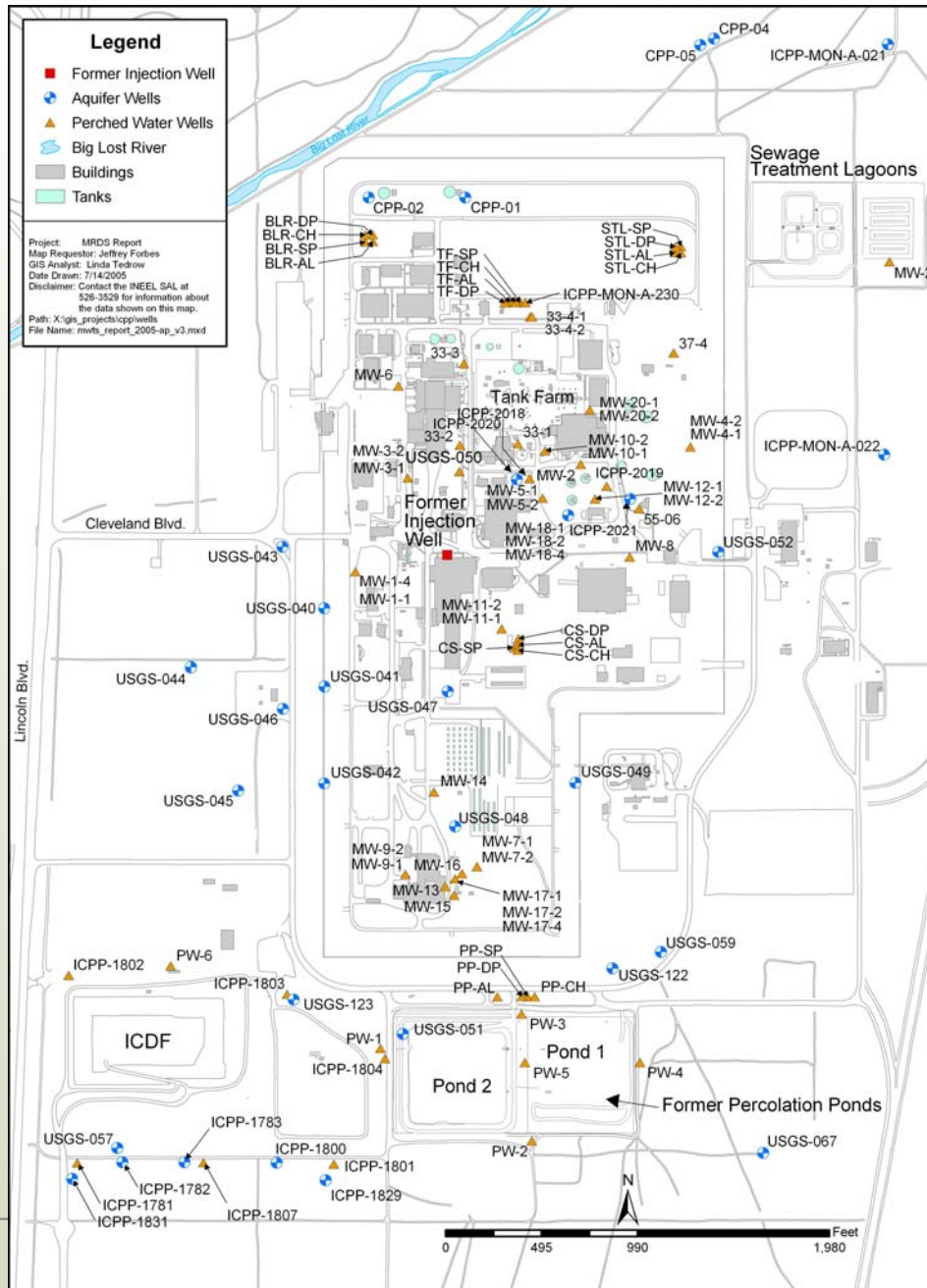
Source: OU 3-14 RI/BRA, Table 8-1.

Note: In 2005, groundwater exceeded safe drinking water standards for Sr-90, Tc-99, I-129, and nitrate. Modeling predicts that Sr-90 is the only COC that will still exceed its MCL in the compliance year 2095.



