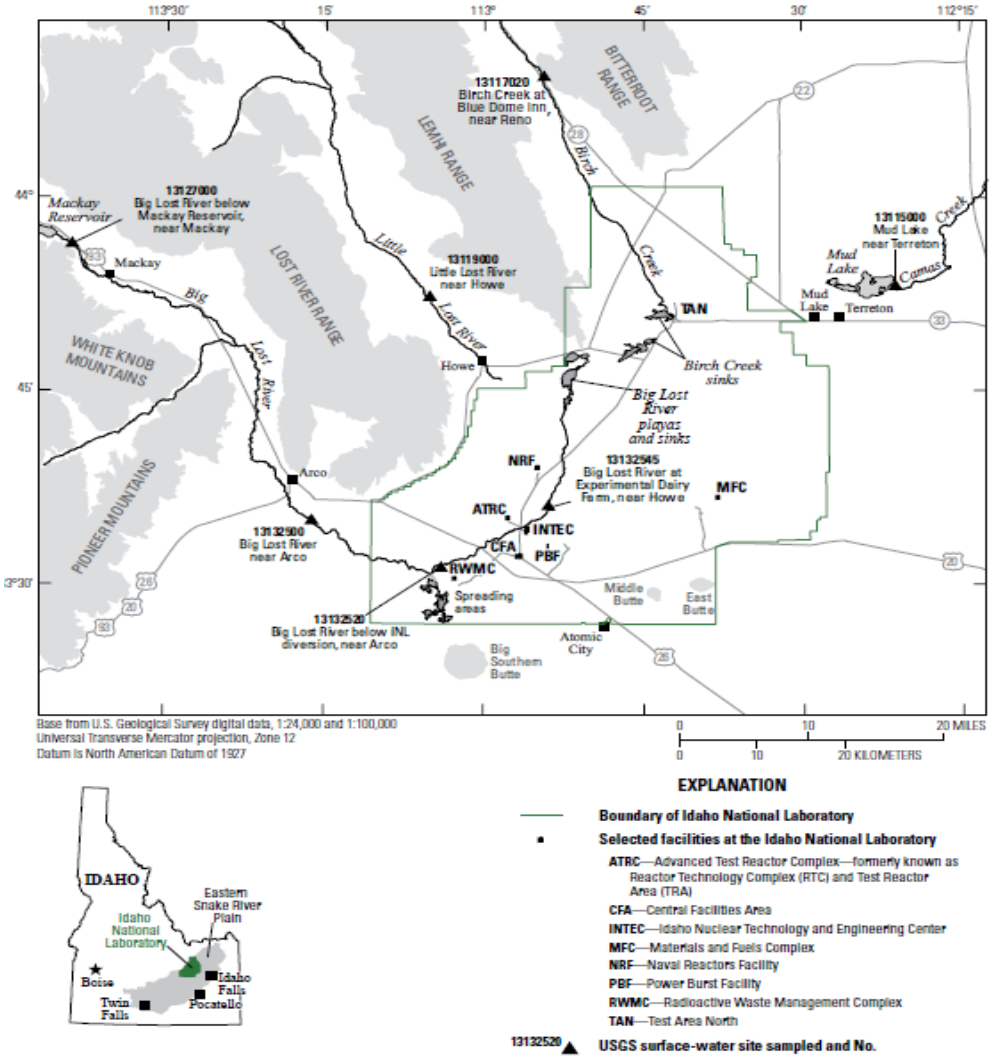
Ground Water Conditions Idaho National Laboratory

Idaho Department of Environmental Quality

October 2012

INL Facilities

(Bartholomay, et al. USGS, SIR 2012-5169)



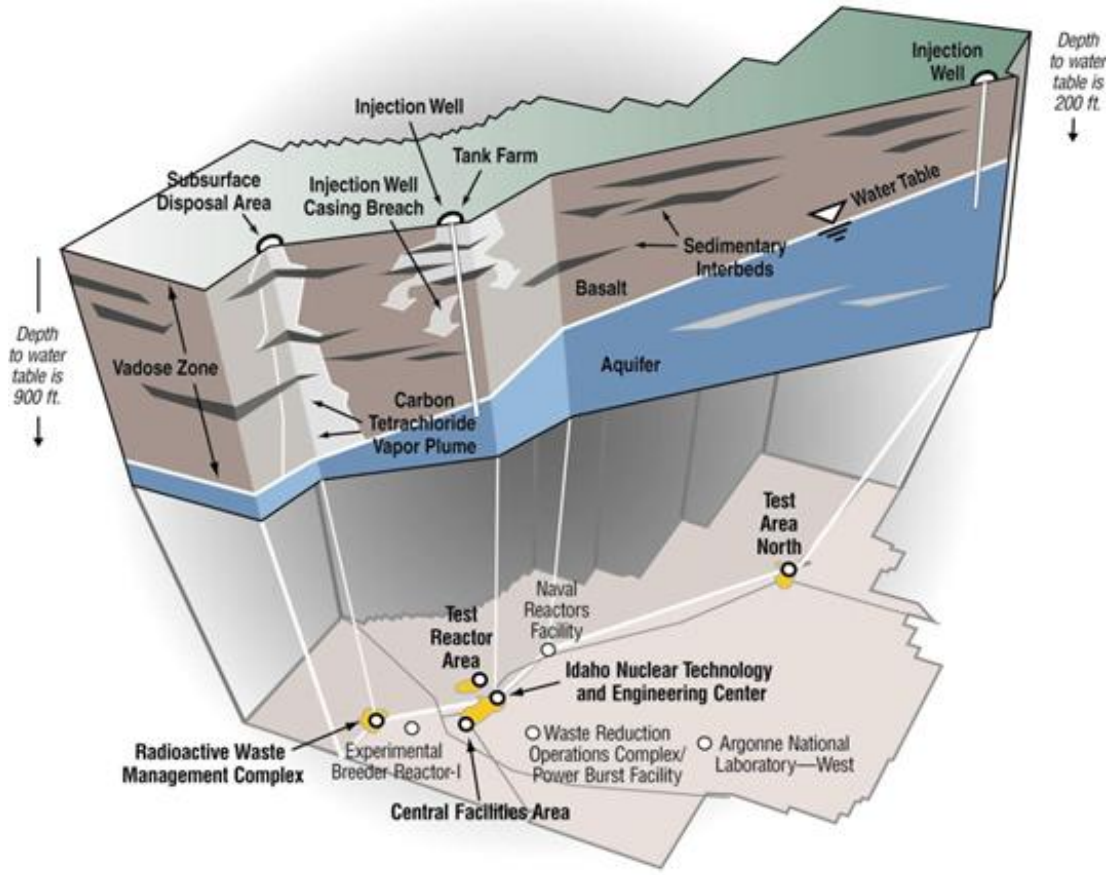
Ground Water Under the INL

Depths to ground water increase from about 200 ft at TAN to about 900 ft on southern boundary of INL in ESRPA

Perched aquifers occur where infiltrating water from the Big Lost River, leaking pipes, or unlined ditches or ponds accumulates on top of lower permeability strata such as interbeds, dense layers of basalt, or heat altered interbeds

Perched aquifers are hard to delineate, saturated pockets may be hydraulically isolated, water yield is low

