
Test Area North Groundwater Project Update

Nicole Hernandez
Department of Energy
Idaho Operations Office
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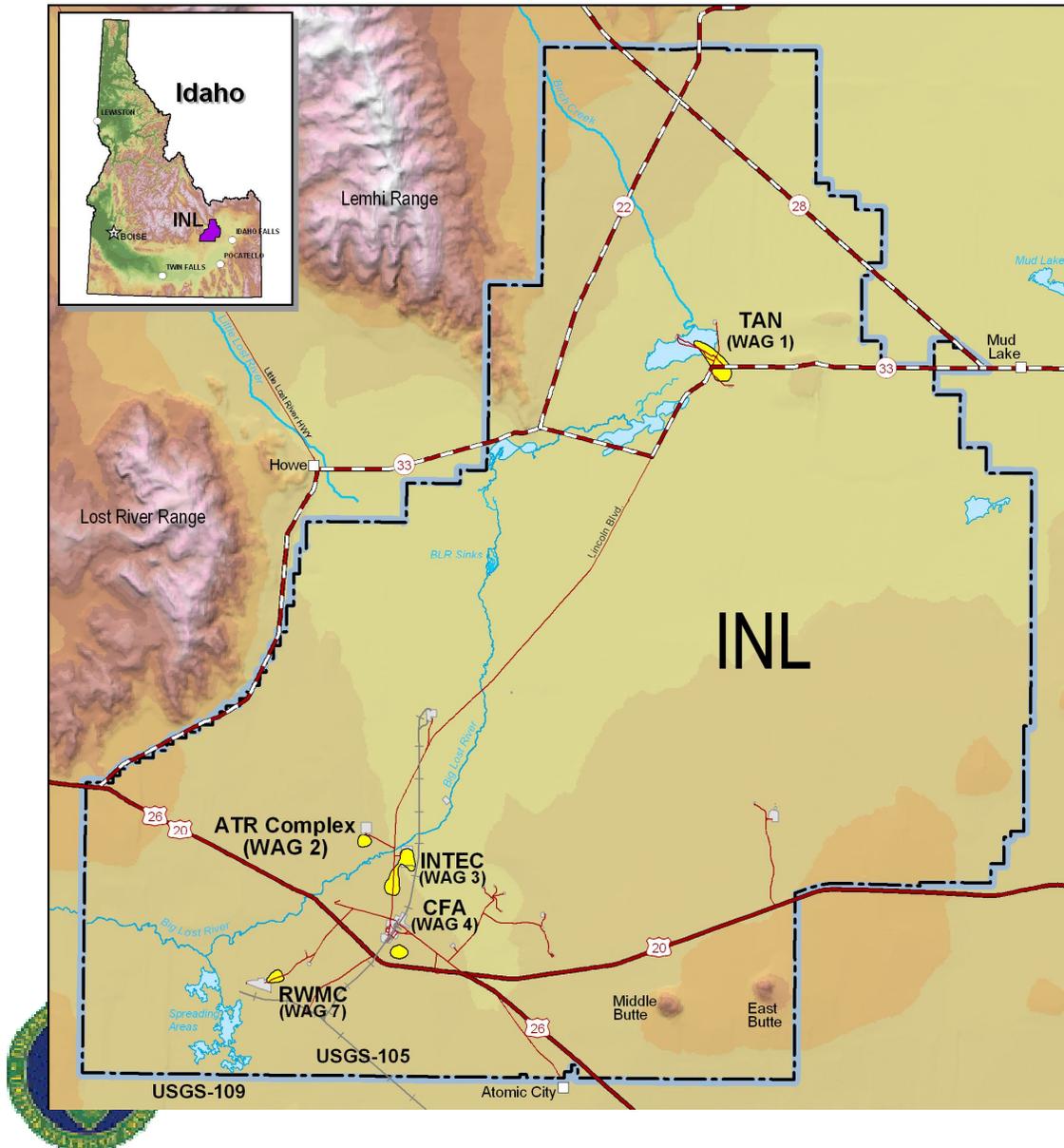
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INL Current Groundwater Contamination

Current Aquifer Contaminants

- WAG 1: VOCs, radionuclides
- WAG 2: Cr
- WAG 3: Sr-90, Tc-99, nitrate
- WAG 4: nitrate
- WAG 7: carbon tetrachloride



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TAN Contaminated Groundwater Background

- Source of groundwater contamination at TAN
 - Former TAN injection well
 - Used from 1953 to 1972
 - Disposed of solvents (trichloroethene-TCE), low-level radioactive wastes, and sanitary sewage directly into vadose zone and aquifer
 - Created plume almost 2 miles long
- Records of Decision: 1994, 1995, 1997, 2001



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TAN Groundwater Contaminants and Cleanup Levels

Contaminant	Historical Maximum	Cleanup Level
TCE	32,000 µg/L	5 µg/L
Cis-1,2-DCE	7,500 µg/L	70 µg/L
Trans-1,2-DCE	3,900 µg/L	100 µg/L
PCE	110 µg/L	5 µg/L
Sr-90	1,880 pCi/L	8 pCi/L
Cs-137	2,150 pCi/L	119 pCi/L