Subsurface Conceptual Model

INTEC Monitoring Well Network



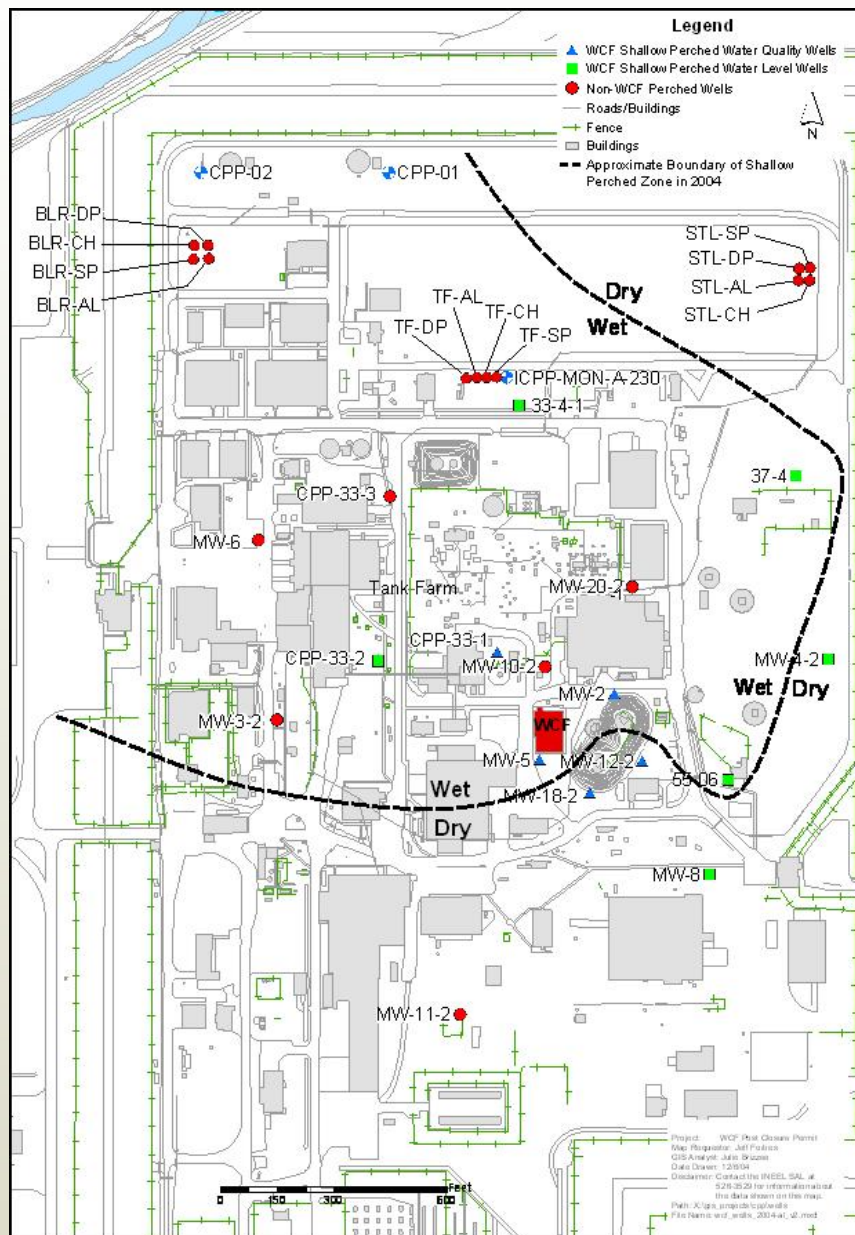
Snake River Plain Aquifer at INTEC

- Depth to Water: ~460 feet
- Aquifer matrix: fractured basalt
- Flow Direction: south to southwest
- Flow velocity: ~5 feet per day
- Exceeds drinking water standards in 2005 at or near INTEC for:
 - Sr-90 (≤ 35 pCi/L; MCL = 8 pCi/L)
 - Tc-99 ($\leq 2,700$ pCi/L; MCL = 900 pCi/L)
 - I-129 (≤ 1.5 pCi/L; MCL = 1 pCi/L)
 - Nitrate (≤ 11 mg/L as N; MCL = 10 mg/L)

Shallow Perched Water at INTEC

- Depth: 100 to 140 feet below ground surface
- Perched water at sedimentary interbeds between basalt flows
- Perched water volume: 5 to 20 million gal (varies seasonally)
- Perched water recharge sources:
 - Precipitation infiltration
 - Big Lost River infiltration (when flowing)
 - Clean water discharges & leaks
- Contains high concentrations of Sr-90 (>100,000 pCi/L)
- Shallow perched water has persisted during drought 2000-2005
- Contaminated shallow perched water continues to move downward, but Sr-90 impacts from the shallow perched water have not yet been observed in the aquifer