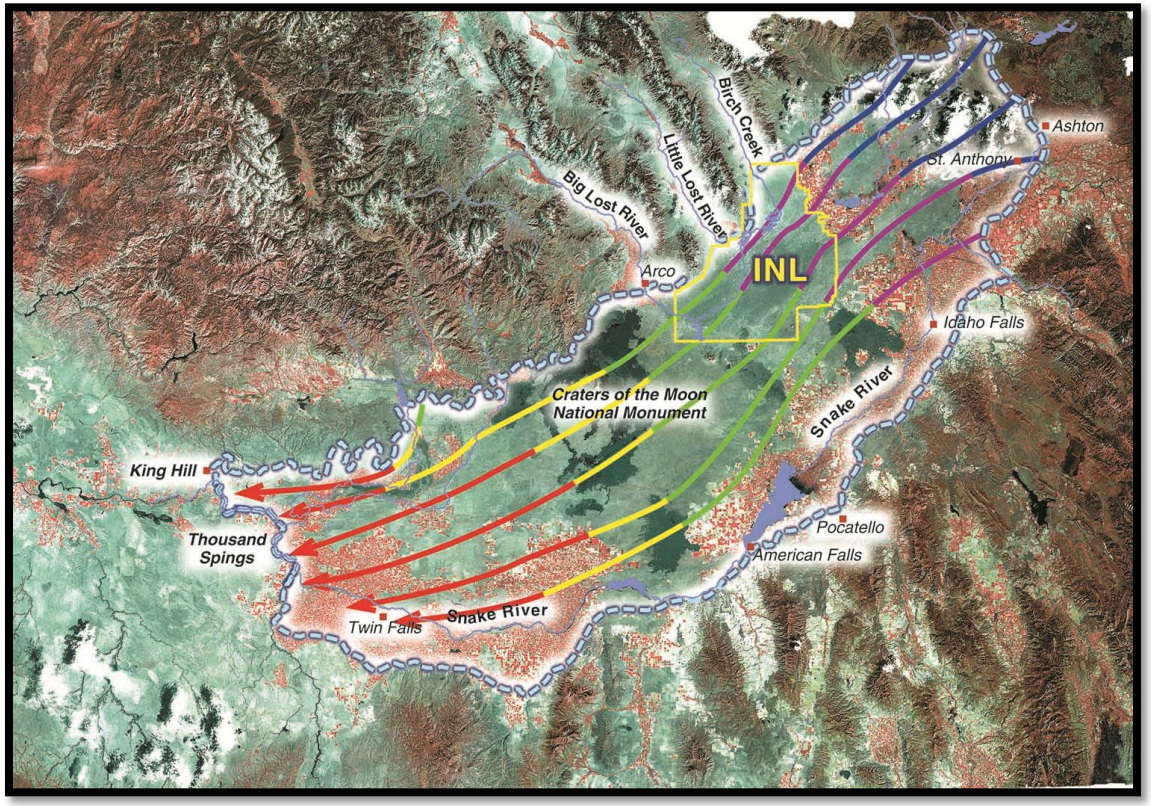
ESRPA is highly productive and is designated as a Sole Source Aquifer by U.S. Environmental Protection Agency



Ground Water Flows in the Eastern Snake River Plain Aquifer

Ground water flow paths under INL eventually discharge near King Hill area

King Hill marks the western terminus of the Eastern Snake River Plain Aquifer (ESRPA)



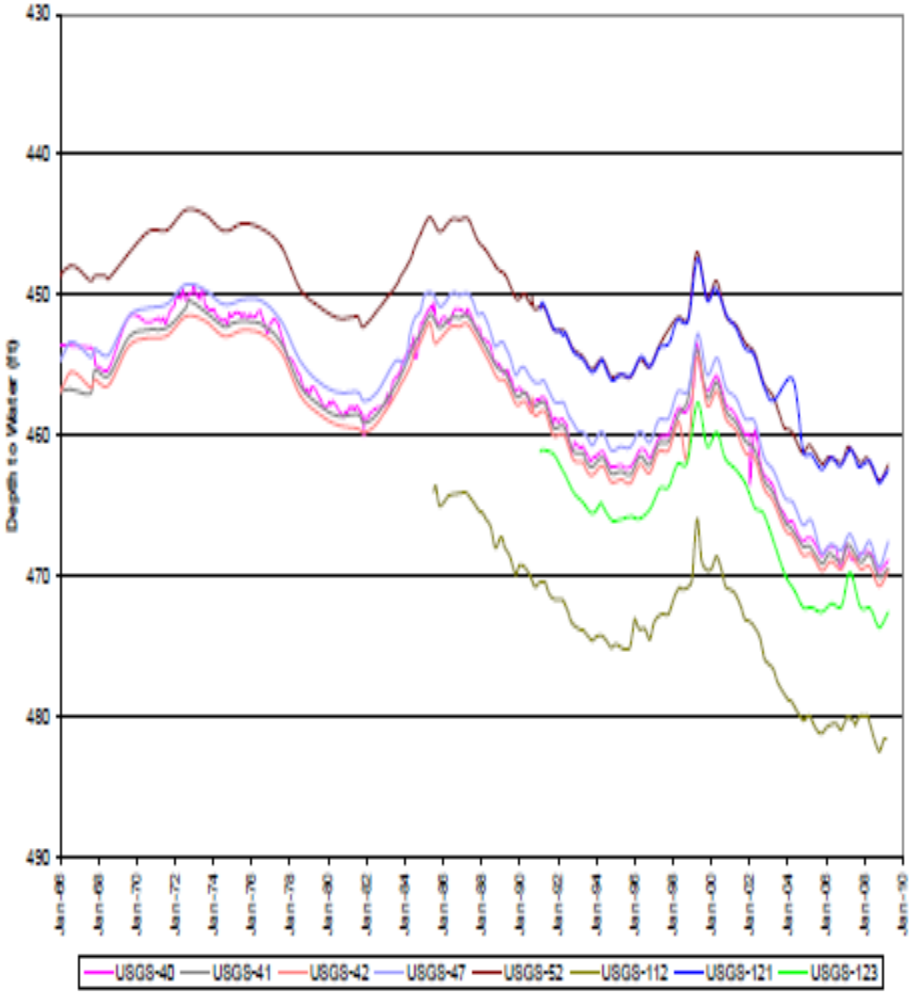
Multi-Well Ground Water Elevation Changes

Three trends in water levels

A general decline of about 0.6 ft/yr

Small seasonal fluctuation typically less than 2 feet per year; rebounds in the spring, declines until next spring

Larger multi-year cycle may exceed 10 feet; dependent upon snowpack in recharge areas



Water Level Contour Map June 2007 WAG 10, Monitoring Report for FY 2011

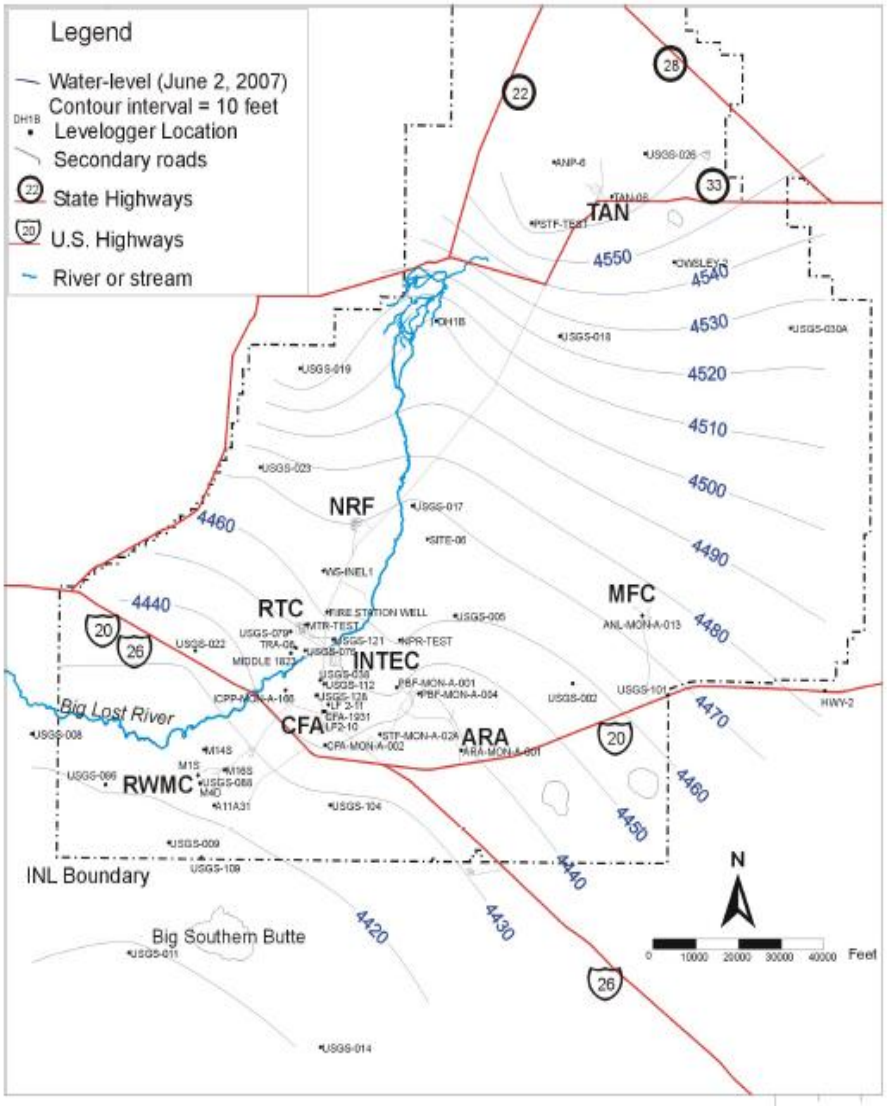
Ground water flow is toward the southwest across the INL