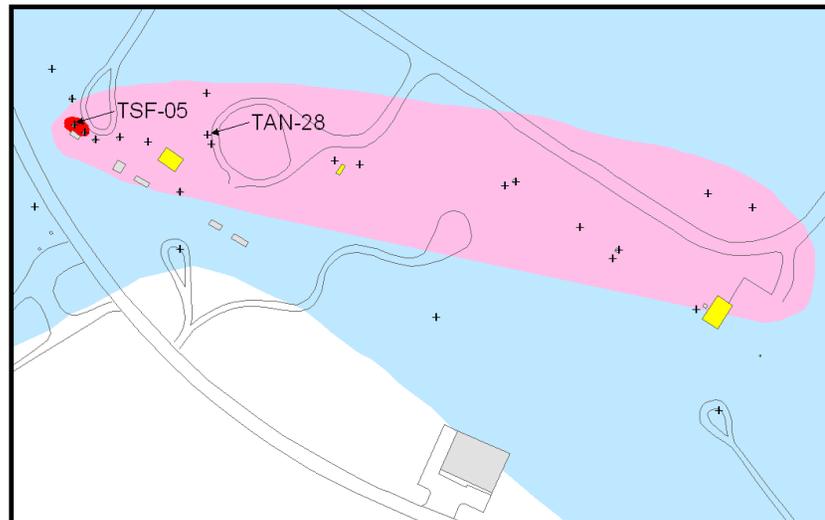
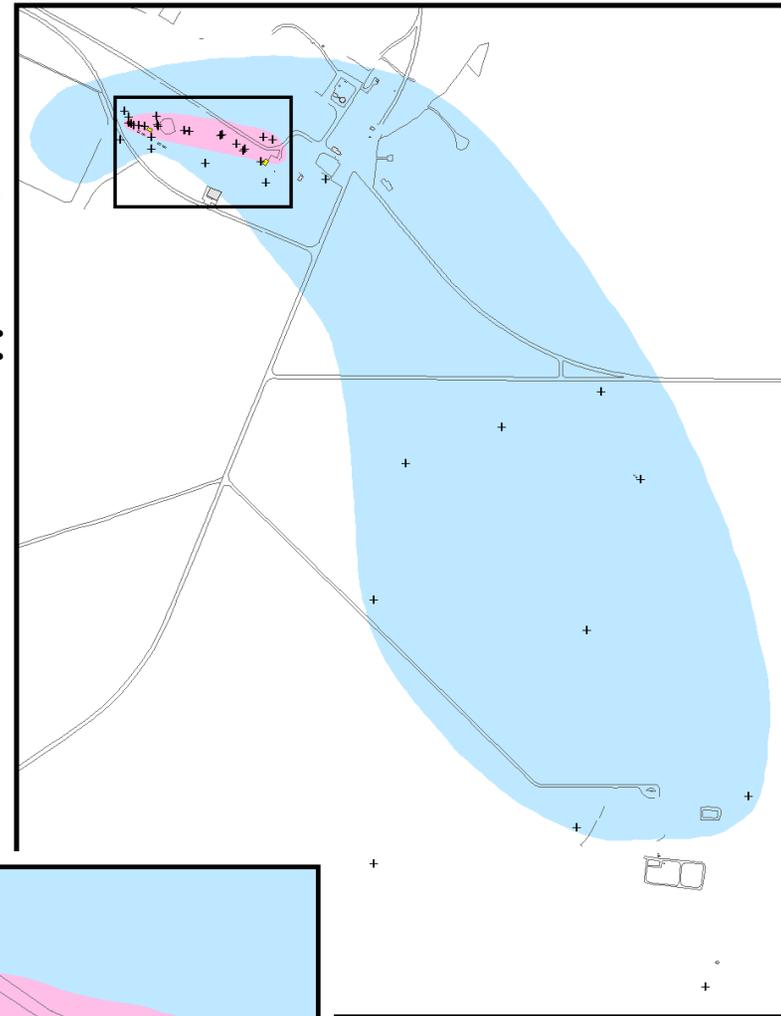
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Three Plume Zones

Zones based on geographic areas where 1997 concentrations were:

- Hot spot (>20,000 $\mu\text{g/L}$ TCE)
- Medial zone (1,000 to 20,000 $\mu\text{g/L}$ TCE)
- Distal zone (5 to 1,000 $\mu\text{g/L}$ TCE)



1997

Legend

- > 20,000 $\mu\text{g/L}$ TCE
- 1,000 - 20,000 $\mu\text{g/L}$ TCE
- 5 - 1,000 $\mu\text{g/L}$ TCE
- + Well



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Three Remedy Components (2001)

