
Idaho Cleanup Project Test Area North Project Review

**Nicole Hernandez
Department of Energy
Idaho Operations Office**

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Operable Unit 1-07B Background

- An injection well at Test Area North, used from 1953 to 1972, contaminated the aquifer with solvents (Trichloroethene-TCE), low-level radioactive wastes, and sanitary sewage.
- Aquifer contamination was discovered in 1987
- TCE plume is nearly 2 miles long.



Initial Actions for Tan Groundwater

- 1987 – low levels of TCE, PCE found in TAN drinking water
- Air sparger installed to protect TAN workers
- January/February 1990 – lower 55 feet of sludge removed from TSF-05



Cleanup Levels—Volatile Organic Compounds

Contaminant of Concern	Maximum Historical Concentration (µg/L)	Cleanup Goal (µg/L)
Trichloroethene (TCE)	12,000–32,000	5
Tetrachloroethene (PCE)	110	5
<i>cis</i> -1,2- dichloroethene	3,200–7,500	70
<i>trans</i> -1,2- dichloroethene	1,300–3,900	100



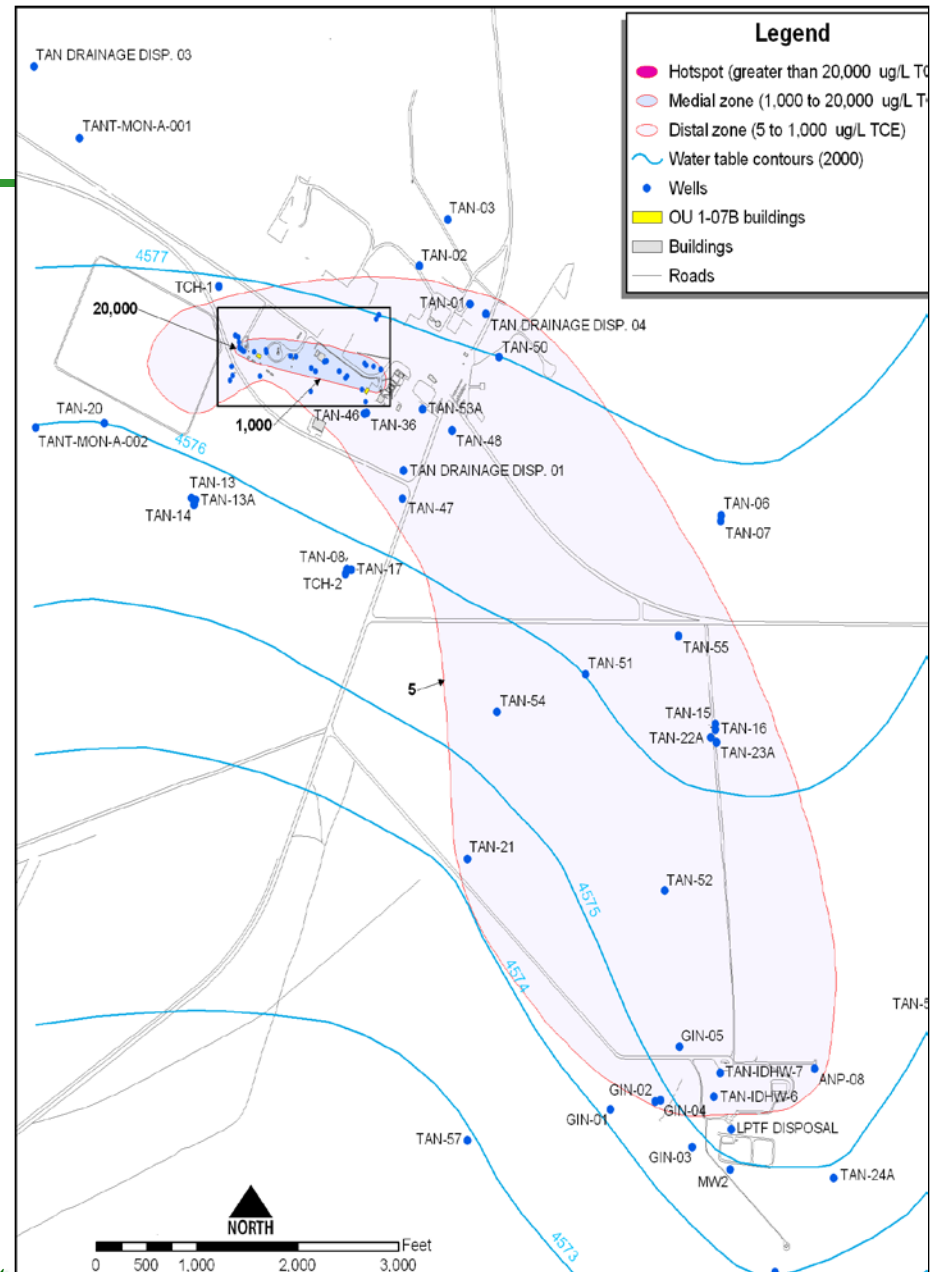
Cleanup Levels—Radionuclides

Contaminant of Concern	Maximum Historical Concentration (pCi/L)	Cleanup Goal (pCi/L)
Tritium	14,900–15,300	20,000
Strontium-90	530–1,880	8
Cesium-137	1,600–2,150	119
Uranium-234	5.2–7.7	27