Hydraulic gradient is flatter around INTEC and CFA indicating greater transmissivity in the ESRPA

Ground water velocities around TAN are estimated to be about 0.6 ft/day

Ground water velocities around INTEC are estimated to be 10 ft/day or higher

Monitoring wells shown are small fraction of total monitoring wells on the INL



Multiple Modeling Efforts

CERCLA

- TAN ground water fate & transport
- TRA ground water fate & transport
- INTEC ground water fate & transport & unsaturated zone reactive transport
- RWMC unsaturated and saturated zones fate & transport
- Site wide ground water fate & transport under WAG 10

DOE Performance Assessments

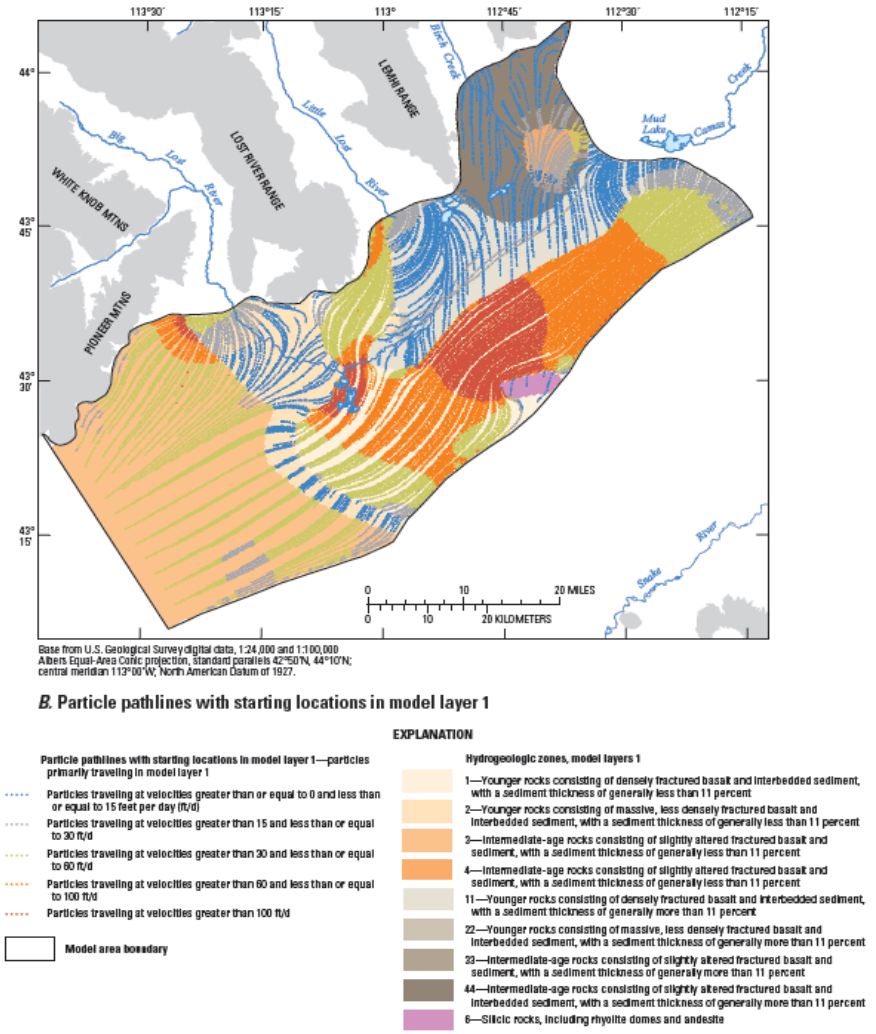
- Required by DOE orders 435.1
- Revisited for INTEC (Tank Farm) in 2003 and 2006 and adjacent ICDF in 2003
- RWMC performed in 1994, revised in 2000 and again in 2007/2008

New Insight Into Flow Paths (Fisher, et al, USGS, SIR 2012-5152)

Multi-layer model constructed by USGS

Particle track modeling used to predict ground water flow paths

Ground water flow path complexity appears to increase as scale changes



Test Area North

Sewage sludge was injected into ESRPA with TCE, Cs-137, Sr-90, & Tritium

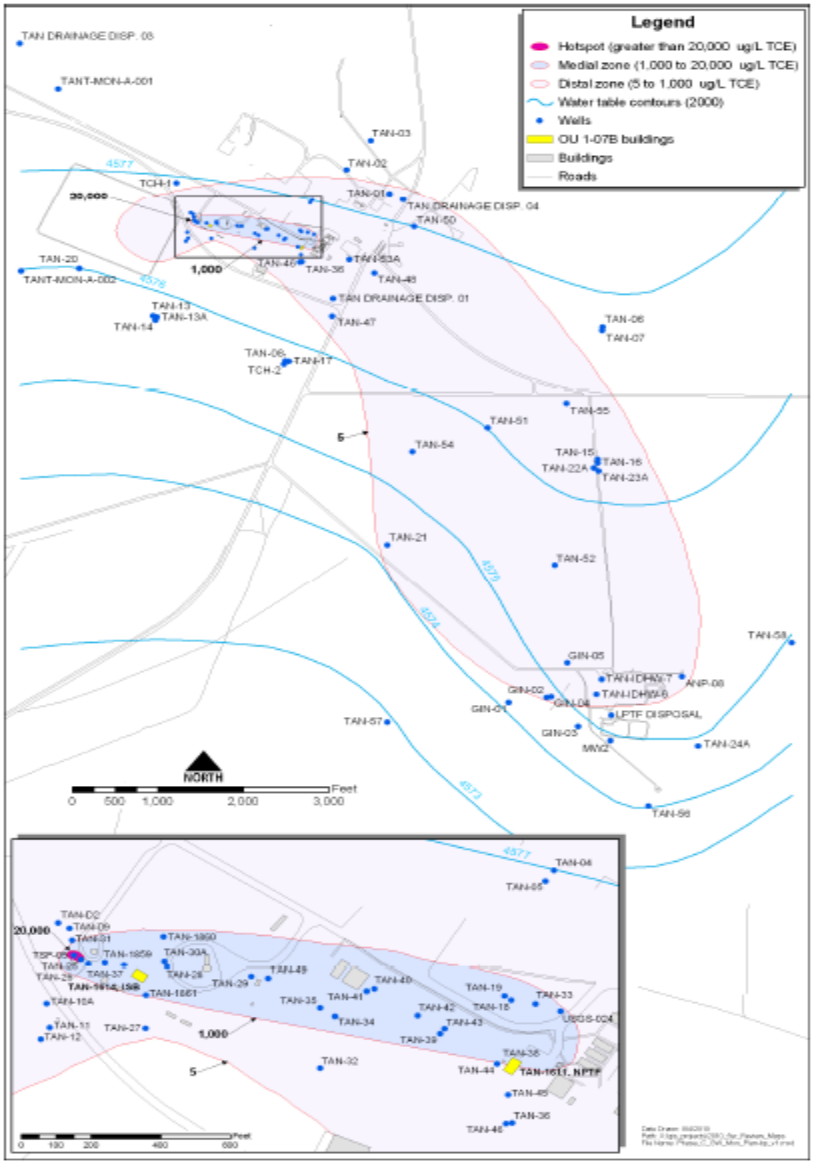
TSF-05 (injection well) was surged and bailed to remove sludge

In situ bioremediation implemented in Hot Spot with air stripping of TCE from ground water at down gradient end of Medial Zone