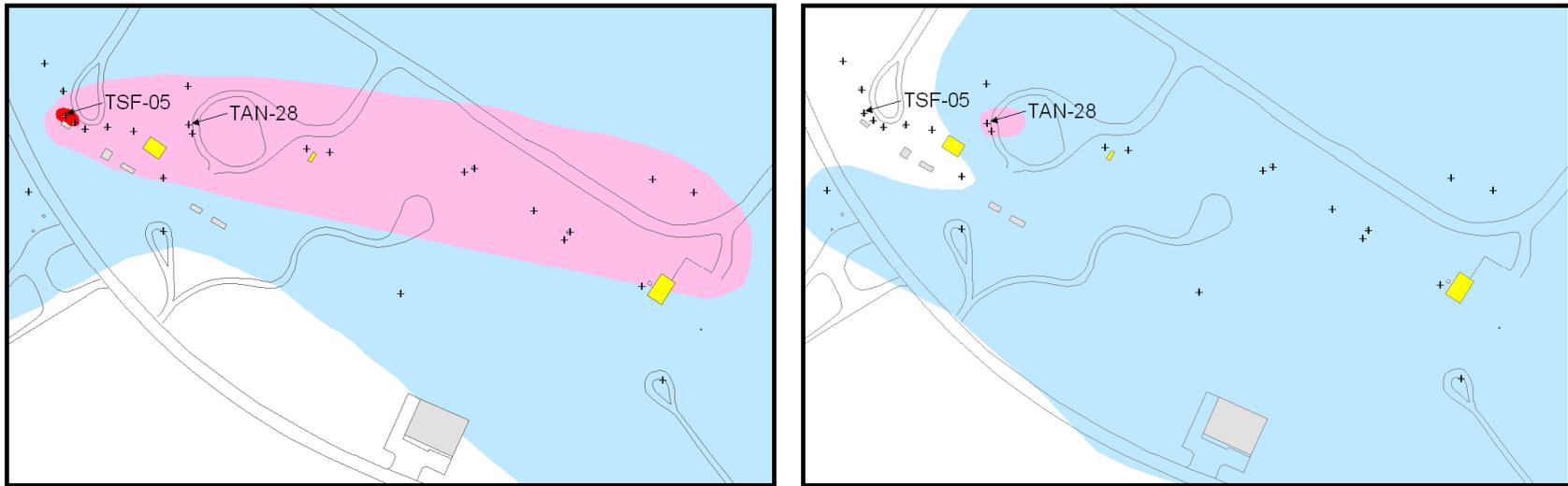
- **In situ bioremediation (ISB)** – Injects food source (whey/lactate) into *hot spot* to feed naturally occurring microbes that degrade volatile organic compounds (VOCs) in aquifer
- **Pump and treat** – Treats VOC concentrations in *medial zone* using New Pump and Treat Facility (NPTF)
- **Monitored natural attenuation (MNA)** - Monitors *distal zone* TCE concentrations while they decline to meet cleanup level by 2095.
 - Plume allowed to expand by 30%.



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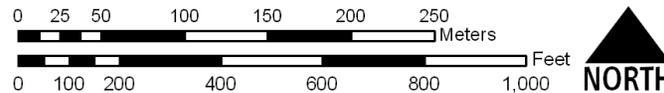
Hot Spot and Medial Zone Progress 1997 to 2011



1997

2011

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



Date Drawn: 2/9/2012
 Path: X:\gis_projects\tan\tan_plume_maps
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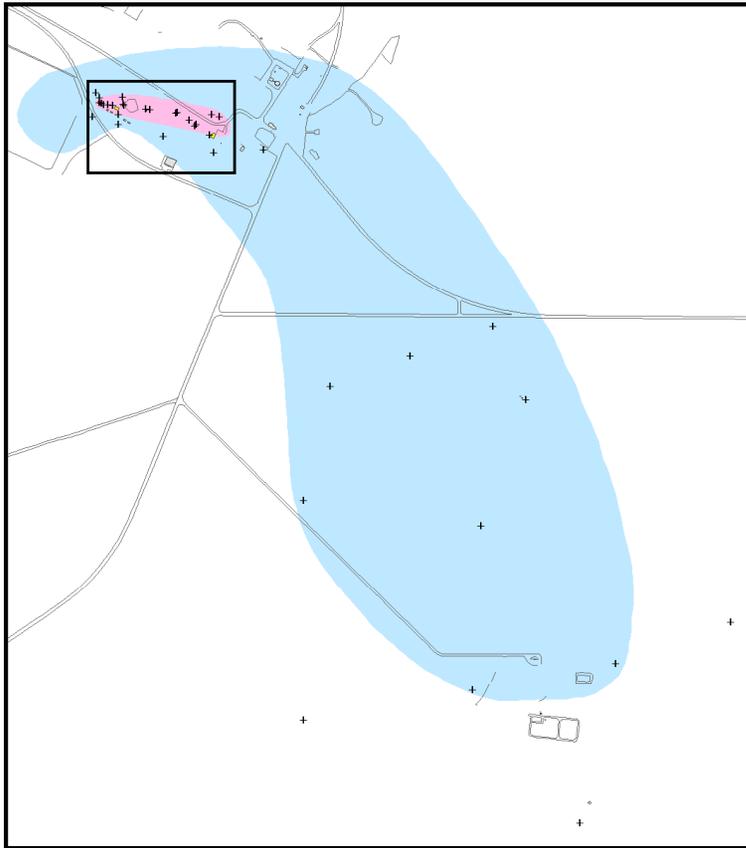
Concentrations are much lower now (TAN-28 >1,000 µg/L only part of the year). Still refer to areas as “hot spot” and “medial zone”.