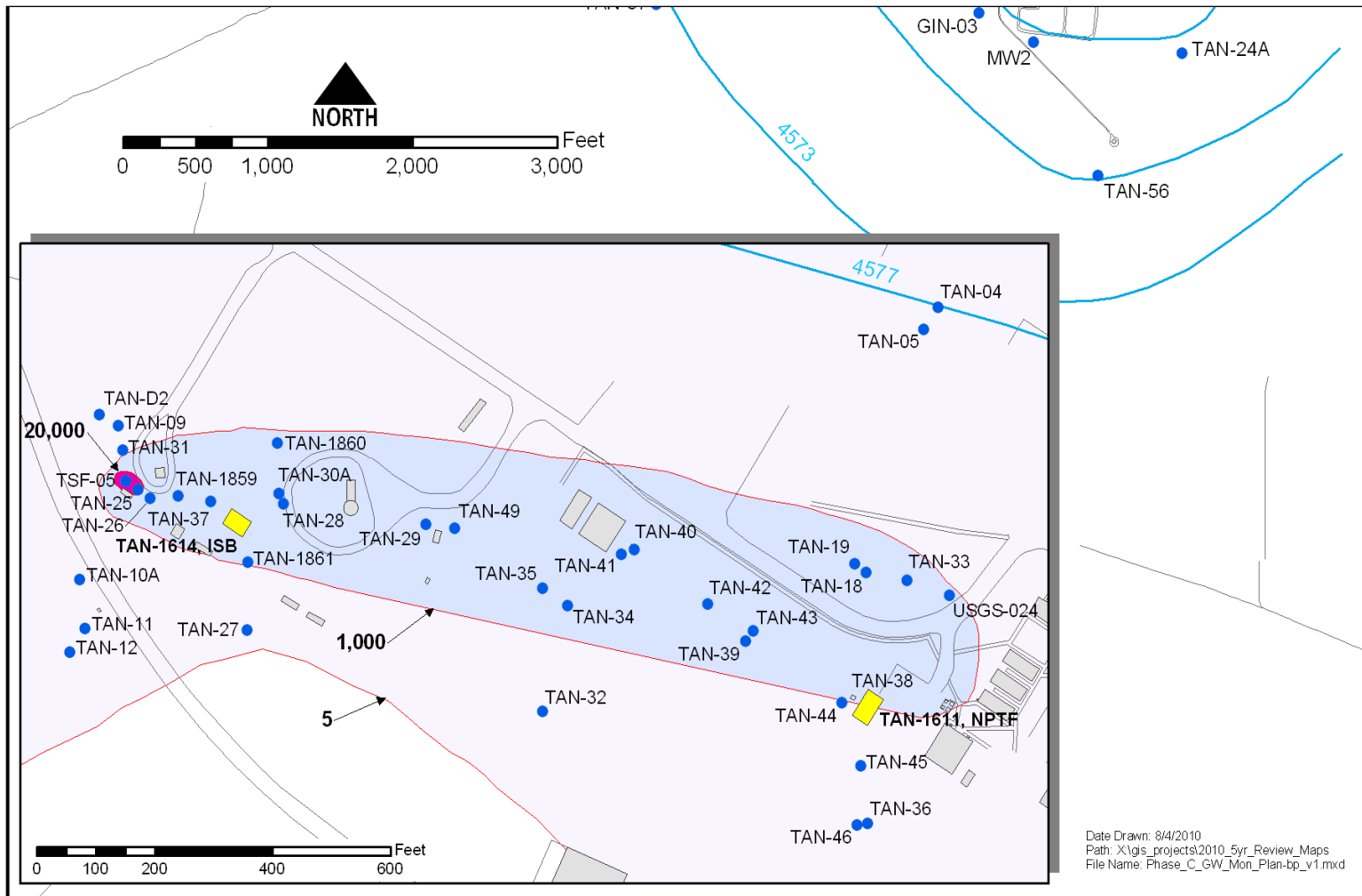
1997 Explanation of Significant Differences

- The plume is subdivided into three zones based on trichloroethene concentrations in 1997:
 1. Hot spot ($>20,000$ ug/L)
 2. Medial zone (1,000 to 20,000 ug/L)
 3. Distal zone (5 to 1,000 ug/L)
- Remedial timeframe 100 years (2095)