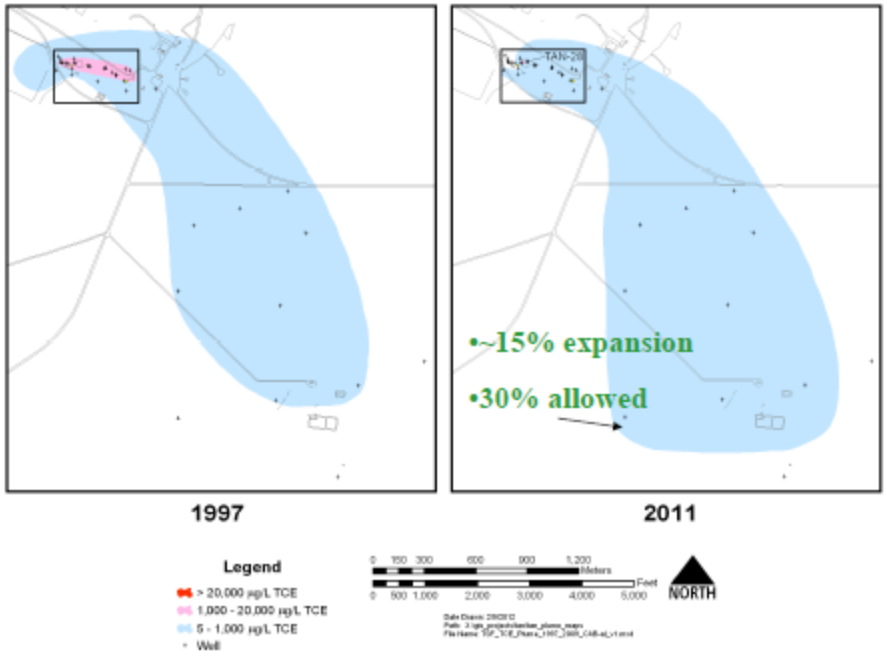
Ground water quality continues to be monitored

Recently began implementation of rebound phase (stopped addition of in situ bio-amendments whey and sodium lactate) to observe changes in concentrations of TCE

Plume Map

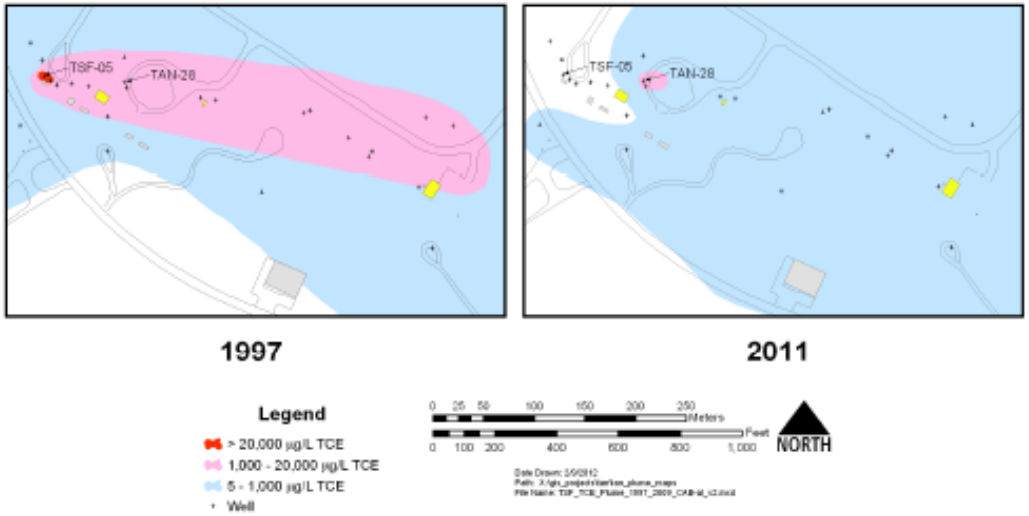


Plume Changes from 1997 to 2011



Test Area North

Hot Spot and Medial Zone Progress 1997 to 2011

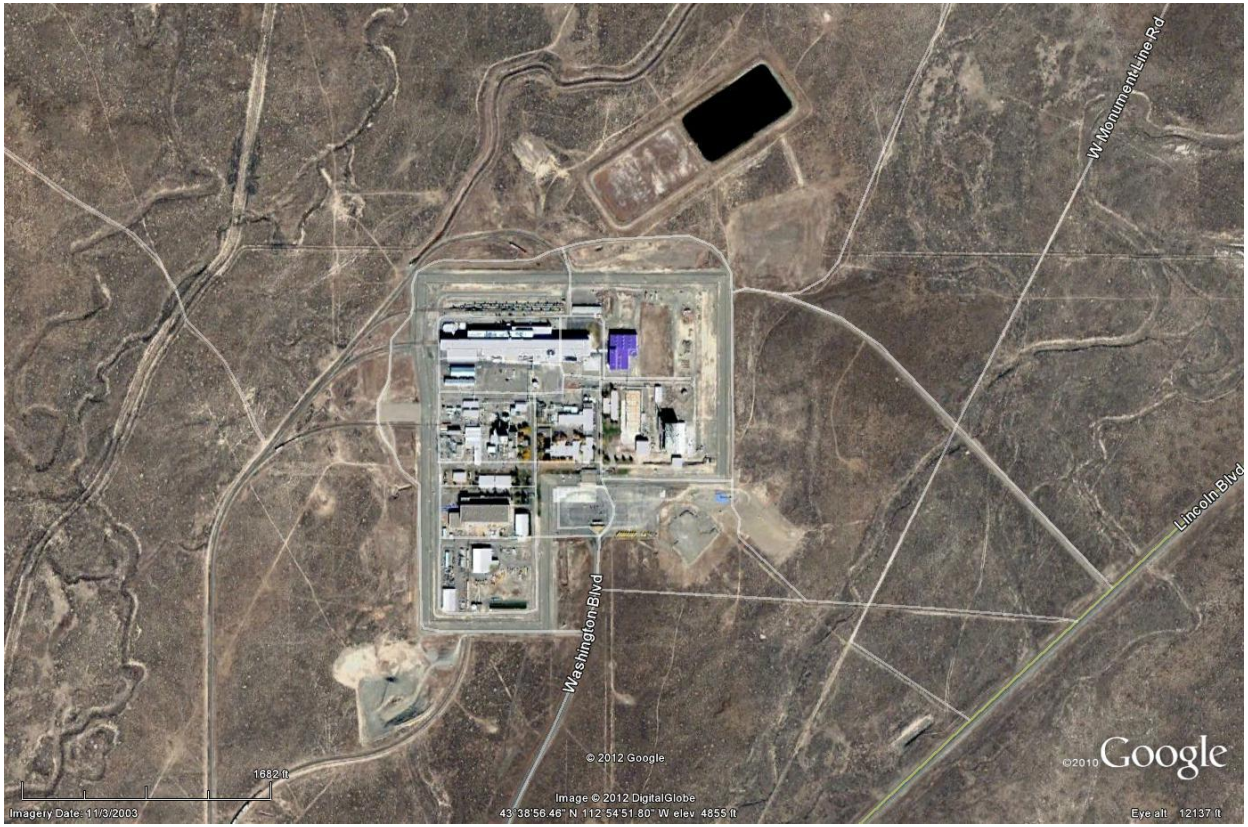


Naval Reactor Facilities

Major sources of contamination to ESRPA were Industrial Waste Ditch and unlined ponds; chromium is a contaminant of concern

Minor ground water contamination in a perched aquifer and ESRPA

NRF drilled new up gradient monitoring well to eliminate problems with sedimentary interbed movement through well screen



Advanced Test Reactor Complex (formerly Test Reactor Area)