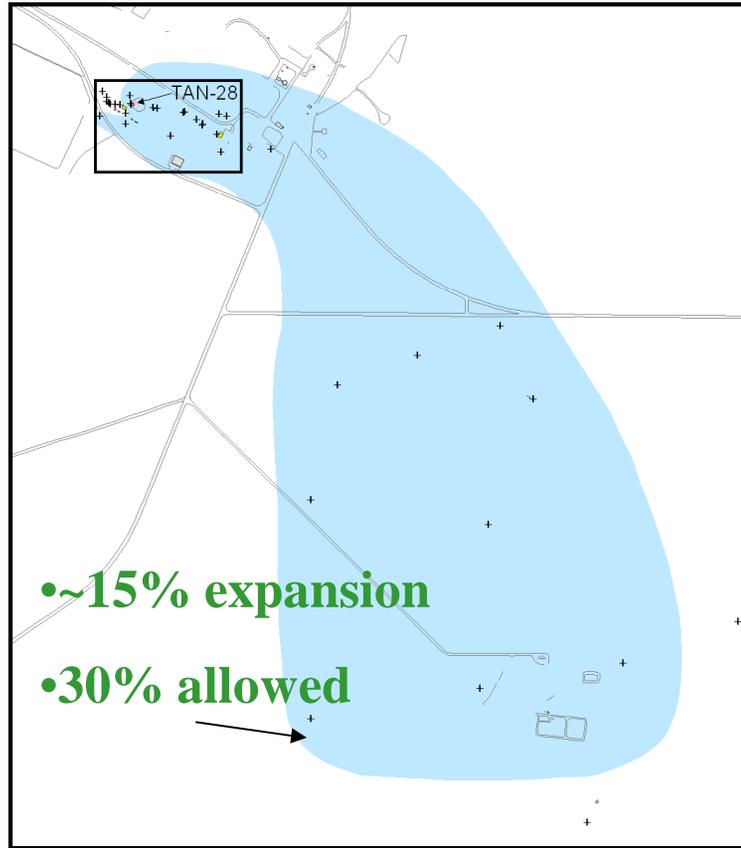
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Plume Changes from 1997 to 2011



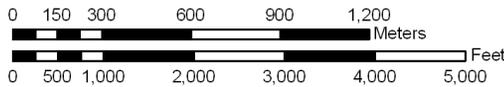
1997



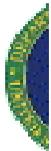
2011

Legend

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



Date Drawn: 2/9/2012
Path: X:\gis_projects\tan\tan_plume_maps
File Name: TSF_TCE_Plume_1997_2009_CAB-al_v1.mxd



CERCLA 5-Year Review Issues Remaining

- TCE has not decreased at TAN-28
- Cs-137 is increasing at injection well and Sr-90 remains high in hot spot and medial zone
- ACTIONS: Rebound Test and Monitoring

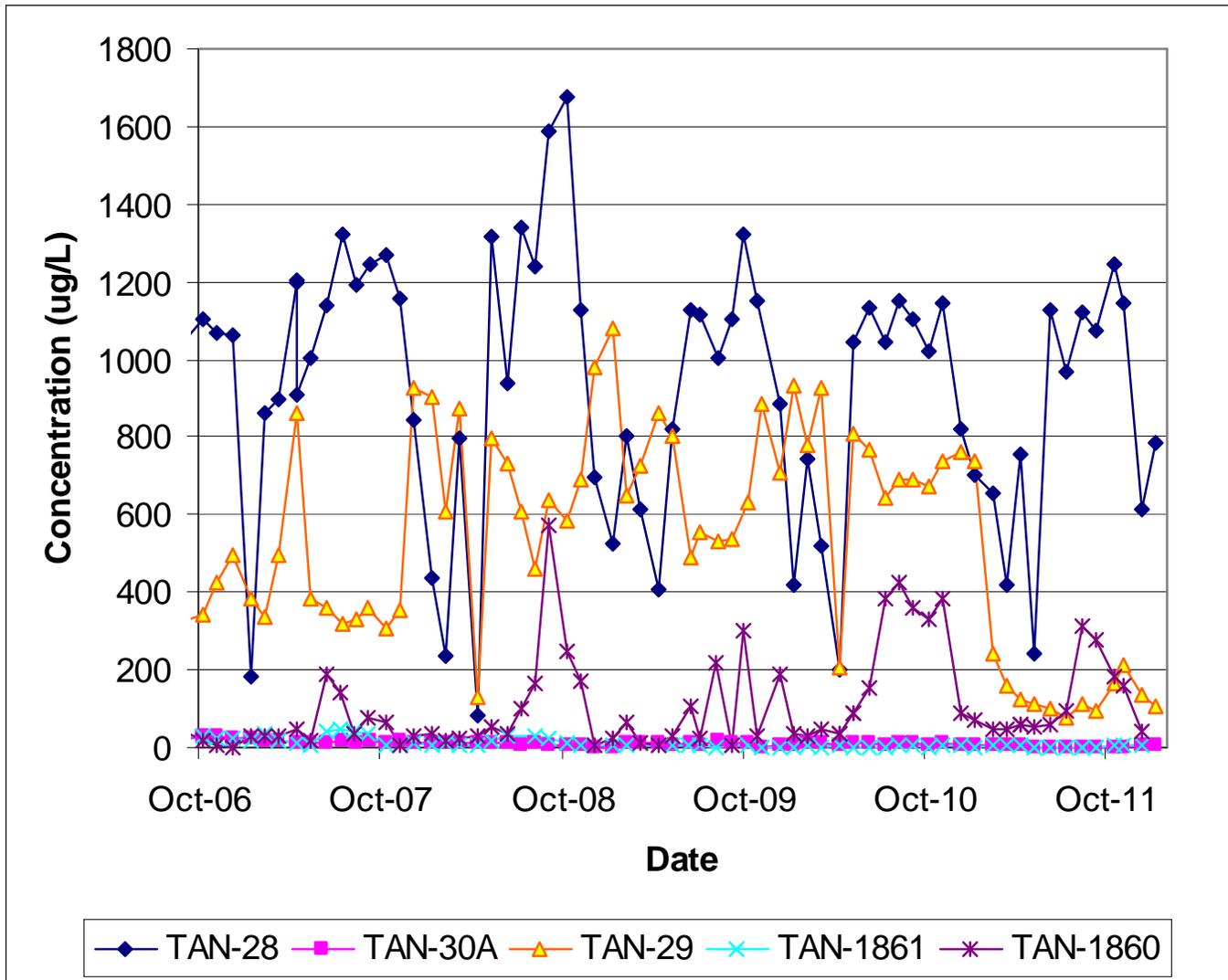
Progress: Rebound Test Plan and Monitoring Plan finalized in August 2011



