Appendix D - Water Sampling and Travel Plan

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Colorado Department of Public Health and Environment

• 4300 Cherry Creek South, B2 • Denver, CO 80246

Source Water Sampling and Travel Plan

September 2007

Report Prepared By:

Malcolm Pirnie, Inc.

100 Fillmore Street, Suite 200
Denver CO 80206
303-316-6500

5322009

MALCOLM PIRNIE

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1. Background

The Colorado Radionuclide Abatement and Disposal Strategy (CO-RADS) project is being undertaken by the Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) in order to provide assistance to public water systems throughout the State of Colorado that are struggling to meet the compliance criteria in the Radionuclide Rule. WQCD has determined that there are 132 unique source water locations (specifically, individual wells) associated with the 33 water systems that are participating in the CO-RADS project.

One element of CO-RADS is to conduct sampling at representative sources to characterize the occurrence of radionuclides, understand temporal trends and collect additional background water quality data that may help support the design of potential treatment processes for radionuclides. In order to capture temporal trends, sampling for four quarters will be conducted on select sources.

WQCD's budget for the CO-RADS source sampling effort is limited and will not allow for all 132 unique source water locations to be sampled. Therefore, to minimize sampling costs, Malcolm Pirnie has worked with WQCD to consolidate the 132 independent sources to a representative subset of 55 sources. This document describes the methodology used for selecting source water sampling sites at specific locations within each system and the methodology that Malcolm Pirnie will use to perform the source sampling.

2. CO-RADs Water Quality Analyses

Source water sampling is being conducted in order to accomplish three primary goals:

- Better characterize radionuclide concentrations
- Understand radionuclide spatial and temporal variability
- Characterize key water quality parameters that will impact potential treatment alternatives

Malcolm Pirnie worked with the Colorado School of Mines (CSM) to identify a list of water quality parameters to be used for the source water sampling. The comprehensive list of water quality data necessary to make treatment decisions is shown in Table 2-1 (it is referred to as the full-suite). Water quality analyses that are sensitive to hold times (pH, temperature, alkalinity, and DO) will be measured in the field. All other parameters will be analyzed at the Laboratory Services Division of the CDPHE. The justification for each parameter is identified in Table 2-1.

The optional parameters listed at the bottom of Table 2-1 include total organic carbon (TOC), isotopic uranium, hardness and bromide. It may be required to measure uranium isotopically in some cases in order to better understand possible gross alpha violations. Isotopic uranium will not be performed as a standard analysis and TOC and bromide will only be performed on a case-by-case basis depending upon occurrence of these contaminants and treatment technology selected (ozonation requires bromide analysis). Hardness will be calculated from the measured calcium and magnesium concentrations.

Select sources will not receive the full suite of analysis but rather a subset of water quality parameters. These parameters are marked in the 'Confirmation Parameters' column below. Confirmation sampling is being conducted to support the consolidation strategy discussed in Section 3.

Table 2-1.
Source Water Sampling Water Quality Parameters

CATEGORY	FULL SUITE OF PARAMETERS	CONFIRMATION PARAMETERS	JUSTIFICATION
Radionuclide Analyses - Lab	Radionuclide suite (GAA[1], ^{226}Ra[2], ^{228}Ra[3] and U[4])		Radionuclide sampling required
	Radon		Possible EPA regulation
Water Quality Parameters – Field	DO	X	Necessary for treatment decisions and comparing representative systems.
	pH	X	
	Temperature	X	
	Alkalinity	X	
Water Quality Parameters - Lab	Turbidity		Necessary for treatment decisions and comparing representative systems.
	Iron**		
	Manganese**		
	TDS[5]	X	
	Sulfate		Ion exchange competition
	Silica		RO[7] fouling (SiO4)
	Barium**		RO fouling
	Nitrate		Ion exchange competition
	Strontium		RO fouling
	20 metals** (see Table 2-2)	X	Includes 3 parameters from full suite – more economical to go with 20
	TOC[6]		Possible on alluvial wells
Optional Analysis	UV_{254}		Possible on alluvial wells
	Isotopic uranium		Needed on some U wells
	Hardness (calculated from Ca and Mg)		Take from 20 metals analysis
	Bromide		Precursor for bromate with O_3[8]

1. GAA - Gross Alpha-particle Activity
2. ^{226}Ra – Radium 226
3. ^{228}Ra – Radium 228
4. U – Uranium
5. TDS – Total dissolved solids
6. TOC – Total organic carbon
7. RO – Reverse Osmosis
8. O_3 – Ozone

The 20 metals analysis referred to in Table 2-1 is a package set of analytics available from the Laboratory Services Division of the CDPHE and the metals are identified in Table 2-2. While not every metal in Table 2-2 is relevant to the source water sampling program, the cost for performing individual metals analyses is greater than ordering the package for all 20 metals. This analysis will provide the project with a wide variety of water quality information and will be very useful in treatment decisions.