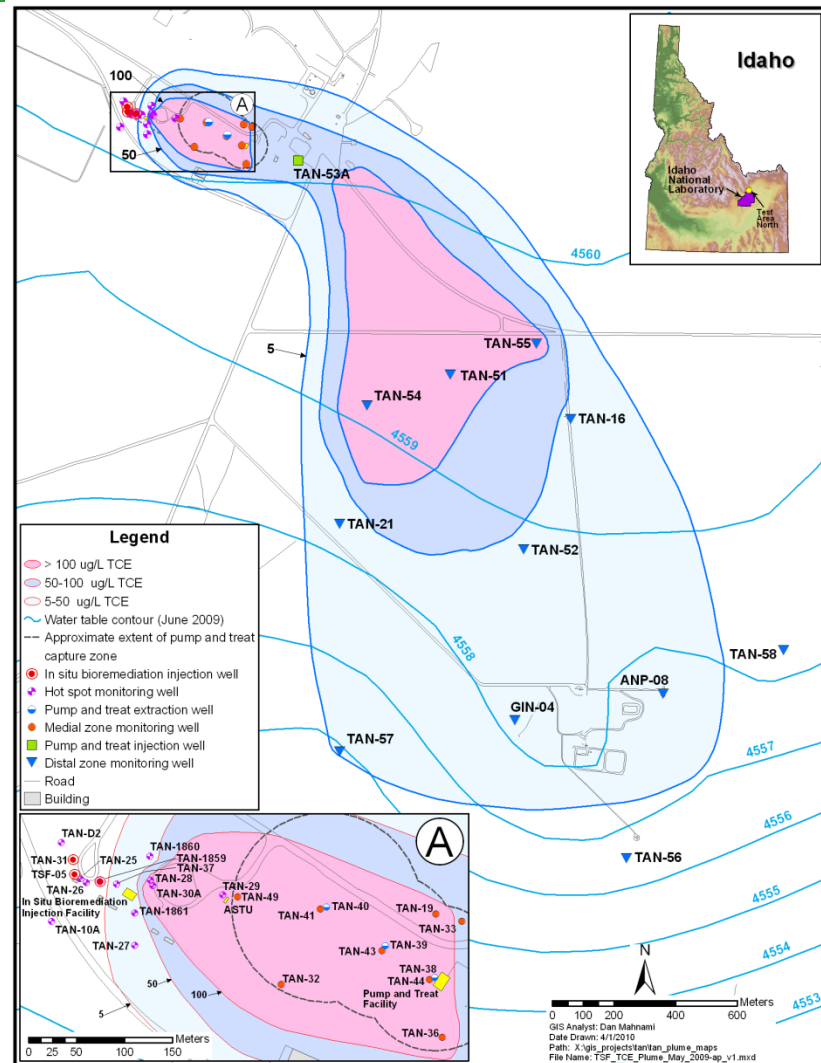
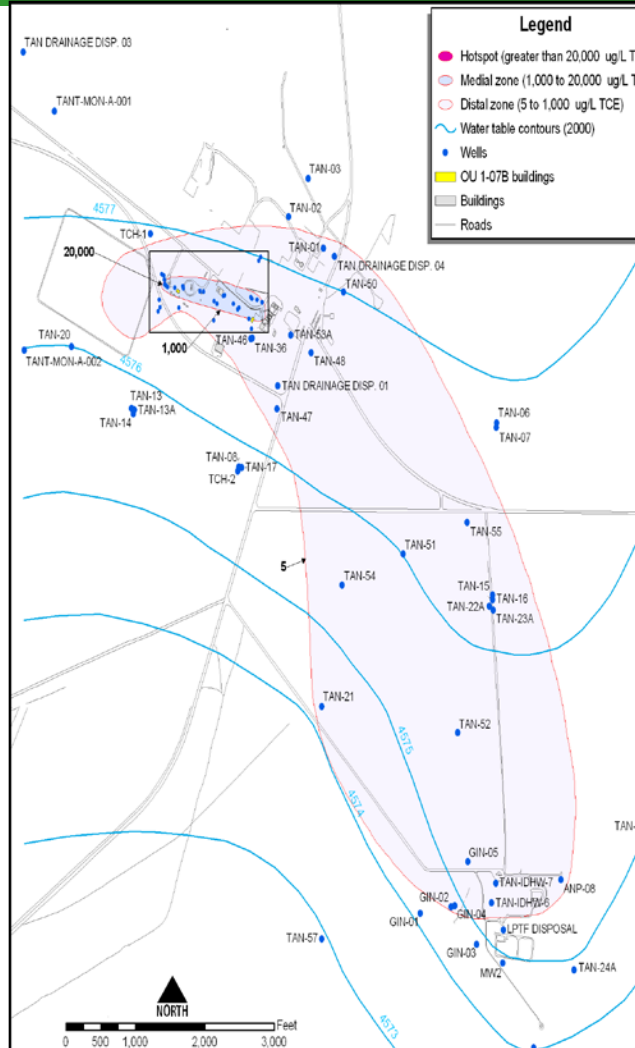
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1997 Hot Spot and Medial Zone



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2009 and 1997 plume Maps



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2001 ROD Amendment

- The ROD Amendment selected in situ bioremediation (ISB) for the hot spot in place of the pump-and-treat remedy selected in the 1995 ROD.
- Changed distal zone remedy from pump and treat to monitored natural attenuation (MNA)

Remedy Components

- **In situ bioremediation (ISB)** – Treats the *hot spot* to reduce the residual VOC source in the aquifer and reduce downgradient VOC flux.
- **Pump and treat** – Treats VOC concentrations in the *medial zone* using the New Pump and Treat Facility (NPTF).
- **Monitored Natural Attenuation (MNA)** - Monitors *distal zone* contaminant concentrations to determine if natural declines are on track to meet RAOs.