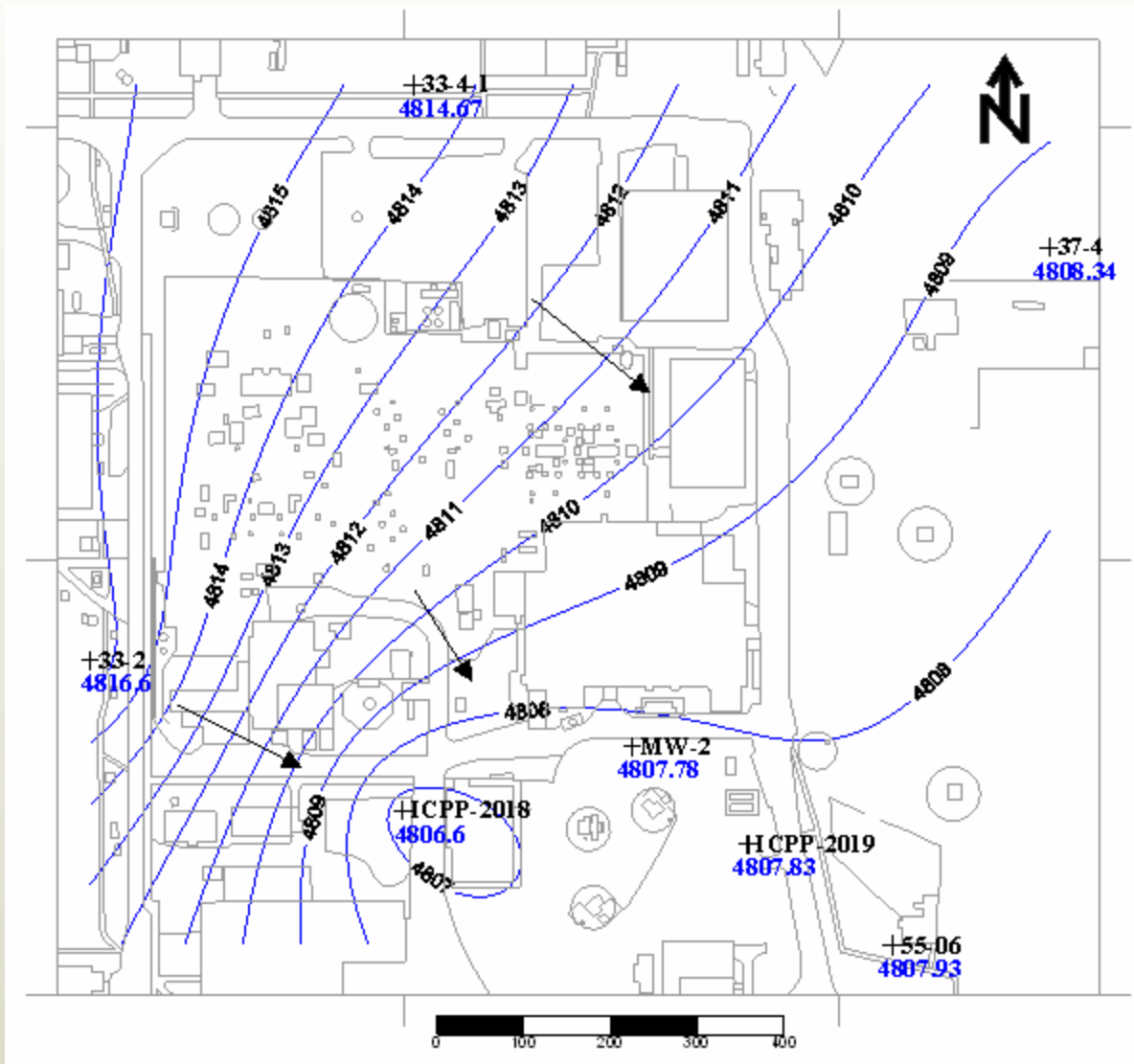
Lateral Extent of Northern Shallow Perched Water in 2005



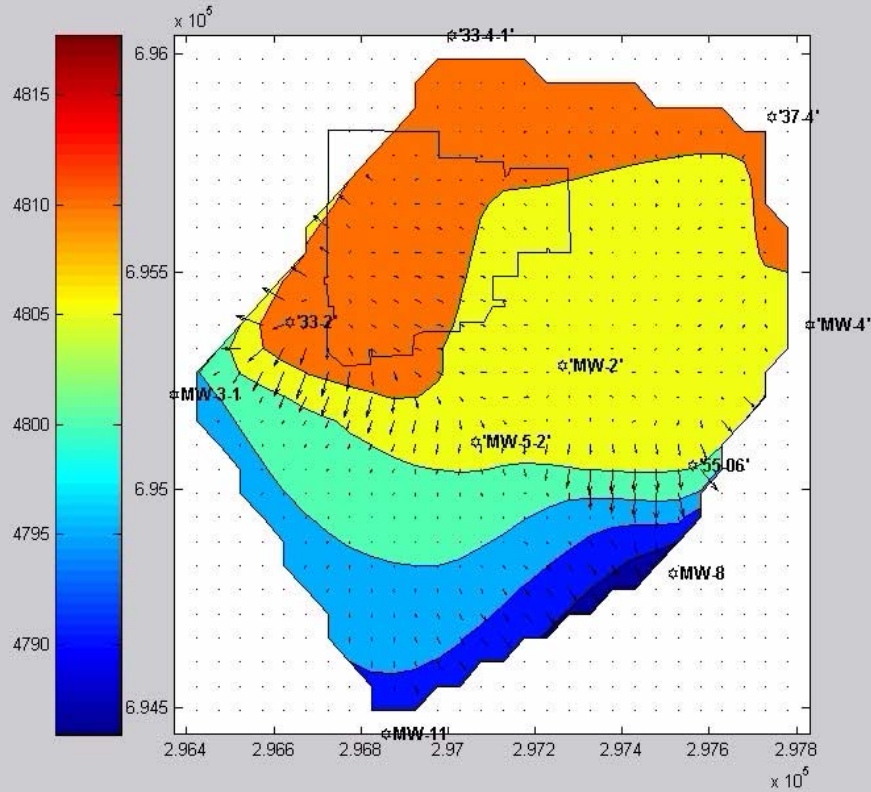
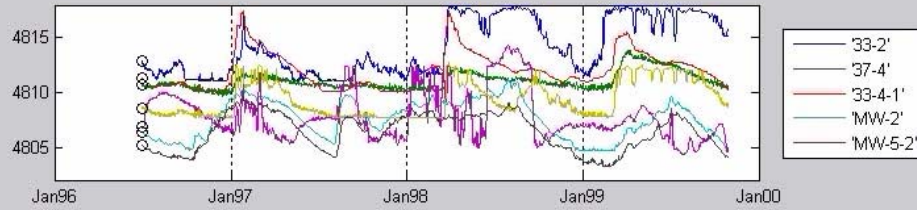
Idaho Cleanup Project