Table 2-2.
List of 20 Metals

Aluminum	Chromium	Molybednum	Uranium
Arsenic	Copper	Nickle	Zinc
Barium	Iron	Potassium	
Berilium	Lead	Selenium	
Cadmium	Magnesium	Silver	
Calcium	Manganese	Sodium	

3. Source Consolidation Methodology

There are 132 individual wells associated with the 33 water systems that are participating in the CO-RADS project. Many of the wells are likely drawing from the same water source (same aquifer and similar well depths, water quality and radionuclide concentrations) and one well can serve as a representative source for multiple wells. The purpose of consolidating sources was:

a. Maximize impact of the sampling budget to support the development of preliminary engineering reports for all 33 water systems
    - Fewer wells will better accommodate budget
b. Allow for as many sources as possible to receive four quarters of samples
c. Make the best effort in identifying the most critical wells in a given system

Prior to conducting the consolidation, several key objectives were identified to guide the consolidation effort:

- Identify at least one representative source water for each water system
- For systems with multiple sources, consolidate wells to a subset of representative water sources to support future treatment recommendations
    - Representative wells will receive the full suite of water quality analyses
    - Some of the consolidated wells will receive confirmation sampling based on a system-specific analysis
- Review current or potential viable blending strategies for each water system based on system-specific information
- If additional sampling of sources could provide valuable information for potential blending strategies, this would be factored into the consolidation strategy

Guidelines were also identified for the consolidation effort. It was important during consolidation not to 'over simplify' any water system. The following strategies were used throughout the consolidation effort:

- Source-by-source approach – treat each system independently
- In systems with multiple sources, select sources with highest radionuclide concentrations
- Emergency wells were not included in the first round of testing; they may be re-evaluated for future rounds of sampling depending on information gathered during site visits (there was one exception to this strategy)

- If radionuclide data is consistent, assume that the entry point is representative of all wells; if data is not consistent, be conservative and select individual wells
- For systems that already have treatment in place for radionuclides, sampling will be done to characterize treatment processes and residuals streams
- No uranium speciation performed during first round of sampling
- If several wells are similar (aquifer type, vicinity, depth of well, radionuclide concentrations), select representative well that has highest flow
- After first round of sampling, revisit consolidation to confirm approach

WQCD provided Malcolm Pirnie with information packets on each system. Information packets includes some or all of the following documents:

- System inventory – all packets contained an inventory listing all components of a water system
- Monitoring plan – only some systems had a monitoring plan, which contains greater detail including system schematics, treatment technologies, and additional information about source waters
- Inspection reports – only some systems had inspection reports, which included specific well information (depth, longitude, latitude, and aquifer type)

In addition to the packets of source water information, historical radionuclide data was compiled by the WQCD. This data is available from 1989 – 2007, but after further discussions with WQCD staff, it was determined that only data from 2003 onward is reliable.

Malcolm Pirnie considered each water system on a case-by-case basis. The following steps were followed for each system:

1. **Create CO-RADs Master Database to store water system information and water quality data** – Malcolm Pirnie created a Master Database to capture system-specific data in a consistent format to support consolidation decisions. The following steps were performed:

   b. Identified key parameters for CO-RADs Master Database - Included a variety of system-specific information to support consolidation decisions (such as well names/depths/locations, treatment systems, summary of radionuclide data)

   c. Developed guidance document for consistent data entry (see Appendix A)
      i. System inventory
      ii. Monitoring plan
      iii. Inspection reports

   d. Formatted and sorted source water data – the source water data provided by WQCD was reviewed and refined prior to being imported into the master database. Specifically, data was converted to consistent units (uranium data had to be standardized to micrograms/L), data that pre-dated 2003 was removed, and

the data was checked for outliers to ensure consistency. The data was then imported into Microsoft Access so that a master report was developed (to view all individual data points) and a summary of data was imported into the CO-RADs Master Database (average, minimum and maximum data for radiounuclides)

2. **System-by-System Source Water Consolidation**: Once all data was compiled in the master database, Malcolm Pirnie Pirnie reviewed each system in detail. Each source was considered for consolidation independently. Each step is listed below with a brief explanation of the actions performed.

   a. **Reviewed system schematic and identify unique sources (wells), blended sources (combined wells at entry points), and emergency sources** – an understanding of system specific layout was necessary for making consolidation decisions. Systems with monitoring plans typically had schematics included. If no monitoring plans existed, only a general flow could be derived from the system inventory form.

   b. **Evaluated if radionuclide data is similar between sources** – based upon the historical database, each source was compared to nearby sources. If sources had similar radionuclide concentrations, it was assumed the sources were similar and consolidation was considered. The number of available historical samples was also taken into consideration when making decisions about data integrity.

      i. Focus on gross alpha, radium, uranium

      ii. Assess number of historical data samples – if there was only one historical data point available, the data was not considered indicative of similarity. It has been shown through the radionuclide variability study that there exists a significant amount of variation, therefore multiple data points are necessary.

   c. **Assessed existing treatment technologies** – based upon the monitoring plans, current treatment technologies were considered. Specifically, data was inspected to determine differences in water quality data from the influent and effluent of the water plant. If it appeared treatment was effecting radionuclide concentrations, samples were scheduled to be taken at the influent and effluent of the treatment process.