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Issue: TCE in TAN-28 Remains High



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



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ISB Rebound Test Objectives-

Objective #2

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



- Key Question: If vapor source exists, will it impact meeting the Remedial Action Objectives
 - Yes-Vadose Zone Investigation
 - No- no action

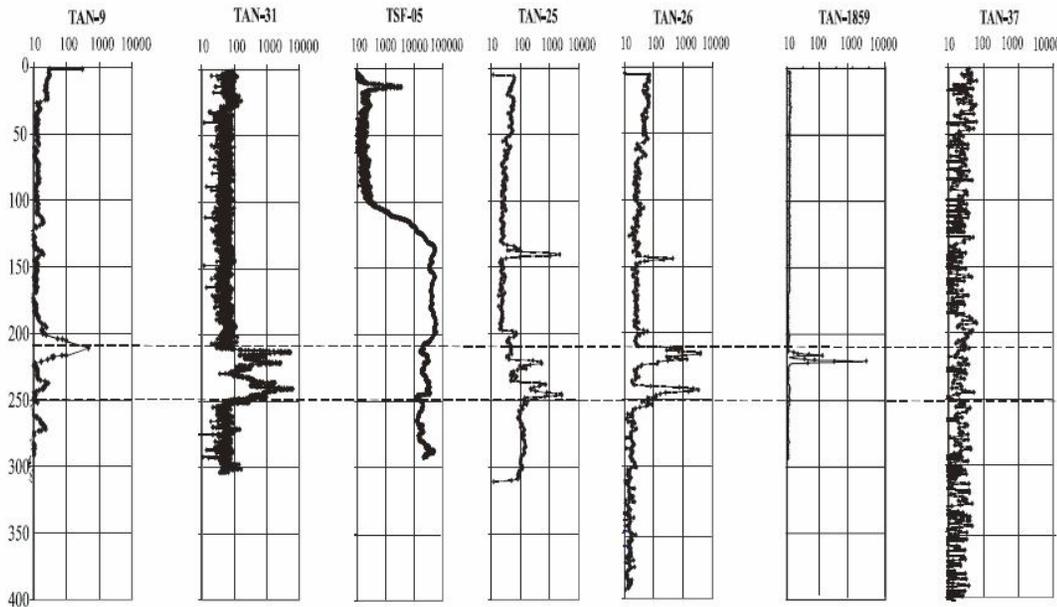


Figure 4-4. Correlation of gamma readings at TAN-9, TAN-31, TSF-05, TAN-25, TAN-26, TAN-1859, and TAN-37.

Vadose Zone-extends from the top of the ground surface to the water table.



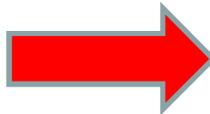
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ISB Rebound Test Objectives

Objective #3

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



- **Potential Causes**

- Mounding water from ISB injections is 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)

