LMS/RVT/S09629

Alternate Water Supply System Flushing Plan Riverton, Wyoming, Processing Site

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Abbreviations

AWSS	alternate water supply system
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
IC	institutional control
MCL	maximum contaminant level
mg/L	milligrams per liter
pCi/L	picocuries per liter
QSAS	Quality Systems for Analytical Services
WREQC	Wind River Environmental Quality Commission

1.0 Introduction

An alternate water supply system (AWSS) was installed in 1998 by the Indian Health Services. The U.S. Department of Energy (DOE) provided $800,000 in funding, which included 25 percent of the cost of a new 1,000,000-gallon storage tank. The AWSS is a component of the institutional controls (ICs) for the Riverton, Wyoming, Processing Site (Riverton site) and is designed to supply drinking water to residents within the IC boundary in lieu of drinking groundwater that could potentially be impacted by the contaminated shallow aquifer. The AWSS is an addition to a pre-existing water supply system, which is managed, operated, and maintained by the Great Plains Utility Organization. The AWSS consists of 8.5 miles of transmission pipeline running from the 1,000,000-gallon tank.

2.0 Background

Elevated concentrations of radionuclides were identified in the AWSS in 2002 (Babits 2003), and these results were confirmed by DOE in 2004 (DOE 2005). In response to these findings, DOE funded an independent analysis of the AWSS, and the analysis recommended implementation of a flushing program to determine if flushing would reduce the radionuclide concentrations to acceptable levels (ASCG 2005).

Based on the recommendation of the independent analysis, DOE implemented a two-year flushing study to determine if flushing would reduce radionuclide concentrations and control radionuclide buildup in the AWSS (DOE 2006). Results of the study indicated that a unidirectional flushing program be implemented on a 6-month frequency (DOE 2008).

3.0 Purpose and Scope

The purpose of this work plan is to detail a flushing and monitoring program for the AWSS as a method to control radionuclide buildup within the system. This flushing program is a collaborative effort among the Great Plains Utility Organization, the Wind River Environmental Quality Commission (WREQC), the Northern Arapaho Tribal Engineer, and DOE. This work plan provides a specific procedure for conducting a unidirectional flush of the system as recommended by ASCG Inc. and the U.S. Environmental Protection Agency (EPA) (ASCG 2005). The sampling portion of this work plan will provide data to verify the flushing program is successful in keeping radionuclide concentrations at acceptable levels.

4.0 Flushing Procedure

This procedure will be used to conduct a unidirectional flush of the AWSS. Water flushed from the system will be directed to the nearest ditch, open field, or appropriate area. During the flushing operations, notes on the condition of the equipment and operations should be recorded.

The location of flushing hydrants and isolation valves are shown in Figure 1. The sequence of locations and the required flushing volume is shown in Table 1. The specific steps for flushing at each location are as follows:

[1] Close the isolation valve on the 6-inch line near the intersection of Goes in Lodge Road and Little Shield Road. The 6-inch line parallels Goes in Lodge Road.

[2] Make sure the isolation valve near the hydrant is open and the valve on the hydrant is closed. Water will not flow to the hydrant if the isolation valve near the hydrant is closed.

[3] Connect flow meters to the hydrant and hoses to the flow meters, if needed.

[4] Record the cumulative reading on flow meters before opening the hydrant valve.

[5] Open the valve on the hydrant. Ensure the valve at the hydrant is opened all the way.

[6] Collect samples as detailed in Section 5.0.

[7] Ensure the flow from the hydrant is directed to a drainage ditch or appropriate area.

[8] Flush the required volume through the flow meters. Table 1 lists the required volume for each section.

[9] Close the hydrant valve when the required volume has been flushed.

[10] Record flushing time, volume flushed from each flow meter, total volume flushed from the two flow meters, and other appropriate information.

Table 1. Flushing Sequence, Volumes, and Times

Sequence Number	Section of Line	Monitoring Location	Pipe Diameter (inches)	Linear Feet	Flush Volume (gallons)	Flushing Time (minutes)
1	Close isolation valve on 6-inch Goes in Lodge Road line	NA	NA	NA	NA	NA
2	1,000,000 gallon tank to Location 0829	0829	8	6,274	20,477	34
3	Left Hand Ditch Road to Location 0830	0830	8	10,334	33,728	56
4	Location 0830 to Location 0818	0818	8 & 6	8,029	20,259	34
5	Red Crow Lane to Location 0819	0819	8	13,084	42,703	71
6	Location 0819 to Location 0843	0843	6	1,440	2,644	4
7	Location 0819 to Location 0821	0821	6 & 8	7,027	16,854	28
8	Line to Location 0820	0820	6	2,616	4,803	8
9	Rendezvous Road to Location 0834	0834	6	528	969	2
10	Open isolation valve on 6-inch Goes in Lodge Road line	NA	NA	NA	NA	NA
			Total	**49,332**	**142,437**	**237**