   d. **Evaluated if there is any potential for blending** – certain water sources may use blending for compliance. Well flows, proximity and radionuclide water quality data were considered to see if blending could be an option. This type of evaluation was not possible for all systems due to insufficient data.

   e. **Confirmed if sources are in the same aquifer** – in most cases aquifer information was available for each well. If sources were not in the same aquifer, they were not considered for consolidation.

   f. **Evaluated well proximity and well depth** – wells which were in proximity and had similar depths were considered for consolidation

g. **Identified additional data needs** – any data that was missing or needed to be confirmed for consolidation decisions was noted. Questions were presented to WQCD.

h. **Selected representative and confirmation sampling location(s)** – based on information collected during steps a through h, sampling locations were selected.

A plan for "confirmation sampling" was identified to support consolidation decisions. In select cases where sources were consolidated with limited water quality data or system data, confirmation sampling will be conducted. Confirmation samples will include several conservative water quality parameters (refer to Table 1) and will serve two purposes:

- reinforce the source water consolidation decisions
- augment information required to make treatment decisions

It is assumed that if the confirmation samples are similar to the representative sources, they represent the similar water quality.

4. CO-RADs Source Water Sampling Plan

Table 4-1 shows the results of the consolidation effort and the CO-RADS sampling plan for the first sampling event. After the first round of sampling, the plan will be revisited to confirm any consolidation decisions that were made and modify the plan based upon additional information collected during the site visits. During the first sampling event 55 full-suite samples and 10 confirmation samples will be collected. Subsequent rounds of sampling may have fewer full-suite source water samples but the sampling details for subsequent rounds will not be finalized until the first round of sample results is reviewed.

Table 4-1.
Source Water Sampling Points for 1st Round of Sampling

System Name	County	Active Wells	In-active Wells	Pop. Served	CO-RADS Sample Points (# - Specific Points)	Full suite	Conf.
Antelope Hills HOA	Gunnison	2	1	350	2 - 002, 003	2	
Camelot Subdivision	El Paso	1	0	38	1 - 001T	1	
Hillside TP	Otero	1	0	81	1 - 001T	1	
Merino, Town of	Logan	1	0	275	1 - 003	1	
North Holbrook WC	Otero	1	0	75	1 - 001T	1	
Turkey Canon Ranch WD	El Paso	1	1	75	1 - 002	1	
Whispering Pines MHP	Teller	1	0	40	1 - 001T	1	
Wayward Wind MHP & CG	Morgan	1	0	300	1 - 002	1	
Patterson Valley WC	Otero	1	0	120	2 - 001T (EP) and 001T (Raw)	2	
TV Hills Water LLC	Custer	1	0	50	2- 001T (EP) and 001 (Raw)	2	
Vroman WC	Otero	1	0	125	1 - 001T	1	
Fayette WC	Otero	1	1	75	1 - 003	1	
Blue Mountain Water District	Jefferson	5	2	300	4 - 001 Entry Point, WTP influent,	4	

System Name	County	Active Wells	In-active Wells	Pop. Served	CO-RADS Sample Points (# - Specific Points)	Full suite	Conf.
					backwash (Cation and Anion X)		
Eureka WC	Otero	3	0	618	1 - 007	1	
Hancock WC	Otero	2	0	100	1 - 001	1	
Las Animas, City of	Bent	7	0	3035	3 - blended raw, permeate and concentrate	3	
Manzanola, Town of	Otero	4	0	500	3 - 001 (EP and Raw) and 005	3	
May Valley WA	Prowers	10	1	1500	4 - 002 (EP and Raw), 003 (EP and Raw) 4 - Confirmation (009,005,014,010)	4	4
Swink, Town of	Otero	3	0	696	1 - 001T	1	
Wiley, Town of	Prowers	4	1	468	2 - 001 (EP and Raw)	2	
Valley WC	Otero	2	0	270	1 - 002T 1 - Confirmation (001T)	1	1
South Swink WC	Otero	4	0	600	1 - 005 1 - Confirmation (003T)	1	1
Redhill Forest POW	Park	2	0	125	2 - WTP influent, effluent	2	
Aspen Park MD	Jefferson	3	0		1 - 004	1	
Buffalo Park Development	Jefferson	8	0	700	2 - 008, 005T 1 - Confirmation (003T)	2	1
Holly, Town of	Prowers	3	0	900	1 - 003T 1 - Confirmation (001T)	1	1
Kit Carson, Town of	Cheyenne	2	0	300	1 - 003T	1	
Larkspur, Town of	Douglas	2	0	4375	1 - 003 2 - Confirmation (001T, 002T)	1	2
Mountain Shadows	Pueblo	2	0	100	1 - 001	1	
Mountain WSD	Jefferson	19	4	900	4 -Consolidation EP's (014, 025, 027) + High Rad Point (029)	4	