Upper Shallow Perched Water Level Contours – 5/16/05

Idaho Cleanup Project



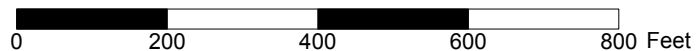
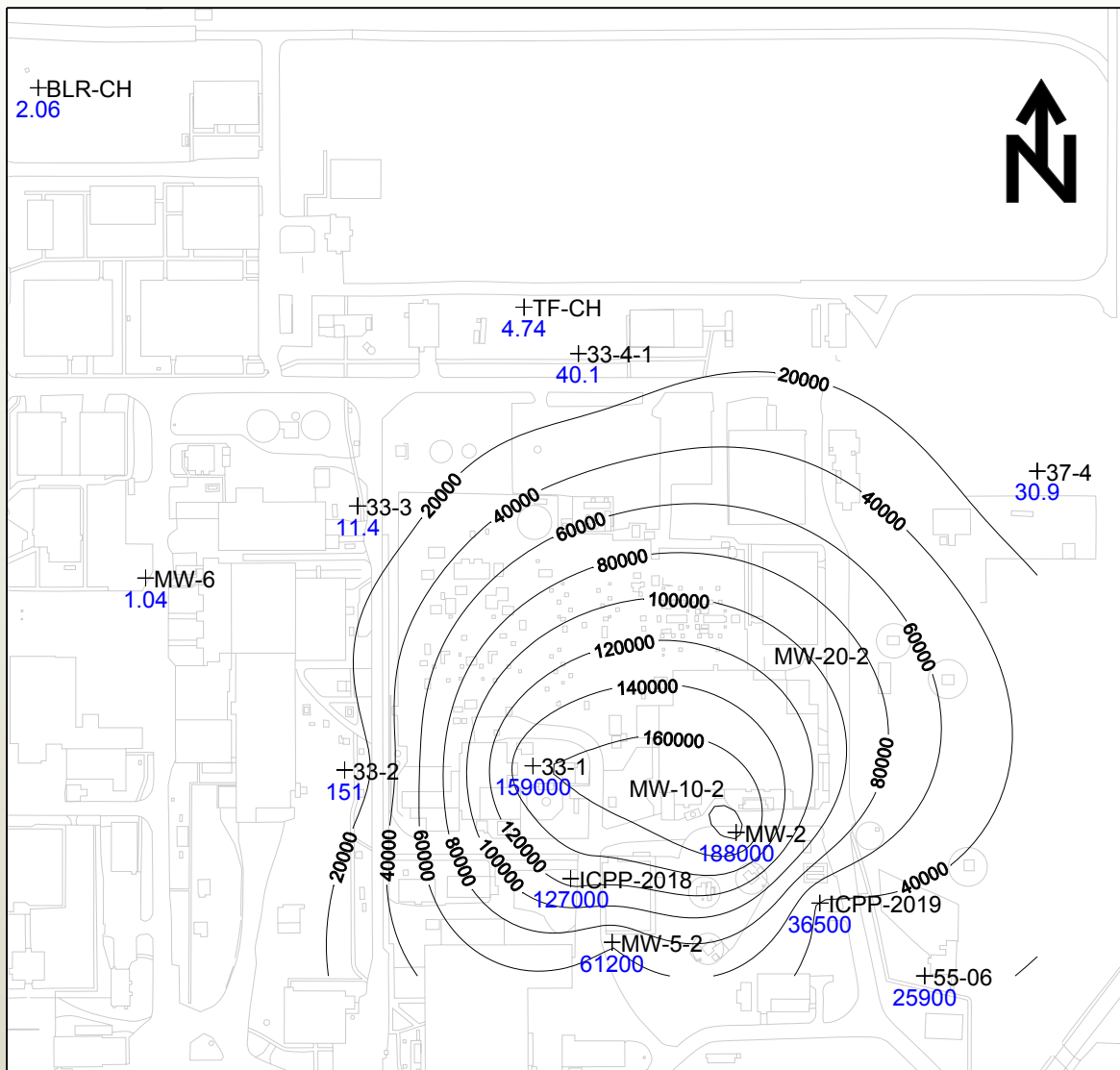
Upper Shallow Perched Water Level Visualization