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Hot Spot – In Situ Bioremediation

- ISB functions by adding electron donors (amendments), such as sodium lactate and whey, to the aquifer to stimulate biological activity
- Microbes cometabolize TCE and dechlorinate it to ethene
- ISB injection facility built in 2003 (field lab, high bay for injection and storage, office)



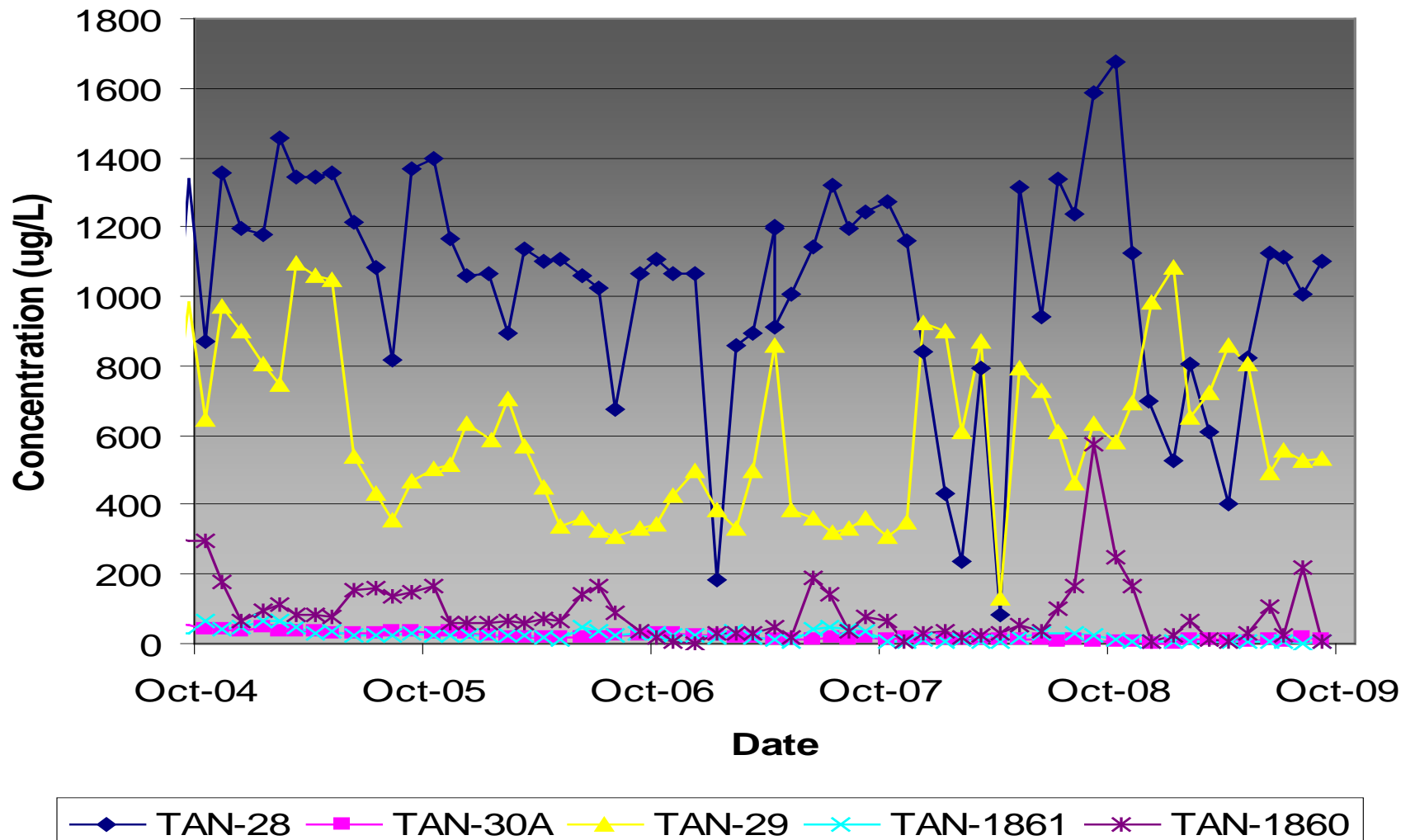
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ISB Data Review Summary

- ISB- Data suggest that more than 95% of the contactable source material will be removed in wells within the residual source area by 2012.
- TCE concentrations have remained elevated at some medial zone wells (e.g., TAN-28, TAN-29 and TAN-1860)
- An evaluation of the cause for the elevated TCE concentrations at the downgradient medial zone wells (TAN-28, TAN-29 and TAN-1860) will be addressed in an ISB rebound test.



Downgradient Flux



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ISB Issues, Operable Unit 1-07B

- Issue: TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.
- Recommendation: Prepare a test plan to address the TCE concentration issue at Well TAN-28 via a rebound test and vadose zone vapor monitoring.
 - Does a contaminated vadose zone exist?
 - Will TCE concentrations in TAN-28 trend downward?



ISB Rebound Test Objectives

Objective #1

- Evaluate whether a residual TCE source will remain in the aquifer after ISB has stopped.



- **Evaluate TCE concentration trends over 2 years**
 - <MCL ISB complete
 - Concentrations rebound
 - Resume ISB
 - Implement alternate remedial action



ISB Rebound Test Objectives-

Objective #2

- Evaluate whether a vadose zone source affects the aquifer.
- Gamma Logs –Source Area Wells



- **Two Part Evaluation**
 - Measure TCE partitioning from vapor into GW using TAN-31 vapor port and groundwater concentrations
 - Evaluate vertical distribution of TCE at two well locations
 - Upper intervals should be impacted more (next to vadose zone) than lower intervals

Key Question: If vapor source exists, will it impact meeting the RAOs?