System Name	County	Active Wells	In-active Wells	Pop. Served	CO-RADS Sample Points (# - Specific Points)	Full suite	Conf.
Park WC Wonderview	Jefferson	4	0	100	1 - 005	1	
Sheridan Lake WC	Kiowa	2	0	80	1 - 001	1	
Sterling, City of	Logan	16	1	13794	4 - 001, 002, 003, 022	4	
	TOTALS	**120**	**12**	**31065**		**55**	**10**

- No Consolidation
- Treatment Systems (Sand filtration, Ion exchange, RO, etc)
- Consolidated Sources

5. Analytical Costs for Source Water Sampling

The projected overall budget for the first round of sampling is shown in Table 5.1. This budget represents over 40% of the CO-RADS source water sampling budget. The unit cost per sample for this first round of sampling is based upon the agreed upon prices for direct billing between CDPHE's Laboratory Services Division (LSD) and WQCD for both full-suite and confirmation sampling. The total cost for the full-suite is approximately $676 and includes analytical costs as well as field testing costs (such as analytical equipment purchase/rental and associated reagents and supplies). Confirmation sampling costs are $115 per source and include both analytical and field testing costs.

For future rounds of sampling, some portion of the analytical costs will be billed from LSD directly to Malcolm Pirnie based on the agreed upon prices between LSD and WQCD (those costs are higher than the prices when LSD directly invoices WQCD). Therefore, subsequent full suite sampling events are estimated to cost approximately $900 for analytical analyses, field testing, and shipping of samples from the system to LSD (the budget for the first round in Table 5.1 does not include shipping costs because Malcolm Pirnie is planning to collect and hand deliver them to LSD). Similarly, the costs for the confirmation tests, if they are performed in future rounds of sampling, will also increase by approximately 30% to account for shipping costs and the increase in analytical fees.

As discussed in Section 4, the strategy for future sampling events will be re-evaluated with WQCD after Malcolm Pirnie compiles the first round results. At that point, the remainder of the sampling budget will be allocated for the subsequent rounds of sampling events.

Table 5-1.
Budget for 1st Round Sampling

Analysis type	Unit cost per sample	# of samples	Total cost
Full-suite	$676	55	$37,180
Confirmation	$115	10	$1150
		Subtotal	**$38,330**
		QA/QC (10% duplicates)	**$3,833**
		Total	**$42,163**

6. Source Water Sampling Schedule

The source water sampling schedule is shown in Table 6.1 below. Currently, four sampling events are planned. The first round of sampling will be conducted during the site visits. During these visits the team will train the utility staff in the proper procedure for collecting future samples. The teams will follow the standard operating procedure (SOP) outlined in Appendix B and use this SOP as a training tool.

Sampling will begin in early October and is planned to be finished by late November. Each subsequent sampling event will occur approximately 90 days after the first event, allowing for a total of four samples throughout a one year period. Utility staff will be responsible for collecting samples during the rounds two, three and four. The number of sources receiving the full-suite of analyses will be reduced after the first round of sampling. Subsequent rounds of samples will be focused on the systems selected for the detailed treatment investigations.

Table 6-1.
Source Water Sampling Matrix

Round	Date	Performed by	Action
1	October 8 – November 30, 2007	Malcolm Pirnie	Collect and analyze 55 full-suite source water samples and 10 confirmation samples. Train water system to collect subsequent samples. Re-evaluate consolidation decisions after data analysis has been completed.
2	~February 2008	Water System	Collect and analyze a subset of the revised source water samples based upon the selection workshop.
3	~May 2008	Water System	Collect and analyze an additional full suite of source water samples (54 total or however many with revisions).
4	~August 2008	Water System	Post July 1, 2008, a new fiscal year budget for CDPHE begins, so additional samples may be added to this quarter – there is a possibility of a complete full suite analysis for all consolidated sources in the 4th quarter as well.

7. CO-RADS Travel Plan

Malcolm Pirnie has developed the following strategies for the CO-RADS Site Visit Travel plan.

- **Teams of two**: Two members of the Malcolm Pirnie team will visit each site. Teams will be comprised of at least one senior level person experienced at system evaluations. This person will typically be teamed with a more junior level person. Malcolm Pirnie anticipates having as many as three different teams available at and given time to perform site visits.
- **Site visits lasting one day per system:** During the site visit the engineering team will perform a comprehensive site evaluation, gather information on the request list and conduct the first round of sampling. Utility training (as needed) will be performed.
- **Three visits per week**: For the systems located in groups (see Table 7-1) Malcolm Pirnie is planning to conduct three visits per group per week in order to complete as many systems as efficiently as possible.
- **Pilot site visit at nearby water system:** the first site visit will be conducted at a local water system (close to the Denver Metro area) in order to train the entire Malcolm Pirnie team and obtain input from CDPHE. This will be conducted the first week in October.

Each of the 33 systems has been assigned to one of seven groups. The groups are geographically ordered for the purposes of coordinating travel with the goal of maximizing on site time by minimizing travel time. The 33 water systems and their respective groups are listed in Table 7-1. The systems locations within Colorado are shown in Figure 1. The systems within the Lamar, Otero, Kit Carson and Sterling groups will be scheduled first. As the schedule fills up, systems in the Local and Pueblo groups will be scheduled for remaining open days, as they can be visited as a day trip.