Notes:
Flushing times are approximate and based on total flow from both flow meters of 600 gallons per minute.
Values in the "Flush Volume" column are 125% of the volume in the lines for each section.
NA = Not applicable

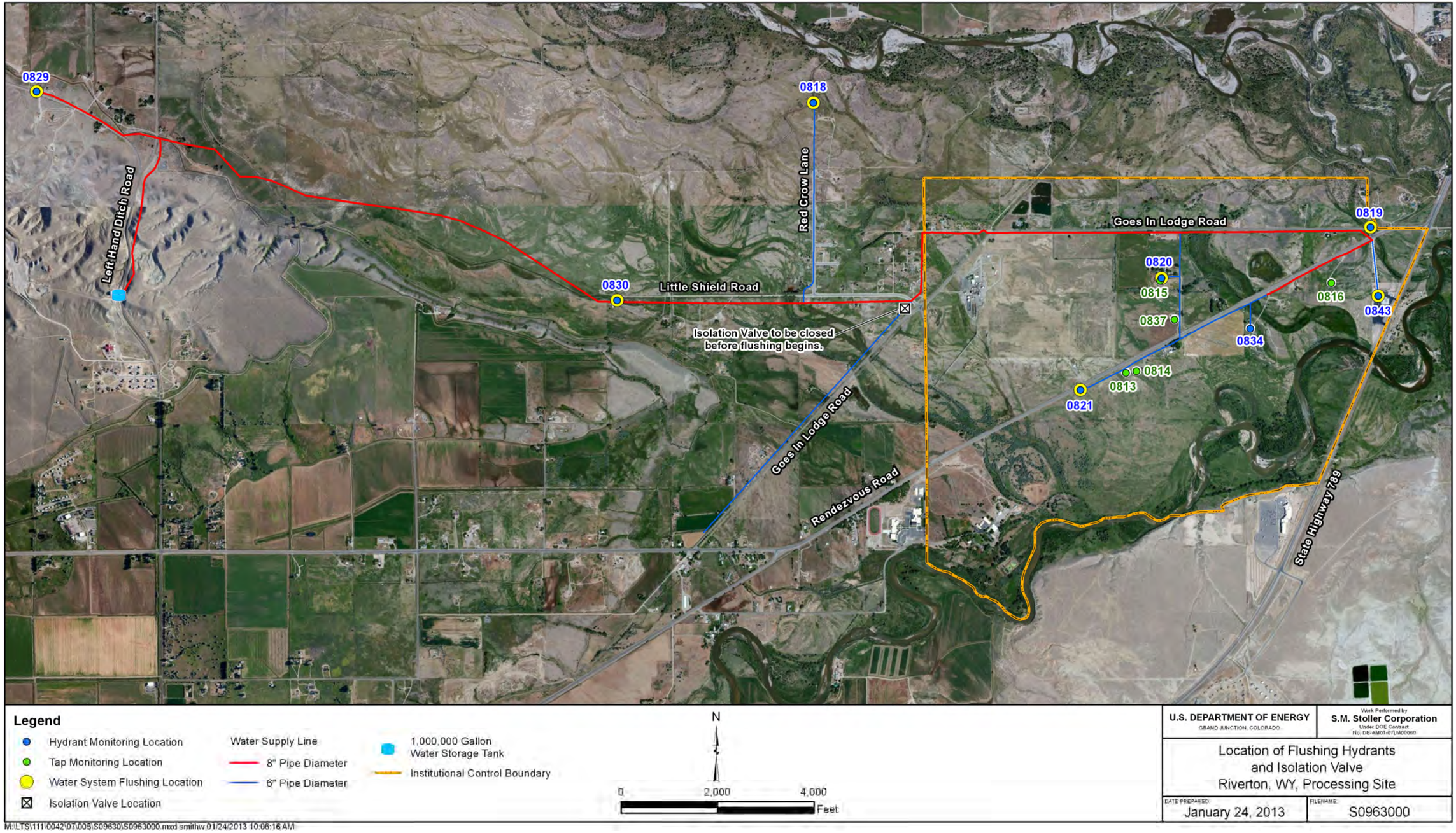

Figure 1. Location of Flushing Hydrants and Isolation Valve, Riverton, Wyoming, Processing Site

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5.0 Monitoring Program

The monitoring program is designed to determine the effectiveness of the flushing program in reducing the radionuclide concentrations and maintaining them at acceptable levels by monitoring contaminant concentrations at hydrant and tap locations. The flushing program will be considered successful if combined radium-226 and radium-228 concentrations are below the Federal drinking water maximum contaminant level (MCL) of 5 picocuries per liter (pCi/L) and the uranium concentrations at all locations are below the MCL of 0.03 milligram per liter (mg/L). Sampling activities will be conducted according to the procedures in the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351).