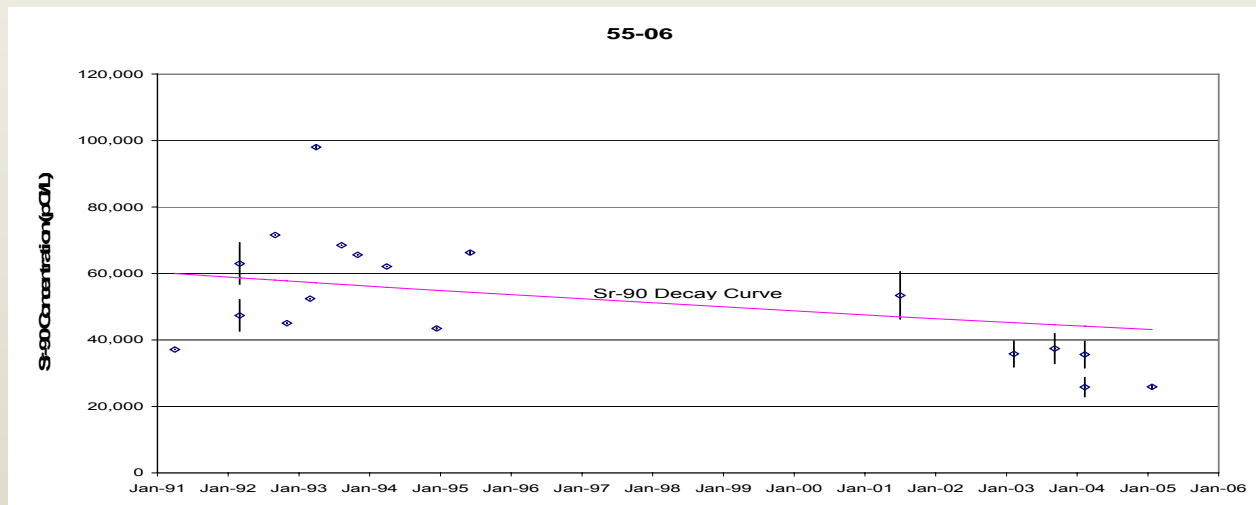
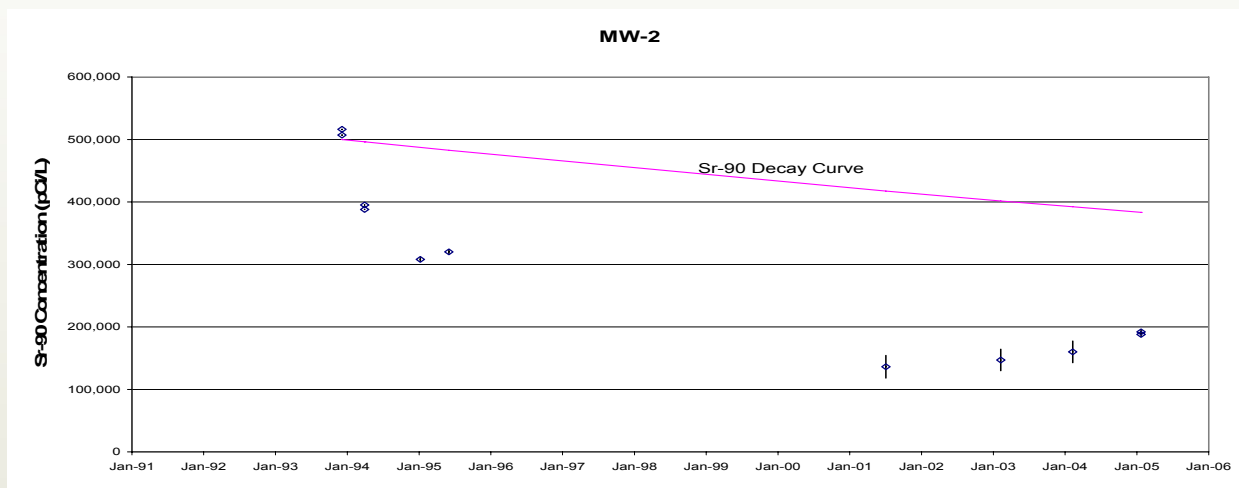
Sr-90 in Shallow Perched Water - 2005

(pCi/L; MCL is 8 pCi/L)

