


# INL CERCLA Overview
# Groundwater Focus

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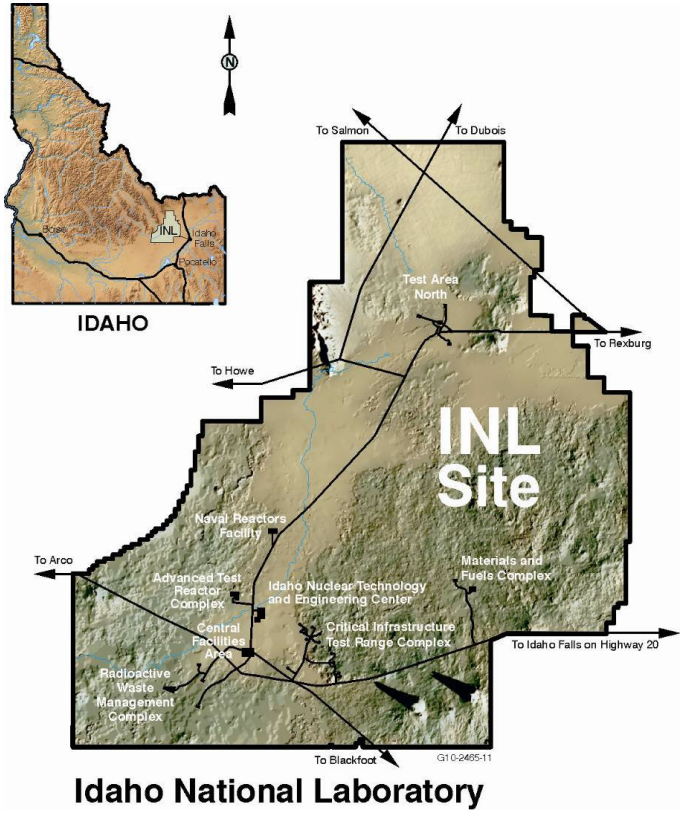
# Overview

- CERCLA Review

- Waste Area Group Overview – Groundwater Focus
  - Mission
  - Primary Groundwater Contaminants of Concern
  - History of Contamination
  - CERCLA Remedial Action Summary
  - Current Status of Remedy and Groundwater Monitoring

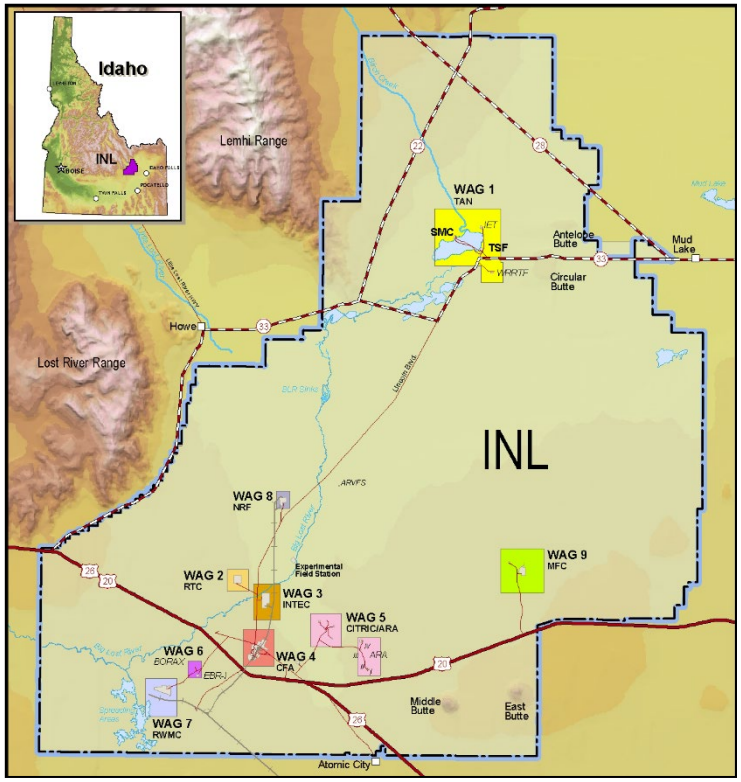
# CERCLA Review

- The INL was placed on the National Priorities List in 1989
- In December 1991, DOE, EPA, and the state of Idaho signed the Federal Facility Agreement and Consent Order (FFA/CO)
- The Idaho Cleanup Project (ICP) remediates past releases to the environment under CERCLA



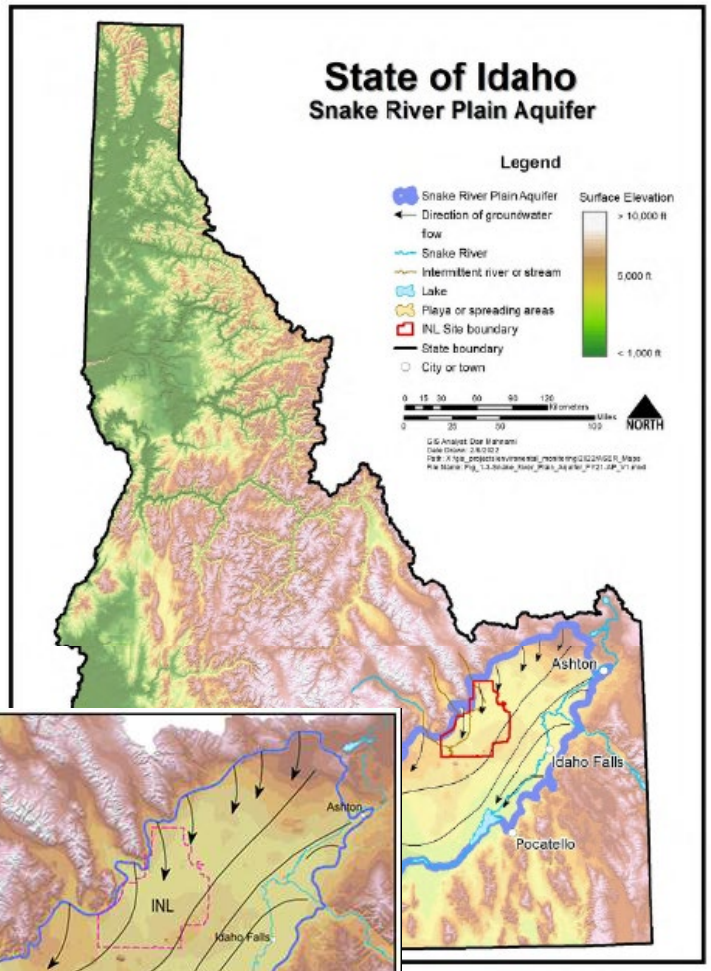
# CERCLA Review

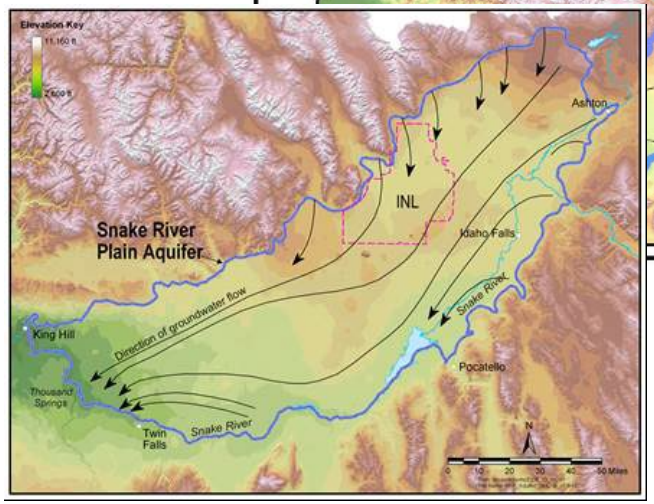
- INL is divided into 10 Waste Area Groups (WAGs)
  - WAGs 1 to 9 correspond to facilities, WAG 10 is sitewide
  - WAG 8 is managed by Naval Reactors Facility
- Each WAG has a Comprehensive Record of Decision (ROD) that addresses groundwater and soil contamination, and human and ecological risk
- Each WAG has actions to protect groundwater in the Snake River Plain Aquifer (SRPA) and restore it to MCLs within 100 years



