



Department of Energy  
Office of Legacy Management

DEC 07 2010

Distribution:

Subject: Results of Sample Filtration Analysis Protocol Reevaluation

Reference: Letter, R. Bush to S. Campbell, June 18, 2009; Letter and Report, S. Campbell to R. Bush, June 15, 2009

Based on concerns from stakeholders at the Shiprock, New Mexico, and Riverton, Wyoming, Uranium Mill Tailings Radiation Control Act disposal sites regarding the collection of filtered water samples, the U.S. Department of Energy, Office of Legacy Management (DOE-LM), reevaluated the sample filtration protocol. The basis for concerns with the standard industry practice of filtering water samples is that a portion of the mobile colloidal fraction found naturally in groundwater would be filtered out; because this mobile fraction of particulates may be capable of transporting attached contaminants, the result of sample filtering may be an underestimation of contaminant mobility which could introduce bias into the sample results.

The reevaluation compared duplicate filtered and unfiltered sample analyses in an effort to determine the adequacy of using a modified protocol in place of the filtration method. The comparison showed that the results were comparable when turbidity is less than 10 nephelometric turbidity units. Therefore, DOE-LM modified the sampling protocol to use unfiltered sampling when the turbidity criterion is met. The study is enclosed.

Please contact me at 970 248-6020 if you have any questions.

Sincerely,

April Gil, PhD  
Site Manager

Enclosures

Distribution:

- D. Aragon, Wind River Environmental Quality Commission
- S. Austin, Navajo Nation EPA
- L. Benally, Jr., Navajo Nation UMTRA
- B. Chestnut, Ziontz, Chestnut, Varnell, Berley, and Slonim
- D. Goggles, Wind River Environmental Quality Commission

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REPLY TO: Grand Junction Office		



Department of Energy  
Office of Legacy Management

JUN 18 2009

Mr. Sam Campbell, Manager  
Environmental Monitoring/Field Services  
S.M. Stoller Corporation  
2597 B 3/4 Road  
Grand Junction, CO 81503

Subject: Sample Filtration Analysis

Dear Mr. Campbell:

I understand that, per my request, Stoller has been providing duplicate filtered and unfiltered sample analyses in an effort to determine the adequacy of using a modified protocol in place of the method of using filtration to eliminate sample bias that may result from dissolution of contained solids. In reviewing the data provided by letter dated June 15, 2009, I see that there is an acceptable comparison between filtered and unfiltered sample results when turbidity is less than 1.0 nephelometric turbidity units (NTU). Only those samples with low analytical results and rather high turbidity were outside the criterion for laboratory duplicates, so I concur that the modified protocol using unfiltered sampling may be used when the turbidity criterion is met. For those samples collected that do not meet the turbidity criterion the method of filtering with 0.45 micron filters should be used.

Thank you for following up on this study. Please contact me at 970-248-6073 if you have any questions.

Sincerely,

Richard P. Bush  
Site Manager

cc:  
C. Carpenter (e)  
File Code: ADM 030.10 (DOE)

Bush\6-17-09 Sample Filtration Analysis.doc

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REPLY TO: Grand Junction Office

June 15, 2009

U.S. Department of Energy  
Office of Legacy Management  
ATTN: Richard Bush  
Site Manager  
2597 B  $\frac{3}{4}$  Road  
Grand Junction, CO 81503

SUBJECT: Contract No. DE-AM01-07LM00060, Stoller  
Sample Filtration

REFERENCE: LM00-501 – LTS&M-LM

Dear Mr. Bush:

In late 2007 the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* was revised to reflect new protocol for field filtration of samples at LM sites. Prior to the revision, samples collected for metals, inorganic, major ion, and radiological analyses were filtered in the field through a 0.45 micron filter, regardless of turbidity. The modified protocol specified continued field filtration of these samples when sample turbidity was greater than 10 nephelometric turbidity units (NTUs), but specified collection of these samples with no field filtration when sample turbidity was less than 10 NTUs.

Per your request, we have been collecting data on filtered and unfiltered sample duplicates (when sample turbidity is less 10 NTUs) to assure the modified protocol did not cause a bias in sample results. The data is presented in the attached spreadsheet.

To assess the precision of the filtered and unfiltered analyte pairs, the U.S. Environmental Protection Agency criteria for assessing laboratory duplicates was used, which provides a conservative acceptance range for field duplicates. As shown in the attached spreadsheet, over 95 percent (114 out of 119) of the filtered/unfiltered analyte pairs met the laboratory duplicate criteria, which indicates no significant bias in sample results from the revised filtration protocol.