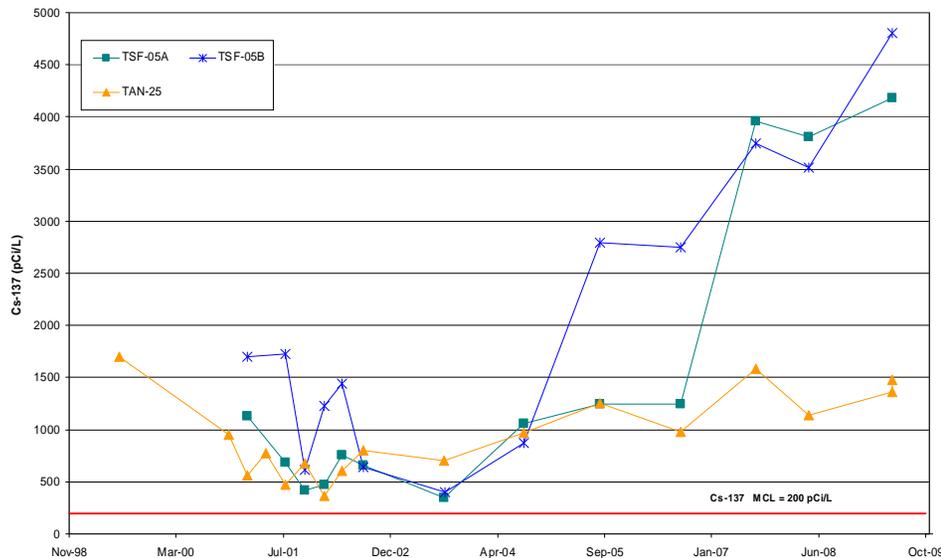


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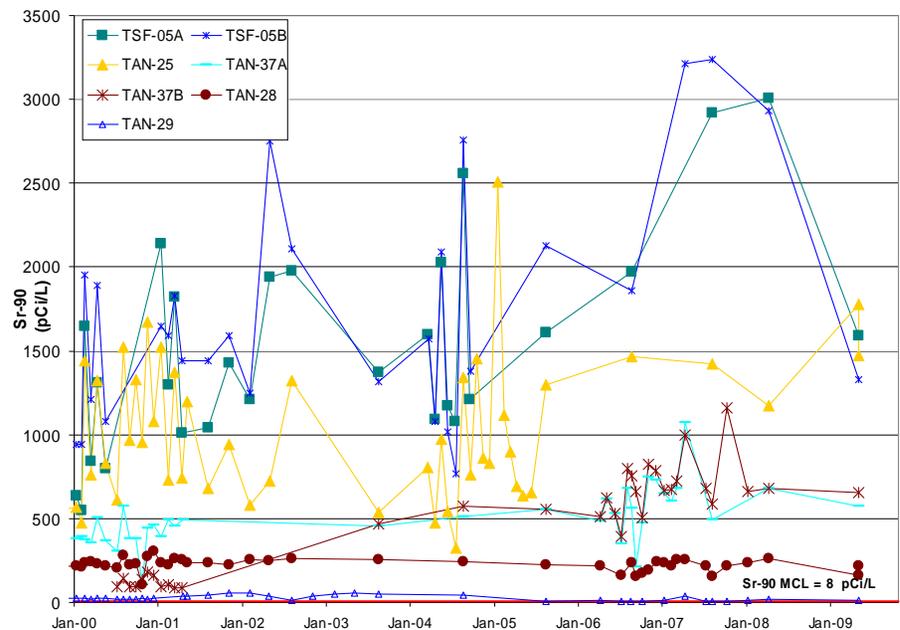
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Issue: Radionuclides in Hot Spot and Medial Zone

- ISB interferes with radionuclide adsorption in hot spot and medial zone



Cs-137 increasing in injection well



Sr-90 remains high in hot spot and medial zone



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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



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ISB Rebound Test

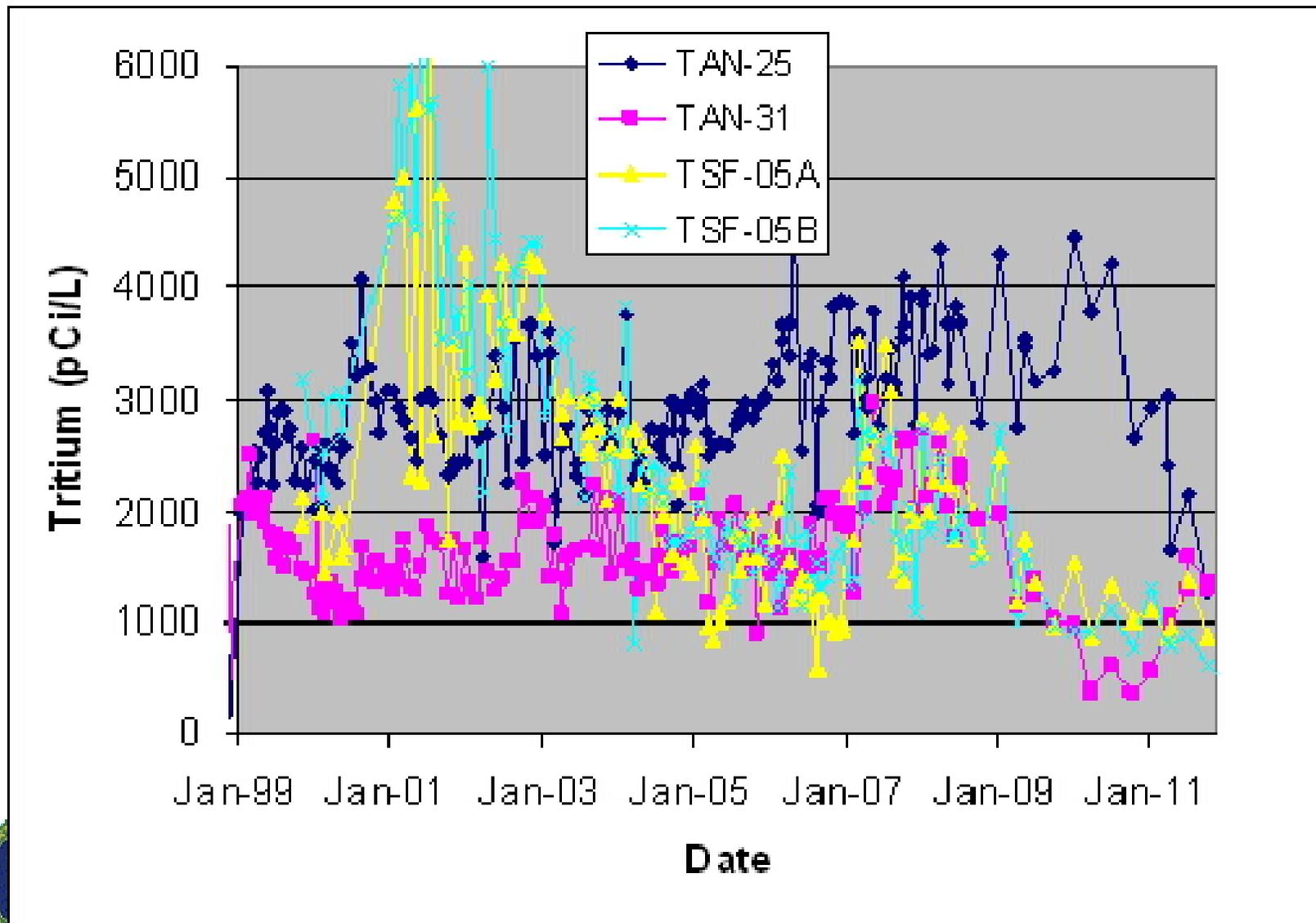
- ISB injections will stop
- Concentrations will be monitored to see how they change (rebound (i.e., rise or decline?))
 - Will a residual TCE source remain in aquifer?
 - Will a vadose zone source affect aquifer?
 - What is causing persistent TCE in TAN-28?
 - Will radionuclides in hot spot and medial zone area decrease?
- When to start test?