5.1 Hydrant Sampling

Hydrant locations that will be monitored are shown in Figure 1. This includes five locations inside the IC boundary (0819, 0820, 0821, 0834, and 0843), and three locations outside the IC boundary (0818, 0829, and 0830).

Two samples will be collected at each hydrant during flushing. The first sample will be collected 5 minutes into the flush to measure the potential highest concentrations after the flushing process has had time to dislodge and mobilize contaminants. The second sample will be collected at the end of the flush to determine the effectiveness of the flushing. (Because of the short flushing time at locations 0834 and 843, a sample collected at the end of the flush will be the only sample collected at these locations.)

All samples collected from hydrant locations will be analyzed for radium-226 and radium-228 (the main contaminants concentrated within the water system) and uranium (the main contaminant in the groundwater plume). In addition, field measurements of pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, turbidity, and residual chlorine will be made in conjunction with each sample collected. A summary of hydrant monitoring is shown in Table 1.

5.2 Tap Sampling

Because the flushing program is designed to mobilize and remove contaminants, sampling at tap locations will be conducted immediately after all hydrants have been flushed to confirm that radionuclide concentrations remain low and that water coming from the taps is unaffected by flushing processes. Each sample will be collected by opening the tap and allowing water to flow prior to sample collection to purge the lines from the transmission line to the tap. Purge volumes from each tap location are shown in Table 2, Sampling will be conducted at five tap locations along Rendezvous Road that were sampled in 2002 by WREQC, in 2004 by DOE, and in May 2012 by the Northern Arapaho Utility Organization and DOE. These five locations are 0813, 0814, 0815, 0816, and 0837 (Figure 1).

Table 2. Tap Location Purge Volumes

Monitoring Location	Pipe Diameter (inches)	Linear Feet	Purge Volume (gallons)
0813	1.5	120	15
0814	1.5	120	15
0815	2	50	10
0816	1.5	660	65
0837	2	480	80

Notes:
Assumption for linear feet of pipe is that the service line extends from the transmission line to the tap.
Flush volume is rounded up to the nearest 5 gallons.

Samples from all tap locations will be analyzed for radium-226, radium-228, and uranium. As with hydrant locations, field measurements of pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, turbidity, and residual chlorine will be made in conjunction with each sample collected. A summary of tap and hydrant monitoring is shown in Table 3.

Table 3. Monitoring Program Summary

Type	Location ID	Frequency	Number of Samples	Analytes and Field Measurements
Hydrant	0818	Semiannual, April and October	2 samples: one at 5 minutes and one at end of flush	Radium-226, radium-228, uranium. Field measurements: pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, turbidity, and residual chlorine
	0819			
	0820			
	0821			
	0829			
	0830			
	0834			
	0843			
Tap	0813	Semiannual, April and October	1 sample after all hydrants are flushed	
	0814			
	0815			
	0816			
	0837			

5.3 Sample Analysis

Sample analysis will be conducted by a laboratory that adheres to the *DOE Quality Systems for Analytical Services* (QSAS) (DOE, annually updated) to ensure that data are of known, documented quality. The QSAS is based in total on EPA's *NELAC Standards*, Chapter 5, "Quality Systems" (EPA 2003). The QSAS provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Analytical data will be validated according to "Standard Practice for Validation of Laboratory Data" found in the *Environmental Procedures Catalog* (LMS/POL/S04325).

Sample collection, preservation, and analytical requirements are shown in Table 4.

Table 4. Sample and Analytical Requirements for the Flushing Program

Analyte	Bottle Type and Size	Preservation	Holding Time	Analytical Method	Detection Limit
Radium-226	1 L HDPE	HNO_3 pH < 2	6 months	Gas proportional counter	1 pCi/L
Radium-228	2 x 1 L HDPE	HNO_3 pH < 2	6 months	Gas proportional counter	1 pCi/L
Uranium	500 mL HDPE	HNO_3 pH < 2	6 months	SW-846 6020	0.01 L

Abbreviations:
L = liter
mL = milliliter
HDPE = high-density polyethylene

6.0 Responsibilities

Following are the responsibilities for implementing this flushing plan.

- The Great Plains Utility Organization will be responsible for conducting the flushing of the water system. Costs for conducting flushing under this plan will be reimbursed in accordance with the cooperative agreement between the Northern Arapaho Tribe and DOE.
- DOE will conduct the monitoring program by providing personnel for sampling, procuring analytical services, and reporting the results.
- After a cooperative agreement between the Joint Business Council and DOE is finalized, WREQC will provide oversight of the flushing and monitoring including field visits and collection of sample splits. Costs will be reimbursed in accordance with the pending cooperative agreement.

7.0 References

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DOE (U.S. Department of Energy), 2005. *Verification Monitoring Report for the Riverton, Wyoming, Processing Site, Update for 2004*, DOE-LM/GJ822-2005, U.S. Department of Energy, Grand Junction Office, April.

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