Major sources of contamination were Injection well and unlined ponds

Contamination in perched aquifer and ESRPA

Contaminants include tritium, chromium, Sr-90, C0-60, & diesel

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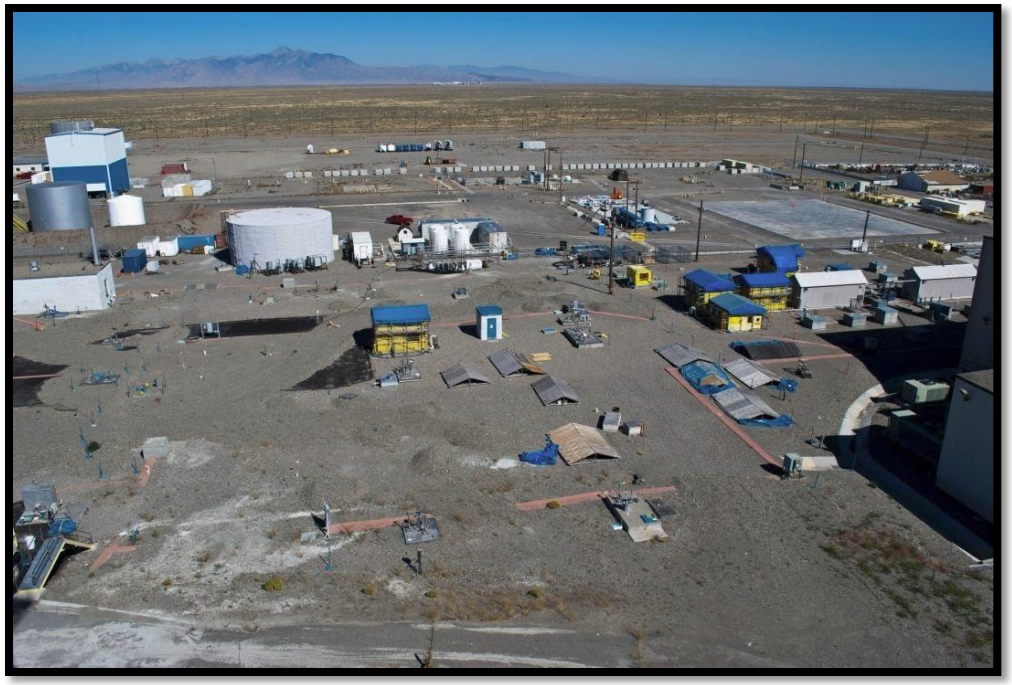
Waste water was injected in ESRPA containing I-129, Tritium, Tc-99, Sr-90, and lesser isotopes

Plumes from injection well have been tracked, at low concentrations, beyond the southern INL boundary

Contaminants released from leaking pipelines and valves within Tank Farm; Sr-90 mobilized because of high concentrations of sodium in waste stream; Sr-90 resides in first perched aquifer; remediation strategy is to reduce sources of water to perched aquifer to allow decay of Sr-90

Ongoing monitoring generally shows decreasing concentrations of I-129, Tritium, Sr-90, & Tc-99

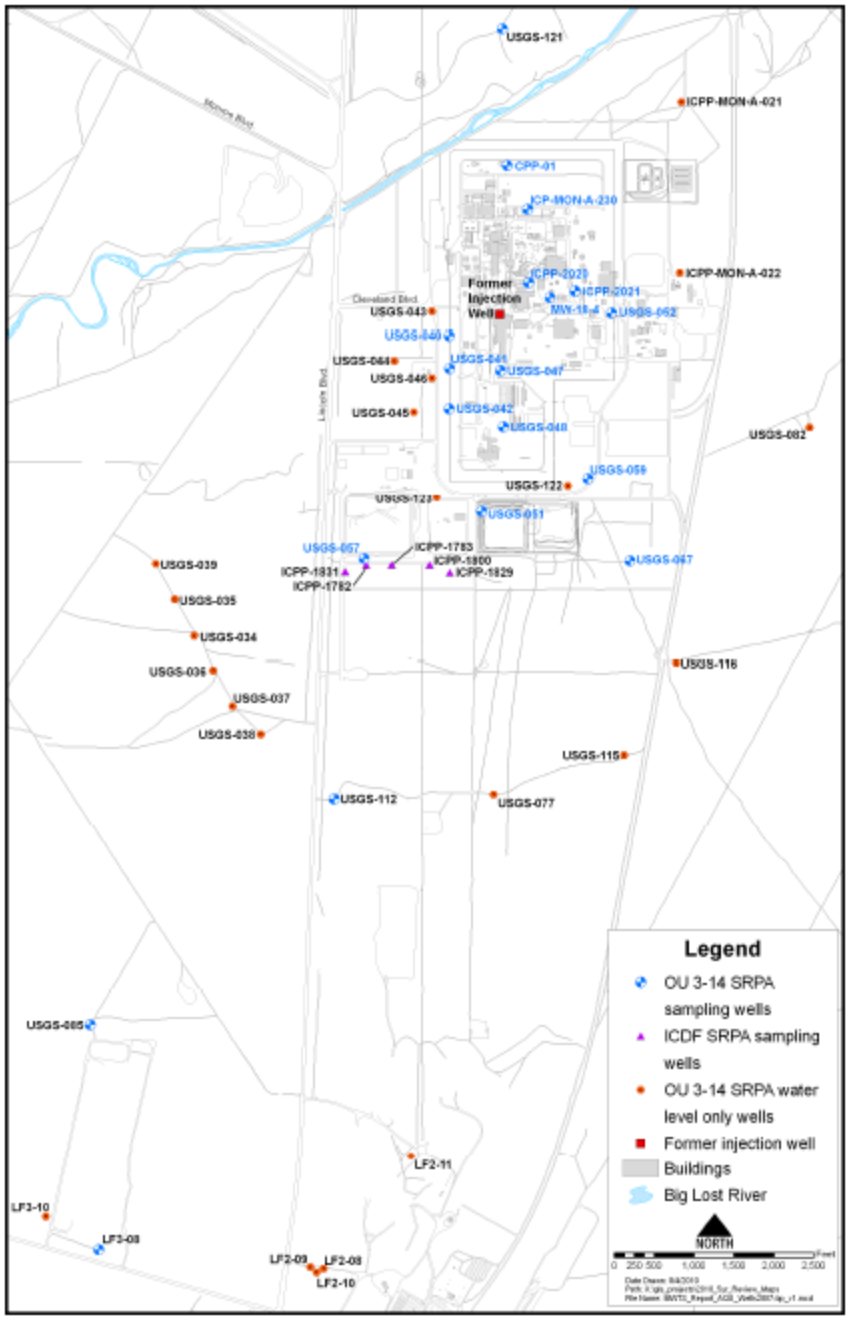


Ground Water Monitoring Wells Around INTEC

Wells sampled for CERCLA + former injection well

Arc of monitoring wells located between INTEC and CFA

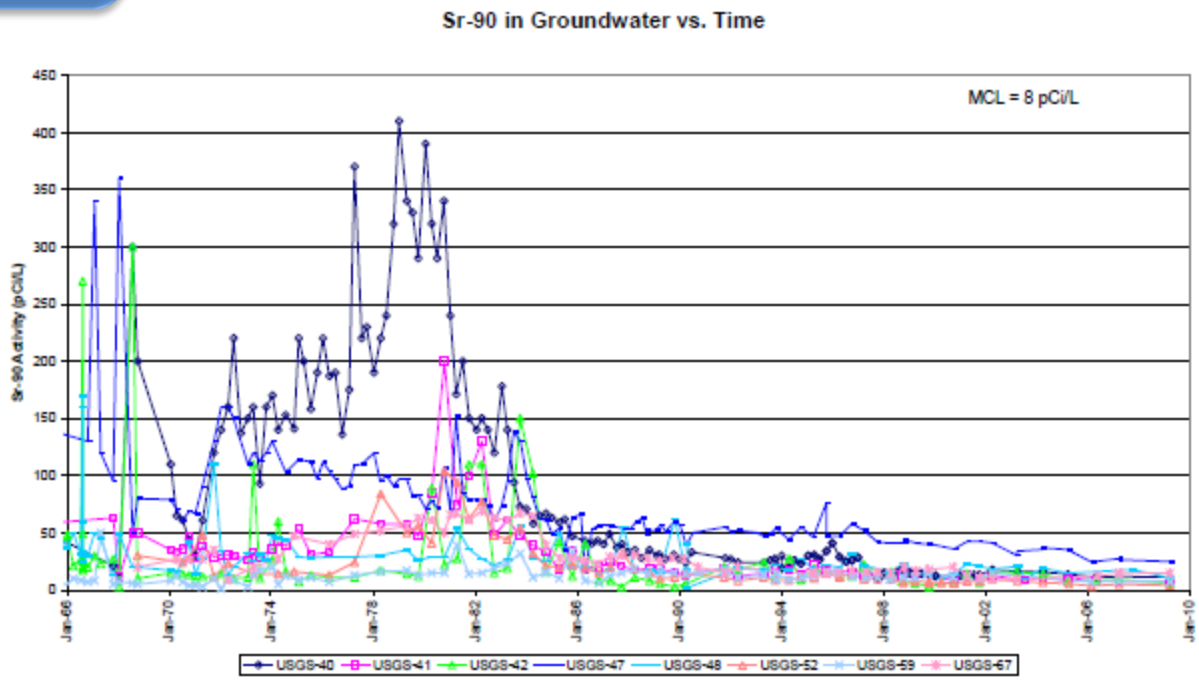
Variable completion depths for monitoring wells requires care in considering concentrations



