

December 21, 2009

U.S. Department of Energy  
Office of Legacy Management  
ATTN: Jack Craig  
Site Manager  
99 Research Park Road  
Morgantown, WV 26505

**SUBJECT:** Rio Blanco, Colorado, Long-Term Hydrologic Monitoring Program  
Sampling and Analysis Results for 2009

Dear Mr. Craig:

The U.S. Department of Energy (DOE) Office of Legacy Management conducted annual sampling at the Rio Blanco, Colorado, Site, for the Long-Term Hydrologic Monitoring Program (LTHMP) on May 13 and 14, 2009. Samples were analyzed by the U.S. Environmental Protection Agency (EPA) Radiation & Indoor Environments National Laboratory in Las Vegas, Nevada. Samples were analyzed for gamma-emitting radionuclides by high-resolution gamma spectroscopy and tritium using the conventional and enriched methods.

## **Site Location and Background**

The Rio Blanco site is located in Rio Blanco County in western Colorado (see attached Figure 1). The Rio Blanco test was designed and conducted to evaluate the use of nuclear detonations to fracture the tight, gas-bearing sandstone reservoirs in the Piceance Basin for enhanced natural gas production. The test involved the simultaneous detonation of three nuclear devices stacked vertically, creating a single elongate chimney. Each of the three detonations had an estimated yield of 33 kilotons. The test was conducted on May 17, 1973, at depths of 5,838, 6,230, and 6,689 feet below ground surface in the upper portion of the Mesa Verde Formation, and the lower portion of the Fort Union Formation.

Sampling locations (see attached Figure 2) are a combination of wells and surface water locations. Sample locations range from approximately 100 feet from surface ground zero (SGZ) to 7 miles from SGZ. EPA performed the LTHMP sampling from program inception at Rio Blanco in 1976 through 2007. The results of the historical monitoring at Rio Blanco have consistently shown that groundwater and surface water at the sample locations have not been impacted by nuclear-test-related contamination. DOE has completed an evaluation of the LTHMP and concluded that monitoring shallow groundwater and surface water at locations both near to and distant from SGZ was not an effective method to detect detonation-related contamination. The evaluation determined

that a monitoring program focused on detection of contaminant migration from the detonation zone was warranted at this time. The new monitoring program will emphasize sampling of natural gas production wells as the most likely pathway for transporting detonation-derived contaminants.

### Sample Analytical Results

Sample analysis results are shown in Table 1. The results demonstrate that none of the sampling locations are being impacted by detonation-related contaminants. Tritium results for the B-1 Equity Camp off-site surface sample location was 18.6 picocuries per liter (pCi/L) using the enriched tritium analysis method. Tritium results for off-site surface sample location CER #1 Black Sulphur was 14.8 pCi/L using the enriched tritium method. These are extremely low tritium concentrations that are consistent with expected background concentrations in surface water. All other tritium sample results were below detection limits. For comparison, the EPA drinking water standard for tritium is 20,000 pCi/L. Figures 3 and 4 show historical enriched tritium analysis results, the EPA drinking water standard, and the tritium decay line (Figure 3 only). The results shown in Figure 4 indicate that very few of the historical well sample analysis results have exceeded the detection limit. All high-resolution gamma spectroscopy results for gamma-emitting radionuclides were below detection limits.

Table 1. Rio Blanco LTHMP Water Sample Analysis Results

Sample Location	Collection Date	Tritium (pCi/L)	Gamma Spectroscopy (pCi/L)
RB-D-01 (on site well)	05/14/2009	ND <sup>a,c</sup>	ND <sup>d</sup>
RB-S-03 (on site well)	05/14/2009	ND <sup>a</sup>	ND
RB-D-03 (private well)	05/13/2009	ND	ND
RB-W-01 (private well)	05/13/2009	ND <sup>a</sup>	ND
Johnson Artesian Well (private well)	05/13/2009	ND	ND
Brennan Windmill (private well)	05/14/2009	ND	ND
Fawn Creek 500ft Dwn (surface location)	05/13/2009	ND	ND
Fawn Creek 500ft Ups (surface location)	05/13/2009	ND	ND
B-1 Equity Camp (surface location)	05/14/2009	18.6 <sup>a,b</sup>	ND
CER #1 Black Sulphur (surface location)	05/14/2009	14.8 <sup>a,b</sup>	ND
CER #4 Black Sulphur (surface location)	05/14/2009	ND	ND
Fawn Creek #1 (surface location)	05/14/2009	ND	ND
Fawn Creek #3 (surface location)	05/13/2009	ND	ND
Fawn Creek 6800ft Up (surface location)	05/13/2009	ND	ND
Fawn Creek 8400ft Dw (surface location)	05/14/2009	ND	ND

<sup>a</sup>Analyzed using both conventional and enriched tritium methods.