# Snake River Plain Aquifer

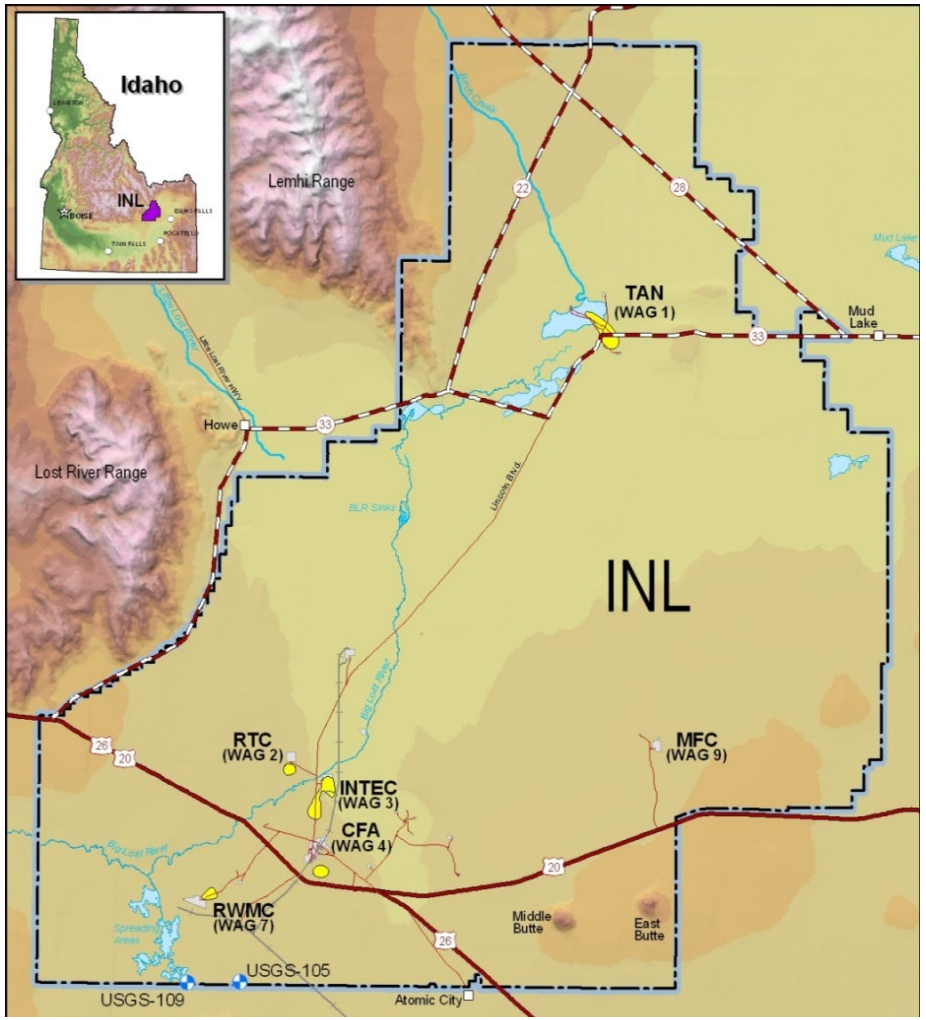
- Snake River Plain Aquifer (SRPA)
  - 28,000 square kilometers
  - Underlain by fractured basalt lava flows, sand, silt, clay and volcanic ash
  - Aquifer begins near Ashton, Idaho, and discharges to the Snake River between King Hill and the Thousand Springs area
  - Provides drinking water to @ 300,000 people
  - Contains an estimated billion acre feet of water
  - Depth to water varies from @ 200 ft in the northeast corer of the INL to 1000 ft in the southeast corner



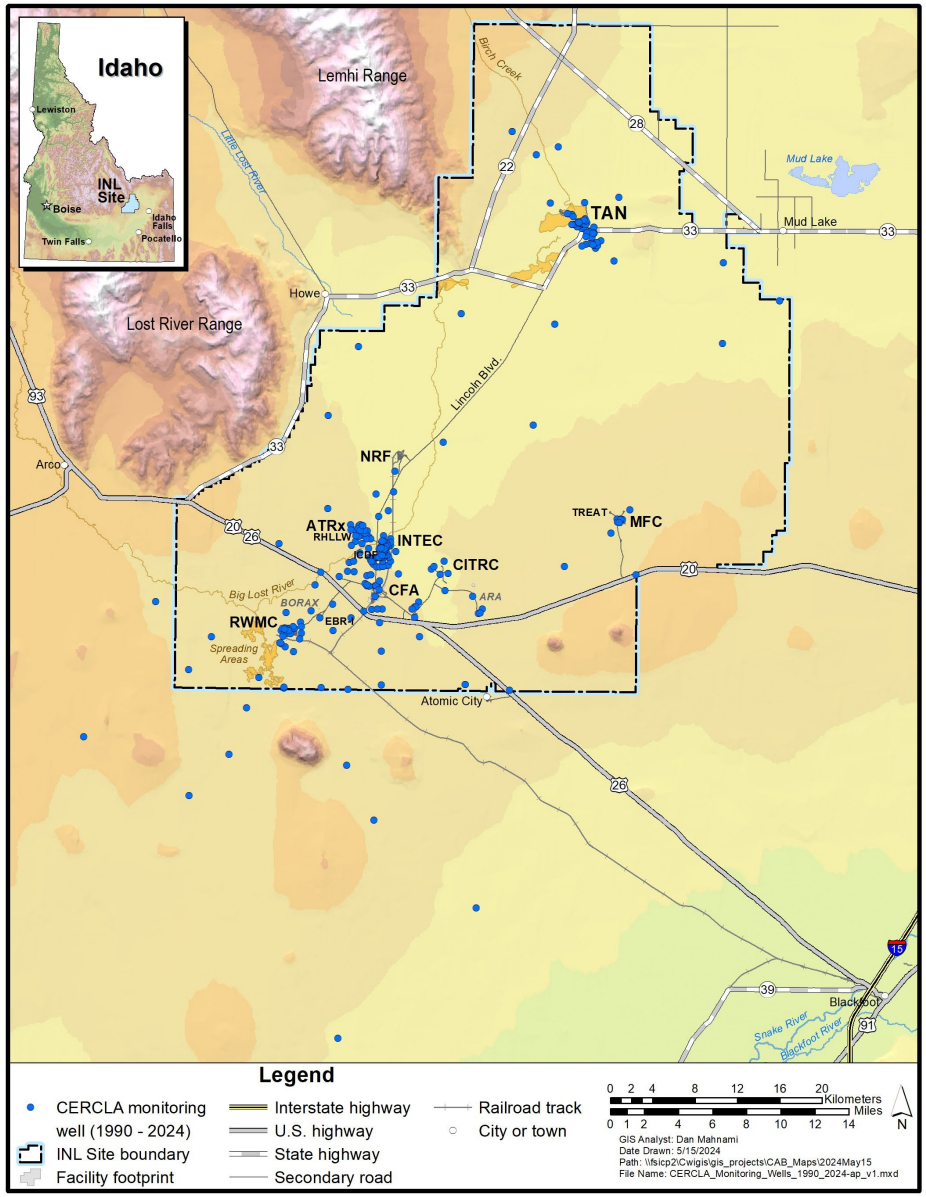
# INL Groundwater Plumes

- WAG 1 – Test Area north (TAN)
- WAG 2 – Advanced Test Reactor Complex (ATR Complex)
- WAG 3 – Idaho Nuclear Technology and Engineering Center (INTEC)
- WAG 4 – Central Facilities Area (CFA)
- WAG 7 – Radioactive Waste Management Complex (RWMC)
- WAG 10 – Site-wide – 12 monitoring wells located near MFC down to the INL southern border
- There are no significant groundwater issues at WAGs 5, 6, 8, and 9



# CERCLA Monitoring Network

- Aquifer Monitoring Network
  - 261 wells
  - 7,550 water-level measurements (1991-2024)
  - 68,394 water-quality samples collected with 471,790 records (1990-2024)
- Perched-Groundwater Monitoring Network
  - 82 wells
  - 8,832 water-level measurements (1990-2024)
  - 8,316 water-quality samples collected with 62,321 records (1990-2024)



# WAG 1 – Test Area North

- Mission
  - Developed and tested designs for nuclear-powered aircraft engines
- Primary Groundwater Contaminants of Concern
  - Volatile organic compounds (primarily Trichloroethylene (TCE)
  - Radionuclides (Strontium-90, Cesium-137)

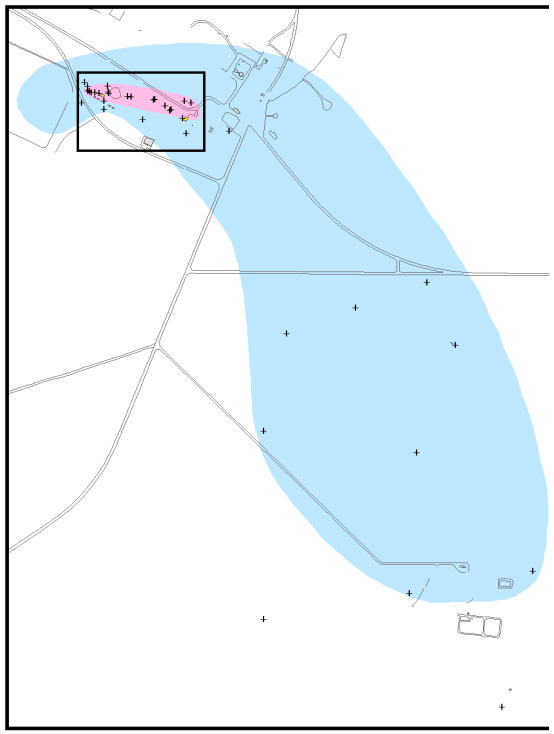


# WAG 1 – Test Area North

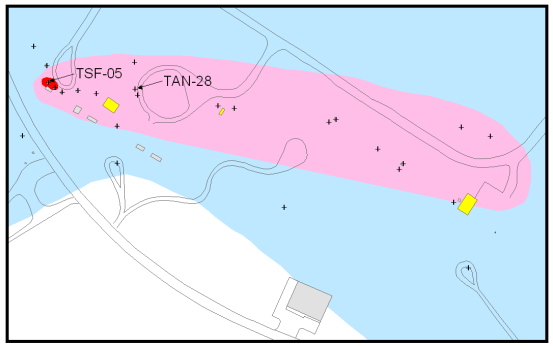
## History of Contamination

- Industrial wastewater containing solvents and radionuclides injected at TSF-05 into SRPA from 1953 to 1972
- Aquifer is in fractured basalt with contamination at ~200-400 fbgs
- Three TCE plume zones based on historical 1997 concentrations
  - Source zone (>20,000 µg/L) (TSF-05)
  - Medial zone (1,000 to 20,000 µg/L)
  - Distal zone (5 to 1,000 µg/L)