Idaho Cleanup Project



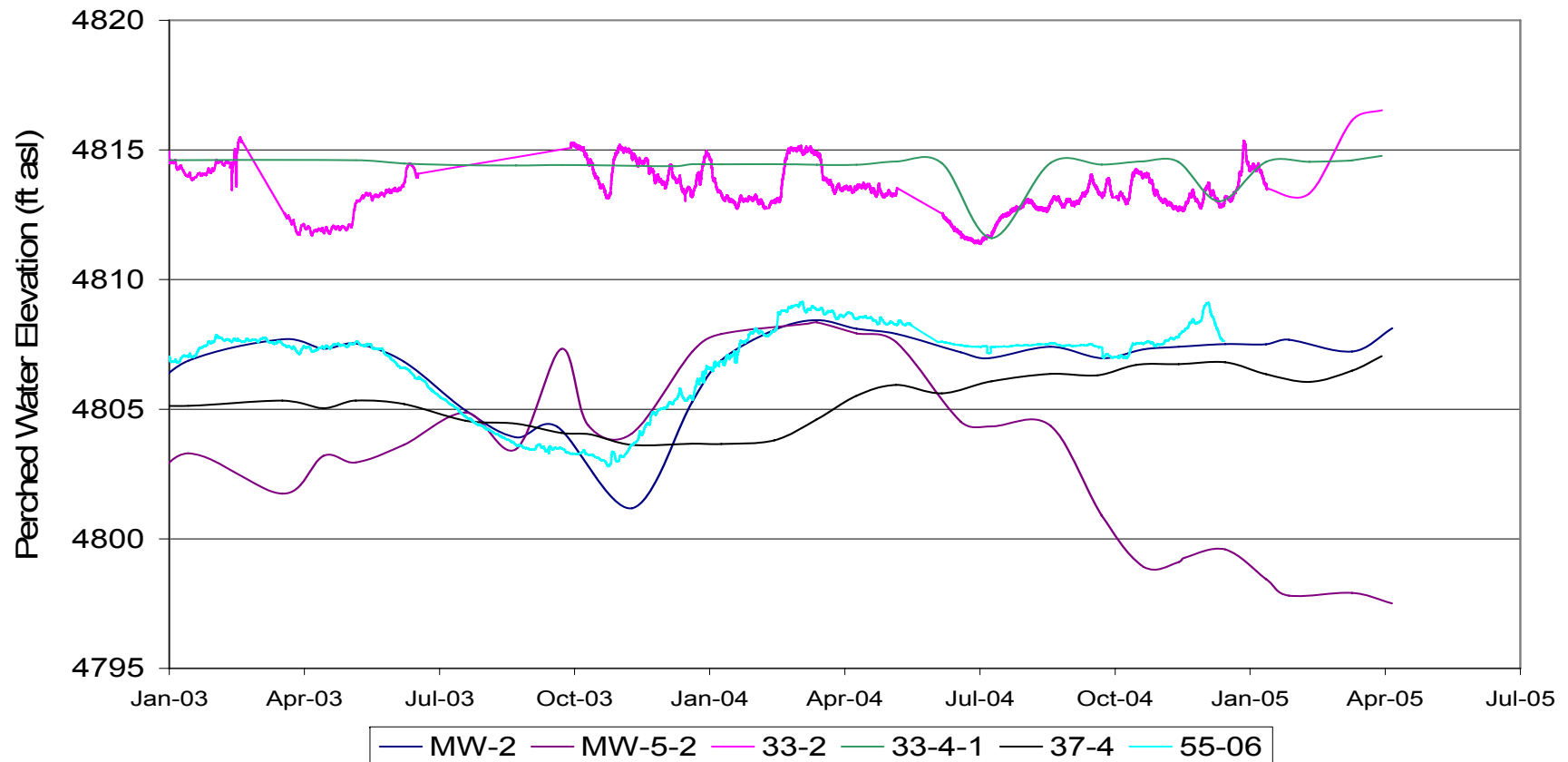
Sr-90 Trends in Selected Shallow Perched Monitoring Wells



Perched Water Remedial Activities Completed

- Old percolation ponds taken out of service 8/26/02
- Sewage effluent re-directed to new percolation ponds 12/02/04
- Concrete-lined ditches installed around Tank Farm (2003-04)
- Lined evaporation pond installed in 2003
- Subsurface injection of steam condensate has been reduced
- Lawn irrigation reduced
- Several underground water line leaks located/repaired 2004-05
- Performed INTEC water balance (2005)
- Monthly perched water-level monitoring
- Annual perched water sampling