Table 7-1.
System Groupings for Travel Plan

Group	Systems	Details and Strategy
LAMAR GROUP	• Wiley • May Valley • Holly • Las Animas	The Lamar Group is farthest from Denver and will require overnight stays. One team could finish the group in a week.
OTERO GROUP	• Manzanola • Valley WC • Vroman • Patterson Valley • Hancock • Swink • South Swink • Eureka • Hillside • Fayette • North Hollbrook	The Otero Group is the largest group and will likely require multiple teams focusing efforts on completing these systems.
PUEBLO GROUP	• Mountain Shadows • TV Hills	The Pueblo group may be able to be completed on a local basis, as the systems are fairly close to Denver.
KIT CARSON GROUP	• Kit Carson • Sheridan Lake	This group is located far enough away from the Otero and Lamar groups it will likely require its own trip.
STERLING GROUP	• Merino • Sterling • Wayward Wind	While Sterling may be close enough to complete with day drives, the City of Sterling is the largest system and will likely require a complete day site visit.
LOCAL GROUP	• Turkey Canyon • Camelot • Larkspur • Redhill Forrest • Mountain WSD • Aspen Park • Park • Buffalo Park • Blue Mountain • Whispering Pines	These systems lie within an easy drive of Denver. Hence, they can be scheduled last and can be completed as holes in the schedule become apparent.
No Group	• Antelope Hills	This is the only West Slope system in CO-RADS. It will require its own trip.