1997




**Legend**

- > 20,000 µg/L TCE
- 1,000 - 20,000 µg/L TCE
- 5 - 1,000 µg/L TCE
- Well

# WAG 1 – Test Area North

## CERCLA Remedial Actions Summary

- Three Remedy Components
  - In situ bioremediation (ISB) – Injects carbon source (electron donor), such as sodium lactate and whey, into the aquifer at the ***source* zone** to stimulate naturally occurring anaerobic microbes to degrade volatile organic compounds in aquifer
  - Pump and treat – Treats VOC concentrations in ***medial zone*** using New Pump and Treat Facility (NPTF)
  - Monitored natural attenuation (MNA) - Monitors ***distal zone*** TCE concentrations
    - Remedial action objective (RAO) is to meet cleanup levels (MCLs) by 2095
    - Plume allowed to expand by 30%

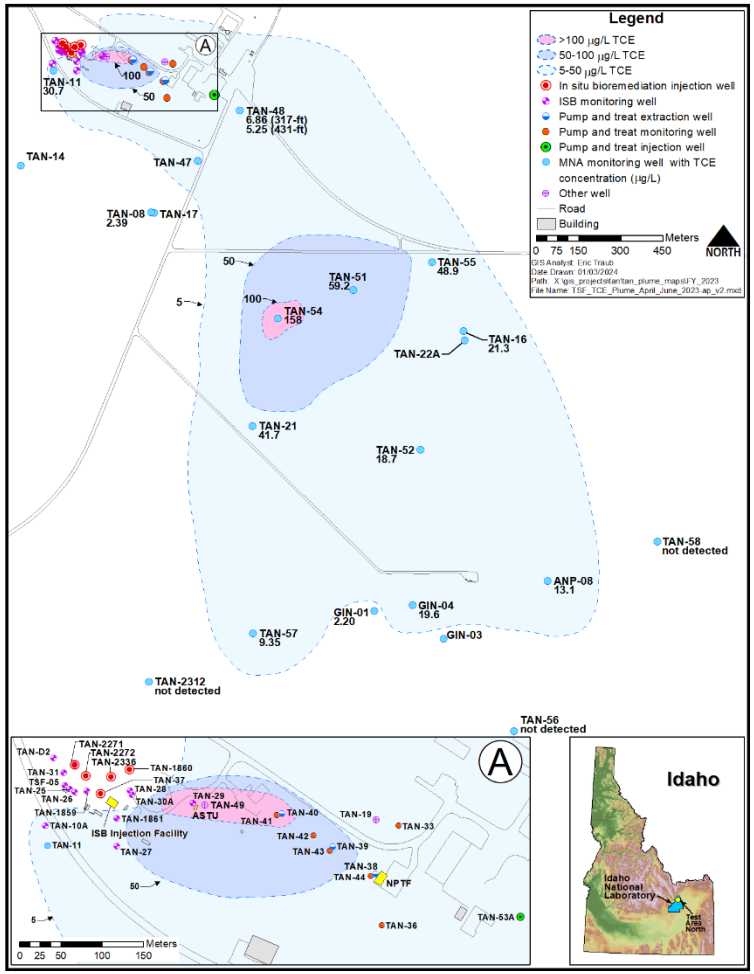




# WAG 1 – Test Area North

## Current Remedy Status

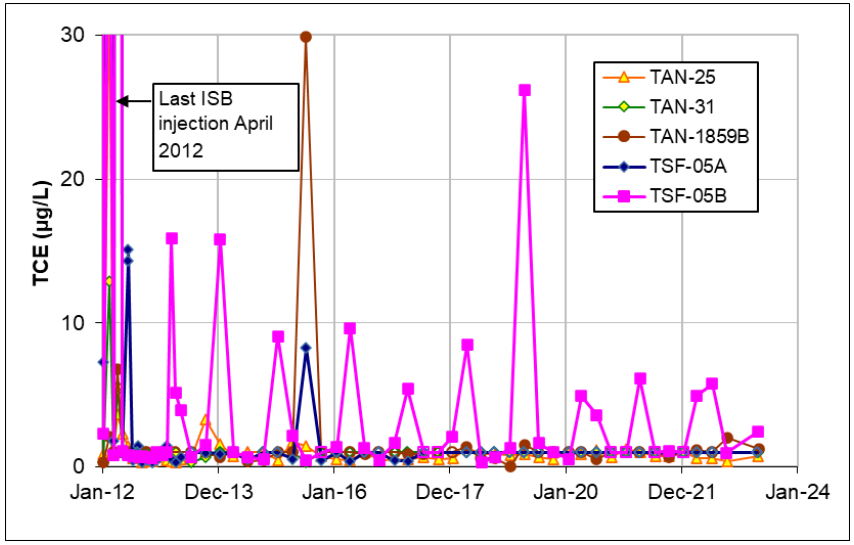
- Source Zone – Partial ISB Rebound Test around former injection well TSF-05 and ISB injections to treat TAN-28 TCE source
- Medial Zone – NPTF operates 4 days/wk to reduce flux of TCE to distal zone
- Distal Zone – MNA well trends are consistent with model simulations that predict TCE MCL will be met by 2095 and plume expansion is within the allowable 30% limit



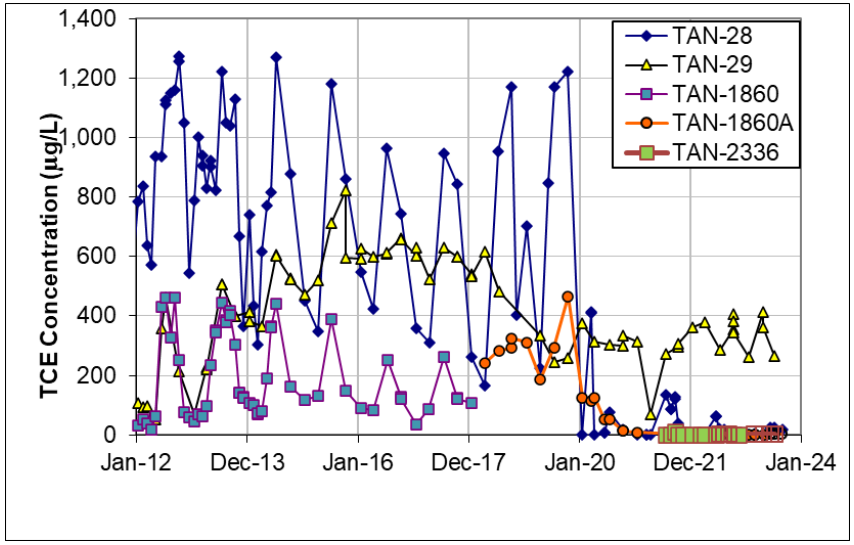
# WAG 1 – Test Area North

## Current TCE Trends

### Residual Source Zone




### TAN-28 Source Zone



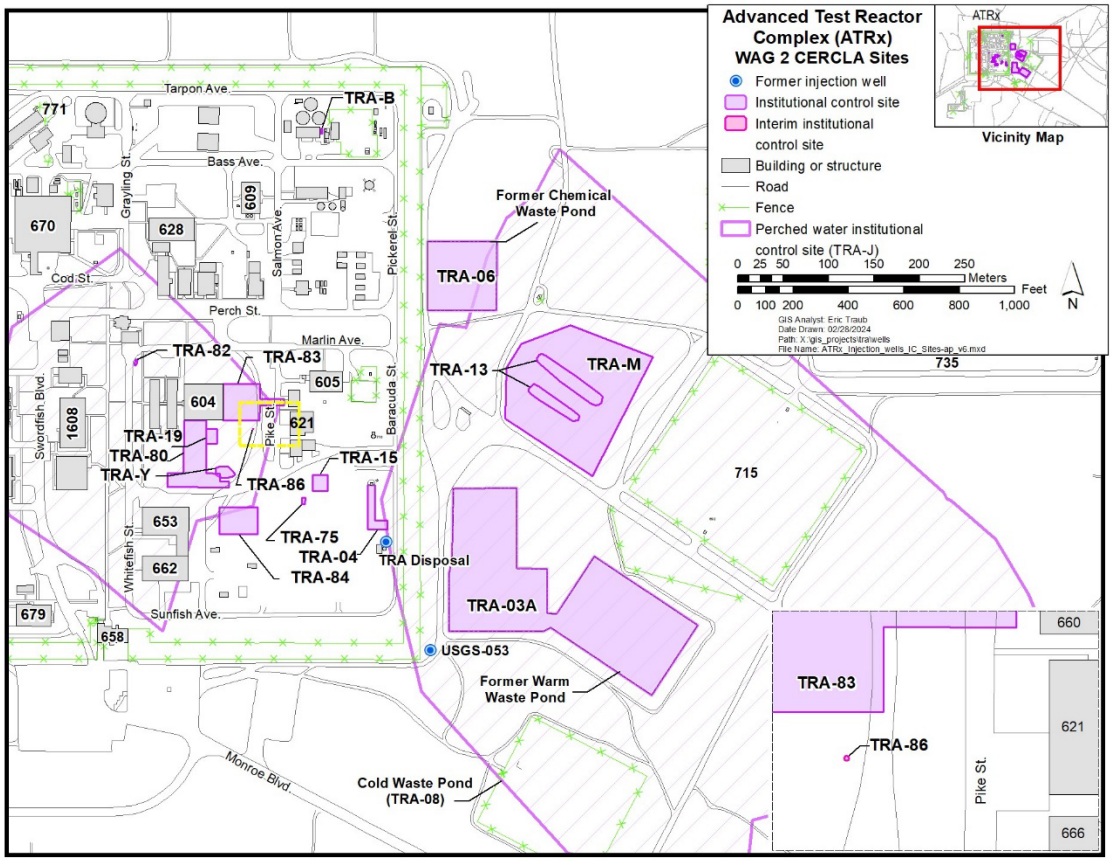
# WAG 2 – Advanced Test Reactor Complex

- Mission
  - Studied the effects of radiation on materials, fuels, and equipment
  - Operate the Advanced Test Reactor, Engineering Test Reactor, and Materials Test Reactor
  - Produced isotopes for medicine and industry, and stored spent fuel
- Primary Groundwater Contaminants of Concern
  - Groundwater – tritium (H-3), Strontium-90 (Sr-90), Chromium (Cr)