<sup>b</sup>Result from enriched tritium analysis method.

<sup>c</sup>Conventional tritium detection limit was 151 pCi/L; enriched tritium detection limits ranged from 3.65 pCi/L to 4.44 pCi/L.

<sup>d</sup>Gamma spectroscopy detection limits are species-specific and sample-specific and range from approximately 5 pCi/L to 170 pCi/L.

ND = Not detected.

## Conclusions

Tritium and gamma-emitting contaminant concentrations in water samples collected at Rio Blanco are consistent with historical sample analysis results. The results continue to verify that groundwater and surface water supplies at the sampling locations have not been impacted by detonation-related contaminants.

If you have any questions concerning this report, please contact me at (970) 248-6477.

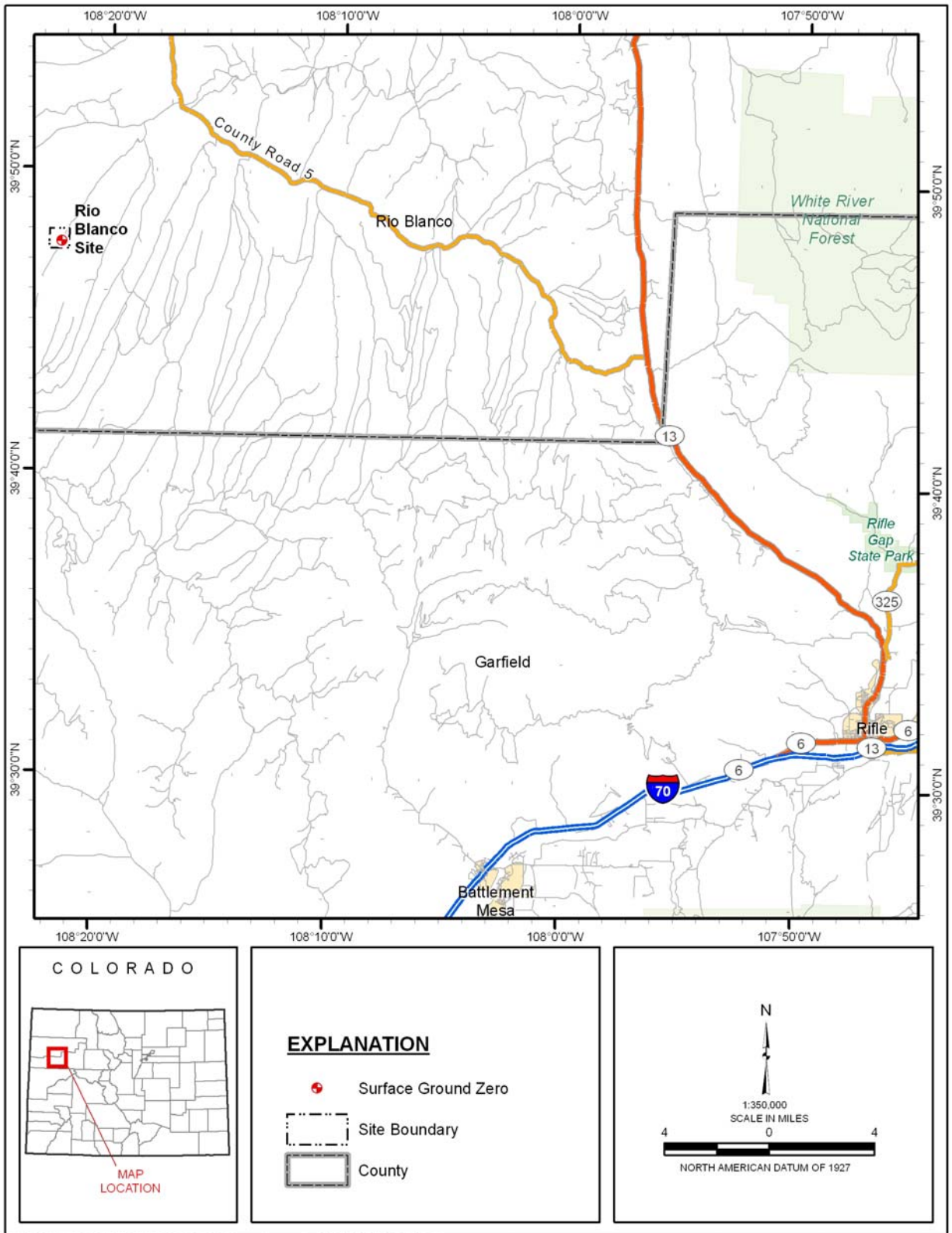
Sincerely,



Richard D. Hutton  
Task Manager

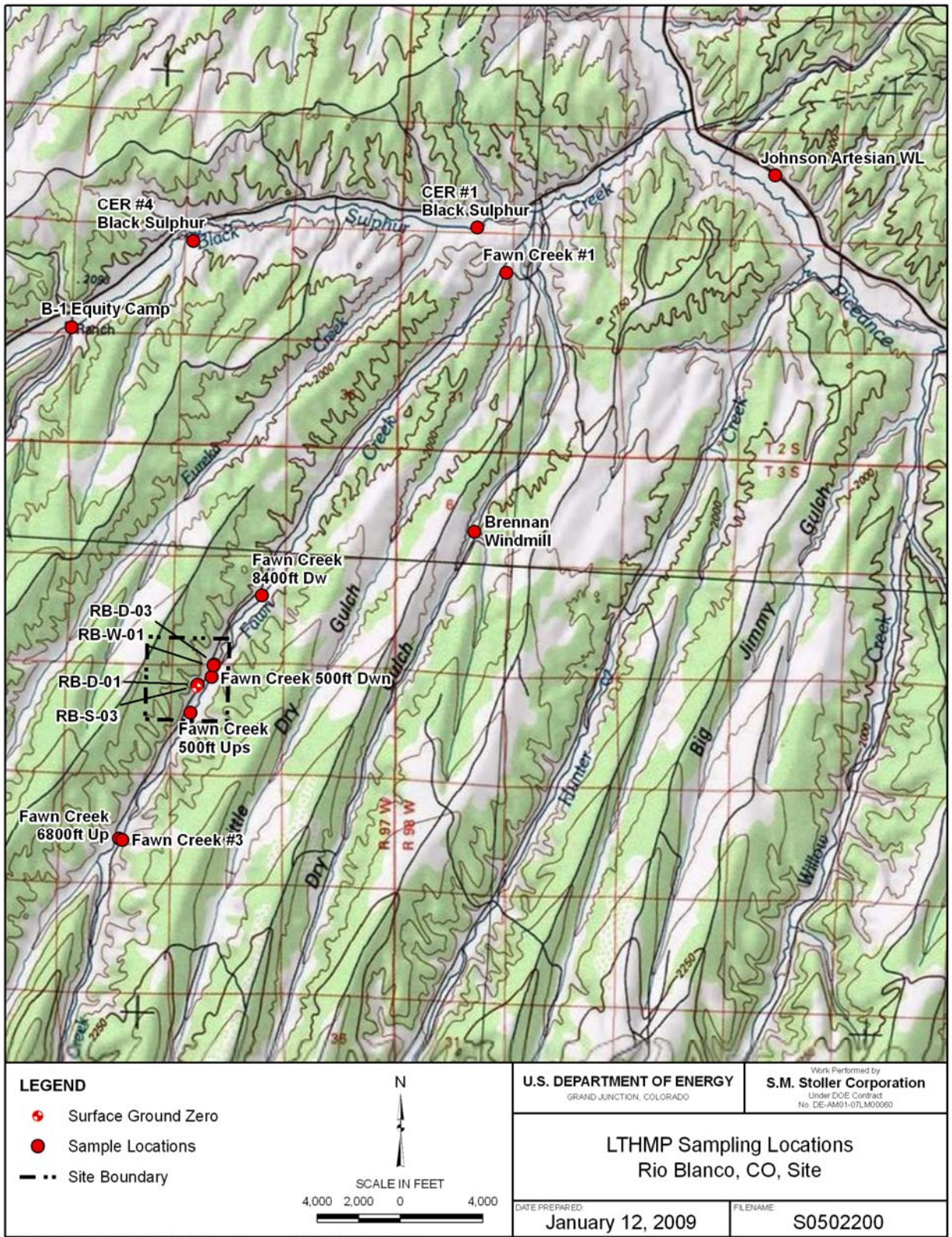
Attachments

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Figure 1. Rio Blanco Site Location Map