Sr-90 Concentrations in Ground Water by INTEC

Sr-90 concentrations in ground water from past use of injection well are declining over time

Drinking water standard for Sr-90 is 8 pCi/L



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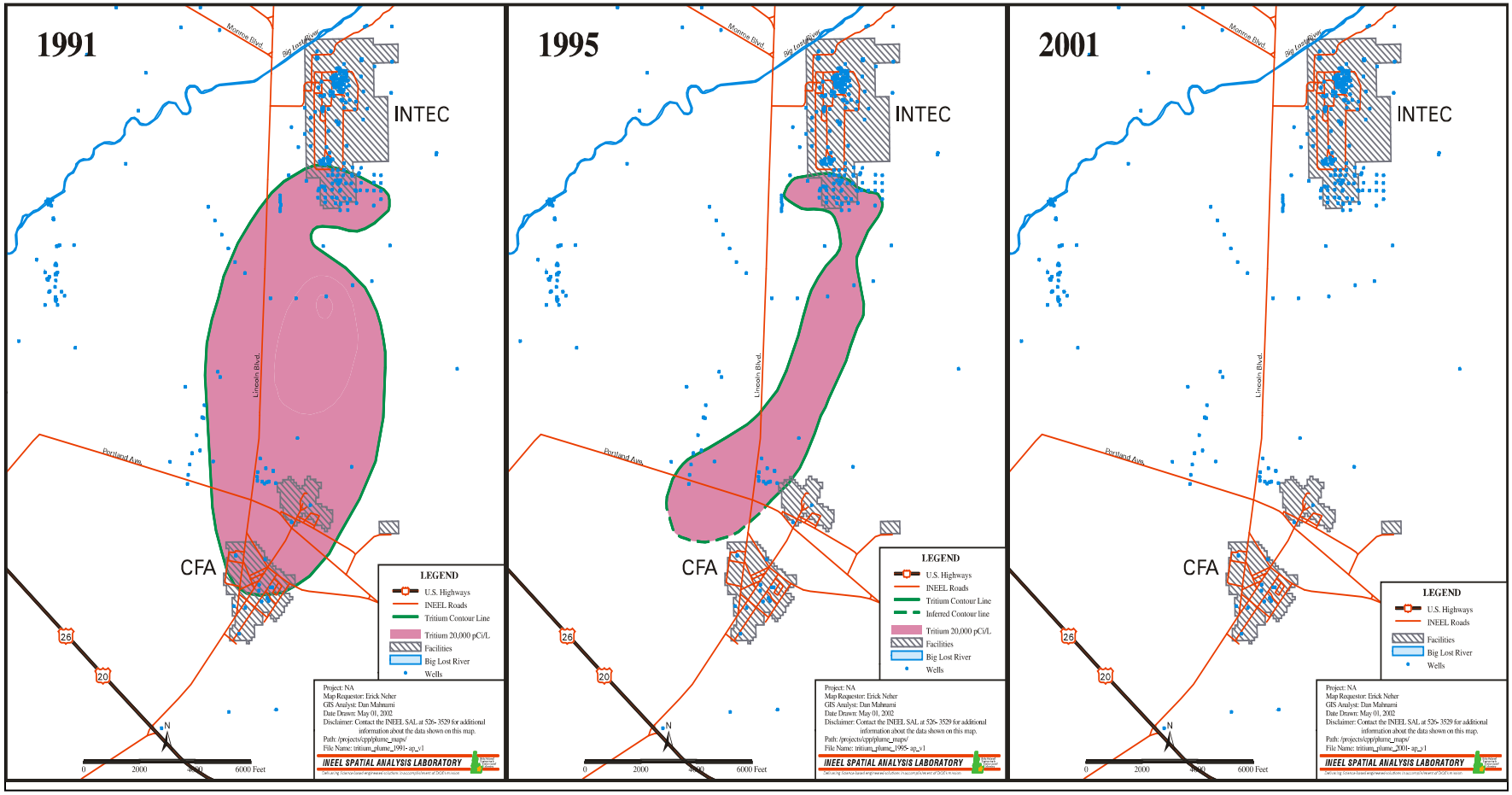
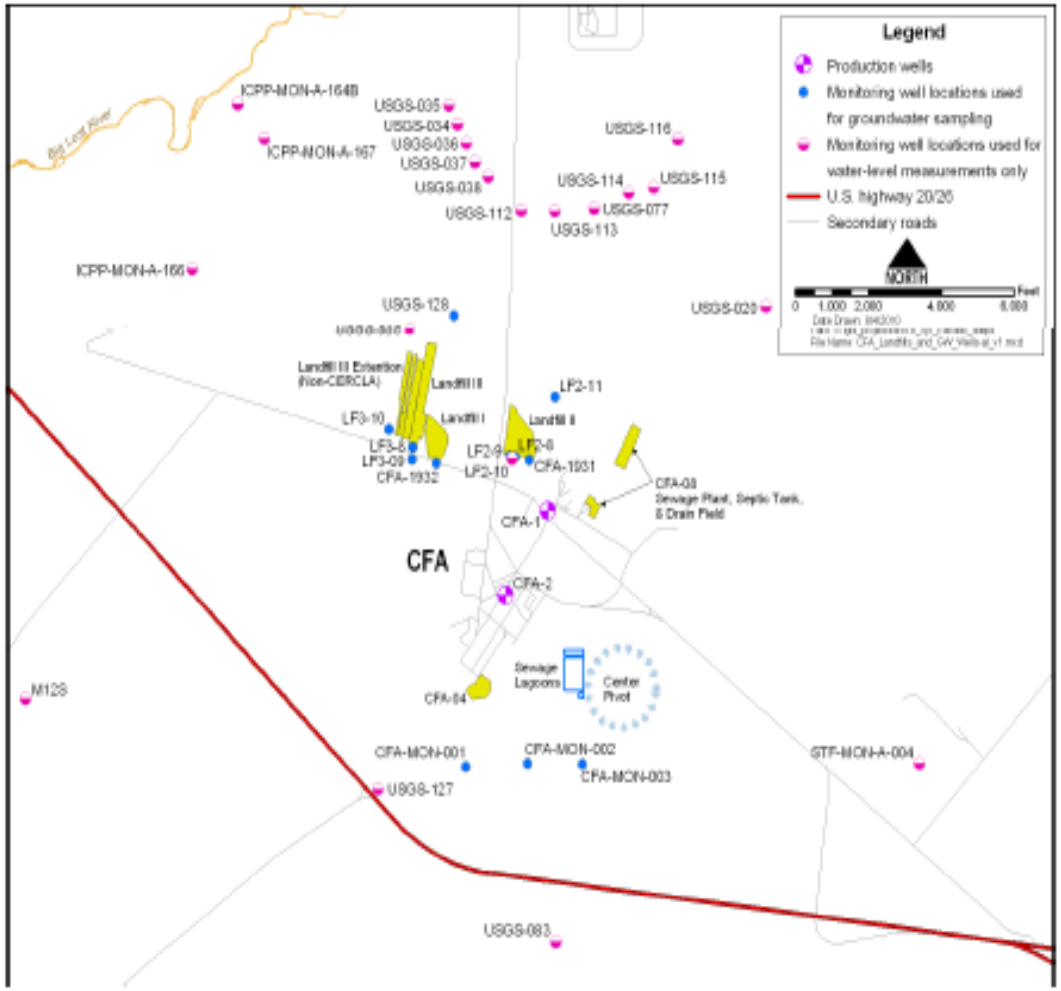


Central Facilities Area

Contaminants include nitrogen found in form of nitrate in ground water, mercury by waste water discharge pipeline and disposal pond

CFA Landfills suspicioned to be sources of various organic compounds found in ESRPA but not at concentrations of concern

Nitrate plume is moving down gradient from CFA; some wells continue to show concentrations at or exceeding MCL