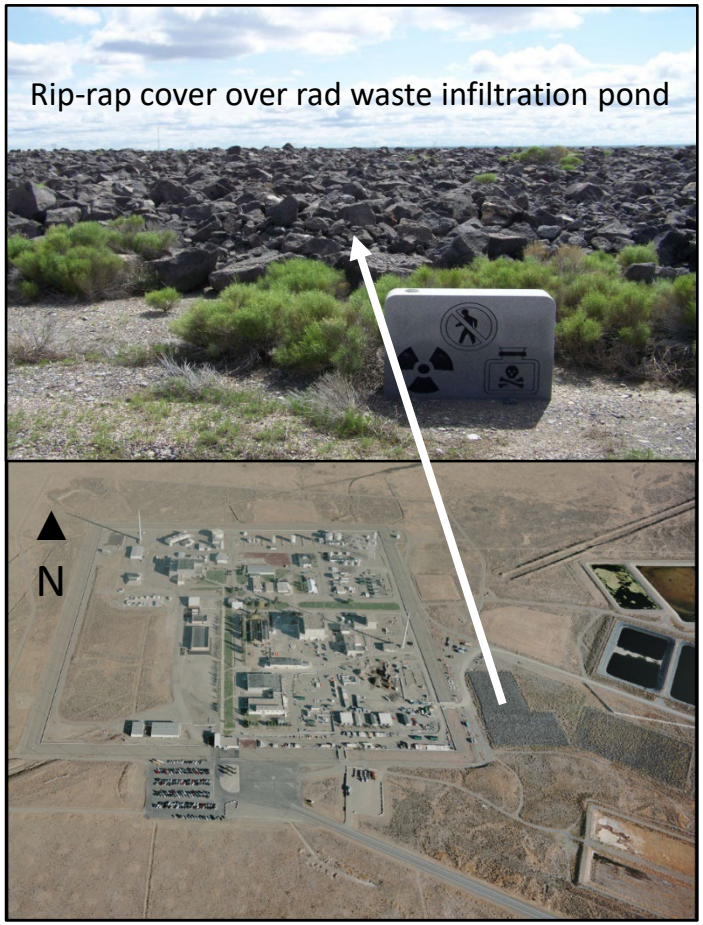
# WAG 2 – Advanced Test Reactor

- History of Contamination
  - Contaminated waste water was injected into the aquifer from the Test Reactor Area disposal well from 1964 until 1972
  - Discharges to the warm waste pond from 1952 until 1993 resulted in soil and perched water contamination



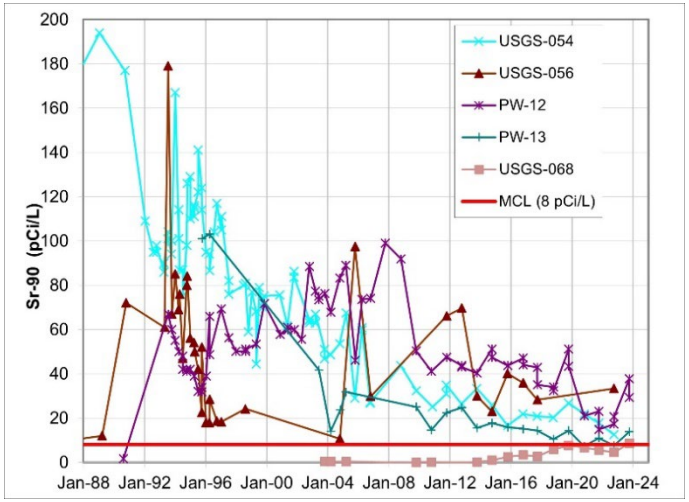
# WAG 2 – Advanced Test Reactor Complex

- CERCLA Remedial Action Summary
  - CERCLA active remediation is complete
    - Containment, rip rap covers over former infiltration ponds
- Long Term Stewardship Actions
  - Ongoing groundwater monitoring
  - Inspections of institutional control sites
  - O&M of institutional control sites

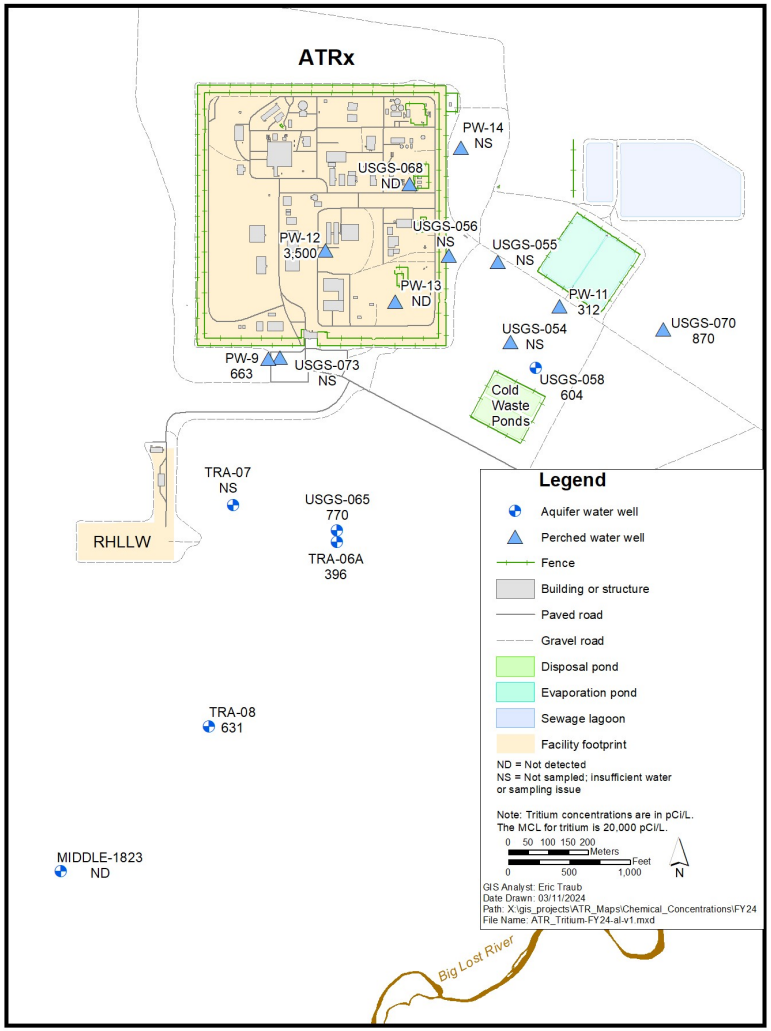


# WAG 2 – Advanced Test Reactor Complex

- Groundwater Monitoring Status
  - Aquifer wells: All COCs below MCLs and showing statistically significant declines
  - Perched aquifer wells:
    Only Sr-90 concentrations were detected above the MCL in FY 2024
  - Continue to monitor to verify contaminants in the perched zone and aquifer decline as predicted in the computer modeling



Sr-90 ATR Perched Wells



# WAG 3 – Idaho Nuclear Technology and Engineering Center

Mission

- Reprocessed spent nuclear fuels; store spent nuclear fuel in both wet and dry storage; store and treat liquid radioactive waste

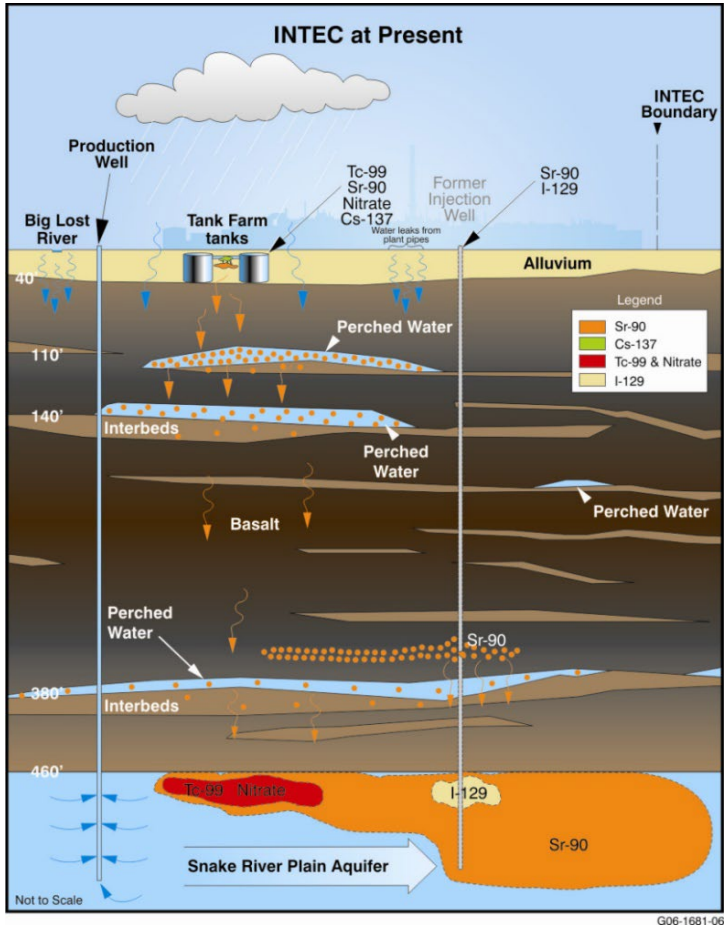
Primary Groundwater Contaminants of Concern