- Yes- Vadose Zone Investigation

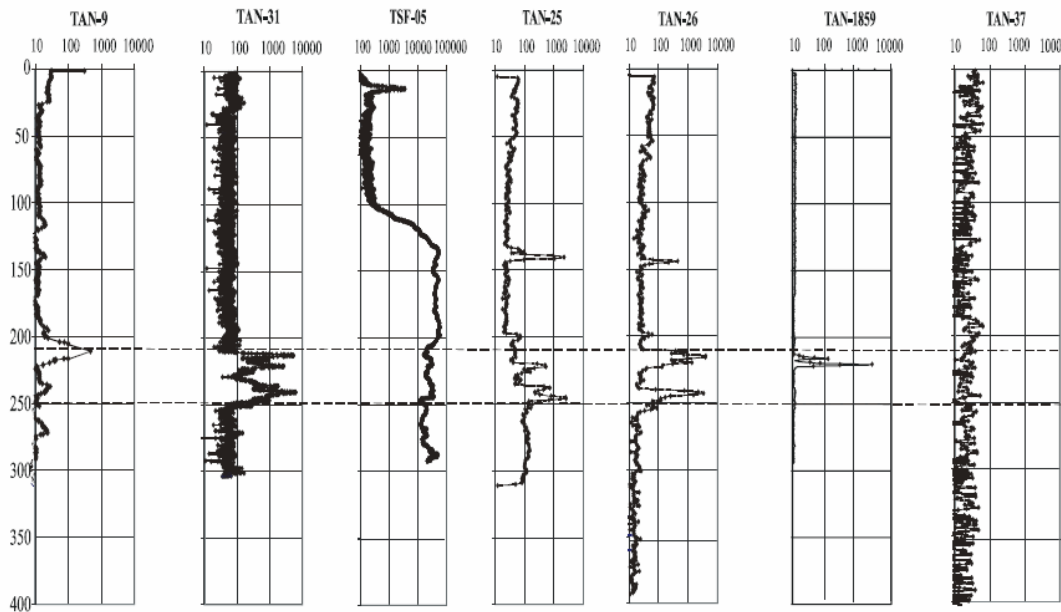


Figure 4-4. Correlation of gamma readings at TAN-9, TAN-31, TSF-05, TAN-25, TAN-26, TAN-1859, and TAN-37.



ISB Rebound Test Objectives

Objective #3

- Evaluate potential causes of persistent TCE concentrations at wells TAN-28 and TAN-1860.



- **Potential Causes**

- Mounding water from ISB injections, migrating through vadose zone, transporting contaminants to well
- ISB not treating all residual source in the aquifer
- Vadose zone source impacting groundwater
- Other (i. e., combination of above)



Medial Zone: New Pump and Treat Facility

Medial Zone Remedy of Pump and Treat:

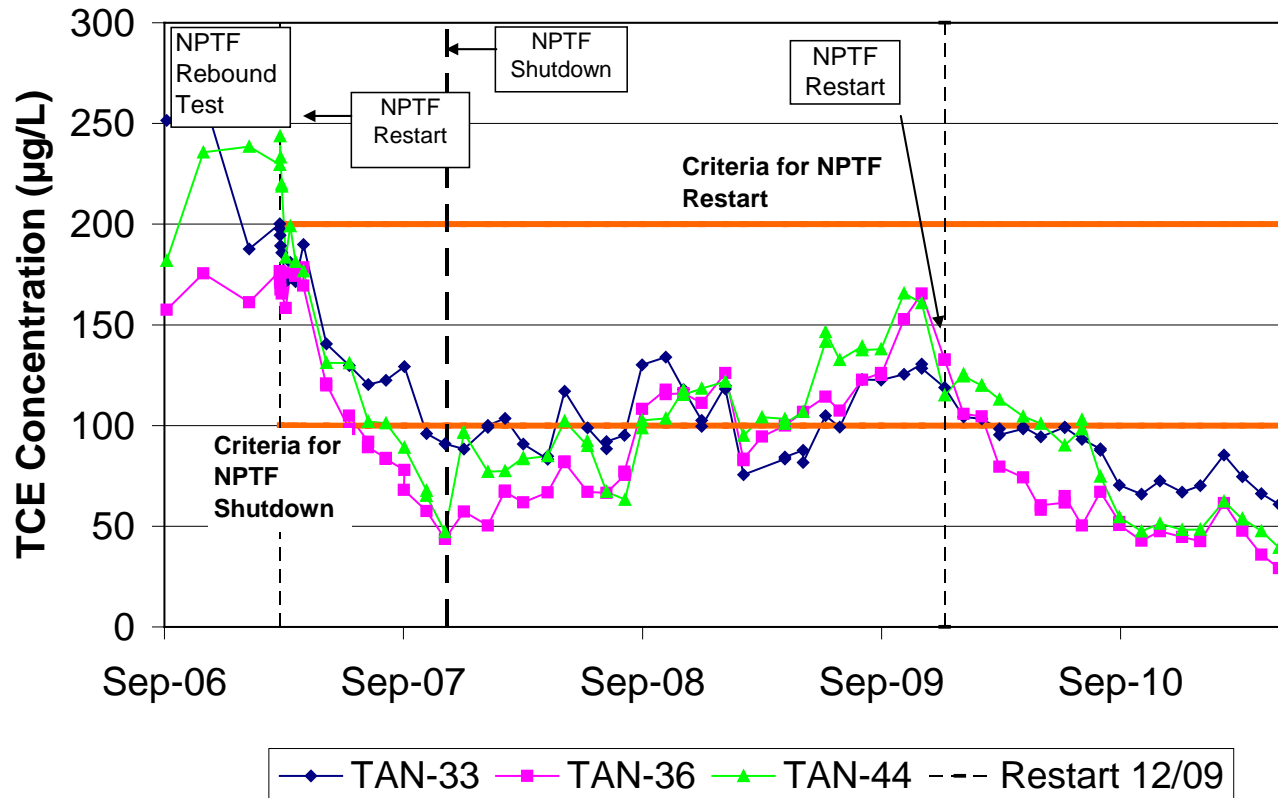
- NPTF began operations in 2001
- Extract water from 1 - 3 wells
- Air stripper removes VOCs to <MCLs
- Reinject treated water downgradient
- Reinject water meets no longer contained-in criteria
- No radionuclide treatment (meets MCLs)
- Process purge water (mix to below MCLs)