Radioactive Waste Management Complex

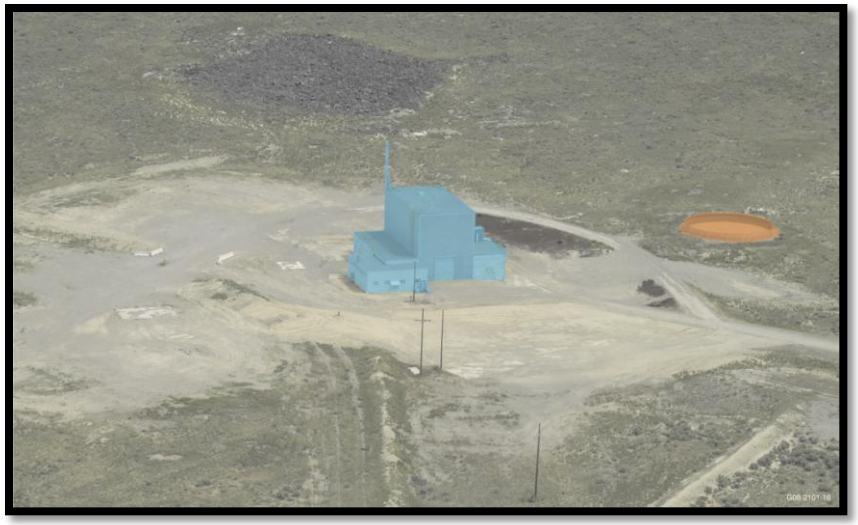
Historically carbon tetrachloride has exceeded drinking water standard in ESRPA until recently; isotopes of concern include C-14, tritium, Tc-99, I-129, Pu, & U

Vapor extraction from unsaturated zone has been ongoing since January 1996; additional vapor extraction by negative pressure applied to ARP structures for operations; and sludges containing CCl_4 are being removed

As of September 27, 2012, 137,475 lbs. of CCl_4 have been removed; 237,892 lbs of total volatile organic compounds have been removed

Probable mechanism for conveyance of CCl_4 to ESRPA is “partitioning of vapor phase to aqueous phase” at top of water table

Army Reactor Area, Power Burst Facility, and Material and Fuels Complex (formerly Argonne West)



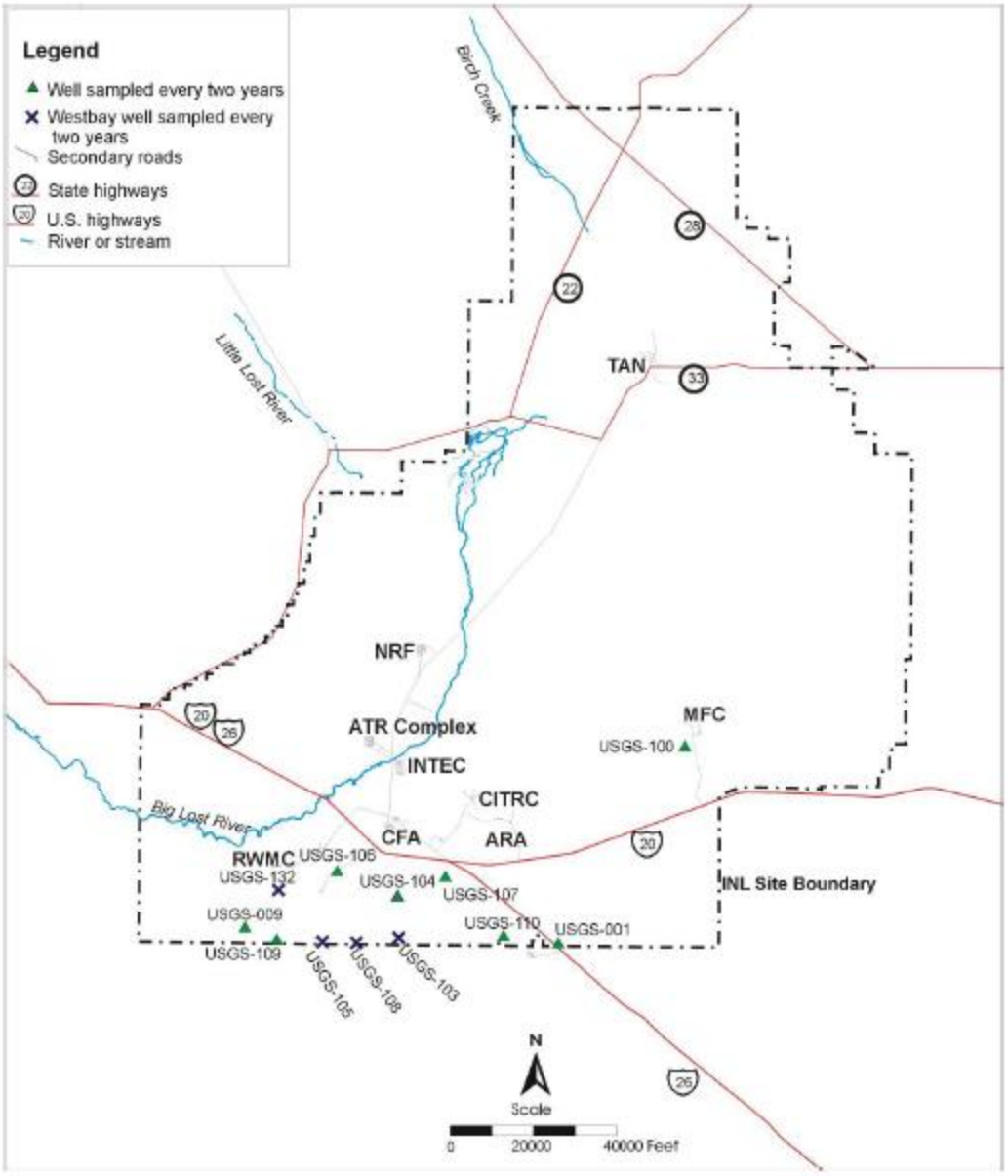
Ground water contamination not found except for diesel in 1 monitoring well

Monitoring data continues to support lack of contamination in ESRPA

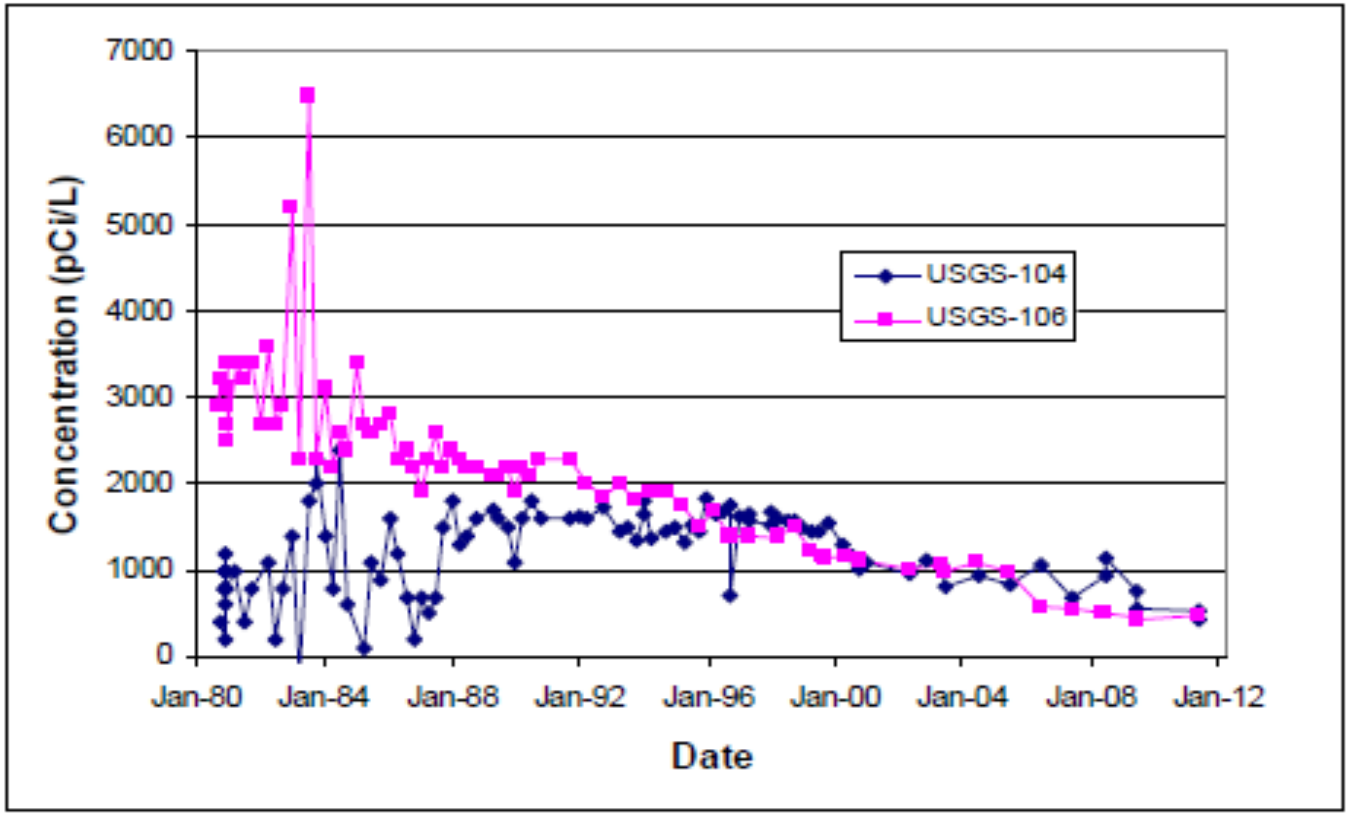
Ground Water Sampling Locations for OU 10-08