- nitrate, strontium-90 (Sr-90) , technicium-99 (Tc-99), Iodine-129 (I-129)

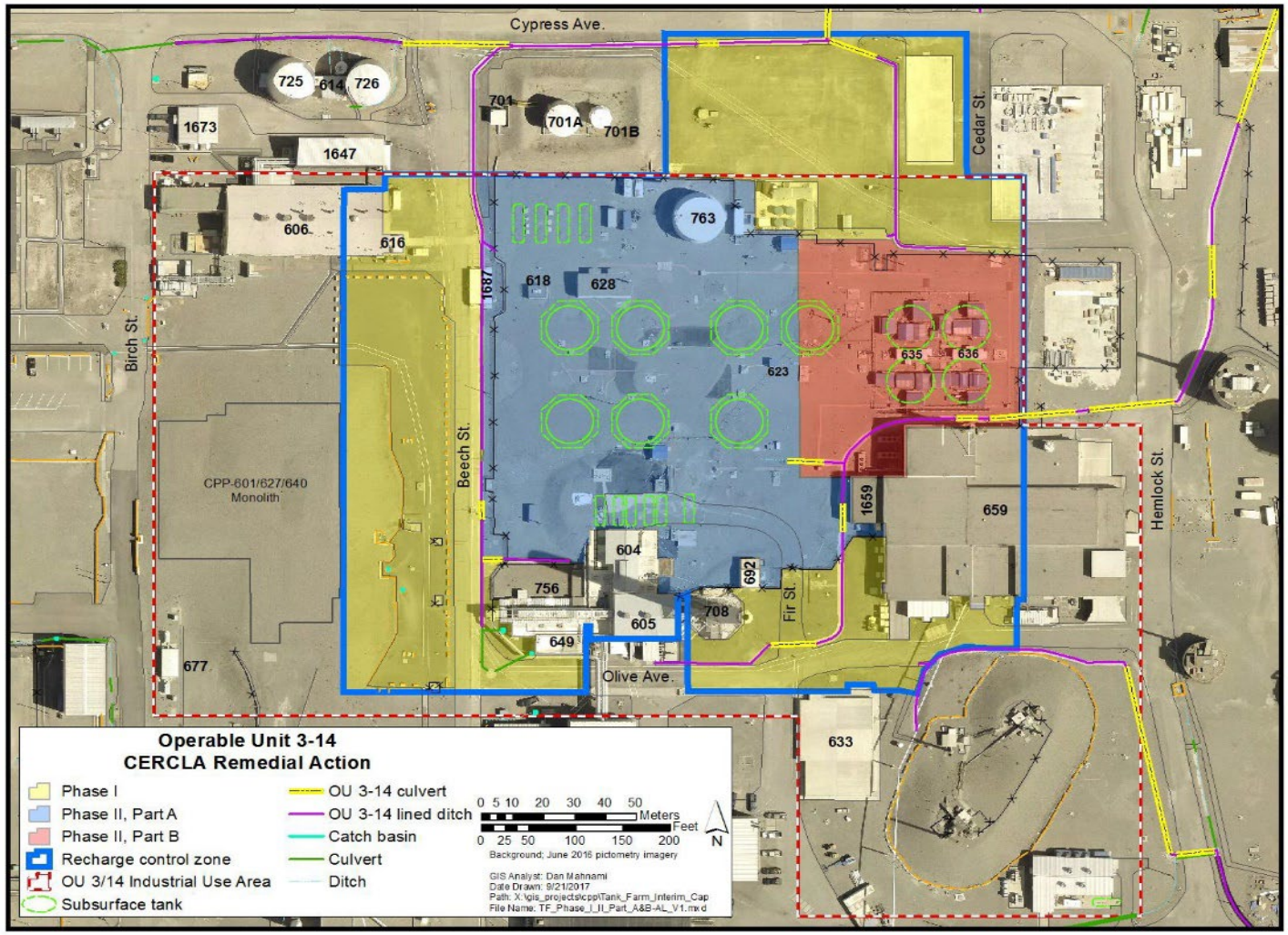


# WAG 3 – Idaho Nuclear Technology & Engineering Center

- History of Contamination
  - Former INTEC injection well contaminated aquifer from 1952 - 1984
  - Tank farm releases contaminated soil, perched water and the aquifer
- CERCLA Remedial Actions Summary
  - Three phase remedy components
    - Phase I - Implement recharge controls to reduce infiltration and migration of Sr-90 to aquifer **(completed)**
    - Phase II - Install low permeability pavement over tank farm to reduce infiltration **(partially complete)**
    - Phase III - Install evapotraspiration cap over tank farm to reduce infiltration

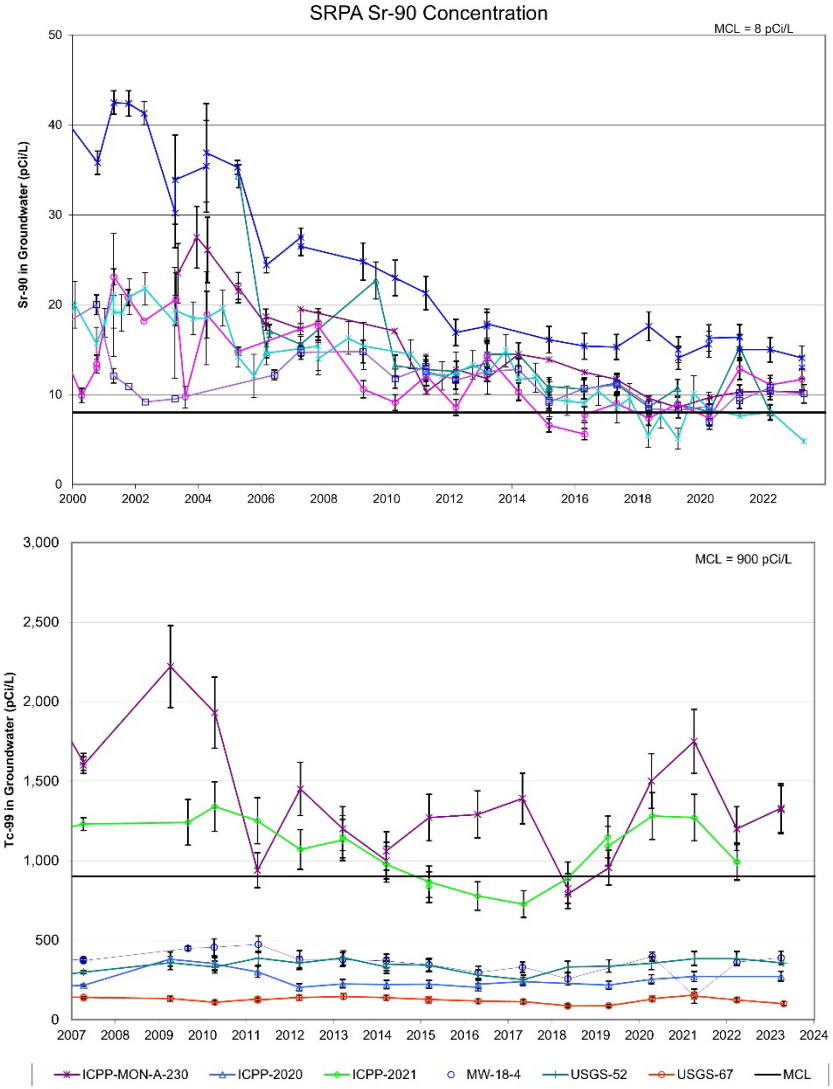


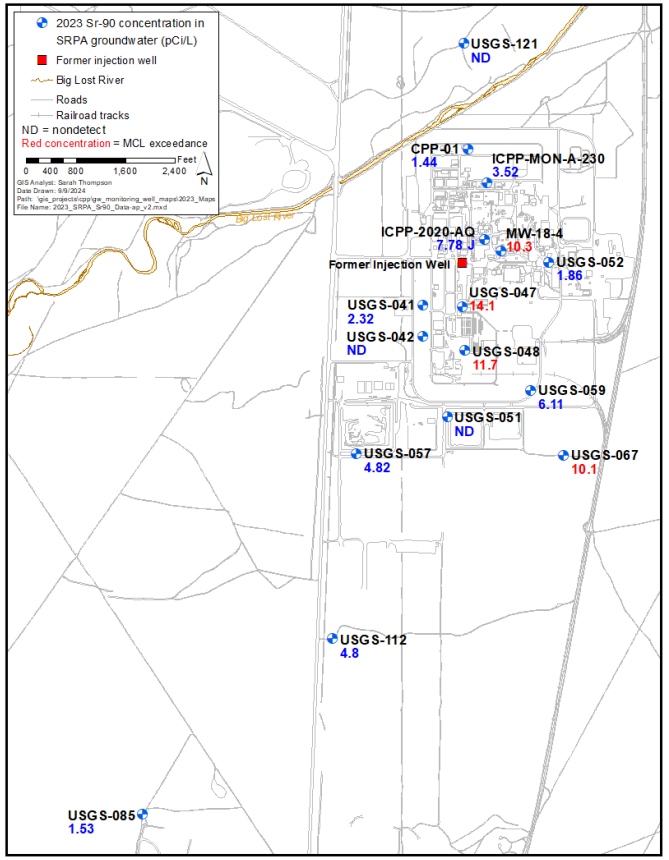
# WAG 3 – Idaho Nuclear Technology & Engineering Center