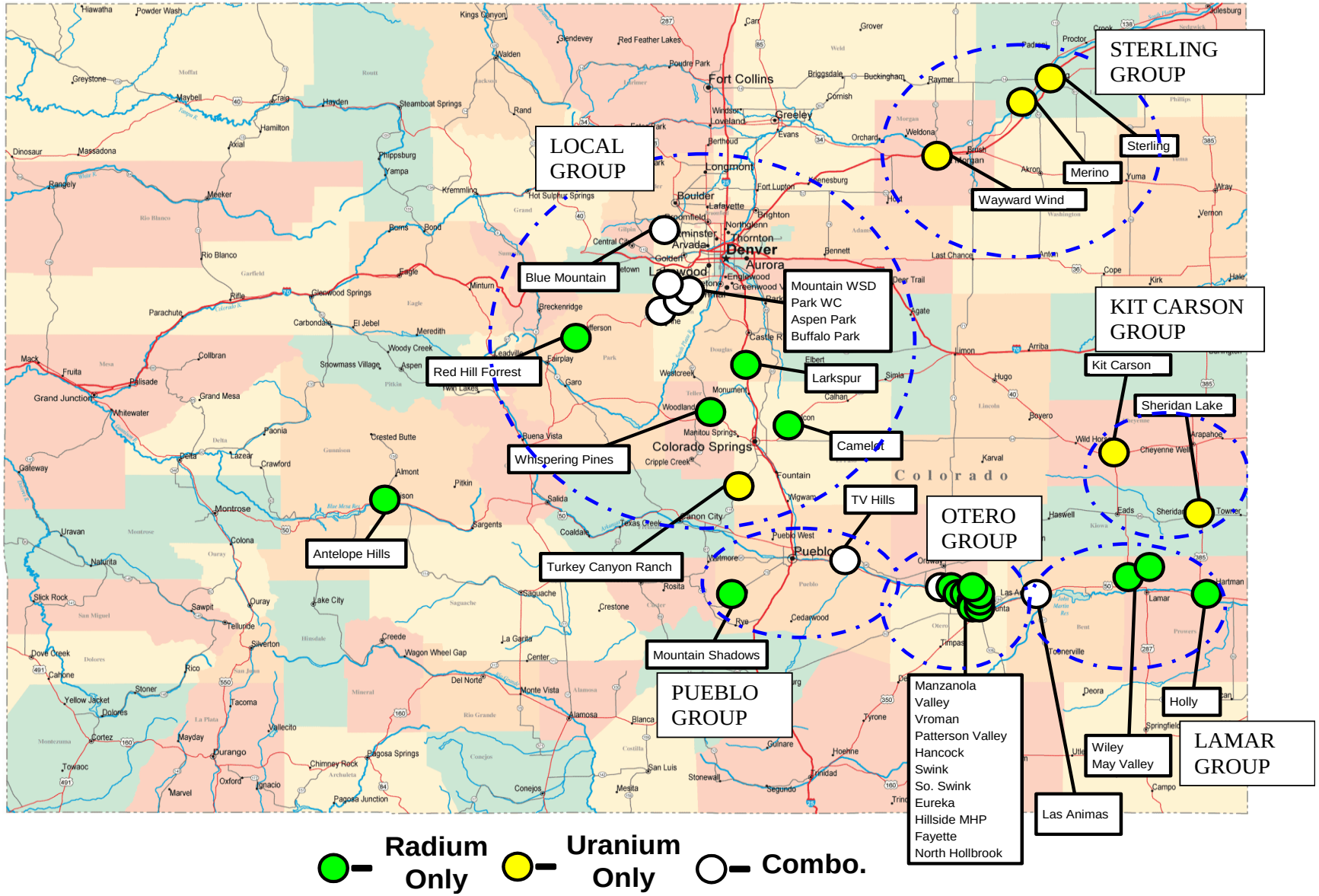

Figure 7-1: Travel Plan Groupings

APPENDIX A

MALCOLM PIRNIE

Interoffice Correspondence

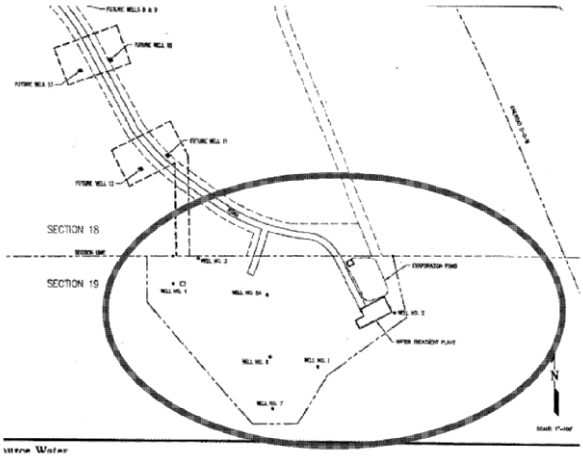

Figure 1: Well Layout from Blue Mountain WD (wells and treatment plant circled)

If the Monitoring Plan is available, you can also get information like aquifer name (See Figure 2).

Source Name	Source ID#	Aquifer Name	Type: Permanent (P) Seasonal (S) Emergency (E)
Well 3	CO0130005-003	Dakota	P ☒ S ☐ E ☐
Well 4	CO0130005-004	Dakota	P ☒ S ☐ E ☐
Well 5-A	CO0130005-005	Dakota	P ☒ S ☐ E ☐
Well 6	CO0130005-006	Dakota	P ☒ S ☐ E ☐
Well 7	CO0130005-007	Dakota	P ☒ S ☐ E ☐

Figure 2: Well Name with Aquifer name and type.

Figure 3 explains how to read the inventory to interpret sample point code and how the system is laid out. There are two sections of the inventory that will interest the team: Facility Flows and Sample Points. The **Sample Points** section describes the sample points and names them. From this information, it can sometimes be discerned what the sample point code represents. The **Facility Flows** section describes the flow of water in the system. In Figure 3, it can be seen that all wells feed the water plant. If there is no monitoring plan, this will sometimes be all the information that is available to use for understanding treatment.

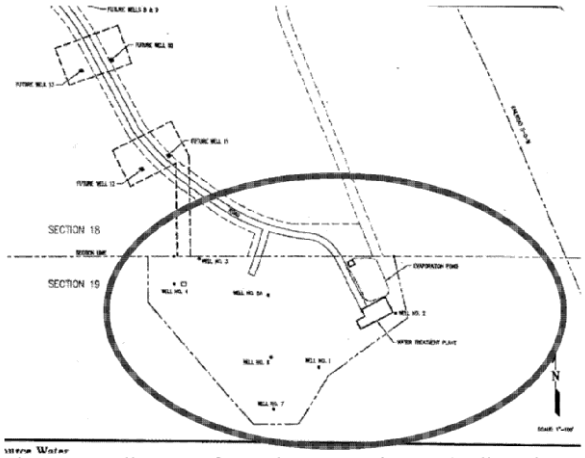

Figure 1: Well Layout from Blue Mountain WD (wells and treatment plant circled)

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Source Name	Source ID#	Aquifer Name	Type: Permanent (P) Seasonal (S) Emergency (E)
Well 3	CO0130005-003	Dakota	P ☒ S ☐ E ☐
Well 4	CO0130005-004	Dakota	P ☒ S ☐ E ☐
Well 5-A	CO0130005-005	Dakota	P ☒ S ☐ E ☐
Well 6	CO0130005-006	Dakota	P ☒ S ☐ E ☐
Well 7	CO0130005-007	Dakota	P ☒ S ☐ E ☐

Figure 2: Well Name with Aquifer name and type.