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Figure 2. LTHMP Sampling Locations, Rio Blanco, CO, Site

### Rio Blanco Site Enriched Tritium Concentration for Surface Water

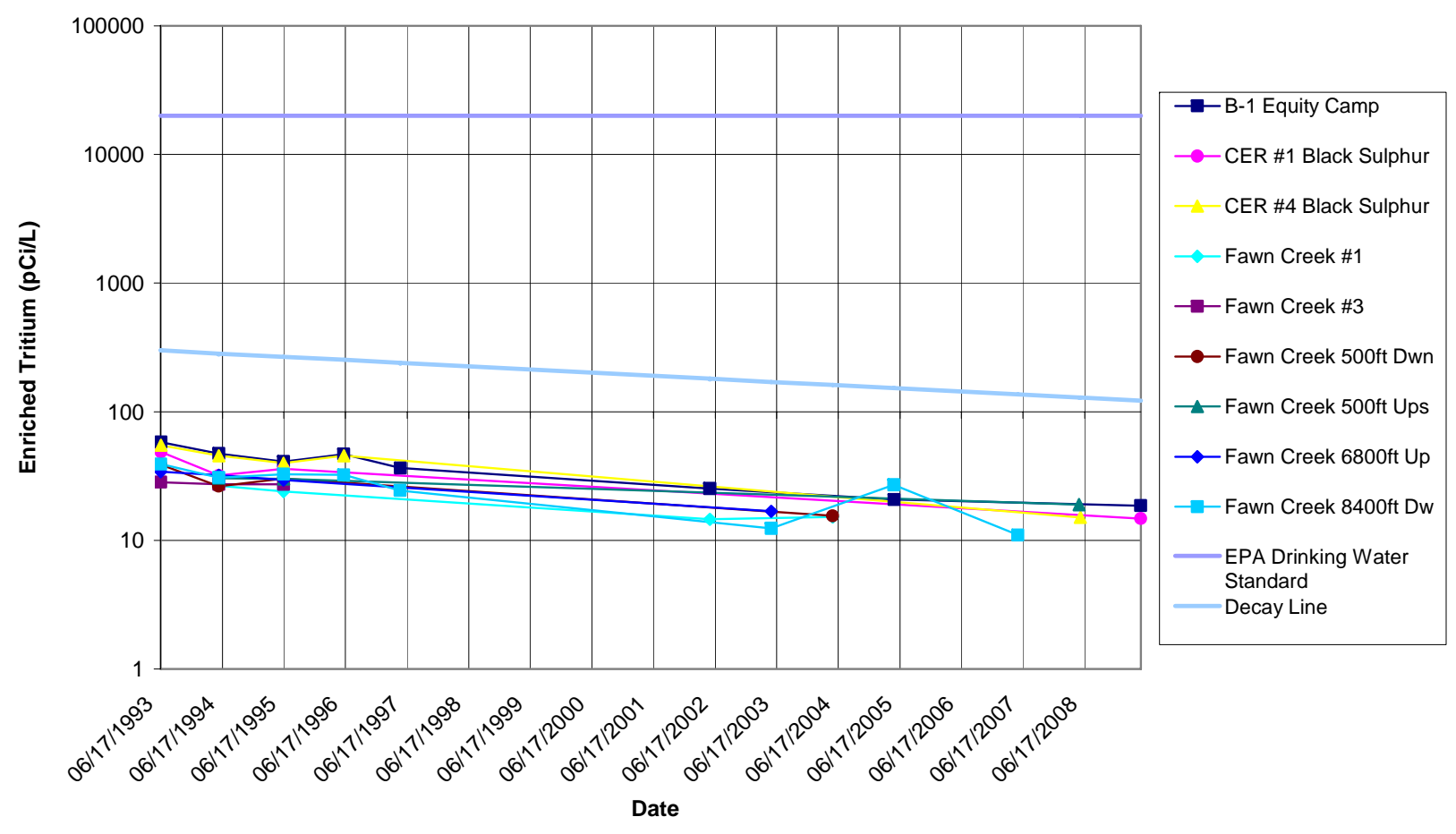