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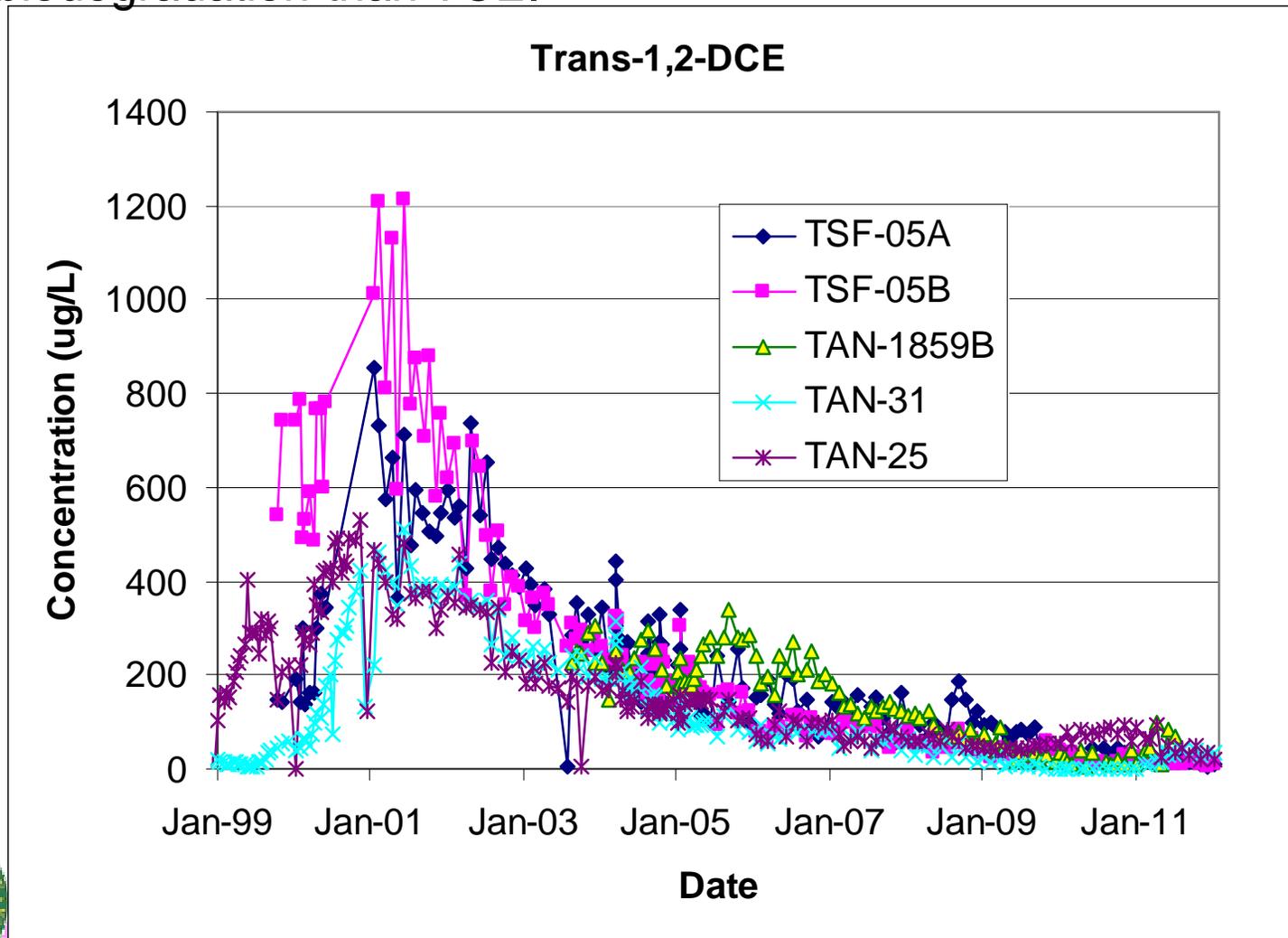
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Parameter : Tritium Trends Downward