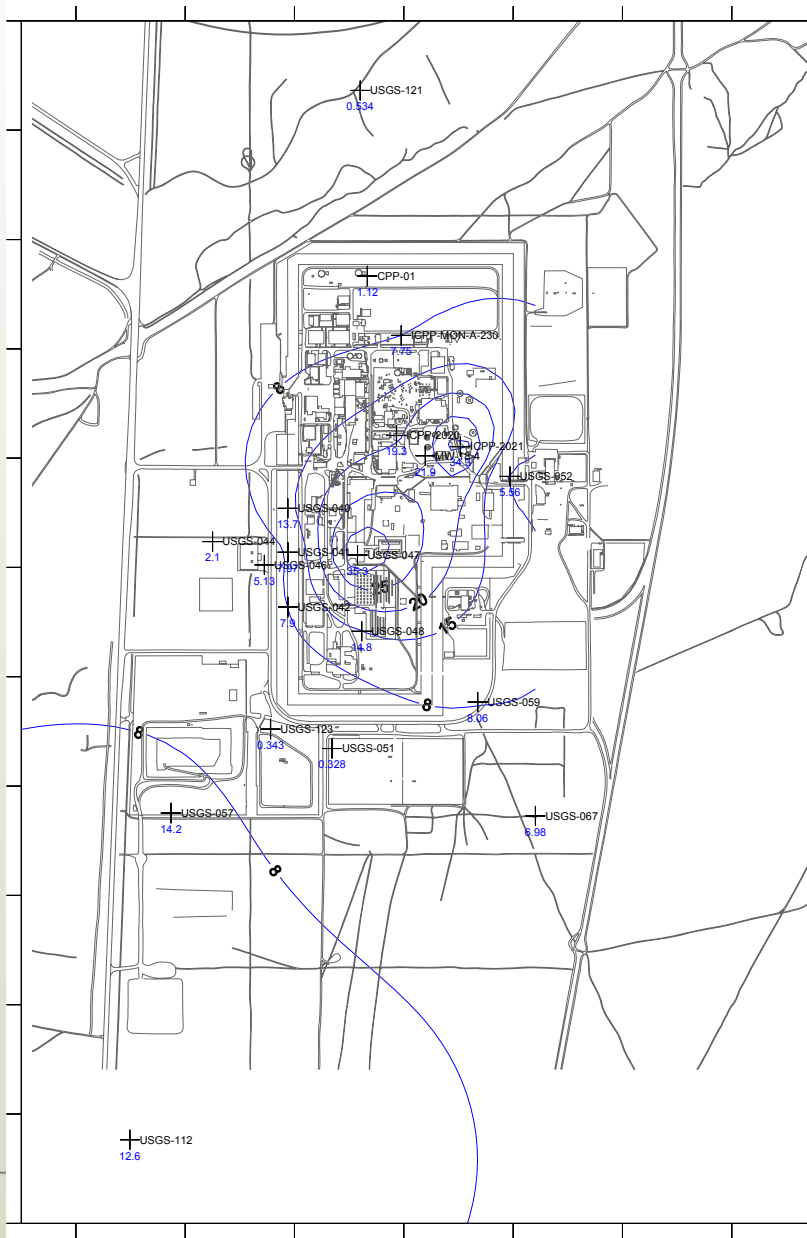
Hydrographs for Selected Shallow Perched Wells



2005 SRPA Sr-90 (pCi/L)

Idaho Cleanup Project

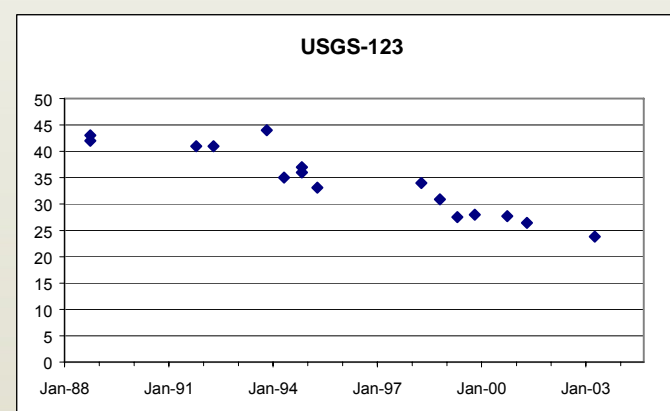
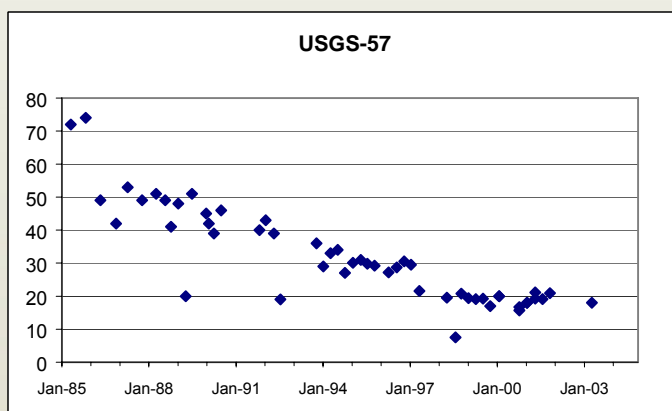
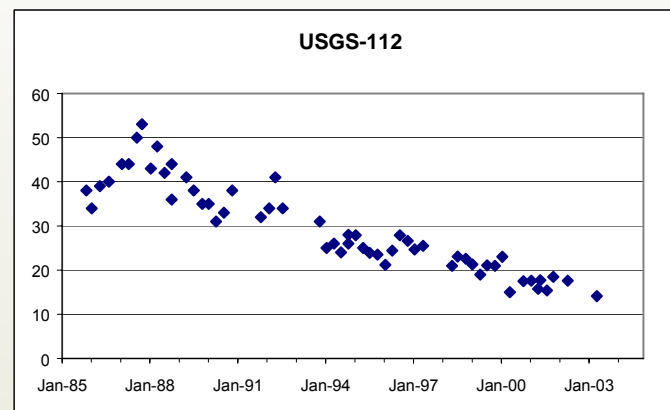
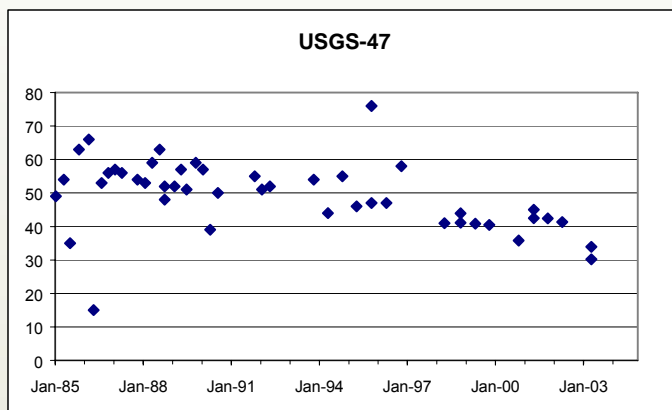
Sr-90 in the Aquifer