Figure 3. Enriched Tritium Concentration-Surface Water, Rio Blanco, CO Site

### Rio Blanco Site Enriched Tritium Concentration for Wells

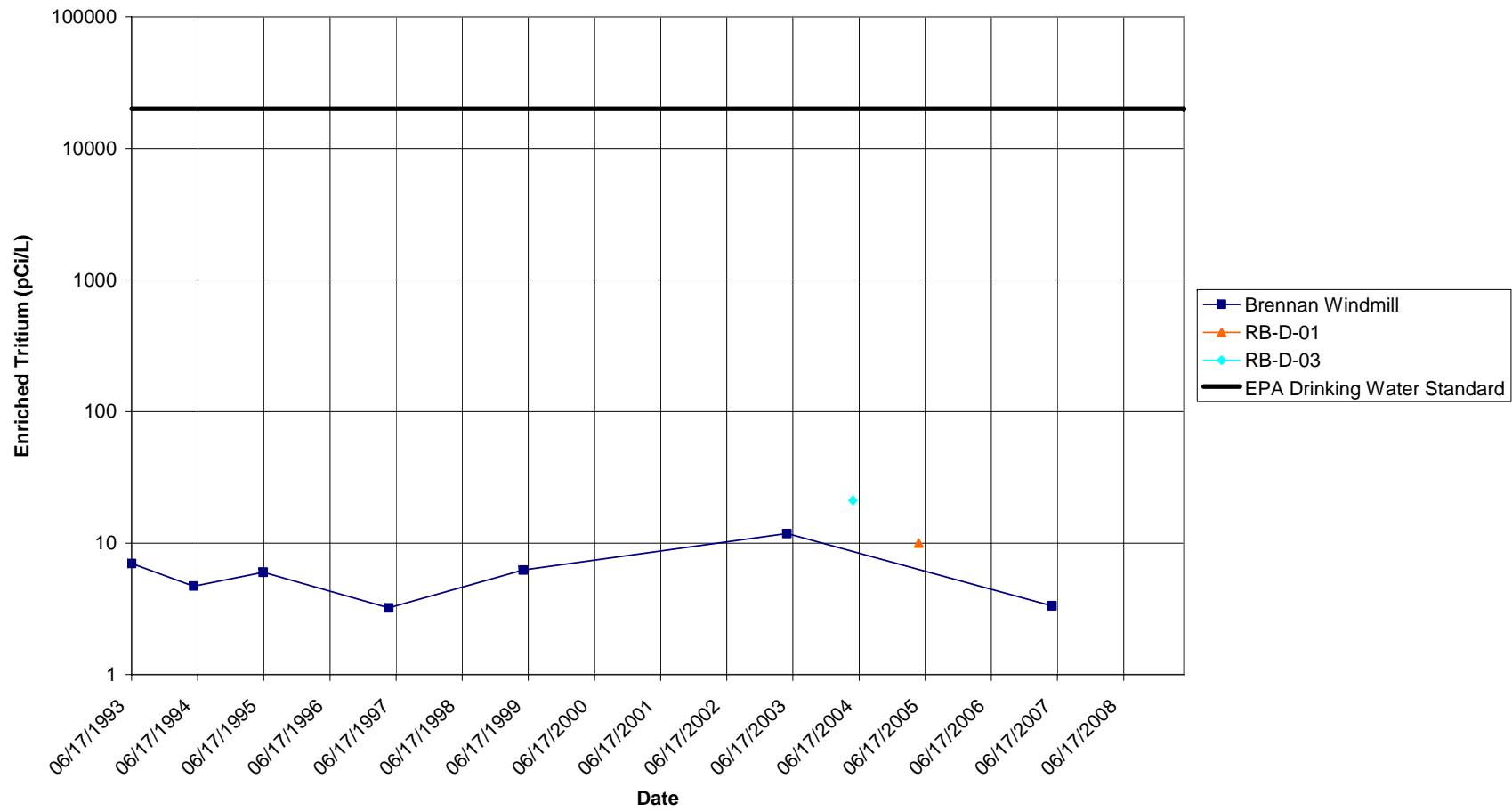


Figure 4. Enriched Tritium Concentration-Wells, Rio Blanco, CO Site