Sampling focused near southern boundary of INL

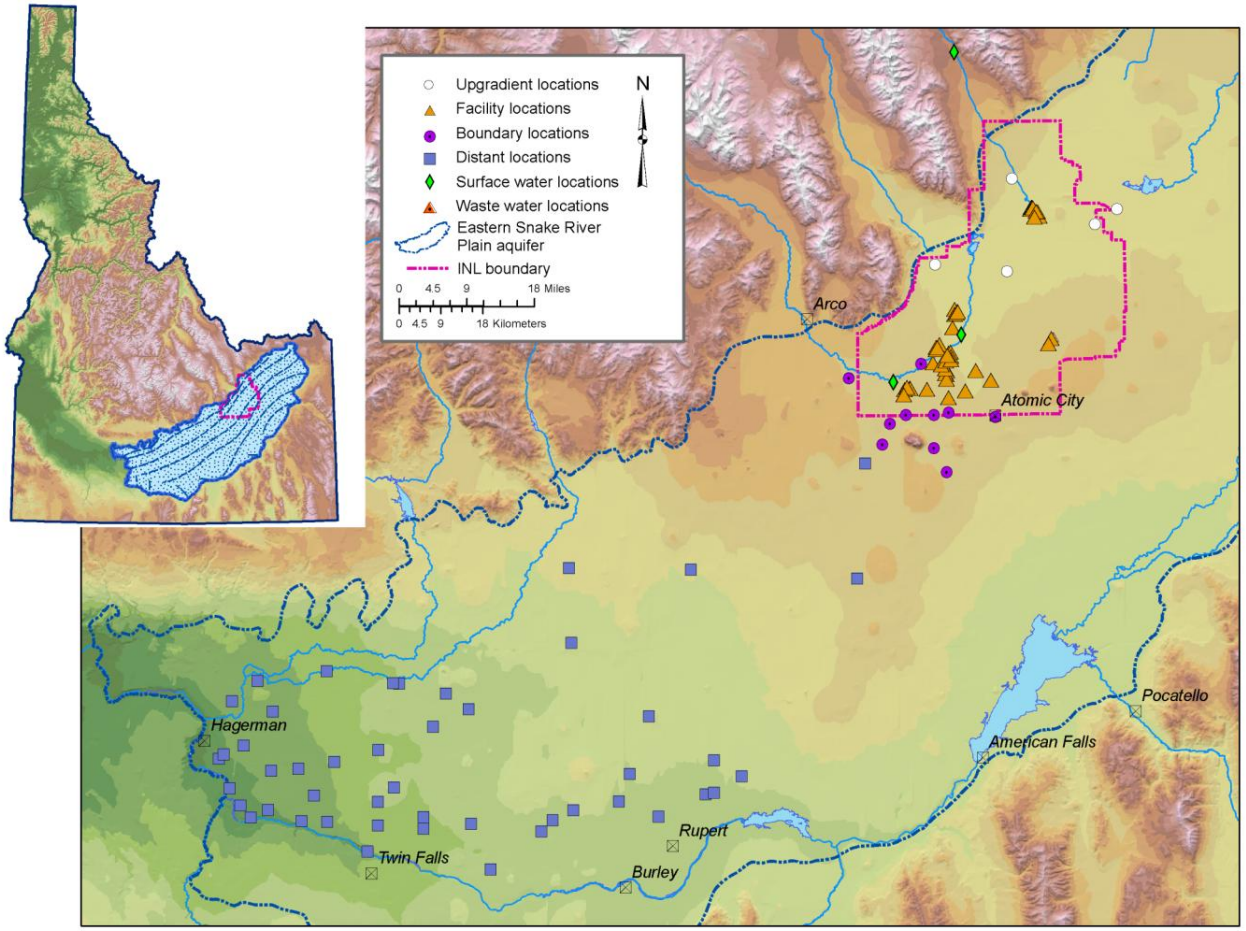
Some wells have multi-depth completions allowing depth specific sampling



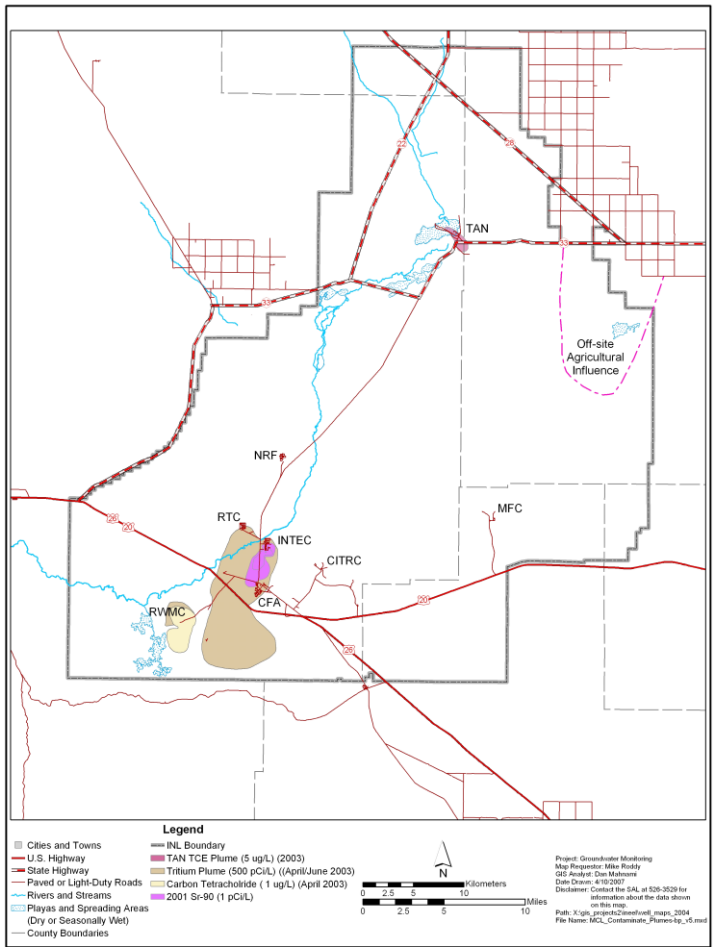
Tritium Concentrations in USGS 104 & USGS 106



Ground Water Sampling Locations by INL Oversight Program - DEQ



Overall Ground Water Plumes in the ESRPA



Summary

- Trends generally show decreasing concentrations in ground water with time
- Ongoing remediation at TAN is reducing amount of TCE in aquifer
- Ongoing remedial strategy at INTEC is to reduce loss of water from piping and managing storm water to retain Sr-90 in perched aquifer allowing for decay
- Ongoing vapor extraction and sludge removal at RWMC
- Ground water monitoring continues across the INL
- Final CERCLA remedies are not in place at INTEC or RWMC