With your concurrence, we will discontinue collection of filtered and unfiltered duplicate samples and consider the filtration protocol finalized.

# COMPARISON OF FILTERED VERSUS UNFILTERED SAMPLES

## Background

The purpose of this paper is to highlight the general issues involved in collection of filtered and unfiltered water samples at sites managed by the Office of Legacy Management (LM).

At most LM sites, water samples collected for inorganic, radiological, and metals analyses are filtered at the point of collection through a disposable 0.45  $\mu\text{m}$  pore-size filter. Filtration of water samples through the 0.45  $\mu\text{m}$  pore-size is the conventional method (although arbitrary) to determine the dissolved fraction of constituents in the water. The U. S. Environmental Protection Agency (EPA) analytical method LM uses to determine metals concentrations defines the difference between dissolved metals versus total recoverable metals as filtration through a 0.45  $\mu\text{m}$  pore-size filter (EPA 1992).

The practice of filtering water samples was started in the early stages of the Uranium Mill Tailings Remedial Action (UMTRA) ground water program and was considered standard industry practice at the time. Although the UMTRA ground water program shifted to low-flow sampling in 2001, filtration of water samples continued, per the client's request, in order to stay consistent with historical practices and avoid any potential data shifts.

Recently, stakeholders at several sites (Navajo sites and Riverton) requested that samples be collected without filtration. These requests have prompted us to reevaluate the sample filtration protocol. One of the major concerns with filtering ground water samples is that a portion of the mobile colloidal fraction (particles 0.45 to 3  $\mu\text{m}$  in diameter) found naturally in ground water will be filtered out using a 0.45  $\mu\text{m}$  pore-size filter. Some studies suggest that this mobile fraction of particulates are capable of transporting attached contaminants large distances and filtering will result in a substantial underestimation of contaminant mobility (Puls et al. 1992).

## Comparison Highlights

### *Filtered Samples*

- Provide consistency with historical practices and a consistent data set.
- Normalize effects of excessive turbidity (well/sampling artifacts or storm event runoff in surface water) on water chemistry.
- Provide comparability within a sampling network with wells or surface locations with high turbidity.
- Required to compare to a standard that is specified as "dissolved" (State of Colorado 1991).

## **Alternatives**

Following are some potential alternatives for discussion:

1. Filter samples with a larger pore-size filter that would permit a portion of the mobile colloids to pass to the sample, but exclude the larger particles that are not indicative of natural ground water. A pore-size of 5  $\mu\text{m}$  has been suggested in some literature (Puls and Powell 1992).
2. Filter samples based on turbidity of the sample. If sample turbidity is over 10 NTUs (LM turbidity criteria), then the sample will be filtered. If the sample turbidity is less than 10 NTUs, then the sample will not be filtered. This practice will help normalize concentrations in samples with high turbidity.
3. Collect all samples unfiltered and qualify data from samples that exceed the turbidity criteria to alert the data user that the sample result may be influenced by high turbidity. Data can be qualified during data validation.
4. Collect site-specific and well-specific splits of filtered and unfiltered samples to determine if colloidal transport of contaminants is significant.

## **Recommendations**

Because LM uses low-flow sampling procedures that result in collection of samples with low turbidity, filtration of samples is not as critical as it was in the past using high-flow purging and sampling procedures. Therefore, it is recommended that unfiltered samples be collected for inorganic, radiological, and metals analyses as the standard practice at LM sites. Exceptions to collection of unfiltered samples should be: (1) the turbidity is above 10 NTUs; (2) filtration is specified by a standard, regulation, or site-specific planning document; or (3) turbidity in surface water is above 10 NTUs, but unfiltered samples are required to determine ecological or human health impacts.

## References

Korte, Nic, 2001. *Application of Low-Flow Purging to the UMTRA Ground Water Project*, Grand Junction, Colorado.

Puls, Robert W., Don A. Clark, Bert Bledsoe, Robert M. Powell, and Cynthia J. Paul, 1992. *Metals in Ground Water: Sampling Artifacts and Reproducibility*, U. S. Environmental Protection Agency, R. S. Kerr Environmental Research Laboratory, Ada, Oklahoma.

Puls, Robert W., and Robert M. Powell, 1992. *Acquisition of Representative Ground Water Quality Samples for Metals*, Ground Water Monitoring Review – Summer 1992 issue.

State of Colorado, 1991. *Classification and Numeric Standards for Gunnison and Lower Dolores River Basins*, Colorado Department of Health, Water Quality Commission, Denver, Colorado.

U. S. Environmental Protection Agency, 1992. *Method 3005A Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICP Spectrometry*, SW-846, Office of Solid Waste and Emergency Response, Washington, D. C.