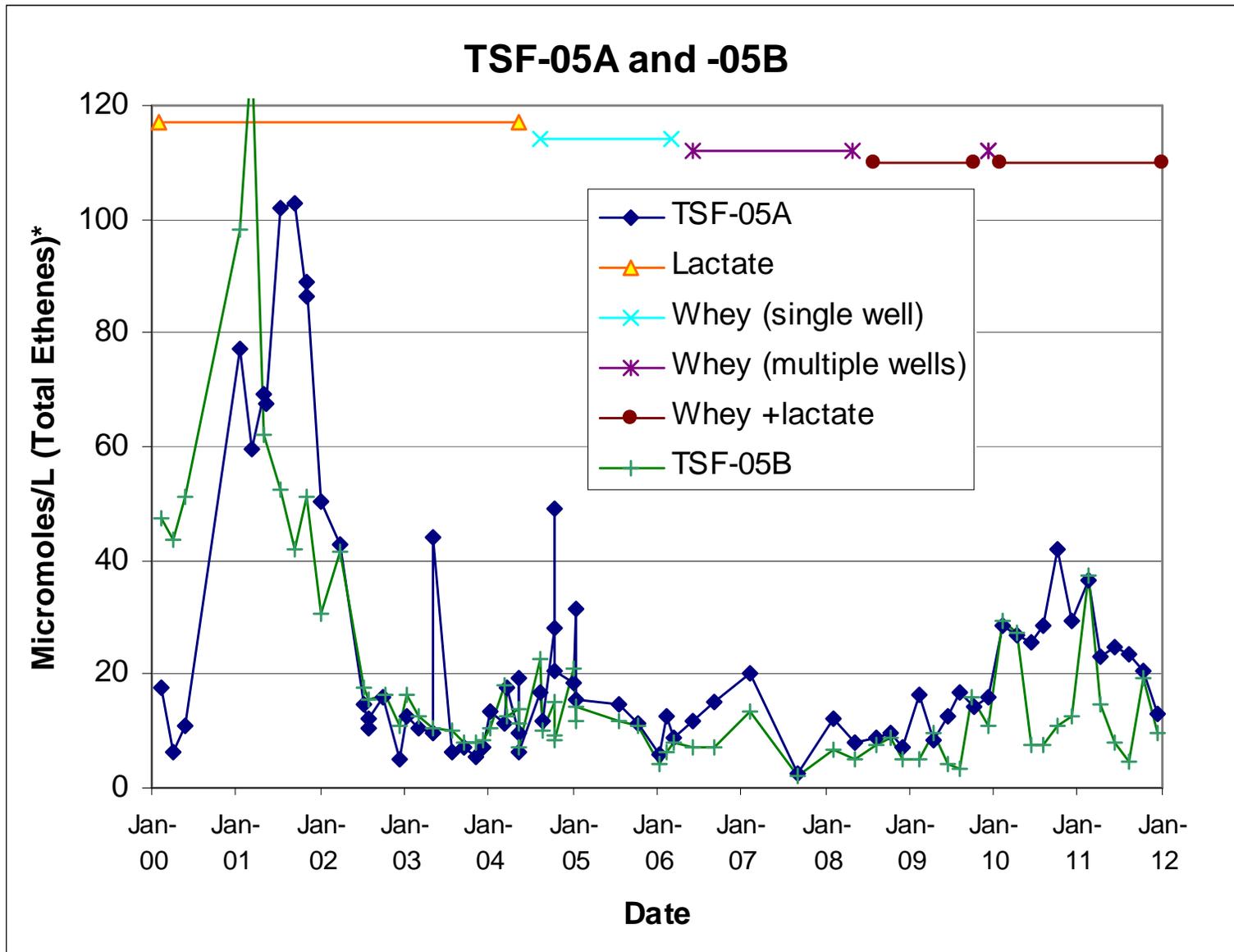


Parameter: Trans- DCE Trends Downward

- Trans-DCE used to indicate source strength because it is more resistant to biodegradation than TCE.



Parameter: Total Ethenes Trends Downward



Remaining Criteria for Starting Rebound Test

Location	Parameter	Current Status	Current Assessment and Criteria for Starting Rebound Test
TSF-05A and TSF-05B ^a	Tritium ^b	Declining trend	Ready, Concentrations need to continue to decline ^c
	Trans-DCE ^b	Declining trend	Ready, Concentrations need to continue to decline
	Total ethenes ^d	Short-term downtrend	Almost ready, Need to see total ethenes in TSF-05A decline or stay at levels similar to Dec injection
TAN-25	Tritium	Trending down	Ready, Concentrations need to continue to decline ^c
	Trans-DCE	Trending down	Ready, Concentrations need to continue to decline
	Total ethenes	Trending down	Ready, Concentrations need to continue to decline
TAN-28	TCE	Seasonal trend	Need to see if injecting into TAN-25 is affecting source impacting TAN-28



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Summary and Conclusions

- Remedy currently protective
- Follow-up actions planned to ensure remedy remains protective long-term.
- Rebound Test Plan and Consolidated Monitoring Plan (published 8/2011) addresses 5-year review issues
- Rebound Test expected to begin in 2012
- Rebound test and monitoring results will determine need for vadose zone and radionuclide investigations
- Vadose zone and radionuclide investigations will determine whether changes to the remedy are needed



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Acronyms

- CERCLA-Comprehensive Environmental Response, Compensation, and Liability Act
- Cr-Chromium
- Cs-Cesium
- DCE-dichloroethene
- ISB-in situ Bioremediation
- MCL-maximum contaminant level
- MNA-monitored natural attenuation
- NPTF-New Pump and Treat Facility
- PCE-tetrachloroethene
- pCi/L-pico curie per liter
- RAO-remedial action objective
- Sr-Strontium
- TAN-Test Area North
- Tc-Technetium
- TCE-trichloroethene
- µg/L-micro grams per liter
- VOC-volatile organic compounds
- WAG-waste area group



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