# WAG 3 – Idaho Nuclear Technology & Engineering Center

- Groundwater Monitoring Status




FY 2023 aquifer samples:

- Sr-90 and Tc-99 exceeded the MCLs
- H-3 and I-129 results were non-detect or below MCLs

# WAG 4 – Central Facilities Area

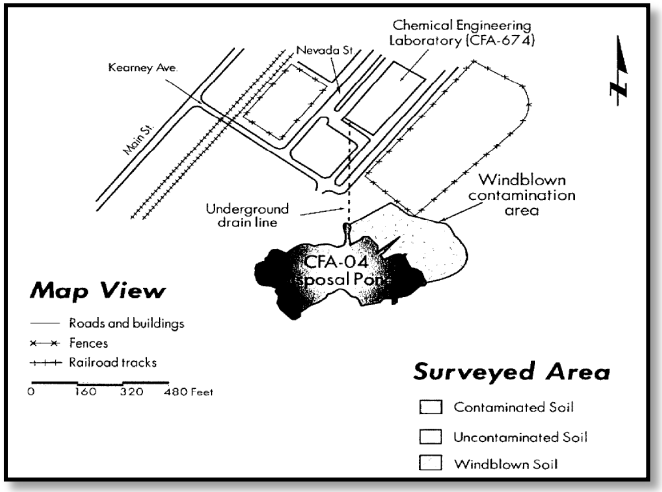
- Mission
  - Originally housed U.S. Navy gunnery range personnel
  - Landfill disposal of non-hazardous commercial industrial waste
  - Provide centralized support (fire, medical, etc) for the INL
- Primary Groundwater Contaminants of Concern
  - Nitrate



# WAG 4 – Central Facilities Area

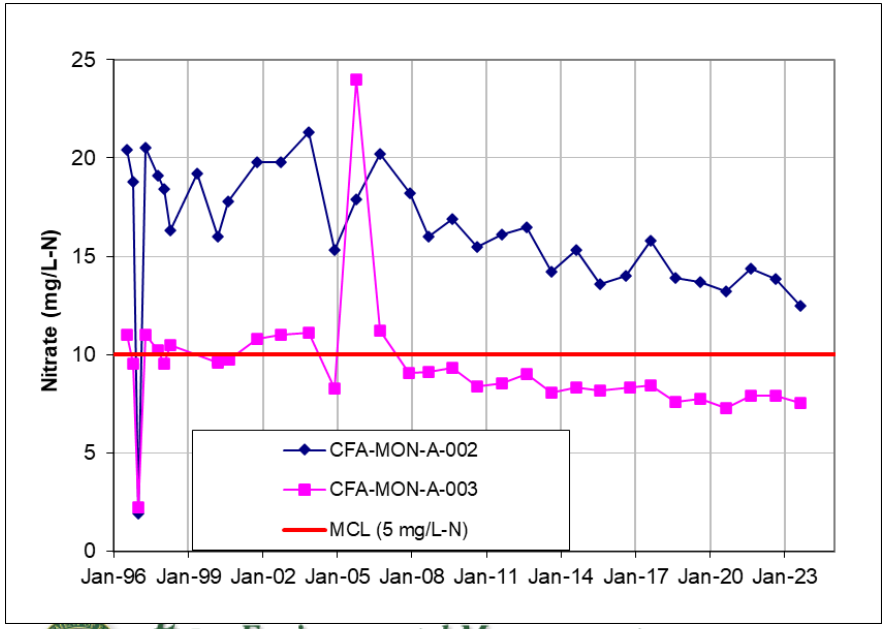
- History of Contamination
  - Landfills used for disposal of industrial waste
  - Nitrate in aquifer originated from the CFA-04 Pond which received waste from the CFA Chemical Engineering laboratory from 1953 to 1965
- CERCLA Remedial Action Summary
  - All active remediation is complete
  - Ongoing inspections of institutional control sites
  - Ongoing O&M of institutional control sites
  - Ongoing groundwater monitoring

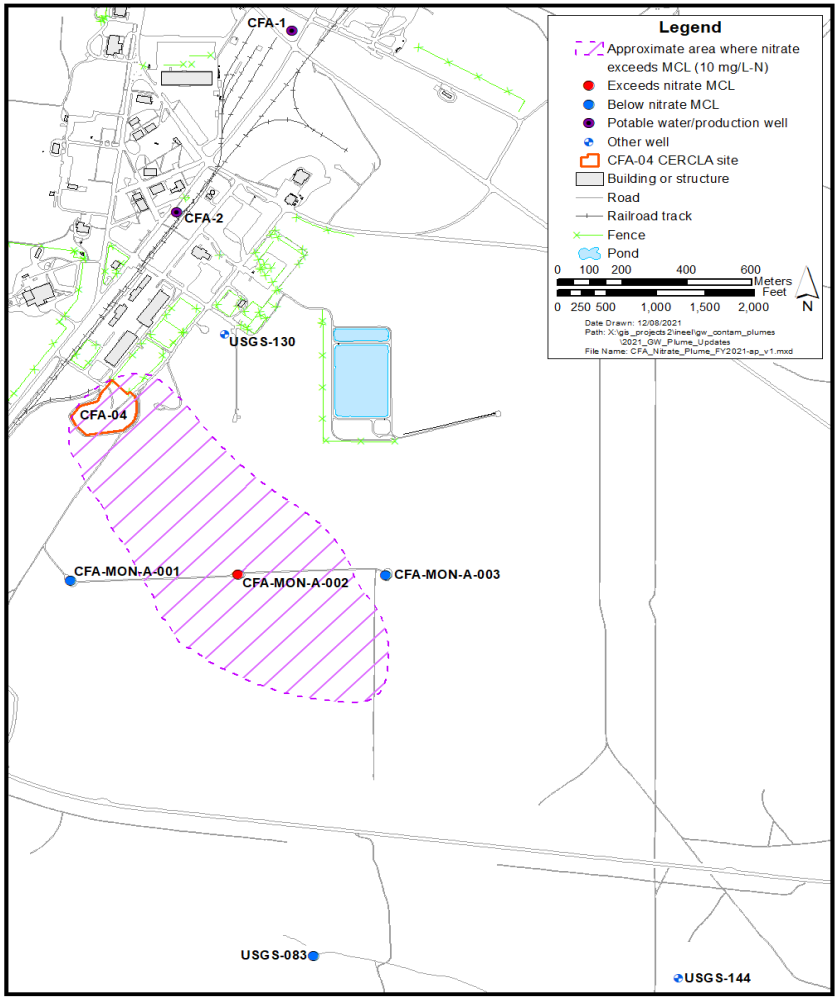


# WAG 4 – Central Facilities Area

- Groundwater Monitoring Summary
  - Monitor groundwater south of CFA until nitrate levels fall below the 10-mg/L MCL
  - Groundwater is monitored from four wells south of CFA-04 (nitrate source)
  - One well exceeds MCL



# WAG 7 – Radioactive Waste Management Complex

## Mission

- Historical disposal of radioactive and hazardous waste
- Retrieved targeted transuranic waste in the Subsurface Disposal Area (SDA)
- Ongoing characterization, packaging, and shipment of waste for offsite disposal



## History of Contamination

- Waste buried in the Subsurface Disposal Area was originally generated during nuclear weapons production at the former Rocky Flats Plant near Denver and was buried at the INL site from 1954 – 1970




## Primary Contaminants of Concern

- Carbon tetrachloride (CCl4), tetrachloroethene (PCE), trichloroethylene (TCE), and methylene chloride (CH2Cl2), iodine-129 (I-129), technetium-99 (Tc-99), and Nitrate

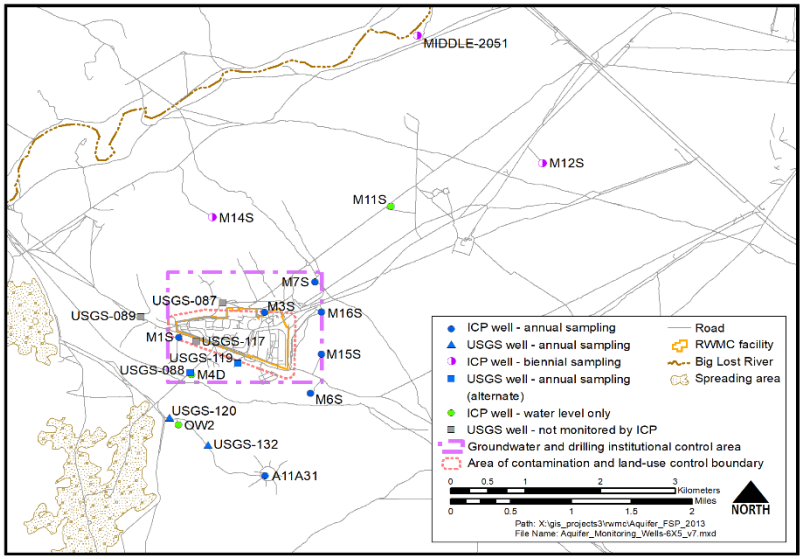
# WAG 7 – Radioactive Waste Management Complex