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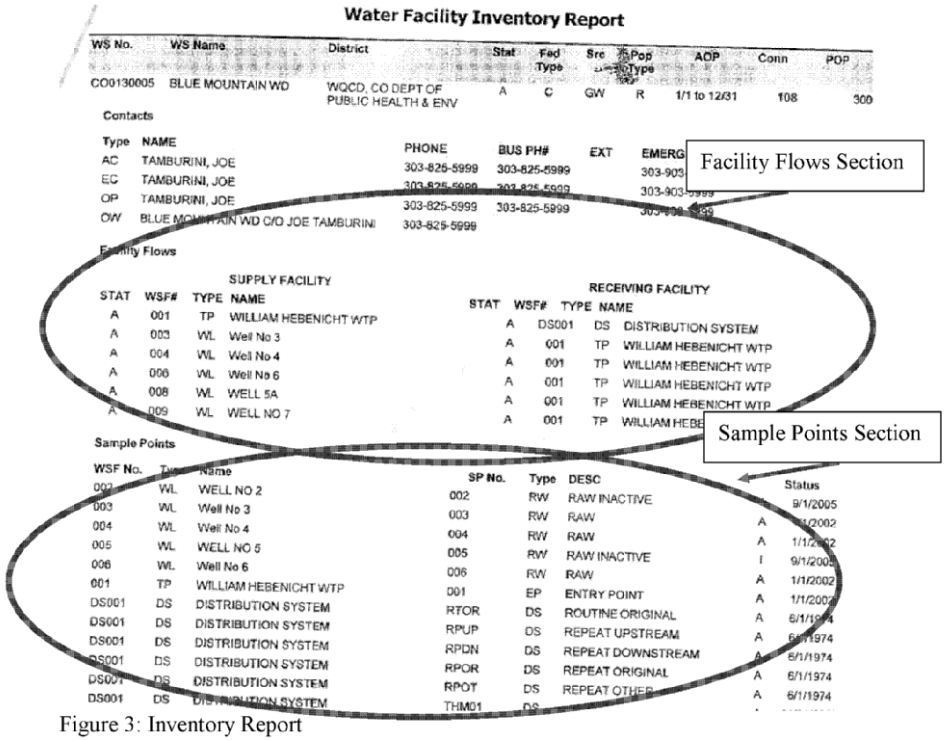

Figure 3: Inventory Report

For **every** sample point which is RW or EP, we will enter a row in the spreadsheet and attempt to fill out as much information as possible. An example is shown in figure 4.

CO-RADS Well and System Information

System Name	PWSID	Sample Point Code	Sample Point Name	Sample Point Type	Supply Facility	Receiving Facility	Latitude		Longitude	
				RW or EP	Code(s)	Code(s)	Degrees	Minutes	Degrees	Minutes
Blue Mountain Water Dist.	CO0130005	001	William Hebenicht WTP	EP	003 004 005 006 008 009	DS001				
Blue Mountain Water Dist.	CO0130005	003	Well No. 3	RW		001				
Buffalo Park Development	CO0130050									

Figure 4: Completed Fields in the spreadsheet.

The final document, a well inspection report is shown in Figure 5. This report will provide flows, if available, as well as GPS coordinates and well depth.

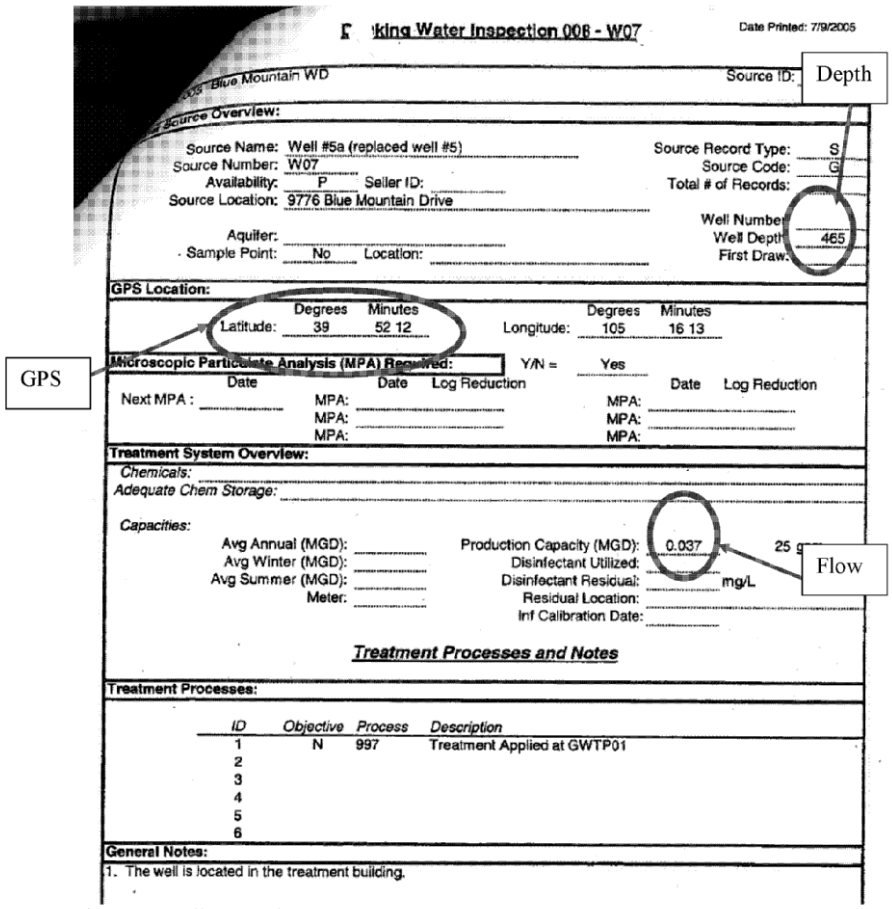

Figure 5: Well Inspection Report

The following section explains the different Fields in the spreadsheet as well as what are acceptable values. If we don't have data for a field, enter "N.A."