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Medial Zone Data Review Summary

TCE Concentrations for the Medial Zone Wells



- NPTF- Data indicate that the remedy is functioning as intended

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TCE Monitored Natural Attenuation – Distal Zone

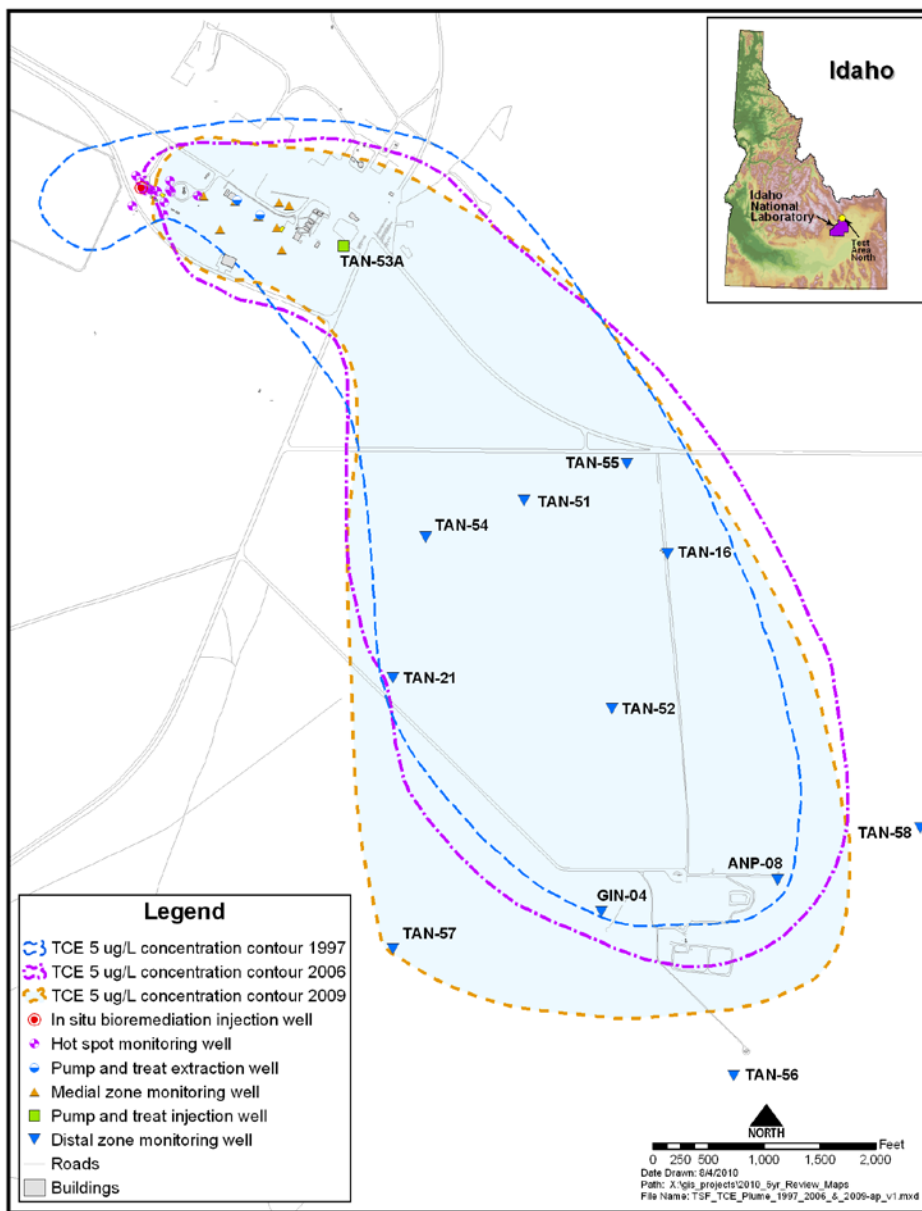
- Natural attenuation is the sum of physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, volume, or concentration of contaminants in groundwater
- Evaluate monitoring data to determine if
 - MNA processes will meet Remedial Action Objectives (RAOs) for the distal zone
 - Plume expansion is less than 30 percent



TCE MNA Evaluation in Distal Zone

- **TCE concentration data:** TCE data collected during FY 2011 and beyond will be compared to model predicted TCE concentration curves to determine if TCE concentrations are on track to meet the RAOs.