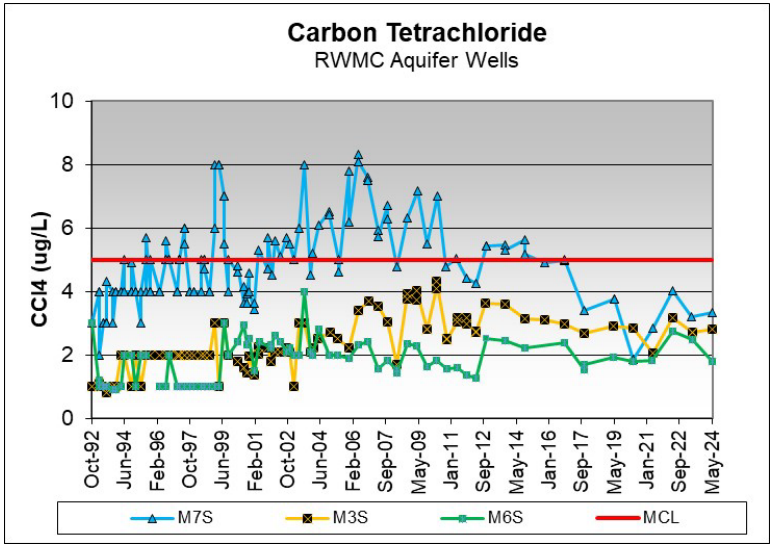
- CERCLA Remedial Actions Summary
- Three phase remedy components
  - Phase 1 – Vapor vacuum extraction of VOCs; exhumation (5.69 acres) of targeted waste in SDA **(completed)**
  - Phase 2 – In situ grouting of beryllium blocks to reduce mobility of C-14 and Tc-99 **(completed)**
  - Phase 3 – Evapotranspiration (ET) barrier over the SDA to reduce infiltration/protect aquifer; long-term monitoring and maintenance **(ongoing)**

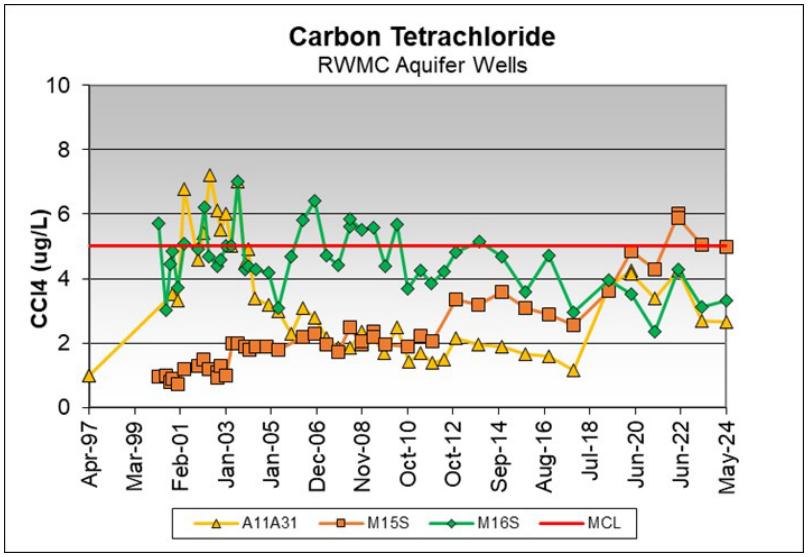


# WAG 7 – Radioactive Waste Management Complex

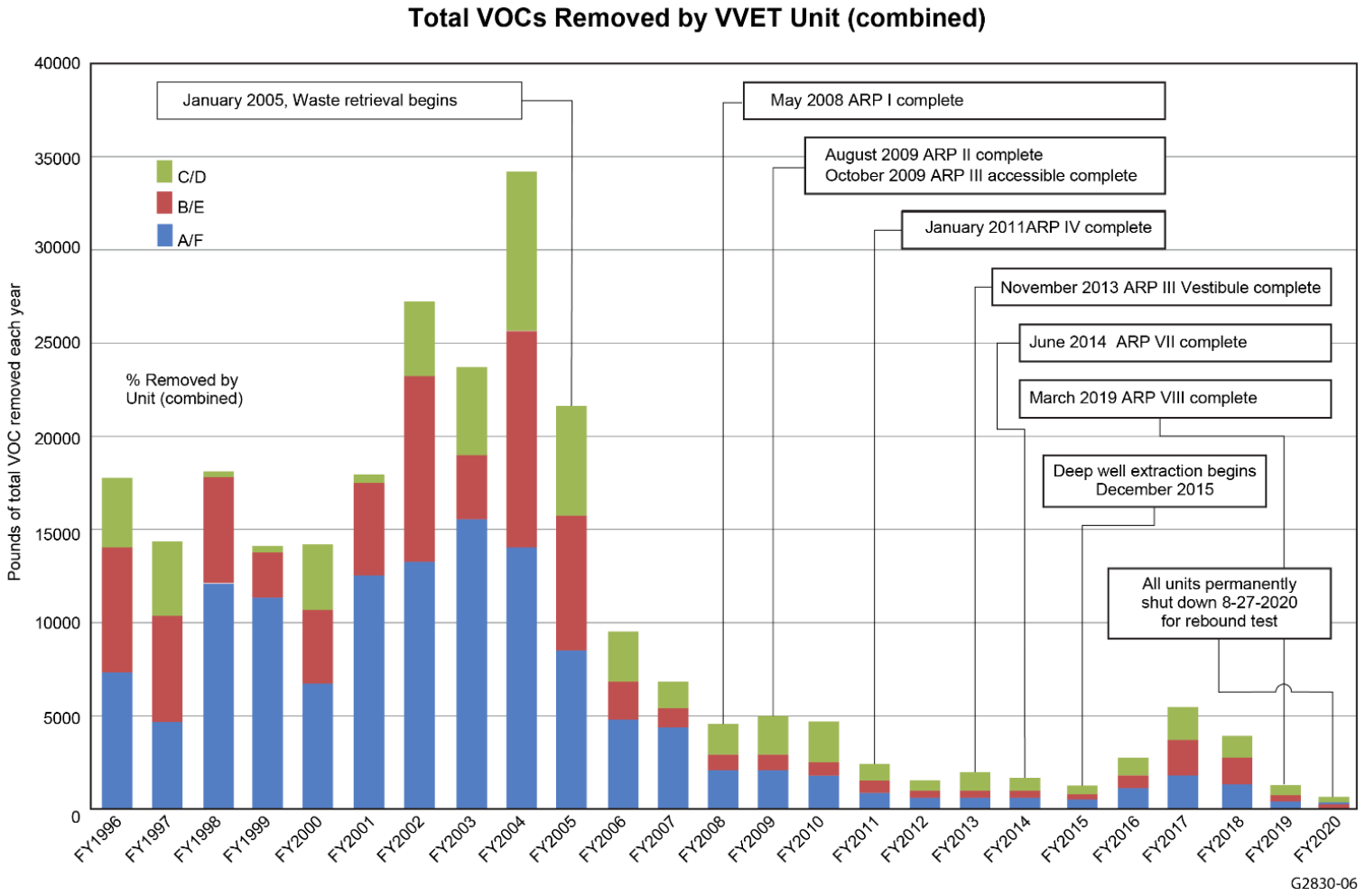
- Groundwater Monitoring Summary
  - Carbon tetrachloride is the only contaminant that recently exceeded its MCL (5µg/L); the MCL was exceeded in Well M15S in 2022 at 6 µg/L but has since declined below MCL