Sr-90 Trends in the Aquifer

(MCL is 8 pCi/L)

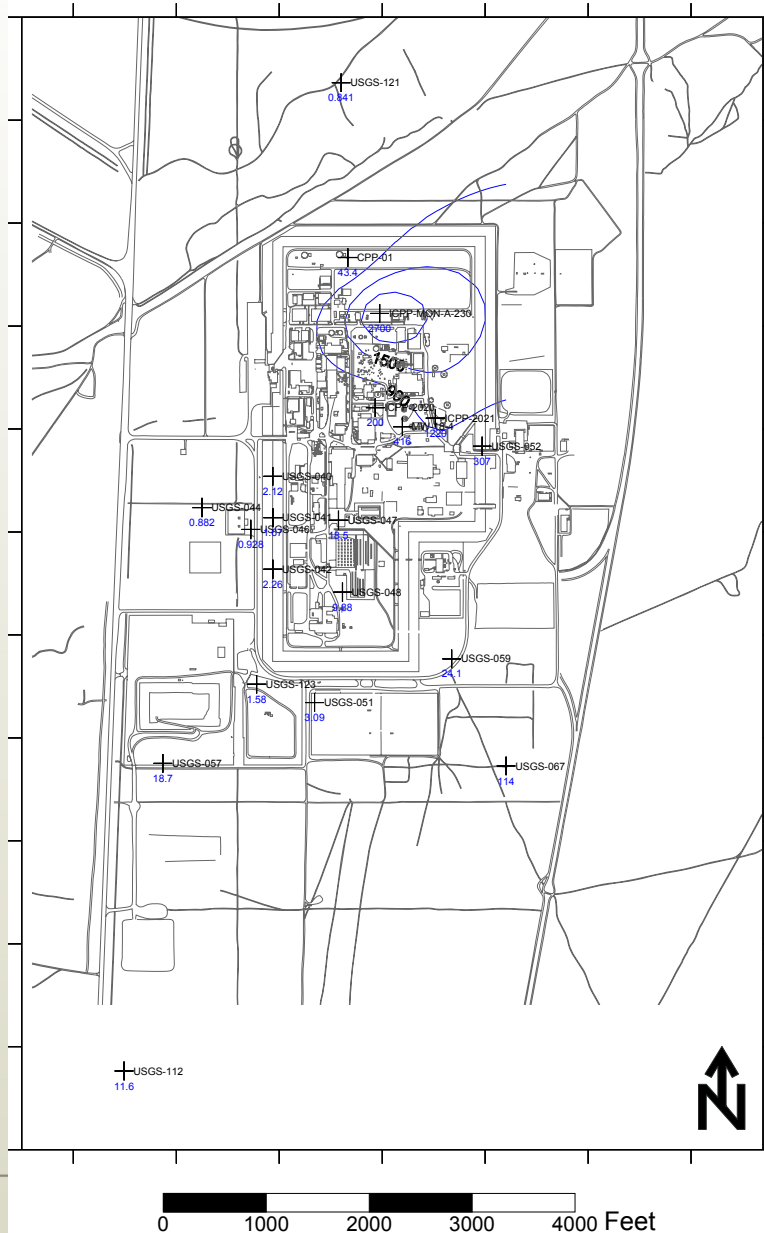
Idaho Cleanup Project



2005 SRPA Tc-99 (pCi/L)

Idaho Cleanup Project

Tc-99 in the Aquifer



Summary

- Former INTEC injection well (1953-1984) was an early source of radionuclides to the aquifer (Sr-90, Cs-137, Tc-99, I-129, tritium), but plume from this source is shrinking
- Past releases of radionuclides beneath the tank farm have impacted the vadose zone and perched water with Sr-90 & Cs-137, and the aquifer with Tc-99 and nitrate. Sr-90 from this source has not yet reached the aquifer.
- The big question: Will the large VZ inventory of Sr-90 decay away before it reaches the aquifer?