Plume Expansion

- Sample data from distal zone wells indicate that the plume could be heading more south-southwesterly than anticipated; therefore, the monitoring strategy should be modified to adequately evaluate plume expansion in that direction.
- Plume expansion remains less than 30 percent to the south-southwest.



MNA TCE Data Assessment

- MNA – Data show MNA is functioning as intended for VOCs. TCE Plume expansion has been less than the 30 % permitted in the ROD Amendment. Evaluation of TCE peak concentrations in distal zone wells continues and is needed to confirm that TCE concentrations will meet RAOs.



MNA TCE Issues

- Issue: The monitoring strategy may not be adequate for evaluating plume expansion.
- Recommendation: Prepare a Monitoring Plan to increase monitoring frequency to yearly rather than once every 3 years at Wells TAN-57 and GIN-4. If TCE concentrations at either TAN-57 or TAN-56 exceed 10 µg/L, evaluate install a downgradient monitoring well.
 - Better track leading edge of the plume

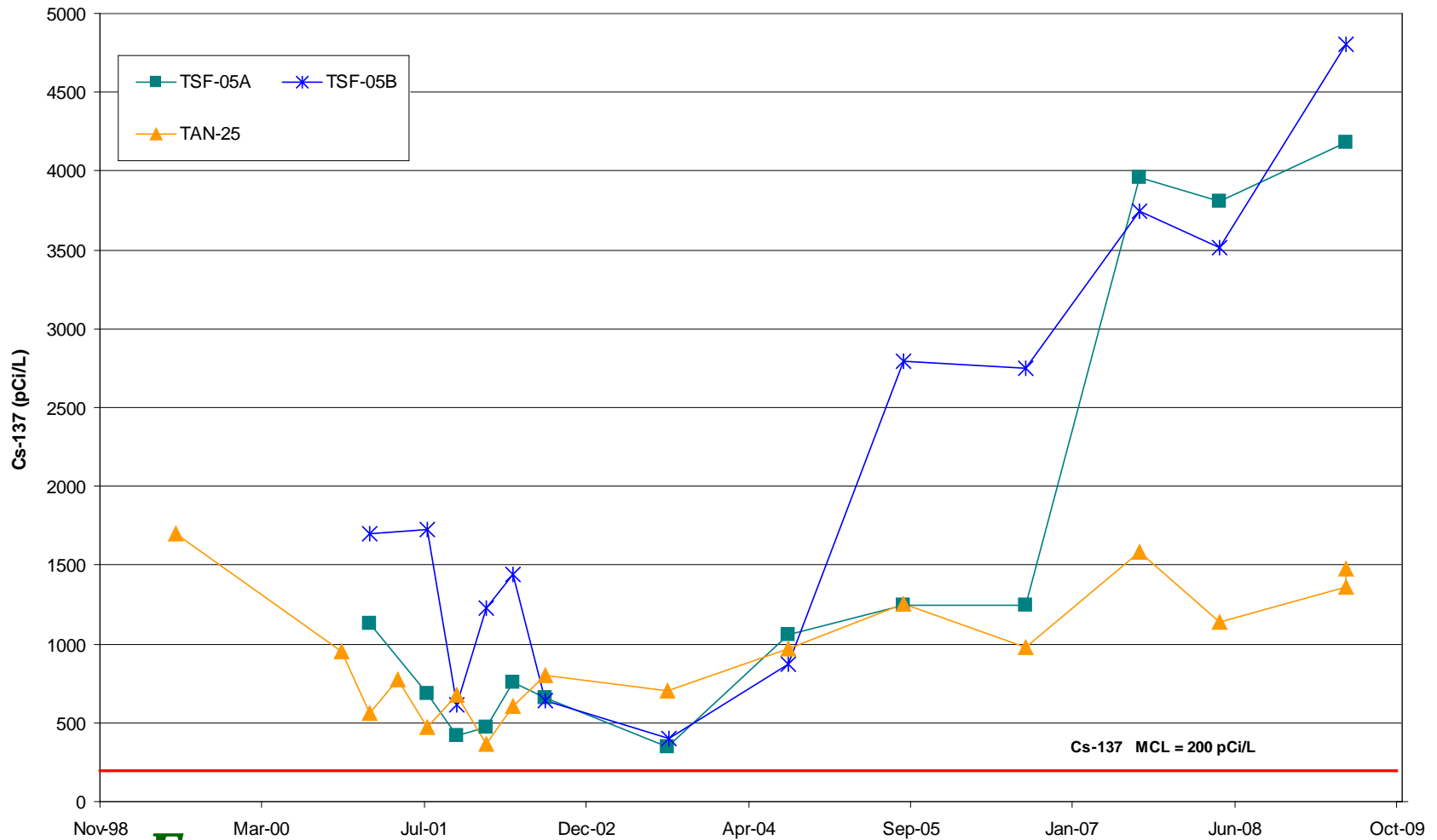


Radionuclide Monitoring

- Monitoring Sr-90 and Cs-137 in the vicinity of TSF-05 to determine if these radionuclides will decline to meet the RAOs
- Because continuing ISB operations may be increasing radionuclide concentrations in the hot spot and medial zone, it is not clear that radionuclides in the source area will meet remedial action objectives.