DEFINITION OF FIELDS

FIELD NAME	SOURCE DOCUMENT	DEFINITION OF FIELD
System Name	Inventory Report	Already filled in – verify in packet
PWSID	Inventory Report	Already filled in – verify in packet (the first two characters of the number are CO not C0)
Sample Point Code	Inventory Report	The code for any specific sample point in the distribution system. This will be the primary search item and so must be accurate. For each system, there will be several sample point codes corresponding to a distribution system. TO ENTER THIS VALUE IN EXCEL, For example sample point 002, you MUST enter '002 so EXCEL stores it as alphanumeric. REMEMBER THE APOSTROPHE
Sample Point Name	Inventory Report	This field should accurately represent the type of unit the sample point represents. It will be named in the Inventory report: Well No. 3 William Hebenicht WTP
Sample Point Type	Inventory Report	We are only concerned with raw water data or entry points in this study. Therefore, this field MUST be one of the following: Raw water - "RW" Entry Point - "EP" Only enter RW or EP, no quotes.
Supply Facility	Inventory Report	This will be a "SAMPLE POINT CODE" corresponding to the UPSTREAM process. A raw water source will not have a supply facility. Enter N.A.
Receiving Facility	Inventory Report	This field will ALWAYS be filled in. This is the process DIRECTLY DOWNSTREAM of the process. If you are entering a well ('002) and a treatment process is downstream ('001) you enter '001 for this field.
Latitude - Degrees	Inspection Report	This data is found under the GPS location of the Inspection Report. The Degrees are reported as whole numbers: 105 39
Latitude - Minutes	Inspection Report	This data is found under the GPS location of the Inspection Report. The minutes are reported as decimal numbers. If there is a space, put a decimal where the space is: 52.13 16.16
Longitude - Degree	Inspection Report	This data is found under the GPS location of the Inspection Report. The Degrees are reported as whole numbers: 105 39

FIELD NAME	SOURCE DOCUMENT	DEFINITION OF FIELD
Longitude - Minutes	Inspection Report	This data is found under the GPS location of the Inspection Report. The minutes are reported as decimal numbers. If there is a space, put a decimal where the space is: 52.13 16.16
Aquifer Name	Monitoring Plan	The aquifer name should be listed here as it is defined in the Monitoring Plan.
Depth of Well	Inspection Report	Usually found in the Water Source Overview section of the Inspection Report.
Flow	Inspection Report	This is found in the Treatment System Overview of the Inspection Report. Report this in MGD.
Schematic Available?	Monitoring Plan	Most schematics are available in the Monitoring Plan. Answer Y or N.
Treatment Plant?	Monitoring Plan or Inventory	Most Treatment is defined in the Monitoring Plan. Answer Y or N.
Type of Treatment	Monitoring Plan or Inventory	This should describe the treatment. For example: Chlorination Cation Exchange – Anion Exchange – Greensand – Chlorination R.O. – Chlorination

TI

Attachment

APPENDIX B

STANDARD OPERATING PROCEDURE		
CO-RADS Source Water Sampling		
	Revision:	1.0
	Author:	Malcolm Pirnie
	Date:	October 2007

PURPOSE

The purpose of this SOP is to describe the sampling protocol for taking radionuclide and other water quality parameters for the CO-RADS project.

SUMMARY

This SOP explains how to take source samples for the CO-RADS project including:

1. Sample bottle preparation
    a. Labeling
2. Sample bottle filling
3. Sample shipping and billing

PROCEDURE	
STEP NUMBER/NAME	
1. Label sample bottles	
The samples bottles necessary for sampling include: • 2 – 1 gallon cubitainers • 1 – 1 liter metals bottle • 1 – 1 liter neutral bottle • 1 – 250 mL nutrient bottle (yellow tape) • 2 – amber glass Radon bottles • 2 – amber glass TOC vials ALL BOTTLES should be labeled with the system PWSID and Sample point code. For example: CO0145690 – 007 (PWSID) – (Sample point code)	
2. Turn on well and let water run continuously	
Water should be running at a minimum of 5 minutes if the well is in operation. If the well is not in operation, the well should be left turned on for a period of 12 hours prior to sample collection.	
3. Fill bottles completely – mark with date and time	
All sample bottles should be filled completely with water prior to being sealed. The nutrient bottle (yellow tape) has preservative inside so do not overflow the bottle when filling it with sample water. The amber glass bottles must be filled with no air bubbles or the analysis will be invalid. If air bubbles are trapped in these samples, empty and refill.	

4. Package samples	
Place all samples in the postage-paid, pre-addressed packaging and ship to CDPHE laboratory services division.	
6. Send notification to Malcolm Pirnie, Inc.	
Once samples are shipped, call or email Malcolm Pirnie, Inc. to record sampling event: Tyson Ingels tingels@pirnie.com phone: 303-316-6526	