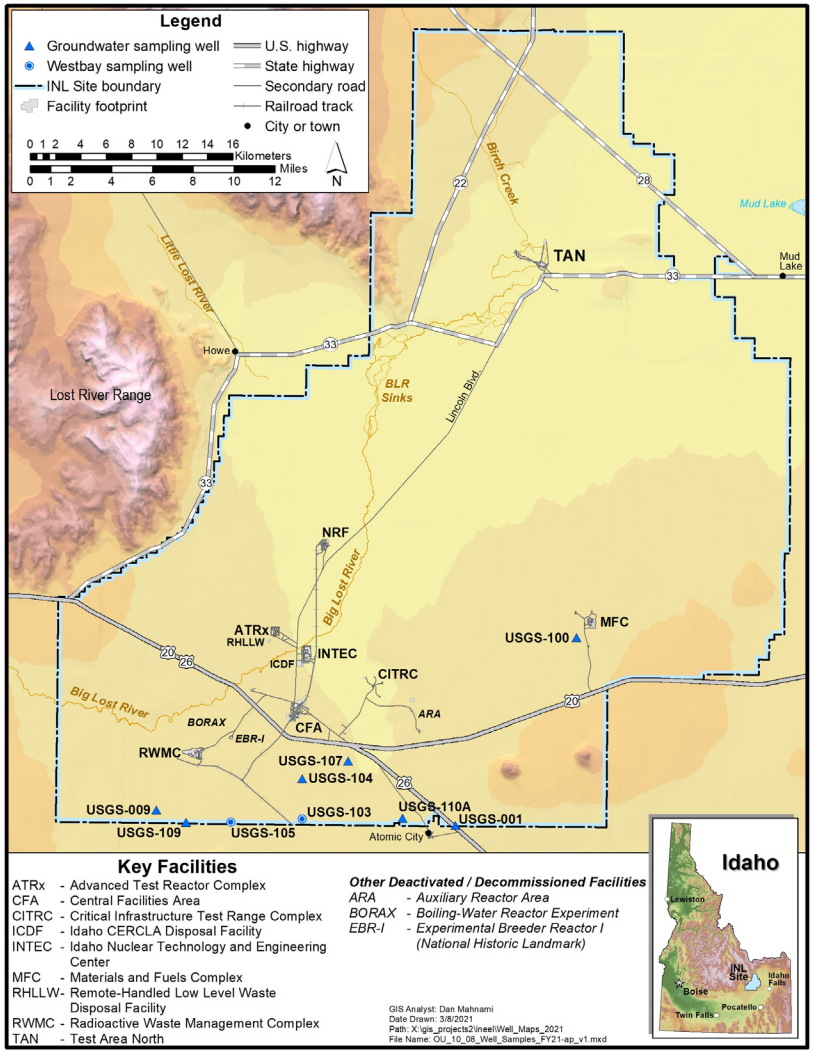



# Vapor Vacuum Extraction



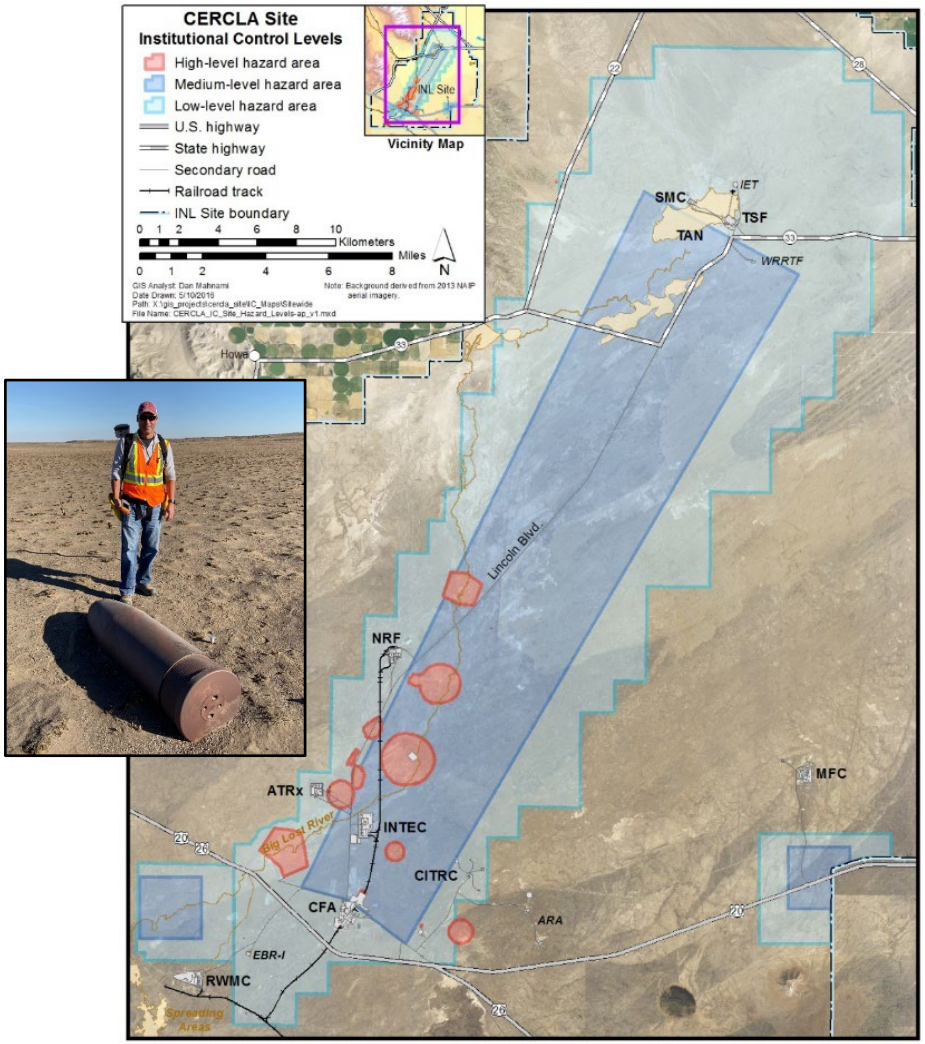
# WAG 10 – Aquifer and Miscellaneous Sites

- Mission
  - Aquifer monitoring across the entire INL site and at site boundary to ensure groundwater leaving the INL meets drinking water standards
  - Evaluation and remediation of miscellaneous sites arising from the new site identification process
  - Long Term Stewardship activities
- Groundwater Contaminants monitored
  - VOCs, nitrate, chloride, sulfate, gross alpha, gross beta, Sr-90, I-129, Tc-99



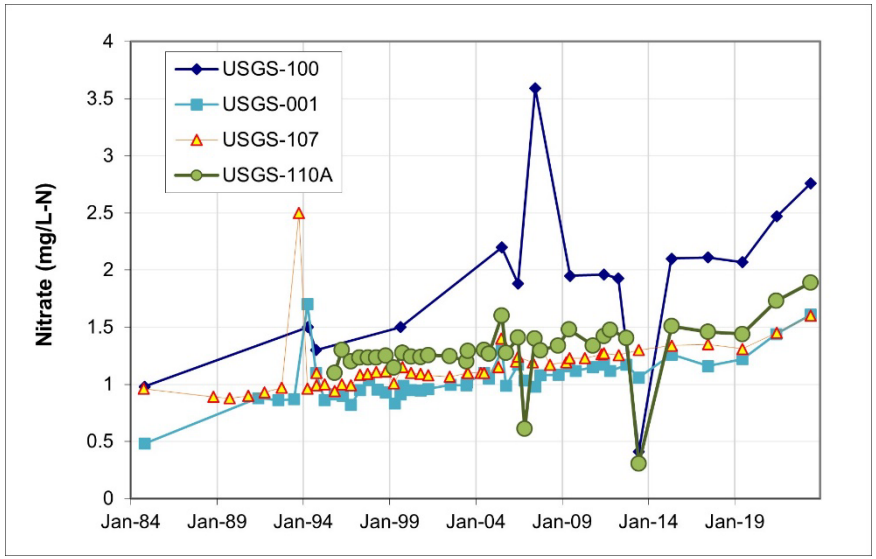
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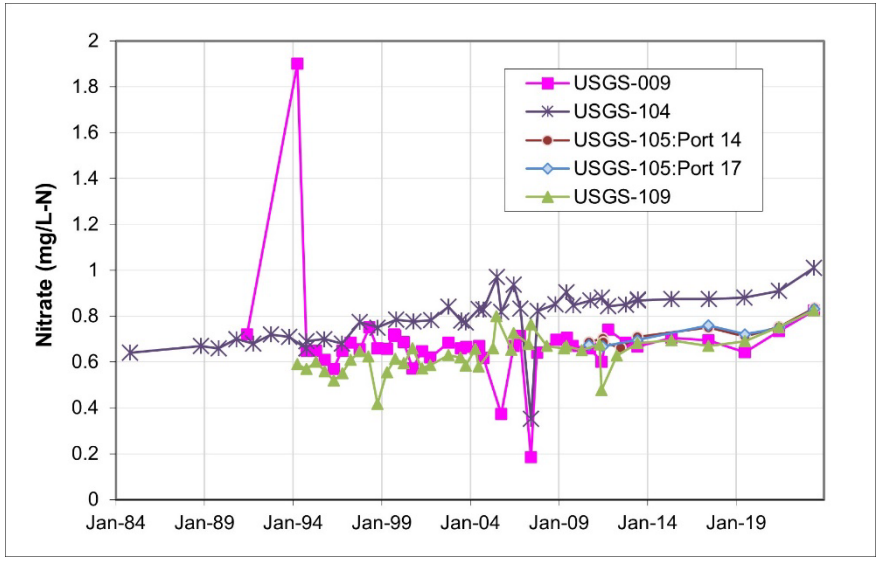
- CERCLA Remedial Actions Summary
- Completed Remedial Actions
  - Munitions and Explosives of Concern remediation
- Active Remedial Actions
  - Continue cleanup of discovered ordnance
  - Evaluate contamination at newly identified sites
  - Groundwater monitoring
  - Implementation of LTS functions



# WAG 10 – Aquifer and Miscellaneous Sites

- Groundwater Monitoring Summary
  - Groundwater leaving the INL Site meets drinking water standards for all analytes
  - Long-term groundwater monitoring will ensure continued protection of off-Site residents and the environment.
  - Aquifer contaminant concentrations on the INL Site are expected to decrease over time due to cleanup actions at other WAGs



# CERCLA Reporting

- INL CERCLA Groundwater Monitoring Reports
  - Annual Monitoring Reports (WAGs 1, 2, 3, 4, 7)
  - Biennial Monitoring Report (WAG 10)
  - Publicly available on the Administrative Record and Information Repository ARIR Home - ARIR (idahoenvironmental.com)

# Acronyms

| | |
|---|---|
| Am | americium |
| ATR | Advanced Test Reactor (Complex) |
| C | carbon |
| $CCl_4$ | carbon tetrachloride |
| $CH_2Cl_2$ | methylene chloride |
| CFA | Central Facilities Area |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| Cr | chromium |
| Cs | cesium |
| CWI | CH2M-WG Idaho, LLC |
| DCE | dichloroethene |
| DOE | Department of Energy |
| EPA | Environmental Protection Agency |
| ER | Environmental Restoration |
| FFA/CO | Federal Facility Agreement and Consent Order |
| FY | fiscal year |
| H-3 | tritium |
| Hg | mercury |
| I | iodine |
| ICP | Idaho Cleanup Project |
| INTEC | Idaho Nuclear Technology and Engineering Center |
| ISB | in situ bioremediation |
| INL | Idaho National Laboratory |
| MCL | maximum contaminant level |
| MNA | monitored natural attenuation |
| NPTF | New Pump and Treat Facility |
| OU | operable unit |
| PCE | petrachloroethylene |
| pCi/L | picocurie per liter |
| Pu | plutonium |
| RI | remedial investigation |
| ROD | record of decision |
| RWMC | Radioactive Waste Management Complex |
| SRPA | Snake River Plain Aquifer |
| Sr | strontium |
| TAN | Test Area North |
| Tc | technetium |
| TCE | trichloroethylene |
| µg/L | micrograms per liter |
| VC | vinyl chlorine |
| VOC | volatile organic compound |
| WAG | waste area group |