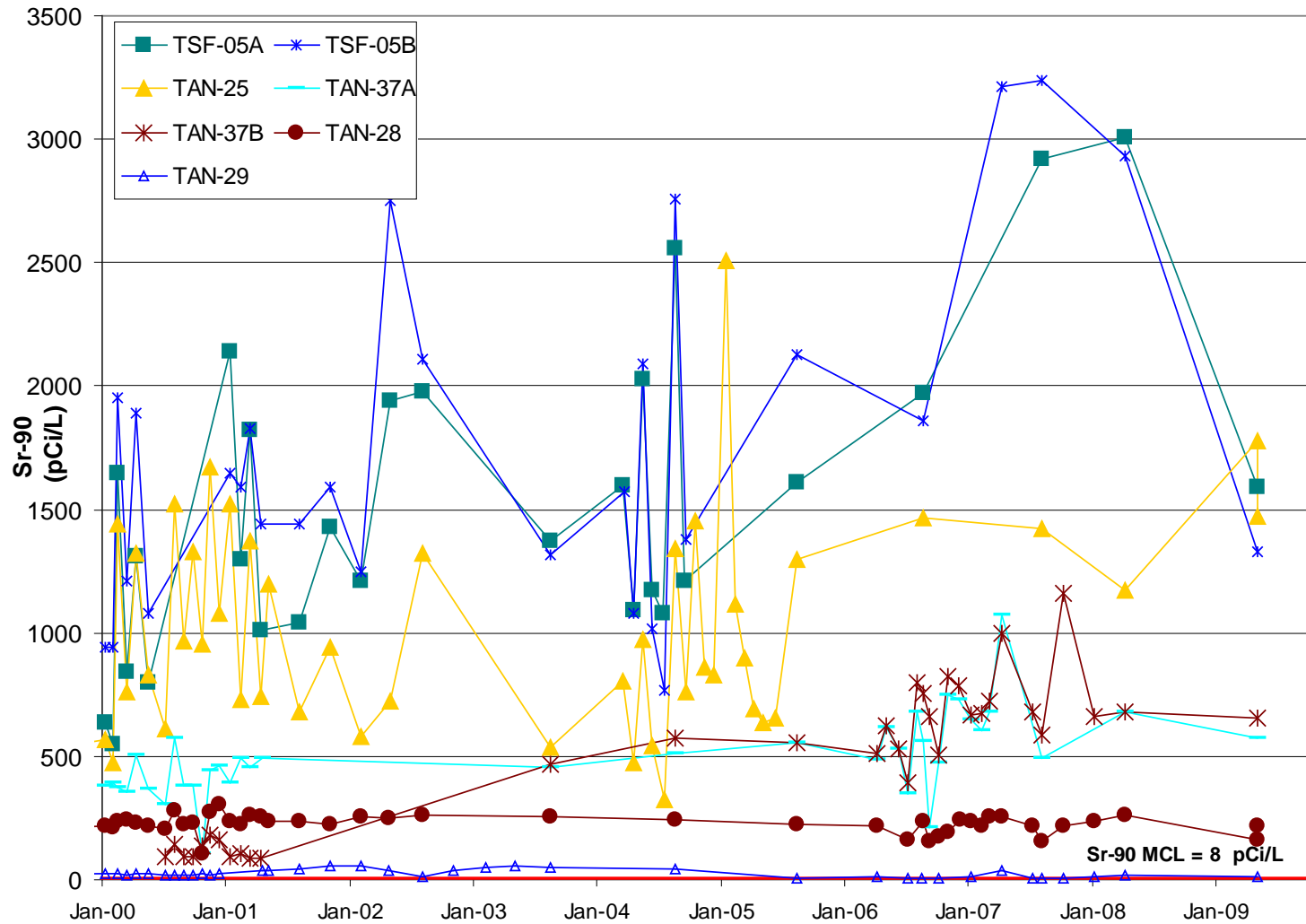


Cesium-137 at the Hot Spot



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Strontium-90 at the Hot Spot and Medial Zone



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Radionuclide Monitoring Issues

- Issue: Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.
- Recommendation: Prepare a test plan to address radionuclide concentrations in the hot spot via a rebound test.
 - Determine if radionuclide concentrations trend downward once ISB has stopped.



Radionuclide Rebound Test Objectives

Objective #4

- Evaluate whether radionuclide concentrations will begin to trend downward after ISB has stopped.



- **Evaluate radionuclide concentration trends over 2 years**
 - Decreasing radionuclide concentrations
 - <MCL by 2095 - remedy is effective
 - >MCL by 2095 – re-evaluate trend in a few years and evaluate remedial options for radionuclides
 - Concentrations remain constant or increase
 - Re-evaluate trend in a few years and/or evaluate remedial alternatives for radionuclides after ISB complete



OU 1-07B Summary and Conclusions

- The remedy is currently protective.
- Follow-up actions are needed to ensure remedy remains protective for the long term.
- A rebound test and consolidated groundwater monitoring plan, approved by the Agencies, will be implemented to address the issues raised in the 5-year review.
 - Rebound Test and consolidated GW plan submitted to Agencies, currently resolving comments
- The rebound test and monitoring will dictate the need for any potential remedy changes in the future.

